



# AMC-PCIe-Carrier

## PCI Express Adapter Board for AMC Boards



## Hardware Manual

to Product U.1003.01



## NOTE

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esd electronic system design gmbh  
Vahrenwalder Str. 207  
30165 Hannover  
Germany

Phone: +49-511-372 98-0

Fax: +49-511-372 98-68

E-Mail: [info@esd.eu](mailto:info@esd.eu)

Internet: [www.esd.eu](http://www.esd.eu)

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<b>Document file:</b>	I:\Texte\Doku\MANUALS\AMC\AMC-PCIe-Carrier\Englisch\AMC-PCIe-Carrier_Manual_en_11.odt
<b>Date of print:</b>	2013-01-24
<b>Document type number:</b>	DOC0800

<b>Hardware version:</b>	AMC-PCIe-Carrier Rev.1.0
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## Document History

The changes in the document listed below affect changes in the hardware as well as changes in the description of the facts, only.

Revision	Chapter	Changes versus previous version	Date
1.0	-	First version	2012-07-04
1.1	-	Title changed	2013-01-24
	1.1	Chapter supplemented	
	4.1, 5.4	Signal names of connector X6 changed	
	5.	Figures of the connectors changed	

Technical details are subject to change without further notice.



## Safety Instructions

- When working with AMC-PCle-Carrier follow the instructions below and read the manual carefully to protect yourself from injury and the AMC-PCle-Carrier from damage.
- The device is a built-in component. It is essential to ensure that the device is mounted in a way that cannot lead to endangering or injury of persons or damage to objects.
- The device has to be securely installed in the control cabinet before commissioning.
- Protect the AMC-PCle-Carrier from dust, moisture and steam.
- Protect the AMC-PCle-Carrier from shocks and vibrations.
- The AMC-PCle-Carrier may become warm during normal use. Always allow adequate ventilation around the AMC-PCle-Carrier and use care when handling.
- Do not operate the AMC-PCle-Carrier adjacent to heat sources and do not expose it to unnecessary thermal radiation. Ensure an ambient temperature as specified in the technical data.
- Do not use damaged or defective cables to connect the AMC-PCle-Carrier.
- In case of damages to the device, which might affect safety, appropriate and immediate measures must be taken, that exclude an endangerment of persons and objects.
- Current circuits which are connected to the device have to be sufficiently protected against hazardous voltage (SELV according to EN 60950-1).
- The AMC-PCle-Carrier may only be driven by power supply current circuits, that are contact protected. A power supply, that provides a safety extra-low voltage (SELV or PELV) according to EN 60950-1, complies with this conditions.



### Attention !

#### **Electrostatic discharges may cause damage to electronic components.**

To avoid this, please perform the steps described on page 10 *before* you touch the AMC-PCle-Carrier, in order to discharge the static electricity from your body.

### Qualified Personal

This documentation is directed exclusively towards personal qualified in control and automation engineering. The installation and commissioning of the product may only be carried out by qualified personal, which is authorized to put devices, systems and electric circuits into operation according to the applicable national standards of safety engineering.

### Intended Use

The intended use of the AMC-PCle-Carrier is the operation as PCI Express adapter for  $\mu$ TCA-AMC boards in a standard PC.

The guarantee given by esd does not cover damages which result from improper use, usage not in accordance with regulations or disregard of safety instructions and warnings.

- The AMC-PCle-Carrier is intended for installation in a PCI Express slot of a standard PC only.
- The operation of the AMC-PCle-Carrier in hazardous areas, or areas exposed to potentially explosive materials is not permitted.
- The operation of the AMC-PCle-Carrier for medical purposes is prohibited.

### Service Note

The AMC-PCle-Carrier does not contain any parts that require maintenance by the user. The AMC-PCle-Carrier does not require any manual configuration of the hardware, except of the adjustment of the operating mode by means of the jumper (see chapter: "Jumper Settings", page 9).

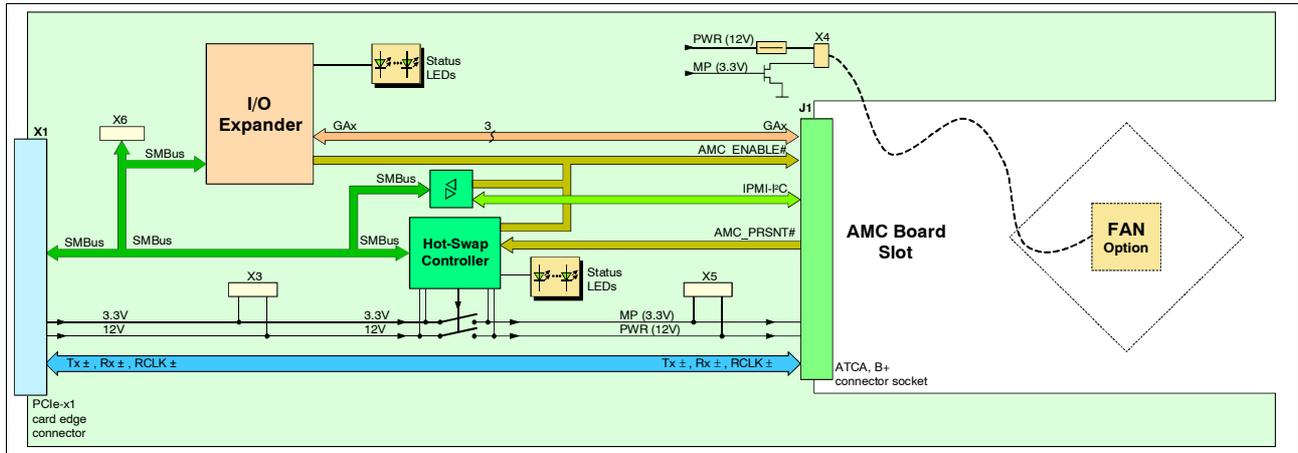
### Disposal

Devices which have become defective in the long run have to be disposed in an appropriate way or have to be returned to the manufacturer for proper disposal. Please, make a contribution to environmental protection.

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# 1. Overview



**Figure 1:** Block circuit diagram

The AMC-PCIe-Carrier is designed for the operation of  $\mu$ TCA-AMC boards in a standard PC for testing and programming purposes. To simplify the factory test procedure of an AMC board, it is possible to generate user-defined  $\mu$ TCA-slot addresses.

Besides passively passing the PCIe-X1 signals through, a Hot-Swap controller is integrated, which enables 'Hot-Insert' and 'Hot-Remove'.

The current consumption of the AMC board can be measured. Coloured LEDs on the board indicate the status of the power supply and of the Hot-Swap controller.

For cooling of the inserted AMC boards an optional fan can be mounted at the AMC-PCIe-Carrier. All  $\mu$ TCA-connector signals are protected by transient voltage suppressors.

Software drivers/library for the Hot-Swap controller are available for Linux.

## 1.1 Operating Modes

The operating modes "stand-alone operation" and "software-controlled operation" are available. They can be selected with the jumper as described in chapter '2.2 Jumper Settings'.

In all operating modes it is possible to communicate with the Hot-Swap-controller (e.g. measuring current/voltage).

### 1.1.1 Stand-Alone Operation without PCIe Bus

The power supply voltage is fed by an external power supply unit, which is connected via connector X3. The AMC-PCIe-Carrier switches the power supply voltage through to the AMC board and ensures the corresponding Power-Sequencing.

The Hot-Swap functionality is exclusively executed by the hardware, the geographic address is set to a value which is not used by IPMI.

The current consumption can be externally determined, and the AMC board can be programmed via the local interfaces (e.g. serial-Debug..).

The SMBus interface (X6) allows communication via the I<sup>2</sup>C bus.

### 1.1.2 Stand-Alone Operation with PCIe Bus

In this operating mode communication with the AMC board can be done via PCIe.

The power supply voltage is supplied via the PCIe interface. As described in chapter 1.2.1 after detecting an AMC board, the power supply voltage is supplied with short-circuit protection to the AMC board. After detecting the reserved geographic address, the esd-AMC board starts up autonomous, a communication via IPMI-IIC/SMBus is not required.

In case if the SMBus-lines of the PCIe-Slot are not supplied, a connection from connector X6 to an SMBus-header and the mainboard is possible.

### 1.1.3 Factory-Test of an AMC Board

In this operating mode the Hot-Swap cycles are controlled by a PC software. Thus it is possible to run systematic power-on and power-off sequences.

The power consumption of both supply lines and the input voltages can be measured.

Additionally the PC software can generate user-defined uTCA-Slot-IDs or start and stop the AMC board.

The PC-SMBus is connected to the AMC-IPMI bus. Therefore standard IPMI commands can be transmitted to the AMC board.

**Note!**

Depending on the I<sup>2</sup>C-Controller used in the PC, request of AMC-data may not work!

The esd-AMC boards handle this situation by an extended firmware.

## 2. PCB View with Connectors and LEDs

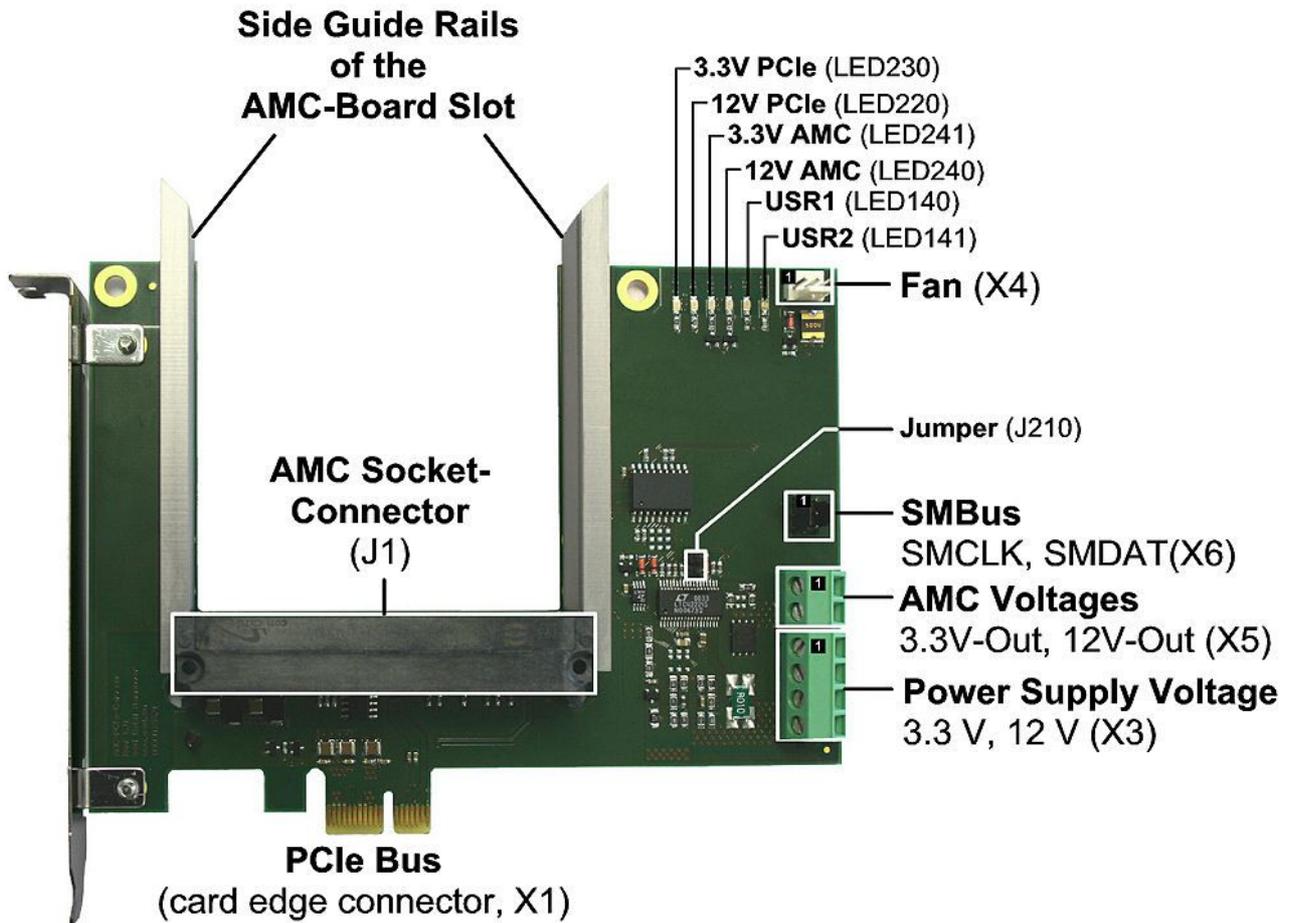


Figure 2: PCB top view

See also page 14 for signal assignment of the connectors.

## 2.1 LED Indication

### 2.1.1 Power LEDs

LED	Colour	Indicator State	Description	LED name in schematic diagram*
3.3V PCIe	green	off	3.3V power supply voltage off	LED230
		on	3.3V power supply voltage on	
12V PCIe	green	off	12 V power supply voltage off	LED220
		on	12 V power supply voltage on	
3.3V AMC	yellow	off	3.3 V AMC voltage off	LED241
		on	3.3 V AMC voltage on	
12V AMC	yellow	off	12 V AMC voltage off	LED240
		on	12 V AMC voltage on	

\*The schematic diagram is not contained in the scope of delivery.

**Table 1:** Description of the Power LEDs

### 2.1.2 User-LEDs

LED	Colour	Indicator State	Description	LED name in schematic diagram*
USR1	yellow	software-controlled	depending on software application used	LED140
USR2	red			LED141

\*The schematic diagram is not contained in the scope of delivery.

**Table 2:** Description of the User LEDs

## 2.2 Jumper Settings

With the jumper (J210) the operating mode can be switched from stand-alone operation to software-controlled operation.

Jumper position	Operating mode
open	stand-alone operation
closed	software controlled operation

See also PCB top view on page 8 for the position of the jumper.



**Note!**

Select the operating mode before you install the AMC-PCIe-Carrier in your computer.

### 3. Hardware Installation



Carefully read and follow the safety instructions at the beginning of this document and the safety instructions contained in the scope of delivery of your PC, before you start with the hardware installation!



To exclude hazards due to live parts and to avoid interruptions of operation, installation, putting into operation and adjustments of the product may only be carried out by qualified personal, which is authorized to put devices, systems and electric circuits into operation according to the applicable national standards of safety engineering!



**Danger!**

Electric shock risk. Never carry out work while power supply voltage is switched on!



**Attention !**

Electrostatic discharges may cause damage to electronic components. To avoid this, please discharge the static electricity from your body by touching the metal case of your PC *before* you touch the AMC-PCIe-Carrier and the AMC board.

**Procedure:**

1. Switch off your computer and all connected peripheral devices (monitor, printer, etc.).
2. Discharge your body as described above.
3. Disconnect the computer from the mains.  
If the computer does not have a flexible mains cable, but is directly connected to mains, disconnect the power supply via the safety fuse and make sure that the fuse cannot switch on again unintentionally (i.e. with caution label).



**Danger!**

Do not insert the AMC-PCIe-Carrier while power supply voltage is switched on!

4. Open the case.
5. Set the operating mode of the AMC-PCIe-Carrier by means of the jumper (J210).
6. Insert the AMC-PCIe-Carrier board into the selected PCIe slot. Carefully push the board down until it snaps into place.
7. You can now insert your AMC board:  
Insert your AMC board carefully into the vertical side guide rails of the AMC board slot of the AMC-PCIe-Carrier and gently push the board down until it snaps into the place.
8. Connect the computer to mains again (mains connector or safety fuse).



**Danger!**

There are dangerous live parts within the equipment (e.g. the computer's power supply). Please read the manual of your computer for further information on this. Do not touch these live parts neither with your fingers, body or clothes nor with an object! This could result in death or serious damage to health or considerable material damage on the hardware of the computer, the AMC-PCIe-Carrier and the AMC board. Activate the unit only if it is secured that parts under dangerous voltages cannot be touched!

9. Switch on the computer and the peripheral devices.
10. Set the interface properties in your operating system. Refer to the documentation of the operating system.

**Note!**

Due to the integrated Hot-Swap controller the AMC-PCIe-Carrier supports 'Hot-Insert' and 'Hot-Remove' of the AMC boards.

Please note that common PCs do not support the 'Hot-Insert' and 'Hot-Remove' capability. Please inform yourself about your PC's capability, if you want to install or remove an AMC board during operation.

If your PC does not support the 'Hot-Insert' and 'Hot-Remove' capability the AMC board may only be inserted or removed if the PC is disconnected from mains as described in point 3.

## 4. Technical Data

### 4.1 General Technical Data

Power supply voltage	nominal voltage:	3.3 V ( $I_{3.3Vmax} = 500 \text{ mA}$ ), 12 V ( $I_{12Vmax} = 5.0 \text{ A}$ )
Connectors	PCIe	PCIe card edge connector (X1)
	AMC plug connector	170-pin AMC socket connector, (J1) - AMC B/B+ compatible (MicroTCA™)
	Power	External power supply voltage, 3.3V- and 12V-Input (X3, Phoenix SMKDSN1,5/4)
	FAN	FAN connection (X4, Molex Series KK® 3-pin)
	AMC Voltages	External load, AMC voltage, 3.3V- and 12V-Output (X5, Phoenix SMKDSN1,5/2)
	SMBus	SMBus connector, SMCLK, SMDAT, (X6, Dubox 3-pin)
Temperature range	5 °C ... 45 °C (free convection)	
Humidity	max. 90%, non-condensing	
Dimensions	approx 111 mm x 150 mm	
Weight	150 g (including side guide rails of the AMC board slot)	

**Table 3:** General data of the module

### 4.2 MicroTCA™/AMC Standards

µTCA	PICMG® MTCA.0 R1.0, PICMG® AMC.0 R2.0
IPMI	IPMI V1.5
Updates	PICMG® HPM.1 R1.0
Slot	designed for single-width (73.5 mm x 180 mm) AMC boards
Connector	170-pin AMC socket connector AMC B/B+ compatible (MicroTCA™)

**Table 4:** MicroTCA standards

### 4.3 PCI Express Interface

PCIe port	according to PCI Express Specification R1.0a
Link width	1x
Connector	PCIe card edge connector

**Table 5:** PCI Express

### 4.4 Current Measurement

Current measurement 3.3 V	Range:	0 - 0.5 A
	Resolution:	10-bit
	Accuracy:	8 mA
Current measurement 12 V	Range:	0 - 5.0 A
	Resolution:	10-bit
	Accuracy:	80 mA

**Table 6:** Current measurement

### 4.5 Voltage Measurement

Voltage measurement 3.3 V	Range:	0 - 4 V
	Resolution:	10-bit
	Accuracy:	40 mV
Voltage measurement 12 V	Range:	0 - 15 V
	Resolution:	10-bit
	Accuracy:	150 mV

**Table 7:** Voltage measurement

### 4.6 Software Support

Software drivers/library for the Hot-Swap controller are available for Linux®.

## 5. Connector Assignments

The connectors are described as seen in the PCB view (page 8)

### 5.1 3.3 V and 12 V External Power Supply Voltage (X3)

**Line connector:** Phoenix Contact SMKDSN1,5/4-5.08 (included in delivery)

Pin Position:	Pin Assignment:	
	Signal	Pin
	3.3 V	1
	GND	2
	12 V	3
	GND	4

#### Signal description:

3.3 V ... 3.3 V external power supply voltage  
 12 V ... 12 V external power supply voltage  
 GND ... reference potential

### 5.2 3.3 V and 12 V AMC Power Supply Voltage (X5)

**Line connector:** Phoenix Contact SMKDSN1,5/2-5.08 (included in delivery)

Pin Position:	Pin Assignment:	
	Signal	Pin
	AMC_3.3 V	1
	AMC_12 V	2

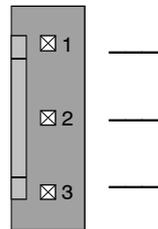
#### Signal description:

AMC\_3.3 V ... 3.3 V AMC power supply voltage  
 AMC\_12 V ... 12 V AMC power supply voltage

### 5.3 FAN connector (X4)

Device connector: DUBOX, 3-pin

Pin Position:



Pin Assignment:

Signal	Pin
GND	1
12 V	2
n.c.	3

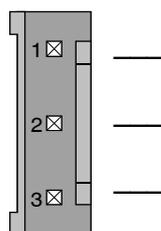
Signal Description:

GND... reference potential  
 12 V... 12 V power supply voltage  
 n.c. ... not connected

### 5.4 SMBus connector (X6)

Device connector: DUBOX, 3-pin

Pin Position:



Pin Assignment:

Signal	Pin
SMCLK	1
SMDAT	2
GND	3

Signal Description:

SMCLK... Serial clock signal line  
 SMDAT... Serial data signal line  
 GND... Reference potential

## 6. Order Information

Type	Properties	Order No.
AMC-PCIe-Carrier	PCI Express adapter board for AMC boards	U.1003.01
<b>Accessories</b>		
AMC-PCIe-Carrier-Fan	Standard fan, 80 mm for AMC-PCIe-Carrier	U.1003.10
<b>Software Drivers</b>		
AMC-PCIe-Carrier-Driver	Software driver/library for the Hot-Swap controller for Linux	U.1003.25

**Table 8:** Order information

### PDF Manuals

Manuals are available in English and usually in German as well. For availability of manuals see table below.

Please download the manuals as PDF documents from our esd website [www.esd.eu](http://www.esd.eu) for free.

Manual		Order No.
<b>AMC-PCIe-Carrier-ME</b>	Hardware manual in English	U.1003.21

**Table 9:** Available manuals

### Printed Manuals

If you need a printout of the manual additionally, please contact our sales team: [sales@esd.eu](mailto:sales@esd.eu) for a quotation. Printed manuals may be ordered for a fee.