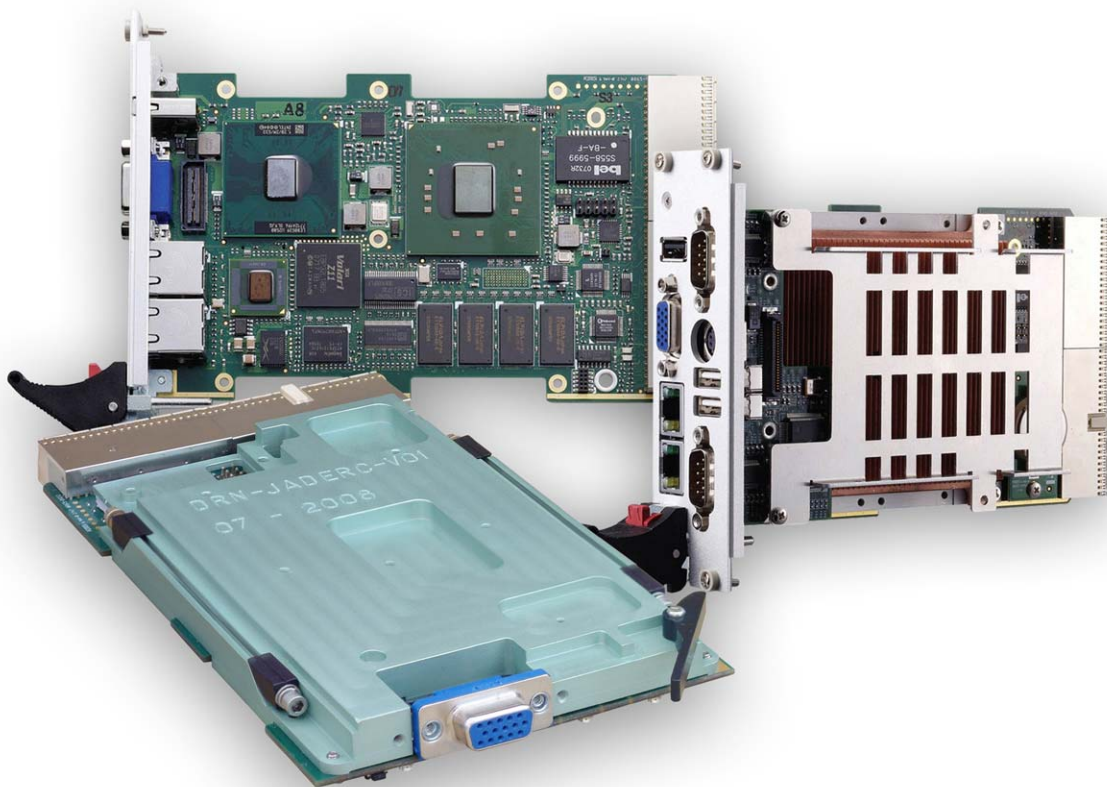


» ITC-320 «



3U cCPI SBC User's Guide

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- > reduce waste arising from electrical and electronic equipment (EEE)
- > make producers of EEE responsible for the environmental impact of their products, especially when they become waste
- > encourage separate collection and subsequent treatment, reuse, recovery, recycling and sound environmental disposal of EEE
- > improve the environmental performance of all those involved during the lifecycle of EEE

Conventions

This guide uses several types of notice: Note, Caution, ESD.



Note: this notice calls attention to important features or instructions.



Caution: this notice alert you to system damage, loss of data, or risk of personal injury.



ESD: This banner indicates an Electrostatic Sensitive Device.

All numbers are expressed in decimal, except addresses and memory or register data, which are expressed in hexadecimal. The prefix `0x` shows a hexadecimal number, following the `C` programming language convention.

The multipliers `k`, `M` and `G` have their conventional scientific and engineering meanings of $*10^3$, $*10^6$ and $*10^9$ respectively. The only exception to this is in the description of the size of memory areas, when `K`, `M` and `G` mean $*2^{10}$, $*2^{20}$ and $*2^{30}$ respectively.



When describing transfer rates, `k` `M` and `G` mean $*10^3$, $*10^6$ and $*10^9$ *not* $*2^{10}$ $*2^{20}$ and $*2^{30}$.

In PowerPC terminology, multiple bit fields are numbered from 0 to n, where 0 is the MSB and n is the LSB. PCI and CompactPCI terminology follows the more familiar convention that bit 0 is the LSB and n is the MSB.

Signal names ending with an asterisk (*) or a hash (#) denote active low signals; all other signals are active high.

Signal names follow the PICMG 2.0 R3.0 CompactPCI Specification and the PCI Local Bus 2.3 Specification.

For Your Safety

Your new Kontron product was developed and tested carefully to provide all features necessary to ensure its compliance with electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interest of your own safety and of the correct operation of your new Kontron product, you are requested to conform with the following guidelines.

High Voltage Safety Instructions



Warning!

All operations on this device must be carried out by sufficiently skilled personnel only.



Caution, Electric Shock!

Before installing a not hot-swappable Kontron product into a system always ensure that your mains power is switched off. This applies also to the installation of piggybacks. Serious electrical shock hazards can exist during all installation, repair and maintenance operations with this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing work.

Special Handling and Unpacking Instructions



ESD Sensitive Device!

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.

It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory backup, ensure that the board is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the board.

Personal Injury

Be careful while handling the board, because of the cutting edges of the CPU heatsink.

Do not touch the CPU heatsink or the ruggedizer while removing the board from a rack because it can get very hot.

Do not place the board on any surface or in any form of storage container until the board and its heatsink have cooled down to room temperature.

General Instructions on Usage

In order to maintain Kontron's product warranty, this product must not be altered or modified in any way. Changes or modifications to the device, which are not explicitly approved by Kontron and described in this manual or received from Kontron's Technical Support as a special handling instruction, will void your warranty.

This device should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This applies also to the operational temperature range of the specific board version, which must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.

In performing all necessary installation and application operations, please follow only the instructions supplied by the present manual.

Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the board, please re-pack it as nearly as possible in the manner in which it was delivered.

Special care is necessary when handling or unpacking the product. Please consult the special handling and unpacking instruction on the previous page of this manual.

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Chapter 1 - Introduction

The ITC-320 series expands Kontron's Intel single and multi-core blade SBC portfolio with a set of fully fledged I/O embedded PCs enabling the design of cost effective, high performance embedded computers to meet the new challenges in transport, medical and defense applications.

In this document, the term:

- » ITC-320 will be associated to the single-slot (4HP) 3U cPCI version of the board
 - ▶ ITC-320-SA Standard Commercial version
 - ▶ ITC-320-RC Rugged Conduction-Cooled version
- » ITC-322 will be associated to the dual-slot (8HP) 3U cPCI version of the board:
ITC-320 and second layer board
- » ITC-320-RTM will be associated to the Rear Transition Module

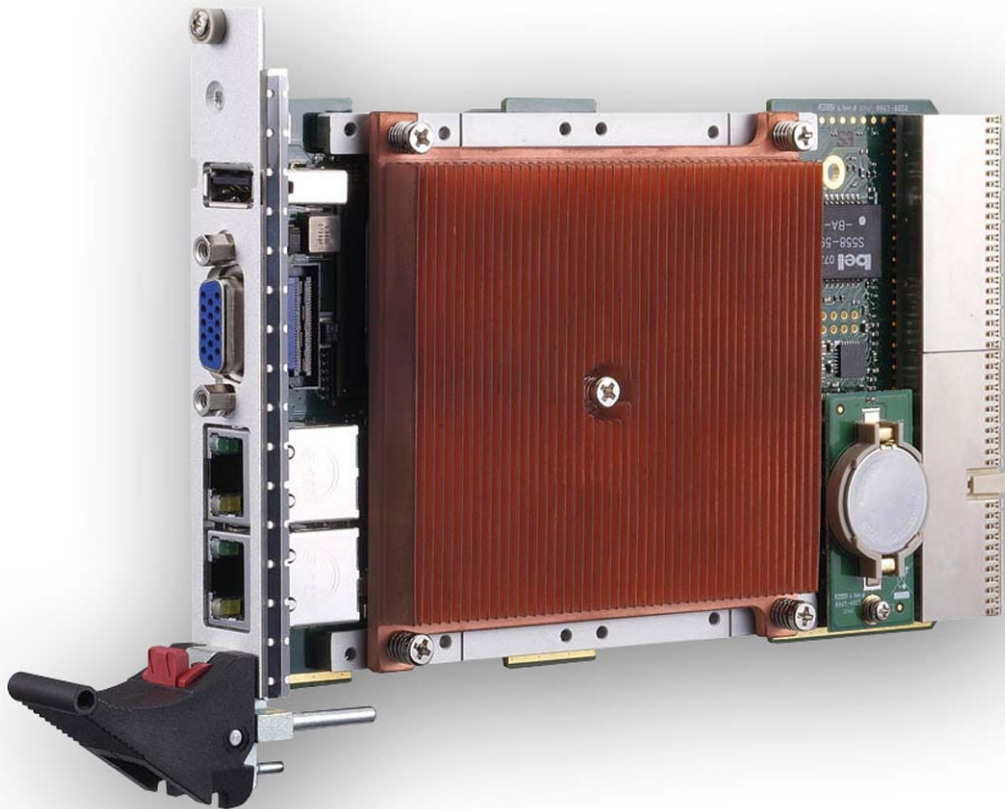


Figure 1: ITC-320-SA Overview



Figure 2: ITC-320-RC Overview with VGA Graphics Option

1.1 Manual Overview

1.1.1 Objectives

This guide provides general information, hardware preparation and installation instructions, operating instructions and a functional description of the ITC-320 board. The onboard programming, onboard firmware and other software (e.g. drivers and BSPs) are described in detail in separate guides (see section 1.9 "Related Publications").



As the standard policy for all the Kontron, hardware technical documentation reflects the most recent version of our products. The "Hardware Release Notes" (see section 1.9 "Related Publications") is to help to keep track of various evolutions that have happened during the early steps of the ITC-320 ramp-up or later in its lifetime.



Functional changes that differ from previous version of the document are identified by a vertical bar in the margin.

1.1.2 Audience

This guide is written to cover, as far as possible, the range of people who will handle or use the ITC-320, from unpackers/inspectors, through system managers and installation technicians to hardware and software engineers. Most chapters assume a certain amount of knowledge on the subjects of single board computer architecture, interfaces, peripherals, systems, cabling, grounding and communications. There is a glossary provided at the back of this guide that explains some of the terms used and expands all abbreviations.

1.1.3 Scope

This guide describes all variants of the ITC-320 series. It does not cover any PMC modules which are described in specific guides (see section 1.9 "Related Publications").

1.1.4 Structure

This guide is structured in a way that will reflect the sequence of operations from receipt of the board up to getting it working in your system. Each topic is covered in a separate chapter and each chapter begins with a brief introduction that tells you what the chapter contains. In this way, you can skip any chapters that are not applicable or with which you are already familiar.

The chapters are:

- Chapter 1 - Introduction (this chapter)
- Chapter 2 - Functional Description
- Chapter 3 - Installation
- Chapter 4 - Configuration
- Chapter 5 - Power Considerations
- Chapter 6 - System Considerations
- Chapter 7 - ITC-322-SA Characteristics
- Chapter 8 - ITC-320-RTM Characteristics
- Chapter 9 - ITC-320-RC Characteristics
- Chapter 10 - AMIBIOS®8 Setup Utility

1.2 System Overview

The CompactPCI board described in this manual operates with the PCI bus architecture to support additional I/O and memory-mapped devices as required by various industrial applications. For detailed information concerning the CompactPCI standard, please consult the complete Peripheral Component Interconnect (PCI) and CompactPCI Specifications. For further information regarding these standards and their use, visit the home page of the [PCI Industrial Computer Manufacturers Group \(PICMG\)](#).

1.3 Board Overview

1.3.1 Board Introduction

» ITC-320

The ITC-320 is a highly integrated, 3U, 4 HP lead-free CompactPCI system controller board. It has been designed to support the Intel® Celeron® M, the Intel® Core™ 2 Duo or the Intel® Core™ Duo processors with frequencies ranging from 1.07 GHz up to 1.5 GHz providing 533/667 MHz Front Side Bus (FSB).

The Intel® Celeron® M, the Intel® Core™ Duo and the Intel® Core™ 2 Duo are low-power processors supporting Intel's Virtualization Technology (VT).

The Intel® Celeron® M consists of one core and up to 1 MB L2 cache.

The Intel® Core™ Duo consists of two cores and up to 2 MB L2 cache shared by both cores.

The Intel® Core™ 2 Duo consists of two cores, up to 4 MB L2 cache shared by both cores, Intel® Extended Memory 64 Technology (Intel® EM64T), enhanced address range for up to 64 GB memory.

The Intel® Celeron® M, the Intel® Core™ Duo and the Intel® Core™ 2 Duo processors deliver optimized power-efficient computing and outstanding dual-core performance with low power consumption.

The ITC-320 utilizes the XGI Volari™ Z11 ultra low powered graphics chipset and the integrated Intel® 3100 chipset (Whitmore Lake) which combines Integrated Memory Hub Controller (IMCH) and Integrated I/O Hub Controller (IICH) functions into a single component.

The board supports 1 GB of soldered Double Data Rate 2 (DDR2) memory operating at 400 MHz. For optional 2 GB of DDR2 memory availability, please contact your Kontron representative.

The board supports one 32-bit/33 MHz CompactPCI interface acting as system master CPU only.

» ITC-322

The optional ITC-322 board, the 8 HP version of the ITC-320, has been designed to make various legacy PC I/O ports available as well as USB interfacing.

Refer to Chapter 7 "ITC-322-SA Characteristics" page 71 for advanced information on the ITC-322 board.

» ITC-320-RC

The optional ITC-320 Rugged Conduction-Cooled board (ITC-320-RC) has been designed for stability and packaged in a rugged format. The board fits into all applications situated in industrial environments, including I/O intensive applications where only one slot is available for the CPU, making it a perfect core technology for long life applications.



The following logo "RC Only" is used to highlight Rugged Conduction-Cooled boards specificities. Refer to Chapter 9 - ITC-320-RC Characteristics page 97 for advanced information on the ITC-320-RC RC Only board. The Rugged Conduction-Cooled boards specificities are summed up in the following table:

FUNCTION	DESCRIPTION	SEE ALSO
Battery	No battery available on RC boards	Section 1.3.4 page 9 Section 2.3.3 page 32
Front Panel	Depending on the board Order Code, only the VGA connector or no connector are available on the board front panel	Section 1.3.4 page 9 Section 1.5.3 page 13 Section 9.3 page 97
Environmental Specifications	Environmental specifications depend on the environmental class.	Section 9.4 page 100
MTBF	MTBF depend on the environmental class.	Section 9.5 page 101
Board Identification	Ruggedizer Identification by Ruggedizer Engineering Change Level	Section 9.6 page 102

Table 1: Rugged Conduction-Cooled Boards Specificities

1.3.2 I/O Interfaces

FUNCTION	DESCRIPTION
Ethernet	Intel® 82571EB Ethernet controller via PCI-E® x4 for two Gigabit Ethernet ports available, by BIOS selection, either on the front panel (ITC-320 User's Guide, ITC-322) or on the rear I/O via J2 connector (ITC-320-RTM front panel)
USB	Up to six USB 2.0 channels - USB port 0 9-pin USB pin header, space reserved for horizontal USB flash module - USB port 1 USB port on front panel (ITC-320 User's Guide, ITC-322) - USB port 2,3 Two USB ports available on rear I/O via J2 connector (ITC-320-RTM front panel) - USB port 4,5 Two USB ports available on the 2nd layer board front panel (ITC-322)
VGA	D-Sub VGA connector available on front panel (ITC-320 User's Guide, ITC-322) output on an extruding IEEE volume boundaries of 3U cPCI Conduction-Cooled boards
Serial ATA (SATA)	Up to 4 SATA interfaces - One onboard SATA connector, 2.5" space reserved on 2nd layer board (ITC-322) - Three 7-pin SATA connector available on rear I/O via J2 connector (ITC-320-RTM onboard connectors)
Serial Ports	Up to 4 serial ports - COM1 TTL-level on rear I/O via J2 connector. Adapted to EIA-232 (simplified) port via the ITC-320-RTM front panel 9-pin D-Sub connector. - COM2 TTL-level on rear I/O via J2 connector. Adapted to EIA-232 (simplified) port via the ITC-320-RTM onboard 10-pin header connector. - COM3 EIA-232 (full modem) port on 2nd layer board front panel (ITC-322), 9-pin D-Sub connector - COM4 EIA-232/422/485/485+ (half duplex) port available on 2nd layer board front panel (ITC-322), 9-pin D-Sub connector
KB/MS	One PS/2 Keyboard/Mouse on 2nd layer board front panel (ITC-322)
LED	Three status LEDs on front panel: HOT, WDT, PWR (ITC-320 User's Guide, ITC-322)
Reset	One reset button on front panel (ITC-320 User's Guide, ITC-322)

Table 2: I/O Interfaces

FUNCTION	ITC-320		ITC-322		ITC-320-RC		ITC-320- RTM	
	Front Panel	On board	Front Panel	On board	Front Panel	On board	Front Panel	On board
Gigabit Ethernet	Y x2 *	-	Y x2 *	-	-	-	Y x2 *	-
USB0	-	Y (9-pin)	-	Y (9-pin)	-	Y (9-pin)	-	-
USB1	Y	-	Y	-	-	-	-	-
USB2, USB3	-	-	-	-	-	-	Y x2	-
USB4, USB5	-	-	Y x2	-	-	-	-	-
VGA	Y	-	Y	-	Y (optional)	-	-	-
SATA	-	-	-	Y	-	-	-	Y x3
COM1 (EIA-232)	-	-	-	-	-	-	Y (DB-9)	-
COM2 (EIA-232)	-	-	-	-	-	-	-	Y (10-pin)
COM3 (EIA-232)	-	-	Y (DB-9)	-	-	-	-	-
COM4 (EIA-232/422/485/485+)	-	-	Y (DB-9)	-	-	-	-	-
PS/2 KB/MS	-	-	Y	-	-	-	-	-
LED	Y x3	-	Y x3	-	Y x3	-	-	-
Reset Button	Y	-	Y	-	-	-	-	-

* Selected by BIOS setting

Table 3: Peripheral Connectivity

1.3.3 Order Code Table

Ordering Information		
Article	Order Code	Description
ITC-320	ITC320-SA52-00000	4HP, Intel® Core™2 Duo (L7400) 1.5 GHz, 4MB L2, 1GB SDRAM
ITC-320	ITC320-SA22-00000	4HP, Intel® Core™ Duo (U2500) 1.2 GHz, 2MB L2, 1GB SDRAM
ITC-320	ITC320-SA02-00000	4HP, Intel® Celeron® M (423) 1.07 GHz, 1MB L2, 1GB SDRAM
ITC-322	ITC322-SA52-00000	8HP, Intel® Core™2 Duo (L7400) 1.5 GHz, 4MB L2, 1GB SDRAM
ITC-322	ITC322-SA22-00000	8HP, Intel® Core™ Duo (U2500) 1.2 GHz, 2MB L2, 1GB SDRAM
ITC-322	ITC322-SA02-00000	8HP, Intel® Celeron® M (423) 1.07 GHz, 1MB L2, 1GB SDRAM
ITC-320	ITC320-RC52-00000	4HP, Intel® Core™2 Duo (L7400) 1.5 GHz, 4MB L2, 1GB SDRAM
ITC-320	ITC320-RC52-G0000	4HP, Intel® Core™2 Duo (L7400) 1.5 GHz, 4MB L2, 1GB SDRAM, version with VGA (-20°C to +75°C)
ITC-320	ITC320-RC22-00000	4HP, Intel® Core™ Duo (U2500) 1.2 GHz, 2MB L2, 1GB SDRAM
ITC-320	ITC320-RC02-00000	4HP, Intel® Celeron® M (423) 1.07 GHz, 1MB L2, 1GB SDRAM
RTM	PB-IT3-000	Rear Transition Module
USB Flash Disk	FDM-USB-4GB-00	4GB USB Flash Disk Module
USB Flash Disk for RC	FDM-USB-4GB-IV	4GB USB Flash disk for use in RC environments
Rack	RTOP-4S200-00	4-slot 200W Development Rack
VGA tool	ADAP-VGA	Tooling board with VGA connector for IEEE -RC boards

Table 4: Order Code

1.3.4 Board-Specific Information

The ITC-320 is a CompactPCI single-board computer based on Intel's technology and is specifically designed for use in highly integrated platforms with solid mechanical interfacing for a wide range of industrial environment applications.

Some of the ITC-320's outstanding features are:

- Supports all Intel® Celeron® M, Intel® Core™ Duo and Intel® Core™ 2 Duo microprocessors with 533/667 MHz FSB
- Up to 4 MB L2 cache on die, running at CPU speed
- Intel® 3100 chipset (Whitmore Lake) Integrated Memory Hub Controller (IMCH) and Integrated I/O Hub Controller (IICH)
- 1 GB DDR2-SDRAM memory running at 400 MHz. Contact Kontron, for 2 GB DDR2-SDRAM availability
- PCI Express:
 - ▶ one 4-lane PCI Express port (4x) configurable in x4 or 4x1; available on rear I/O
 - ▶ one 4-lane PCI Express port (4x) dedicated to Gigabit Ethernet controller
 - ▶ one 4-lane PCI Express port (4x) dedicated to Graphics chipset
- Volari™ Z11, ultra low powered Graphics chipset
 - ▶ Analog display support up to 2048 x 1536 pixels at 75 Hz
 - ▶ VGA connector available on ITC-320 front panel



ITC-320-RC Specificities

Boards with Order Code ITC320-RCX2-G0000 have only the VGA connector available on the front RC Only panel.

Boards with Order Code ITC320-RCX2-00000 have no VGA connector available on the front panel. An adaptor kit, Order Code ADAP-VGA, fitted with a VGA connector, is available for BIOS maintenance/debug purposes.

- Two Gigabit Ethernet interfaces (Intel® 82571EB). Refer to section 1.3.2 "I/O Interfaces" page 6
- Up to four Serial ATA (SATA) interfaces (150 MB/S). Refer to section 1.3.2 "I/O Interfaces" page 6
- Up to six USB ports. Refer to section 1.3.2 "I/O Interfaces" page 6
- Up to four Serial ports. Refer to section 1.3.2 "I/O Interfaces" page 6
- One PS/2 keyboard and mouse port. Refer to section 1.3.2 "I/O Interfaces" page 6
- Low Pin Count (LPC) interface support
- SMBus 2.0 interface support
- AMI on AMI 16 Mbit FWH (FirmWare Hub) Flash Memory
- Compatible with CompactPCI® Standards: PICMG® 2.0 R3.0 and PICMG® 2.1 R2.0
- Watchdog timer integrated in Intel® 3100. Two stages, system reset and NMI, with programmable intervals from 1 μs to 1 second, or from 1 ms to 1050 seconds
- Battery available on ITC-320 and ITC-322.



ITC-320-RC Specificities

Battery not available on Rugged Conduction-Cooled boards (ITC-320-RC)
RC Only

- SA (Standard Commercial) and RC (Rugged Conduction-Cooled) environmental classes

1.4 System Relevant Information

The following system relevant information is general in nature but should still be considered when developing applications using the ITC-320.

SUBJECT	INFORMATION
System Configuration	The ITC-320 system controller board can support up to 7 peripheral boards with 32-bit and 33 MHz.
Master/Slave Functionality	The ITC-320 can operate only as a master board.
Board Location in the System	The ITC-320 board must be installed in a system slot of a CompactPCI backplane.
Hot Swap Compatibility	The ITC-320 supports the addition or removal of other boards whilst in a powered-up state. Individual clocks for each slot and ENUM signal handling are in compliance with the PICMG 2.1 Hot Swap specification.
Hardware Requirements	The ITC-320 can be installed in any CompactPCI 3U rack.
Operating Systems	The ITC-320 can operate under the following operating system: - Linux Please contact Kontron for further information concerning other operating systems.

Table 5: System Relevant Information

1.5 Board Diagrams

The following diagrams provide additional information concerning board functionality and component layout.

1.5.1 Functional Block Diagram

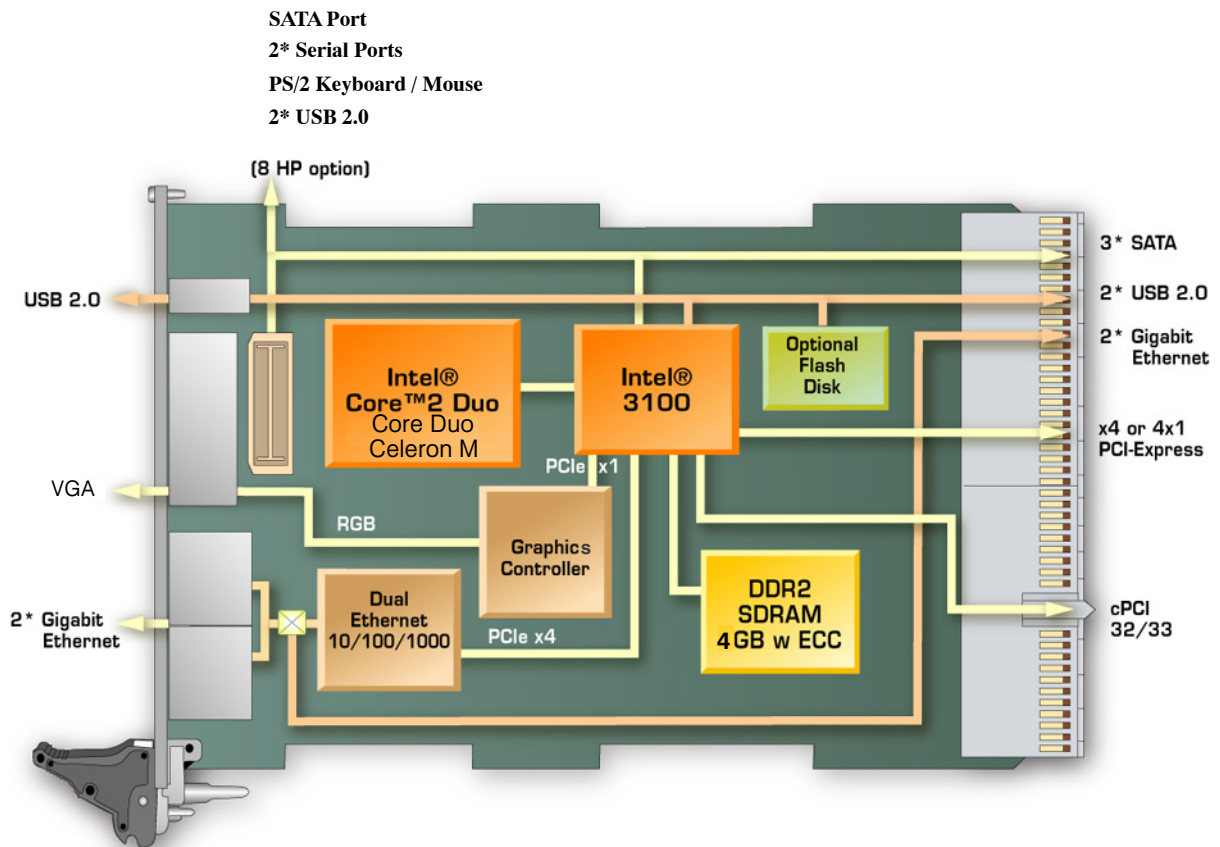


Figure 3: ITC-320 Functional Block Diagram

1.5.2 ITC-320 Layout

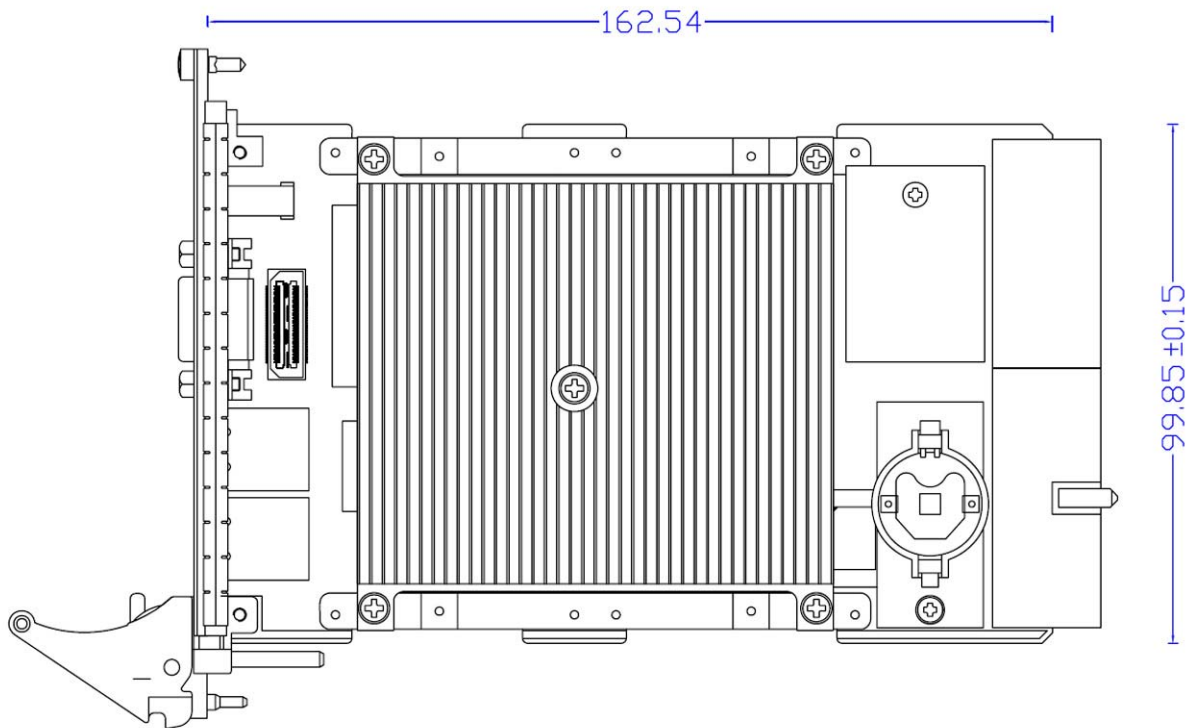


Figure 4: ITC-320 Layout

1.5.3 ITC-320 Front Panel

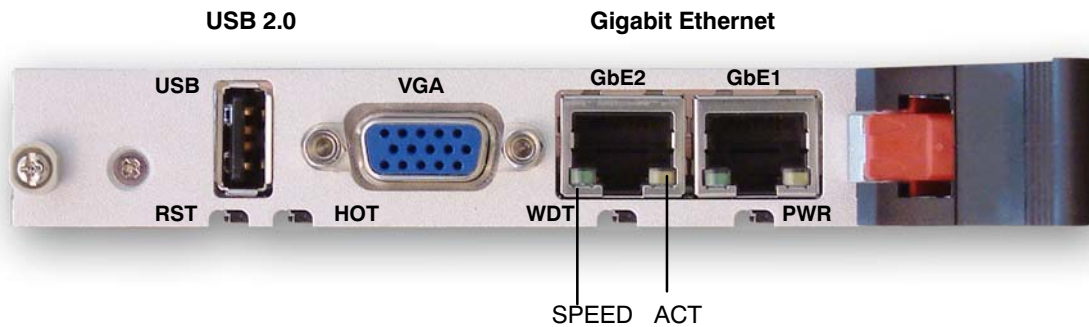


Figure 5: ITC-320 Front Panel

» Reset Button

- ▶ RST

» Temperature LED

- ▶ HOT (red): CPU Overtemperature Status, connected to the CPU signal PROCHOT

» Status LEDs

- ▶ WDT (yellow): Watchdog Status
- ▶ PWR (green): Power Supply Status

» Gigabit Ethernet LEDs

Status		SPEED LED green	ACT LED yellow
Ethernet link is not established		OFF	OFF
10/100 Mbps	Ethernet link established	OFF	ON
	Ethernet Link Activity	OFF	BLINK
1000 Mbps	Ethernet link established	ON	ON
	Ethernet Link Activity	ON	BLINK

Table 6: Ethernet LEDs Status Definition

1.5.4 ITC-320 Components Layout

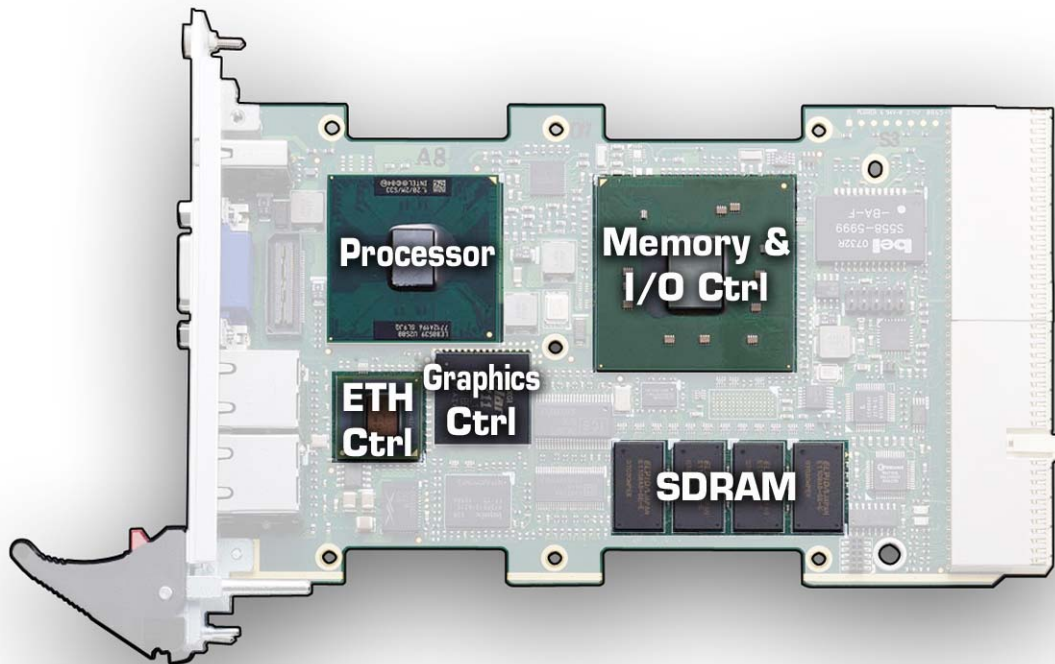


Figure 6: ITC-320 Components Layout (Top View)

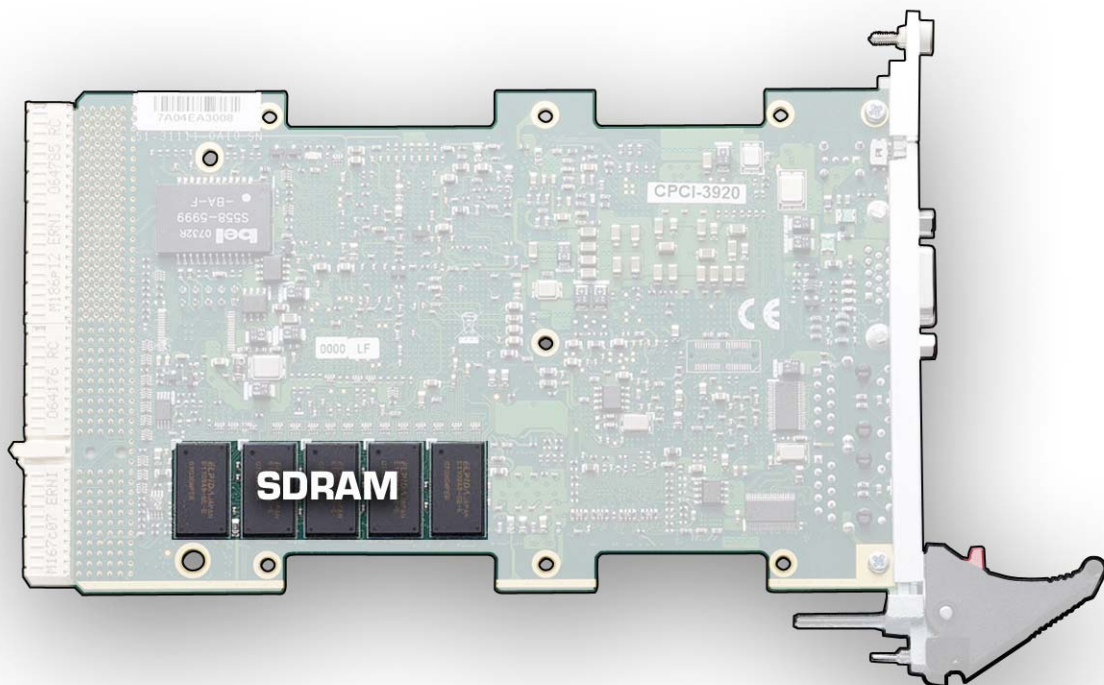


Figure 7: ITC-320 Board Components Layout (Bottom View)

1.6 Technical Specification

ITC-320	SPECIFICATIONS
Processor and Memory	
CPU	<p>The ITC-320 supports the following microprocessors:</p> <ul style="list-style-type: none"> - Intel® Celeron® M <ul style="list-style-type: none"> Intel® Celeron® M processor LV 423, 1.07 GHz, 533 MHz FSB, 1MB L2 cache - Intel® Core™ Duo <ul style="list-style-type: none"> Intel® Core™ Duo processor U2500 (ULV), 1.2 GHz, 533 MHz FSB, 2 MB L2 cache - Intel® Core™ 2 Duo <ul style="list-style-type: none"> Intel® Core™ 2 Duo processor L7400 (LV), 1.5 GHz, 667 MHz FSB, 4 MB L2 cache
Memory	<p>Main Memory:</p> <ul style="list-style-type: none"> - 1 GB DDR2-400 SDRAM memory soldered - 400 MHz FSB - Error Checking and Correction (ECC) provided <p>Cache structure:</p> <ul style="list-style-type: none"> - 64 kB L1 on die full speed processor cache <ul style="list-style-type: none"> - 32 kB for instruction cache - 32 kB for data cache - Up to 4 MB L2 on die full speed processor cache <p>System Flash Memory:</p> <ul style="list-style-type: none"> - 16 Mbit FWH Flash Memory for BIOS <p>User Flash Memory:</p> <ul style="list-style-type: none"> - Socket for USB Flash Disk, Low Profile, 2.54 pitch connector, up to 8 GB

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ITC-320	SPECIFICATIONS
Chipset	
Intel® 3100 Whitmore Lake	<p>Integrated Memory Controller Hub (IMCH) and Integrate I/O Controller HUB (IICH)</p> <ul style="list-style-type: none"> - Supports Intel® Celeron® M LV processor, Intel® Core™ Duo ULV processor and Intel® Core™ 2 Duo LV processor - 533/667 MHz FSB - System memory supports 400 MHz buffered ECC/register DDR2 Mini-RDIMM SDRAM - PCI Express interface in IMCH configurable in 1x8, 2x4 or 2x1 - PCI Express interface in IICH configurable in 4x1 or 1x4 - Four Serial ATA ports, 150 MB/s, integrate AHCI controller - Four USB 2.0 ports - PCI 32-bit/33 MHz Bus interface - SMBus 2.0 interface support - Low Pin Count (LPC) I/F - Firmware Hub I/F support s VIOS memory size up to 8 MB - Package: FCBGA3, 1284-pin, 40x40 mm <p>ITC-320 includes a PCI arbiter CPLD to generate 7 pairs REQ/GNT to meet PICMG® 2.0 R 3.0 specification.</p>
XGI Volari™ Z11	<ul style="list-style-type: none"> - PCI-Express 1x controller and 64-bit 2D graphics engine - Flexible 16-bit DDR2 memory interface - Configurable 3.3V DVO digital interface to support a thrid party LVDS/TMDS transmitter - High 2D performance with a memory interface supporting a bandwidth of up to 1 GB/S (DDR2@250 MHz) - 256-ball, 19x19 mm BGA lead free

ITC-320	SPECIFICATIONS
Interfaces	
CompactPCI	Compliant with CompactPCI Specification PICMG® 2.0 R 3.0 and PICMG® 2.1 R 2.0 - System master operation - 32-bit / 33 MHz master interface
Rear I/O	The following interfaces are routed to the Rear I/O connector J2: - 2x USB 2.0 - 2x Gigabit Ethernet - 3x SATA - 7x General Purpose Inputs and Outputs Signals (GPIO) - x4 or 4x1 PCI-Express links
Hot Swap	The ITC-320 is not hot-swappable but supports the addition or removal of other boards whilst in a powered-up state. Individual clocks for each slot and Enum signal handling are in compliance with the PICMG® 2.1 Hot Swap Specification.
VGA	XGI Volari™ Z11 PCI-Express x1 graphics Controller - 64-bit 2D Accelerator - Up to 1600 x 1200 at 70 NI 16 M colors
Gigabit Ethernet	Two 10 Base-T/100 Base-TX/1000 Base-T Gigabit Ethernet interfaces based on the Intel® 82571EB Ethernet PCI Express bus controller individually switchable to front or rear I/O - Dual RJ-45 connector on the front panel - Automatic mode recognition - Automatic cabling configuration recognition Cabling requirement: Category 5, UTP, four-pair cabling
USB	Four USB ports supporting UHCI and EHCI on ITC-320: - One onboard to connect the optional Flash Disk - One USB 2.0 connectors on the front panel - Two USB 2.0 connectors on the Rear I/O interface
Mass Storage	SATA: Integrated Serial ATA Host Controllers - One SATA port available for a 2.5" HDD (ITC-322 onboard connector) - Three ports available on Rear I/O - Data transfer rate up to 3 Gbit/s
I/O Extension Interfaces	I/O extension interfaces (ITC-322): - One SATA port available for a 2.5" HDD (ITC-322 onboard connector) - Two USB 2.0 (ITC-322 Front panel connectors) - PS/2 keyboard and mouse (ITC-322 Front panel connector) - One UART, EIA-232 compatible (ITC-322 Front panel connector) - One UART EIA-232/422/485+ configurable (ITC-322 Front panel connector)
Sockets	
Front Panel Connectors	- VGA: 15-pin D-Sub connector - USB: one 4-pin connector - Ethernet: two RJ-45 connectors
Onboard Connectors	- CompactPCI Connector J1 and J2 - USB: onboard connector for Compact Flash module - I/O extension connector for 2nd layer board (ITC-322) - RTC connector - Debug connector

ITC-320	SPECIFICATIONS
Hardware Monitoring	
LEDS	System status: - WDT (yellow): Watchdog - PWR (green): Power Supply Status - HOT (red): CPU Overtemperature Status, connected to the CPU signal PRO-CHOT Gigabit Ethernet status: - SPEED (green): Network Speed - ACT (yellow): Network/Link Activity
Watchdog	Two stages, System reset and NMI, with programmable interval, 1 ms to 1050 sec.
Thermal Management	Intel SpeedStep® Technology
Software	
Software BIOS	Onboard 16 Mbit FWH Flash Memory - Flash-write protection implemented under software control BIOS features: - QuickBoot - QuietBoot - BootBlock - LAN boot capability for diskless systems (standard PXE) - Boot from USB floppy disk drive - BIOS legacy support for USB keyboards - Plug and Play capability - BIOS parameters are saved in the EEPROM - Board serial number is saved within the EEPROM - PC Health Monitoring
Operating Systems	Operating systems supported: - Linux Please contact Kontron for further information concerning other operating systems.

ITC-320	SPECIFICATIONS												
General													
Mechanical	3U, 4HP, CompactPCI compliant form factor												
Power Consumption	<table> <tr> <td>Under OS</td> <td>Idle</td> <td>100 % CPU</td> </tr> <tr> <td>- Intel® Core™ 2 Duo 1.5 GHz</td> <td>29W</td> <td>36W</td> </tr> <tr> <td>- Intel® Core™ Duo 1.2 GHz</td> <td>24 W</td> <td>27 W</td> </tr> <tr> <td>- Intel® Celeron® M 1.07 GHz</td> <td>22 W</td> <td>24 W</td> </tr> </table>	Under OS	Idle	100 % CPU	- Intel® Core™ 2 Duo 1.5 GHz	29W	36W	- Intel® Core™ Duo 1.2 GHz	24 W	27 W	- Intel® Celeron® M 1.07 GHz	22 W	24 W
Under OS	Idle	100 % CPU											
- Intel® Core™ 2 Duo 1.5 GHz	29W	36W											
- Intel® Core™ Duo 1.2 GHz	24 W	27 W											
- Intel® Celeron® M 1.07 GHz	22 W	24 W											
Temperature Range (SA environmental class)	<p>Operational: 0°C to +55°C Standard (depending on processor version and airflow in the system)</p> <p>Storage: -40°C to +85°C Without hard disk and without battery</p> <p>NOTE: When a battery is installed, refer to the operational specifications of the battery as this determines the storage temperature of the ITC-320 (See "Battery" below).</p>												
Climatic Humidity (SA environmental class)	90% non-condensing												
Dimensions	99.85 mm x 162.54 mm												
Board Weight (SA environmental class)	320 g (with heat sink and front panel)												
MTBF	Refer to section 1.6.1 "MTBF Data" page 20												
Battery	<p>3.0V lithium battery for RTC with battery socket. Recommended types: - VARTA CR2032</p> <p>Temperature ranges:</p> <p>Operational (load): -20°C to +70°C typical (refer to the battery manufacturer's specifications for exact range)</p> <p>Storage (no load): -55°C to +70°C typical (no discharge)</p>												
Real Time Clock (RTC) stability	<p>Intel 3100 chipset (Whitmore Lake) offers internal RTC feature. This RTC stability depends on an external 32.768 KHz oscillator. This external oscillator has a parabolic coefficient of 0.4 ppm/°C² and +/-20 ppm stability at 25°C. At first order, only considering external oscillator parameters, Intel 3100 chipset (Whitmore Lake) RTC stability for ambient temperature is 20 ppm at 25°C. 20 ppm stability is equivalent to 10 mn/year, worse case.</p> <p>External oscillator parabolic coefficient : 0.4 ppm/°C². External oscillator stability : +/-20 ppm at 25°C.</p>												

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Table 7: ITC-320 Main Specifications



For a detailed description of the ITC-322 (8HP version), refer to the Technical Specifications table in Chapter 7 "ITC-322 Characteristics", section 7.2 "Technical Specifications" page 72.



For a detailed description of the ITC-320-RTM (Rear Transition Module), refer to the Technical Specifications table in Chapter 8 "ITC-320-RTM Characteristics", section 8.2 "Technical Specifications" page 87.

1.6.1 MTBF Data

Calculations are made according to the standard MIL-HDBK217F-2 for following types of environment:

- > Ground Benign (GB)
- > Air Inhabited Cargo (AIC)
- > Naval Sheltered (NS),
- > Air Rotary Wing (ARW)

» ITC320-SA52-00000 - Intel® Core™ 2 Duo

Ground Benign (Hours)	25°C: 189 431	40°C: 152 767
Air Inhabited Cargo (Hours)	40°C: 27 498	
Naval Sheltered (Hours)	25°C: 30 553	40°C: 27 498
Air Rotary Wing (Hours)	25°C: 8 708	

Table 8: ITC320-SA52-0000 MTBF Data

» ITC320-SA22-00000 - Intel® Core™ Duo

Ground Benign (Hours)	25°C: 181 163	40°C: 146 099
Air Inhabited Cargo (Hours)	40°C: 26 298	
Naval Sheltered (Hours)	25°C: 29 220	40°C: 26 298
Air Rotary Wing (Hours)	25°C: 8 328	

Table 9: ITC320-SA22-0000 MTBF Data

» ITC320-SA02-00000 - Intel® Celeron® M

Ground Benign (Hours)	25°C: 190 939	40°C: 153 983
Air Inhabited Cargo (Hours)	40°C: 27 717	
Naval Sheltered (Hours)	25°C: 30 797	40°C: 27 717
Air Rotary Wing (Hours)	25°C: 8 777	

Table 10: ITC320-SA02-0000 MTBF Data



Refer to section 7.2.1 page 73 for MTBF Data related to the ITC-322 board.



Refer to section 9.5 page 101 for MTBF Data related to the ITC-320-RC board.

1.7 Software Support

Kontron is one of the few CompactPCI and VME vendors providing inhouse support for most of the industry-proven real-time operating systems that are currently available. Due to its close relationship with the software manufacturers, Kontron is able to produce and support BSPs and drivers for the latest operating system revisions thereby taking advantage of the changes in technology.

Finally, customers possessing a maintenance agreement with Kontron can be guaranteed hotline software support and are supplied with regular software updates. A dedicated web site is also provided for online updates and release downloads.

1.8 Standard

This Kontron product complies with the requirements of the following standards.

TYPE	ASPECT	DESCRIPTION
CE	Emission	EN55022 EN61000-6-3
	Immission	EN55024 EN61000-6-2
	Electrical Safety	EN60950-1
Mechanical	Mechanical Dimensions	IEEE1101.10
Environmental	WEEE	Waste electrical and electronic equipment
	RoHS	Restriction of the use of certain hazardous substances in electrical and electronic equipment
Environmental Specifications	Conformal Coating	Optional
SA Standard Commercial	Airflow	1.5 m/s without throttling at 55°C
	Temperature VITA 47-Class AC1 VITA 47-Class C1	Cooling Method: Convection Operating: 0°C to +55°C Storage: -40°C to +85°C
	Vibration Sine (Operating)	2g / 20-500 Hz acceleration / frequency range
	Random	VITA 47-Class V1
	Shock (Operating)	20g / 11ms peak acceleration / shock duration half sine
	Altitude (Operating)	-1,640 to 15,000 ft
	Climatic Humidity	90% non-condensing
	Environmental Specifications	Refer to section 9.4 "Environmental Specifications" page 100.
RC Rugged Conduction-Cooled		

Table 11: Standards

1.9 Related Publications

The following publications contain information relating to this product.

PRODUCT	PUBLICATION
ITC-320 Boards	ITC-320 Hardware Release Notes CA.DT.A53 Releases Notes Fedora 9 for ITC-320 SD.DT.F29
CompactPCI Systems and Boards	CompactPCI Specification 2.0, Rev. 3.0 CompactPCI Specification 2.1, Rev. 2.0 CompactPCI System Management Specification PICMG 2.9 Rev. 1.0 CompactPCI Hot Swap Specification PICMG 2.1 Rev. 2.0
	Hot Swap Specification PICMG 2.1
Serial ATA	Serial ATA 1.0a Specification

Table 12: Related Publications

Chapter 2 - Functional Description

2.1 CPU, Memory and Chipset

2.1.1 CPU

» Intel® Core™ Duo and Intel® Core™ 2 Duo

The ITC-320 supports the latest Intel® Core™ Duo and Intel® Core™ 2 Duo processor family up to speeds of 1.5 GHz with up to 667 MHz FSB.

The Intel® Core™ Duo consists of two cores and up to 2 MB L2 cache shared by both cores. The Intel® Core™ 2 Duo consists of two cores, up to 4 MB L2 cache shared by both cores, Intel Extended Memory 64 Technology (Intel EM64T), and enhanced address range for up to 64 GB memory. The Intel® Core™ Duo and the Intel® Core™ 2 Duo processors deliver optimized power-efficient computing and outstanding dual-core performance with low power consumption.

The Intel® Core™ Duo and the Intel® Core™ 2 Duo support the latest Intel's Virtualization Technology (VT), which allows a platform to run multiple operating systems and applications in independent partitions, such as performing system upgrades and maintenance without interrupting the system or the application, keeping software loads and virus attacks separate, combining multiple servers in one system, etc. With processor and I/O enhancements to Intel's various platforms, Intel Virtualization Technology improves the performance and robustness of today's software-only virtual machine solutions.

Furthermore, the Intel® Core™ Duo and the Intel® Core™ 2 Duo also support the Intel SpeedStep® technology which enables real-time dynamic switching of the voltage and frequency between several modes. This is achieved by switching the bus ratios, core operating voltage, and core processor speeds without resetting the system.

The following list sets out some of the key features of the Intel® Core™ Duo and the Intel® Core™ 2 Duo processors:

- Two mobile execution cores in one single processor
- Support of Intel's Virtualization Technology (Vanderpool)
- Support of Intel Architecture with Dynamic Execution
- Outstanding dual-core performance with low power consumption
- On die, primary 32 KB instruction cache and 32KB write-back data cache
- On die, L1 and L2 cache with Advanced Transfer Cache Architecture
 - ▶ Intel® Core™ Duo processor (ULV), 1.2 GHz, 533 MHz FSB, 2 MB L2 cache
 - ▶ Intel® Core™ 2 Duo processor (LV), 1.5 GHz, 667 MHz FSB, 4 MB L2 cache
- Advanced Branch Prediction and Data Prefetch Logic
- Streaming SIMD Extensions 3 (SSE3)
- Up to 667 MHz, Source-Synchronous Front Side Bus (FSB)
- Advanced Power Management features including Enhanced Intel SpeedStep technology
- Intel Extended Memory 64 Technology for 64-bit computing (only with the Intel® Core™ 2 Duo)
- Enhanced address range for up to 64 GB memory (only with the Intel® Core™ Duo)

» Intel® Celeron® M

The ITC-320 supports the low power 1.07 GHz Intel® Celeron® M processor with 533 MHz FSB.

The Intel® Celeron® M consists of one core and 1 MB L2 cache.

The following list sets out some of the key features of the Intel® Celeron® M processor:

- Supports Intel architecture with dynamic execution
- High-performance, low-power core featuring architectural innovations like micro-ops fusion and advanced stack management that reduce the number of micro-ops handled by the processor.
- On-die, primary 32-kB instruction cache and 32-kB, write-back, data cache
- On-die, 1 MB second level cache with Advanced Transfer Cache architecture
- Advanced branch prediction and data prefetch logic
- Streaming SIMD extensions 2 (SSE2) that enables breakthrough levels of performance in multimedia applications including 3D graphics, video decoding/encoding, and speech recognition.
- 533-MHz, source-synchronous front side bus (FSB)
- Advanced power management features
- Maintained support for MMX™ technology (technology designed to accelerate multimedia and communications software)
- Compatible with IA-32 software

» Supported Processors, Maximum Power Dissipation

The following tables indicate the processors supported on the ITC-320 and their maximum power dissipation.

SPEED	Intel® Celeron® M 1.07 GHz (LV ⁽¹⁾)	Intel® Core™ Duo 1.2 GHz (ULV ⁽²⁾)	Intel® Core™ 2 Duo 1.5 GHz (LV ⁽¹⁾)
PACKAGE	µFCBGA	µFCBGA	µFCBGA
L2 CACHE	1 MB	2 MB	4 MB
FSB	533 MHz	533 MHz	667 MHz

(1) LV: Low Voltage

(2) ULV: Ultra low Voltage

Table 13: Processors Supported on the ITC-320

FREQUENCY MODE	Intel® Celeron® M 1.07 GHz (LV) 1 MB L2 Cache	Intel® Core™ Duo 1.2 GHz (ULV) 2 MB L2 Cache	Intel® Core™ 2 Duo 1.5 GHz (LV) 4 MB L2 Cache
Maximum Power HFM ⁽³⁾	5.5W	9.0W	17W

(3) HFM: High Frequency Mode (maximum frequency of the CPU)

Table 14: Maximum Power Dissipation of the Processors (CPU only)

2.1.2 Memory

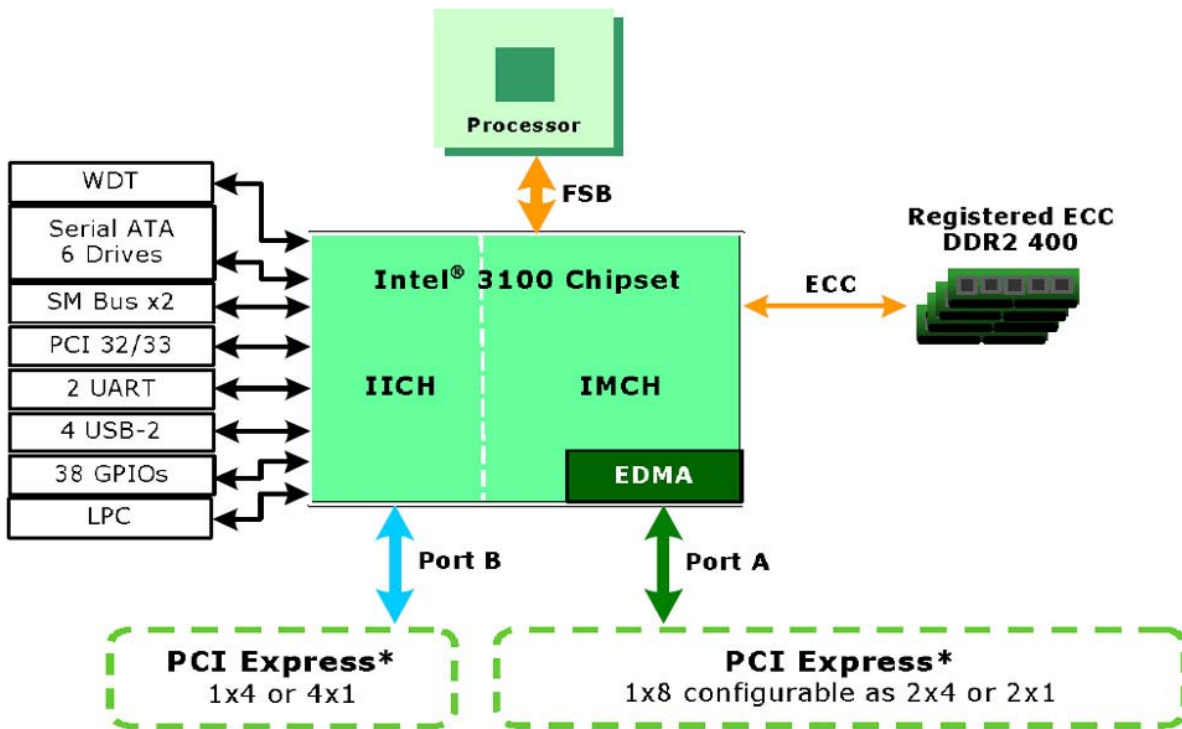
The ITC-320 supports a single soldered channel DDR2 memory with Error Checking and Correcting (ECC) running at 400 MHz. The available memory module configuration is 1 GB. 2 GB available on request, please contact your Kontron representative.



Memory configuration changes are only permitted to be performed at the factory. Failure to comply with the above may result in damage to your board or improper operation.

2.1.3 Intel® 3100 Chipset Overview

The Intel® 3100 Chipset is a single integrated chip that contains the functionality of a Memory Controller Hub and an I/O Controller Hub (see Figure 8). In this document the Memory Controller Hub unit and I/O Controller Hub unit in the Intel® 3100 Chipset are referenced as IMCH (Integrated Memory Controller Hub) and IICH (Integrated I/O Controller Hub) respectively.



* Other names and brands may be claimed as the property of others.

Figure 8: Intel® 3100 Chipset Block Diagram

» PCI Express

The Intel® 3100 Chipset provides one configurable x8 PCI Express interface with a maximum theoretical bandwidth of 4 GByte/s. The x8 PCI Express interface may alternatively be configured as two independent x4 PCI Express interfaces with a maximum theoretical bandwidth of 2 GBytes/s each. The Intel® 3100 Chipset also supports an additional x4 PCI Express interface with a maximum theoretical bandwidth of 2 GBytes/s which may alternatively be configured as four independent x1 PCI Express interfaces.

» IICH

I/O Controller Hub (IICH) functions are integrated into the Intel® 3100 Chipset, eliminating the requirement for a legacy I/O bridge.

I/O Controller Hub Feature set comprises:

- PCI Express Interface
- Low-Pincount (LPC) Interface
- Firmware Hub (FWH) Interface
- Integrated Serial ATA (SATA) Host Controllers:
 - ▶ Independent DMA operation on six ports
 - ▶ Four ports in SATA 1.0a and AHCI mode
 - ▶ Six ports in AHCI mode only
 - ▶ Data transfer rates up to 150 Mbyte/s
- Two USB controllers with up to four USB 2.0 ports:
 - ▶ One EHCI USB 2.0 Host Controller to support a total of four ports (shared with the UHCI ports)
 - ▶ Two UHCI Host Controllers to support a total of four ports (shared with the EHCI ports)
- Interrupt Controller
- Power Management Logic
- DMA Controller
- Timers Based on 82C54
- High Precision Event Timers (HPET)
- Real Time Clock with 256-byte Battery-backed CMOS RAM
- System TCO Reduction Circuits
- SMBus
- Watchdog Timers
- PCI 2.3 Interface
- Two fully functional serial ports
- 38 General Purpose I/Os (GPIO)

» IMCH

The Intel® 3100 Chipset provides an integrated memory controller for direct-connection to one channel of DDR2-400 (unstacked) registered memory devices with ECC. Peak theoretical memory data bandwidth using DDR2-400 is 3.2 GByte/s.

2.1.4 Volari™ Z11 Graphics Controller

Volari™ Z11 GPU is the extreme programmable GPU of the XGI™ 2D GPU family. The Volari™ Z11 integrates a PCI-Express 1x controller and a 64-bit 2D graphics engine. It offers a flexible 16-bit DDR-II memory interface. The Z11 also incorporates a configurable 3.3V DVO digital interface to support a third party LVDS/TMDS transmitter. It can achieve high 2D performance with a memory interface supporting a bandwidth of up to 1 GB/s (DDR-II @250MHz).

Volari™ Z11 GPU main features:

- PCI-Express 1x Bus Interface
 - ▶ Supports PCIE local bus standard Revision 1.1 compliant
- High Performance 2D Accelerator
 - ▶ Built-in hardware command queue
 - ▶ Built-in Direct Draw Accelerator
 - ▶ Built-in GDI 2000 Accelerator
 - ▶ Built-in an 1T pipelined 64-bit BITBLT graphics engine
 - ▶ Supports memory-mapped, zero wait-state, burst engine write
 - ▶ Built-in 64x64x2 bit-mapped mono hardware cursor
- High Efficient BroadBahn™ Memory Architecture
 - ▶ Supports DDR-II SDRAM memory
 - ▶ 64 MB memory configuration
 - ▶ Supports VGA BIOS auto memory size detection
- High Performance Flat Panel Display Interface
 - ▶ Supports graphics mode up to 1600x1200@70NI 16M colors
- High Integration
 - ▶ Built-in CRT FIFO to support ultra high resolution graphics modes and reduce CPU wait-state
 - ▶ Built-in programmable 24-bit true-color RAMDAC with 230 MHz pixel clock
- Resolution, Color & Frame Rate
 - ▶ Supports 230 MHz pixel clock
 - ▶ Supports VESA standard super high resolution graphics modes
 - ▶ 4:3 resolution up to 1600x1200 256/32K/64K/16M colors 70Hz NI
 - ▶ Wide Screen resolution modes
 - ▶ Low resolution modes
 - ▶ Supports virtual screen up to 4096x4096
- Power Management
 - ▶ Supports power management for VGA monitor
- Multimedia Application
 - ▶ Supports DDC1, DDC2B and DDC 3.0 specifications
 - ▶ Supports RAMDAC snoop fir multimedai applications
- Miscellaneous
 - ▶ Lead-free package
 - ▶ RoHS compliance

2.2 ITC-320 Connectors Layout

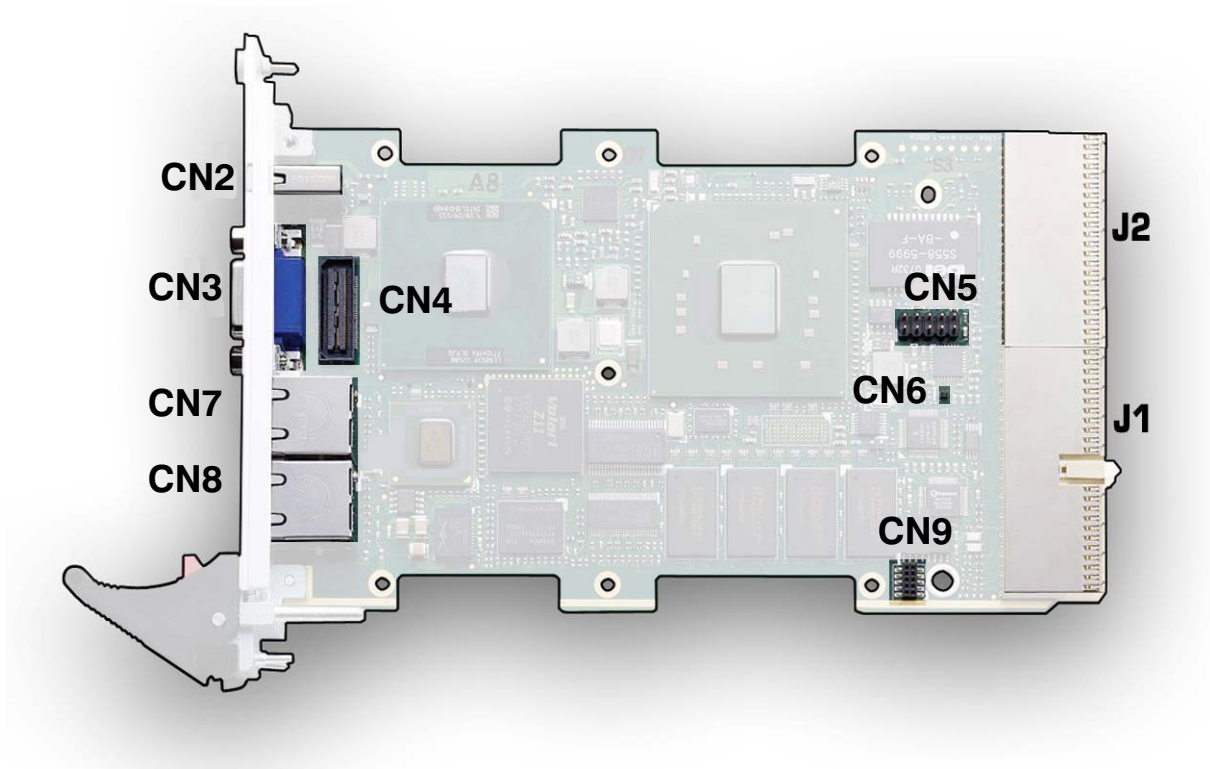


Figure 9: ITC-320 Connectors Layout

- » J1, J2 See section 2.4.4 "CompactPCI Bus Interface" page 42
- » CN2 See section 2.4.1 "USB Interfaces" page 35
- » CN3 See section 2.4.2.3 "VGA Analog Interface" page 39
- » CN4 See section 2.4.5 "Second Layer Interface" page 47
- » CN5 See section 2.4.1 "USB Interfaces" page 35
- » CN6 See section 2.3.3 "Battery" page 32
- » CN7, CN8 See section 2.4.3 "Dual Gigabit Ethernet" page 40
- » CN9 Connector used for debug purpose only. Reserved usage, please contact your Kontron representative for more information on this topic.

2.3 Peripherals

The following standard peripherals are available on the ITC-320 board:

- Timer, refer to section 2.3.1 page 30
- Watchdog Timer, refer to section 2.3.2 page 31
- Battery, refer to section 2.3.3 page 32
- Reset, refer to section 2.3.4 page 33
- SMBus Devices refer to section 2.3.5 page 34
- Thermal Management / System Monitoring, refer to section 2.3.6 page 34
- FWH Flash Memory, refer to section 2.3.7 page 34

2.3.1 Timer

The ITC-320 is equipped with the following timers:

- Real-Time Clock

The IICH contains real-time clock with 256-byte of batterybacked RAM.

The real-time clock performs timekeeping functions and includes 256 bytes of general purpose battery-backed CMOS RAM. Features include an alarm function, programmable periodic interrupt and a 100-year calendar. All battery-backed CMOS RAM data remains stored in an additional EEPROM. This prevents data loss in case the ITC-320 is operated without battery.

- Counter/Timer

Three 8254-style counter/timers are included on the ITC-320 as defined for the PC/AT (System Timer, Refresh Request, Speaker Tone Output).

- In addition to the three 8254-style counters, the IICH includes three High Precision Event Timers (HPET) that may be used by the operating system. They are implemented as a single counter each with its own comparator and value register. They support One-shot and periodic interrupts.

2.3.2 Watchdog Timer

The ITC-320 provides a Watchdog Timer that is programmable for a timeout period ranging from 1 μ s to 1 second, or from 1 ms to 1050 seconds. Failure to trigger the Watchdog Timer in time results in a system reset, an interrupt, or NMI. In the dual-stage mode, a combination of both NMI, and reset if the Watchdog is not serviced. A hardware status flag will be provided to determine if the Watchdog Timer generated the reset when it times out.

The ITC-320 implements the internal Watchdog unit of the Intel® 3100 chipset and its LPC interface. The basic functions of the Watchdog Timer include:

- ▶ Setting the watchdog timeout interval
- ▶ Starting the timer countdown
- ▶ Selecting 1 step or 2 step Watchdog Timer
- ▶ Enabling or disabling the Watchdog Timer
- ▶ Reloading the timeout value to keep the Watchdog from timing out
- ▶ Setting the range of the timeout period from 1 μ s to 1 second, or from 1 ms to 1050 seconds

The primary function of the Watchdog Timer is to monitor the ITC-320 operation and to reset the system if a software application fails to function as programmed. The following Watchdog Timer functions may be controlled using a software application:

- ▶ Enabling and disabling
- ▶ Reloading timeout value

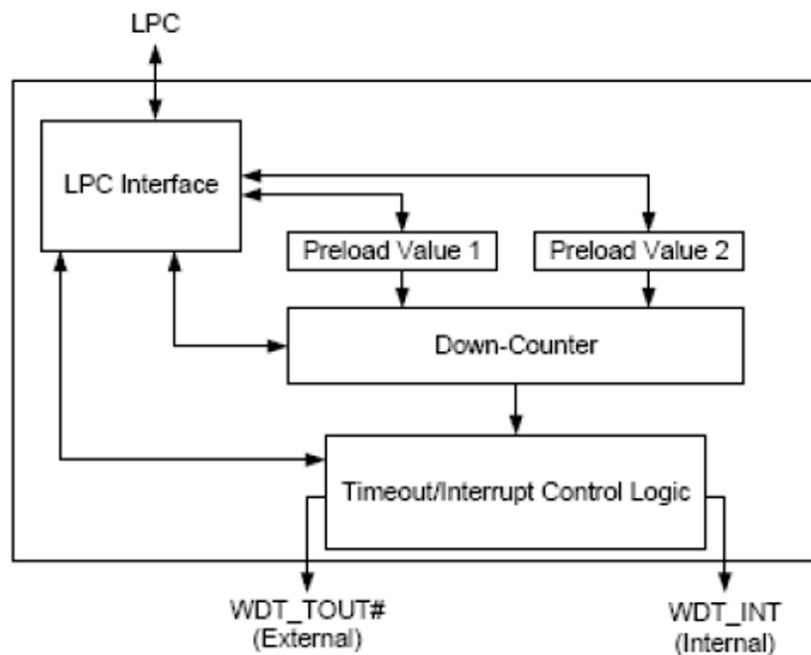


Figure 10: ITC-320 Watchdog Timer Architecture

2.3.3 Battery

The ITC-320 is provided with a 3.0 V "coin cell" lithium battery for the RTC.



ITC-320-RC Specificities

The battery is not available on the ITC-320-RC boards.

RC Only

The lithium battery must be replaced with an identical battery or a battery type recommended by the manufacturer. Suitable batteries include the VARTA CR2032.

To replace the battery, proceed as follows:

- Turn off power
- Press on the safety catch; the battery is ejected
- Remove the battery
- Place the new battery in the socket
- Make sure that you insert the battery the right way round. The plus pole must be on the top!



The user must be aware that the battery's operational temperature range is less than that of the ITC-320's storage temperature range (see Table 7 "ITC-320 Main Specifications" page 19).

For exact range information, refer to the battery manufacturer's specifications.



Care must be taken to ensure that the battery is correctly replaced.

The battery should be replaced only with an identical or equivalent type recommended by the manufacturer.

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

The typical life expectancy of a 225 mAh battery (VARTA CR2032) is 4-5 years with an average on-time of 8 hours per working day at an operating temperature of 30°C. However, this typical value varies considerably because the life expectancy is dependent on the operating temperature and the standby time (shutdown time) of the system in which it operates.

To ensure that the lifetime of the battery has not been exceeded, it is recommended to exchange the battery after 3-4 years.

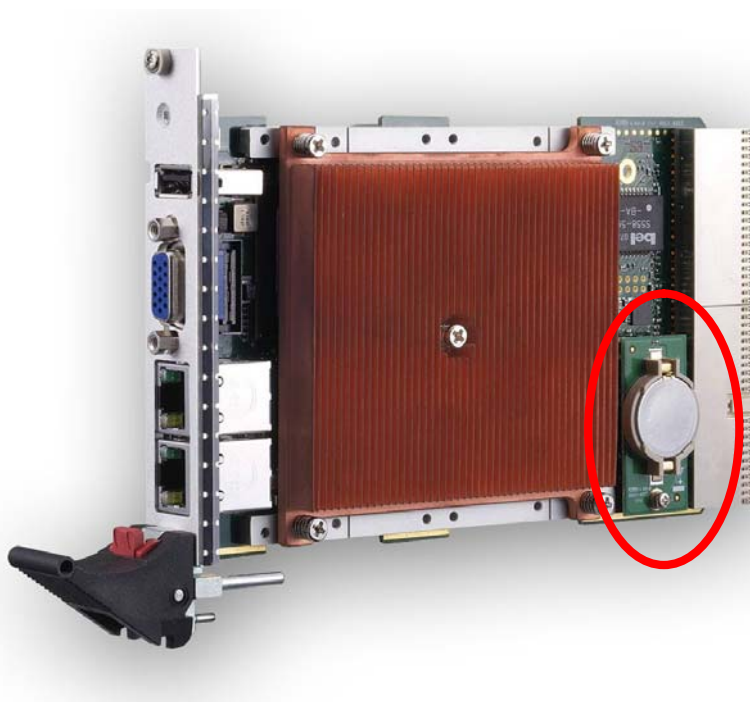


Figure 11: Battery Location

2.3.4 Reset

The ITC-320 is automatically reset by a precision voltage monitoring circuit that detects a drop in voltage below the operating limit of 4.85V for the 5V line and below 3.2V for the 3.3V line. Other reset sources include the watchdog timer and the front-panel push-button reset. The ITC-320 responds to any of these sources by initializing local peripherals.

A reset will be generated by the following conditions:

- > +5V supply falls below 4.1V (typ.)
- > +3.3V supply falls below 2.93V (typ.)
- > "RESET" button pressed
- > Watchdog overflow
- > CompactPCI backplane PRST# input (CompactPCI connector J2, pin C17)

2.3.5 SMBus Devices

The ITC-320 provides a System Management Bus (SMBus) for access to several system monitoring and configuration functions. The SMBus consists of a two-wire I²C bus interface.

The following table describes the function and address of every onboard SMBus device.

DEVICE	SMBUS ADDRESS
Clock Buffer	DCh
Clock Generator	D2h
SPD	A0h
EEPROM (Board VPD)	AEh

Table 15: SMBus Device Addresses

2.3.6 Thermal Management / System Monitoring

The IICH can be used to monitor several critical hardware parameters of the system, including power supply voltages, fan speeds and temperatures, all of which are very important for the proper operation and stability of a high-end computer system. The IICH provides an LPC bus interface.

The voltages +12 V, +5 V, +3.3 V, +2.5 V, and Vcore are supervised. One fan tachometer output can be measured using the IICH's FAN1 input. One pulse width modulation (PWM1) output can be used for FAN speed control.

The temperature sensors on the IICH monitor the CPU temperature and the ambient temperature around the IICH to ensure that the system is operating at a safe temperature level. If the CPU temperature is too high, the sensor automatically reduces the CPU clock frequency, depending on the mode chosen in the BIOS settings.

2.3.7 FWH Flash Memory

For simple BIOS updating a standard onboard 16 Mbit Firmware Hub device is used. The FWH stores both the system BIOS and graphics BIOS. It can be updated as new versions of the BIOS become available.

2.4 Board Interfaces

2.4.1 USB Interfaces

The ITC-320 supports four USB 2.0 ports:

- > one on the front panel,
- > one onboard to connect a Flash disk
- > two on the Rear I/O Module (ITC-320-RTM)

On the USB 2.0 front panel port, USB cable with up to 5 meters in length can be used.

On the USB 2.0 Rear I/O ports, it is strongly recommended to use a cable below 3 meters in length for USB 2.0 devices.

The USB 2.0 ports are high-speed, full-speed, and low-speed capable. Hi-speed USB 2.0 allows data transfers of up to 480 Mb/s - 40 times faster than a full-speed USB (USB 1.1).

One USB peripheral may be connected to each port.

To connect more USB devices than there are available ports, an external hub is required.

» USB Front Panel

PIN	SIGNAL	FUNCTION	I/O
1	VCC	VCC	--
2	USB1_D-	Differential USB-	I/O
3	USB1_D+	Differential USB+	I/O
4	GND	GND	--

Table 16: USB Connector CN2 Pinout

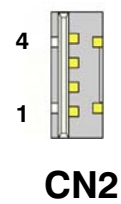


Figure 12: USB Connector CN2



The ITC-320 host interfaces can be used with maximum 500 mA continuous load current as specified in the Universal Serial Bus Specification, Revision 2.0. Short-circuit protection is provided. All the signal lines are EMI-filtered.

» USB onboard

The onboard USB device (CN5 connector) is used to connect an USB Flash Disk.

The following figure and table provide pinout information for the onboard USB connector CN5:

PIN	SIGNAL	FUNCTION	I/O
1	VCC	VCC	--
2	USB0_D-	Differential USB-	I/O
3	USB0_D+	Differential USB+	I/O
4	GND	GND	--
5	--	Not used	--
6	--	Not used	--
7	GND	GND	--
8	Reserved	Do Not Connect - Reserved	--
9	Reserved	Do Not Connect - Reserved	--
10	VCC	VCC	--

Table 17: USB onboard CN5 Pinout

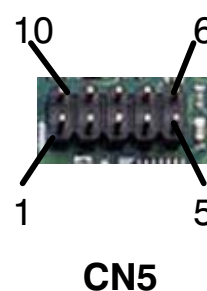


Figure 13: USB onboard Connector

USB Flash Disk Layout:

- ▶ Maximum space reserved for USB flash disk is 50 mm x 30 mm (LxW)
- ▶ The distance between connector and screw hole is 27.3 mm~27.9mm
- ▶ Maximum allowable connector height is 9.78 mm

Order Code for the USB flash disk:

FDM-USB-4GB-00: standard version

FDM-USB-4GB-IO: industrial version for use in extended temperature environments

FDM-USB-4GB-IV: industrial version with conformal coating for use with rugged versions

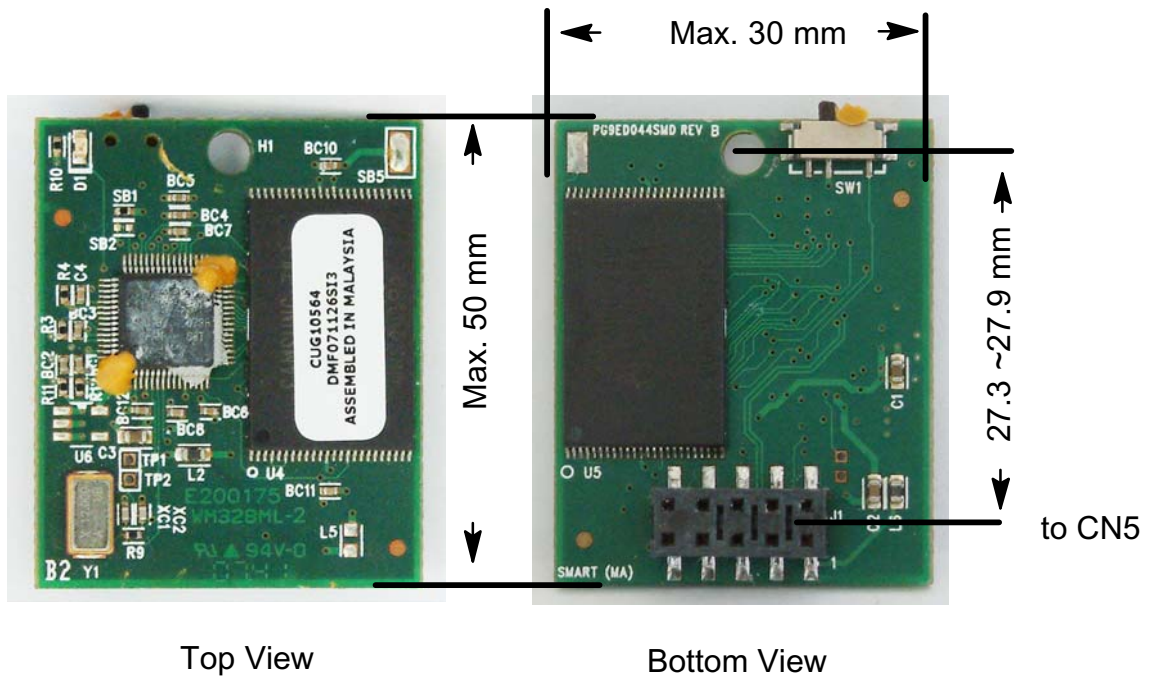


Figure 14: USB Flash Disk Overview

The USB Flash module is fixed to the board, by using:

- ▶ on one side the CN5 connector,
- ▶ on the other side, a standoff screwed to the ITC-320 board and to the USB Flash module.

2.4.2 Graphics Controller

The Volari™ Z11 graphics controller incorporates a powerful 64-bit graphics engine to enhance the performance of 2D operations. The capabilities of the graphics engine include, but are not limited to BitBlit, Color Expansion, Enhanced Color Expansion, Line Drawing, Transparent BitBlit, and Rectangle Fill.

For all enhanced 256 color (8 bpp), 32k & 64k hi-color (16 bpp), and 16M true color (32 bpp) graphics modes, the 2D engine supports the following functions:

- > 256 raster operations
- > Rectangle fill
- > Color expansion
- > Enhanced Color expansion
- > Line drawing with styled pattern
- > Built-in bytes pattern registers
- > Built-in 8x8 mask registers
- > Rectangle Clipping Transparent BitBlit with source and destination keys
- > Source data in command queue Bitblt

The engine also support new GDI 2000 functions

2.4.2.1 PCI Bus Interface

The Volari™ Z11 GPU is a native PCI-E device which connects directly to the PCI-E bus onboard the motherboard. The Z11 decodes 32-bit addresses and configures the device based on the applicable control lines between the target and initiator. The GPU can execute both I/O and memory access instructions as a 32-bit device.

2.4.2.2 BroadBahn™ Memory Architecture

The internal memory controller of the Z11 generates the timing parameters for display memory. It supports the DDRII SDRAM timing specifications

The frequency of the Volari™ Z11 memory controller interface is synchronous with the 2D engine at 125 MHz with the I/O interface at 250 MHz. It can support up to a 1 GB/s bandwidth, with a 16-bit DDRII SDRAM interface. A DRAM capacity of 64 MB is currently supported on ITC-320 boards.

2.4.2.3 VGA Analog Interface and Connector CN3

The 15-pin female connector CN3 is used to connect a VGA analog monitor to the ITC-320 board.

PIN	SIGNAL	FUNCTION	I/O
1	Red	Red Video Signal Output	O
2	Green	Green Video Signal Output	O
3	Blue	Blue Video Signal Output	O
4	NC	Not Connected	--
5	GND	Ground Signal	--
6	GND	Ground Signal	--
7	GND	Ground Signal	--
8	GND	Ground Signal	--
9	VCC	Power +5V 1.5 A fuse protection	O
10	GND	Ground Signal	--
11	NC	Not Connected	--
12	Sdata	I ² C Data	I/O
13	Hsync	Horizontal Sync	TTL Out
14	Vsync	Vertical Sync	TTL Out
15	Sclk	I ² C Clock	I/O

Table 18: D-Sub VGA Connector CN3 Pinout

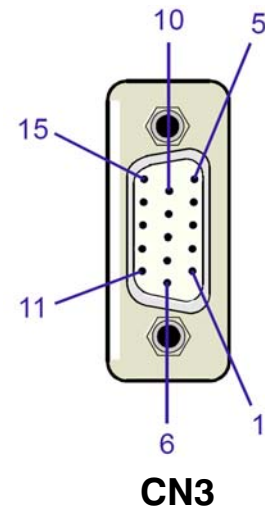


Figure 15: D-Sub VGA Connector CN3



If the automatic VGA detection mechanism on the ITC-320 is used, the user must ensure that the VGA cable and the connected monitor have a GND signal on pin 10. Otherwise the interface is not operable.

2.4.3 Dual Gigabit Ethernet

The ITC-320 board includes two 10Base-T/100Base-TX/1000Base-T Ethernet ports based on the Dual Gigabit Ethernet controller, which is connected to the x4 PCI Express interfaces of the Intel® 3100.

The Intel® 82571EB Dual Gigabit Ethernet Controller's architecture is optimized to deliver high performance with the lowest power consumption. The controller's architecture includes independent transmit and receive queues and a PCI Express interface that maximizes the use of bursts for efficient bus usage.

The Boot from LAN feature is supported.

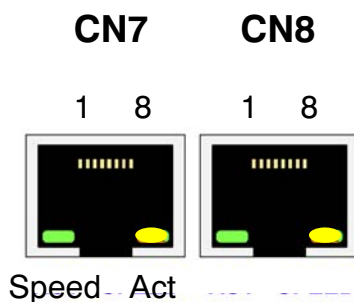


Figure 16: Dual Gigabit Ethernet Connector CN7/CN8



The Ethernet transmission can operate effectively using a CAT5 cable with a maximum length of 100 m.

The Ethernet connectors are realized as RJ-45 connectors. The interfaces provide automatic detection and switching between 10Base-T, 100Base-TX and 1000Base-T data transmission (Auto-Negotiation). Auto-wire switching for crossed cables is also supported (Auto-MDI/X).

2.4.3.1 RJ-45 Connector CN7/CN8 Pinouts

The CN7/CN8 connector supplies the 10Base-T, 100Base-TX and 1000Base-T interfaces to the Ethernet controller.

PIN	10BASE-T		100BASE-TX		1000BASE-T	
	I/O	SIGNAL	I/O	SIGNAL	I/O	SIGNAL
1	O	TX+	O	TX+	I/O	BI_DA+
2	O	TX-	O	TX-	I/O	BI_DA-
3	I	RX+	I	RX+	I/O	BI_DB+
4	-	-	-	-	I/O	BI_DC+
5	-	-	-	-	I/O	BI_DC-
6	I	TX-	I	RX-	I/O	BI_DB-
7	-	-	-	-	I/O	BI_DD+
8	-	-	-	-	I/O	BI_DD-

Table 19: Dual Gigabit Ethernet Connectors CN7/CN8 Pinout

2.4.3.2 Ethernet LED Status

» ACT (yellow)

This LED monitors network connection and activity. The LED lights up when a valid link (cable connection) has been established. The LED goes temporarily off if network packets are being sent or received through the RJ-45 port. When this LED remains off, a valid link has not been established due to a missing or a faulty cable connection.

» SPEED (green)

Status		SPEED LED green	ACT LED yellow
Ethernet link is not established		OFF	OFF
10/100 Mbps	Ethernet link established	OFF	ON
	Ethernet Link Activity	OFF	BLINK
1000 Mbps	Ethernet link established	ON	ON
	Ethernet Link Activity	ON	BLINK

Table 20: Ethernet LEDs Status Definition

2.4.4 CompactPCI Bus Interface

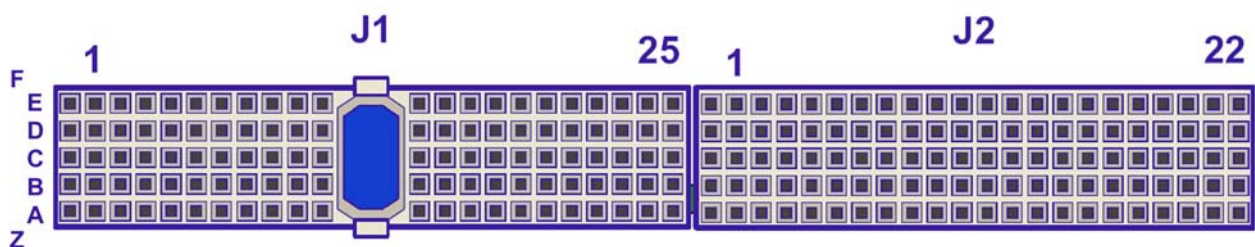
The complete CompactPCI connector configuration comprises two connectors named J1 and J2.

Their function is as follows:

- J1: 32-bit CompactPCI interface with PCI bus signals, arbitration, clock and power
- J2: has optional Rear I/O interface functionality or 64-bit termination

The board is capable of driving up to seven CompactPCI slots, with individual arbitration and clock signals. The ITC-320 is not hot-swappable but supports the addition or removal of other boards whilst in a powered-up state.

The ITC-320 is designed for a CompactPCI bus architecture. The CompactPCI standard is electrically identical to the PCI local bus. However, these systems are enhanced to operate in rugged industrial environments and to support multiple slots.



Pin rows F and Z are GND pins

Figure 17: CPCI Connectors J1/J2

2.4.4.1 CompactPCI Connectors J1 and J2 Pinouts

The ITC-320 is provided with two 2 mm x 2 mm pitch female CompactPCI bus connectors, J1 and J2.

» J1 Pinout

PIN	ROW Z	ROW A	ROW B	ROW C	ROW D	ROW E	ROW F
25	N.C.	+5V	REQ64#	N.C.	+3.3V	+5V	GND
24	N.C.	AD[1]	+5V	V(I/O)	AD[0]	ACK64#	GND
23	N.C.	+3.3V	AD[4]	AD[3]	+5V	AD[2]	GND
22	N.C.	AD[7]	GND	+3.3V	AD[6]	AD[5]	GND
21	N.C.	+3.3V	AD[9]	AD[8]	M66EN	C/BE[0]#	GND
20	N.C.	AD[12]	GND	V(I/O)	AD[11]	AD[10]	GND
19	N.C.	+3.3V	AD[15]	AD[14]	GND	AD[13]	GND
18	N.C.	SERR#	GND	+3.3V	PAR	C/BE[1]#	GND
17	N.C.	+3.3V	N.C.	N.C.	GND	PERR#	GND
16	N.C.	DEVSEL#	GND	V(I/O)	STOP#	N.C.	GND
15	N.C.	+3.3V	FRAME#	IRDY#	GND	TRDY#	GND
12-14	Key Area						
11	N.C.	AD[18]	AD[17]	AD[16]	GND	C/BE[2]#	GND
10	N.C.	AD[21]	GND	+3.3V	AD[20]	AD[19]	GND
9	N.C.	C/BE[3]#	NC	AD[23]	GND	AD[22]	GND
8	N.C.	AD[26]	GND	V(I/O)	AD[25]	AD[24]	GND
7	N.C.	AD[30]	AD[29]	AD[28]	GND	AD[27]	GND
6	N.C.	REQ0#	GND	+3.3V	CLK[0]	AD[31]	GND
5	N.C.	N.C.	N.C.	RST#	GND	GNT[0]#	GND
4	N.C.	IPMB_PWR	NC	V(I/O)	N.C.	N.C.	GND
3	N.C.	INTA#	INTB#	INTC#	+5V	INTD#	GND
2	N.C.	TCK	+5V	TMS	TDO	TDI	GND
1	N.C.	+5V	-12V	TRST#	+12V	+5V	GND

Table 21: CompactPCI Bus Connector J1 Pinout

» J2 Pinout

The ITC-320 board provides Rear I/O connectivity for special compact systems. Some standard PC interfaces are implemented and assigned to the front panel and to the rear connector J2.

When the Rear I/O module is used, the signals of some of the main board/front panel connectors are routed to the Rear I/O module interface. Thus the Rear I/O module makes it much easier to remove the CPU in the rack as there is practically no cabling on the CPU board.

For the system Rear I/O feature a special backplane is necessary. The ITC-320 with Rear I/O is compatible with all standard CompactPCI passive backplanes with Rear I/O support on the system slot.

The ITC-320 Rear I/O provides the following interfaces:

- > 32-bit/33 MHz CompactPCI (J1) and Rear I/O (J2)
- > Two USB 2.0 ports
- > Two Gigabit Ethernet ports without LED signals
- > Three SATA ports
- > Two TTL-Level COM ports
- > Seven GPIOs



To support the Rear I/O feature a special backplane is necessary. Do not plug a Rear I/O configured board in a non-system slot Rear I/O backplane. Failure to comply with the above will result in damage to your board.

» Legend for Table 22

USB _x	USB interface and power
ETH _x	Gigabit Ethernet port
SATA _x	Serial ATA port
COM _x	TTL-Level COM port
GPIO _x	GPIO
PEX_RX0L _x	x4 or 4x1 PCI-Express
PEX_TX0L _x	

PIN	ROW Z	ROW A	ROW B	ROW C	ROW D	ROW E	ROW F
22	N.C.	GA[4]	GA[3]	GA[2]	GA[1]	GA[0]	GND
21	N.C.	CLK[6]	GND	COM1_RXD	COM2_RXD	GPIO7	GND
20	N.C.	CLK[5]	GND	COM1_TXD	COM2_TXD	GPIO6	GND
19	N.C.	GND/CLK100+	GND/CLK100+	SMB_SDA	SMB_SCL	SMB_ALERT	GND
18	N.C.	SATA3_TX+	SATA3_TX-	GND	SATA3_RX+	SATA3_RX-	GND
17	N.C.	USB2_D+	USB2_D-	RST_BP#	N.C.	GNT[6]#pull	GND
16	N.C.	USB2_PWR	USB3_PWR	DEGXB	GND	GPIO5	GND
15	N.C.	USB3_D+	USB3_D-	FALXB	N.C.	GNT[5]#pull	GND
14	N.C.	SATA2_TX+	SATA2_TX-	GND	SATA2_RX+	SATA2_RX-	GND
13	N.C.	SATA1_TX+	SATA1_TX-	GND	SATA1_RX+	SATA1_RX-	GND
12	N.C.	PEX_RX0L0+	PEX_RX0L0-	GND	PEX_TX0L0+	PEX_TX0L0-	GND
11	N.C.	PEX_RX0L1+	PEX_RX0L1-	GND	PEX_TX0L1+	PEX_TX0L1-	GND
10	N.C.	PEX_RX0L2+	PEX_RX0L2-	GND	PEX_TX0L2+	PEX_TX0L2-	GND
9	N.C.	PEX_RX0L3+	PEX_RX0L3-	GND	PEX_TX0L3+	PEX_TX0L3-	GND
8	N.C.	ETH0_DA+	ETH0_DA-	GND	ETH0_DC+	ETH0_DC-	GND
7	N.C.	ETH0_DB+	ETH0_DB-	GND	ETH0_DD+	ETH0_DD-	GND
6	N.C.	ETH1_DA+	ETH1_DA-	GND	ETH1_DC+	ETH1_DC-	GND
5	N.C.	ETH1_DB+	ETH1_DB-	GND	ETH1_DD+	ETH1_DD-	GND
4	N.C.	V(I/O)	GPIO1	GPIO2	GPIO3	GPIO4	GND
3	N.C.	CLK[4]	GND	GNT[3]#	N.C.	GNT[4]#pull	GND
2	N.C.	CLK[2]	CLK[3]	SYSEN#	GNT[2]#	REQ[3]#	GND
1	N.C.	CLK[1]	GND	REQ[1]#	GNT[1]#	REQ[2]#	GND

Table 22: 64-bit CompactPCI Bus Connector J2 Pinout

» USB Interfaces

There are up to six independent USB interfaces available:

- ITC-320
 - ▶ one onboard to connect a Flash Disk
 - ▶ one on front panel
 - ▶ two on the Rear I/O J2 connector (USB2 and USB3 in above Table)
- ITC-322
 - ▶ two on front panel (USB4 and USB5)



All USB ports may be used at the same time. It is strongly recommended to use cables less than 3 metres in length for the Rear I/O interfaces.

» Ethernet Interfaces

Gigabit Ethernet signals are available either on the front R-J45 connector or on the Rear I/O interface.

Both Gigabit Ethernet channels are individually switchable to front or Rear I/O. Switching over from front to Rear I/O or vice versa is effected using the BIOS settings or the board-specific registers (default: front I/O).

For further information on the BIOS settings, refer to Chapter 10 “AMIBIOS®8 Setup Utility” page 103.

» TTL-Level COM Ports

COM1 and COM2 are available on the Rear I/O interface.

» SATA Interface

The ITC-320 provides up to four SATA interfaces. Three SATA ports, SATA1, SATA2 and SATA3, can be used only on the Rear I/O interface. All SATA ports can be used simultaneously.

SATA PORT	CONNECTOR	USAGE
SATA0	CN3-2 on the ITC-322	onboard 2.5" DATA HDD drive mounted on ITC-322
SATA1	CN5-R on the ITC-320 Rear Transition Module	external SATA HDD drives, e.g. 2.5" or 3.5 SATA HDDs
SATA2	CN4-R on the ITC-320 Rear Transition Module	external SATA HDD drives, e.g. 2.5" or 3.5 SATA HDDs
SATA3	CN2-R on the ITC-320 Rear Transition Module	external SATA HDD drives, e.g. 2.5" or 3.5 SATA HDDs

Table 23: SATA Port Features

2.4.5 Second Layer Interface

The second layer of the ITC-320 provides the following interfaces:

- > Two USB 2.0 ports
- > One SATA port
- > One PS2 port
- > Two COM ports (COM3, COM4)
- > XDP port

» Legend for Table 24

USB _x	USB port (x 2)
SATA _x	Serial ATA port
COM _x	COM port (x 2) via LPC bus
K _{xxxx} M _{xxxx}	PS2 port (Keyboard/Mouse)
XDP	XDP - eXtended Debug Port



The Debug Port is a connection into a target system environment that provides access to JTAG, run control, and in some case system control resources. Debug port on the second layer of the ITC-320 User's Guide board comes in XDP style.

The 60-pin female connector CN4 is used to connect a second layer board to the ITC-320 board. The assembly of the ITC-320 board and the second layer board is an ITC-322 board.

PIN	SIGNAL	FUNCTION	PIN	SIGNAL	FUNCTION
1	GND	Ground Signal	2	LPC_FRAME	
3	USB5_D-	Differential USB-	4	LPC_AD3	
5	USB5_D+	Differential USB+	6	LPC_AD2	
7	GND	Ground Signal	8	LPC_AD1	
9	USB4_D-	Differential USB-	10	LPC_AD0	
11	USB4_D+	Differential USB+	12	PCIRST	Global PCI Reset
13	GND	Ground Signal	14	CLK33	33 MHz clock
15	SATA_RX-	Differential Receive -	16	GND	Ground Signal
17	SATA_RX+	Differential Receive +	18	+5V	
19	GND	Ground Signal	20	+5V	
21	SATA_TX+	Differential Transmit +	22	+5V	
23	SATA_TX-	Differential Transmit -	24	GND	
25	GND	Ground Signal	26	+3.3V	
27	USB5_PWR		28	+3.3V	
29	USB4_PWR		30	IN_L	2nd Layer Board Presence
31	Reserved		32	KCLK	Keyboard Clock
33	Reserved		34	KDATA	Keyboard Data
35	WML_SERIRQ		36	MCLK	Mouse Clock
37	KBD_RST		38	MDATA	Mouse Data
39	PWRGOOD		40	BPM0#	
41	DBRESET#		42	BPM1#	
43	TDI	XDP Data In	44	BPM2#	
45	TMS	XDP Mode Select	46	BPM3#	
47	TRST#	XDP reset	48	BPM4#	
49	TCK	XDP Clock	50	BPM5#	
51	TDO	XDP Data Out	52	CPU RESET#	
53	+1.05V		54	Reserved	
55	+1.5V		56	Reserved	
57	ClkOut+		58	Reserved	
59	ClkOut-		60	Reserved	

Table 24: Connector CN4 Pinout

Chapter 3 - Installation

The ITC-320 has been designed for easy installation. However, the following standard precautions, installation procedures, and general information must be observed to ensure proper installation and to preclude damage to the board, other system components, or injury to personnel.

3.1 Safety Requirements

The following safety precautions must be observed when installing or operating the ITC-320. Kontron assumes no responsibility for any damage resulting from failure to comply with these requirements.



Due care should be exercised when handling the board due to the fact that the heat sink can get very hot. Do not touch the heat sink when installing or removing the board.

In addition, the board should not be placed on any surface or in any form of storage container until such time as the board and heat sink have cooled down to room temperature.



If your board type is not specifically qualified as being hot swap capable, switch off the CompactPCI system power before installing the board in a free CompactPCI slot. Failure to do so could endanger your life or health and may damage your board or system.



Certain CompactPCI boards require bus master and/or Rear I/O capability. If you are in doubt whether such features are required for the board you intend to install, please check your specific board and/or system documentation to make sure that your system is provided with an appropriate free slot in which to insert the board.



This CompactPCI board contains electrostatically sensitive devices. Please observe the necessary precautions to avoid damage to your board:

- ▶ Discharge your clothing before touching the assembly. Tools must be discharged before use.
- ▶ Do not touch components, connector-pins or traces.
- ▶ If working at an anti-static workbench with professional discharging equipment, please do not omit to use it.

3.2 Board Identification

3.2.1 ITC-320-SA Board Identification

The ITC-320-SA boards are identified by labels fitted to the top and bottom sides.

➤ Top Side

- A** “Board Identification” label. This is the Order Code of the board.
- B** “Functional Identification” label.
- C** “GbE1 Ethernet Number” label: This number is in hexadecimal.
- D** “GbE2 Ethernet Number” label: This number is in hexadecimal.
- E** “Chronological Serial Number” label (1/2)

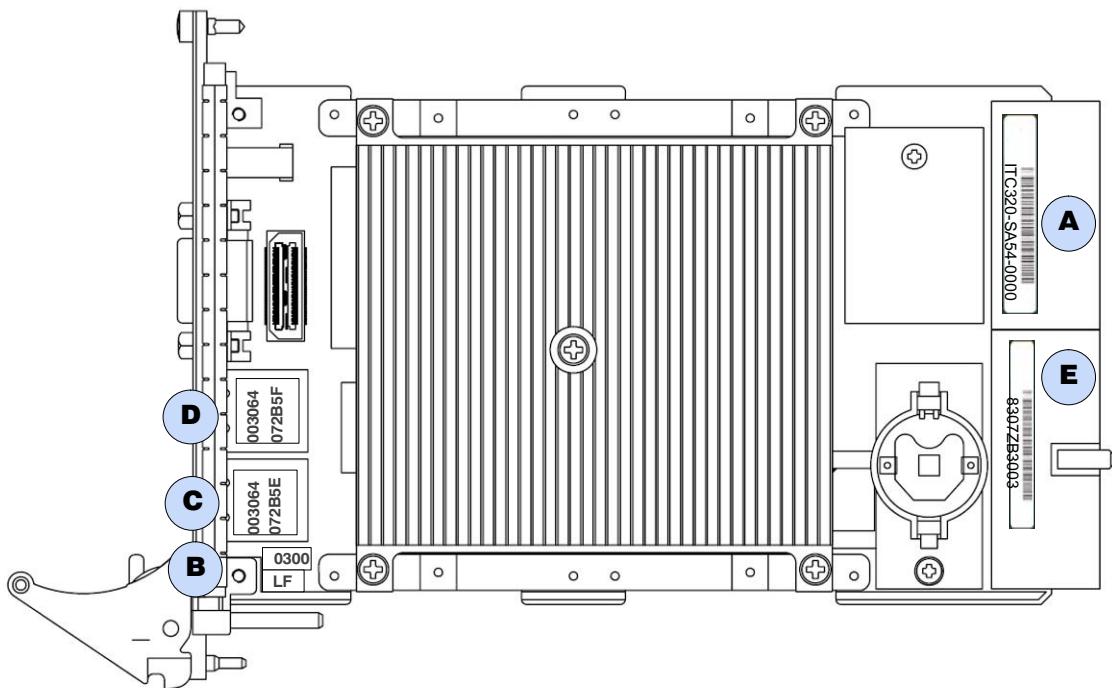


Figure 18: ITC-320-SA Identification (Top Side)

➤ Bottom Side

- F** "Chronological Serial Number" label (2/2)

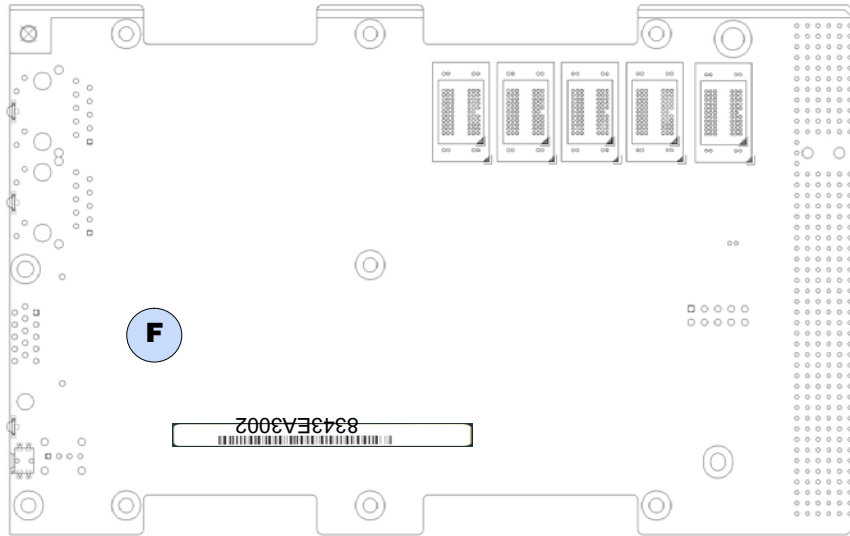


Figure 19: ITC-320-SA Identification (Bottom Side)



ITC-320-RC Specificities: Refer to Section 9.6 page 102

RC Only

3.2.2 ITC-322-SA Board Identification

The ITC-322-SA boards are identified by labels fitted to the top and bottom sides.

➤ Top Side

- A** "Board Identification" label. This is the Order Code of the board.

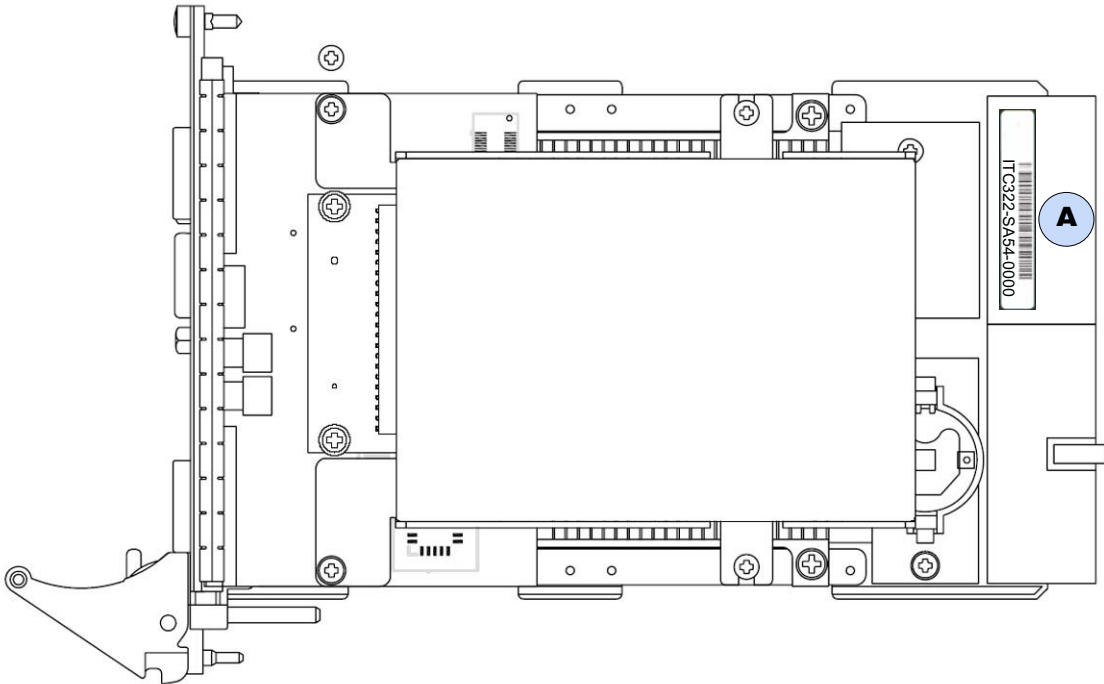


Figure 20: ITC-322-SA Identification (Top Side)

> Bottom Side

- B** “Functional Identification” label.
- C** “GbE1 Ethernet Number” label: This number is in hexadecimal.
- D** “GbE2 Ethernet Number” label: This number is in hexadecimal.
- E** “Chronological Serial Number” label (1/2)
- F** “Chronological Serial Number” label (2/2)

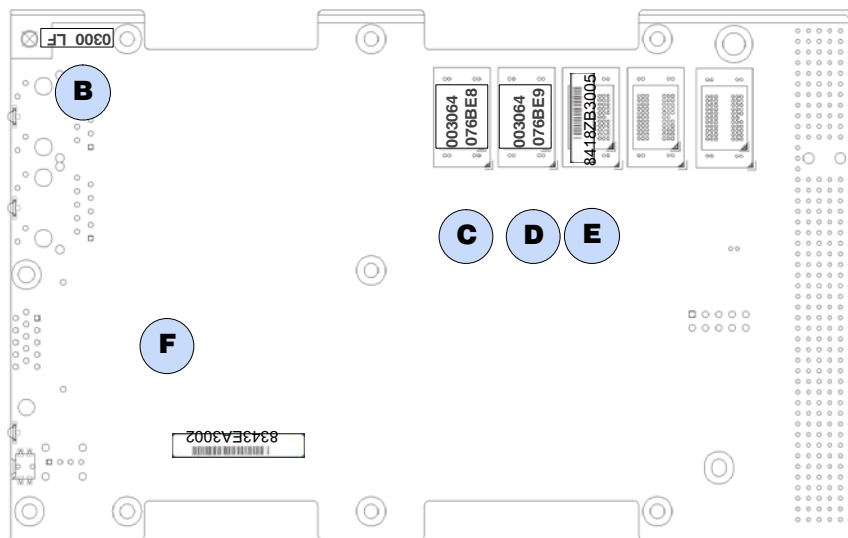


Figure 21: ITC-322-SA Identification (Bottom Side)

3.3 Package Content

The ITC-320 is packaged with several components. The packing contents of the ITC-320 Series may vary depending on customer requests.

➤ CPU Module

- ▶ Order Code: ITC320-*xxxx-xxxxx* or ITC322-*xxxx-xxxxx*
 - ▶ Processor specifications differ depending on Order Code
 - ▶ Heat sink assembled on the board
 - ▶ Battery assembled on the board
 - ▶ HDD bracked assembled on the board (ITC322-*xxxx-xxxxx* only)
- ▶ Four screws for HDD (ITC322-*xxxx-xxxxx* only)
- ▶ Y-cable for PS/2 Keyboard / Mouse (ITC322-*xxxx-xxxxx* only)
- ▶ CD-ROM Technical Documentation

➤ Rear Transition Module

- ▶ Order Code: PB-IT3-000

➤ USB Flash Disk Module

- ▶ Order Code: FDM-USB-4GB-00

➤ VGA Adaptor Card

- ▶ Order Code: ADAP-VGA (associated with boards ITC320-RCX2-00000 if a VGA connector is temporarily needed)

3.4 Initial Installation Procedures

The following procedures are applicable only for the initial installation of the ITC-320 in a system. Procedures for standard removal and hot swap operations are found in their respective chapters.

To perform an initial installation of the ITC-320 in a system proceed as follows:

1. Ensure that the safety requirements indicated in Chapter 3.1 are observed.



Failure to comply with the instruction below may cause damage to the board or result in improper system operation.

2. Ensure that the board is properly configured for operation in accordance with application requirements before installing. For information regarding the configuration of the ITC-320 refer to Chapter 4. For the installation of ITC-320 specific peripheral devices and Rear I/O devices refer to the appropriate sections in Chapter 3.



Care must be taken when applying the procedures below to ensure that neither the ITC-320 nor other system boards are physically damaged by the application of these procedures.

3. To install the ITC-320 perform the following:

1. Ensure that no power is applied to the system before proceeding.



When performing the next step, DO NOT push the board into the backplane connectors. Use the ejector handles to seat the board into the backplane connectors.

2. Carefully insert the board into the slot designated by the application requirements for the board until it makes contact with the backplane connectors.
3. Using the ejector handle, engage the board with the backplane. When the ejector handle is locked, the board is engaged.
4. Fasten the front panel retaining screws (two on the 4HP version and four on the 8HP).
5. Connect all external interfacing cables to the board as required.
6. Ensure that the board and all required interfacing cables are properly secured.

The ITC-320 is now ready for operation. For operation of the ITC-320, refer to appropriate ITC-320 specific software, application, and system documentation.

3.5 Standard Removal Procedure

To remove the board proceed as follows:

1. Ensure that the safety requirements indicated in Chapter 3.1 are observed. Particular attention must be paid to the warning regarding the heat sink!



Care must be taken when applying the procedures below to ensure that neither the ITC-320 nor system boards are physically damaged by the application of these procedures.

2. Ensure that no power is applied to the system before proceeding.
3. Disconnect any interfacing cables that may be connected to the board.
4. Unscrew the front panel retaining screws (two on the 4HP version and four on the 8HP).
5. Disengage the board from the backplane by first unlocking the board ejection handles and then by pressing the handles as required until the board is disengaged.
6. After disengaging the board from the backplane, pull the board out of the slot.



Due care should be exercised when handling the board due to the fact that the heat sink can get very hot. Do not touch the heat sink when changing the board.

7. Dispose of the board as required.

3.6 Hot Swap Procedures

The ITC-320 is not designed for hot swap operation. Do not attempt to hot swap this board. However, the ITC-320 supports the addition or removal of other boards whilst in a powered-up state.

3.7 Installation of ITC-320 Peripheral Devices

The ITC-320 is designed to accommodate a variety of peripheral devices whose installation varies considerably. The following chapters provide information regarding installation aspects and not detailed procedures.

3.7.1 USB Device Installation

The ITC-320 supports all USB plug and play computer peripherals (e.g. keyboard, mouse, printer, etc.).



All USB devices may be connected or removed while the host or other peripherals are powered up.

» USB Flash Disk Installation



The USB Flash module is fixed to the board, by using:

- ▶ on one side the CN5 connector,
- ▶ on the other side, a standoff screwed to the ITC-320 board and to the USB Flash module.

Figure 22: USB Flash Disk Bottom View

3.7.2 Battery Replacement

The lithium battery must be replaced with an identical battery or a battery type recommended by the manufacturer. Suitable batteries include the VARTA CR2032.

To replace the battery, proceed as follows:

- Turn off power
- Press on the safety catch; the battery is ejected
- Remove the battery
- Place the new battery in the socket
- Make sure that you insert the battery the right way round. The plus pole must be on the top!



The user must be aware that the battery's operational temperature range is less than that of the ITC-320's storage temperature range. For exact range information, refer to the battery manufacturer's specifications.



Care must be taken to ensure that the battery is correctly replaced.

The battery should be replaced only with an identical or equivalent type recommended by the manufacturer.

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

The typical life expectancy of a 225 mAh battery (VARTA CR2032) is 4 - 5 years with an average on-time of 8 hours per working day at an operating temperature of 30°C. However, this typical value varies considerably because the life expectancy is dependent on the operating temperature and the standby time (shutdown time) of the system in which it operates.

To ensure that the lifetime of the battery has not been exceeded it is recommended to exchange the battery after 3 - 4 years.

3.7.3 Hard Disk Installation

The following information pertains to hard disks which may be connected to the ITC-320. To install a slim-type 2.5" SATA HDD, it is necessary to perform the following operations in the given order:

1. Place the HDD into the bracket.
2. Plug the HDD connector with the SATA CN3-2 signal/power connector.
3. Tighten the four bracket screws to secure the HDD in place.

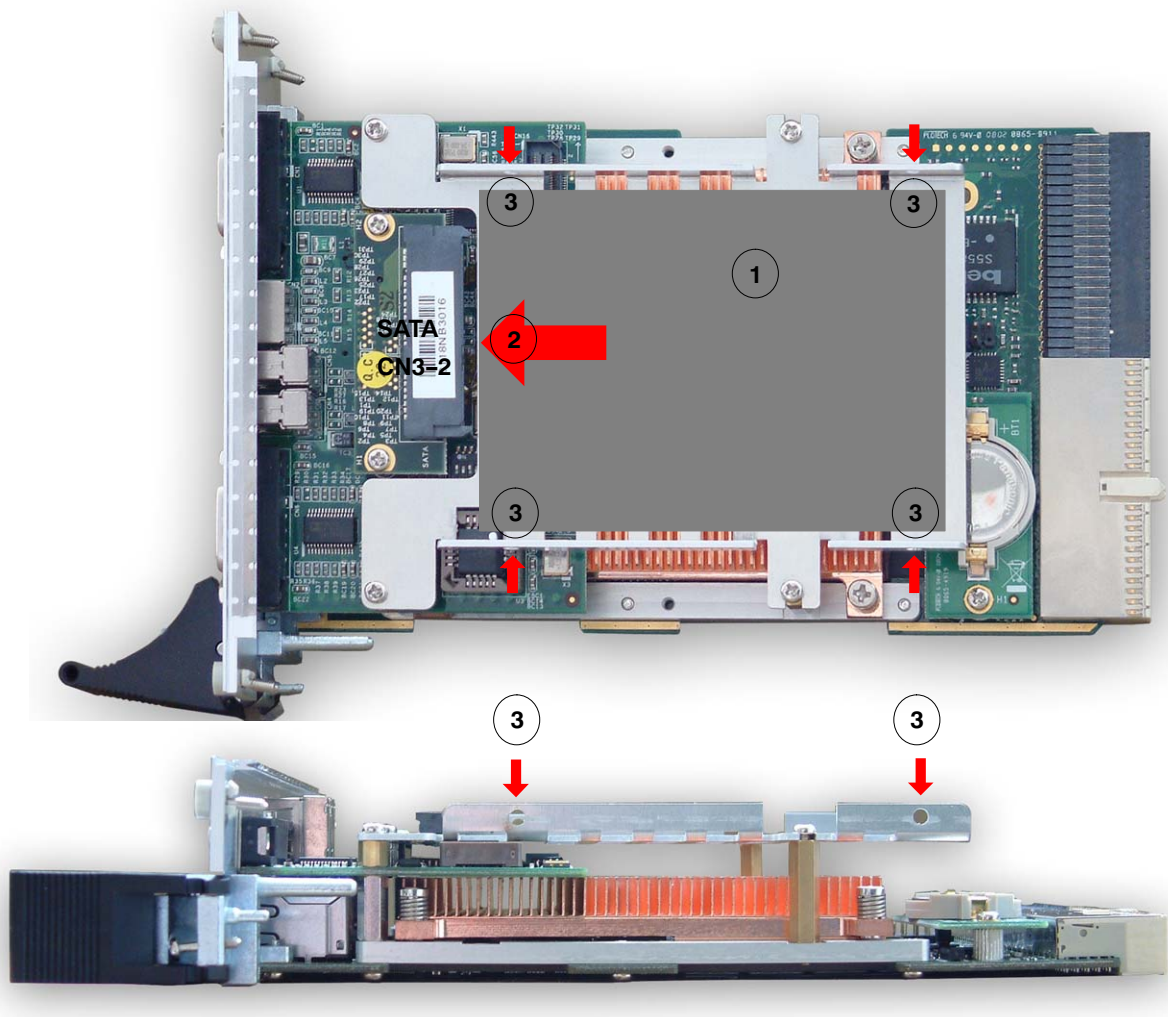


Figure 23: Hard Disk Installation

3.8 Software Installation

The installation of all onboard peripheral drivers is described in detail in the relevant Driver Kit files or Board Support Packages (BSP).

Installation of an operating system is a function of the OS software and is not addressed in this manual. Refer to appropriate OS software documentation for installation.

Chapter 4 - Configuration

4.1 Legacy Interrupts

The ITC-320 board uses the standard AT IRQ routing (8259 controller) for legacy devices. The following table indicates the default interrupt routing. The shaded table cells indicate the interrupt which can be made "Available" or "Reserved" via the BIOS setup.

IRQ	PRIORITY	BIOS STANDARD FUNCTION	OS FUNCTION
IRQ0	1	System Timer	System Timer
IRQ1	2	Keyboard Controller	Keyboard Controller
IRQ2	--	Input of the second IRQ controller (IRQ8-IRQ15)	Input of the second IRQ controller (IRQ8-IRQ15)
IRQ3	11	COM2	COM2
IRQ4	12	COM1	COM1
IRQ5	13	Free	Watchdog
IRQ6	14	Floppy	Floppy
IRQ7	15	Printer	Printer
IRQ8	3	System Real-Time Clock	System Real-Time Clock
IRQ9	4	Free	APIC
IRQ10	5	Free	COM4
IRQ11	6	Free	COM3
IRQ12	7	Mouse	Mouse
IRQ13	8	Floating Point Unit (FPU)	Floating Point Unit (FPU)
IRQ14	9	Primary IDE	Primary IDE
IRQ15	10	Secondary IDE	Secondary IDE

Table 25: Legacy Interrupt Setting

4.2 Onboard PCI Interrupt Routing

The IICH of the Intel® 3100 Chipset provides up to eight PCI interrupt inputs. The table below describes the connection of these IRQ signals.

IRQ	IICH IRQ INPUT	CPCI INTERFACE	FUNCTION INTERNAL IICH
16	PIRQA	CPCI IRQA	USB EHCI Controller IDE AC97 Audio USB UHCI 0 Controller PCI Express 1 (Gigabit Ethernet 1)
17	PIRQB	CPCI IRQB	SMBUS SATA AC97 Modem USB UHCI 1 Controller PCI Express 2 (Gigabit Ethernet 2)
18	PIRQC	CPCI IRQC	USB UHCI 2 Controller
19	PIRQD	CPCI IRQD	USB UHCI 3 Controller
20	PIRQE	Not available	Not used
21	PIRQF	Not available	Not used
22	PIRQG	Not available	Not used
23	PIRQH	Not available	Not used

Table 26: PCI Interrupt Routing

For more information, refer to the Intel® 3100 Chipset Data Sheet.

4.3 Memory Map

The ITC-320 board uses the standard AT ISA memory map.

4.3.1 Memory Map for the 1st MegaByte

The following table sets out the memory map for the first megabyte:

MEMORY RANGE	SIZE	FUNCTION
0xE0000 - 0xFFFFF	128 k	BIOS implemented in FWH Reset vector 0xFFFF0
0xD0000 - 0xDFFFF	64 k	Free
0xCF000 - 0xCFFFF	4 k	Free
0xC0000 - 0xCEFFF	60 k	VGA BIOS
0xA0000 - 0xBFFFF	128 k	Normally used as video RAM as follows: CGA video: 0xB8000 - 0xBFFFF Monochrome video: 0XB0000 - 0xB7FFF EGA/VGA video: 0xA0000 - 0xAFFFF
0x00000 - 0x9FFFF	640 k	DOS reserved memory space

Table 27: Memory Map for the 1st Megabyte

Chapter 5 - Power Considerations

5.1 System Power

The considerations presented in the ensuing chapters must be taken into account by system integrators when specifying the ITC-320 system environment.

5.1.1 ITC-320 Baseboard

The ITC-320 baseboard itself has been designed for optimal power input and distribution. Still it is necessary to observe certain criteria essential for application stability and reliability.

The table below indicates the absolute maximum input voltage ratings that must not be exceeded. Power supplies to be used with the ITC-320 should be carefully tested to ensure compliance with these ratings.

SUPPLY VOLTAGE	MAXIMUM PERMITTED VOLTAGE
+3.3V	+3.6V
+5V	+5.5V
+12V	+14.0V

Table 28: Maximum Input Power Voltage Limits



The maximum permitted voltage indicated in the table above must not be exceeded. Failure to comply with the above may result in damage to your board.

The following table specifies the ranges for the different input power voltages within which the board is functional. The ITC-320 is not guaranteed to function if the board is not operated within the prescribed limits.

INPUT SUPPLY VOLTAGE	ABSOLUTE RANGE
+3.3V	3.2V min. to 3.47V max.
+5V	4.85V min. to 5.25V max.
+12V	11.4V min. to 12.6V max.

Table 29: DC Operational Input Voltage Ranges

5.1.2 Backplane

Backplanes to be used with the ITC-320 must be adequately specified. The backplane must provide optimal power distribution for the +3.3 V, +5 V and +12 V power inputs. It is recommended to use only backplanes which have at least two power planes for the +3.3 V and +5 V voltages.

Input power connections to the backplane itself should be carefully specified to ensure a minimum of power loss and to guarantee operational stability. Long input lines, under dimensioned cabling or bridges, high resistance connections, etc. must be avoided. It is recommended to use POSITRONIC or M-type connector backplanes and power supplies where possible.

5.1.3 Power Supply Units

Power supplies for the ITC-320 must be specified with enough reserve for the remaining system consumption. In order to guarantee a stable functionality of the system, it is recommended to provide more power than the system requires. An industrial power supply unit should be able to provide at least twice as much power as the entire system requires. An ATX power supply unit should be able to provide at least three times as much power as the entire system requires.

As the design of the ITC-320 has been optimized for minimal power consumption, the power supply unit shall be stable even without minimum load.

Where possible, power supplies which support voltage sensing should be used. Depending on the system configuration this may require an appropriate backplane. The power supply should be sufficient to allow for die resistance variations.



Non-industrial ATX PSUs may require a greater minimum load than a single ITC-320 is capable of creating. When a PSU of this type is used, it will not power up correctly and the ITC-320 may hangup. The solution is to use an industrial PSU or to add more load to the system.

The start-up behavior of CPCI and PCI (ATX) power supplies is critical for all new CPU boards. These boards require a defined power of sequence and start-up behavior of the power supply.

For information on the required behavior refer to the power supply specifications on the formfactors.org web site and to the CompactPCI (PICMG) specification on the picmgeu.org web site.

5.1.3.1 Start-Up Requirement

Power supplies must comply with the following guidelines, in order to be used with the ITC-320.

- Beginning at 10% of the nominal output voltage, the voltage must rise within > 0.1 ms to < 20 ms to the specified regulation range of the voltage. Typically: > 5 ms to < 15 ms.
- There must be a smooth and continuous ramp of each DC output voltage from 10% to 90% of the regulation band.
- The slope of the turn-on waveform shall be a positive, almost linear voltage increase and have a value from 0 V to nominal V_{out} .

5.1.3.2 Power-Up Sequence

The +5 VDC output level must always be equal to or higher than the +3.3 VDC output during power-up and normal operation.

The time from +5 VDC until the output reaches its minimum in regulation level and from +3.3 VDC until the output reaches its minimum in regulation level must be < 20 ms.

5.1.3.3 Tolerance

The tolerance of the voltage lines is described in the CPCI specification (PICMG 2.0 R3.0). The recommended measurement point for the voltage is the CPCI connector on the CPU board.

The following table provides information regarding the required characteristics for each board input voltage.

VOLTAGE	NOMINAL VALUE	TOLERANCE	MAX. RIPPLE (P-P)	REMARKS
5V	+5.0 VDC	+5%/-3%	50 mV	Main voltage
3.3V	+3.3 VDC	+5%/-3%	50 mV	Main voltage
+12V	+12 VDC	+5%/-5%	240 mV	Required
-12V	-12 VDC	+5%/-5%	240 mV	Not Required
V I/O (PCI) signalling voltage	+3.3 VDC or +5 VDC	+5%/-3%	50 mV	Depends on board version
GND	Ground, not directly connected to potential earth (PE)			

Table 30: Input Voltage Characteristics

The output voltage overshoot generated during the application (load changes) or during the removal of the input voltage must be less than 5% of the nominal value. No voltage of reverse polarity may be present on any output during turn-on or turn-off.

5.1.3.4 Regulation

The power supply shall be unconditionally stable under line, load, unload and transient load conditions including capacitive loads. The operation of the power supply must be consistent even without the minimum load on all output lines.



If the main power input is switched off, the supply voltages will not go to 0V instantly. It will take a couple of seconds until capacitors are discharged. If the voltage rises again before it went below a certain level, the circuits may enter a latch-up state where even a hard RESET will not help any more. The system must be switched off for at least 3 seconds before it may be switched on again. If problems still occur, turn off the main power for 30 seconds before turning it on again.

5.1.3.5 Rise Time Diagram

The following figure illustrates an example of the recommended start-up ramp of a CPCI power supply for all Kontron boards delivered up to now.

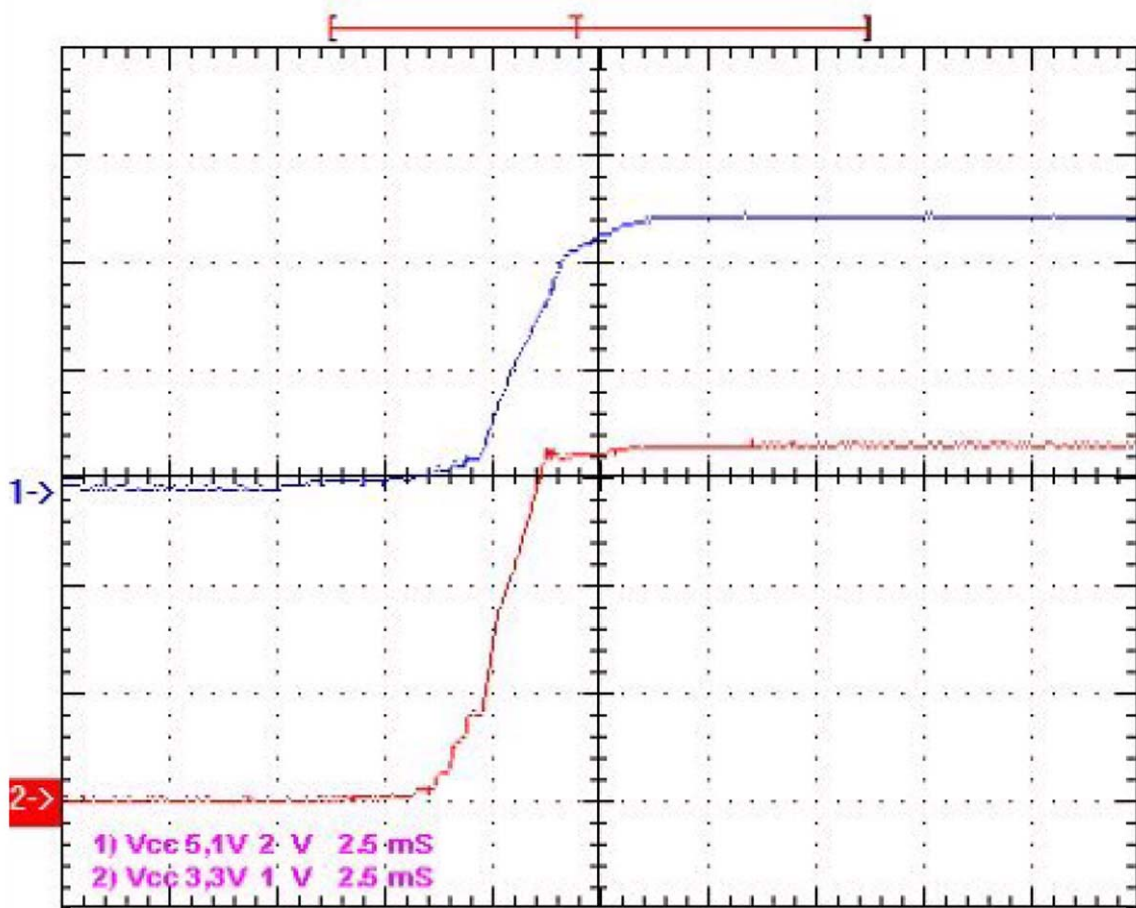


Figure 24: Start-Up Ramp of the CP3-SVE180 AC Power Supply

5.2 Power Consumption

The goal of this description is to provide a method to calculate the power consumption for the ITC-320 baseboard and for additional configurations. The processor dissipates the majority of the thermal power.

The power consumption tables below list the voltage and power specifications for the ITC-320 board and the ITC-320 accessories. The values were measured using an 8-slot passive CompactPCI backplane with two power supplies: one for the CPU, and the other for the hard disk.

The operating system used was Windows XP. All measurements were conducted at a temperature of 25°C. The measured values varied, because the power consumption was dependent on processor activity.

5.2.1 Real Applications

The following tables indicate the power consumption using real applications with soldered DDR2 SDRAM. The power consumption in the BIOS was measured with power management not active.

POWER	Intel® Celeron® M 1.07 GHz	Intel® Core™ Duo 1.2 GHz (ULV)	Intel® Core™ 2 Duo 1.5 GHz (LV)
5V	16.37 W	17.48 W	22.05 W
3.3V	4.98 W	5.08 W	5.06 W
Total	21.35 W	22.56 W	27.11 W

Table 31: Power Consumption: BIOS

The Power Consumption was measured using Linux IDLE Mode.

POWER	Intel® Celeron® M 1.07 GHz	Intel® Core™ Duo 1.2 GHz (ULV)	Intel® Core™ 2 Duo 1.5 GHz (LV)
5V	15.61 W	16.48 W	17.65 W
3.3V	5.28 W	5.40 W	5.39 W
Total	20.89 W	21.28 W	23.04 W

Table 32: Power Consumption: Linux IDLE Mode

The Power Consumption was measured using Windows® XP with 100% processor load.

POWER	Intel® Celeron® M 1.07 GHz	Intel® Core™ Duo 1.2 GHz (ULV)	Intel® Core™ 2 Duo 1.5 GHz (LV)
5V	18.20 W	21.51 W	30.09 W
3.3V	5.26 W	5.38 W	5.31 W
Total	23.46 W	26.89 W	35.40 W

Table 33: Power Consumption: Windows® XP: 100% Processor Load

Chapter 6 - System Considerations

The following chapters provide system integrators with the necessary information to satisfy thermal requirements when implementing ITC-320 applications.

6.1 Passive Thermal Regulation

The thermal management architecture implemented on the ITC-320 can be described as being two separate but related functions. The goal of all three functions is to protect the processor and reduce processor power consumption. Enabling the thermal control circuit allows the processor to maintain a safe operating temperature without the need for special software drivers or interrupt handling routines.

The three thermal protection functions provided by the processor are:

1. Intel® Core™ Duo and Intel® Core™ 2 Duo internal Digital Thermal Sensor (DTS): This function controls the processor temperature by SpeedStep or clock modulation.
2. Processor Hot: In the event of a cooling failure resulting in extreme overheating, the processor and/or the Intel® 3100 will automatically shut down when the die temperature has reached approximately 125°C. This event is known as "PROCHOT".

6.1.1 CPU Internal Thermal Supervision

This function can be enabled and disabled in the BIOS, whereby the default value is: enabled. When the internal thermal control circuit has been enabled and a high temperature situation occurs, the internal clocks are either controlled by SpeedStep, or modulated by alternately turning the clocks off and on with a duty cycle dependent on the processor type (typically 30- 50%). This results in the reduction of the processor power dissipation and the processor performance depending on the active SpeedStep. Cycle times are processor speed dependent and will decrease linearly as processor core frequencies increase. The thermal control circuit is automatically deactivated when the temperature goes below the internal thermal supervision point. The internal temperature sensors are located near on the hottest area of the processor dies. Each processor is individually calibrated during manufacturing to eliminate any potential manufacturing variations.



The duty cycle and the internal thermal supervision point is factory configured by Intel and cannot be modified. For all Intel® Core™ Duo and Intel® Core™ 2 Duo processors the internal thermal supervision point is 100°C.



The HOT LED on the front panel shows always the status of the internal thermal supervision regardless of whether it is enabled or disabled in the BIOS.

6.1.2 Processot Hot Supervision (PROCHOT)

This function cannot be enabled or disabled in the BIOS. It is always enabled to ensure that the processor is protected in any event. Assertion of PROCHOT indicates that the processor junction temperature has reached a level beyond which permanent silicon damage may occur. Measurement of the temperature is accomplished through an internal thermal sensor which is configured to trip at approximately 125°C. Upon assertion of PROCHOT, the processor will shut off its internal clocks (thus halting program execution) in an attempt to reduce the processor junction temperature. Once activated, PROCHOT remains latched until the ITC-320 undergoes a cold restart is performed (all power off and then on again).

6.1.3 Thermal Management Recommendations

If the ITC-320 is operated in a properly configured CompactPCI environment with enough air flow, there is no need to enable the Thermal Management function. However, sometimes the system environment is not optimized for an Intel® Core™ Duo or an Intel® Core™ 2 Duo processor board and this requires thermal protection to guarantee a stable system. The Thermal Management feature allows system designers to design lower cost thermal solutions without compromising system integrity or reliability.



For Benchmarks and performance tests all Thermal Management functions should be disabled, if enabled the results will be erroneous due to the thermal power reduction.

6.2 Active Thermal Regulation

The thermal management concept of the ITC-320 also encompasses active thermal regulation. For this processor, a specifically designed heat sink is employed to ensure the best possible basis for operational stability and long term reliability. Coupled together with system chassis which provide variable configurations for forced air flow, controlled active thermal energy dissipation is guaranteed.

6.2.1 Heat Sinks

The ITC-320 is fitted with an optimally designed heat sink. The physical size, shape, and construction ensures the best possible thermal resistance (Rth) coefficients. In addition, it is specifically designed to efficiently support forced air flow concepts as found in a modern CompactPCI system chassis.

Even though the ITC-320 is fitted with an optimally designed heat sink, the thermal energy dissipated by the Intel Core Duo and the Intel Core2 Duo processors exceeds the thermal capabilities of the heat sink except for very low performance applications which still require the outstanding features offered by this processor. For higher performance applications, the ITC-320 must be operated with forced air flow.

6.2.2 Forced Air Flow

When developing applications using the ITC-320, the system integrator must be aware of the overall system thermal requirements. System chassis must be provided which satisfy these requirements.

The ITC-320 has been validated with an airflow of 17 CFM.

The ITC-320 boards, Order Code ITC320-SA02 (Intel® Celeron® M processor), support up to ambient temperature of 40°C with aluminium heatsink in fan-less chassis.

6.2.3 Peripherals

When determining the thermal requirements for a given application, peripherals to be used with the ITC-320 must also be considered. Devices such as hard disks, extension modules, etc. which are directly attached to the ITC-320 must also be capable of being operated at the temperatures foreseen for the application. It may very well be necessary to revise system requirements to comply with operational environment conditions. In most cases, this will lead to a reduction in the maximum allowable ambient operating temperature or even require active cooling of the operating environment.



As Kontron assumes no responsibility for any damage to the ITC-320 or other equipment resulting from overheating of the CPU, it is highly recommended that system integrators as well as end users confirm that the operational environment of the ITC-320 complies with the thermal considerations set forth in this document.

Chapter 7 - ITC-322 Characteristics

7.1 Overview

The Kontron ITC-322 board supports an ITC-320-HDD module which extends the ITC-320 version from 4 HP to 8 HP.

This additional capability opens up the broadest range of expansion possibilities. The ITC-320-HDD module has been designed to include two COM ports, a PS/2 keyboard and mouse port, two USB 2.0 interfaces and a SATA hard disk interface.

The connectors for the COM ports, the PS/2 keyboard and mouse, and the USB ports are situated at the front panel, while the SATA hard disk is an onboard connectors. The module connects to the ITC-320 via the I/O extension connector (J5 connector on Figure 9 page 29).

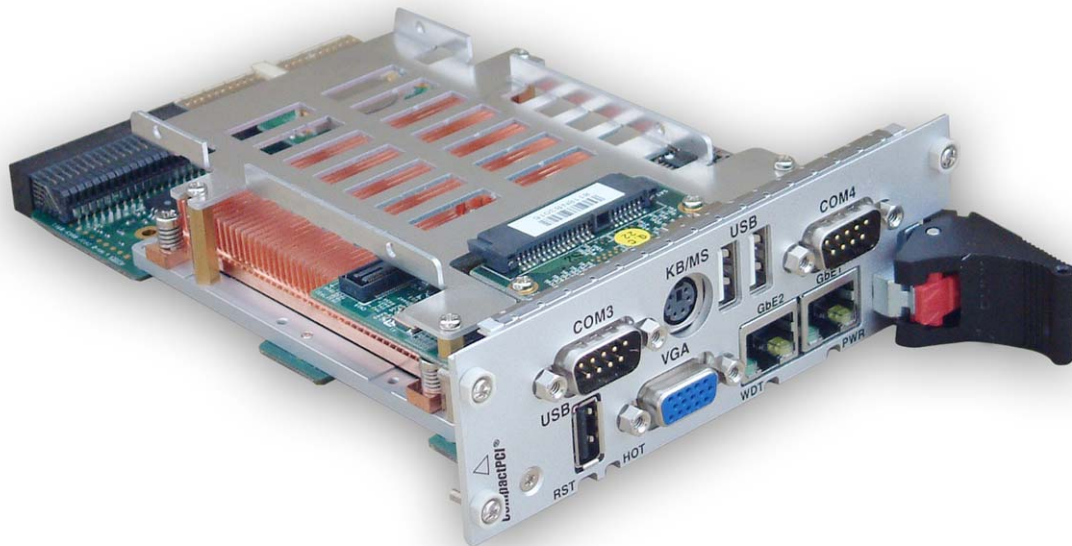


Figure 25: ITC-322 Overview

7.2 Technical Specifications

ITC-322		SPECIFICATIONS		
External Interfaces	Keyboard and Mouse Interface	PS/2 type, 6-pin, shielded mini-DIN connector for the keyboard and mouse (via Y-cable)		
	Serial Port	Two 16C550 compatible serial ports , 9-pin D-Sub connectors COM3: EIA-232 full-modem COM4: EIA-232 full-modem / EIA-422/485/ 485+ half-duplex		
	USB	Two USB 2.0 interfaces		
Internal Interfaces	SATA	SATA interface which supports one 2.5" hard disk drive		
General	Power Consumption	Under OS	Idle 100 % CPU	
		- Intel® Core™ 2 Duo 1.5 GHz	29W 36W	
		- Intel® Core™ Duo 1.2 GHz	24 W 27 W	
		- Intel® Celeron® M 1.07 GHz	22 W 24 W	
	Temperature Range VITA 47-Class AC1 VITA 47-Class C1	Operational: 0°C to +55°C Storage: -40°C to +85°C		
	Climatic Humidity	90% non-condensing		
Dimensions	Dimensions: 99.85 mm x 162.54 mm			
Board Weight	ITC-322 with heat sink: 745g (without mounted 2.5" HDD)			
MTBF	Refer to section 7.2.1 "MTBF Data" page 73			

Table 34: ITC-322 Main Specifications

7.2.1 MTBF Data

Calculations are made according to the standard MIL-HDBK217F-2 for following types of environment:

- > Ground Benign (GB)
- > Air Inhabited Cargo (AIC)
- > Naval Sheltered (NS),
- > Air Rotary Wing (ARW)

» ITC322-SA52-00000 - Intel® Core™ 2 Duo

Ground Benign (Hours)	25°C: 155 889	40°C: 125 717
Air Inhabited Cargo (Hours)	40°C: 22 629	
Naval Sheltered (Hours)	25°C: 25 143	40°C: 22 629
Air Rotary Wing (Hours)	25°C: 7 166	

Table 35: ITC322-SA52-0000 MTBF Data

» ITC322-SA22-00000 - Intel® Core™ Duo

Ground Benign (Hours)	25°C: 158 302	40°C: 127 663
Air Inhabited Cargo (Hours)	40°C: 22 979	
Naval Sheltered (Hours)	25°C: 25 553	40°C: 22 979
Air Rotary Wing (Hours)	25°C: 7 277	

Table 36: ITC322-SA22-0000 MTBF Data

» ITC322-SA02-00000 - Intel® Celeron® M

Ground Benign (Hours)	25°C: 156 791	40°C: 126 444
Air Inhabited Cargo (Hours)	40°C: 22 760	
Naval Sheltered (Hours)	25°C: 25 289	40°C: 22 760
Air Rotary Wing (Hours)	25°C: 7 207	

Table 37: ITC322-SA02-0000 MTBF Data

7.3 Functional Block Diagram

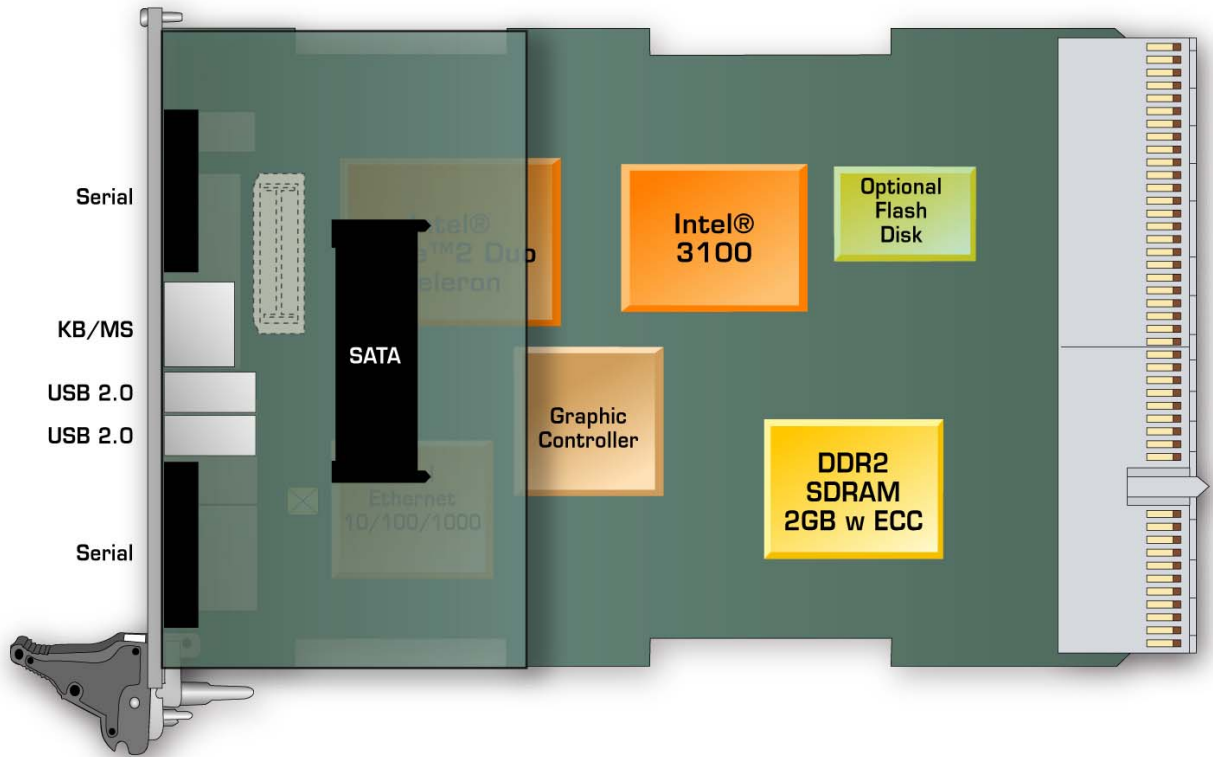


Figure 26: ITC-322 Functional Block Diagram

7.4 Board Layout

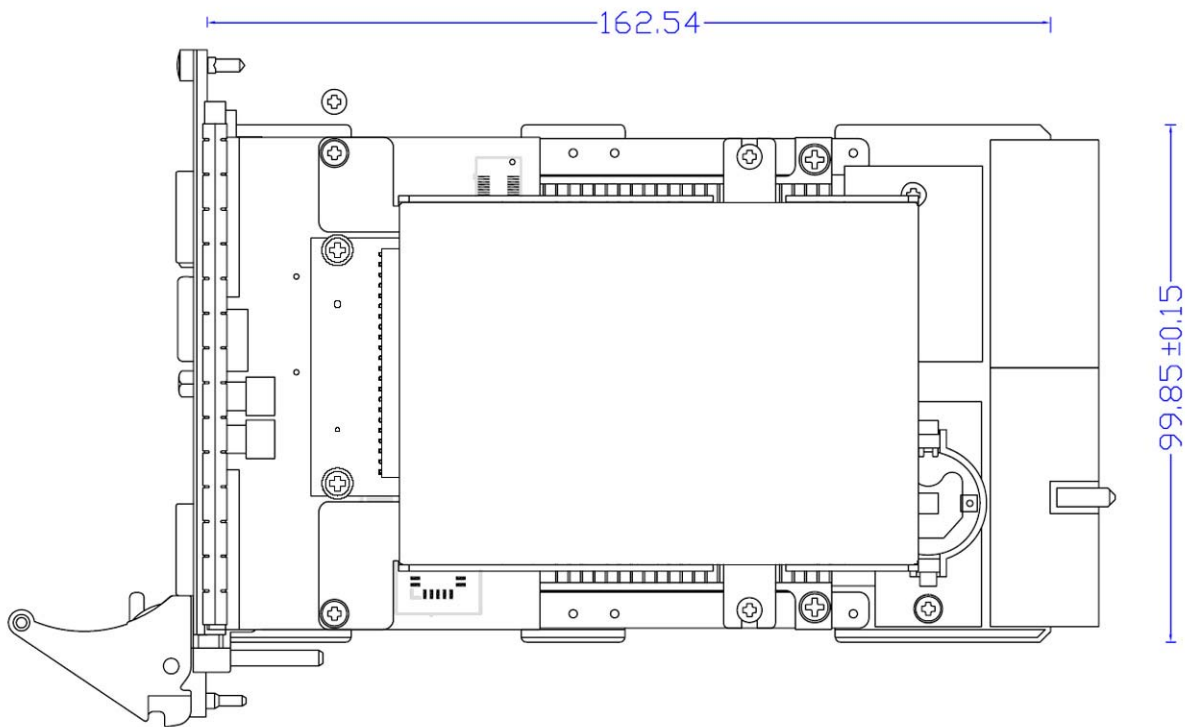


Figure 27: ITC-322 Layout

7.5 Connectors

7.5.1 Front Panel Connectors

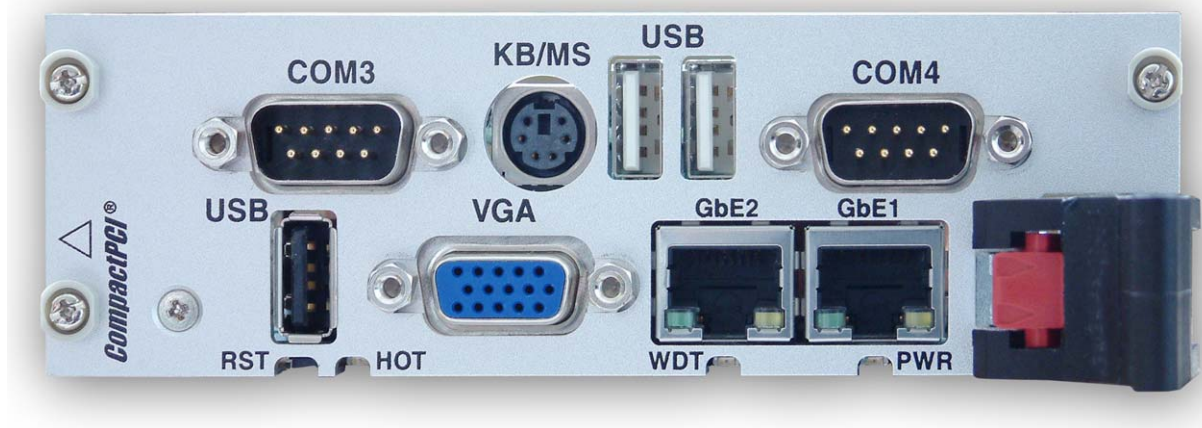


Figure 28: ITC-322 Front Panel Connectors

7.5.2 Onboard Connectors

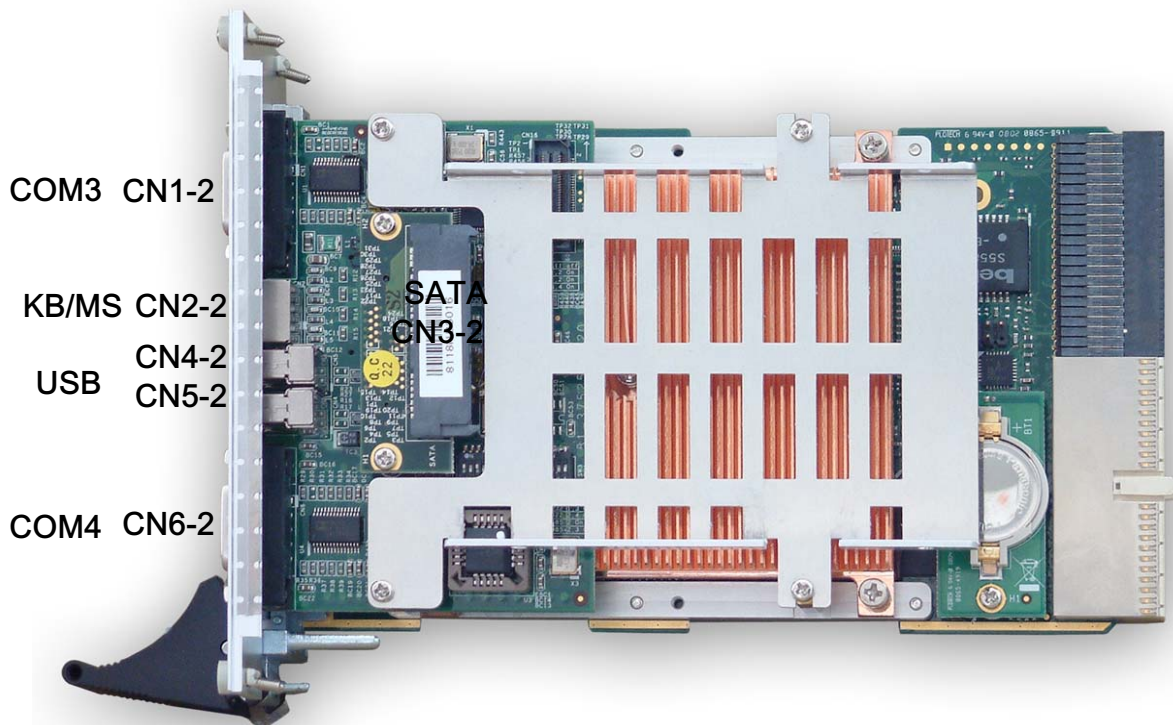


Figure 29: ITC-322 Connectors Layout

- » CN1-2, CN6-2 See section 7.6.2 “Universal Serial Ports” page 80
- » CN2-2 See section 7.6.1 “Keyboard/Mouse Interface” page 78
- » CN3-2 See section 7.6.4 “SATA Interface” page 85
- » CN4-2, CN5-2 See section 7.6.3 “USB Interface” page 84

7.6 Modules Interfaces (Front Panel and Onboard)

7.6.1 Keyboard/Mouse Interface

The keyboard controller is located on the ITC-322 and is 8042 software compatible.

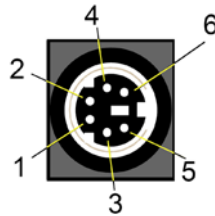


Figure 30: Keyboard/Mouse Connector

The PC/AT standard keyboard/mouse connector is a PS/2-type 6-pin shielded Mini-DIN connector. A special adapter to connect a mouse device and/or a keyboard to the PS/2 connector is available from Kontron.

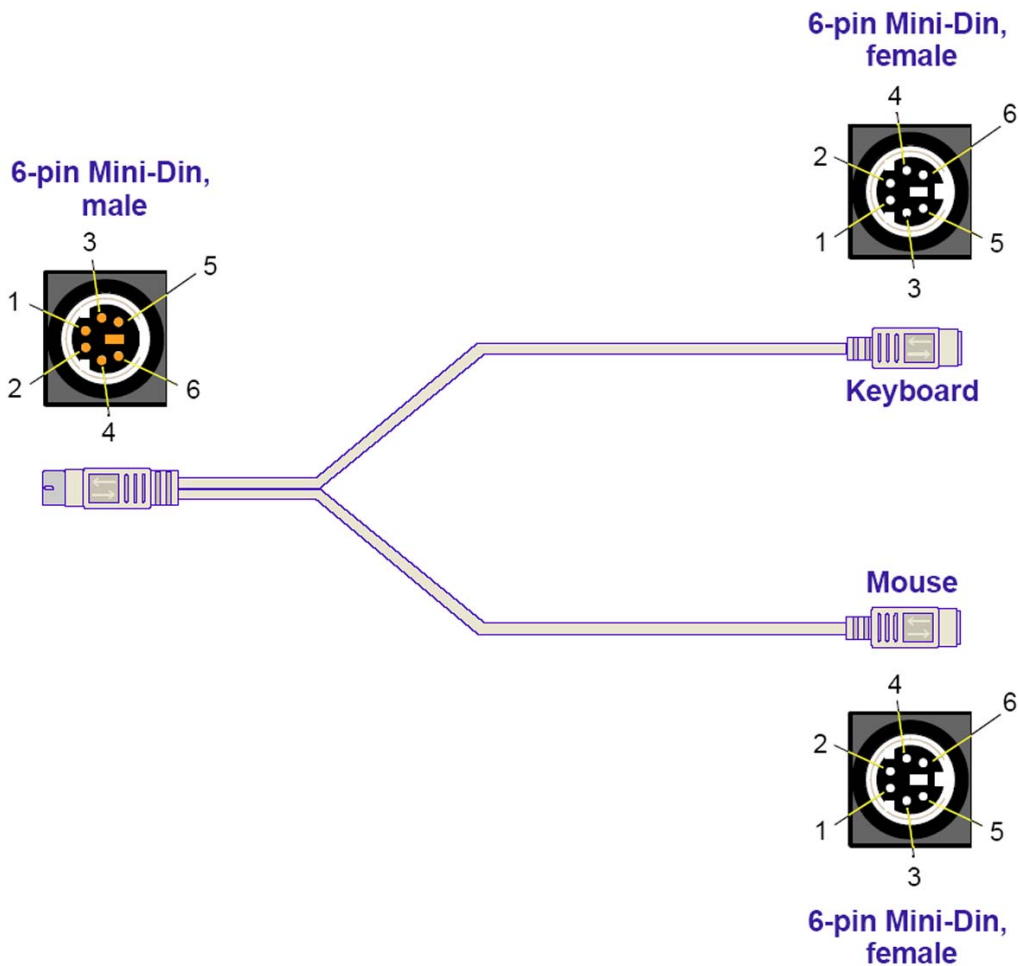


Figure 31: Adapter for Connecting Mouse/keyboard via PS/2

The ITC-322 has the AT keyboard connector implemented on a 6-pin Mini-Din connector.

PIN	SIGNAL	DESCRIPTION	I/O
1	KDATA	Keyboard data	I/O
2	MDATA	Mouse data	I/O
3	GND	Ground signal	--
4	VCC	VCC signal	--
5	KCLK	Keyboard clock	I/O
6	MCLK	Mouse clock	I/O

Table 38: Keyboard Connector CN2-2



The PS/2 power supply provides short-circuit protection and all the signal lines are EMI-filtered.

7.6.2 Universal Serial Ports

Two PC-compatible serial EIA-232, 9-pin D-Sub ports are available and fully compatible with the 16C550 controller. These port includes a complete set of handshaking and modem control signals. Data transfer rates up to 115.2 kB/s are supported.

» EIA-232 Full Modem

The COM3 interface is routed to the connector CN1-2. The COM3 interface is compatible serial EIA-232 Full Modem.

PIN	SIGNAL	DESCRIPTION	I/O
1	DCD	Data carrier detect	I
2	RXD	Receive data	I
3	TXD	Transmit data	O
4	DTR	Data terminal ready	O
5	GND	Signal ground	--
6	DSR	Data send request	I
7	RTS	Request to send	O
8	CTS	Clear to send	I
9	RI	Ring indicator	I

Table 39: Serial Port Connector CN1-2 (COM3) Pinout

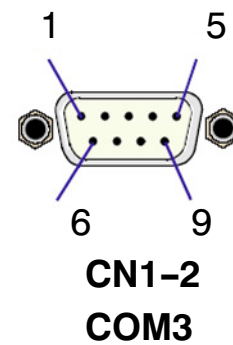


Figure 32: Serial Port Connector CN1-2

» EIA-232 Full Modem - EIA-422/485/485+ Half Duplex

The COM4 interface is routed to the connector CN6-2. The COM4 interface is compatible EIA-232 Full Modem or EIA-422/485+ Half Duplex

Depending on SW1, SW2, SW3 and SW4 micro-switches configuration, the CN6-2 (COM4) can be configured as:

- ▶ EIA-232 Full Modem - Default configuration
- ▶ EIA-422 Half Duplex
- ▶ EIA-485 Half Duplex
- ▶ EIA-485+ Half Duplex

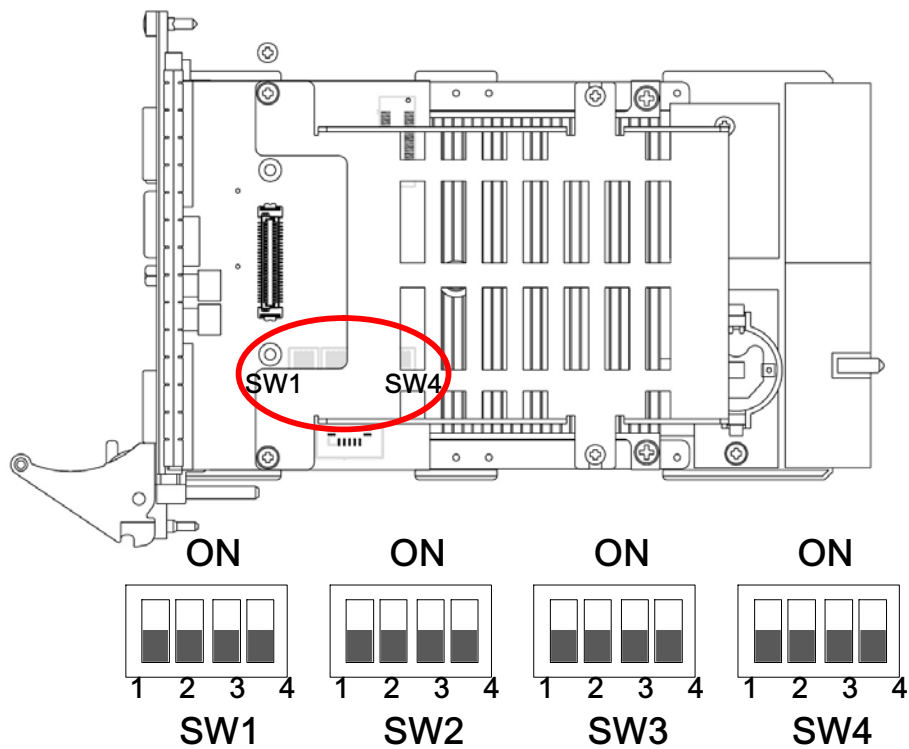


Figure 33: Micro-switches (SW1-SW4) Location

	Location	SW1	SW2	SW3	SW4
EIA-232 Full Modem	1	ON	ON	OFF	ON
	2	OFF	OFF	OFF	OFF
	3	ON	ON	OFF	OFF
	4	OFF	OFF	OFF	OFF
EIA-422 Half Duplex	1	OFF	OFF	ON	OFF
	2	ON	ON	ON	ON
	3	OFF	OFF	OFF	OFF
	4	ON	ON	OFF	OFF
EIA-485 Half Duplex	1	OFF	OFF	ON	OFF
	2	ON	ON	ON	OFF
	3	OFF	OFF	OFF	ON
	4	ON	ON	OFF	OFF
EIA-485+ Half Duplex	1	OFF	OFF	OFF	OFF
	2	ON	ON	OFF	OFF
	3	OFF	OFF	ON	OFF
	4	ON	ON	ON	ON

Table 40: Micro-switches (SW1-SW4) Configuration

► EIA-232 (COM4) Full Modem Pinout

PIN	EIA-232 SIGNAL	DESCRIPTION	I/O
1	DCD	Data carrier detect	I
2	RXD	Receive data	I
3	TXD	Transmit data	O
4	DTR	Data terminal ready	O
5	GND	Signal ground	--
6	DSR	Data send request	I
7	RTS	Request to send	O
8	CTS	Clear to send	I
9	RI	Ring indicator	I

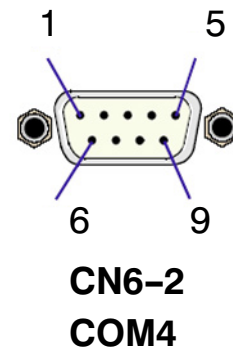


Table 41: Serial Port Connector CN6-2 (COM4) EIA-232 Pinout

Figure 34: Serial Port Connector CN6-2

▶ EIA-422/485/485+ (COM4) Half Duplex Pinout

PIN	EIA-422/485/485+ SIGNAL	DESCRIPTION	I/O
1	TXD-	Transmit data (-)	O
2	TXD+	Transmit data (+)	O
3	RXD+	Receive data (+)	I
4	RXD-	Receive data (-)	I
5	GND	Signal ground	--
6	--	Not used	--
7	--	Not used	--
8	--	Not used	--
9	--	Not used	--

Table 42: Serial Port Connector CN6-2 (COM4) EIA-422/485/485+ Pinout

7.6.3 USB Interfaces

The ITC-322 provides two standard USB 2.0 ports (USB4 and USB5) on CN4-2 and CN5-2.

On the USB 2.0 front panel ports, USB cables with up to 5 meters in length can be used. The USB 2.0 ports are high-speed, full-speed, and low-speed capable. Hi-speed USB 2.0 allows data transfers of up to 480 Mb/s - 40 times faster than a full-speed USB (USB 1.1).

One USB peripheral may be connected to each port. To connect more USB devices than there are available ports, an external hub is required.

PIN	SIGNAL	FUNCTION	I/O
1	VCC	VCC	--
2	UV0-	Differential USB-	I/O
3	UV0+	Differential USB+	I/O
4	GND	GND	--

Table 43: USB Connectors CN4-2 and CN5-2 Pinout

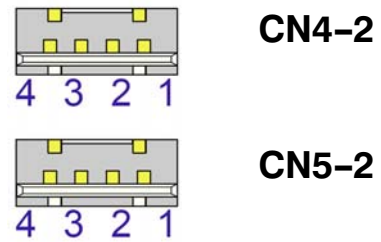


Figure 35: USB Connectors CN4-2 and CN5-2



The ITC-322 host interfaces can be used with maximum 500 mA continuous load current as specified in the Universal Serial Bus Specification, Revision 2.0. Short-circuit protection is provided. All the signal lines are EMI-filtered.

7.6.4 SATA Interface

The SATA connector, CN3-2, on the ITC-322 module is provided for connecting a 2.5" SATA HDD to the ITC-322 module. The SATA connector is divided into two segments, a signal segment and a power segment.

PIN	SIGNAL	FUNCTION	I/O
Signal Segment Key			
S1	GND	Ground signal	--
S2	SATA_TX2+	Differential Transmit+	O
S3	SATA_TX2-	Differential Transmit-	O
S4	GND	Ground signal	--
S5	SATA_RX2-	Differential Receive-	O
S6	SATA_RX2+	Differential Receive+	O
S7	GND	Ground signal	--
Signal Segment "L"			
Central Connector Polarizer			
Power Segment "L"			
P1	3.3V	3.3V power	--
P2	3.3V	3.3V power	--
P3	3.3V	3.3V power	--
P4	GND	Ground signal	--
P5	GND	Ground signal	--
P6	GND	Ground signal	--
P7	5V	5V power	--
P8	5V	5V power	--
P9	5V	5V power	--
P10	GND	Ground signal	--
P11	RES	Reserved	--
P12	GND	Ground signal	--
P13	NC (12V)	Not connected	--
P14	NC (12V)	Not connected	--
P15	NC (12V)	Not connected	--
Power Segment Key			

Table 44: SATA Connector CN3-2 Pinout

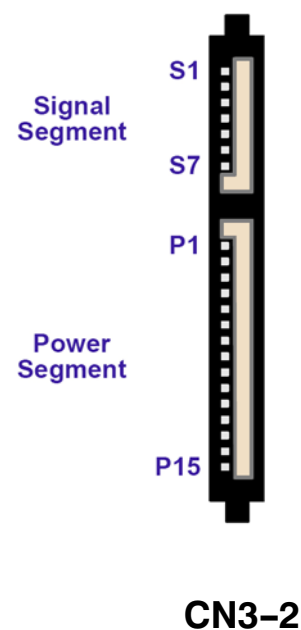


Figure 36: SATA Connector CN3-2

Chapter 8 - ITC-320-RTM Characteristics

8.1 Overview

The ITC-320 provides optional Rear I/O connectivity for peripherals, a feature which may be particularly useful in specialized CompactPCI systems. Some standard PC interfaces are implemented and assigned to the front panel and to the Rear I/O connector J2 on the ITC-320.

When the ITC-320-RTM is used, the signals of some of the main board/front panel connectors are routed to the module interface. Thus, the ITC-320 Rear Transition Module makes it much easier to remove the CPU in the rack as there is practically no cabling on the CPU board.

For the system Rear I/O feature a special backplane is necessary. The CPU board with Rear I/O is compatible with all standard CompactPCI passive backplanes with Rear I/O support on the system slot.

The ITC-320-RTM provides the following interfaces.

- CompactPCI Rear I/O
- Two USB 2.0 ports
- Two Gigabit Ethernet ports without LED signals
- One COM port
- Three SATA ports

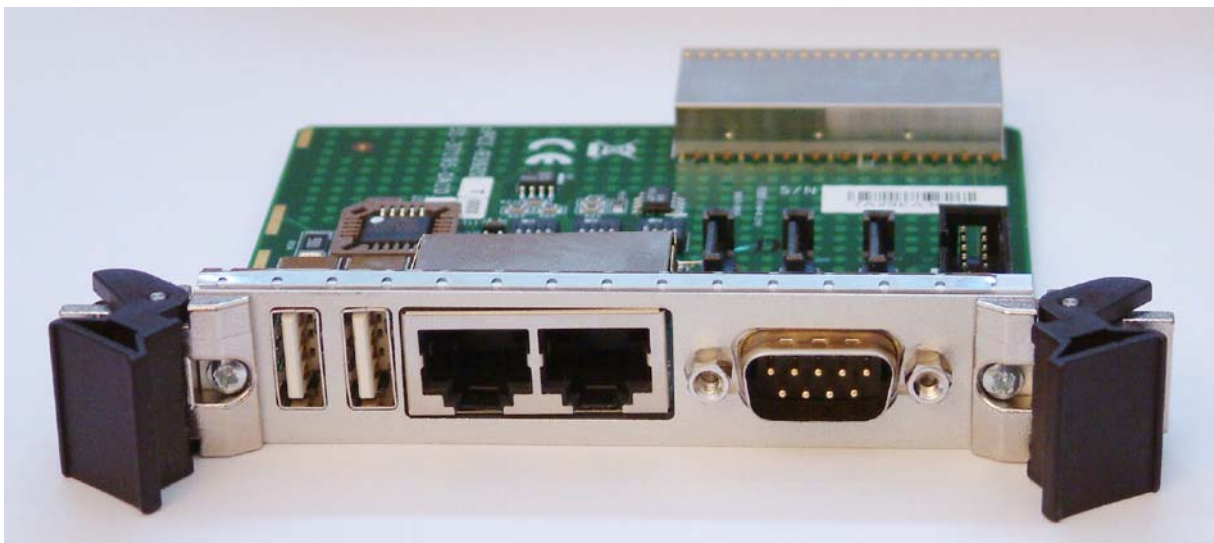


Figure 37: ITC-320-RTM Overview

8.2 Technical Specifications

ITC-320-RTM		SPECIFICATIONS
External Interfaces	USB	Two USB 2.0 interfaces, two 4-pin connectors
	Ethernet	Two Gigabit Ethernet interfaces implemented as dual RJ-45 connector without LEDs
	COM	One serial port (COM1), RS-232 simplified, 9-pin D-Sub connectors
Internal Interfaces	SATA	Three SATA interfaces; SATA1, SATA2 and SATA3
	Compact PCI	CompactPCI connector for connecting Rear I/O to the backplane
	COM	One serial port (COM2) implemented as a 10-pin, 2.54 mm onboard connector, RS-232 simplified
General	Temperature Range	Operational: 0°C to +55°C Storage: -55°C to +85°C
	Climatic Humidity	99% non-condensing
	Dimensions	Dimensions: 99.85 mm x 82.54 mm
	Board Weight	120g

Table 45: ITC-320-RTM Main Specifications

8.3 Board Layout

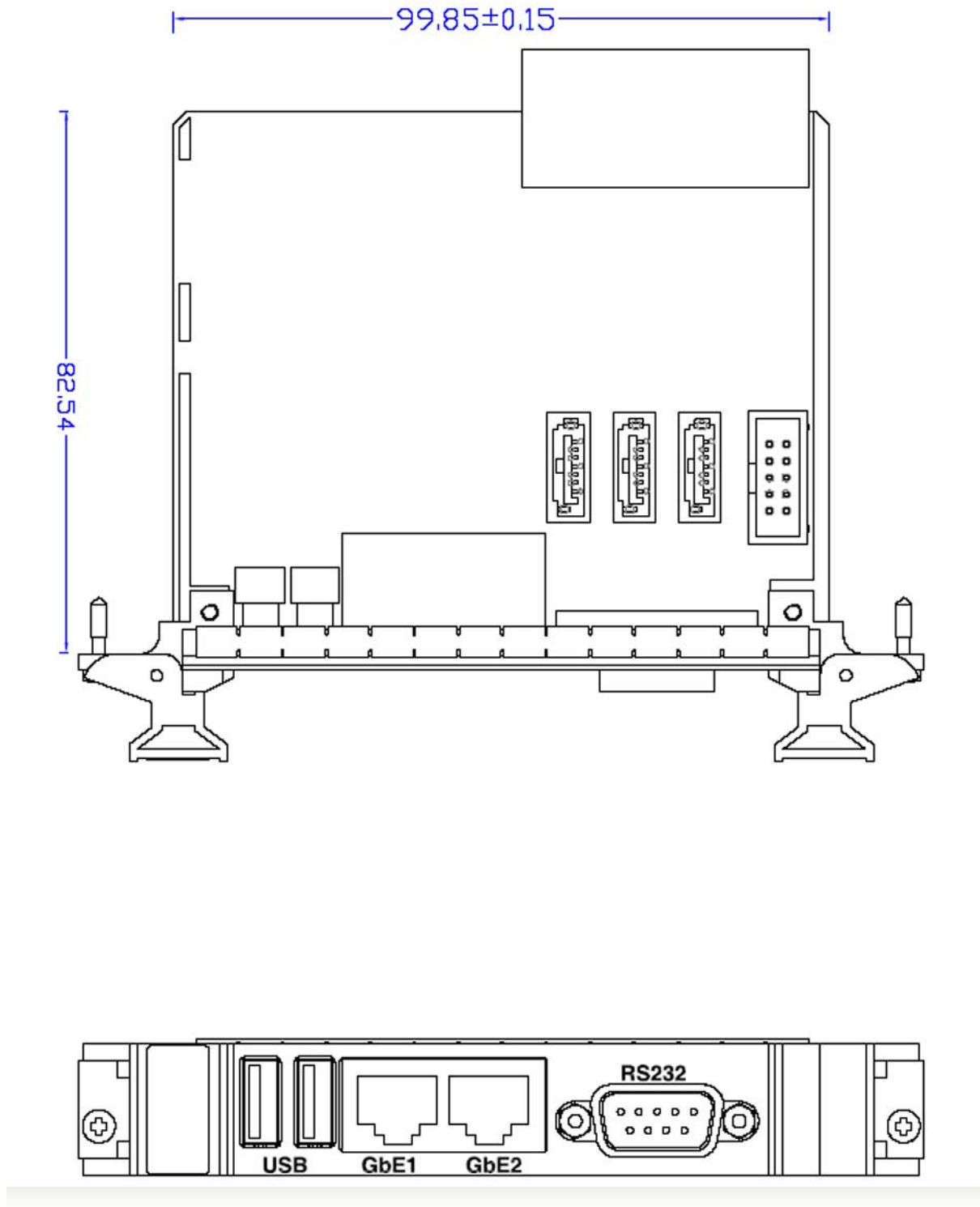


Figure 38: ITC-320-RTM Layout

8.4 Connectors

8.4.1 Front Panel Connectors

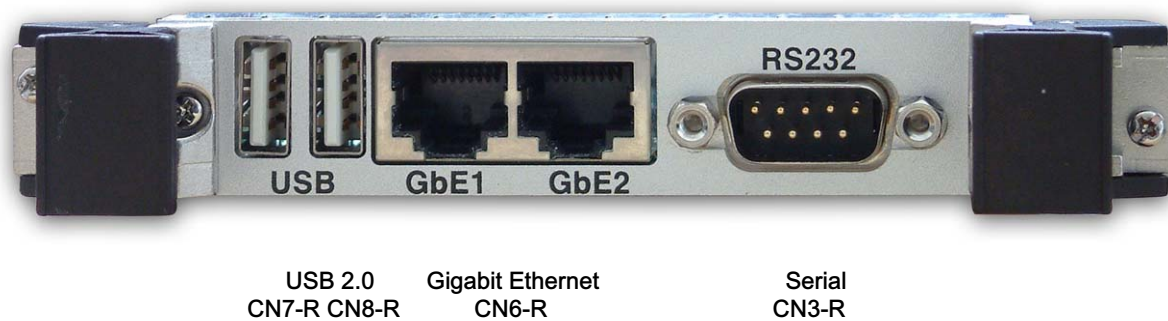


Figure 39: ITC-320-RTM Front Panel Connectors

8.4.2 Onboard Connectors

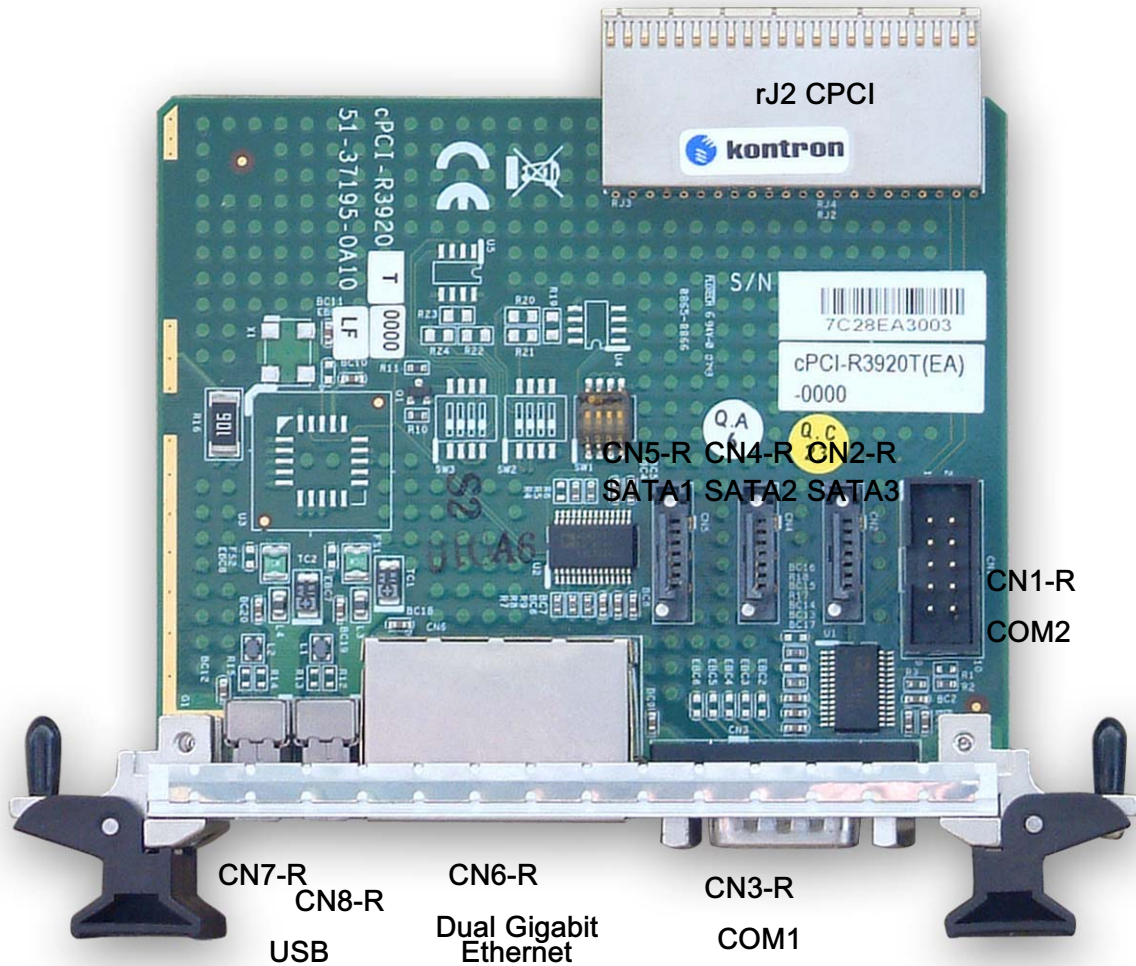


Figure 40: ITC-320-RTM Onboard Connectors

- » CN1-R, CN3-5 See section 8.5.3 “COM1 and COM2 Interfaces” page 93
- » CN2-R, CN4-R, CN5-R See section 8.5.4 “Serial ATA Interfaces” page 94
- » CN6-R See section 8.5.2 “Gigabit Ethernet Interfaces” page 92
- » CN7-R, CN8-R See section 8.5.1 “USB Interfaces” page 91
- » rJ2 See section 8.5.5 “Rear I/O Interfaces” page 95

8.5 Modules Interfaces

8.5.1 USB Interfaces

There are two identical USB interfaces on the ITC-320-RTM, each with a maximum transfer rate of 480 Mb/s provided for connecting USB devices. One USB peripheral may be connected to each port. To connect more USB devices than there are available ports, an external hub is required.

PIN	SIGNAL	FUNCTION	I/O
1	VCC	VCC	--
2	UV0-	Differential USB-	I/O
3	UV0+	Differential USB+	I/O
4	GND	GND	--

Table 46: USB Connectors CN7-R and CN8-R Pinout

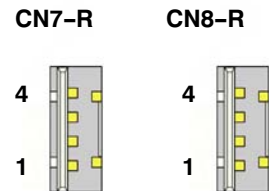


Figure 41: USB Connectors CN7-R / CN8-R



The USB host interfaces on the ITC-320-RTM can be used with maximum 500 mA continuous load current as specified in the Universal Serial Bus Specification, Revision 2.0. Short-circuit protection is provided. All the signal lines are EMI-filtered.



The Rear I/O interface supports the USB 1.1 and USB 2.0 standards. For USB 2.0 it is strongly recommended to use a cable length not exceeding 3 meters.

8.5.2 Gigabit Ethernet Interfaces

The Ethernet connectors are realized as RJ-45 connectors. The interfaces provide automatic detection and switching between 10Base-T, 100Base-TX and 1000Base-T data transmission (Auto-Negotiation). Auto-wire switching for crossed cables is also supported (Auto-MDI/X).

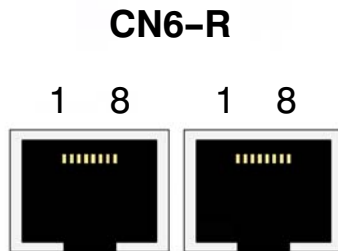


Figure 42: Dual Gigabit Ethernet Connector CN6-R

The CN6-R connector supplies the 10Base-T, 100Base-TX and 1000Base-T interfaces to the Ethernet controller.

MDI/STANDARD ETHERNET CABLE						PIN	MDIX/CROSSED ETHERNET CABLE					
10BASE-T		100BASE-TX		1000BASE-T			10BASE-T		100BASE-TX		1000BASE-T	
I/O	SIGNAL	I/O	SIGNAL	I/O	SIGNAL		I/O	SIGNAL	I/O	SIGNAL	I/O	SIGNAL
O	TX+	O	TX+	I/O	BI_DA+	1	I	RX+	I	RX+	I/O	BI_DB+
O	TX-	O	TX-	I/O	BI_DA-	2	I	RX-	I	RX-	I/O	BI_DB-
I	RX+	I	RX+	I/O	BI_DB+	3	O	TX+	O	TX+	I/O	BI_DA+
-	-	-	-	I/O	BI_DC+	4	-	-	-	-	I/O	BI_DD+
-	-	-	-	I/O	BI_DC-	5	-	-	-	-	I/O	BI_DD-
I	TX-	I	RX-	I/O	BI_DB-	6	O	TX-	O	TX-	I/O	BI_DA-
-	-	-	-	I/O	BI_DD+	7	-	-	-	-	I/O	BI_DC+
-	-	-	-	I/O	BI_DD-	8	-	-	-	-	I/O	BI_DC-

Table 47: Pinouts of CN6-R Based on the Implementation



The Ethernet transmission can operate effectively using a CAT5 cable or higher specifications.

8.5.3 COM Interfaces

The ITC-320-RTM provides two COM (COM1 and COM2) ports for connecting devices to the ITC-320-RTM.

» COM1: EIA-232 Simplified

The following figure and table provide pinout information for the 9-pin D-Sub COM1 connector CN3-R located on the front panel.

PIN	EIA-232 SIGNAL	DESCRIPTION	I/O
1	--	Not used	--
2	RXD	Receive data	I
3	TXD	Transmit data	O
4	--	Not used	--
5	GND	Signal ground	--
6 .. 9	--	Not used	--

Table 48: Serial Port Connector CN3-R (COM1)
EIA-232 Simplified Pinout

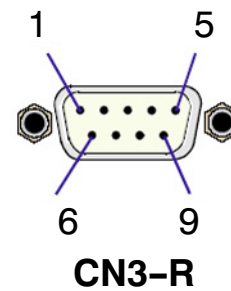


Figure 43: Serial Port Connector CN3-R (COM1)

» COM2: EIA-232 Simplified

The following figure and table provide pinout information for the onboard COM2 connector CN1-R.

PIN	SIGNAL	DESCRIPTION	I/O
1 .. 2	--	Not used	--
3	RXD	Receive data	I
4	--	Not used	--
5	TXD	Transmit data	O
6 .. 8	--	Not used	--
9	GND	Signal Ground	--
10	N.C.	Not connected	--

Table 49: Serial Port Connector CN1-R (COM2)
EIA-232 Simplified Pinout

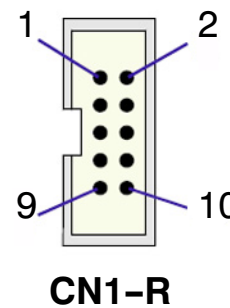


Figure 44: Serial Port Connector CN1-R (COM2)

8.5.4 Serial ATA Interfaces

The onboard Serial ATA connectors CN2-R, CN4-R and CN5-R allow the connection of standard HDDs and other Serial ATA devices to the ITC-320 Rear Transition Module.

The following figure and table provide pinout information for the SATA connectors CN2-R, CN4-R and CN5-R.

PIN	SIGNAL	DESCRIPTION	I/O
1	GND	Ground signal	--
2	SATA_TX+	Differential Transmit +	O
3	SATA_TX-	Differential Transmit -	O
4	GND	Ground signal	--
5	SATA_RX-	Differential Receive -	I
6	SATA_RX+	Differential Receive +	I
7	GND	Groudn Signal	--

Table 50: SATA Connectors CN2-R, CN4-R and CN5-R Pinout

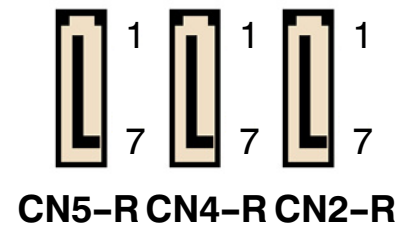


Figure 45: SATA Connectors CN2-R, CN4-R and CN5-R



When using a Serial ATA cable, it is recommended to use a special right-angled Serial ATA cable due to possible space limitations within the system. For further information, contact Kontron Technical Support.

8.5.5 Rear I/O Interfaces

The ITC-320 Rear Transition Module conducts a wide range of I/O signals through the Rear I/O connector rJ2.



To support the Rear I/O feature a special backplane is necessary. Do not plug a Rear I/O configured board in a non-system slot Rear I/O backplane. Failure to comply with the above may result in damage to your board.

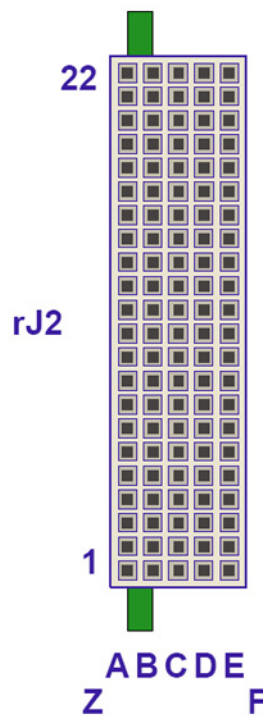


Figure 46: Rear I/O CompactPCI Connector rJ2

» Legend for Table 51:

USB _x	USB interface and power
ETH _x	Gigabit Ethernet port
SATA _x	Serial ATA port
COM _x	TTL-Level COM port

PIN	ROW Z	ROW A	ROW B	ROW C	ROW D	ROW E	ROW F
22	N.C.	GA[4]	GA[3]	GA[2]	GA[1]	GA[0]	GND
21	N.C.	CLK[6]	GND	COM1_RXD	COM2_RXD	N.C.	GND
20	N.C.	CLK[5]	GND	COM1_TXD	COM2_TXD	N.C.	GND
19	N.C.	GND/CLK100+	GND/CLK100+	SMB_SDA	SMB_SCL	SMB_ALERT	GND
18	N.C.	SATA3_TX+	SATA3_TX-	GND	SATA3_RX+	SATA3_RX-	GND
17	N.C.	USB2_D+	USB2_D-	RST_BP#	N.C.	GNT[6]#pull	GND
16	N.C.	USB2_PWR	USB3_PWR	DEGXB	GND	GPIO5	GND
15	N.C.	USB3_D+	USB3_D-	FALXB	N.C.	GNT[5]#pull	GND
14	N.C.	SATA2_TX+	SATA2_TX-	GND	SATA2_RX+	SATA2_RX-	GND
13	N.C.	SATA1_TX+	SATA1_TX-	GND	SATA1_RX+	SATA1_RX-	GND
12	N.C.	N.C.	N.C.	GND	N.C.	N.C.	GND
11	N.C.	N.C.	N.C.	GND	N.C.	N.C.	GND
10	N.C.	N.C.	N.C.	GND	N.C.	N.C.	GND
9	N.C.	N.C.	N.C.	GND	N.C.	N.C.	GND
8	N.C.	ETH0_DA+	ETH0_DA-	GND	ETH0_DC+	ETH0_DC-	GND
7	N.C.	ETH0_DB+	ETH0_DB-	GND	ETH0_DD+	ETH0_DD-	GND
6	N.C.	ETH1_DA+	ETH1_DA-	GND	ETH1_DC+	ETH1_DC-	GND
5	N.C.	ETH1_DB+	ETH1_DB-	GND	ETH1_DD+	ETH1_DD-	GND
4	N.C.	V(I/O)	N.C.	N.C.	N.C.	N.C.	GND
3	N.C.	CLK[4]	GND	GNT[3]#	N.C.	GNT[4]#pull	GND
2	N.C.	CLK[2]	CLK[3]	SYSEN#	GNT[2]#	REQ[3]#	GND
1	N.C.	CLK[1]	GND	REQ[1]#	GNT[1]#	REQ[2]#	GND

Table 51: Rear I/O CompactPCI Connector rJ2 Pinout

Chapter 9 - ITC-320-RC Characteristics

9.1 Technical Specifications

ITC-320-RC		SPECIFICATIONS
<i>External Interfaces</i>	VGA	D-Sub VGA connector available on front panel. Order Code: ITC320-RCX2-G0000
General	Power Consumption	Under OS - Intel® Core™ 2 Duo 1.5 GHz 100 % CPU 42W - Intel® Core™ Duo 1.2 GHz 33 W - Intel® Celeron® M 1.07 GHz 28 W
	Environmental Specifications	Refer to section 9.4 "Environmental Specifications" page 100
	Dimensions	Dimensions: 99.85 mm x 162.54 mm
	Board Weight	ITC-320-RC with heat sink: 460g
	MTBF	Refer to section 9.5 "MTBF Data" page 101

Table 52: ITC-320-RC Main Specifications

9.2 ITC-320-RC Specificities

FUNCTION	DESCRIPTION	SEE ALSO
Battery	No battery available on RC boards	Section 1.3.4 page 9 Section 2.3.3 page 32
Front Panel	Depending on the board Order Code, only the VGA connector or no connectors are available on the board front panel	Section 9.3 page 97 Section 1.3.4 page 9 Section 1.5.3 page 13
Environmental Specifications	Environmental specifications depend on the environmental class.	Section 9.4 page 100
MTBF	MTBF depend on the environmental class.	Section 9.5 page 101
Board Identification	Ruggedizer Identification by Ruggedizer Engineering Change Level	Section 9.6 page 102

Table 53: Rugged Conduction-Cooled Boards Specificities

9.3 External Interfaces

» ITC320-RCX2-G0000

Boards with Order Code ITC320-RCX2-G0000 have only the VGA connector available on the front panel. For this boards family, because of the VGA location, the IEEE standard conduction cooled volume is not respected.

» ITC320-RCX2-00000

Boards with Order Code ITC320-RCX2-00000 have no VGA connector available on the front panel. For this boards family, the IEEE standard conduction cooled volume is respected. The ITC-320 board is fitted with a female socket to take in a removable VGA adaptor card (Order Code: ADAP-VGA). This VGA adaptor car may be used mainly for BIOS maintenance/debug purposes.

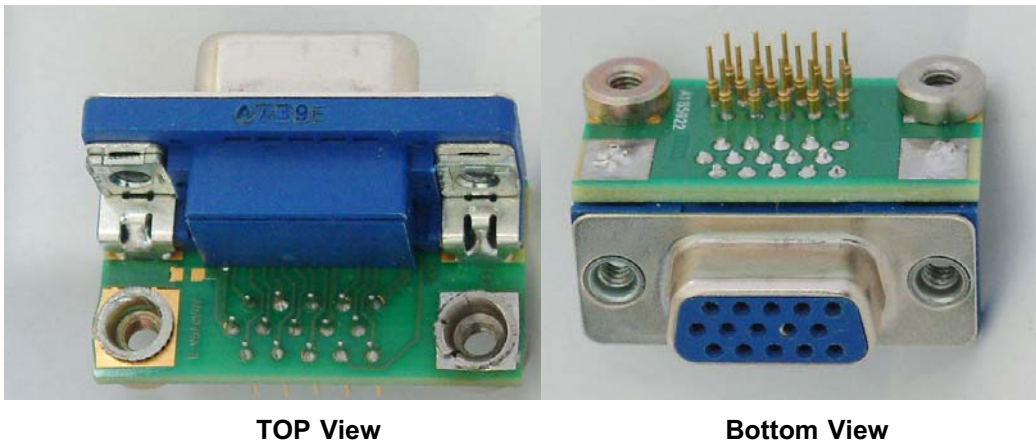


Figure 47: ADAP-VGA Overview

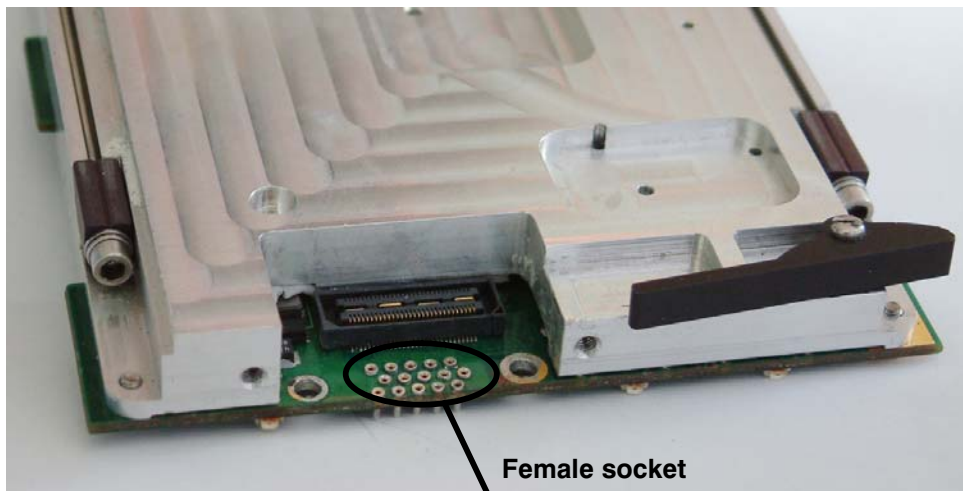


Figure 48: ADAP-VGA Location

On these boards, the AMIBIOS® can be configured to switch the console from the onboard graphics device to a serial line (use COM1 port on the with Order Code ITC320-RCX2-00000).

1. Mount the VGA adaptor board (ADAP-VGA) on the ITC320-RCX2-00000 board to use the onboard graphics device as console (default mode)
2. Power-on the system
3. Press <SUPPR> to enter the AMIBIOS® Setup Utility
4. Configure the AMI BIOS as described below:

Menu → Sub-menu	Field	Value
Advanced → Remote Access Configuration	Remote Access Serial port number	Enabled COM1
Chipset	On Board VGA	Disabled
Exit	Save Changes and Exit	Select and activate the field

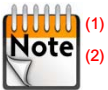
5. Power-off the system and remove the VGA adaptor board

The ITC320-RCX2-00000 board can be started by using the serial line (COM1 port on the ITC-320-RTM)) as console instead of the VGA.

For Linux OS, please refer to the Kontron documentation “BSP Fedora 9 on ITC-320 Series” (SD.DT.F29). The section 5.3.3 “Post-Installation Configuration” details how to redirect the boot loader (GRUB) to the serial line, and set the Linux console to the serial line too (use COM1 port on the ITC-320-RTM).

9.4 Environmental Specifications

TYPE	ASPECT	DESCRIPTION
Environmental Specifications	Conformal Coating	Standard
RC	Airflow	N.A.
Rugged Conduction-Cooled	Temperature VITA 47-Class CC4 VITA 47-Class CC3	Cooling Method: Conduction Operating: -40°C to +85°C ⁽¹⁾ Operating: -40°C to +70°C ⁽²⁾
	VITA 47-Class C2	Storage: -40°C to +85°C
	Vibration Sine (Operating)	2g / 22-2,000 Hz acceleration / frequency range
	Random	VITA 47-Class V3
	Shock (Operating)	40g / 11ms peak acceleration / shock duration half sine
	Altitude (Operating)	-1,640 to 50,000 ft
	Climatic Humidity	95% non-condensing



(1)
(2)

ITC-320-RC Intel® Core™ 2 Duo Standard Frequency Operation (1.33 GHz)
ITC-320-RC Intel® Core™ 2 Duo Higher Frequency Operation (1.5 GHz)

» Standard Frequency Operation

The ITC-320-RC Intel® Core™ 2 Duo processor frequency is set to 1.33 GHz. With this default setting, the ITC-320-RC processing performance is guaranteed across the whole operating temperature range (VITA 47-Class CC4: -40°C to +85°C). The ITC-320-RC thermal design is such as the processor, running at 1.33 GHz does not enter thermal management mode (frequency throttling) when the wedgelock temperature is maintained within the approved operating range.

» Higher Frequency Operation

The processor upper frequency limit can also be set to 1.5 GHz so as to get increased computing performance. In this case, the highest operating temperature on the wedgelock should be limited to 70°C (VITA 47-Class CC3: -40°C to +70°C). This will also keep the dual-core processor outside of its thermal management mode.

> Exceeding the limits will lock the board

Operating the processor at 1.5 GHz and allowing the wedgelock temperature to reach 85°C is tempting, but the board behaviour cannot be guaranteed. Even if the CPU chip may adapt quickly to the situation with frequency reduction, other components of the board, such as the host bridge, the ethernet chips are not capable of temperature throttling and will start causing errors. This shall not be authorised.

9.5 MTBF Data

Calculations are made according to the standard MIL-HDBK217F-2 for following types of environment:

- > Ground Benign (GB)
- > Air Inhabited Cargo (AIC)
- > Naval Sheltered (NS)
- > Air Rotary Wing (ARW)

» ITC320-RC52-00000 - Intel® Core™ 2 Duo

Ground Benign (Hours)	25°C: 277 519	40°C: 223 806
Air Inhabited Cargo (Hours)	40°C: 40 285	
Naval Sheltered (Hours)	25°C: 44 761	40°C: 40 285
Air Rotary Wing (Hours)	25°C: 12 757	

Table 54: ITC320-RC52-0000 MTBF Data

» ITC320-RC22-00000 - Intel® Core™ Duo

Ground Benign (Hours)	25°C: 335 293	40°C: 270 398
Air Inhabited Cargo (Hours)	40°C: 48 672	
Naval Sheltered (Hours)	25°C: 54 080	40°C: 48 672
Air Rotary Wing (Hours)	25°C: 15 413	

Table 55: ITC320-RC22-0000 MTBF Data

» ITC320-RC02-00000 - Intel® Celeron® M

Ground Benign (Hours)	25°C: 320 658	40°C: 258 595
Air Inhabited Cargo (Hours)	40°C: 46 547	
Naval Sheltered (Hours)	25°C: 51 719	40°C: 46 547
Air Rotary Wing (Hours)	25°C: 14 740	

Table 56: ITC320-RC02-0000 MTBF Data

9.6 ITC-320-RC Board Identification

The ITC-320-RC boards are identified by labels fitted to the top and bottom sides.

These labels are at the same position and have the same meaning as the ITC-322 boards labels (refer to the section 3.2.2 "ITC-322 Board Identification" page 52).

In addition, the ruggedizer is identified by the

- AA "Ruggedizer Engineering Change Level" (E.C. Level) label.

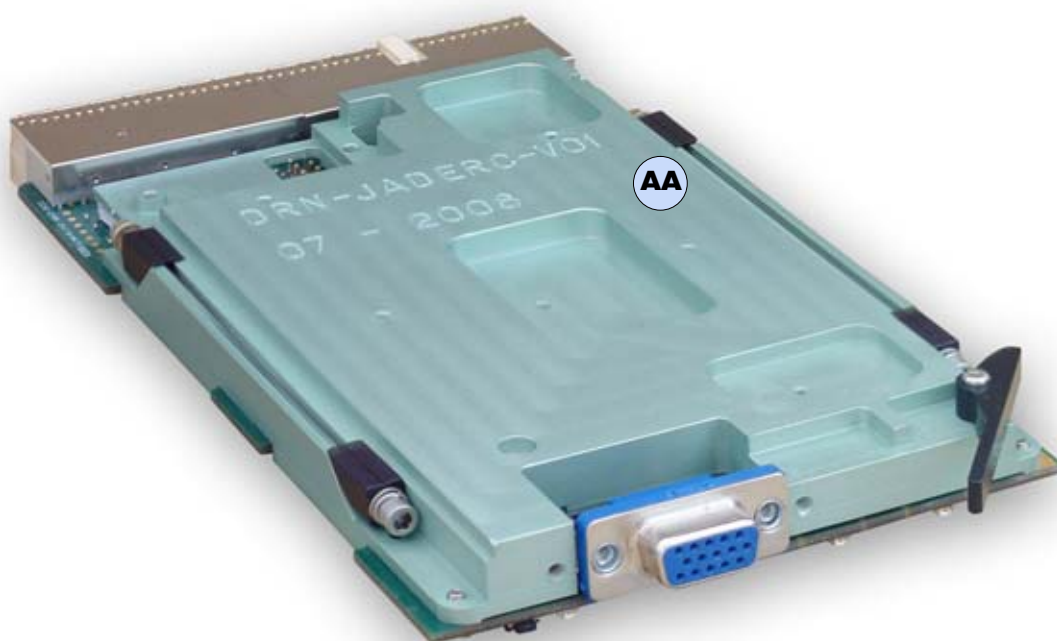


Figure 49: ITC-320-RC Identification (Top Side)

Chapter 10 - AMIBIOS®8 Setup Utility

The following chapter describes basic navigation for the AMIBIOS®8 BIOS setup utility.

10.1 Starting the BIOS

To enter the setup screen, follow these steps:

1. Power on the motherboard
2. Press the <Delete> key on your keyboard when you see the following text prompt:
 <Press DEL to run Setup>
3. After you press the <Delete> key, the main BIOS setup menu displays. You can access the other setup screens from the main BIOS setup menu, such as Chipset and Power menus.



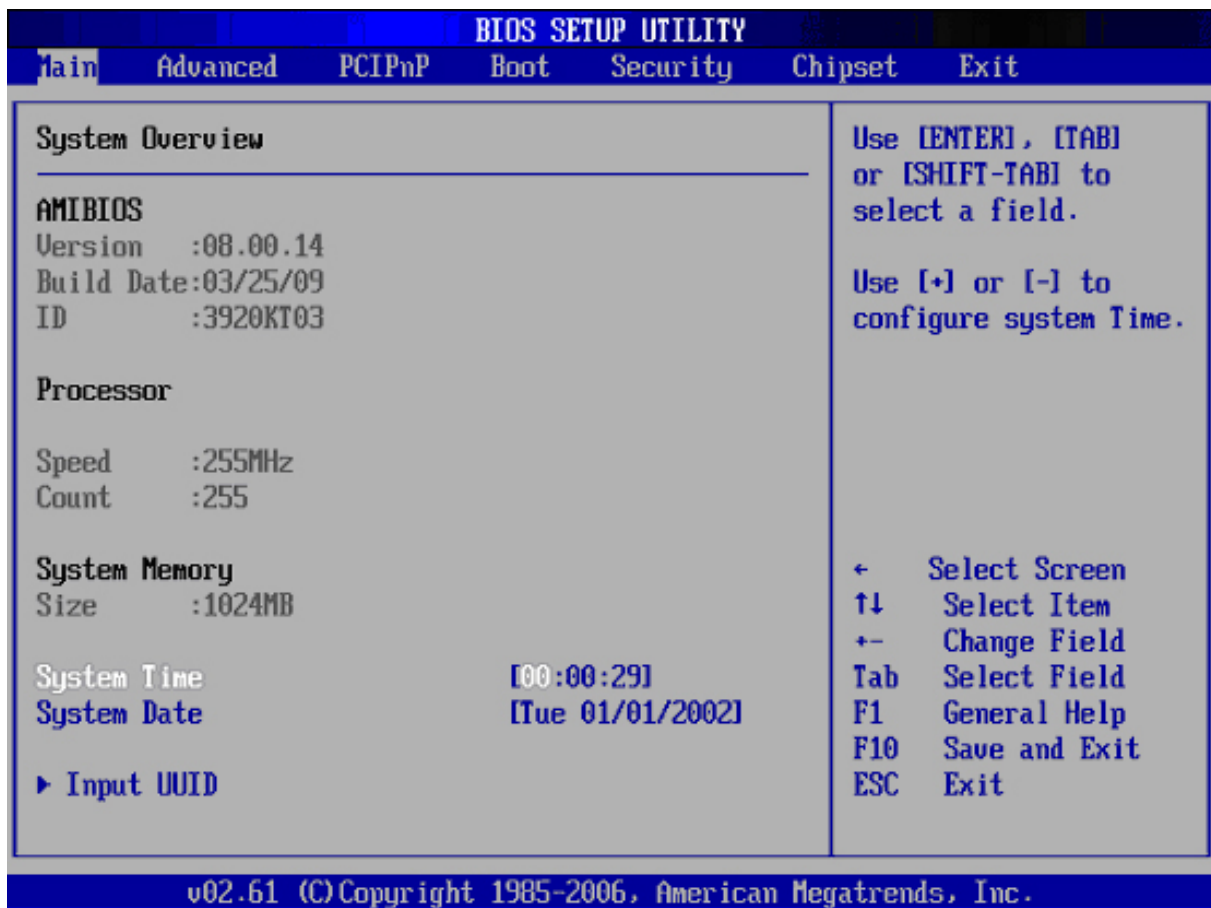
In most cases, the <Delete> key is used to invoke the setup screen. There are several cases that use other keys, such as <F1>, <F2>, and so on.

10.1.1 Setup Menu

The main BIOS setup menu is the first screen that you can navigate. Each main BIOS setup menu option is described in this user's guide.

The Main BIOS setup menu screen has two main frames. The left frame displays all the options that can be configured. "Grayed" options cannot be configured, "Blue" options can be.

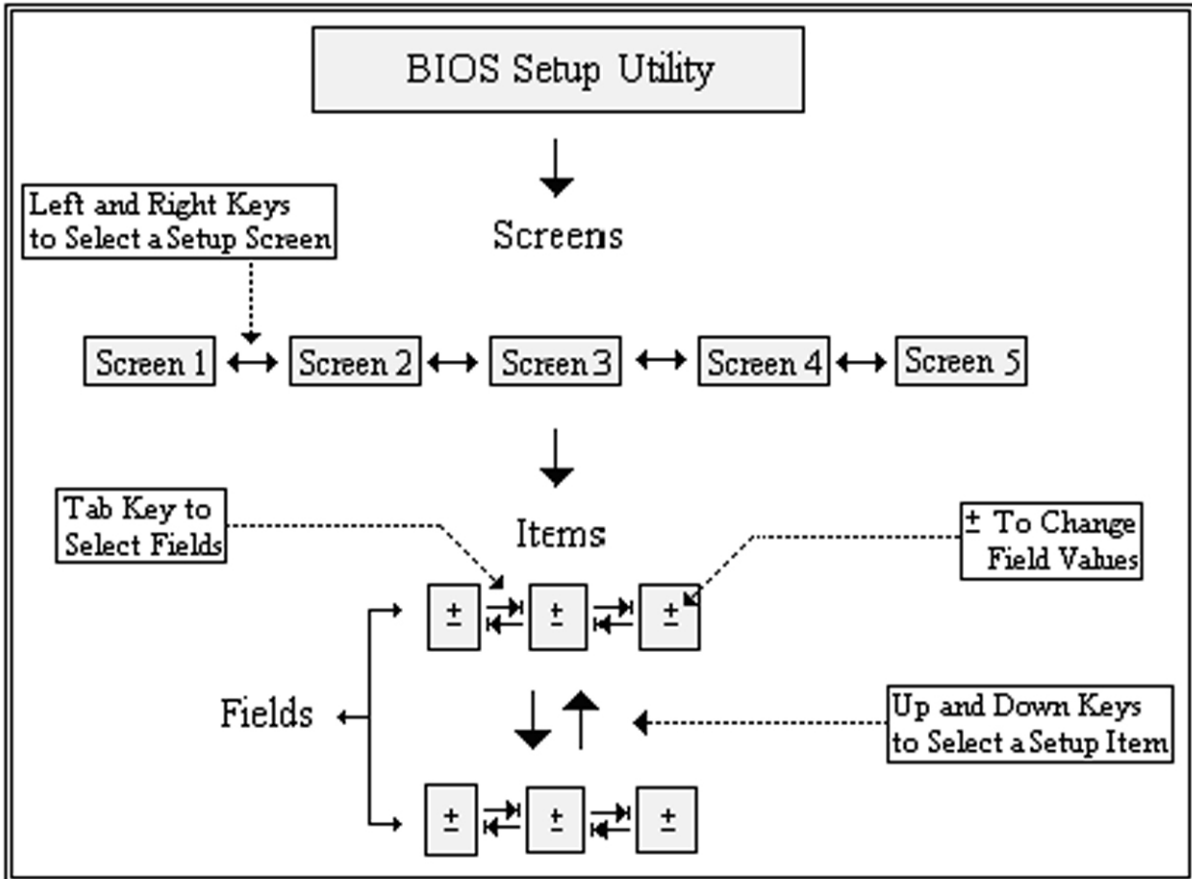
The right frame displays the key legend. Above the key legend is an area reserved for a text message. When an option is selected in the left frame, it is highlighted in white. Often a text message will accompany it.



10.1.2 Navigation

The BIOS setup/utility uses a key-based navigation system called hot keys. Most of the BIOS setup utility hot keys can be used at any time during the setup navigation process.

These keys include <F1>, <F10>, <Enter>, <ESC>, <Arrow> keys, and so on.



There is a hot key legend located in the right frame on most setup screens.

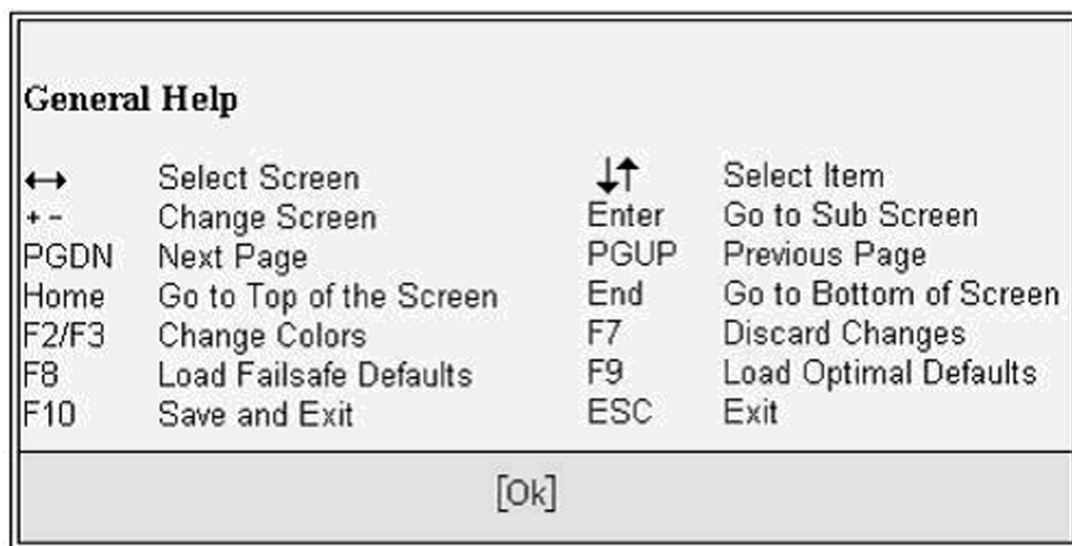
- ← Left/Right. The Left and Right <Arrow> keys allow you to select a setup screen.
For example: Main screen, Advanced screen, Chipset screen, and so on.
- ↑↓ Up/Down The Up and Down <Arrow> keys allow you to select a setup item or sub-screen.
- + - Plus/Minus The Plus and Minus <Arrow> keys allow you to change the field value of a particular setup item.
For example: Date and Time.
- Tab The <Tab> key allows you to select setup fields.



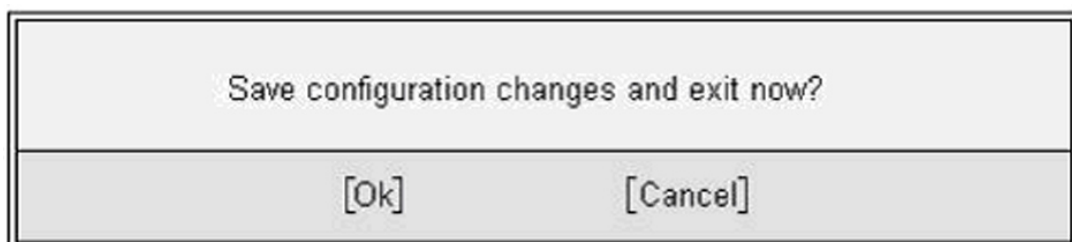
The <F8> key on your keyboard is the Fail-Safe key. It is not displayed on the key legend by default. To set the Fail-Safe settings of the BIOS, press the <F8> key on your keyboard. It is located on the upper row of a standard 101 keyboard. The Fail-Safe settings allow the motherboard to boot up with the least amount of options set. This can lessen the probability of conflicting settings.

Hot Key	Description
---------	-------------

F1	The <F1> key allows you to display the General Help screen. Press the <F1> key to open the General Help screen.
----	---

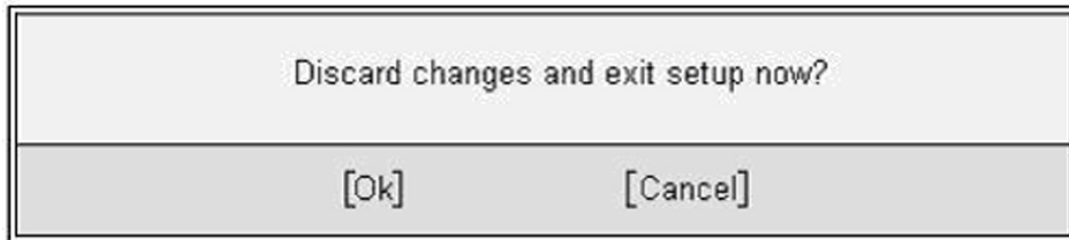


F10	The <F10> key allows you to save any changes you have made and exit Setup. Press the <F10> key to save your changes. The following screen will appear:
-----	--



Press the <Enter> key to save the configuration and exit. You can also use the <Arrow> key to select Cancel and then press the <Enter> key to abort this function and return to the previous screen.

ESC The <Esc> key allows you to discard any changes you have made and exit the Setup. Press the <Esc> key to exit the setup without saving your changes. The following screen will appear:

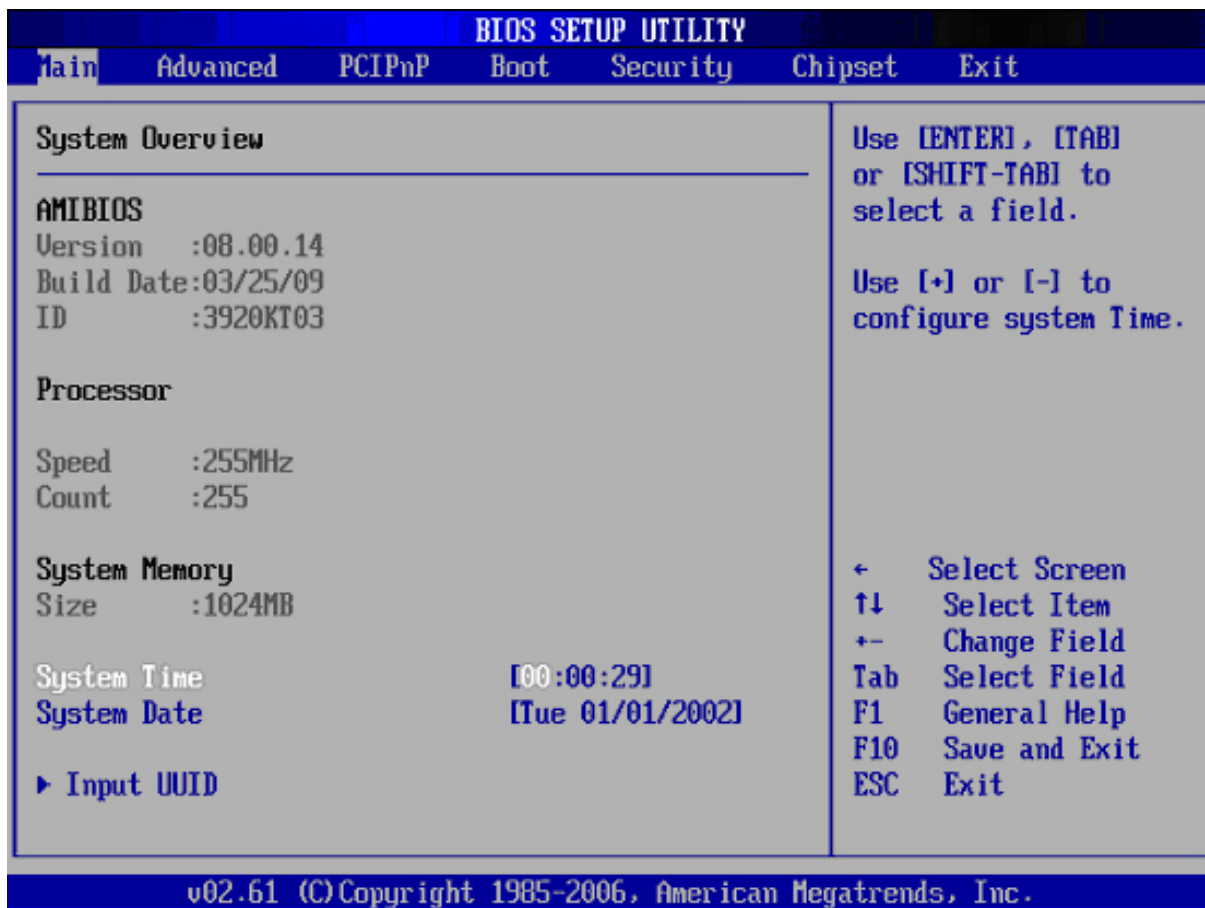


Press the <Enter> key to discard changes and exit. You can also use the <Arrow> key to select Cancel and then press the <Enter> key to abort this function and return to the previous screen.

Enter The <Enter> key allows you to display or change the setup option listed for a particular setup item. The <Enter> key can also allow you to display the setup sub-screens.

10.2 Main Setup

When you first enter the Setup Utility, you will enter the Main setup screen. You can always return to the Main setup screen by selecting the *Main* tab. There are two Main Setup options. They are described in this section. The Main BIOS Setup screen is shown below.



10.2.1 System Time/System Date

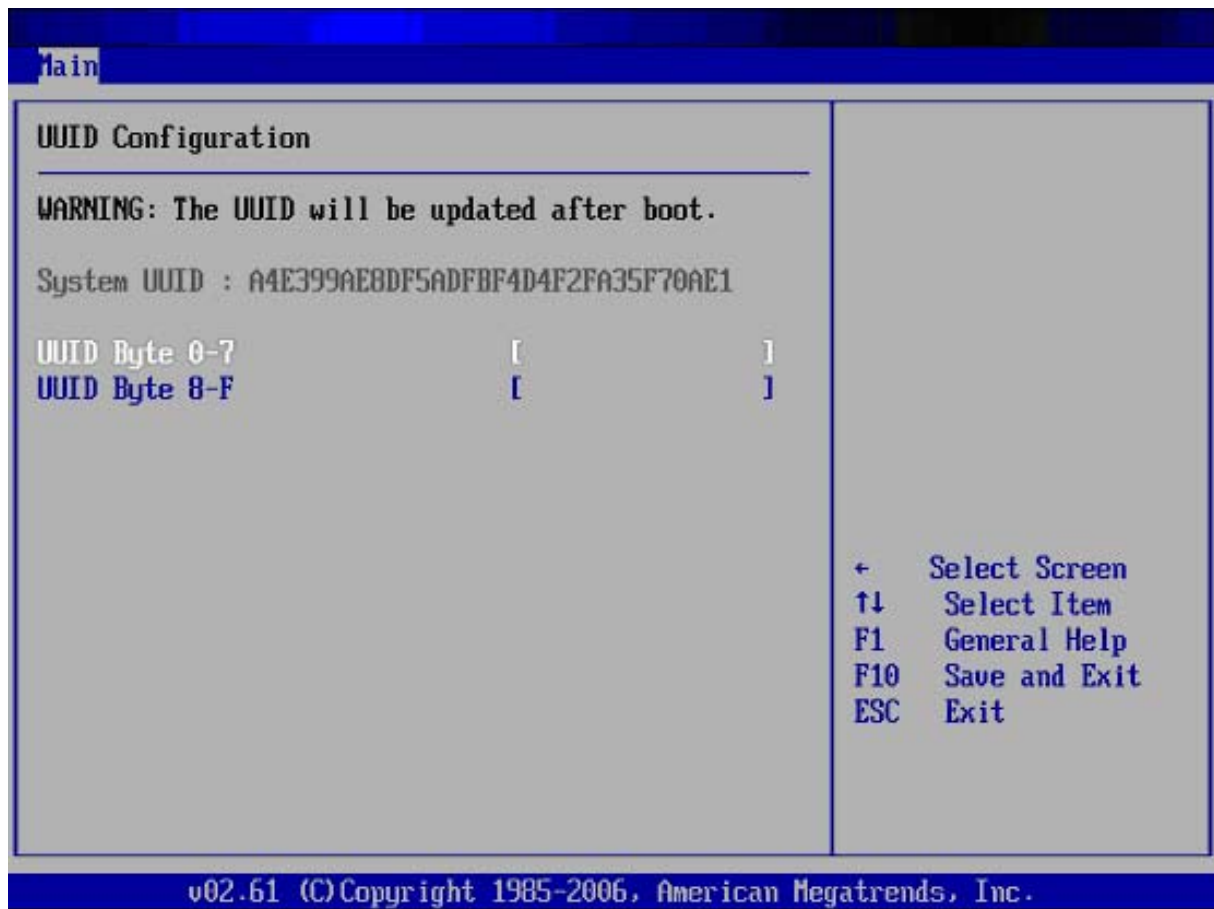
Use this option to change the system time and date. Highlight *System Time* or *System Date* using the <Arrow> keys. Enter new values using the keyboard. Press the <Tab> key or the <Arrow> keys to move between fields. The date must be entered in MM/DD/YY format. The time is entered in HH:MM:SS format.



The time is in 24-hour format. For example, 5:30 A.M. appears as 05:30:00, and 5:30 P.M. as 17:30:00.

10.2.2 Input UUID

You can use the function to set unique UUID for each computer.



»» UUID Byte 0-7

You can use the function to set unique UUID for each computer. This is byte 0-7 of UUID.

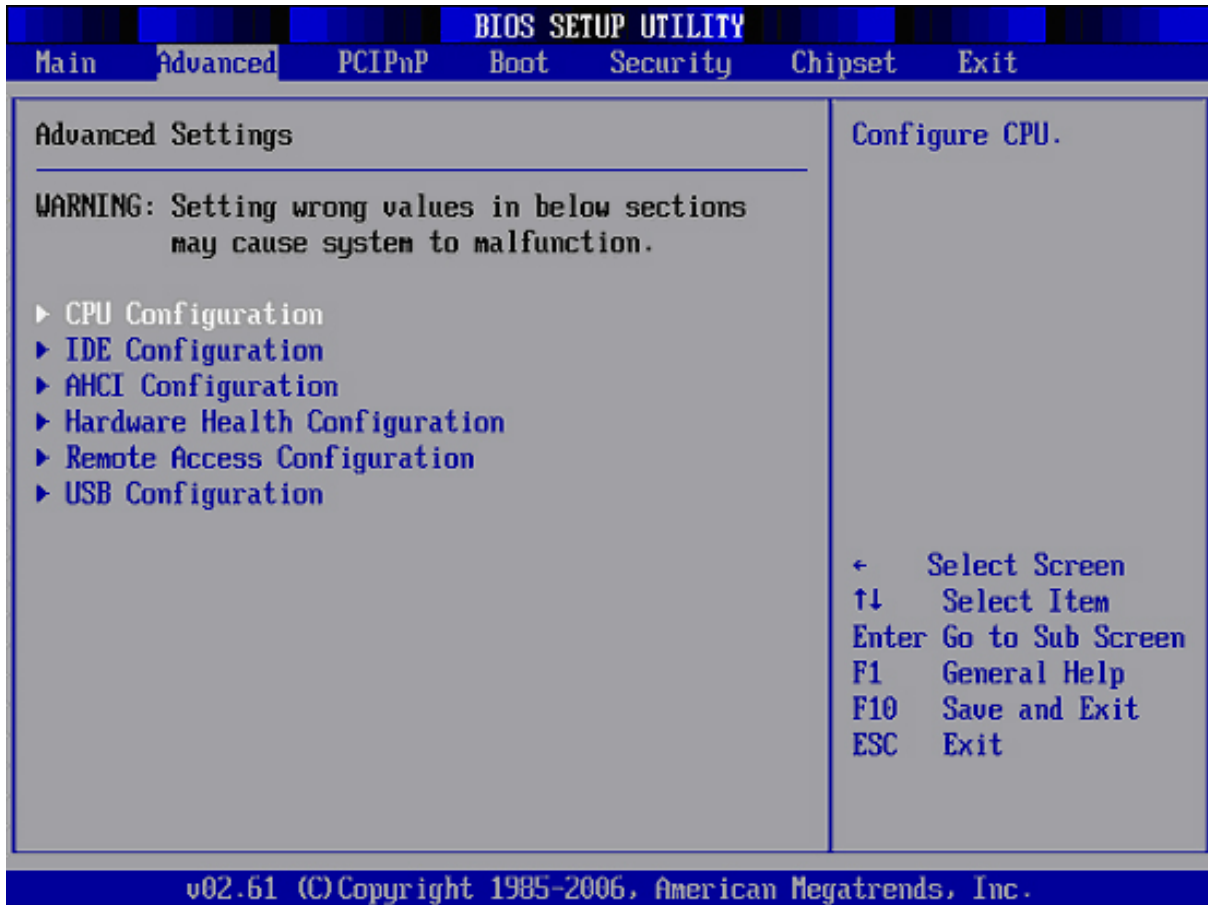
»» UUID Byte 8-F

You can use the function to set unique UUID for each computer. This is byte 8-F of UUID.

10.3 Advanced BIOS Setup

Select the *Advanced* tab from the setup screen to enter the Advanced BIOS Setup screen. You can select any of the items in the left frame of the screen, such as SuperIO Configuration, to go to the sub menu for that item. You can display an Advanced BIOS Setup option by highlighting it using the <Arrow> keys. The Advanced BIOS Setup screen is shown below.

The sub menus are described on the following pages.



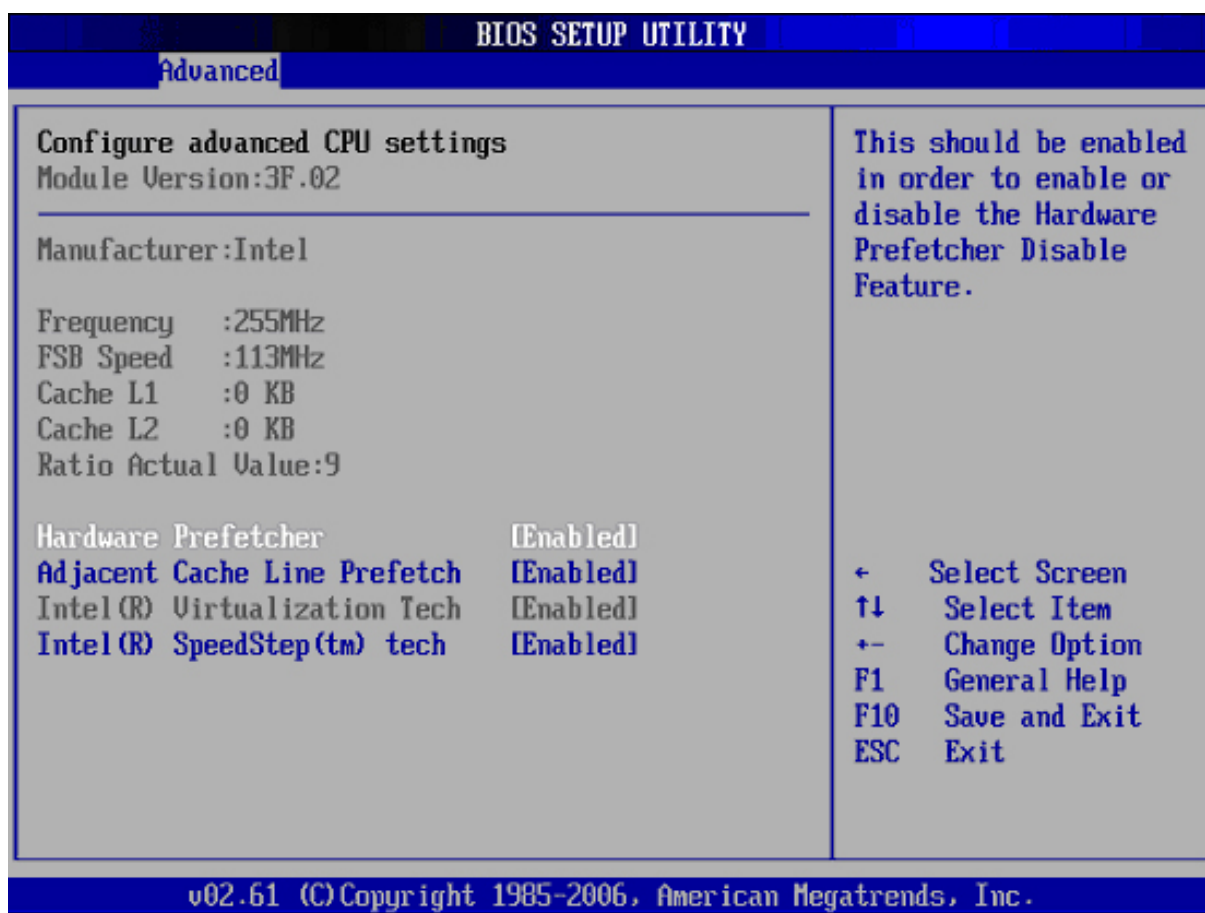
10.3.1 CPU Configuration

» CPU Configuration Settings

You can use this screen to select options for the CPU Configuration Settings. Use the up and down <Arrow> keys to select an item. Use the <+> and <-> keys to change the value of the selected option. A description of the selected item appears on the right side of the screen. The settings are described on the following pages.

An example of the CPU Configuration screen is shown below.

10.3.1.1 L7400



» Hardware Prefetcher

The processor has a hardware prefetcher that automatically analyzes its requirements and prefetches data and instructions from the memory into the Level 2 cache that are likely to be required in the near future. This reduces the latency associated with memory reads.

When enabled, the processor's hardware prefetcher will be enabled and allowed to automatically prefetch data and code for the processor.

When disabled, the processor's hardware prefetcher will be disabled.

» Adjacent Cache Line Prefetch

The processor has a hardware adjacent cache line prefetch mechanism that automatically fetches an extra 64-byte cache line whenever the processor requests for a 64-byte cache line. This reduces cache latency by making the next cache line immediately available if the processor requires it as well.

When **enabled**, the processor will retrieve the currently requested cache line, as well as the subsequent cache line.

When **disabled**, the processor will only retrieve the currently requested cache line.

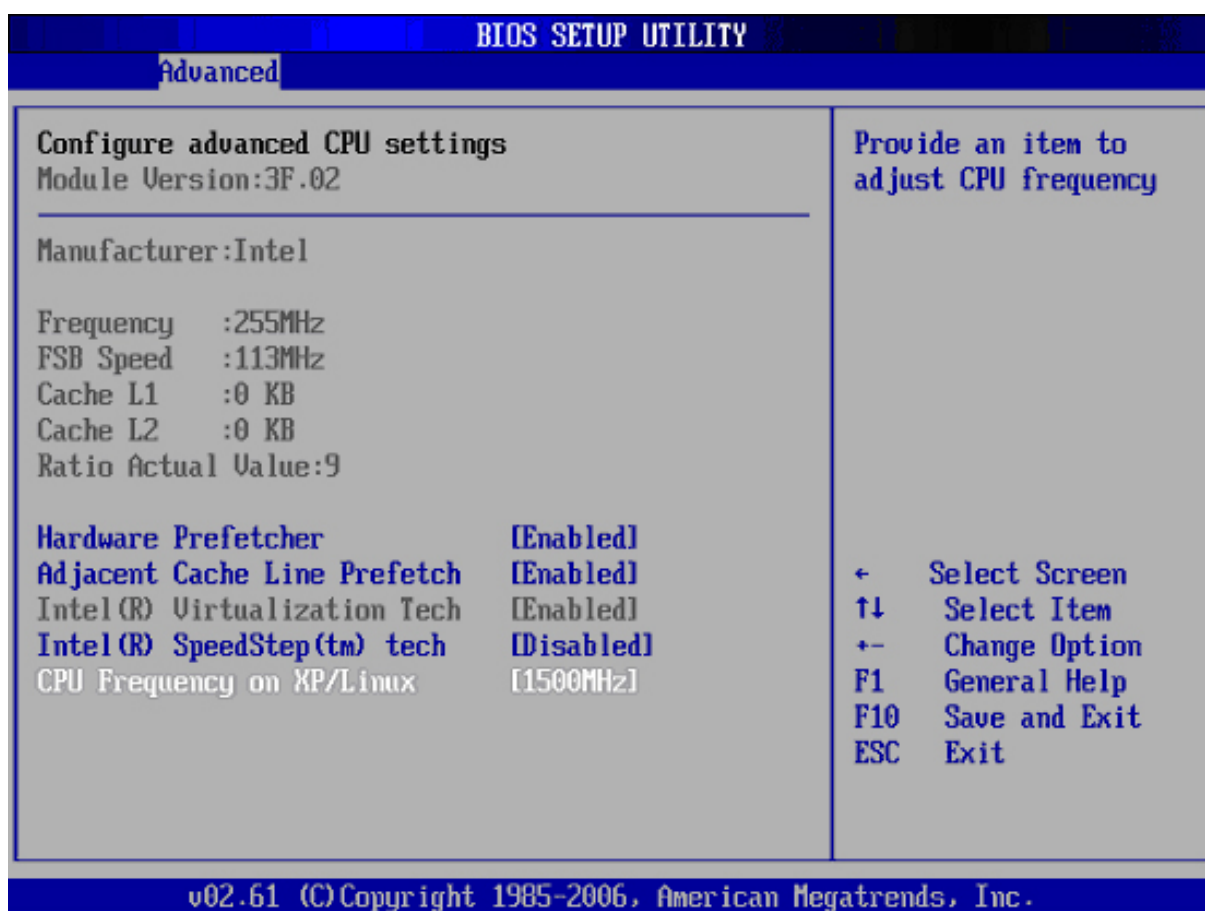
» Intel® Virtualization Tech

This is used to enable or disable the Intel Virtualization Technology (IVT) extension, which is also known by the development code name of Vanderpool. It allow multiple operating systems to run simultaneously on the same system. It does this by creating virtual machines, each running its own x86 operating system. When **Enabled**, the IVT extensions will be enabled, allowing for hardware-assisted virtual machine management. When **Disabled**, the IVT extensions will be disabled. However, software virtual machine managers like VMware can still be used if virtualization is required.

» Intel® SpeedStep(tm) tech

It is a trademark for a series of technologies (including SpeedStep, SpeedStep II, and SpeedStep III) built into some Intel microprocessors that allows the clock speed of the processor to be dynamically changed by software.

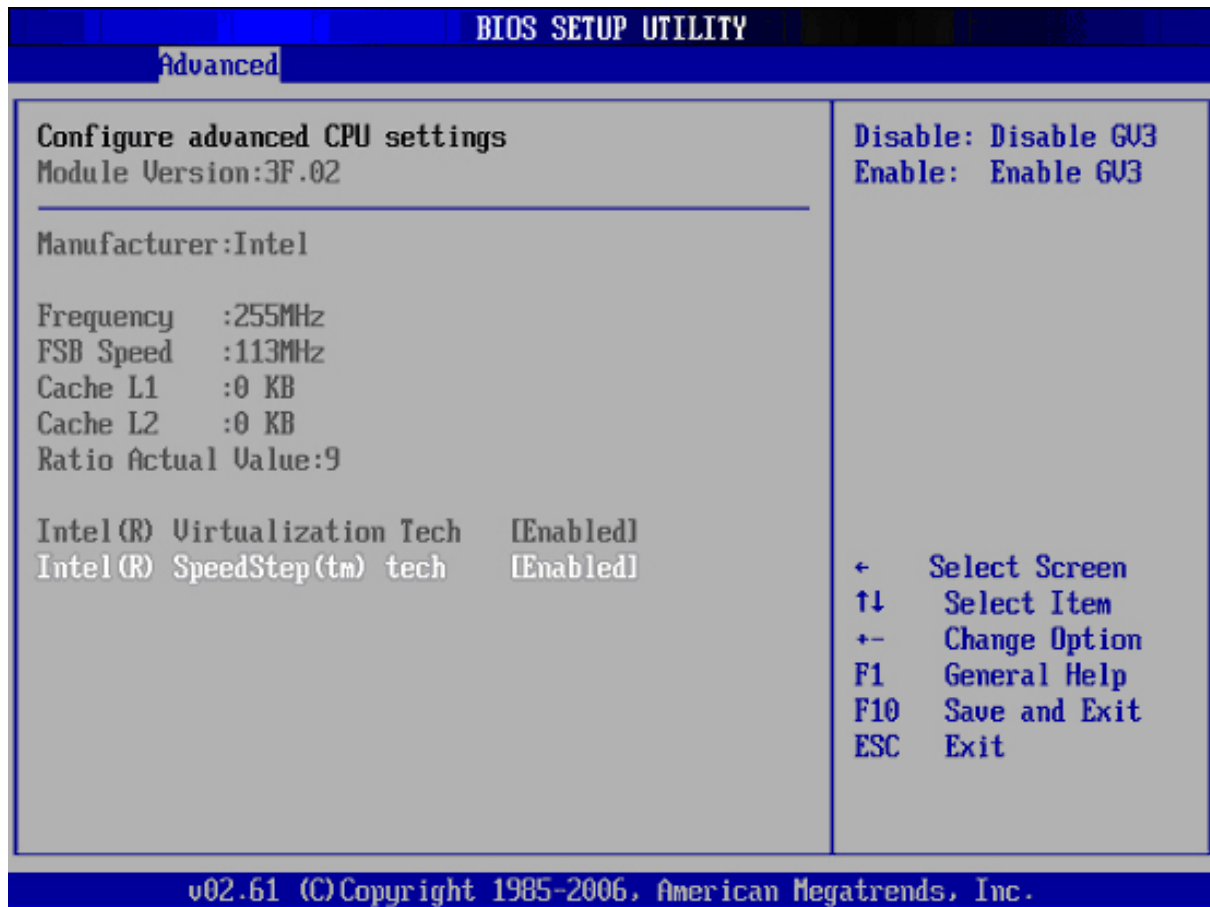
It allows to **Enabled**, and **Disabled** Intel speedstep technology. When setting is disabled, a new item that is CPU Frequency on XP/Linux is shown.



» CPU Frequency on XP/Linux

This is used to fix CPU frequency on XP and Linux. CPU runs different speed on XP/Linux. 1500MHz, 1333MHz, 1166MHz, and 1000MHz are selected.

10.3.1.2 U2500



» Intel® Virtualization Tech

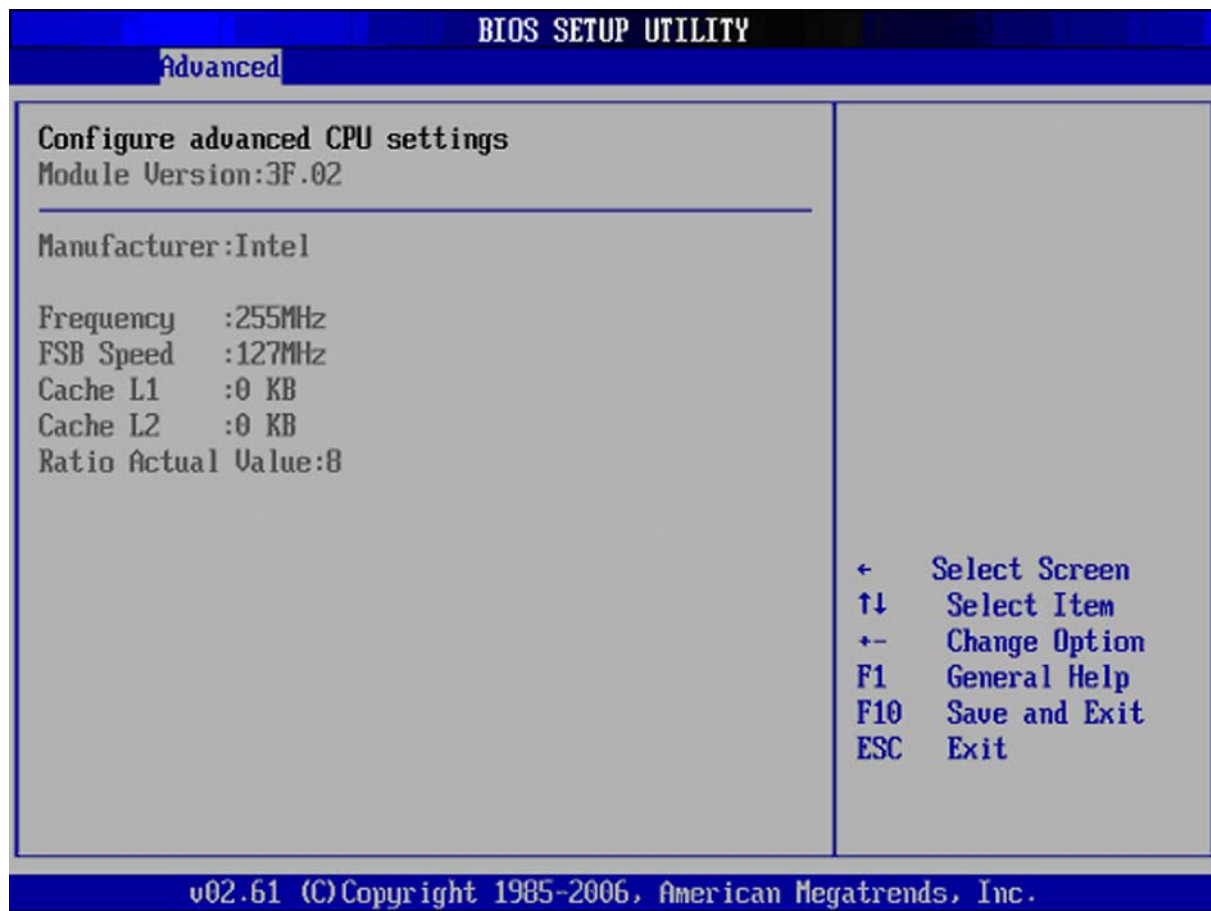
This is used to enable or disable the Intel Virtualization Technology (IVT) extension, which is also known by the development code name of Vanderpool. It allows multiple operating systems to run simultaneously on the same system. It does this by creating virtual machines, each running its own x86 operating system. When **Enabled**, the IVT extensions will be enabled, allowing for hardware-assisted virtual machine management. When **Disabled**, the IVT extensions will be disabled. However, software virtual machine managers like VMware can still be used if virtualization is required.

» Intel® SpeedStep(tm) tech

It is a trademark for a series of technologies (including SpeedStep, SpeedStep II, and SpeedStep III) built into some Intel microprocessors that allows the clock speed of the processor to be dynamically changed by software.

It allows to **Enabled**, and **disabled** Intel speedstep technology.

10.3.1.3 Celeron 423

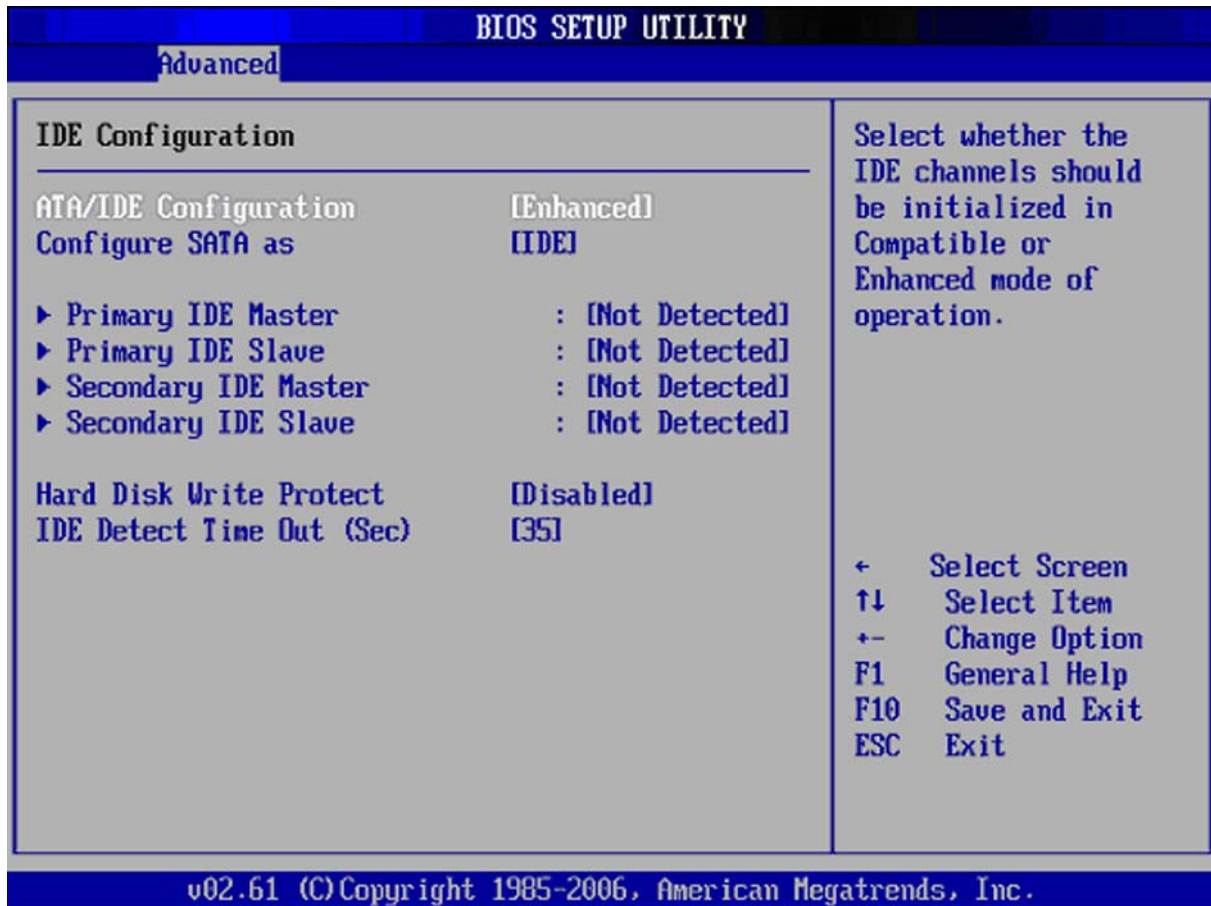


10.3.2 IDE Configuration

» IDE Configuration

You can use this screen to select options for the IDE Configuration Settings. Use the up and down <Arrow> keys to select an item. Use the <+> and <-> keys to change the value of the selected option. A description of the selected item appears on the right side of the screen. The settings are described on the following pages.

An example of the IDE Configuration screen is shown below.



» ATA/IDE Configuration

This item specifies whether the IDE channels should be initialized in Compatible or Enhanced mode of operation. The settings are Disabled, Compatible and Enhanced.

» Configure SATA as

The item specifies SATA channels transport to what kind of channels. The settings are IDE mode and AHCI mode.

- ▶ Primary IDE Master
- ▶ Primary IDE Slave
- ▶ Secondary IDE Master
- ▶ Secondary IDE Slave

Select one of the hard disk drives to configure it. Press **<Enter>** to access its sub menu.

» Hard Disk Write Protect

This will be affective only if device is accessed through BIOS. The settings are Enabled and Disabled.

» IDE Detect Time Out (Sec)

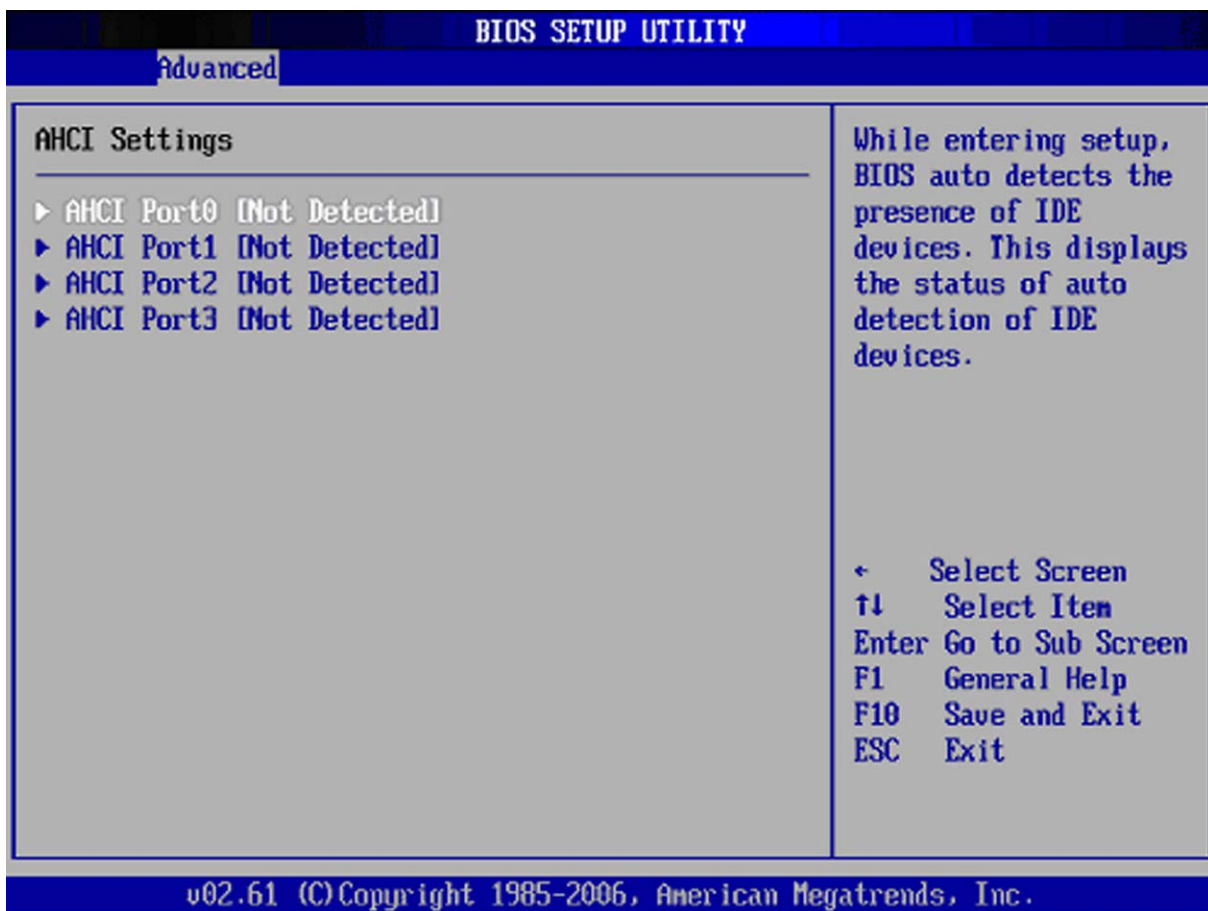
Select the time out value for detecting ATA/ATAPI devices. The settings are 0 sec, 5 sec, 10 sec, 15 sec, 20 sec, 25sec, 30 sec, and 35 sec.

10.3.3 AHCI Configuration

» AHCI Settings

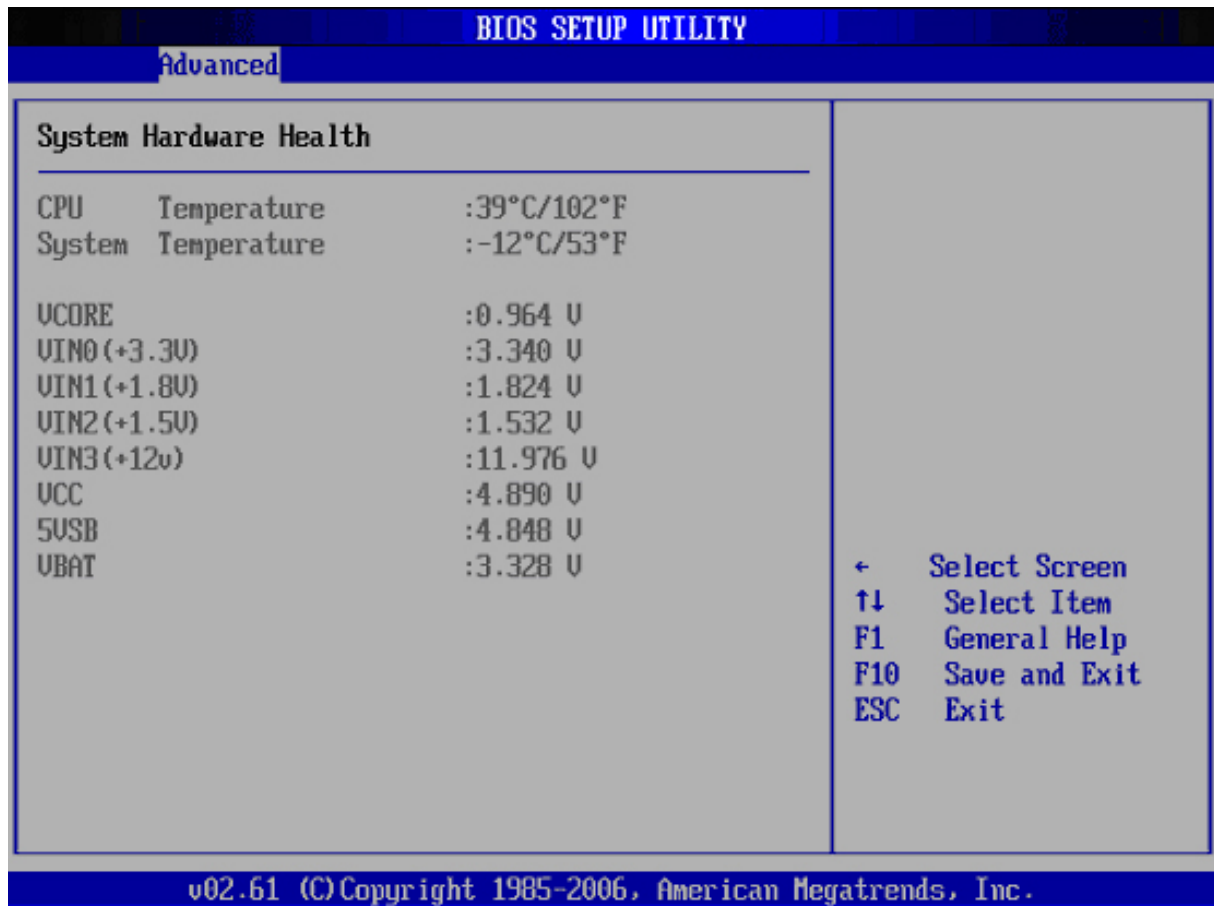
The Advanced Host Controller Interface (AHCI) is a hardware mechanism that allows software to communicate with Serial ATA (SATA) devices (such as host bus adapters) that are designed to offer features not offered by Parallel ATA (PATA) controllers, such as hot-plugging and native command queuing. The specification details a system memory structure for computer hardware vendors in order to transfer data between system memory and the device. As of July 2007, the current version of the specification is v1.2.

Many SATA controllers can enable AHCI either separately or in conjunction with RAID support. Intel recommends choosing RAID mode on their motherboards (which also enables AHCI) rather than the plain AHCI/SATA mode for maximum flexibility, due to the issues caused when the mode is switched once an operating system has already been installed.



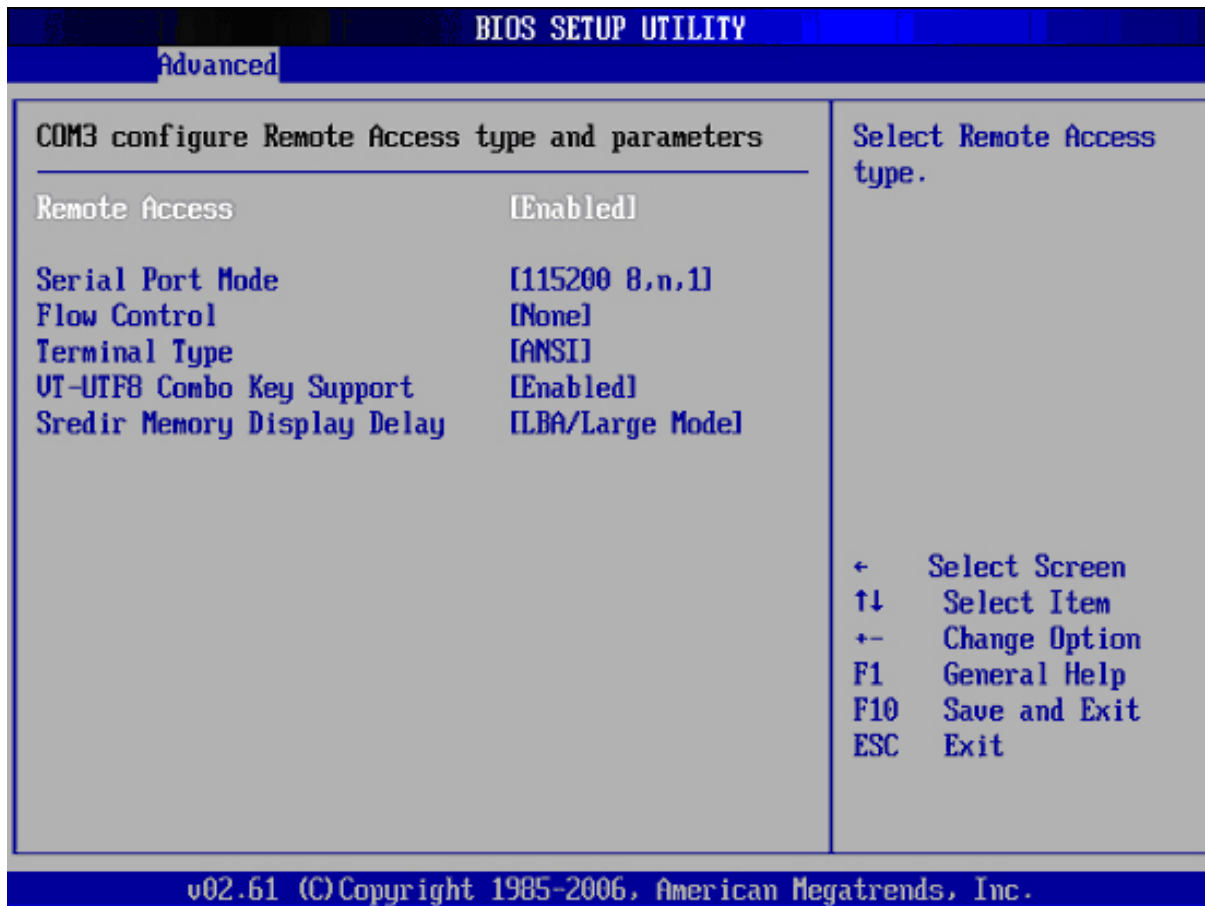
10.3.4 Hardware Health Configuration

This option displays the current status of all of the monitored hardware devices / components such as voltages and temperatures.



10.3.5 Remote Access Configuration

Remote access configuration provides the settings to allow remote access by another computer to get POST messages and send commands through serial port access.



» Remote Access

Select this option to Enable or Disable the BIOS remote access feature here.



Enabled Remote Access requires a dedicated serial port connection. Once both serial ports are configured to disabled, you should set this value to Disabled or it may cause abnormal boot.

» Serial Port Mode

Select the baud rate you want the serial port to use for console redirection. The options are 115200 8,n,1; 57600 8,n,1; 19200 8,n,1; and 09600 8,n,1.

» Flow Control

Set this option to select Flow Control for console redirection. The settings for this value are None, Hardware, or Software.

» Terminal Type

This option is used to select either VT100/VT-UTF8 or ANSI terminal type. The settings for this value are ANSI, VT100, or VT-UTF8.

» VT-UTF8 Combo Key Support

This option enables VT-UTF8 Combination Key Support for ANSI/VT100 terminals. The settings for this value are Enabled or Disabled.

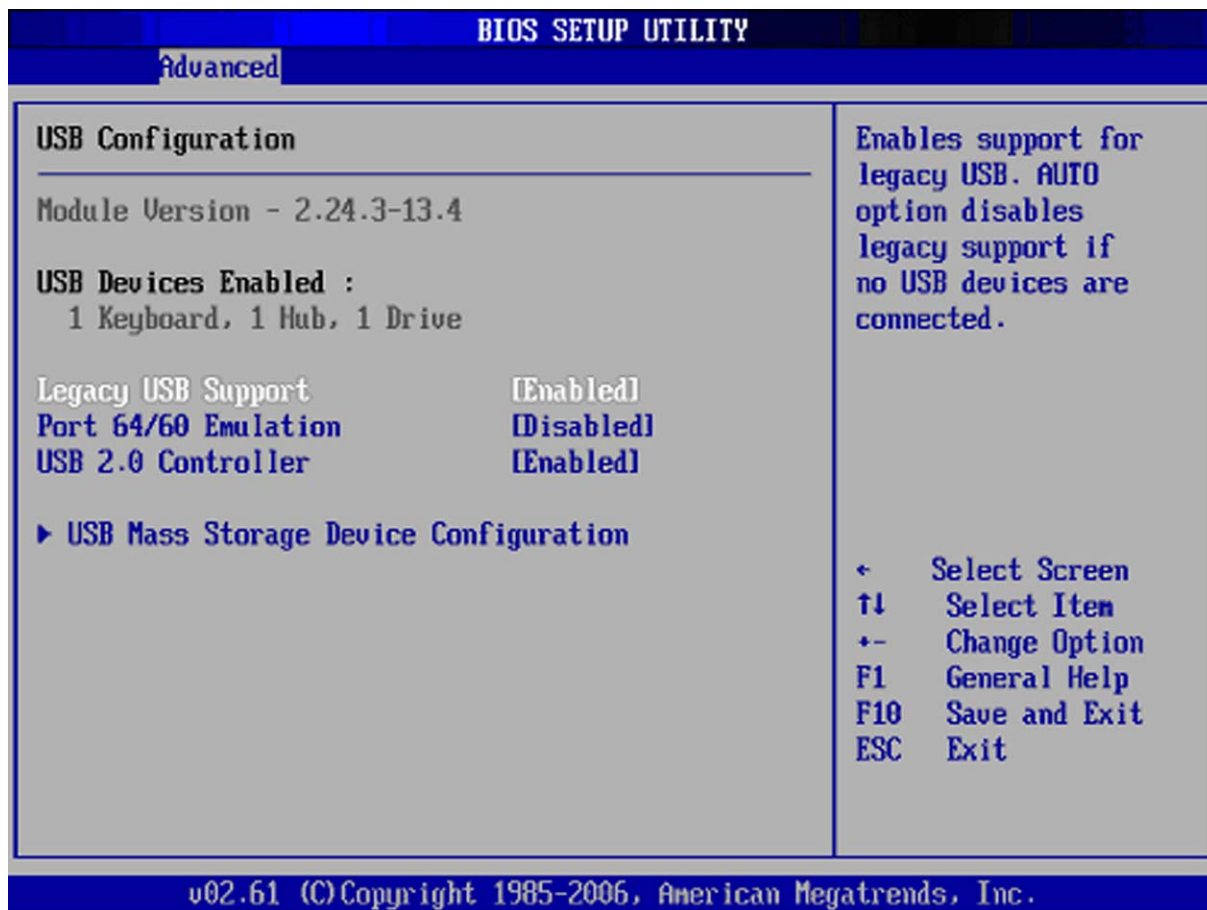
» Sredir Memory Display Delay

This option gives the delay in seconds to display memory information. The options for this value are No Delay, Delay 1 Sec, Delay 2 Sec, or Delay 4 Sec.

10.3.6 USB Configuration

» USB Configuration

You can use this screen to select options for the USB Configuration. Use the up and down <Arrow> keys to select an item. Use the <+> and <-> keys to change the value of the selected option. The settings are described on the following pages. The screen is shown below.



» Legacy USB Support

Legacy USB Support refers to the USB mouse and USB keyboard support. Normally if this option is not enabled, any attached USB mouse or USB keyboard will not become available until an USB compatible operating system is fully booted with all USB drivers loaded. When this option is enabled, any attached USB mouse or USB keyboard can control the system even when there is no USB drivers loaded on the system. Set this value to enable or disable the Legacy USB Support.

- Disabled Set this value to prevent the use of any USB device in DOS or during system boot.
- Enabled Set this value to allow the use of USB devices during boot and while using DOS.
- Auto This option auto detects USB Keyboards or Mice and if found, allows them to be utilized during boot and while using DOS.

» Port 64/60 Emulation

It uses USB to receive the IO port 64/60 trap to emulate the legacy keyboard controller.



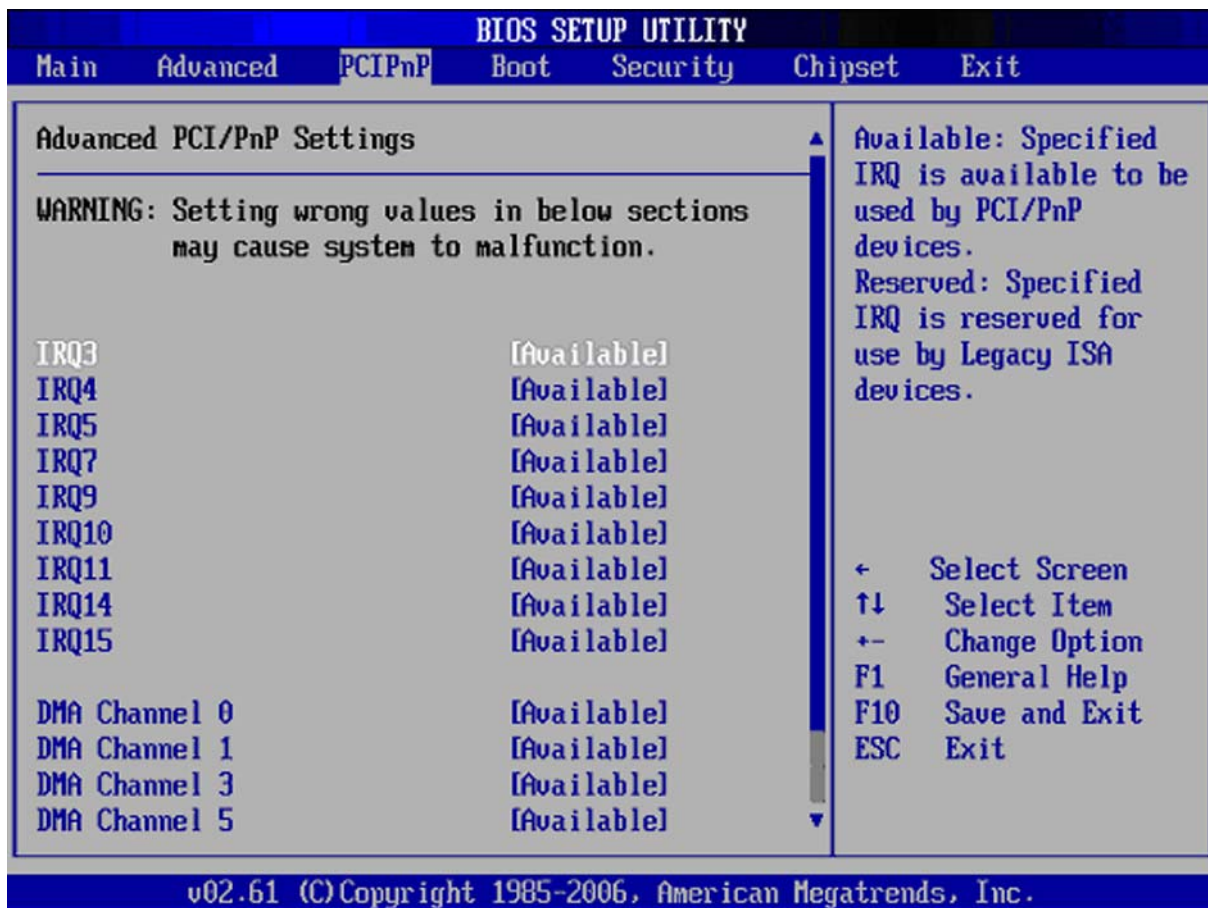
Be careful: MUST BE SET TO DISABLED TO BOOT LINUX FEDORA CORE.

» USB 2.0 Controller Mode

The USB 2.0 Controller Mode configures the data rate of the USB port. The options are: FullSpeed (12 Mbps) and HiSpeed (480 Mbps).

10.4 PCI/PnP Setup

Select the PCI/PnP tab from the setup screen to enter the Plug and Play BIOS Setup screen. You can display a Plug and Play BIOS Setup option by highlighting it using the <Arrow> keys. The Plug and Play BIOS Setup screen is shown below.



» IRQ

Set this value to allow the IRQ settings to be modified. Available - This setting allows the specified IRQ to be used by a PCI/PnP device. Reserved - This setting allows the specified IRQ to be used by a legacy ISA device.

» DMA Channel

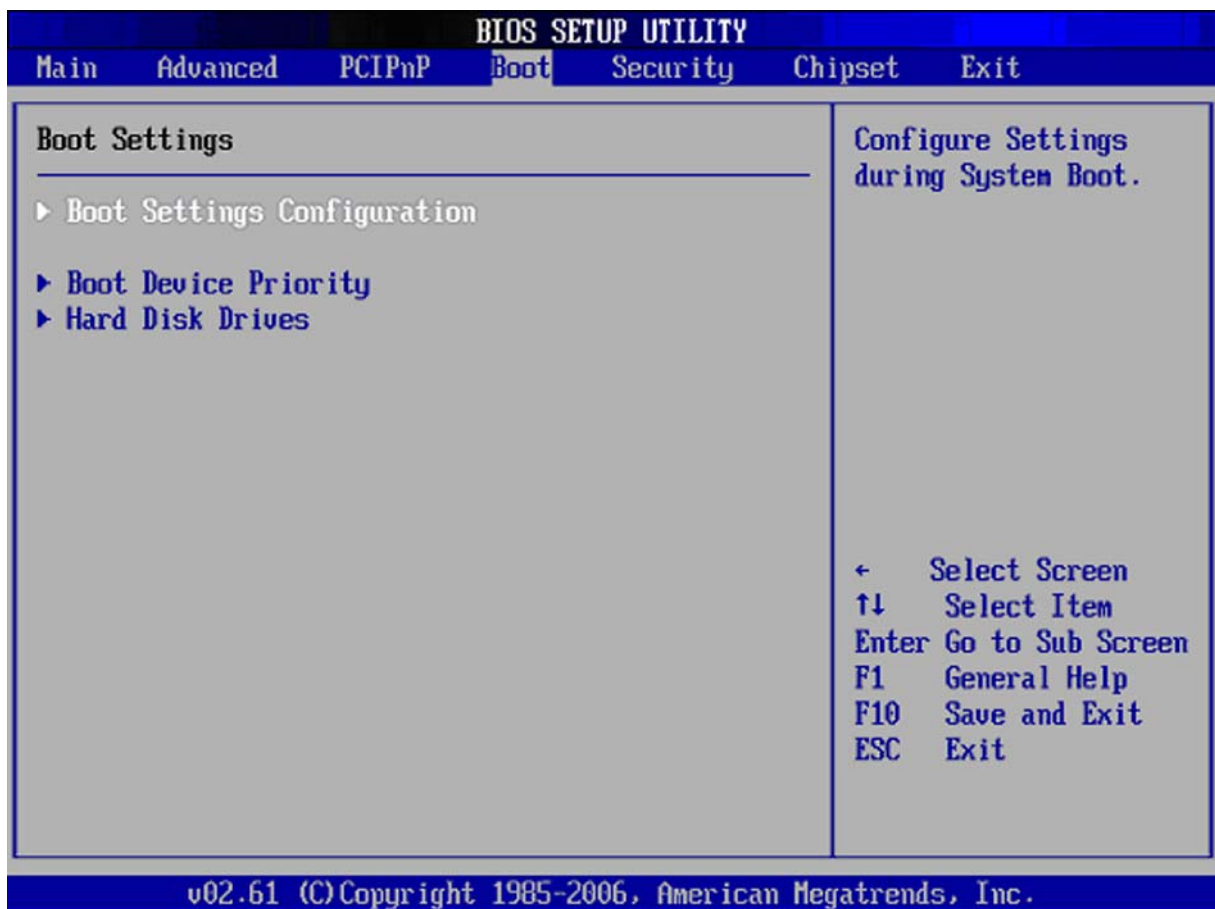
Set this value to allow the MDA settings to be modified. Available - This setting allows the specified DMA to be used by a PCI/PnP device. Reserved - This setting allows the specified DMA to be used by a legacy ISA device.

10.5 Boot Setup

Select the Boot tab from the setup screen to enter the Boot BIOS Setup screen. You can select any of the items in the left frame of the screen, such as Boot Device Priority, to go to the sub menu for that item. You can display a Boot BIOS Setup option by highlighting it using the <Arrow> keys. Select an item on the Boot Setup screen to access the sub menu for:

- ▶ Boot Settings Configuration
- ▶ Boot Device Priority
- ▶ Removable Devices

The Boot Settings screen is shown below:



10.5.1 Boot Setting Configuration

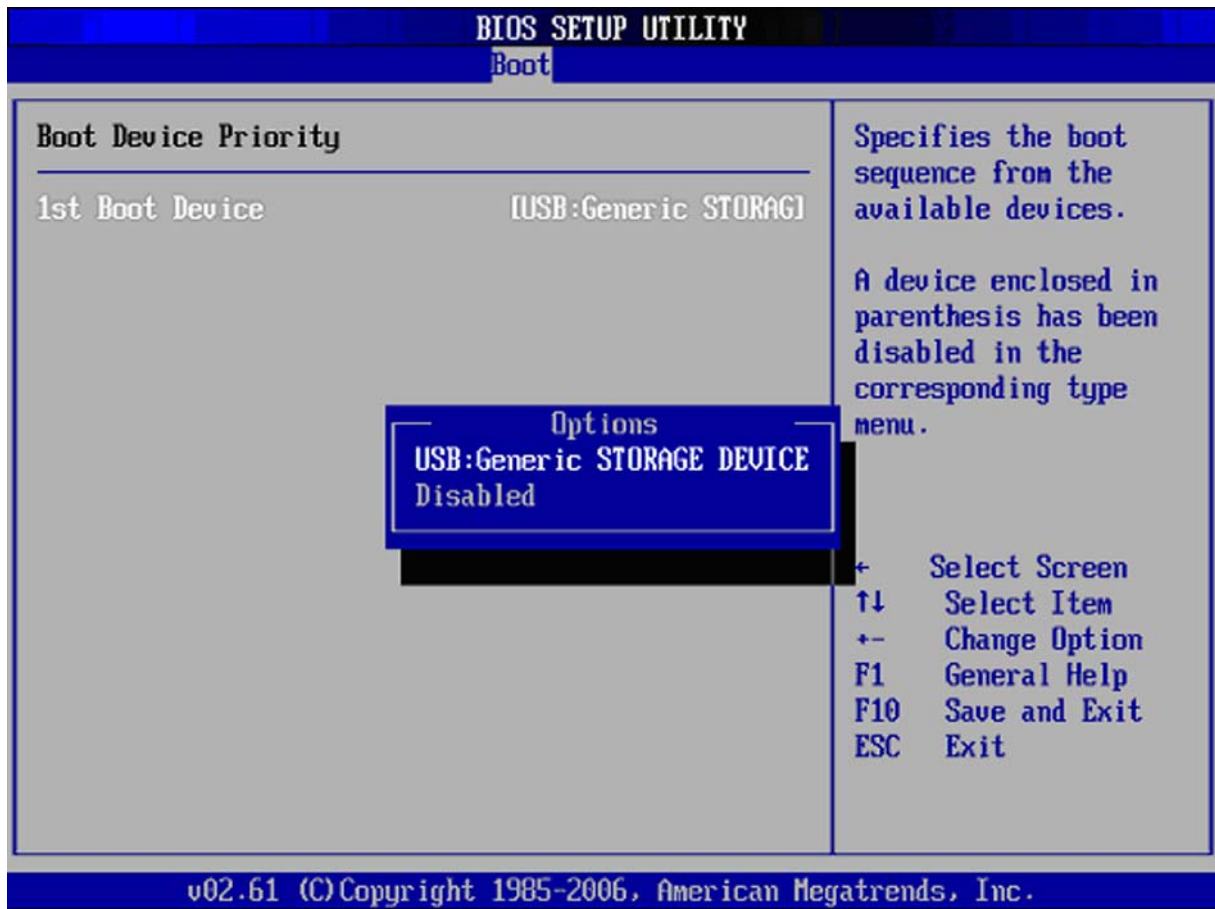
Use this screen to select options for the Boot Settings Configuration. Use the up and down <Arrow> keys to select an item. Use the <Plus> and <Minus> keys to change the value of the selected option. The settings are described on the following pages. The screen is shown below.



» Quick Boot

Disabled - Set this value to allow the BIOS to perform all POST tests. Enabled - Set this value to allow the BIOS to skip certain POST tests to boot faster.

10.5.2 Boot Device Priority



» Boot Devices Priority

It's specifies the boot sequence from the available devices. The 1st Boot Device is primary device.

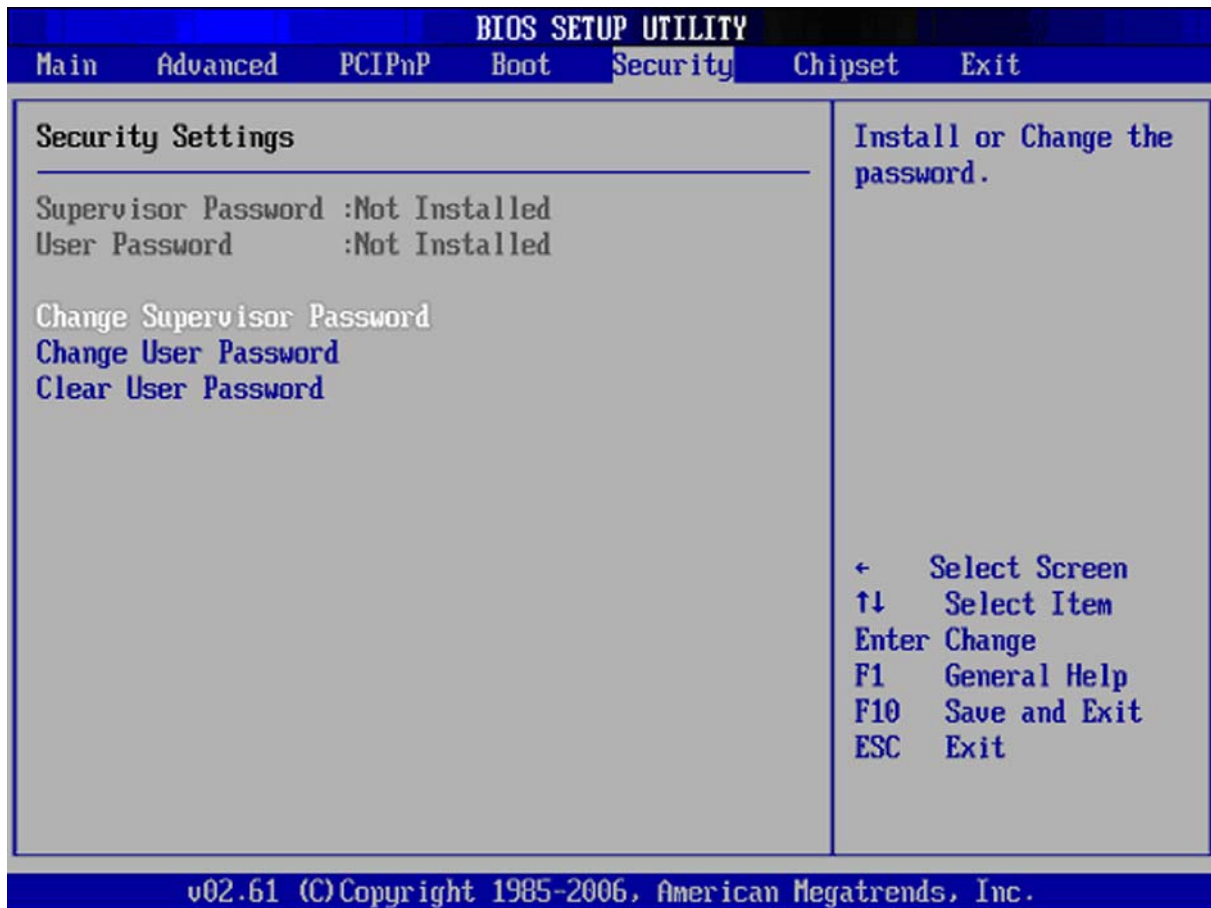
10.5.3 Hard Disk Drives



» Hard Disk Devices priority

It's specifies the boot sequence from the available devices. The 1st Hard Disk Boot Device is primary device.

10.6 Security Setup



10.6.1 Password Support

» Two Levels of Password Protection

Provides both a Supervisor and a User password. If you use both passwords, the Supervisor password must be set first.

The system can be configured so that all users must enter a password every time the system boots or when Setup is executed, using either or either the Supervisor password or User password.

The Supervisor and User passwords activate two different levels of password security. If you select password support, you are prompted for a one to six character password. Type the password on the keyboard. The password does not appear on the screen when typed. Make sure you write it down. If you forget it, you must drain NVRAM and re-configure.

» Remember the Password

Keep a record of the new password when the password is changed. If you forget the password, you must erase the system configuration information in NVRAM.

To access the sub menu for the following items, select the item and press <Enter>:

- ▶ Change Supervisor Password
- ▶ Change User Password
- ▶ Clear User Password

» Supervisor Password

Indicates whether a supervisor password has been set.

» User Password

Indicates whether a user password has been set.

» Change Supervisor Password

Select this option and press <Enter> to access the sub menu. You can use the sub menu to change the supervisor password.

» Change User Password

Select this option and press <Enter> to access the sub menu. You can use the sub menu to change the user password.

» Clear User Password

Select this option and press <Enter> to access the sub menu. You can use the sub menu to clear the user password.

10.6.2 Change Supervisor Password

Select Change Supervisor Password from the Security Setup menu and press <Enter>.

Enter New Password:

Type the password and press <Enter>. The screen does not display the characters entered. Retype the password as prompted and press <Enter>. If the password confirmation is incorrect, an error message appears. The password is stored in NVRAM after completes.

10.6.3 Change User Password

Select Change User Password from the Security Setup menu and press <Enter>.

Enter New Password:

Type the password and press <Enter>. The screen does not display the characters entered. Retype the password as prompted and press <Enter>. If the password confirmation is incorrect, an error message appears. The password is stored in NVRAM after completes.

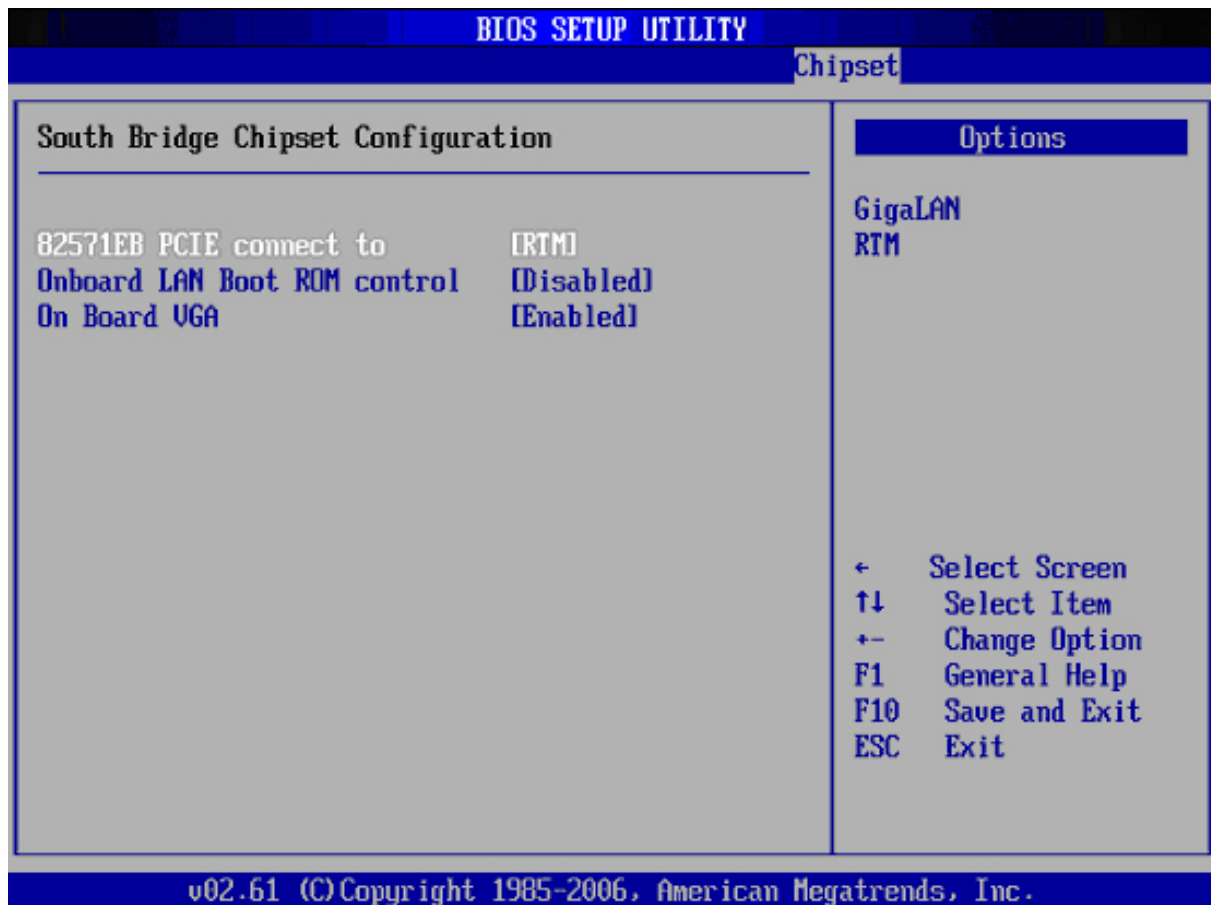
10.7 Chipset Setup

Select the Chipset tab from the setup screen to enter the Chipset BIOS Setup screen. You can select any of the items in the left frame of the screen, such as CPU Configuration, to go to the sub menu for that item. You can display a Chipset BIOS Setup option by highlighting it using the <Arrow> keys. The Chipset BIOS Setup screen is shown below.



10.7.1 South Bridge Configuration

You can use this screen to select options for the South Bridge Configuration. South Bridge is a chipset on the motherboard that controls the basic I/O functions, USB ports, audio functions, modem functions, IDE channels, and PCI slots. Use the up and down < Arrow > keys to select an item. Use the < Plus > and < Minus > keys to change the value of the selected option.



» 82571EB PCIE connect to

Set the onboard LAN to connect to either J2/RTM or Front I/O. The settings are RTM (J2) and GigaLAN (Front I/O).

» Onboard LAN 82571EB Controller

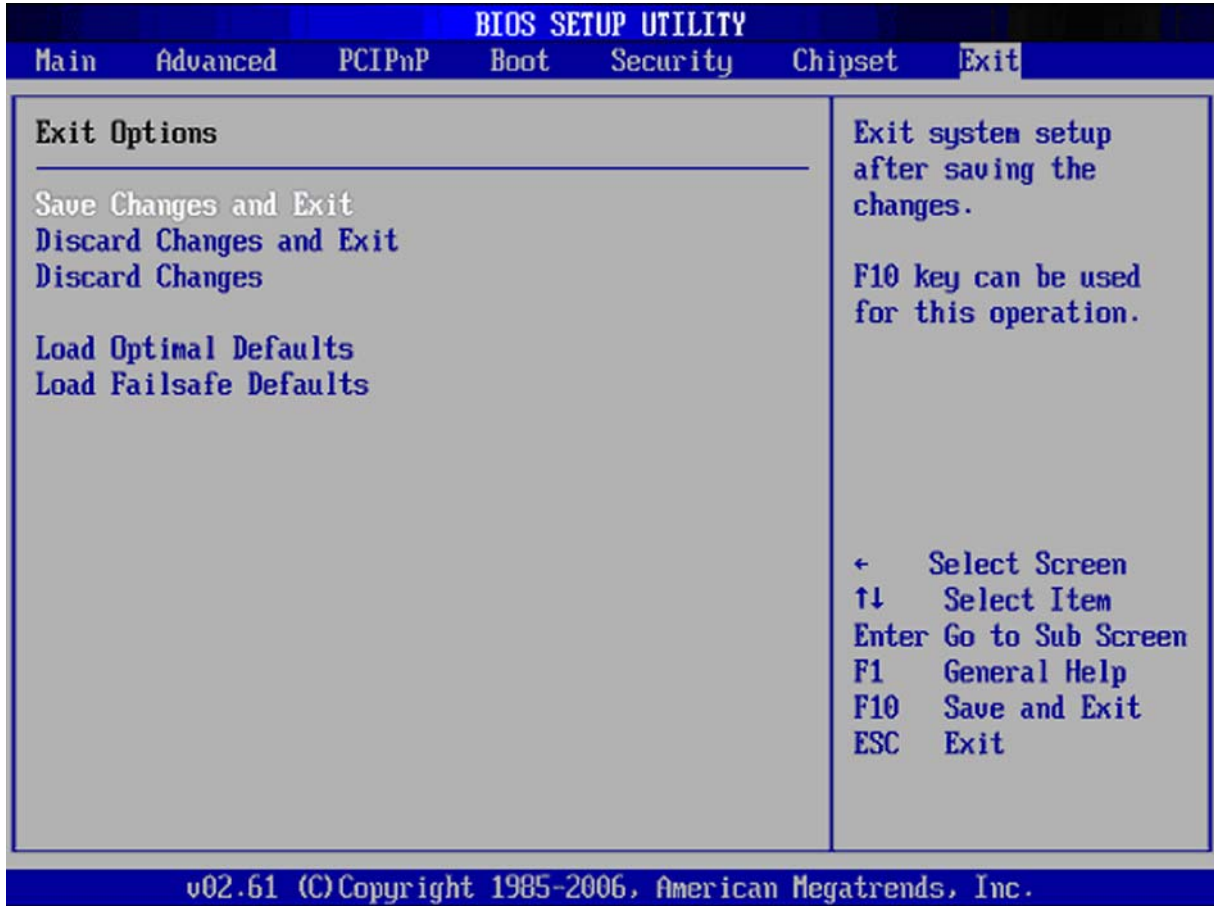
Set this value to Enable/Disable the LAN Controller PXE function. The PXE function allows system boot from a network environment.

» Onboard VGA

You can use this option to control the onboard VGA. The settings are Enabled and Disabled.

10.8 Exit Menu

Select the Exit tab from the setup screen to enter the Exit BIOS Setup screen. You can display an Exit BIOS Setup option by highlighting it using the <Arrow> keys. The Exit BIOS Setup screen is shown below.



» Save Changes and Exit

When you have completed the system configuration changes, select this option to leave Setup and reboot the computer so the new system configuration parameters can take effect.

Save Configuration Changes and Exit Now?

[Ok] [Cancel]

appears in the window. Select Ok to save changes and exit.

» Discard Changes and Exit

Select this option to quit Setup without making any permanent changes to the system configuration.

Discard Changes and Exit Setup Now?

[Ok] [Cancel]

appears in the window. Select Ok to discard changes and exit.

» Discard Changes

Select Discard Changes from the Exit menu and press <Enter>.

Select *Ok* to discard changes.

» Load Optimal Defaults

Automatically sets all Setup options to a complete set of default settings when you select this option. The Optimal settings are designed for maximum system performance, but may not work best for all computer applications. In particular, do not use the Optimal Setup options if your computer is experiencing system configuration problems.

Select Load Optimal Defaults from the Exit menu and press <Enter>.

Select *Ok* to load optimal defaults.

» Load Failsafe Defaults

Automatically sets all Setup options to a complete set of default settings when you select this option. The Failsafe settings are designed for maximum system stability, but not maximum performance. Select the FailSafe Setup options if your computer is experiencing system configuration problems.

Select Load Fail-Safe Defaults from the Exit menu and press <Enter>.

Load FailSafe Defaults?

[Ok]

[Cancel]

appears in the window. Select Ok to load FailSafe defaults.

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