**NAMC-EXT**
**NAMC-EXT-PS**
**AMC Extender Module**
**Technical Reference Manual V1.6**
**HW Revision 1.5**

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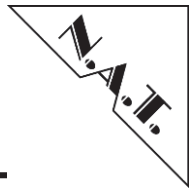

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**Note:**

**The release of the Hardware Manual is related to a certain HW board revision given in the document title. For HW revisions earlier than the one given in the document title please contact N.A.T. for the corresponding older Hardware Manual release.**

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## Conventions

If not otherwise specified, addresses and memory maps are written in hexadecimal notation, identified by 0x.
The following table gives a list of the abbreviations used in this document.

**Table 1: List of used abbreviations**

| Abbreviation | Description |
|---|---|
| AMC | Advanced Mezzanine Card |
| ATCA | Advanced Telecommunications Computing Architecture |
| BUT | Board Under Test |
| CLK | Clock |
| E1 | PDH signal – data rate 2.048 Mbit/s |
| GND | Ground |
| H.110 | Timeslot Interchange Bus |
| I/O | Input/Output |
| IPMB | Intelligent Platform Management Bus |
| LED | Light Emitting Diode |
| µTCA/MTCA | Micro Telecommunications Computing Architecture |
| P2P | Peer-To-Peer |
| SMD | Surface Mounted Device |
| SPI | Serial Peripheral Interface |
| TCKL | Telecom Clock |
| TDM | Time Division Multiplex |

# 1 Introduction

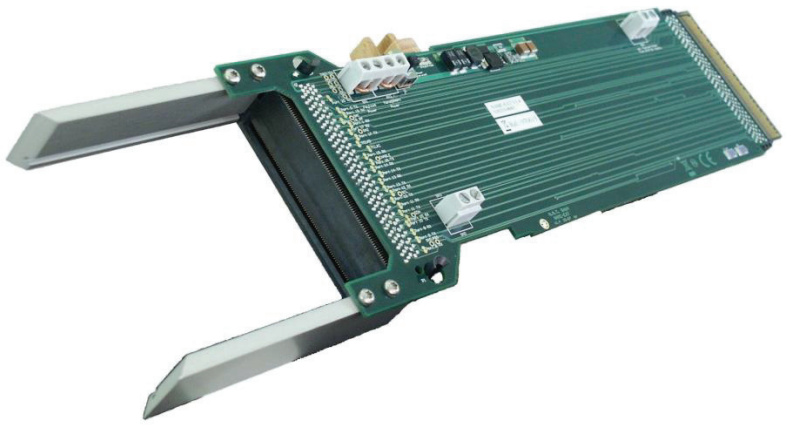
The **NAMC-EXT** is an extender card for standard AMCs, single width, double height. It can be plugged onto any ATCA carrier board supporting AMC standards. It is also designed to meet the requirements of µTCA systems.

It eases debugging of AMC boards by enabling the user to access the module under test from both sides, install debug port cables, and allow access for measurement of power supplies.

***Please note:*** As an assembly option the board can be equipped with an on-board +3.3V power supply for generating +3.3V Management Power from +12V Payload Power, so the module under test can be operated with an external +12V power supply only (**NAMC-EXT-PS**).
For reasons of simplification this manual refers to the notation **NAMC-EXT** if common functionality is described. If the behaviour differs on the variants, differences are described for each variant separately.

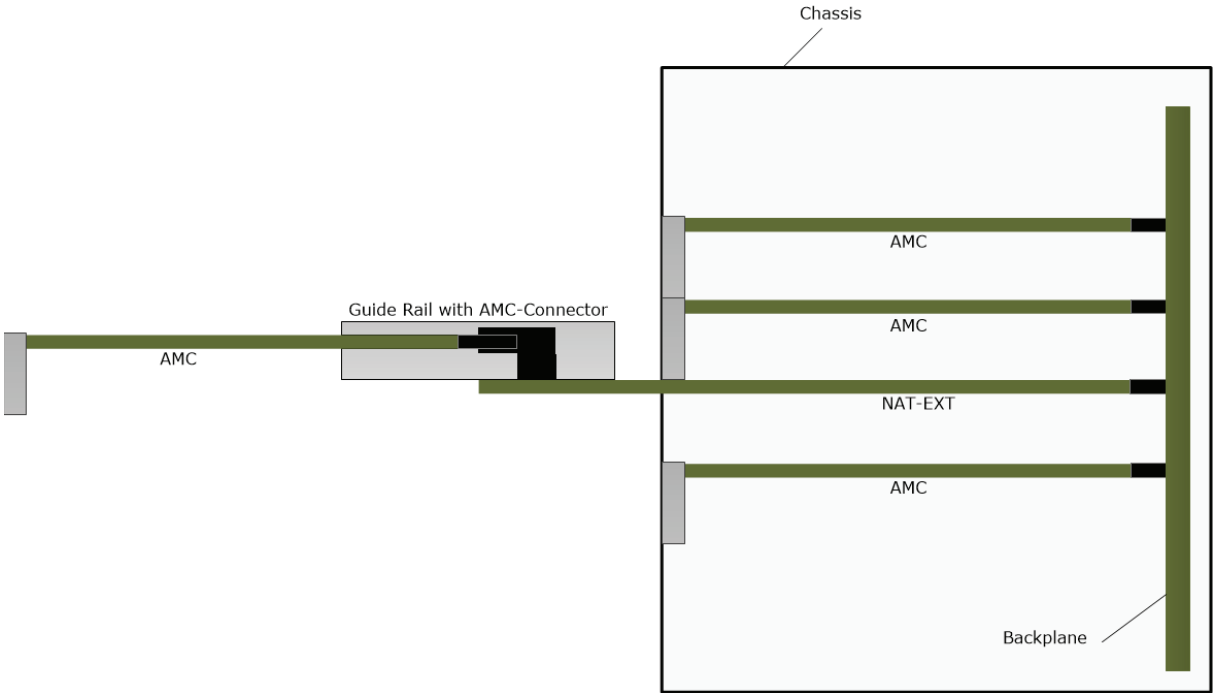
The following figure shows a photo of the **NAMC-EXT**. It is equipped with two AMC-Connectors; one on the rear side to connect to the backplane of the chassis and the other one – surrounded by a guide rail – for insertion of the front AMC.

**Figure 1: NAMC-EXT**



Mechanical installation of the **NAMC-EXT** is shown in the figure below.

**Figure 2: Mechanical Installation in a Chassis**




For detailed information about the dimensions of the **NAT-EXT**, please refer to chapter 2.3.

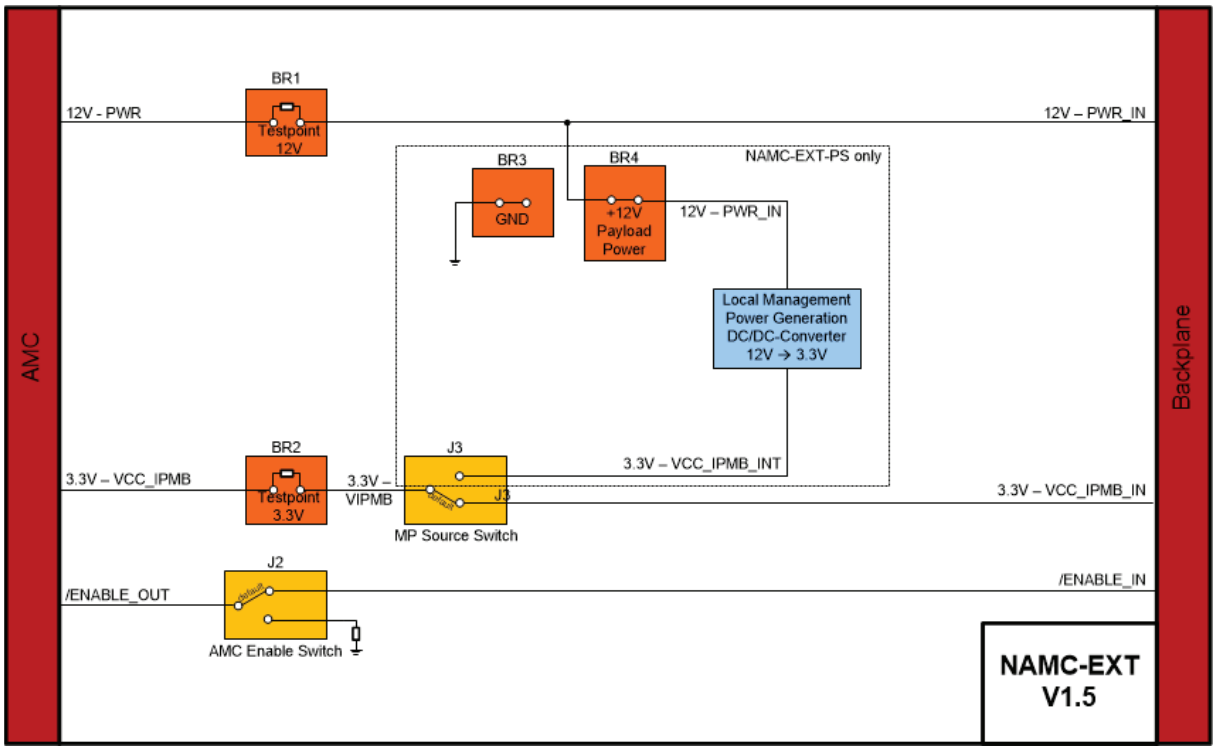
# 2 Overview

The **NAMC-EXT** is a passive extender board, it does not contain any circuitry. The **NAMC-EXT-PS** features an on-board +3.3V power supply for generating Management Power from Payload Power, so the module under test can be operated with an external +12V power supply only.

## 2.1 Block Diagram

The following figure shows a block diagram of the **NAMC-EXT-PS** with the optional power supply.

**Figure 3: NAMC-EXT-PS – Block Diagram**



## 2.2 Location Diagram

The following figures highlight the position of the important components. Depending on the board type it might be that the board does not include all components named in the location diagrams. This applies in particular to the optional +3.3V power supply of the **NAMC-EXT-PS**.

**Figure 4: NAMC-EXT – Location Diagram (top left side)**

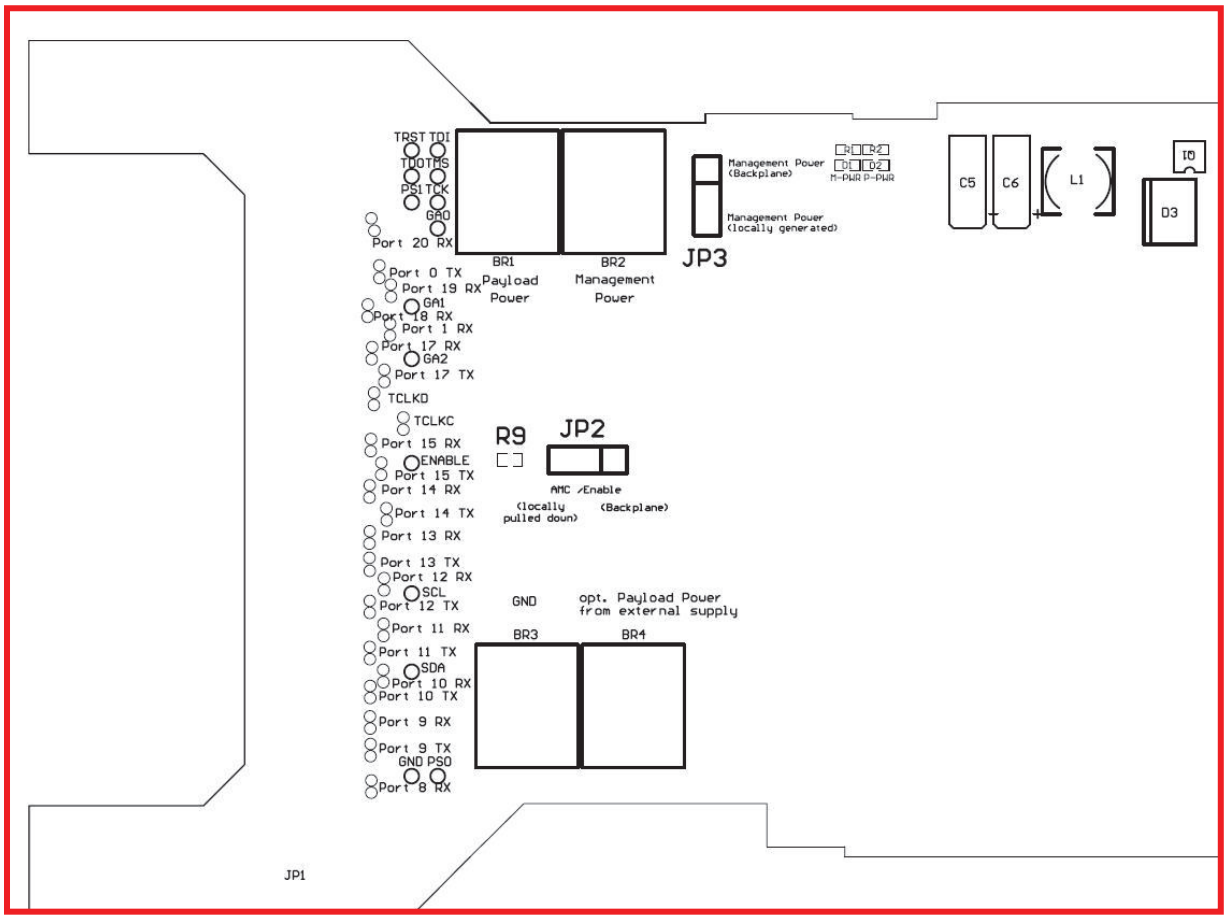
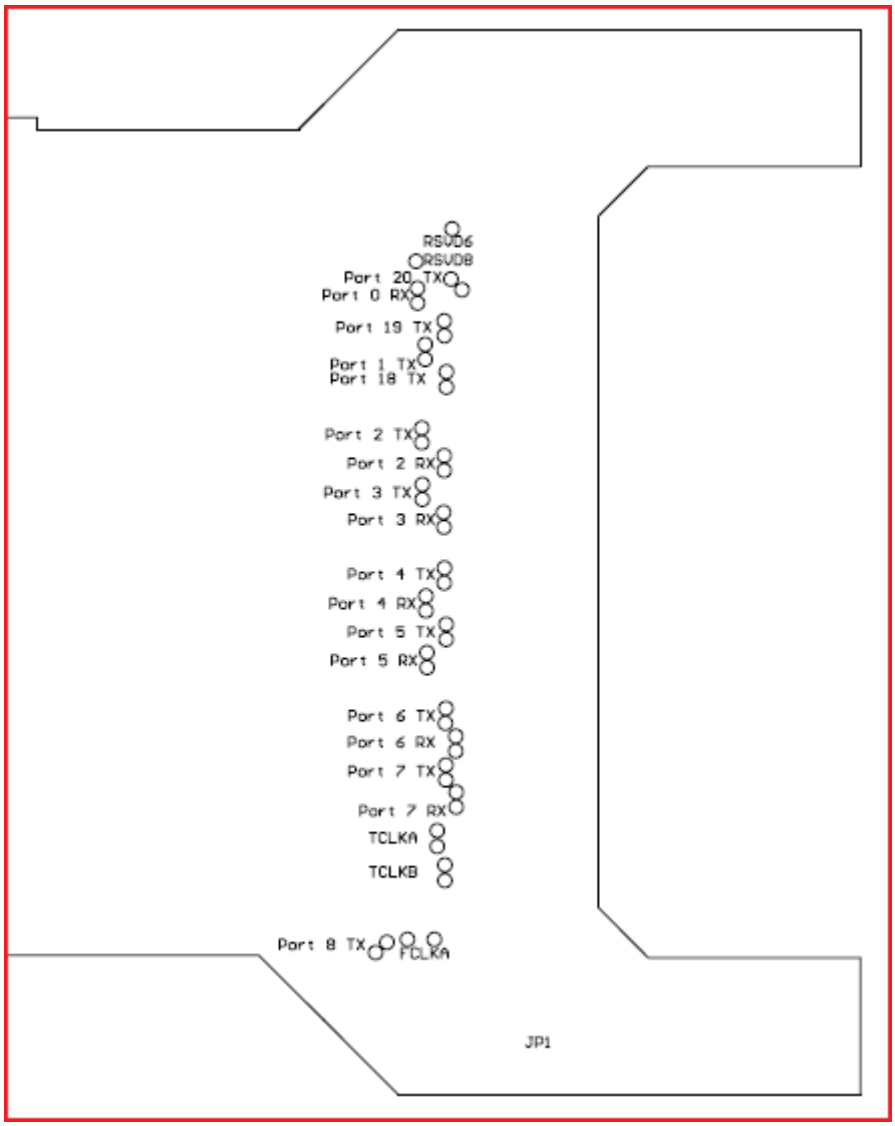


**Figure 5: NAMC-EXT – Location Diagram (bottom left side)**

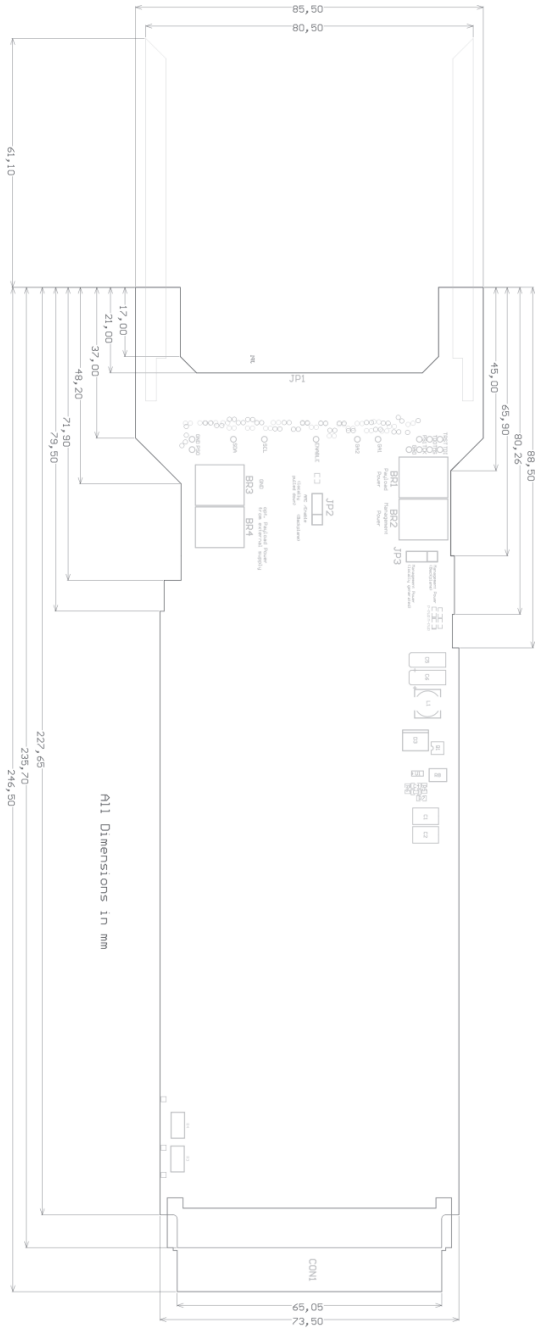


## 2.3 Dimensions

The main function of the **NAMC-EXT** is to allow access for measuring and debugging purposes to a standard AMC. Hence connector JP1 (that picks up the AMC) and all measuring points are located on the extended part outside the chassis.

To allow this it is inevitable that the extended area varies from the outlines defined in the AMC.0 specification, whereas the part that fits into the chassis still complies with the defined dimensions. Figure 6:The following figure shows the dimensions of the **NAMC-EXT**.

**Figure 6: NAMC-EXT – Dimensions**



# 3 Board Features

## 3.1 Bus Interface

- All AMC ports connected

## 3.2 Power Supply

- The **NAMC-EXT** draws very little power from the carrier supplies. Current drawn from +3.3V and +12V is less than 10mA each.
- Power planes for GND, payload power and management power.
- Both power supplies drive signalling LEDs.
- Both power supplies may be cut by opening wire bridges for current measurements.
- On the **NAMC-EXT-PS** +3.3V Management power may either be taken from the backplane or generated locally from Payload Power (assembly option).
- Payload Power may either be taken from the backplane or a +12V power supply may be connected to wire bridge BR4.

# 4 Hardware

## 4.1 AMC Port Definition

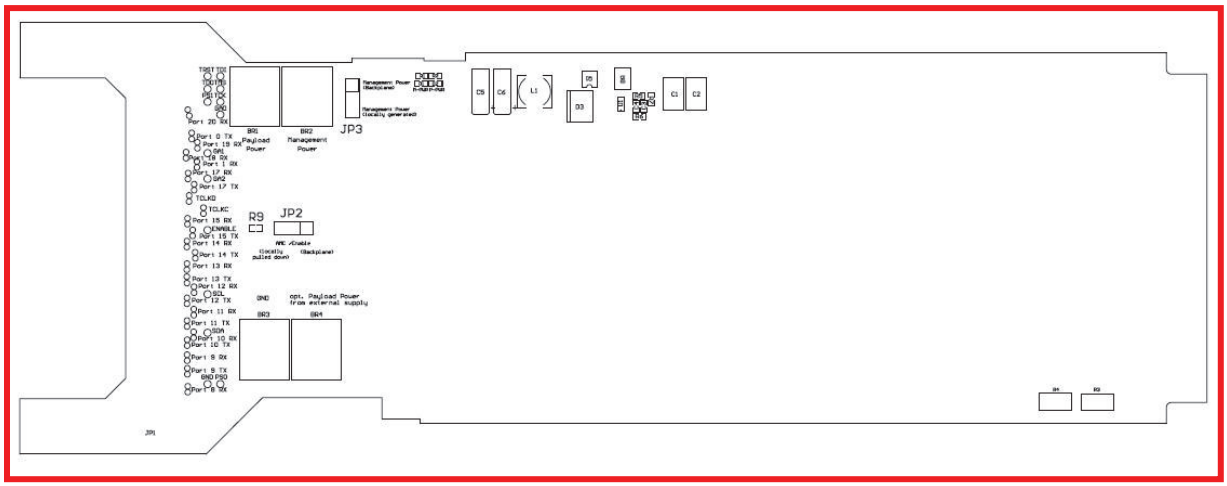
**Table 2: AMC Port Definition for N.A.T. AMC Modules**

| | Port # | AMC Port Mapping Strategy | Port used as |
|---|---|---|---|
| Basic Connector | CLK1 | Clocks | Universal Clock Signal, depends on used AMC |
| | CLK2 | | Universal Clock Signal, depends on used AMC |
| | CLK3 | | Universal Clock Signal, depends on used AMC |
| | 0 | Common Options Region | Not specified, depends on used AMC |
| | 1 | | Not specified, depends on used AMC |
| | 2 | | Not specified, depends on used AMC |
| | 3 | | Not specified, depends on used AMC |
| | 4 | Fat Pipes | Not specified, depends on used AMC |
| | 5 | | Not specified, depends on used AMC |
| | 6 | | Not specified, depends on used AMC |
| | 7 | | Not specified, depends on used AMC |
| Extended Connector | 8 | Region | Not specified, depends on used AMC |
| | 9 | | Not specified, depends on used AMC |
| | 10 | | Not specified, depends on used AMC |
| | 11 | | Not specified, depends on used AMC |
| | 12 | Extended Options Region | Not specified, depends on used AMC |
| | 13 | | Not specified, depends on used AMC |
| | 14 | | Not specified, depends on used AMC |
| | 15 | | Not specified, depends on used AMC |
| | 16 | | TCLKC / TCLKD |
| | 17 | | Not specified, depends on used AMC |
| | 18 | | Not specified, depends on used AMC |
| | 19 | | Not specified, depends on used AMC |
| | 20 | | Not specified, depends on used AMC |

## 4.2 Connectors, Jumpers and Wire Bridges

There are 2 connectors and 3 wire bridges on the **NAMC-EXT**. Connector J1 is a direct connector and fits into the ATCA or μTCA AMC slot. Connector JP1 is the socket into which the device under test is plugged. The figure below shows the connectors, as well as the wire bridges:

**Figure 7: NAMC-EXT – Connectors**



### *4.2.1 J1/JP1: AMC Connectors*

**Table 3: J1/JP1: AMC Connectors – Pin Assignment**

| Pin # | AMC-Signal | AMC-Signal | Pin # |
|---|---|---|---|
| 1 | GND | GND | 170 |
| 2 | PWR | TDI | 169 |
| 3 | /PS1 | TDO | 168 |
| 4 | PWR_IPMB | /TRST | 167 |
| 5 | GA0 | TMS | 166 |
| 6 | RESVD | TCK | 165 |
| 7 | GND | GND | 164 |
| 8 | RESVD | Tx20+ | 163 |
| 9 | PWR | Tx20- | 162 |
| 10 | GND | GND | 161 |
| 11 | Tx0+ | Rx20+ | 160 |
| 12 | Tx0- | Rx20- | 159 |
| 13 | GND | GND | 158 |
| 14 | Rx0+ | Tx19+ | 157 |
| 15 | Rx0- | Tx19- | 156 |
| 16 | GND | GND | 155 |
| 17 | GA1 | Rx19+ | 154 |
| 18 | PWR | Rx19- | 153 |
| 19 | GND | GND | 152 |
| 20 | Tx1+ | Tx18+ | 151 |
| 21 | Tx1- | Tx18- | 150 |
| 22 | GND | GND | 149 |
| 23 | RLINK2_P | Rx18+ | 148 |
| 24 | RLINK2_N | Rx18- | 147 |
| 25 | GND | GND | 146 |
| 26 | GA2 | Tx17+ | 145 |
| 27 | PWR | Tx17- | 144 |
| 28 | GND | GND | 143 |
| 29 | Tx2+ | Rx17+ | 142 |
| 30 | Tx2- | Rx17- | 141 |
| 31 | GND | GND | 140 |
| 32 | Rx2+ | Tx16+ | 139 |
| 33 | Rx2- | Tx16- | 138 |
| 34 | GND | GND | 137 |
| 35 | Tx3+ | Rx16+ | 136 |
| 36 | Tx3- | Rx16- | 135 |
| 37 | GND | GND | 134 |
| 38 | Rx3+ | Tx15+ | 133 |
| 39 | Rx3- | Tx15- | 132 |
| 40 | GND | GND | 131 |
| 41 | /ENABLE | Rx15+ | 130 |
| 42 | PWR | Rx15- | 129 |
| 43 | GND | GND | 128 |
| 44 | Tx4+ | Tx14+ | 127 |
| 45 | Tx4- | Tx14- | 126 |
| 46 | GND | GND | 125 |

| Pin # | AMC-Signal | AMC-Signal | Pin # |
|---|---|---|---|
| 47 | Rx4+ | Rx14+ | 124 |
| 48 | Rx4- | Rx14- | 123 |
| 49 | GND | GND | 122 |
| 50 | Tx5+ | Tx13+ | 121 |
| 51 | Tx5- | Tx13- | 120 |
| 52 | GND | GND | 119 |
| 53 | Rx5+ | Rx13+ | 118 |
| 54 | Rx5- | Rx13- | 117 |
| 55 | GND | GND | 116 |
| 56 | IPMB_SCL | Tx12+ | 115 |
| 57 | PWR | Tx12- | 114 |
| 58 | GND | GND | 113 |
| 59 | Tx6+ | Rx12+ | 112 |
| 60 | Tx6- | Rx12- | 111 |
| 61 | GND | GND | 110 |
| 62 | Rx6+ | Tx11+ | 109 |
| 63 | Rx6- | Tx11- | 108 |
| 64 | GND | GND | 107 |
| 65 | Tx7+ | Rx11+ | 106 |
| 66 | Tx7- | Rx11- | 105 |
| 67 | GND | GND | 104 |
| 68 | Rx7+ | Tx10+ | 103 |
| 69 | Rx7- | Tx10- | 102 |
| 70 | GND | GND | 101 |
| 71 | IPMB_SDA | Rx10+ | 100 |
| 72 | PWR | Rx10- | 99 |
| 73 | GND | GND | 98 |
| 74 | TCLKA+ | Tx9+ | 97 |
| 75 | TCLKA- | Tx9- | 96 |
| 76 | GND | GND | 95 |
| 77 | TCLKB+ | Rx9+ | 94 |
| 78 | TCLKB- | Rx9- | 93 |
| 79 | GND | GND | 92 |
| 80 | FCLKA+ | Tx8+ | 91 |
| 81 | FCLKA- | Tx8- | 90 |
| 82 | GND | GND | 89 |
| 83 | /PS0 | Rx8+ | 88 |
| 84 | PWR | Rx8- | 87 |
| 85 | GND | GND | 86 |

### *4.2.2 Jumper JP2*

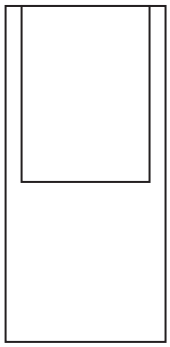
The setting of jumper JP2 defines the source for /AMC_ENABLE signal. The default position (right aligned) means the signal is connected to the backplane. In the left aligned position the signal is pulled down locally on the extender board.

### *4.2.3 Jumper JP3 (NAMC-EXT-PS only)*

The setting of jumper JP3 defines the source of Management Power. By default, Management Power is taken from the backplane (jumper JP3 in the upper position). In case there is no Management Power available (e.g. a test assembly with just a +12V supply), Management Power can be generated on-board from the +12V Payload Power. In order to make use of this feature, set jumper JP3 to the lower position.

***Upper position:***
Management Power taken from backplane

***Lower position:***
Management Power generated locally



***Please note:*** The function of Jumper JP3 is only valid on the **NAMC-EXT-PS**.

### *4.2.4 Wire Bridges*

The wire bridges BR1 and BR2 connect the supply voltages. The supply current can be measured between both contacts of one bridge if the respective wire bridge is opened.

***Please note:*** Instead of using a simple ampere meter it is recommended to insert a shunt resistor (e.g. 10 mΩ) between the contacts and measure the voltage drop to calculate the current or to monitor it on an oscilloscope.

Both contacts of BR3 are connected to ground; it can be used as a reference contact for measuring and/or to connect an external power supply (**NAMC-EXT-PS** only).

Both contacts of BR4 are connected to +12V Payload Power; it can be used to connect an external power supply to the extender board (**NAMC-EXT-PS** only).

The following table gives an overview of the wire bridges and the supplies they connect.

**Table 4: Wire Bridges**

| Supply | Wire Bridge |
|---|---|
| +12V<br>Payload Power | BR1 |
| +3.3V<br>Management Power | BR2 |
| GND<br>(reference point or external supply) | BR3 |
| +12V<br>Payload Power<br>(external supply) | BR4 |

## 4.3 Test points

There are a number of test points available on the **NAMC-EXT**. Due to layout reasons there are only small SMD test points for the differential signals. All other signals (e.g. geographical address, IPMB signals, etc.) are routed to standard test points, into which standard 100 mil header connectors may be assembled. By default, there are no headers assembled. The names of the signals carried by the test points are printed on the silkscreen.

# 5 Board Specifications

**Table 5: NAMC-EXT: Board Specifications**

| | |
|---|---|
| **AMC-Module** | Extender for Standard Advanced Mezzanine Cards, single width, double height |
| **Power Consumption (NAMC-EXT only)** | +3.3V / 0.01A typical<br>+12V / 0.01A typical |
| **Operating Temperature** | -40°C - +85°C |
| **Storage Temperature** | -40°C - +85°C |
| **Humidity** | 5% – 90% rh non-condensing |

# 6 Installation

## 6.1 Safety Note

To ensure proper functioning of the **NAMC-EXT** during its usual lifetime take the following precautions before handling the board.

**CAUTION**
Electrostatic discharge and incorrect board installation and uninstallation can damage circuits or shorten their lifetime.

- Before installing or uninstalling the **NAMC-EXT** read this installation section
- Before installing or uninstalling the **NAMC-EXT** in a rack:
  - Check all installed boards and modules for steps that you have to take before turning on or off the power.
  - Take those steps.
  - Finally turn on or off the power.
- Before touching integrated circuits ensure to take all require precautions for handling electrostatic devices.

## 6.2 Installation Requirements

**IMPORTANT**
Before powering up check this section for installation prerequisites and requirements!

### *6.2.1 Requirements*

The installation requires only

- an AMC backplane for connecting the **NAMC-EXT.**
  This can be either an ATCA carrier board or a μTCA backplane
- a power supply

### *6.2.2 Power supply*

The power supply for the **NAMC-EXT** must meet the following specifications:

- required for the extender board:
  - +3.3V / 0.01A typical
  - +12V / 0.01A typical
- required for the board under test:
  - refer to the BUT power specification

# 6.3 Statement on Environmental Protection

### *6.3.1 Compliance to RoHS Directive*

Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the "Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS) predicts that all electrical and electronic equipment being put on the European market after June 30th, 2006 must contain lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and poly-brominated diphenyl ethers (PBDE) and cadmium in maximum concentration values of 0.1% respective 0.01% by weight in homogenous materials only.

As these hazardous substances are currently used with semiconductors, plastics (i.e. semiconductor packages, connectors) and soldering tin any hardware product is affected by the RoHS directive if it does not belong to one of the groups of products exempted from the RoHS directive.

Although many of hardware products of N.A.T. are exempted from the RoHS directive it is a declared policy of N.A.T. to provide all products fully compliant to the RoHS directive as soon as possible. For this purpose since January 31st, 2005 N.A.T. is requesting RoHS compliant deliveries from its suppliers. Special attention and care has been payed to the production cycle, so that wherever and whenever possible RoHS components are used with N.A.T. hardware products already.

### *6.3.2 Compliance to WEEE Directive*

Directive 2002/95/EC of the European Commission on "Waste Electrical and Electronic Equipment" (WEEE) predicts that every manufacturer of electrical and electronical equipment which is put on the European market has to contribute to the reuse, recycling and other forms of recovery of such waste so as to reduce disposal. Moreover this directive refers to the Directive 2002/95/EC of the European Comission on the "Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS).

Having its main focus on private persons and households using such electrical and electronic equipment the directive also affects business-to-business relationships. The directive is quite restrictive on how such waste of private persons and households has to be handled by the supplier/manufacturer, however, it allows a greater flexibility in business-to-business relationships. This pays tribute to the fact with industrial use electrical and electronical products are commonly integrated into larger and more complex environments or systems that cannot easily be split up again when it comes to their disposal at the end of their life cycles.

As N.A.T. products are solely sold to industrial customers, by special arrangement at time of purchase the customer agreed to take the responsibility for a WEEE compliant disposal of the used N.A.T. product. Moreover, all N.A.T. products are marked according to the directive with a crossed out bin to indicate that these products within the European Community must not be disposed with regular waste.

If you have any questions on the policy of N.A.T. regarding the Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the "Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS) or the Directive 2002/95/EC of the European Commission on "Waste Electrical and Electronic Equipment" (WEEE) please contact N.A.T. by phone or e-mail.

### *6.3.3 Compliance to CE Directive*

Compliance to the CE Directive is declared. A 'CE' sign can be found on the PCB.

### *6.3.4 Product Safety*

The board complies to EN60950 and UL1950.

### *6.3.5 Compliance to REACH*

The REACH EU regulation (Regulation (EC) No 1907/2006) is known to N.A.T. GmbH. N.A.T. did not receive information from their European suppliers of substances of very high concern of the ECHA candidate list. Article 7(2) of REACH is notable as no substances are intentionally being released by NAT products and as no hazardous substances are contained. Information remains in effect or will be otherwise stated immediately to our customers.

# 7 Known Bugs / Restrictions

none

# Appendix A: Document's History

| Revision | Date | Description | Author |
|---|---|---|---|
| 1.0 | 05.01.2007 | initial revision | ga |
| 1.1 | 14.03.2007 | adapted to HW Release 1.3 and to AMC Spec R. 2.0 | ga |
| 1.2 | 02.05.2007 | adapted to HW Release 1.4 | ga |
| 1.3 | 26.06.2007 | altered naming of signals to be board-independent | te |
| 1.4 | 10.06.2008 | adapted to HW Release 1.5 | te |
| 1.5 | 14.11.2011 | Added chapter 4.4 Dimensions | Ks |
| 1.6 | 17.05.2013 | Address, phone and fax , words updated | Fh |
| | 18.08.2014 | Adaption to new layout incl. renaming of headings<br>Minor changes, typo correction<br>Updated chapter 6.3 RoHS-Directive / REACH | se |
| | 1.09.2014 | Added **–PS** option<br>Added installation drawing<br>Added Block Diagram | Se |
| | 17.09.2014 | Update Block Diagram<br>Reworked Chapter 4.2.4 | se |