The Embedded I/O Company

TEWS TECHNOLOGIES

TAMC261

PMC-Carrier for MTCA.4 Rear-I/O

Version 1.0

User Manual

Issue 1.0.0

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powerBridge Computer

Ehlbeek 15a
30938 Burgwedel
fon 05139-9980-0
fax 05139-9980-49

www.powerbridge.de
info@powerbridge.de

TEWS TECHNOLOGIES GmbH
Am Bahnhof 7 25469 Halstenbek, Germany
ne: +49 (0) 4101 4058 0 Fax: +49 (0) 4101 4058 19
e-mail: info@tews.com www.tews.com

TAMC261-10R

Mid-Size PMC-Carrier for MTCA.4 Rear-I/O

TAMC261-11R

Full-Size PMC-Carrier for MTCA.4 Rear-I/O

TAMC261-20R

Mid-Size PMC-Carrier for MTCA.4 Rear-I/O, with additional M-LVDS transceivers

TAMC261-21R

Full-Size PMC-Carrier for MTCA.4 Rear-I/O, with additional M-LVDS transceivers

Style Conventions

Hexadecimal characters are specified with prefix 0x, i.e. 0x029E (that means hexadecimal value 029E).

For signals on hardware products, an ‚Active Low' is represented by the signal name with # following, i.e. IP_RESET#.

Access terms are described as:

W	Write Only
R	Read Only
R/W	Read/Write
R/C	Read/Clear
R/S	Read/Set

Issue	Description	Date
1.0.0	Initial Issue	October 2013

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1 Product Description

The TAMC261 is a standard Mid-Size/Full-Size AMC.1 (PCI-Express) and MTCA.4 compliant PMC carrier module that provides one slot for a single-width PMC, used to build modular, flexible and cost effective I/O solutions for applications in process control, medical systems, telecommunication and traffic control.

A PI7C9X130 PCIe-to-PCI bridge provides the real connection between primary PCIe link and the secondary PMC slot. The bridge controls all PCI accesses and the frequency for the PMC access. PCI is supported up to 64-bit @66MHz and PCI-X is supported up to 64-bit @133MHz.

The TAMC261 supports front panel I/O, alternatively the MTCA.4 interface provides access to the PMC P14 back I/O lines. According to MTCA.4, the TAMC261 provides two 30-pair ADF connectors at the Zone 3 interface (Rear I/O) that provide access to all P14 back I/O lines via a compatible µRTM.

The TAMC261-2x additionally provide M-LVDS transceivers connected to AMC port 12-15, port 17-20 and the TCLKA-D. All control and data lines of the M-LVDS transceivers are routed to the zone 3 interface, enabling a mounted PMC to access the AMC port signals via the µRTM.

The TAMC261 is a versatile solution to upgrade well known legacy I/O solutions to a high performance form factor.

According to AMC.0, the TAMC261 provides an IPMI compliant Module Management Controller (MMC) with temperature monitoring and hot-swap support.

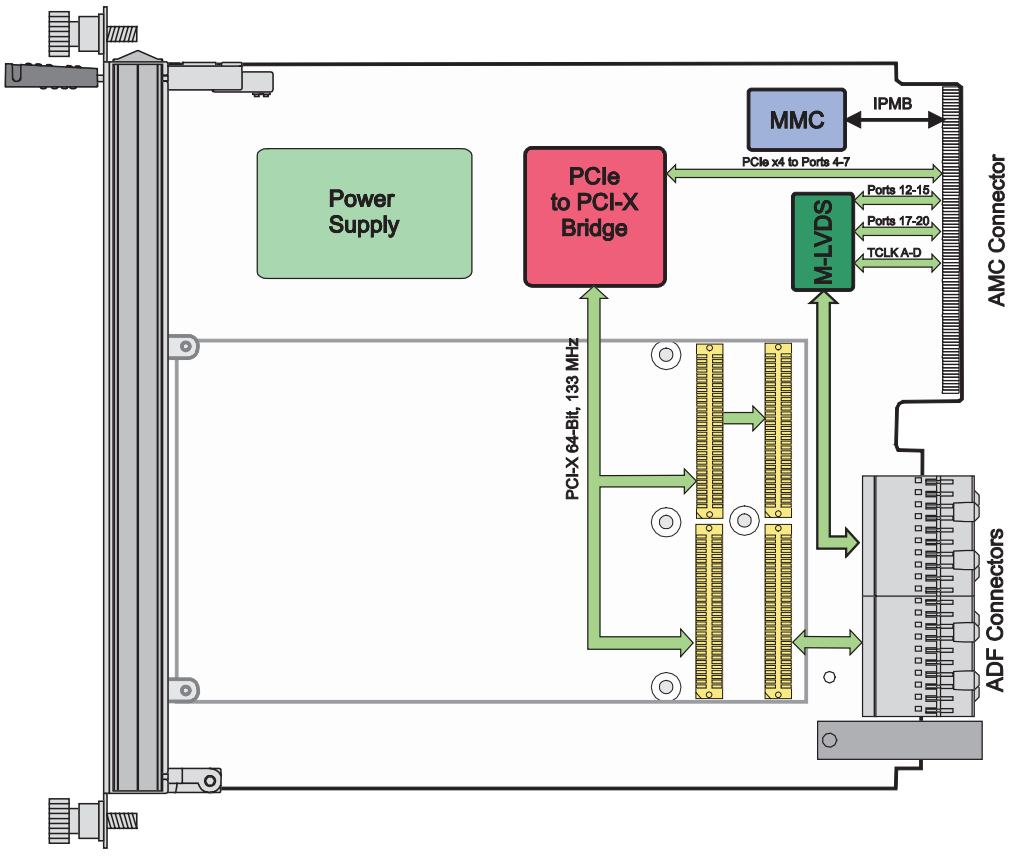

Figure 1-1 : Block Diagram

2 Technical Specification

AMC Interface		
Mechanical Interface	Advanced Mezzanine Card (AMC) Interface conforming to PICMG® MTCA.4 (MicroTCA Enhancements for Rear I/O and Precision Timing) Module Type: Double Full-Size Module (-x1R) Module Type: Double Mid-Size Module (-x0R)	
Electrical Interface	PCI Express x4 Link conforming to PICMG® AMC.1 R1.0 (PCI Express® on AdvancedMC™) AMC.1 Fabric Type 4	
IPMI Support		
IPMI Version	1.5	
Front Panel LEDs	Blue Hot-Swap LED Red Failure Indication LED (LED1) Green Board OK / PMC Activity LED (LED2)	
Main On-Board Devices		
PCI/PCI-X to PCIe Bridge	PI7C9X130 (Pericom)	
PMC Interface		
Supported PCI Data Width	32-bit / 64-bit	
Supported PCI Clock Frequency	33MHz / 66MHz (PCI) 100MHz / 133MHz (PCI-X)	
PCI I/O Signaling Voltage	3.3V (5V tolerant)	
PMC I/O Access	Front panel I/O Rear-I/O: all 64 signals are accessible via a compatible µRTM	
Physical Data		
Power Requirements	Management Power: 30mA typical @ +3.3V DC (without PMC)	
	Payload Power: 150mA typical @ +12V DC (without PMC)	
	max. Current Draw as per Module Current Requirements record: 2.5A	
Temperature Range	Operating	-40°C to +85°C
	Storage	-40°C to +85°C
MTBF	TAMC261-1x: 281.000 h TAMC261-2x: 254.000 h MTBF values shown are based on calculation according to MIL-HDBK-217F and MIL-HDBK-217F Notice 2; Environment: G_B 20°C. The MTBF calculation is based on component FIT rates provided by the component suppliers. If FIT rates are not available, MIL-HDBK-217F and MIL-HDBK-217F Notice 2 formulas are used for FIT rate calculation.	
Humidity	5 – 95 % non-condensing	
Weight	209 g	

Table 2-1 : Technical Specification

3 Handling and Operating Instructions

3.1 ESD Protection

The AMC module is sensitive to static electricity. Packing, unpacking and all other module handling has to be done in an ESD/EOS protected Area.

3.2 Thermal Considerations

Forced air cooling is recommended during operation. Without forced air cooling, damage to the device can occur.

3.3 Voltage Limits on PMCs

The AMC.0 specification limits the voltages on AMC modules. These limits also apply to mounted PMCs.

Refer to the chapter "Voltage Limits on PMC Modules" for details.

3.4 Mid-Size Option Usage Restrictions

Please note that the Mid-Size module has restrictions to its usage because of a component height violation. It is within the responsibility of the user to carefully check if the Mid-Size module with its component height violation can be used in the system. Otherwise, damage to the TAMC261 or the slot it is used in may occur!

Refer to the chapter "Component Height Violation on TAMC261-x0R" for details.

4 IPMI Support

The AMC module provides a Module Management Controller (MMC) that performs health monitoring, hot-swap functionality and stores the Field Replaceable Unit (FRU) information. The MMC communicates via an Intelligent Platform Management Interface (IPMI).

4.1 Temperature and Voltage Sensors

The MMC monitors on-board sensors and signals sensor events to the superordinated IPMI controller / shelf manager. Available sensors are listed in the table below.

Sensor Number	Signal Type	Thresholds	Signal Monitored
0	Event	-	Hot-swap switch
1	Temperature	lcr lnc unc ucr	Board Temp.
2	Temperature	lcr lnc unc ucr	Board Temp.
3	Voltage	lcr lnc unc ucr	+12V (PWR)
4	Voltage	lcr lnc unc ucr	+1.8V
5	Voltage	lcr lnc unc ucr	+12V (PMC)
6	Voltage	lcr lnc unc ucr	-12V (PMC)
7	Event	-	RTM Hot-Swap
8	Temperature	lcr lnc unc ucr	RTM Temp.

unr: upper non-recoverable, ucr: upper critical, unc: upper non-critical
lnr: lower non-recoverable, lcr: lower critical, lnc: lower non-critical

Table 4-1 : Temperature and Voltage Sensors

The following on-board power supplies are monitored by the MMC via a digital power good signal: 3.3V, 5V.

4.1.1 Sensor Locations

The following figure shows the location of the TAMC261 physical sensors.

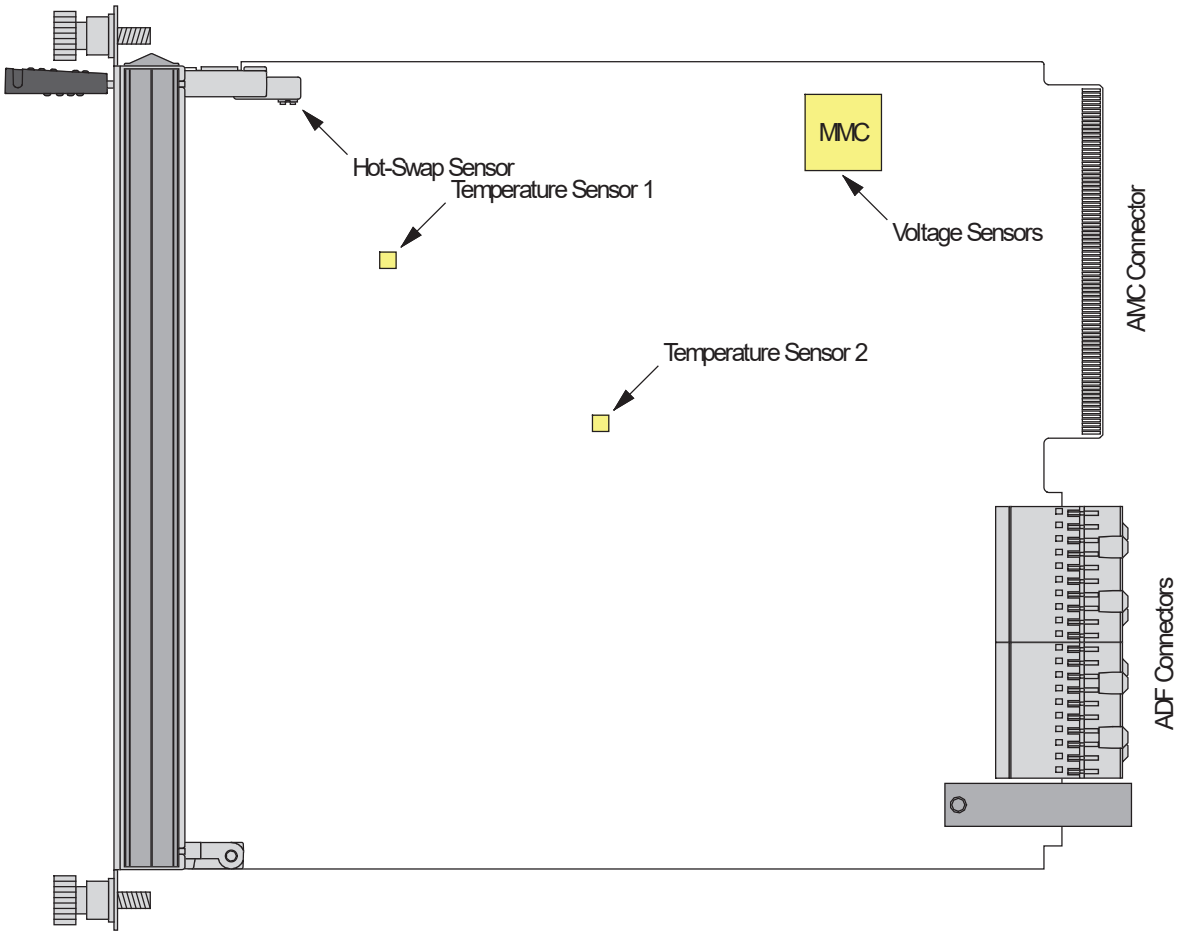

Figure 4-1 : Sensor Locations

4.2 FRU Information

The MMC stores the module FRU information in a non-volatile EEPROM. Some of the records are writeable. If records are modified, the user is responsible for setting the proper checksums. The actual FRU information data is shown below.

Area	Size (in Bytes)	Writeable
Common Header	8	no
Internal Use Area	0	no
Chassis Info Area	0	no
Board Info Area	variable	no
Product Info Area	variable	no
Multi Record Area		
Module Current Requirements	variable	yes
AMC Point-to-Point Connectivity	variable	yes
Clock Configuration	variable	yes
Zone 3 Interface Compatibility Record	variable	yes

Table 4-2 : FRU Information

4.2.1 Board Info Area

Product Information	Value
Version	1
Language Code	0x00 - English
Manufacturer date/time	determined at manufacturing
Board manufacturer	TEWS TECHNOLOGIES GmbH
Board product name	TAMC261
Board serial number	determined at manufacturing (see board label)
Board part number	TAMC261-xx -xx = -10R / -11R / -20R / -21R

Table 4-3 : Board and Product Info Area

4.2.2 Product Info Area

Product Information	Value
Version	1
Language Code	0x00 - English
Product manufacturer	TEWS TECHNOLOGIES GmbH
Product name	TAMC261
Board part/model number	TAMC261-xx -xx = --10R / -11R / -20R / -21R
Product version	V1.0 Rev. A (see board label)
Product serial number	determined at manufacturing (see board label)
Asset tag	= Product serial Number

Table 4-4 : Board and Product Info Area

4.2.3 Multi Record Area

4.2.3.1 Module Current Requirements

The “Current Draw” value holds the Payload Power (PWR) requirement of the AMC given as current requirement in units of 0.1A at 12V. The table below shows the factory default “Current Draw” value for this AMC module.

Product Information	Value
Current Draw	0x19 (2.5 A)

Table 4-5 : Module Current Requirements

The AMC’s MMC announces the current demand to the shelf manager. If the power budget for the AMC slot is smaller than this value, the shelf manager may not enable Payload power for the used slot.

If required, the “Current Draw” value in the Module Current Requirements record may be modified to a value that falls within the given power budget. **Make sure that the modified value still satisfies the power requirements for the AMC module, the mounted PMC module and the mounted µRTM!**

4.2.3.2 AMC Point-to-Point Connectivity

The AMC module provides the following AMC Point-to-Point Connectivity Record Data.

Channel	Port	Link Type	Link Type Extension	Link Grouping ID	Asymmetric Match
0	4	AMC.1 PCI Express	Gen 1 PCI Express, non-SSC	Single Channel Link	PCI Express Primary Port
1	4-7	AMC.1 PCI Express	Gen 1 PCI Express, non-SSC	Single Channel Link	PCI Express Primary Port

Table 4-6 : AMC Point-to-Point Connectivity

4.2.3.3 Clock Configuration

AMC FCLKA (CLK3) is used as the PCI Express Reference Clock.

Clock ID	Clock Features	Clock Family	Clock Accuracy	Clock Frequency
FCLKA	Clock Receiver, not connected through PLL	PCI Express	PCI Express Gen 1	100 MHz nom.

Table 4-7 : Clock Configuration

4.2.3.4 Zone 3 Interface Compatibility Record

The Zone 3 Interface Compatibility data of AMC and µRTM must match for the µRTM to be considered as compatible.

Product Information	Value
Version	1
Type of Interface Identifier	0x03 - OEM Interface Identifier
Manufacturer ID (IANA) of the OEM	0x0071E3 (TEWS TECHNOLOGIES GmbH)
OEM-defined interface designator	0x81050000 (0x8 = TAMC, 0x105 = 261)

Table 4-8 : Zone 3 Interface Compatibility Record

If any Zone 3 Interface Compatibility record in the µRTM's FRU information matches the Zone 3 Interface Compatibility record shown, the TAMC261 considers the µRTM to be compatible. Otherwise the TAMC261 considers the µRTM to be incompatible.

The Zone 3 Interface Compatibility records are considered as matching if the records are the same length and are identical from offset 9 to the end of the record. Otherwise the record is considered as not matching.

4.2.4 Modifying FRU Records

Some of the records are writeable to allow adaption to certain systems. If records are modified, the user is responsible for setting the proper checksums.

5 Functional Description

This chapter gives a brief overview of the various AMC module functions.

5.1 PCI Bus Device Number Mapping

The PCI bus device number of the PMC slot is defined by configuration type translation of the PI7C9X130 PCI-Express to PCI Bridge.

By default PMC slot 1 is mapped to bus device number 0x01.

PCI Bus Device Number (HEX)	PCI Bus AD(31:16) (Binary)	PCI AD Line used as PMC IDSEL	Purpose
0	0000 0000 0000 0001	16	Reserved for the source bridge
1	0000 0000 0000 0010	17	IDSEL for PMC1
2 – F	0000 0000 0000 0100 … 1000 0000 0000 0000	18 – 31	Not used on TAMC261
10 – 1E	0000 0000 0000 0000	None	Not implemented by PCI-Express to PCI bridge
1F	Special Cycle Data	-	Special Cycles for PMC

Table 5-1 : PCI Bus Device Number Mapping

5.2 PCI Clock

The PCI bus clock on the TAMC261 is configured by the plugged PMC modules. The TAMC261 supports 66MHz PCI and 133MHz PCI-X bus clock. If the plugged PMC module only supports 33 MHz PCI or 100MHz PCI-X operation, the PCI bus will operate with the slower clock rate.

5.3 PCI Signaling Voltage

PMC modules are specified for 3.3V only, 5V only, or universal (3.3V or 5V) PCI signal voltage operation.

The voltage key pin defines the PCI signal voltage level for the TAMC261 PCI bus and prevents PMCs with a wrong signaling voltage from being plugged onto the carrier.

5V Keying Pin Configuration	3.3V Keying Pin Configuration	PMC PCI Signaling Voltage		
		5V only PMC	Universal PMC	3.3V only PMC
Installed	Not Installed	✓	✓	×
Not Installed	Installed	×	✓	✓

Table 5-2 : PCI Signaling Voltage

As factory default, TAMC261 is assembled with the 3.3 Volt keying pin. To configure the TAMC261 for 5V signaling voltage, install the keying pin on the 5V keying pin position.

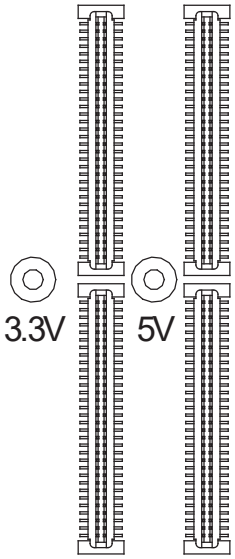

Figure 5-1 : Voltage Keying Positions

5.4 Bridge Configuration DIP-Switch

The PCIe-to-PCI-X Bridge senses the capabilities of the mounted PMC and sets the PCI bus to suitable modes. A DIP-switch allows configuring the PCIe-to-PCI-X Bridge to specific PCI modes:

Description	Position	No.	Position	Description
Enable PCI-X operation	OFF	1	ON	Force to conventional PCI
Select 100 MHz PCI-X clock	OFF	2	ON	Select 133 MHz PCI-X clock
Enable 64 bit PCI	OFF	3	ON	Disable 64 bit PCI
Enable 66 MHz PCI clock	OFF	4	ON	Limit PCI clock to 33 MHz

Table 5-3 : Bridge Configuration DIP-Switch

As factory default, TAMC261 is configured to 133 MHz PCI-X, 64 bit / 66 MHz PCI (off, on, off, off).

5.5 AMC Interface

5.5.1 Overview

AMC Connector	Backplane	TAMC261
Port 4-7	PCIe	PCIe (x1 Link, x4 Link), connected to the PCIe-to-PCI-X Bridge
Port 12-15	Point-to-Point links	Connected to M-LVDS transceivers
Port 17-20	Multi-Point bus for Triggers, Clocks, Interlocks	Connected to M-LVDS transceivers
TCLKA-TCLKD	“Telecom Clocks”	Connected to M-LVDS transceivers

Table 5-4: AMC Interface Overview

5.5.2 M-LVDS Transceiver

The TAMC261-2x provides M-LVDS transceivers, connected to the AMC point-to-point connections on port 12-15, the MTCA.4 trigger, clock and interlock connections on port 17-20 and to the TCLKA-D lines. The transceiver control lines are connected to the zone 3 interface.

The transceiver control and data lines are connected to the uRTM interface. The uRTM may map PMC P14 I/O lines to the transceiver control and data lines.

To consider signal delays, the transceiver control lines are routed with the same length.

5.5.2.1 Point-to-Point Links

AMC backplane ports 12-15 are connected to DS91M040 M-LVDS transceivers. There is one bi-directional M-LVDS transceiver for each Rx and Tx differential lines. Each differential line is terminated with a 100R termination resistor.

5.5.2.2 Multi-Point Links

AMC backplane ports 17-20 are connected to DS91M040 M-LVDS transceivers. There is one bi-directional M-LVDS transceiver for each Rx and Tx differential lines. Since the backplane provides termination for the M-LVDS bus lines, the TAMC261 provides no termination resistors for the Multi-Point links.

5.5.2.3 Telecom Clocks

AMC backplane TCLKA, TCLKB, TCLKC and TCLKD are also connected to DS91M040 M-LVDS transceivers. There is one bi-directional M-LVDS transceiver for each TCLK differential line. Each differential line is terminated with a 100R termination resistor.

5.5.2.4 M-LVDS Transceiver Interface

The control signals of the M-LVDS transceivers are connected to the zone 3 interface. For each differential line two signals are available:

Control Signal	Description	Naming Example
Direction	Transceiver direction signal When Direction is low, the transceiver driver is disabled and the receiver is enabled (default when signal is not connected) When Direction is high, the transceiver driver is enabled and the receiver is disabled	DIR_RX12, DIR_TCLKA
Data	Transceiver data signal When Direction is low, the transceiver drives this signal with the received data (signal is transceiver output). When Direction is high, the transceiver drives the data on this signal on the M-LVDS bus (signal is transceiver input).	RX_12, TCLKA

Table 5-5: M-LVDS Transceiver Control Signals

5.5.2.5 M-LVDS Transceiver Master Enable

Per default the M-LVDS transceiver master enable is connected to the ZONE3_EN signal (a local signal on the AMC module), which is set when the µRTM is enabled. Thus it is assured that the M-LVDS transceivers are only active when a matching µRTM is available.

For the case that a simple µRTM without management is used, the M-LVDS transceivers can be enabled permanently with a jumper (J3):

Jumper	Description
Jumper 1-2 Installed	M-LVDS transceivers enabled by ZONE3_EN (factory default)
Jumper 2-3 Installed	M-LVDS transceivers permanently enabled

Table 5-6: M-LVDS Jumper (J3)

6 Installation

This chapter contains general notes regarding installing the AMC module into a system.

6.1 Installation of a PMC Module

Before installing a PMC module, be sure that the power supply for the TAMC261 is turned off.

The components are Electrostatic Sensitive Devices (ESD). Use an anti-static mat connected to a wristband when handling or installing the components.

If the PMC has a front panel, remove the cover from the PMC front panel cut-out of the TAMC261. Install the PMC at an angle so that the PMC front panel penetrates the PMC front panel cut-out. Then rotate down to mate with the PMC connectors on the TAMC261. If the PMC has no front panel, simply plug in the PMC, and leave the cover in the PMC front panel cut-out of the TAMC261.

After the PMC module has been installed, it can be mounted on the TAMC261 using the mounting screws that come with the PMC module. There are four screw mounting locations, two at the PMC front panel and two at the standoffs near the PMC bus connectors.

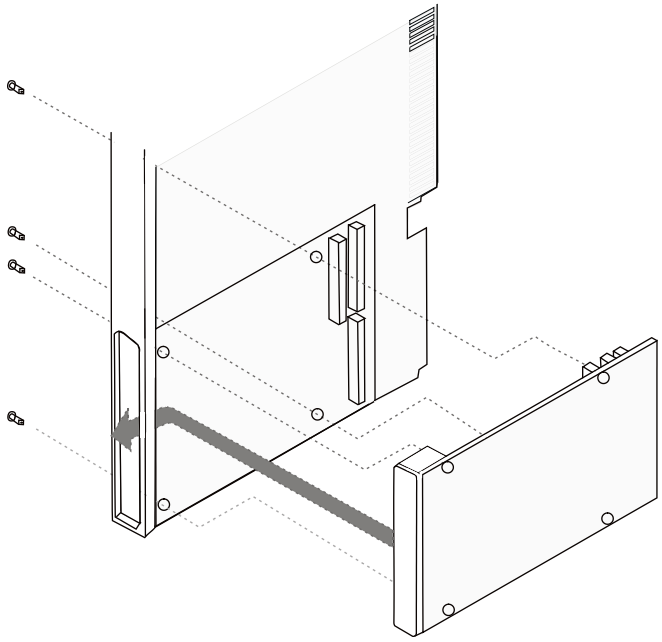

Figure 6-1 : Installation of a PMC Module

6.1.1 Voltage Limits on PMC Modules

The AMC.0 specification limits the voltages on AMC modules to following thresholds:

	DC voltage	AC voltage
Positive	+27V	+27V peak
Negative	-15V	-15V peak

Table 6-1 : Voltage Limits

For PMC modules using voltages (including I/O voltages) that exceed these thresholds, an additional insulation to adjacent modules or carrier boards becomes necessary.

6.1.2 Component Height Violation on TAMC261-x0R

With an assembled standard PMC module the Mid-Size TAMC261-x0R violates the AMC component envelope as defined in AMC.0. The picture shows in red the violation of the hatched AMC component envelope.

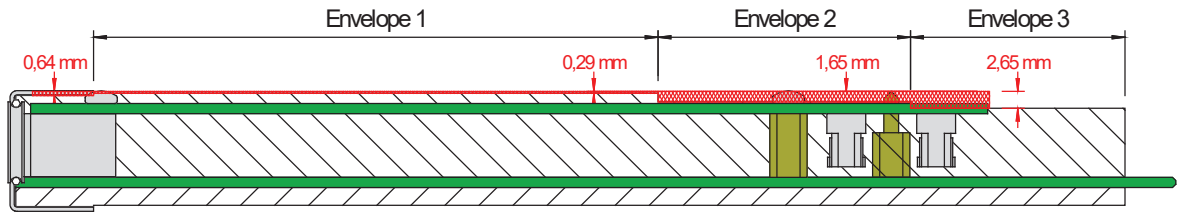

Figure 6-2 : Component Height Violation according to AMC.0

When using the TAMC261-x0R on an AdvancedTCA carrier, it is within the responsibility of the user to carefully check if the Mid-Size module with its component height violation can be used. Otherwise damage of the TAMC261 or the carrier may occur!

MTCA.0, although the adjacent board is also an AMC, maintains the steps in the Mid-Size AMC component envelope, which were originally defined in AMC.0 to provide spacing for components on ATCA carrier boards.

MTCA.4 removes the steps in the Mid-Size AMC component envelope. This results in a reduced component height violation if the TAMC261-x0R is used in MTCA.4 systems.

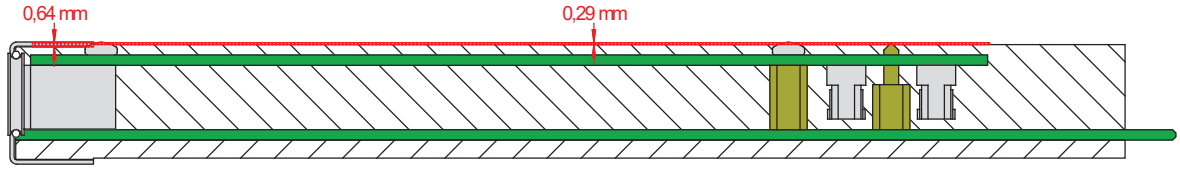

Figure 6-3 : Component Height Violation according to MTCA.4

The TAMC261-x0R is intended for the use in µTCA systems because the adjacent AMC module provides enough spacing for the protruding PMC module. Despite the fact that the AMCs component envelope is violated by the PMC, the PMC does not cross the interboard separation plane, and a minimum distance between the PMC and the adjacent AMC is guaranteed. This allows improving the density of the µTCA system.

If you are not sure that the available spacing is sufficient, it is strongly recommended to use the Full-Size TAMC261-x1. It is within the responsibility of the user to carefully check if the Mid-Size module with its component height violation can be used in his system. Otherwise damage of the TAMC261 or the AMC slot may occur!

6.1.3 Using PMCs with Mid-Size faceplates

The TAMC261 places the PMC directly at the AMC faceplate. A TAMC261 Mid-Size faceplate provides a cut-out to ease PMC installation. Pins of PMC I/O-connectors that protrude on the PMC Side 2 may still contact the AMC front panel. This is a potential hazardous electrical problem, depending on the I/O circuitry used.

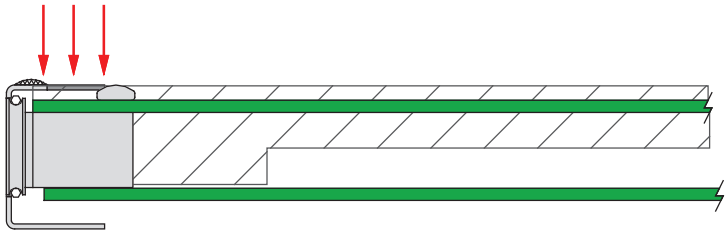

Figure 6-4 : Using PMCs with Mid-Size faceplates

It is within the responsibility of the user to carefully check if a specific PMC can be used on a Mid-Size TAMC261. If you are not sure that the available spacing to conductive parts of the PMC is sufficient, it is strongly recommended to use a TAMC261 with Full-Size front panel.

6.2 AMC Module Installation

During insertion and extraction, the operational state of the AMC is visible via the blue LED in the AMCs front panel. The following table lists all valid combinations of Hot-swap handle position and blue LED status, including a short description of what's going on.

Blue LED / Handle	On	Off	Long Blink	Short Blink
Open (Pulled out)	**Extraction:** Module can be extracted **Insertion:** Module is waiting for closed Handle	Module is waiting for hot swap negotiation	-	Hot swap negotiation in progress (Extraction)
Closed (Pushed all way in)	Module is waiting for hot swap negotiation	Module is active (operating)	Hot swap negotiation in progress (Insertion)	-

Figure 6-5 : Hot-Swap states

6.2.1 Insertion

Typical insertion sequence:

1. Insert the AMC module into its slot, with the board edges aligned to the card guides
2. Make sure that the module handle is pushed into the inserted position
    a. Blue LED turns “ON.” (Module is ready to attempt activation by the system)
    b. Blue LED starts “Long Blink” (Hot Swap Negotiation / Module activation in progress)
    c. Blue LED turns “OFF”, and green LED turns “ON” (Module is ready and powered)

When the Blue LED does not go off but returns to the “ON” state, the module FRU information is invalid or the system cannot provide the power requested by the AMC module.

6.2.2 Extraction

Typical Extraction sequence:

1. Pull the module handle out ½ way
    a. Blue LED starts “Short Blink” (Hot Swap Negotiation in progress)
    b. Blue LED turns “ON” (Module is ready to be extracted)
2. Pull the module handle out completely and extract the AMC module from the slot.

6.1 µRTM Module Installation

6.1.1 µRTM Insertion

1. Make sure that the front AMC is fastened to the MTCA.4 system
2. Simply insert the µRTM into the MTCA.4 system (slot must match for the front AMC) and fasten the µRTM to the MTCA.4 system
3. Close the µRTM Hot-Swap handle (if not already closed right from the start)
4. Wait until the blue Hot-Swap LED goes off and the green LED goes on

If the blue Hot-Swap LED stays active and the green LED stays off, the µRTM has been considered as incompatible to the front AMC (e.g. missing FRU information in µRTM EEPROM)

6.1.2 µRTM Extraction

1. Normal Operating (green LED is on, blue Hot-Swap LED is off)
2. Pull the µRTM Hot-Swap handle
3. Wait until the green LED goes off and the blue Hot-Swap LED shows activity
4. Wait until the blue Hot-Swap LED is permanently on
5. Unfasten the µRTM from the MTCA.4 system
6. Pull the µRTM from the MTCA.4 system (handle still pulled)

7 Indicators

This chapter describes board indicators such as LEDs.

7.1 LED Indicators

7.1.1 Front Panel LEDs

For a quick visual inspection, the AMC module provides the following front panel LEDs.

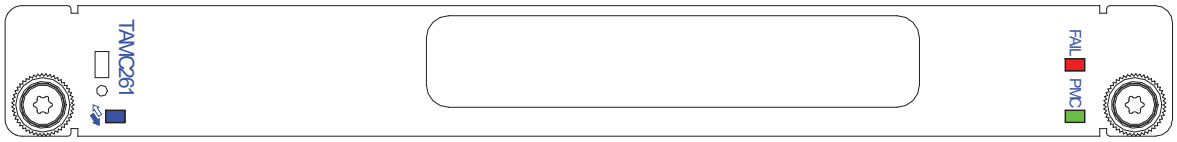

Figure 7-1 : Front Panel LED View

LED	Color	State	Description
HS	Blue	Off	No Power or Module is ready for normal operation
		Short Blink	Hot-Swap negotiation (extraction)
		Long Blink	Hot-Swap negotiation (insertion)
		On	Module is ready to attempt activation by the system or Module is ready to be extracted
FAIL	Red	Off	No fault
		On	Failure or out of service status
PMC	Green	Off	Board is unpowered
		On	Board is powered
		Blink	PMC activity

Table 7-1 : Front Panel LEDs

7.1.2 On-Board LEDs

The AMC module provides a couple of board-status LEDs as shown below.

Indicator	Color	Description
PGOOD	Green	Power Good Carrier Card Indicates that the PMC 5V, 3.3V and core voltages supplies are within tolerance

Table 7-2: Board-Status LEDs

8 I/O Connectors

This chapter provides information about user accessible on-board connectors

8.1 Overview

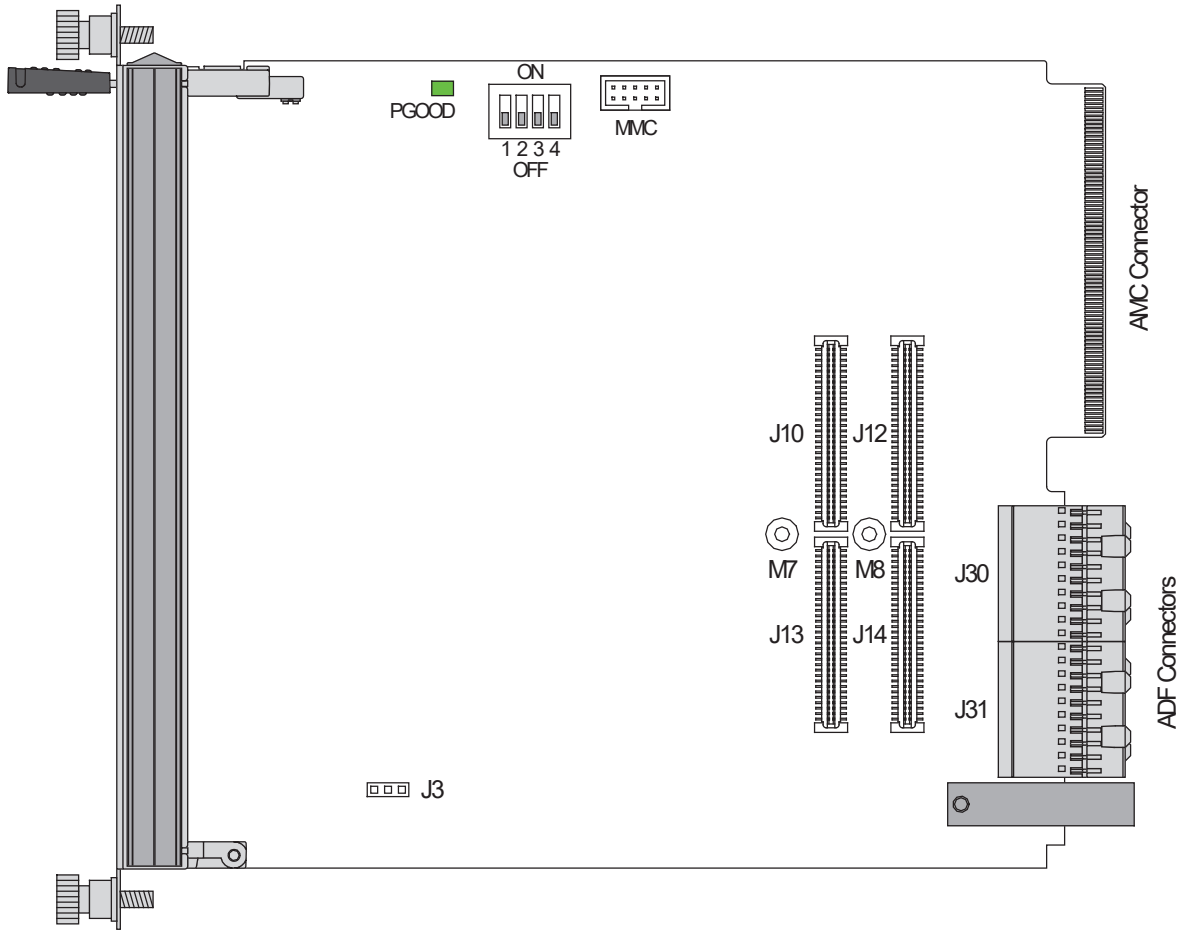

Figure 8-1 : On-Board Connector Overview

8.2 Board Headers

8.2.1 MMC JTAG/ISP Header

The dedicated MMC JTAG/ISP Header is for factory use only.

Pin-Count	10
Connector Type	10-pin 2mm box header
Source & Order Info	Molex 87832-1020

Pin	Signal	Description
1	TCK	Test Clock
2	GND	Ground
3	TDO	Test Data Output (TAP Controller: TDI)
4	VT_{REF}	Reference Voltage
5	TMS	Test Mode Select Input
6	nSRST	MMC RESET#
7	n.c.	Connected to MP
8	nTRST	Connected to PENABLE#
9	TDI	Test Data Input (TAP Controller: TDO)
10	GND	Ground

Table 8-1: MMC JTAG Header

8.3 Board Connectors

8.3.1 AMC Connector

Pin-Count	170
Connector Type	AMC-Plug Connector
Source & Order Info	Harting ECPI0612001001

This is an excerpt from the AMC-connector pin assignment. Only the user available signals are listed.

Pin	Signal Group	TAMC261 Usage
11-15	Port 0	Not used / Not supported
20-24	Port 1	Not used / Not supported
29-33	Port 2	Not used / Not supported
35-39	Port 3	Not used / Not supported
44-48	Port 4	PCIe (x1 Link, x4 Link)
50-54	Port 5	PCIe (x4 Link)
59-63	Port 6	PCIe (x4 Link)
65-69	Port 7	PCIe (x4 Link)
74-75	TCLKA	Connected to zone 3 interface with M-LVDS transceivers
77-78	TCLKB	Connected to zone 3 interface with M-LVDS transceivers
80-81	FCLKA	PCIe Reference Clock
87-97	Port 8	Not used / Not supported
93-97	Port 9	Not used / Not supported
99-103	Port 10	Not used / Not supported
105-109	Port 11	Not used / Not supported
111-115	Port 12	Connected to zone 3 interface with M-LVDS transceivers
117-121	Port 13	Connected to zone 3 interface with M-LVDS transceivers
123-127	Port 14	Connected to zone 3 interface with M-LVDS transceivers
129-133	Port 15	Connected to zone 3 interface with M-LVDS transceivers
135-136	TCLKC	Connected to zone 3 interface with M-LVDS transceivers
138-139	TCLKD	Connected to zone 3 interface with M-LVDS transceivers
141-145	Port 17	Connected to zone 3 interface with M-LVDS transceivers
147-145	Port 18	Connected to zone 3 interface with M-LVDS transceivers
153-145	Port 19	Connected to zone 3 interface with M-LVDS transceivers
159-145	Port 20	Connected to zone 3 interface with M-LVDS transceivers

Table 8-2: AMC Connector Pin Assignment

8.3.2 PMC Connector

J11, J12, J13: Refer to the according specifications

J14: Compare the Zone 3 connector

The I/O lines from PMC connector J14 are routed as 50Ohm single-ended length matched signals, but not as differential pairs. This approach may support differential signaling (e.g. for Ethernet etc.) but does not cause cross-talk when used with cards that provide single-ended I/O.

8.4 Zone 3 Interface

8.4.1 Zone 3 Mechanical Keying

The TAMC261 provides a female (receptable) Zone 3 mechanical key as shown below.

The part number used is Tyco 5223957-1.

N	A Rotation in degrees	View	Voltage Levels
0	NA	 View from the µRTM to the rear of the AMC white = clearance	Alignment only

Table 8-3: Zone 3 Mechanical Keying

8.4.2 Zone 3 Connector

The TAMC261 provides two 30-pair ADF connectors (J30 and J31) at the Zone 3 Interface.

Pin-Count	30 contact pairs (60 signal contacts) + 30 GND pins
Connector Type	Advanced Differential Fabric (ADF) connector
Source & Order Info	Erni: 973028

8.4.2.1 Pin Assignment

ADF connector ground pins are not shown.

	F	E	D	C	B	A
10	J14_48	J14_47	J14_46	J14_45	J14_44	J14_43
9	J14_42	J14_41	J14_40	J14_39	J14_38	J14_37
8	J14_36	J14_35	J14_34	J14_33	J14_32	J14_31
7	J14_30	J14_29	J14_28	J14_27	J14_26	J14_25
6	J14_24	J14_23	J14_22	J14_21	J14_20	J14_19
5	J14_18	J14_17	J14_16	J14_15	J14_14	J14_13
4	J14_12	J14_11	J14_10	J14_9	J14_8	J14_7
3	J14_6	J14_5	J14_4	J14_3	J14_2	J14_1
2	µRTM_TMS	µRTM_TDI	µRTM_SCL	µRTM_MP	µRTM_PWR	µRTM_PWR
1	µRTM_TDO	µRTM_TCK	µRTM_SDA	µRTM_PS#	µRTM_PWR	µRTM_PWR

Table 8-4: Zone 3 J30 Connector Pin Assignment

	F	E	D	C	B	A
10	-	-	Tx_20	DIR_Tx_20	Rx_20	DIR_Rx_20
9	Tx_19	DIR_Tx_19	Rx_19	DIR_Rx_19	Tx_18	DIR_Tx_18
8	Rx_18	DIR_Rx_18	Tx_17	DIR_Tx_17	Rx_17	DIR_Rx_17
7	TCLKD	DIR_TCLKD	TCLKC	DIR_TCLKC	TCLKB	DIR_TCLKB
6	TCLKA	DIR_TCLKA	Tx_15	DIR_Tx_15	Rx_15	DIR_Rx_15
5	Tx_14	DIR_Tx_14	Rx_14	DIR_Rx_14	Tx_13	DIR_Tx_13
4	Rx_13	DIR_Rx_13	Tx_12	DIR_Tx_12	Rx_12	DIR_Rx_12
3	-	-	J14_64	J14_63	J14_62	J14_61
2	J14_60	J14_59	J14_58	J14_57	J14_56	J14_55
1	J14_54	J14_53	J14_52	J14_51	J14_50	J14_49

Table 8-5: Zone 3 J31 Connector Pin Assignment

8.4.3 Zone 3 Quiescence Actions

The TAMC261 does not support any quiescence actions (except for bypassing the JTAG chain), because all I/O lines are directly controlled by the PMC module mounted on the TAMC261.

Any required Zone 3 quiescence actions have to be implemented on the µRTM.

9 Requirements for Compatible µRTM Designs

This chapter is intended for designers of TAMC261 compatible µRTM's.

9.1 Management Functions

9.1.1 General Notes

The TAMC261 provides the following µRTM related management signals at the Zone 3 (µRTM) interface:

Signal	Description
GND	Ground
RTM_PS#	µRTM present status (input for AMC)
RTM_MP	µRTM Management Power (gated AMC MP)
RTM_SCL, RTM_SDA	µRTM I2C Management Bus
RTM_PWR	µRTM Payload Power (gated AMC PWR)
RTM_TCK, RTM_TMS, RTM_TDI, RTM_TDO	µRTM JTAG Chain Signals 3.3V Level (supplied by Payload Power)

Table 9-1: µRTM Management Signals at the Zone 3 Interface

Other µRTM management functions are handled via the Zone 3 interface I2C management bus (i.e. via an I2C I/O Extender device on the µRTM).

The TAMC261 MMC firmware supports the following additional µRTM management signals handled via the µRTM I2C management bus:

Signal/Description
Hot Swap Handle Status
Blue Hot Swap LED Enable/Disable Control
LED1 (red) Enable/Disable Control
LED2 (green) Enable/Disable Control
EEPROM Write Protect Control (not recommended)
µRTM Payload Power Good Status
µRTM Payload Reset Control
µRTM Payload Enable/Disable Control

Table 9-2: Supported µRTM Management Signals via I2C

9.1.2 Present Detection

The µRTM must connect the RTM_PS# signal to the ground signal.

The TAMC261 provides a pullup resistor (to the AMC-MP power supply rail) on the RTM_PS# signal.

Note: The TAMC261 monitors the RTM_PS# signal for µRTM module present detection. The TAMC261 will gate the AMC Management Power to the µRTM upon µRTM present detection.

9.1.3 Power Good Detection

The µRTM must provide a kind of overall Payload Power Good signal.

See I2C I/O Extender section for additional information.

9.1.4 JTAG Signals

The TAMC261 provides 3.3V level JTAG signals at the Zone 3 Interface.

The µRTM module must not break the JTAG chain. If the µRTM module does not use JTAG, RTM_TDI must be connected to RTM_TDO on the µRTM module.

The JTAG signals at the Zone 3 Interface are not powered by the management power supply, but by the AMC 3.3V payload power supply.

The JTAG signals (except TDO) will be driven by the TAMC261 when all of the following is true:

- The µRTM is present
- The AMC has enabled payload power to the µRTM (µRTM is compatible)
- The AMC has set the ZONE3_EN signal (local signal on AMC)

The µRTM must provide means for safe JTAG signal levels during the time the µRTM JTAG devices are not powered properly. A pulldown resistor on TCK and a pullup resistor on TMS is recommended.

9.1.5 I2C Management Bus

(Only) The following I2C devices / addresses must be present on the µRTM I2C management bus.

Device	Supported Devices	I2C Address	
EEPROM	AT24C32 or compatible	50h	1010000b
Temperature Sensor	LM75 or compatible	48h	1001000b
8-bit I2C I/O Port	PCA9534 or compatible	20h	0100000b

Table 9-3: Supported µRTM I2C Devices

Other I2C devices or addresses are not supported and are also not allowed.

The TAMC261 reserves the following I2C addresses for the AMC board: 70h (1110000), 71h (1110001).

All devices on the µRTM modules I2C management bus must be powered by the RTM_MP power supply.

MTCA.4 limits the total current for the RTM_MP power supply to 30mA. This must be taken into account for the µRTM hardware design (LEDs etc.).

The µRTM must provide pullup resistors to RTM_MP on the I2C 2-wire signals.

9.1.5.1 EEPROM

The µRTM must provide a serial EEPROM on the I2C management bus (AT24C32 or compatible).

The EEPROM I2C address must be 50h (1010000b).

The EEPROM must contain FRU information for the µRTM module.

The EEPROM must be powered by the RTM_MP power supply.

9.1.5.2 Temperature Sensor

The µRTM must provide a temperature sensor on the I2C management bus, as defined below.

The Temperature Sensor must be powered by the RTM_MP power supply.

A LM75 or compatible device with I2C address 48h (1001000b) must be used.

9.1.5.3 I2C I/O Extender

The µRTM must provide an 8-bit I2C I/O Extender device on the I2C management bus used for controlling certain management signals on the µRTM.

The I2C I/O device must be powered by the RTM_MP power supply.

A PCA9534 or compatible device with I2C address 20h (0100000b) must be used.

The TAMC261 supports the following pin/signal assignment for the µRTM I2C I/O Extender device:

I/O Port	I/O Direction	Description
7	I	Payload Power Supply Status 0 = Payload Power Supply status is not Good 1 = Payload Power Supply status is Good
6	O	Payload (Zone 3) Enable Control 0 = Payload Enable signal not active 1 = Payload Enable signal active Intended for Zone 3 interface and other I/O driver enable/disable control.
5	O	Payload Reset Control 0 = Payload Reset signal not active 1 = Payload Reset signal active
4	O	EEPROM Write Protect Control 0 = EEPROM write protection not active 1 = EEPROM write protection active Using this pin is not recommended. See note below.
3	O	LED2 (Green) Control 0 = LED off 1 = LED on

2	O	LED1 (Red) Control 0 = LED off 1 = LED on
1	O	Hot Swap LED (Blue) Control 0 = LED off 1 = LED on
0	I	Handle Status 0 = Handle/Switch closed 1 = Handle/Switch open

Table 9-4: µRTM I2C I/O Extender Port Assignment

Notes:

(1) Per default (after power-up) all the I2C I/O ports are inputs. External circuitry on the µRTM must ensure the proper function according to the µRTM I2C I/O Extender Port Assignment. E.g. the µRTM board logic must ensure that the Blue Hot Swap LED defaults to the ON state and that LED1 and LED2 default to the OFF state. Therefore the Blue Hot Swap LED should not be connected directly to the I2C I/O port. In general it is recommended to use external LED drivers (controlled by the I2C I/O ports). It is also recommended that the reset signal defaults to the active state and the enable signal defaults to the not-active state. Please see the following example adding a single 74LVC06-type device (6x Inverter with open drain output).

(2) Usually the EEPROM on the µRTM I2C Management Bus provides an input pin for Write Control/Protection. It is recommended to provide some mechanism on the µRTM to control this pin independently from the front AMC/MMC, e.g. a jumper that provides EEPROM write protection when open and supports EEPROM writes when closed. This would make it more convenient to program an empty µRTM EEPROM (thus an incompatible µRTM) per IPMI commands.

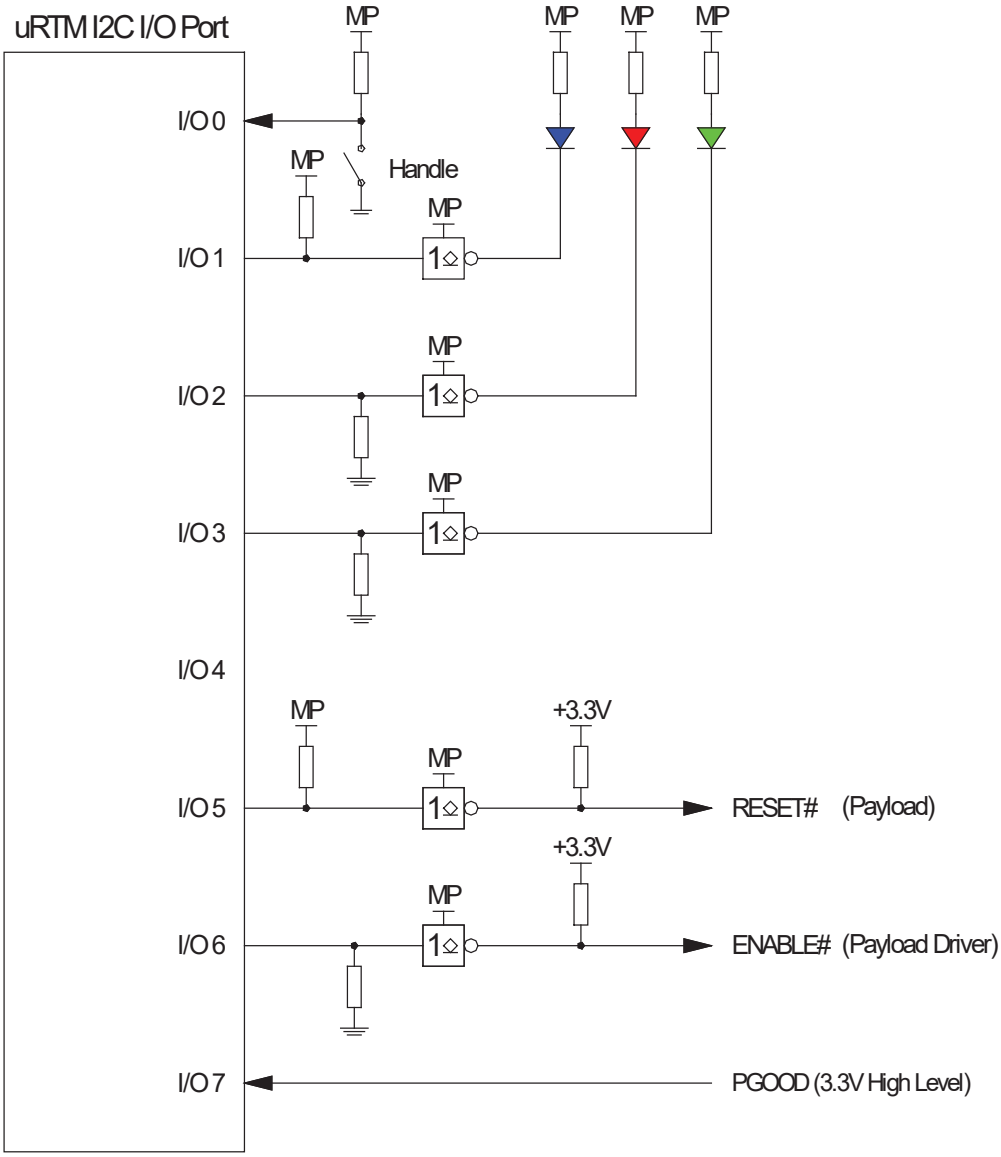

Figure 9-1: Example I2C I/O Extender Interface on µRTM

9.1.6 µRTM FRU Information Requirements

The EEPROM on the µRTM I2C bus must contain FRU information data for the µRTM.

The µRTM FRU information must include:

- Common Header
- Zone 3 Interface Compatibility Record (Multi-Record Area)

The µRTM FRU information may optionally include:

- Board Info Area
- Product Info Area

9.1.6.1 Common Header

The µRTM FRU information (Common Header) must start at EEPROM address 0h.

Offset	Length	Description
0	1	Common Header Format Version [7:4] Reserved. Write as 0h. [3:0] Format Version Number (Value 1h)
1	1	Internal Use Area Starting Offset (in multiples of 8 bytes) 00h indicates that this area is not present.
2	1	Chassis Info Area Starting Offset (in multiples of 8 bytes) 00h indicates that this area is not present.
3	1	Board Info Area Starting Offset (in multiples of 8 bytes) 00h indicates that this area is not present.
4	1	Product Info Area Starting Offset (in multiples of 8 bytes) 00h indicates that this area is not present.
5	1	Multi-Record Area Starting Offset (in multiples of 8 bytes) 00h indicates that this area is not present.
6	1	Value 00h
7	1	Common Header Checksum (zero checksum)

Table 9-5: µRTM FRU Common Header

9.1.6.2 Zone 3 Interface Compatibility Record

In the Multi-Record Area, the µRTM module must only provide the Zone 3 Interface Compatibility Record, defined as follows.

Offset	Length	Description	Value (Hex)
0	1	Record Type ID Value C0h (OEM)	C0
1	1	[7:7] End of list. Set to one for the last record. [6:4] Reserved. Write as 0h. [3:0] Record format version (2h for this definition)	82
2	1	Record Length	0D
3	1	Record Checksum Holds the zero checksum of the record	E0
4	1	Header Checksum Holds the zero checksum of the header	D1
5	3	Manufacturer ID For MTCA.4 the value is 12634 = 0x00315A, LSB first	5A
6			31
7			00
8	1	PICMG Record ID Value 30h	30
9	1	Record Format Version	01

		Value 01h	
10	1	Type of Interface Identifier 03h = OEM interface identifier	03
11	3	Interface Identifier Body Manufacturer ID (IANA) of the OEM that owns the definition of the interface. LS Byte first. 0x0071E3 (TEWS Technologies Private Enterprise Number)	E3
12			71
13			00
14	4	Interface Identifier Body OEM-defined interface designator, 32 bits, LS Byte first 0x81050000 (0x8 = TAMC, 0x105 = 261)	00
15			00
16			8B
17			82

Table 9-6: Zone 3 Interface Compatibility Record

If the Zone 3 Interface Compatibility record in the µRTM FRU information matches the Zone 3 Interface Compatibility record shown, the TAMC261 considers the µRTM to be compatible. Otherwise the TAMC261 considers the µRTM to be incompatible.

9.1.6.3 Sensor Data Records (SDR)

The TAMC261 MMC provides a SDR for one (mandatory) LM75 temperature sensor located on the µRTM. This pre-configured SDR is kept in the EEPROM of the AMCs MMC.

Parameter	Temperature-Level
Nominal Reading	25°C
Normal Maximum	70°C
Normal Minimum	0°C
Sensor Maximum Reading	125°C
Sensor Minimum Reading	-55°C
Upper Critical Threshold	85°C
Upper Non-Critical Threshold	75°C
Lower Critical Threshold	-40°C
Lower Non-Critical Threshold	-30°C

Table 9-7: Pre-configured µRTM Temperature Sensor

At this time, the TAMC261 MMC firmware does not support any SDR data stored in the µRTM I2C EEPROM.