» Kontron User's Guide «



MPCX28R

Document Revision 107 Draft

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1 User Information

1.1 About This Document

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For the circuits, descriptions and tables indicated, Kontron assumes no responsibility as far as patents or other rights of third parties are concerned.

1.2 Copyright Notice

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- Microsoft is a registered trademark of Microsoft Corp.
- Intel is a registered trademark of Intel Corp.

All other products and trademarks mentioned in this manual are trademarks of their respective owners.

1.4 Standards

Kontron AG is certified to ISO 9001:2000 standards.

1.5 Warranty

This Kontron AG product is warranted against defects in material and workmanship for the warranty period from the date of shipment. During the warranty period, Kontron AG will, at its discretion, decide to repair or replace defective products.

Within the warranty period, the repair of products is free of charge as long as warranty conditions are observed.

The warranty does not apply to defects resulting from improper or inadequate maintenance or handling by the buyer, unauthorized modification or misuse, operation outside of the product's environmental specifications or improper installation or maintenance.

Kontron AG will not be responsible for any defects or damages to other products not supplied by Kontron AG that are caused by a faulty Kontron AG product.

Empty batteries (external and onboard), as well as all other battery failures, are not covered by this manufacturer's limited warranty.

1.6 Technical Support

Technicians and engineers from Kontron AG and/or its subsidiaries are available for technical support. We are committed to making our products easy to use and will help you use our products in your systems.

Please consult our Web site at http://www.digitallogic.com/index.php?id=products-download for the latest product documentation, BIOS, drivers, tools and software information.

For technical support consult http://support.kcc-ag.ch/ .

1.7 Environmental Protection Statement

This product has been manufactured to satisfy environmental protection requirements wherever possible. Many of the components used (structural parts, printed circuit boards, connectors, batteries, etc.) are capable of being recycled. Final disposal of this product after its service life must be accomplished in accordance with applicable country, state, or local laws or regulations. All components within this product fulfill the requirements of the RoHS (Restriction of Hazardous Substances Directive). The product is soldered with a lead free process.

1.8 RoHS Commitment

Kontron Compact Computers AG (Switzerland) is committed to develop and produce environmentally friendly products according to the Restriction of Hazardous Substances (RoHS) Directive (2002/95/EC) and the Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) established by the European Union. The RoHS directive was adopted in February 2003 by the European Union and came into effect on July 1, 2006. It is not a law but a directive, which restricts the use of six hazardous materials in the manufacturing of various types of electronic and electrical equipment. It is closely linked with the Waste Electrical and Electronic Equipment Directive (WEEE) 2002/96/EC, which has set targets for collection, recycling and recovery of electrical goods and is part of a legislative initiative to solve the problem of huge amounts of toxic e-waste.

Each European Union member state is adopting its own enforcement and implementation policies using the directive as a guide. Therefore, there could be as many different versions of the law as there are states in the EU. Additionally, non-EU countries like China, Japan, or states in the U.S. such as California may have their own regulations for green products, which are similar, but not identical, to the RoHS directive.

RoHS is often referred to as the "lead-free" directive but it restricts the use of the following substances:

- Lead
- Mercury
- Cadmium
- Chromium VI
- PBB and PBDE

The maximum allowable concentration of any of the above mentioned substances is 0.1% (except for Cadmium, which is limited to 0.01%) by weight of homogeneous material. This means that the limits do not apply to the weight of the finished product, or even to a component but to any single substance that could (theoretically) be separated mechanically.

1.8.1 RoHS Compatible Product Design

All Kontron Compact Computers (KCC) AG standard products comply with RoHS legislation.

Since July 1, 2006, there has been a strict adherence to the use of RoHS compliant electronic and mechanical components during the design-in phase of all KCC AG standard products.

1.8.2 RoHS Compliant Production Process

KCC selects external suppliers that are capable of producing RoHS compliant devices verified by:

- A confirmation from the supplier indicating that their production processes and resulting devices are RoHS compliant.
- If there is any doubt of the RoHS compliancy, the concentration of the previously mentioned substances in a produced device will be measured. These measurements are carried out by an accredited laboratory.

1.8.3 WEEE Application

The WEEE directive is closely related to the RoHS directive and applies to the following devices:

- Large and small household appliances
- IT equipment
- Telecommunications equipment (although infrastructure equipment is exempt in some countries)
- Consumer equipment
- Lighting equipment – including light bulbs
- Electronic and electrical tools
- Toys, leisure and sports equipment
- Automatic dispensers

It does not apply to fixed industrial plants and tools. The compliance is the responsibility of the company that brings the product to market, as defined in the directive. Components and sub-assemblies are not subject to product compliance. In other words, since Kontron Compact Computers AG does not deliver ready-made products to end users the WEEE directive is not applicable for KCC AG. Users are nevertheless encouraged to properly recycle all electronic products that have reached the end of their life cycle.

1.9 Swiss Quality

- 100% Made in Switzerland
- This product was not manufactured by employees earning piecework wages
- This product was manufactured in humane work conditions
- All employees who worked on this product are paid customary Swiss market wages and are insured
- ISO 9000:2001 (quality management system)

1.10 The Swiss Association for Quality and Management Systems

The Swiss Association for Quality and Management Systems (SQS) provides certification and assessment services for all types of industries and services. SQS certificates are accepted worldwide thanks to accreditation by the Swiss Accreditation Service (SAS), active membership in the International Certification Network, IQNet, and co-operation contracts/agreements with accredited partners.

www.sqs.ch

The SQS Certificate ISO 9001:2000 has been issued to Kontron Compact Computers AG in the field of development, manufacturing and sales of embedded computer boards, embedded computer modules and computer systems. The certification is valid for three years at which time an audit is performed for recertification.

2 Assembly

The following parts must be included in the MPCX28R delivery package:

1. MPCX28R System
2. MPCX28/R front cover (mounted on the system)
3. Product CD
4. Hard disk mounting kit
5. This User's Guide



3 Specifications

3.1 Technical Data

Function	Description
CPU / Performance	Intel® Atom™ Z530 / 1.6GHz
Chipset	Intel® US15W
Memory	1GB DDR2
Hard Disk / SSD	Exchangeable SATA 2.5", not installed
Video Controller	Intel® GMA 500
3D-Support	DirectX 9
1st Video Interface	DVI-D (Customer specific: DVI-A or VGA)
Display Resolution	Maximum 1600x1200 @ 60Hz (UXGA)
Keyboard / Mouse	USB
Serial Interface PORT1	RS-232C / RS-422 / RS-485 / Wake-on-Ring function
Serial Interface PORT2	RS-232C / RS-422 / RS-485
Digital I/O PORT 3	4x DC-isolated digital in-/output / 5V SATA HD power supply / optional: LPT
USB Ports	2x front panel (USB 2.0) / 2x back panel (USB 2.0) / 1x M12 connector back panel (USB 2.0)
Internal SATA Interface	SATA II, (2.5" HD slot in front panel)
LAN PORT A	100Mbit/s M12 connector / WakeOnLan function
LAN PORT B	100Mbit/s M12 connector
Audio Controller	Realtek audio codec
Audio SPK	Stereo line output
Audio MIC	Stereo microphone / line input
Expansions	2x PCIe MiniCard / 1x PCI/104

3.2 MPCX28R Ordering Information

Part / Option	Part No.	Description
MPCX28R-V1248	814430	MPCX28R system with 12-48 V DC input (evaluation only, no EN50155, no coating)
MPCX28R-I24	814431	MPCX28R system with 24V isolated DC input
MPCX28R-I36	814432	MPCX28R system with 36V isolated DC input
MPCX28R-I48	814433	MPCX28R system with 48V isolated DC input
MPCX28R-I72	814434	MPCX28R system with 72V isolated DC input
MPCX28R-I110	814435	MPCX28R system with 110V isolated DC input
Option 80GB 24h SATA	807411	80GB hard disk automotive, SATA
Option 32GB SSD	807417	SATA2 SLC 2.5"-SSD Intel®
Option MPCX28/R w/o front cover	814441	No protective cover, only hard disk enclosure
Option MPCX28/R LPT	814439	LPT Port instead of Digital I/O for MPCX28/R
Option MPCX28/R audio back panel	814440	Audio line / Mic on PORT1 (DSUB-9) instead of COM1
Option MPCX28 WLAN MCex	807430	PCIex MiniCard Intel® 4965AGN with antenna cable
Option MPCX28UC GSM/GPS	814438	Telit UC864-G, UMTS / HSDPA 7.2Mbit/s, 12CH GPS, with antenna cables
Option MPCX28 GPS A1080	807432	GPS assembled with antenna cable
Option MPCX28 2xCAN PEAK	814443	2xPeak CAN opto-isolated
MPCxx power adapter	807436	110/220VAC, 90W supply, with M12 connector (19V)
MPCxx M12 power connector	814690	M12-plug with 2m cable for DC input 12-48VDC
MPCxx M12 USB to standard USB	814691	M12-plug with 1.8m cable to standard USB connector
MPCxx M12 LAN to standard LAN	814692	M12-plug with 2.5m cable to standard LAN RJ-45 connector

3.3 Electrical Specifications

3.3.1 Supply Voltage

814430 MPCX28R-V1248

Input	DC In min.	DC In nominal	DC In max.
DC Main	10V	**12V – 48V**	54V
DC Main (redundant)	10V	**12V – 48V**	54V

814431 MPCX28R-I24

Input	DC In min.	DC In nominal	DC In max.	DC In max. transient (< 1s)
DC Main	17V	**24V**	30V	34V
DC Main (redundant)	17V	**24V**	30V	34V

814432 MPCX28R-I36

Input	DC In min	DC In nominal	DC In max.	DC In max. transient (< 1s)
DC Main	25V	**36V**	45V	51V
DC Main (redundant)	25V	**36V**	45V	51V

814433 MPCX28R-I48

Input	DC In min.	DC In nominal	DC In max.	DC In max. transient (< 1s)
DC Main	34V	**48V**	60V	67V
DC Main (redundant)	34V	**48V**	60V	67V

814434 MPCX28R-I72

Input	DC In min.	DC In nominal	DC In max.	DC In max. transient (< 1s)
DC Main	50V	**72V**	90V	101V
DC Main (redundant)	50V	**72V**	90V	101V

814435 MPCX28R-I110

Input	DC In min.	DC In nominal	DC In max.	DC In max. transient (< 1s)
DC Main	77V	**110V**	137V	154V
DC Main (redundant)	77V	**110V**	137V	154V

See Appendix A for the pin assignments of the DC Main Connector.

3.3.2 Supply Currents

Note: The currents listed below are valid from system version 1.1 and higher.

814430 MPCX28R-V1248

State	I @ 12VDC	P	I @ 24VDC	P	I @ 48VDC	P
OFF	12mA	0.14W	6mA	0.14W	4mA	0.14W
OFF, Operating Mode 3 (WOL)	65mA	0.78W	35mA	0.84W	20mA	0.96W
ON, WinXP, idle, PowerSaveMode	620mA	7.44W	330mA	7.92W	185mA	8.88W
ON, WinXP, idle	710mA	8.52W	365mA	8.76W	210mA	10W
ON, WinXP, 100% CPU load	960mA	11.5W	500mA	12W	275mA	13.2W
S3	255mA	3.06W	136mA	3.26W	78mA	3.74W

814431/2/3 MPCX28R-Ixx

State	MPCX28R-I24	P	MPCX28R-I36	P	MPCX28R-I48	P
OFF	22mA	0.53W	15mA	0.54W	13mA	0.62W
OFF, Operating Mode 3 (WOL)	56mA	1.34W	40mA	1.44W	30mA	1.44W
ON, WinXP, idle, PowerSaveMode	360mA	8.64W	265mA	9.54W	182mA	8.74W
ON, WinXP, idle	410mA	9.84W	295mA	10.6W	205mA	9.84W
ON, WinXP, 100% CPU load	520mA	12.5W	360mA	13W	260mA	12.5W
S3	180mA	4.32W	130mA	4.68W	93mA	4.46W

814434/5 MPCX28R-Ixx

State	MPCX28R-I72	P	MPCX28R-I110	P
OFF	7mA	0.5W		
OFF, Operating Mode 3 (WOL)	15mA	1.08W		
ON, WinXP, idle, PowerSaveMode	118mA	8.5W		
ON, WinXP, idle	133mA	9.58W		
ON, WinXP, 100% CPU load	172mA	12.4W		
S3	60mA	4.32W		

3.4 Mechanical Specifications

Property	Description
Size (W x L x H in mm)	159 x 187 x 66 (See Appendix C)
Weight	1.5 kg
Housing	Aluminum
Color	Anthracite / black anodized
Protection Class	IP52
Vibration / Shock (with HD)	1G / 10G
Vibration / Shock (with SSD)	16G / 150G

3.5 Environmental Specifications

3.5.1 Temperature

» Operating (with HD): -25°C to +55°C

» Operating (with SSD): -25°C to +70°C

3.5.2 Humidity

» Operating: 10% to 90% (non-condensing)

3.6 MTBF (Mean Time Between Failures)

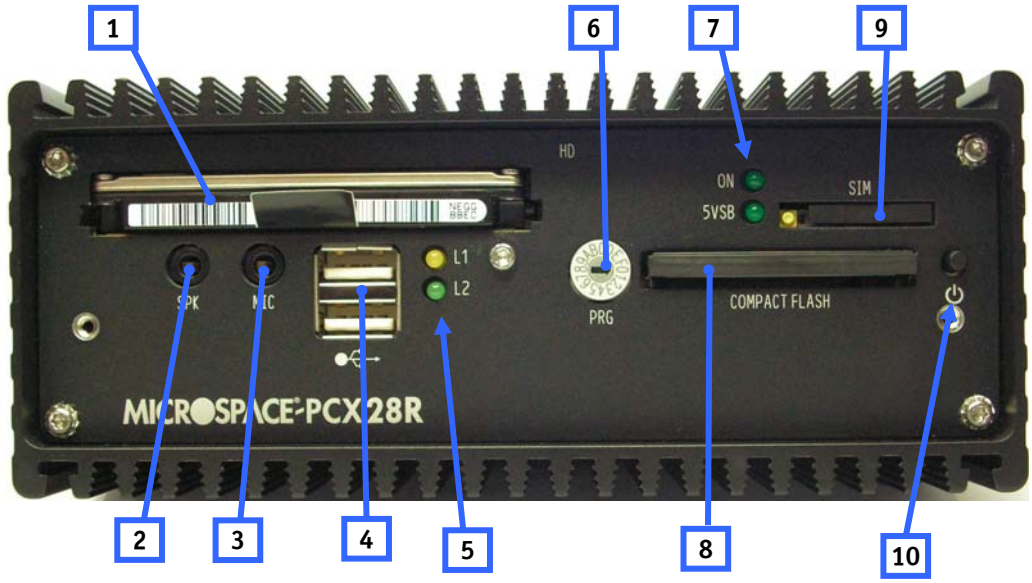
» MTBF: 60,000 hrs

4 MPCX28R Connectors & Operating Elements

4.1 Front Panel

Note: Insert SIM card this way!



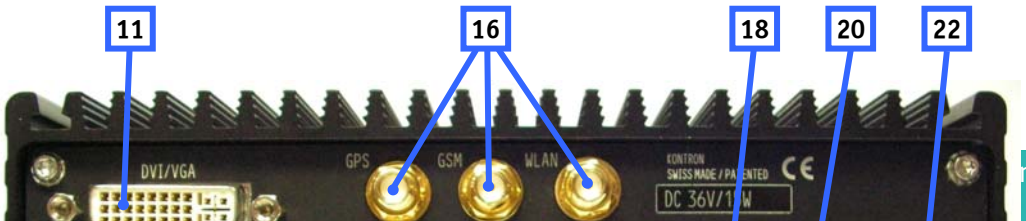


Position	Description	Connector Type	Information
1	Slot for Hard Disk Drive	2.5" SATA	Appendix B, hard disk mounting
2	Audio Line Output	3.5mm audio jack	
3	Audio Microphone Input	3.5mm audio jack	
4	Dual USB Port ✶	2x USB-A (female)	
5	Indicator LEDs 1 & 2		Section 5.2
6	Rotary Switch to select Operating Mode		Section 5.3
7	Power Indicator LEDs		Section 5.1
8	CompactFlash (CF) Card Slot		
9	SIM Card Holder		
10	Power Switch		

✶ Upper Port is USB 2.0 only. USB keyboard/mouse or other such USB 1.0 devices may not work.

See Appendix A for the pin assignments.

4.2 Back Panel



Position	Description	Connector Type	Information
11	DVI-D Digital Video Output (Customer specific DVI-A or VGA analog Output)	DVI (DVI or VGA)	
12	Port 2 (RS-232 / RS-485)	DSUB-9 (male)	Section 8.7
13	M12 LAN Port B (100MB)	M12, 4pin, D-Coded (female)	
14	M12 LAN Port A (100MB / WakeOnLan function)	M12, 4pin, D-Coded (female)	
15	Digital I/O Port / 5V Supply for External HDD (Optional LPT1 Port)	DSUB-25 (female)	Section 5.5
16	GPS / GSM / WLAN Antenna Connector (Option)	SMA (WLAN reverse SMA)	
17	M12 USB 2.0 Port	M12, 4pin (female)	
18	Dual USB 2.0 Port	2x USB-A (female)	
19	COM Port 1 (RS-232 / RS-485) DSUB-9 Connector	DSUB-9 (male)	Section 8.7
20	Fuse Holder (250VAC / 2A)	-	
21	Grounding Screw	M3 screw	
22	Power Supply	M12, 4pin (male)	Section 3.3

See Appendix A for the pin assignments.

5 Functions

5.1 Power LEDs (ON / 5VSB)

LED ON	LED 5VSB	Description
OFF	OFF	MPCX28R is not powered
OFF	BLINK	MPCX28R is in the off state
ON	OFF	MPCX28R is on
ON	BLINK FAST	MPCX28R is in the S3 state

5.2 Indicator LEDs L1 & L2

LED	Description
L1	Disk activity (CompactFlash, internal SATA HD / SSD, external HD / SSD)
L2	LAN activity (LAN A & LAN B)

Other functions for L1 & L2 are possible in customer specific configurations.

5.3 Operating Modes

The MPCX28R can be run in different operating modes. With the rotary switch (Pos. 6) the source to switch on the MPCX28R can be selected. Additional operating modes are possible for customer specific configurations.

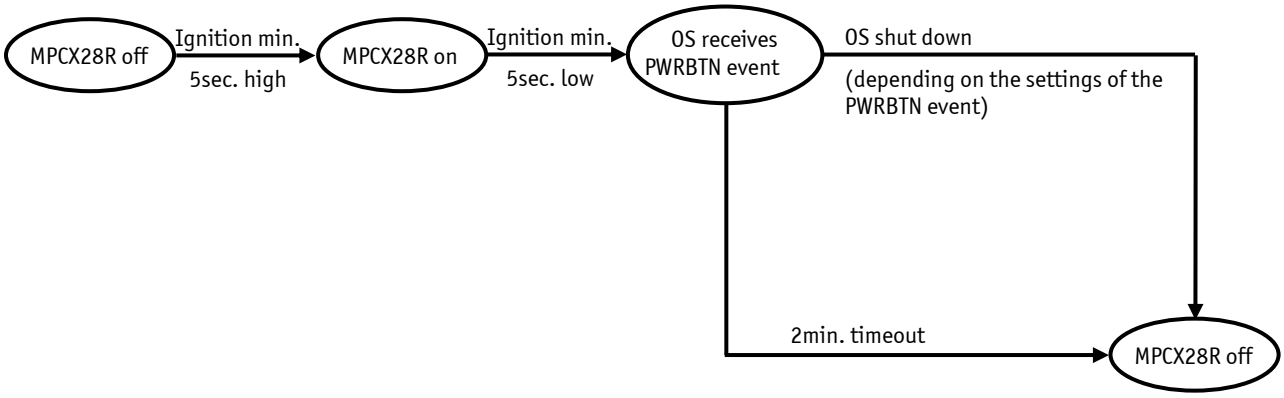
Mode	Function	Description
0	Autostart Mode	MPCX28R starts automatically 2 seconds after DC IN is connected
1	Ignition Mode	MPCX28R starts on ignition input (see Section 5.3.1 for further details)
2	Desktop Mode	MPCX28R starts with a push of the power button (Pos. 10)
3	WOL / WOR Mode	Wake-on-LAN / Wake-on-Ring
4	WOM Mode	MPCX28R starts when the system has moved
5	Reserved	Switch to Mode 0
6	Reserved	Switch to Mode 0
7	Reserved	Switch to Mode 0
8	Autostart Mode ★	MPCX28R starts automatically 2 seconds after DC IN is connected / PowerSaveMode ★
9	Ignition Mode ★	MPCX28R starts on ignition input / PowerSaveMode ★
A	Desktop Mode ★	MPCX28R starts with a push of the power button / PowerSaveMode ★
B	WOL / WOR Mode ★	Wake-on-LAN / Wake-on-Ring / PowerSaveMode ★
C	WOM Mode ★	MPCX28R starts when the system has moved / PowerSaveMode ★
D	Reserved	Switch to Mode 0
E	Reserved	Switch to Mode 0
F	Reserved	Switch to Mode 0

★ PowerSaveMode: The SATA Controller is switched off. This is recommended if a SATA hard disk is not used.

Note:	In PowerSaveMode the hard disk slot does not work! PowerSaveMode is available in system version 1.1 and later.

5.3.1 Ignition Mode

The ignition pin of the DC MAIN connector is a DC-isolated input which can be connected to the switched board supply of a car. This function allows the OS to shut down after switching off the car's ignition, without loss of data.



Electrical Characteristics of the Ignition Input

Warning: The following values are valid from system version 1.1.
Version 1.0 has an ignition input voltage range from 8V to 25V DC for all system types!

System	Voltage Ranges
MPCX28R – V1248	8V – 54V DC
MPCX28R – I24	24V DC ±10%
MPCX28R – I36	36V DC ±10%
MPCX28R – I48	48V DC ±10%

5.3.2 WOL (Wake-on-LAN)

The LAN A chip is powered in the off state and wakes up the system if a magic packet is received. Note that Wake-on-LAN must also be enabled in the operating systems driver, otherwise it is disabled after the first start of the operating system.

5.3.3 WOR (Wake-on-Ring)

A logical zero (meaning a voltage level from 3V to 15VDC) on the Ring Indicator Input on the COM/PORT 1 (Pin 9) for at least 5ms wakes up the system.

5.3.4 WOM (Wake-on-Move)

In the Wake-on-Move mode, the system wakes up if a difference of approximately 20° rotation angle is detected in comparison to the previous powered position of the MPCX28R or when the OS was last shut down. The rotation of two axes will be detected, X and Y. In the Z axis, the MPCX28R detects a vertical acceleration. The MPCX28R also wakes up from a harder vibration or shock.

5.4 COM Port RS-232 / RS-422 / RS-485

The two COM ports of the MPCX28R are configurable as RS-232, RS-422 or RS-485. For each port the following settings can be made in the BIOS setup:

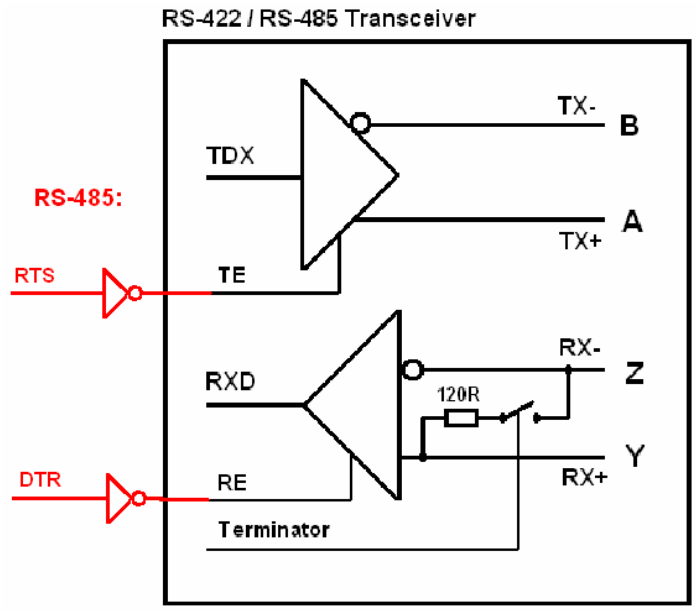
- » Mode: RS-232 / RS-422 / RS-485
- » Termination: ON / OFF

RS-232

The COM port is in RS-232 mode.

RS-422 / RS-485

The COM port is internally connected over an RS-422 / RS-485 transceiver.



Mode	Transmitter	Receiver
RS-422	Enabled	Enabled
RS-485	Enabled when RTS is active (low)	Enabled when DTR is active (low)

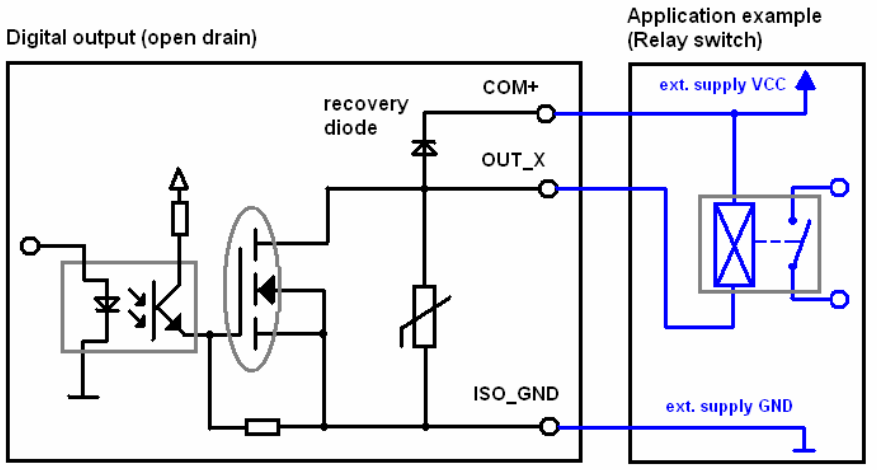
If the termination is enabled in the BIOS, a 120 Ohm resistor is switched between the differential input pair of the RS-422 / RS-485 transceiver.

The COM Ports (PORTs 1 & 2) are on the DSUB-9 connectors on the back panel. See Appendix A for the pin assignments.

5.5 Digital I/O

The MPCX28R features four DC-isolated digital inputs and four DC-isolated digital outputs on PORT 3 (DSUB-25 connector on the back panel). The I/O pins are controlled by the FPGA. See Section 6.2 to get access to the FPGA.

The following diagram shows the digital output circuit and an application example to switch a relay.



The digital output works as an open drain output, so a high to the output ties the output pin to ISO_GND.

See Appendix A for the pin assignments.

Electrical Characteristics of the Digital I/O

Warning: The following values are valid from system version 1.1.
Version 1.0 has a digital input voltage range from 8V to 20V DC for all system types!

Pin	Input	Output Active	Output Inactive
Min. Voltage	8V DC	-	-
Max. Voltage	58V DC	-	58V DC
Max. Current	-	1.5A DC	-
Resistance	≈ 22kΩ	< 10mΩ	> 5MΩ

The digital I/O voltage and current values are the same for all system types.

6 BIOS Setup

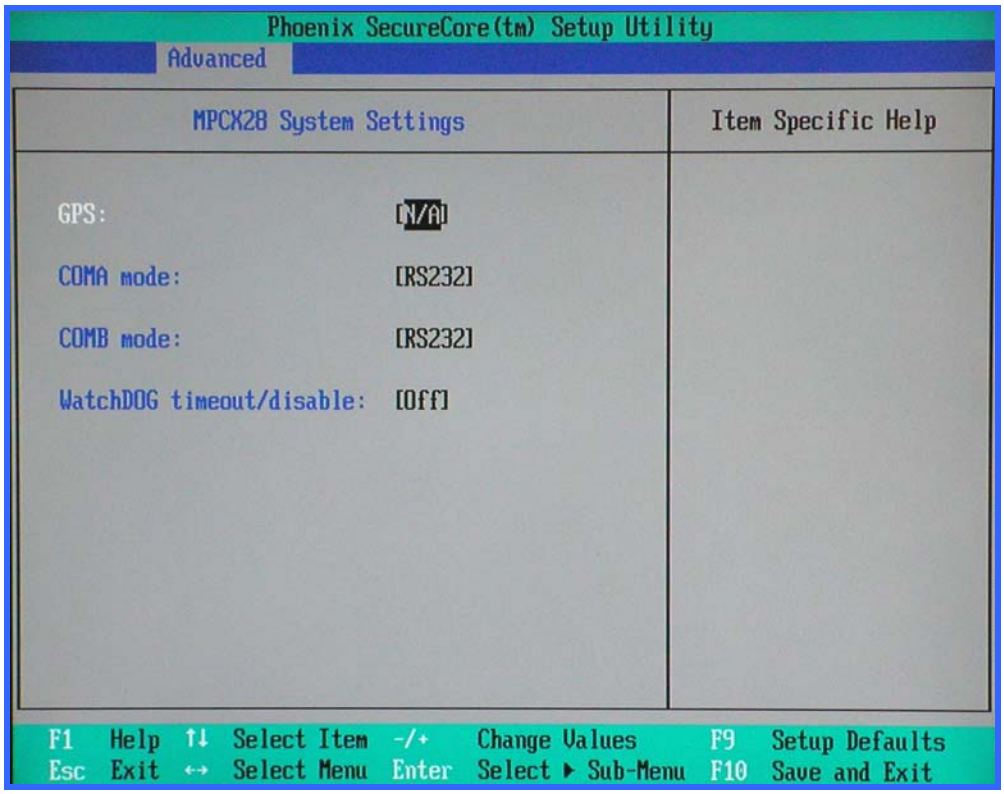
The MPCX28R BIOS setup is similar to the setup of the SMA200 BIOS. The following sections show only the part of the BIOS setup specific to the MPCX28/R.

6.1 Enter BIOS Setup

To enter the BIOS setup, press **F2** during startup, when the Kontron logo is shown.

6.2 MPCX28R System Settings

In the BIOS setup, press the **right cursor** to change to the "Advanced" window. In this window, there is a submenu "MPCX28R System Settings". Select this submenu and open it by pressing **Enter**.



6.2.1 GPS

Note:	These settings are only for the Option MPCX28 GPS A1080.

If the MPCX28 GPS 1080A option is assembled, the COM Port of the GPS module can be set to either one of the two COM ports of the MPCX28R. Note that the used COM port is not available for default RS-232 / RS-422 / RS-485 operation.

- » GPS = N/A: COMA & COMB are set to default COM port operation
- » GPS = COMA: The GPS module A1080 is connected to COMA (COM/PORT1)
- » GPS = COMB: The GPS module A1080 is connected to COMB (COM/PORT2)

Default value = N/A

6.2.2 COMA / COMB

These settings define the operation mode of the selected COM port, as described in Section 5.4.

- » COMA/B mode = RS232: COMA/B is in RS-232 mode
- » COMA/B mode = RS485: COMA/B is in RS-485 mode
  - » Terminate = Off: Termination resistor is disabled
  - » Terminate = On: Termination resistor is enabled
- » COMA/B mode = RS422: COMA/B is in RS-422 mode
  - » Terminate = Off: Termination resistor is disabled
  - » Terminate = On: Termination resistor is enabled

Default value = RS232

6.2.3 Watchdog

With this setting, the watchdog timer of the MPCX28R can be enabled and the time until a reset is asserted can be selected. The watchdog timer is part of the FPGA features and can be reset by directly accessing the FPGA.

See Chapter 7 on how to access the FPGA.

- » WatchDOG timeout/disable = Off: The watchdog timer is disabled
- » WatchDOG timeout/disable = 1 / 5 / 15min: The watchdog timer resets the MPCX28R after this time has elapsed

Default value = Off

Warning:	If this setting is enabled without a working watchdog reset in your program, your computer will reset after the time set in the BIOS setup.

7 FPGA Features

The FPGA features include:

- Watchdog circuit
- SATA power control
- Digital input and digital output

7.1 FPGA Features Access

The FPGA features of the MPCX28R are I/O mapped. The following table shows the addresses used.

Address	Name	Type	Description
0x208	FGIR	RW	Indexed register access number
0x209	FGDR	RW	Indexed register content
0x20A			Reserved
0x20B			Reserved
0x20C			Reserved
0x20D			Reserved
0x20E	WDRST	WO	Watchdog timeout reset
0x20F			Reserved

The FPGA features are accessible over the computer when the system is running.

7.2 Indexed Register Map

Index	Access	Function	Section
0x00	RO	System type	FPGA Information
0x02	RO	FPGA version	
0x03	RO	FPGA revision	
0x31	RW	Serial ATA power control	SATA Power Control
0x40	RW	Digital output control	Digital Output
0x41	RW	Digital output inversion control	
0x48	RO	Digital input status	Digital Input
0x49	RW	Digital input inversion control	
0x50	RW	Watchdog timeout time	Watchdog
0x51	RW		
0x58	RW	Watchdog control	
0x59	WO	Watchdog timeout reset	

7.2.1 Register Attributes

Attribute	Description
RsvdP	RESERVED AND PRESERVED Reserved for future RW implementations. Registers are Read-only and software must preserve the value for writes to this bit.
RW	READ-WRITE REGISTER Register bits are Read-Write and can be set or cleared by software.
RO	READ-ONLY Register bits are read only and can not be altered by software.
WO	WRITE-ONLY Register bits can only be written. Reading returns indeterminable data.

7.2.2 Writing to an Indexed Register

1. Write the index to the FGIR register (Port 0x208)
2. Write the data to the FGDR register (Port 0x209)

Example:

```
; Set digital output 0 to low
mov dx, 208h          ; Store port in dx for in/out instruction
mov al, 40h           ; Digital output control register
out dx, al            ; Set index register
inc dx                ; Increment dx to data register
in al, dx             ; Read current digital output control
or al, 01h            ; Set digital output 0 control to 1
out dx, al            ; Write back new digital output status
```

7.2.3 Reading from an Indexed Register

1. Write the index to the FGIR register (Port 0x208)
2. Read the data from the FGDR register (Port 0x209)

Example:

```
; Read digital input status
mov dx, 208h          ; Store port in dx for in/out instruction
mov al, 48h           ; Digital input status register
out dx, al            ; Set index register
inc dx                ; Increment dx to data register
in al, dx             ; Read indexed register content into al register
```

7.3 Descriptions of Features

7.3.1 FPGA Information

The FPGA information register contains essential information for the application program which will access the special functions. If new features are added or removed, the version index will be increased. If an error was fixed without adding new functionality, the revision index will be increased. The system identification can be used to detect the presence and the accessibility of the FPGA.

INDEX 0x00 - System ID

Bit	Access	Default	Description
7:0	RO	0x1C	System identification 0x1C (28 decimal) specifies an MPCX28R system

INDEX 0x02 - FPGA Version

Bit	Access	Default	Description
7:4	RO	0x1 *	Major version
3:0	RO	0x1 *	Minor version

* Example (valid for FPGA version 1.1)

INDEX 0x03 - FPGA Revision

Bit	Access	Default	Description
7:0	RO	0x02 *	Major version

* Example (valid for FPGA revision 2)

7.3.2 SATA Power Control

The external SATA hard disk power can be controlled by software. The port is powered after a system reset.

INDEX 0x31 - SATA Power Control

Bit	Access	Default	Description
7:2	RsvdP	00 0000b	Reserved; write as 0b
1	RW	1b	Serial ATA external connector power control 0b: Power off 1b: Power on
0	RsvdP	0b	Reserved; write as 0b

7.3.3 Digital Output

The MPCX28R provides four digital output pins. The pins are optically isolated and are suitable for switching the load to the output ground (ISO_GND) pins. Integrated flyback diodes are connected to a common pin COM+. Inductive loads such as relays can be connected directly to the pins.

The digital outputs are accessible over two registers. One register controls the switching and the other controls the inverters. To change an output state, a read-modify-write sequence is required.

INDEX 0x40 - Digital Output Control

Bit	Access	Default	Description
7:4	RO	0000b	Reserved; read as 0b
3:0	RW	0000b	Digital output data 0b: Digital output open drain 1b: Digital output closed

INDEX 0x41 - Digital Output Inversion Control

Bit	Access	Default	Description
7:4	RO	0000b	Reserved; read as 0b
3:0	RW	0000b	Digital output inversion control 0b: Digital output state equals these in Index 0x40 1b: Digital output state is the opposite of these in Index 0x40

7.3.4 Digital Input

The MPCX28R provides four digital input pins. The pins are optically isolated to provide a wide input voltage range.

The digital inputs are accessible over two registers. One register holds the status of the input and the other controls the inverters.

INDEX 0x48 - Digital Input Status

Bit	Access	Default	Description
7:4	RO	0000b	Reserved; read as 0b
3:0	RO	xxxxb	Digital input status 0b: Digital input level low 1b: Digital input level high

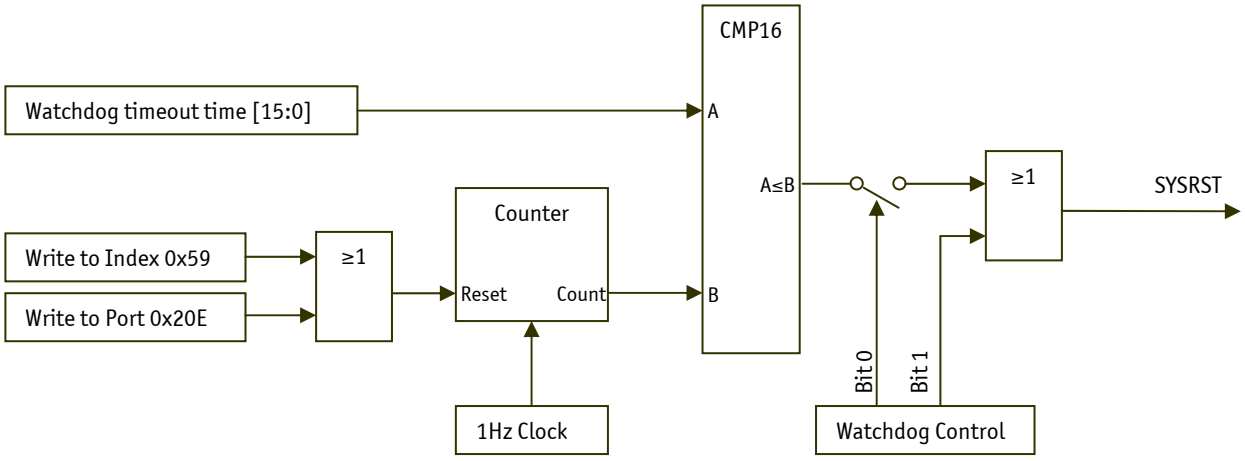
INDEX 0x49 - Digital Input Inversion Control

Bit	Access	Default	Description
7:4	RO	0000b	Reserved; read as 0b
3:0	RW	0000b	Digital input inversion control 0b: Digital input state reflects the pin state 1b: Digital input state reflects the inverted pin state

7.3.5 Watchdog

The MPCX28R provides a watchdog function which resets the system when a specific amount of time has elapsed without watchdog reset activity. The watchdog is highly configurable and the timeout time can be set between two seconds and 65,535 seconds. The watchdog timeout reset can be made via port 0x20E (WDRST) write or write to the register 0x59 (watchdog timeout reset).

The watchdog output is connected to the system controller. The action that happens can be configured in the system controller software.



INDEX 0x50/0x51 - Watchdog Timeout Time

Index	Bit	Access	Default	Description
0x50	7:0	RW	0x2C	Watchdog timeout time in seconds (bits 7:0)
0x51	7:0	RW	0x01	Watchdog timeout time in seconds (bits 15:8)

INDEX 0x58 - Watchdog Control

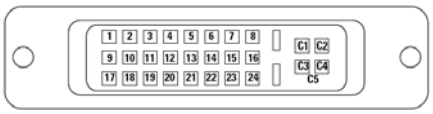
Bit	Access	Default	Description
7:2	RO	00 0000b	Reserved; read as 0b
1	RW	0b	System reset request 0b: Normal operation 1b: Send reset request to system controller
0	RW	1b	Watchdog enable 0b: Disable watchdog 1b: Enable watchdog

INDEX 0x59 - Watchdog Timeout Reset

Write to this index to reset the watchdog timeout timer.

8 Appendix A: Pin Assignments of the Connectors

8.1 DVI / (VGA)



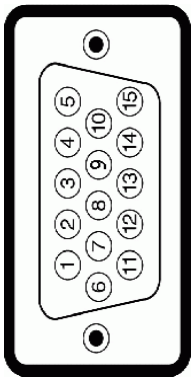
Pin	Function
1	TMDS D2-
2	TMDS D2+
3	TMDS D2/4 Shield
4	TMDS D4-
5	TMDS D4+
6	DDC Clk
7	DDC Dat
8	Analog VSYNC

Pin	Function
9	TMDS D1-
10	TMDS D1+
11	TMDS D1/3 Shield
12	TMDS D3-
13	TMDS D3+
14	+5V
15	GND
16	Hotplug Detect

Pin	Function
17	TMDS D0-
18	TMDS D0+
19	TMDS D0/5 Shield
20	TMDS D5-
21	TMDS D5+
22	TMDS CLK Shield
23	TMDS CLK+
24	TMDS CLK-

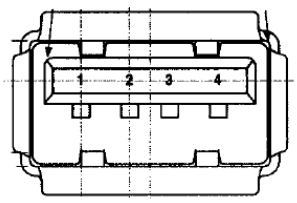
Pin	Function
C1	Analog Red
C2	Analog Green
C3	Analog Blue
C4	Analog HSYNC
C5	Analog GND

8.2 VGA



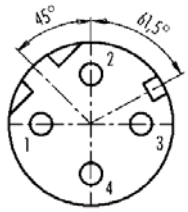
Pin	Signal Name
1	Red
2	Green
3	Blue
4	Reserved
5	GND
6	Red return (GND)
7	Green return (GND)
8	Blue return (GND)
9	NC (not connected)
10	GND
11	Reserved
12	DD-DAT
13	H. Drive
14	V. Drive
15	DD-CLK

8.3 USB



Pin	Function
1	VCC
2	Data -
3	Data +
4	GND

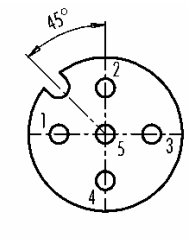
8.4 LAN A/B (M12)



Pin	100MB/s
1	TX+
2	RX+
3	TX-
4	RX-

Cable connector type: Binder 99-3729-810-04

8.5 USB (M12)

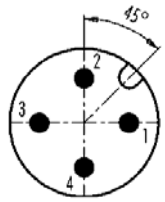


Pin	Function
1	GND
2	VCC
3	Data +
4	Data -

Cable connector type: Binder 99-1437-814-05

Warning: USB on the M12-connector is ***not*** hot pluggable!

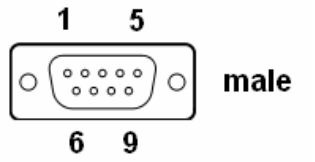
8.6 DC MAIN (M-12)



Pin	Function
1	+ DC Main
2	GND
3	Ignition
4	+ DC Main (redundant)

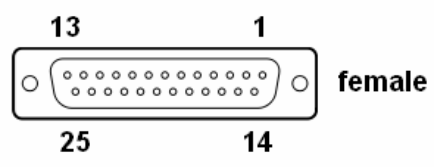
Cable connector type: Binder 99-0430-14-04

8.7 PORT 1/2



Pin	RS-232	RS-422 / RS-485	CAN (optional)	Audio (optional on PORT 1)
1	DCD	RX+ (Y)		+5V (Supply)
2	RXD	RX- (Z)	CAN-L	GND (Supply)
3	TXD	TX+ (A)	CAN GND	MIC R
4	DTR	TX- (B)		Audio GND
5	GND	GND	Term A (120 Ohm)	Line L
6	DSR		CAN GND	+5V (Supply)
7	RTS		CAN-H	GND (Supply)
8	DCD			MIC L
9	RI	RI	Term B (120 Ohm)	Line R

8.8 PORT 3



Pin	Digital I/O	LPT (Opt)
1	COM+	STROBE
2	NC	D0
3	OUT_0	D1
4	OUT_1	D2
5	OUT_2	D3
6	OUT_4	D4
7	NC	D5
8	IN_0	D6
9	IN_1	D7

Pin	Digital I/O	LPT (Opt)
10	IN_2	ACK
11	IN_3	BUSY
12	5V (SATA)	PE
13	5V (SATA)	SEL
14	COM+	AUTOFD
15	ISOGND	ERROR
16	ISOGND	INIT
17	ISOGND	SELIN
18	ISOGND	GND

Pin	Digital I/O	LPT (Opt)
19	NC	GND
20	ISOGND	GND
21	ISOGND	GND
22	ISOGND	GND
23	ISOGND	GND
24	GND (SATA)	GND
25	GND (SATA)	GND

Note: In system version 1.0, the ISOGND Pins 15-18 are the grounds to the digital output and are isolated to Pins 20-23, which are the grounds to the digital inputs.

9 Appendix B: Hard Disk Mounting

To mount or exchange the hard disk / SSD from the front panel, follow these steps.

Note:	Only a **2.5" SATA drive** fits into the slot!

» Remove the front cover.

» If a hard disk is already mounted, pull it out using the tab which is bonded to the hard disk.

» Remove the four stud screws, the 1.5 pitch hexagonal screwdriver and one new adhesive tab from the bag.



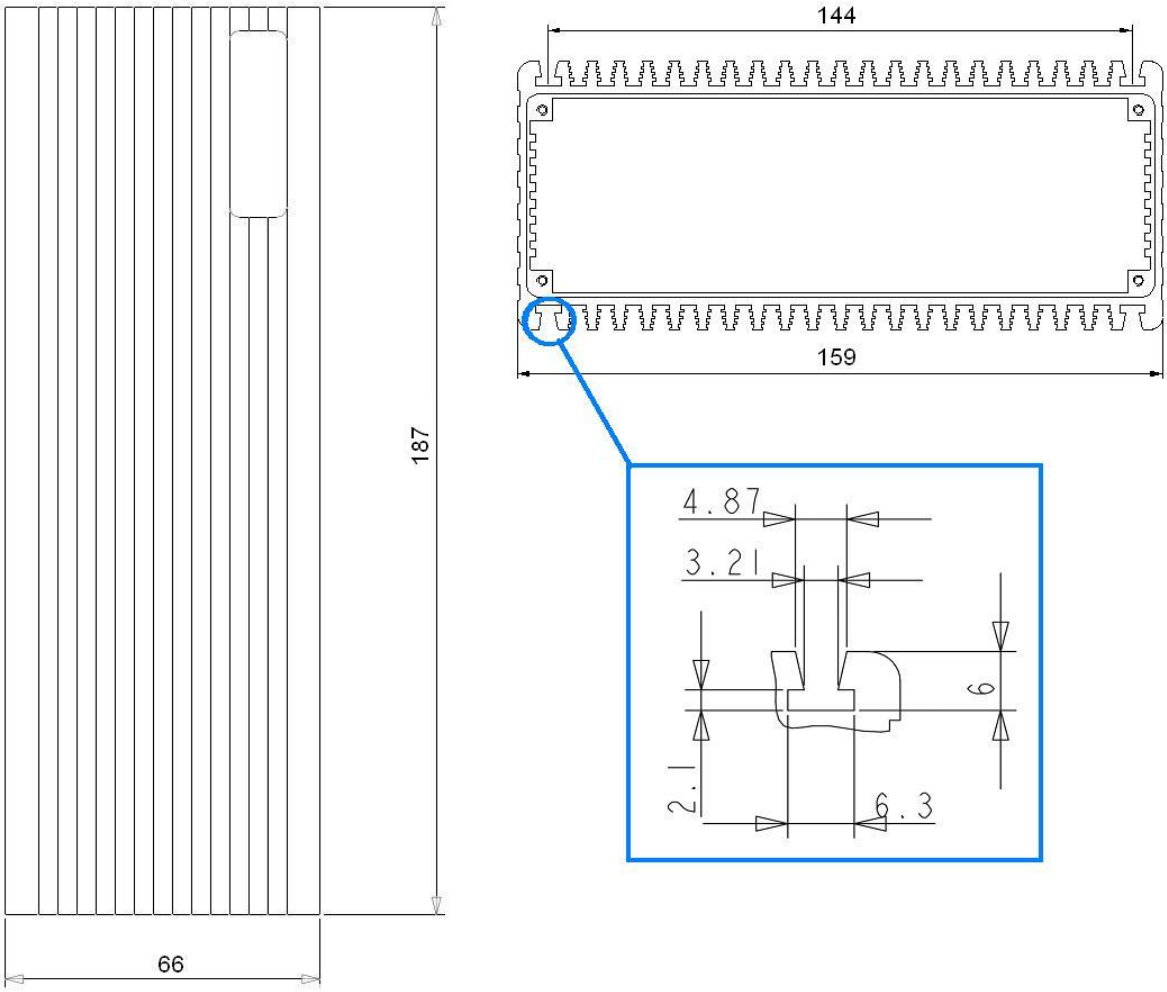
» Place the four stud screws into the four side holes of the hard disk and tighten them.
Do not tighten the screws too much.

» Stick the new tab on the bottom side of the hard disk, centered, with the non-adhesive part sticking out.



» Put the hard disk into the slot and mount the cover.

10 Appendix C: Mechanical Dimensions



All dimensions are in mm.

11 Appendix D: Document Revision History

Revision	Date	Edited by	Changes
100	02.Mar.2010	ISS	Initial, preliminary version.
101	23.Mar.2010	ISS	Added description of wake modes, mechanical dimensions.
102	12.Apr.2010	ISS	Corrected wrong operating modes.
103	21.Apr.2010	ISS	Added Opt. Audio Back on Port 1.
104	22.Jun.2010	ISS	Corrected wrong transient voltage for MPCX28R-I36.
105	19.Jul. 2010	ISS	Corrected wrong pin assignments of the M12 USB Connector, added 814434 MPCX28R-I72 and 814435 MPCX28R-I110 data.
106	08.Nov 2010	BRW / SCM	Added VGA
107	19.Jan.2011	WAS / BRW	English & formatting checked.

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