CP332

3U CompactPCI
Graphics Controller Board with
Dual Display Support

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User Guide

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Caution, Electric Shock!

This symbol and title warn of hazards due to electrical shocks (> 60V) when touching products or parts of them. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.

Please refer also to the section “High Voltage Safety Instructions” on the following page.



Warning, ESD Sensitive Device!

This symbol and title inform that 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.

Please read also the section “Special Handling and Unpacking Instructions” on the following page.



Warning!

This symbol and title emphasize points which, if not fully understood and taken into consideration by the reader, may endanger your health and/or result in damage to your material.



Note ...

This symbol and title emphasize aspects the reader should read through carefully for his or her own advantage.

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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



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Caution, Electric Shock!

Before installing your new 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!

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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.

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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 Modular Computers GmbH 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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If the customer's eligibility for warranty has not been voided, in the event of any claim, he may return the product at the earliest possible convenience to the original place of purchase, together with a copy of the original document of purchase, a full description of the application the product is used on and a description of the defect. Pack the product in such a way as to ensure safe transportation (see our safety instructions).

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Chapter 1

Introduction

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1. Introduction

1.1 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)*.

Many system-relevant CompactPCI features that are specific to Kontron Modular Computers CompactPCI systems may be found described in the Kontron CompactPCI System Manual. Due to its size, this manual cannot be downloaded via the internet. Please refer to the section “Related Publications” at the end of this chapter for the relevant ordering information.

The CompactPCI System Manual includes the following information:

- Common information that is applicable to all system components, such as safety information, warranty conditions, standard connector pinouts etc.
- All the information necessary to combine Kontron’s racks, boards, backplanes, power supply units and peripheral devices in a customized CompactPCI system, as well as configuration examples.
- Data on rack dimensions and configurations as well as information on mechanical and electrical rack characteristics.
- Information on the distinctive features of Kontron CompactPCI boards, such as functionality, hot swap capability. In addition, an overview is given for all existing Kontron CompactPCI boards with links to the relating data sheets.
- Generic information on the Kontron CompactPCI backplanes, such as the slot assignment, PCB form factor, distinctive features, clocks, power supply connectors and signalling environment, as well as an overview of the Kontron CompactPCI standard backplane family.
- Generic information on the Kontron CompactPCI power supply units, such as the input/output characteristics, redundant operation and distinctive features, as well as an overview of the Kontron CompactPCI standard power supply unit family.

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1.2 Board Overview

1.2.1 Board Introduction

Developed around the ATI Mobility™ Radeon® M9-CSP64 graphics controller, the CP332 is a CompactPCI 2D/3D high-performance graphics board built for use with all industrial standard displays. The CP332 provides two display channels for connecting displays with different refresh rates and resolutions at the same time. The physical interfaces are selectable for usage as CRT/analog or TMDS digital interfaces.

The CP332 provides two DVI-I connectors on the front panel enabling the user to connect up to two analog or digital monitors to the CP332.

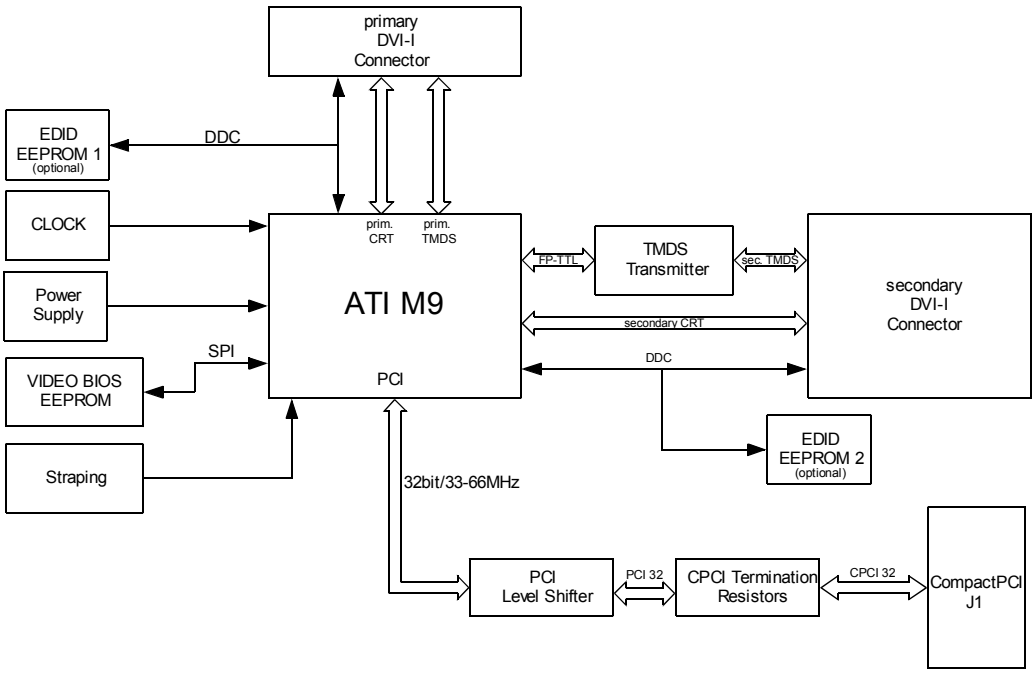
The board can operate with the Microsoft® Windows® 2000, Windows® XP and Windows® XP Embedded and Linux operating systems. Please contact Kontron Modular Computers for further information concerning other operating systems.

1.3 Board Diagrams

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

1.3.1 Functional Block Diagram

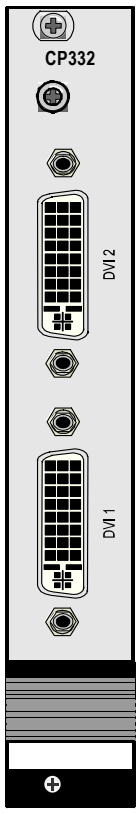
Figure 1-1: CP332 Functional Block Diagram



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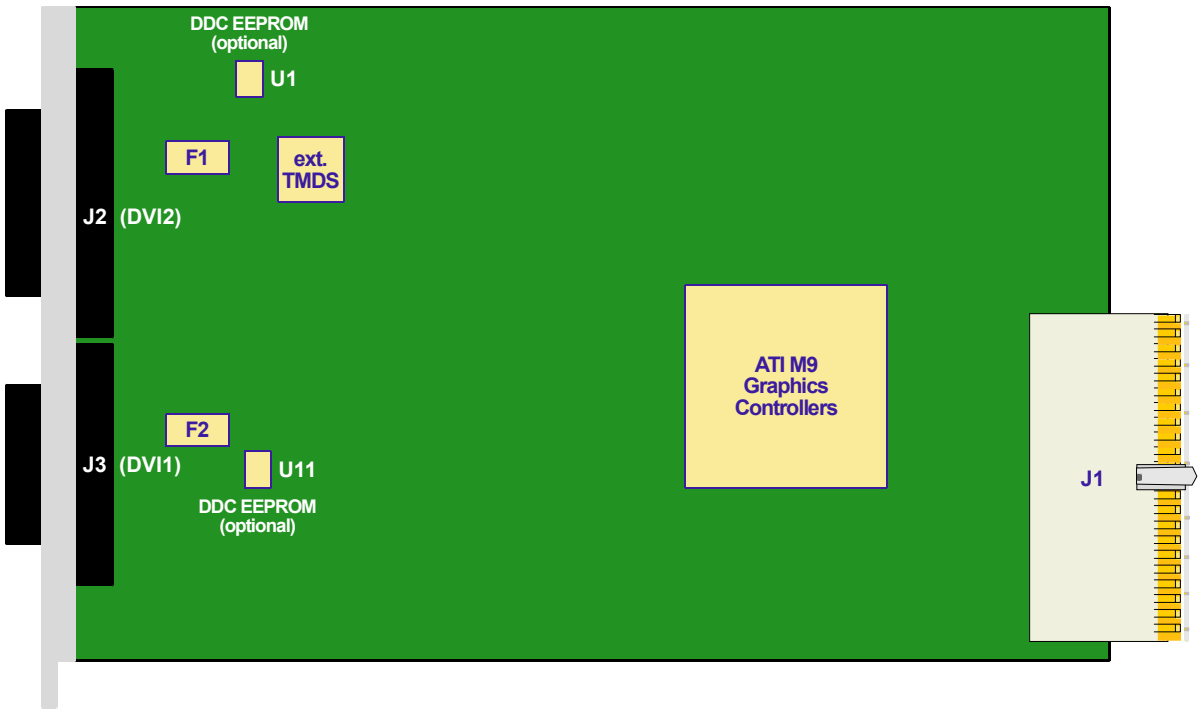
1.3.2 Front Panel

Figure 1-2: CP332 Front Panel



1.3.3 Board Layout

Figure 1-3: CP332 Board Layout



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1.4 Technical Specification

Table 1-1: CP332 Main Specifications

	CP332	SPECIFICATIONS
Controller	Graphics Controller	ATI Mobility™ Radeon® M9-CSP64 • 64 MB DDR memory integrated on the substrate of the chip • 128-bit memory path
Interfaces	CompactPCI	Compliant with CompactPCI Specification PICMG® 2.0 R 3.0 • 32-bit / 33 MHz master interface • 3.3V / 5.0V compatible (signalling voltage)
	DVI	The two independent graphic pipes of the ATI graphics controllers are routed as follows: • DVI1 interface: support for CRT1 and integrated TMDS channel 1 (165 MHz) • DVI2 interface: support for CRT2 and external TMDS channel 2 (165 MHz)
	Display Combinations	The M9-CSP64 graphics controller supports the following display combinations: • CRT + CRT (analog display) • CRT + TMDS (analog + digital display) • TMDS + TMDS (digital display)
	Graphic Performance	Graphic performance of the M9-CSP64 graphics controller: • DAC speed: 400 MHz • Max. 2D resolution: 2048 x 1536 • Max. 3D resolution: 2048 x 1536 • Digital resolution TMDS: 1600 x 1200
Sockets	Front Panel Connectors	• Two 29-contact DVI-I connectors, J2 and J3
	Onboard Connectors	• One CompactPCI Connector, J1
	Fuses	• Two fuses, F1 and F2, for EDID data EEPROM power
General	Optional Feature	• DDC EEPROMs for providing EEDID data if the flat panel display does not provide the EEDID data
	Mechanical	3U, 4HP, CompactPCI compliant form factor
	Power Supply	For detailed information on the power consumption, refer to Chapter 5, “Power Considerations”
	Temperature Range	Operational: 0°C to +55°C with estimated natural convection 0°C to +75°C with a forced airflow of 1.5 m/s Storage: -40°C to +125°C
	Climatic Humidity	93% RH at 40°C, non-condensing
	Dimensions	100 mm x 160 mm (single-height Eurocard)
	Board Weight	182 grams (with heat sink)
Software	Graphic BIOS Extension	Graphic BIOS Extension provided via Serial EEPROM (SPI), size: 64 KB
	Driver Support	Operating systems supported: • Microsoft Windows 2000 • Microsoft Windows XP • Linux (does not support all features of the graphics controller) Please contact Kontron Modular Computers for further information concerning other operating systems.

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1.5 Standards

The *Kontron Modular Computers'* CompactPCI systems comply with the requirements of the following standards.

Table 1-2: Standards

COMPLIANCE	TYPE	STANDARD
CE	Emission	EN 55022 EN 61000-6-3
	Immission	EN 55024 EN 61000-6-2
	Electrical Safety	EN 60950-1
Mechanical	Mechanical Dimensions	IEEE 1101.10
Environmental and Health Aspects	Vibration (Sinusoidal)	IEC 60068-2-6
	Shock	IEC 60068-2-27
	Bump	IEC 60068-2-29
	Vibration, broad-band random (digital control) and guidance	IEC 60068-2-64
	Climatic Humidity	IEC 60068-2-78
	WEEE	Directive 2002/96/EC
	RoHS	Directive 2002/95/EC

1.6 Related Publication

The following publication contains information relating to this product.

Table 1-3: Related Publication

PRODUCT	PUBLICATION
CompactPCI Systems and Boards	*Kontron Modular Computers*' CompactPCI System Manual, ID 19954

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Chapter 2

Functional Description

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2. Functional Description

2.1 Controllers, Memory

2.1.1 Graphics Controllers

The CP332 supports the M9-CSP64 graphics controller out of the ATI embedded roadmap. The M9-CSP64 graphics controller provides industry leading 2D/3D performance with 64 MB integrated video DDR memory.

The following table sets out the key features of the M9-CSP64 graphics controllers supported on the CP332:

Table 2-1: Key Features of the M9-CSP64 Graphics Controller

FEATURES	M9-CSP64
System Interface	PCI
Internal Memory	64 MB
Memory Speed	200 MHz
Maximum 2D Resolution	2048 x 1536
Maximum 3D Resolution	2048 x 1536
Supported Interface Combinations	DVI/DVI, DVI/CRT, CRT/CRT
RAMDAC	400 MHz
Spread Spectrum Support	Yes
Max. Power Consumption	6.42 W
Integrated TMDS	165 MHz
DirectX Support	DirectX 8.1
OpenGL Support	1.3

For further information on the ATI Mobility™ Radeon® M9-CSP64 graphics controller, refer to the respective data sheets.

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2.1.1.1 Video Resolutions

The M9-CSP64 graphics controller has an integrated 400 MHz RAMDAC and integrated TMDS interfaces. The following table indicates the maximum available video resolutions provided by the RAMDAC and the TMDS interfaces:

Table 1-2: Video Resolutions Supported on the M9-CSP64 Graphics Controller

DISPLAY MODE	VIDEO RESOLUTIONS
Max. 2D resolution	2048 x 1536
Max. 2D resolution	2048 x 1536
Digital TMDS resolution	1600 x 1200

2.1.2 Video BIOS Memory

A 128 KB Flash memory device provides the video BIOS extension needed for all X86-based CPU platforms. The Video BIOS Extension firmware can be updated with special software tools as soon as new versions are available.

For further information on video BIOS updates and appropriate software tools contact Kontron's Technical Support.

2.1.3 DDC/EEDID EEPROMs (Optional)

The CP332 provides two footprints for the SO8 EEPROMs which are connected to the graphics controller's DDC channels. Customer-specific board variants can include at least two EEPROMs to provide display information to the controller/operating system if the displays/monitors do not support EEDID data.

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2.2 Board Interfaces

2.2.1 DVI-I Connectors J2 and J3

The CP332 is equipped with two 29-contact, female DVI-I connectors, J2 and J3, on the front panel which are used to connect up to two analog or digital monitors to the CP332 board. The following figure and table provide pinout information for these connectors.

Figure 2-1: DVI-I Connectors J2 and J3

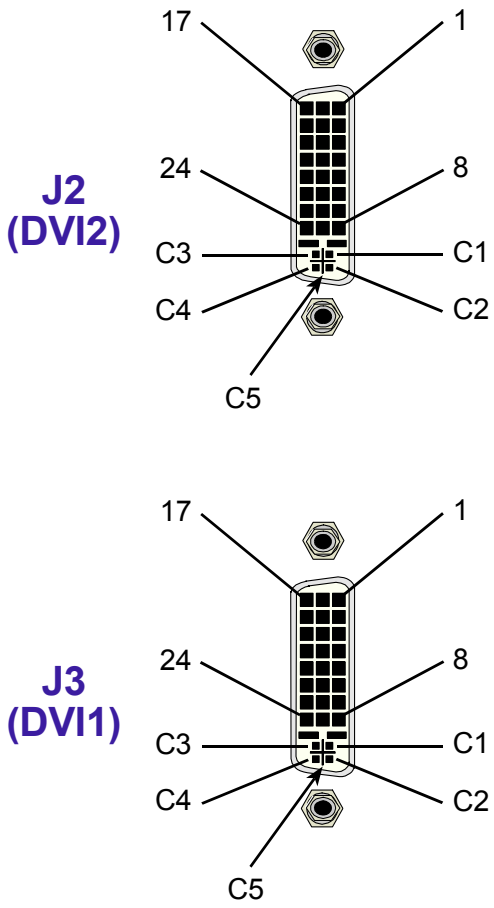


Table 2-3: DVI-I Con. J2 and J3 Pinouts

PIN	SIGNAL
1	T.M.D.S. Data2-
2	T.M.D.S. Data2+
3	T.M.D.S. Data 2 Shield
4	NC
5	NC
6	DDC Clock
7	DDC Data
8	Analog Vertical Sync
9	T.M.D.S. Data1-
10	T.M.D.S. Data1+
11	T.M.D.S. Data1 Shield
12	NC
13	NC
14	+5V Power[1)]
15	GND
16	Hot Plug Detect
17	T.M.D.S. Data0-
18	T.M.D.S. Data0+
19	T.M.D.S. Data0 Shield
20	NC
21	NC
22	T.M.D.S. Clock Shield
23	T.M.D.S. Clock+
24	T.M.D.S. Clock-
C1	Analog red
C2	Analog Green
C3	Analog Blue
C4	Analog Horizontal Sync
C5	Analog Ground

[1)] +5V power provided by the system to enable the monitor to provide EDID data when the monitor circuitry is not powered

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The DVI1 connector J3 supplies the signals from the DAC1 (CRT/analog) and the signals of the integrated TMDS transmitter of the ATI graphics controllers. In addition, a DDC channel is provided to detect the presence of a display device and its capabilities.

The DVI2 connector J2 supplies the signals from the DAC2 of the graphic controllers. The TMDS signals on this connector are provided by a TMDS transmitter which is connected to the multiplexed video interface of the ATI graphic controllers. The PanelLink/TMDS transmitter used on the CP332 is the Silicon Image SiI 164. In addition, a DDC channel is provided to detect the presence of a display device and its capabilities.

2.2.2 Fuses F1 and F2

The CP332 is equipped with two 1.5 A fuses, F1 and F2, of type Little Fuse 154 01.5. They are used to protect the +5V power (see connectors J2 and J3, pin 14) supply against overcurrent.

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2.2.3 CompactPCI Connector J1

The CP332 is equipped with one 2 mm x 2 mm pitch, 32-bit, female, CompactPCI connector, J1, with support for PCI bus signals, arbitration, clock and power.

The CP332 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.

Figure 2-2: CompactPCI Connector J1

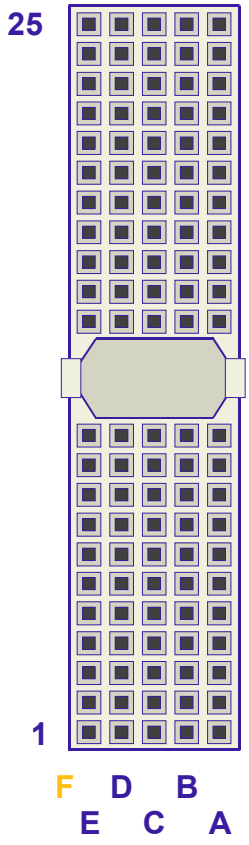


Table 2-4: CompactPCI Connector J1 Pinout

PIN	ROWZ	ROW A	ROW B	ROW C	ROWD	EROW	ROWF
1	GND	+5V	NC	NC	NC	+5V	GND
2	GND	NC	+5V	NC	TDO	TDI	GND
3	GND	INTA#	NC	NC	+5V	NC	GND
4	GND	NC	GND	V(I/O)	NC	NC	GND
5	GND	NC	NC	RST	GND	NC	GND
6	GND	NC	GND	NCV	CLK	AD[31]	GND
7	GND	AD[30]	AD[29]	AD[28]	GND	AD[27]	GND
8	GND	AD[26]	GND	V(I/O)	AD[25]	AD[24]	GND
9	GND	C/BE[3]	IDSEL	AD[23]	GND	AD[22]	GND
10	GND	AD[21]	GND	NCV	AD[20]	AD[19]	GND
11	GND	AD[18]	AD[17]	AD[16]	GND	C/BE[2]	GND
12-14 Key Area							
15	GND	NCV	FRAME#	IRDY#	GND	TRDY#	GND
16	GND	DEVSEL#	GND	V(I/O)	STOP#	LOCK#	GND
17	GND	NCV	NC	NC	GND	PERR#	GND
18	GND	SERR#	GND	NCV	PAR	C/BE[1]	GND
19	GND	NCV	AD[15]	AD[14]	GND	AD[13]	GND
20	GND	AD[12]	GND	V(I/O)	AD[11]	AD[10]	GND
21	GND	NCV	AD[9]	AD[8]	M66EN	C/BE[0]	GND
22	GND	AD[7]	GND	NCV	AD[6]	AD[5]	GND
23	GND	NCV	AD[4]	AD[3]	+5V	AD[2]	GND
24	GND	AD[1]	+5V	V(I/O)	AD[0]	NC	GND
25	GND	+5V	NC	NC	NCV	+5V	GND



Note ...

The CP332 has no hot swap capability.

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Chapter 3

Installation

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3. Installation

The CP332 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 CP332. *Kontron* assumes no responsibility for any damage resulting from failure to comply with these requirements.



Warning!

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.



Caution!

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.



ESD Equipment!

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.

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3.2 CP332 Initial Installation Procedures

The following procedures are applicable only for the initial installation of the CP332 in a system.

To perform an initial installation of the CP332 in a system, proceed as follows:

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



Warning!

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

2. To install the CP332 perform the following:
   1. Ensure that no power is applied to the system before proceeding.



Warning!

When performing the next step, **DO NOT** push the board into the backplane connectors. Use the ejector handle 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).
   5. Connect all external interfacing cables to the board as required.
   6. Ensure that the board and all required interfacing cables are properly secured.
3. The CP332 is now ready for operation. For operation of the CP332, refer to appropriate CP332 specific software drivers and system documentation.
4.



Note ...

The CP332 can drive regular CRT monitors using a DVI-to-CRT connector adapter on the front-panel. Flat panel monitors are usually addressed by the CP332 via the 29-pin DVI-I connectors.

CP332-30073-01-060202-ml

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3.3 Standard Removal Procedures

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!



Warning!

Care must be taken when applying the procedures below to ensure that neither the CP332 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).
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.



Warning!

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.

3.4 Driver Installation

Drivers for Microsoft® Windows® operating systems are provided with the CP332 driver kit included in the installation package. Exact guidelines can be found in the readme file which should be followed before starting the installation procedure. Please follow also the interactive instructions of the installation program and enter specific data when prompted. The driver kit also provides the guideline for installing a Linux driver.



Note ...

Please ensure that the connected monitor or display supports the selected resolution. Otherwise damage may result due to incorrect operating frequency parameters.

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Chapter 4

Video BIOS Extension

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4. Video BIOS Extension

The Video BIOS Extension firmware can be updated using special software tools as soon as new versions are available.

For further information on video BIOS updates and appropriate software tools contact Kontron's Technical Support.

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Chapter 5

Power Considerations

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5. Power Considerations

5.1 System Power

The considerations presented in the ensuing sections must be taken into account by system integrators when specifying the CP332 system environment.

5.2 CP332 Voltage Ranges

The CP332 board 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 CP332 should be carefully tested to ensure compliance with these ratings.

Table 5-1: Absolute Maximum Ratings

SUPPLY VOLTAGE	ABSOLUTE MAXIMUM RATINGS
+3.3 V	+3.6 V
+5 V	+5.5 V



Warning!

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 CP332 is not guaranteed to function if the board is not operated within the prescribed limits.

Table 5-2: DC Operational Input Voltage Ranges

INPUT SUPPLY VOLTAGE	ABSOLUTE RANGE	RECOMMENDED RANGE	REMARKS
+3.3 V	3.135 V min. to 3.47 V max.	3.3 V min. to 3.47 V max.	Main voltage
+5 V	4.75 V min. to 5.25 V max.	5.0 V min. to 5.25 V max.	Main voltage

5.3 Power Supply Units

Power supplies for the CP332 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.

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As the design of the CP332 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.

Warning!

An underdimensioned power supply may cause damage to system components.

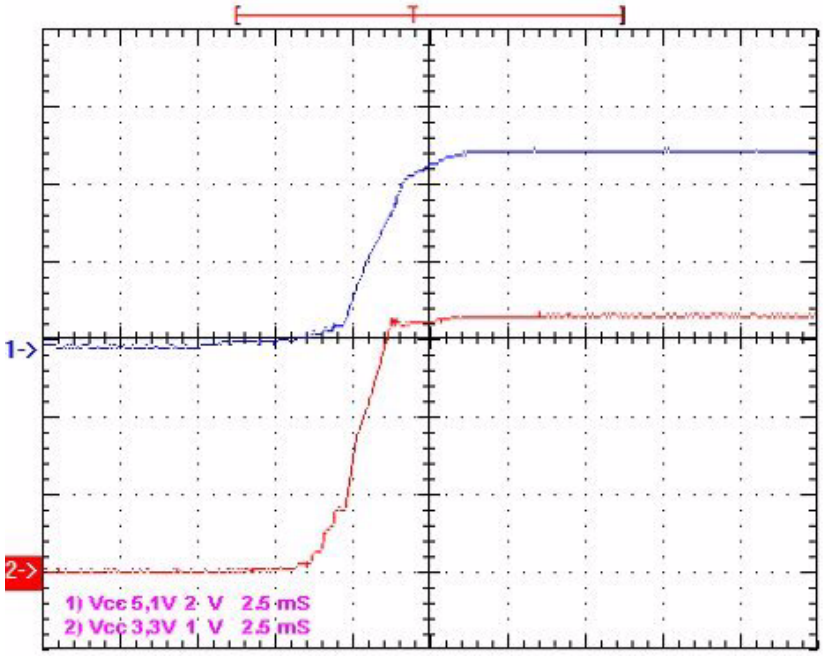
5.3.1 Voltage Sequencing Requirements

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

5.3.2 Rise Time Diagram

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

Figure 5-1: Voltage Ramp of the CP3-SVE180 AC Power Supply



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5.3.3 Recommended Operating Conditions

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

Table 5-3: Input Voltage Characteristics

VOLTAGE	NOMINAL VALUE	TOLERANCE	MAX. RIPPLE (p-p)
5 V	+5.0 VDC	+5%/-3%	50 mV
3.3 V	+3.3 VDC	+5%/-3%	50 mV
GND	Ground, not directly connected to protective earth (PE)		

5.4 Power Consumption of the CP332

The goal of this description is to provide a method to calculate the power consumption for the CP332 board and for additional configurations.

The power consumption table below lists the power consumption of the CP332 using the M9-CSP64 graphics controller. The applications used were Static DOS, Static Windows 2000, and Windows 2000 with 3D Mark 2001. All measurements were conducted at a temperature of 25°C. The measured values varied because the power consumption was dependent on the running application.

Table 5-4: Power Consumption of the CP332

APPLICATION	3.3 V		5 V	
Static DOS	0.075 A	0.25 W	0.14 A	0.7 W
Static Windows 2000 1024 x 768	0.105 A	0.35 W	0.2 A	1.0 W
Windows 2000 with 3D Mark 2001	0.115 A	0.38 W	0.9 A	4.5 W

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Chapter 6

System Considerations

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6. System Consideration

6.1 Thermal Management

It is the responsibility of the system integrator to ensure that sufficient air flow or cooling is provided for proper operation of the CP332.

The following sections provide system integrators with the necessary information to satisfy thermal requirements when implementing CP332 applications.

6.1.1 Heat Sink

The CP332 is fitted with an optimally designed heat sink. The physical size, shape, and construction ensures the best possible thermal resistance (R_{th}) 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 CP332 is fitted with an optimally designed heat sink, the thermal energy dissipated by the graphics controller exceed the thermal capabilities of the heat sink except for very low performance applications. For higher performance applications, the CP332 must be operated with forced air flow.

6.1.2 Forced Air Flow

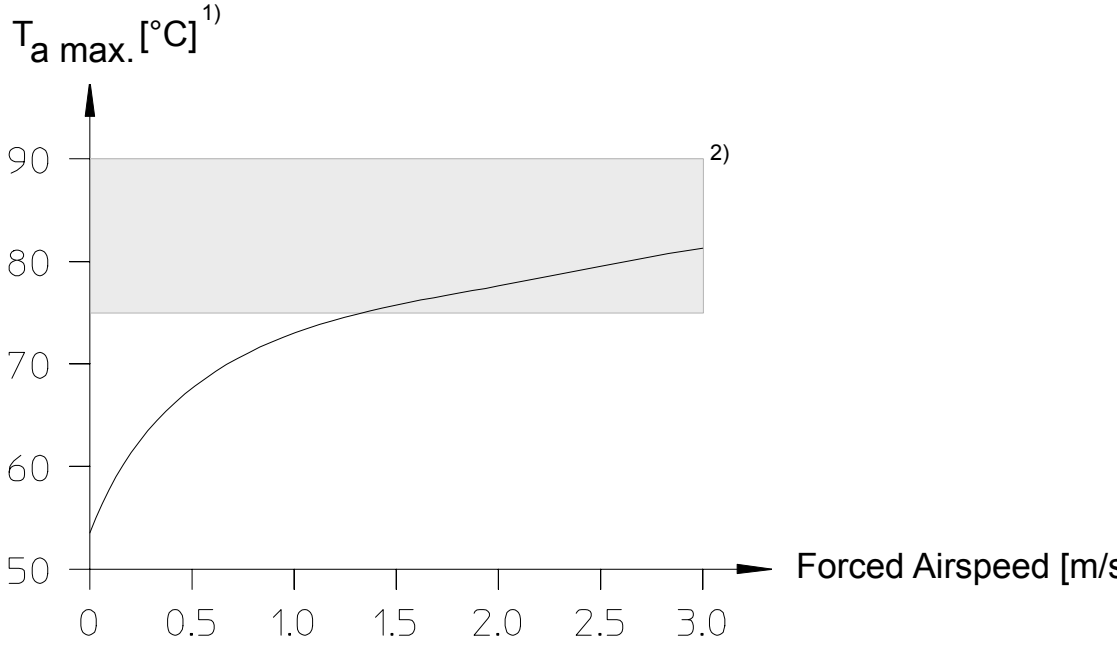
When developing applications using the CP332, the system integrator must be aware of the overall system thermal requirements. System chassis must be provided which satisfy these requirements. As an aid to the system integrator, a graphics controller characteristics graph is provided for the M9-CSP64.

The values have been measured using typical applications such as Static DOS, Static Windows 2000, and Windows 2000 with 3D Mark 2003. In worst case situations, the values vary and the temperature range must be reduced. In all situations the maximum junction temperature of the M9-CSP64 graphics controller must be kept below the maximum allowable temperature.

The maximum junction temperature for the M9-CSP64 is 125°C.

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Figure 6-1: M9-CSP64 Temperature Vs. Airspeed Graph



Warning!

1) T_a is the initial temperature of the ambient air used for convectional cooling of the board. In a typical installation where the board is mounted vertically in a system rack, this would be the temperature of the air measured at the bottom of the board before the air flows over the board.

2) If the board is to be operated within the shaded area indicated above, it is imperative to verify that it can be safely operated before the board is integrated in an application system. This will require an empirical thermal design analysis and verification by the system designer.

As individual graphics controller characteristics vary as well as the system environment of the CP332, the information contained in Figures 6-1 must be viewed as a guide and not as an absolute specification. It is the responsibility of the system integrator to ensure that system requirements are specified accordingly.

An airflow of 1.0 m/s is a typical value for a standard *Kontron* ASM rack (3U CompactPCI rack with a 1U cooling fan tray). Newer ASMs from *Kontron* will have an airspeed of 2.0 m/s or more. For other racks or housings the available airflow will differ. The maximum ambient operating temperature must be recalculated and/or measured for such environments. For the calculation of the maximum ambient operating temperature, the processor junction temperature must never exceed the specified limit for the involved processor type.

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