NATIVE-DISCOVERY

ONE SLOT CHASSIS WITH MTCA FUNCTIONALITY

DESIGNED BY N.A.T. GMBH

TECHNICAL REFERENCE MANUAL V0.9

HW REVISION 1.X

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. PREFACE

1.1. Disclaimer

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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.

1.2. About This Document

This document is intended to give an overview on the **NATIVE-Discovery's** functional capabilities.

Preface

General information about this document

Introduction

Abstract on the **NATIVE-Discovery's** main functionality and application field

Quick Start

Important information and mandatory requirements to be considered before operating the **NATIVE-Discovery-Box** for the first time

Hardware

Details on the **NATIVE-Discovery's** most important components and interfaces

Operation

Information on start-up sequence and options for temperature management

Specifications and Compliances

Detailed list of specifications, abbreviations, and datasheets of components referred to in this document, as well as standards, the **NATIVE-Discovery** complies to

Document's History

Revision record

Note:

It is assumed, that the **NATIVE-Discovery** is handled by qualified personnel only!

2. INTRODUCTION

The **NATIVE-Discovery** is a one slot MTCA.0 chassis AMC box with minimum MTCA infrastructure including cooling as well as basic management and switching functionality. The system is powered by an external power supply.

The chassis can accommodate one single- or double-width, mid- or fullsize AMC. All AMC ports and a debug interface are routed towards the rear panel of the box, so they are accessible externally.

As the **NATIVE-Discovery** aims amongst others on testing and development applications, it offers sliding covers on top and bottom to access top and bottom side of the AMC's PCB.

Moreover, the **NATIVE-Discovery** is a good choice for applications which request the operation of just a single AMC and make minor demands on management and switching functionality, or redundancy.

The following figure shows the **NATIVE-Discovery**, populated with a single-width full-size AMC and filler panel, with open and closed sliding cover.

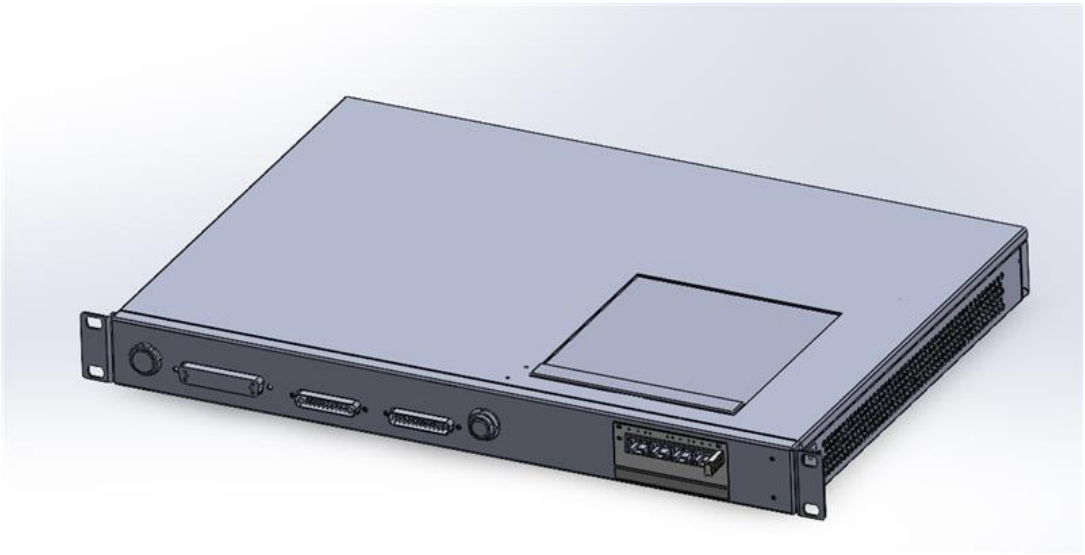
Figure 1 – Front View, open and closed sliding cover

Figure 2 – Rear View, open sliding cover

For special demands, the **NATIVE-Discovery** can be integrated in another chassis. In this case, the core of the **NATIVE-Discovery** (without enclosure) is mounted inside a customized chassis.

The CAD-sketch below shows this option in combination with a 1U 19" chassis.

Figure 3 – Example for custom-specific integration of the NATIVE-Discovery



2.1. Main Features

Table 1 – Technical Data

Form Factor	
	• W 206mm x H 46mm x D 312mm (+ appr. 5mm for rear connectors) • designed for one single- or double-width, mid- or full-size AMC • standalone operation or integration in customized chassis
Management & Switching	
Processing Resources	• Atmel ATxmega128 • Marvel 88E6320 Ethernet Switch
Firmware	• Microcontroller Firmware for MTCA environment simulation
Power Supply	
	• External 240W Power Supply • Input Voltage: 18-36V
Cooling Units	
	• Integrated fan unit with five fans and 120W cooling power for AMC • Airflow direction: right to left
Front Panel	
	• Slot for single- or double-width AMC with mid-/ full-sized front panel • Depending on the form factor, the use of filler panel(s) is mandatory
Rear Panel	

Interfaces	• AMC Ports 0/1: 2x 1GbE via RJ45
	• AMC Ports 2/3: 2x SAS/SATA via Dual Port SATA Connector including SSD power in/out
	• AMC Ports 4-7 / 8-11: 8 lanes to QSFP-DD for PCIe or 10G/40G/100G Ethernet
	• AMC Ports 12-15 / 17-20: 8 lanes to QSFP-DD for PCIe or 10G/40G/100G Ethernet
	• TCLK 1-4: single-ended TCLK A-D via SMA
	• UART interface via USB Type A
	• LEDs for:
	  • Power / Fan Status
	  • Temperature
	  • MMC Status

Compliance	
	• PICMG AMC.0 Rev. 2.0 • PICMG µTCA.0 Rev. 3 • CE, RoHS • EN55032:2015, EN 55024:2010+A1:2015, EN IEC 62368-1:2020 + A11:2020
Environmental	
Ambient Temperature	• 0°C to +45°C (long term)* • 0°C to +55°C (short term)*
Humidity	• 5% to 85%, non-condensing

Please note: These values are only valid with **closed housing** and **managed cooling** functionality! During operation with open sliding cover(s) or if the fan speed is set via Dip switch, the board temperature must be **supervised** by the user **manually**!

3. QUICK START

To ensure proper functioning of the **NATIVE-Discovery** during its usual lifetime, take the following precautions before handling the shelf.

3.1. Unpacking

Electrostatic discharge, incorrect board installation, and uninstallation can damage circuits or shorten their lifetime. Before touching integrated circuits ensure to take all required precautions for handling electrostatic devices.

Avoid touching gold contacts of the AMC-Edge-Connectors to ensure proper contact when inserting the modules into the **NATIVE-Discovery**.

Make sure that the chassis and its attachments are undamaged and complete according to delivery note.

3.2. Mechanical Requirements

Despite its compact design the **NATIVE-Discovery** compliant to the open standards MTCA.0 and AMC.0. Therefore, every standard-compliant AMC module can be integrated.

Before installing or uninstalling an AMC, read the Installation Guide and the User's Manual of the module.

Check all modules for steps that you have to take before turning on or off the power. After taking those steps, turn on or off the power if necessary.

Make sure the part to be installed/removed is hot-swap-capable, if you don't switch off the power.

Ensure that the module is connected to the **NATIVE-Discovery** with the connector completely inserted.

If the device is installed in an enclosed rack or chassis, ensure that the system has adequate ventilation.

Maintain ambient airflow to ensure normal operation. If the airflow is blocked or restricted, or if the intake air is too warm, an over temperature condition can occur.

Ensure that cables from other equipment do not obstruct the airflow through the shelf. Depending on the AMC form factor, the use of a filler panel, which prevents fan air from escaping out of the front of an open slot, is mandatory.

The **NATIVE-Discovery** is intended to be grounded. Ensure that the shelf ground terminals are connected to Protective Earth of the building.

3.3. Voltage Requirements

3.3.1. Power supply

The **NATIVE-Discovery** consumes up to 240W via an external power supply at an input voltage range from 18-36VDC via the rear panel.

Alternatively, power can also be provided via an onboard power connector. This option may be useful in case the **NATIVE-Discovery** is integrated in a customized chassis.

3.3.2. Hot-Swap

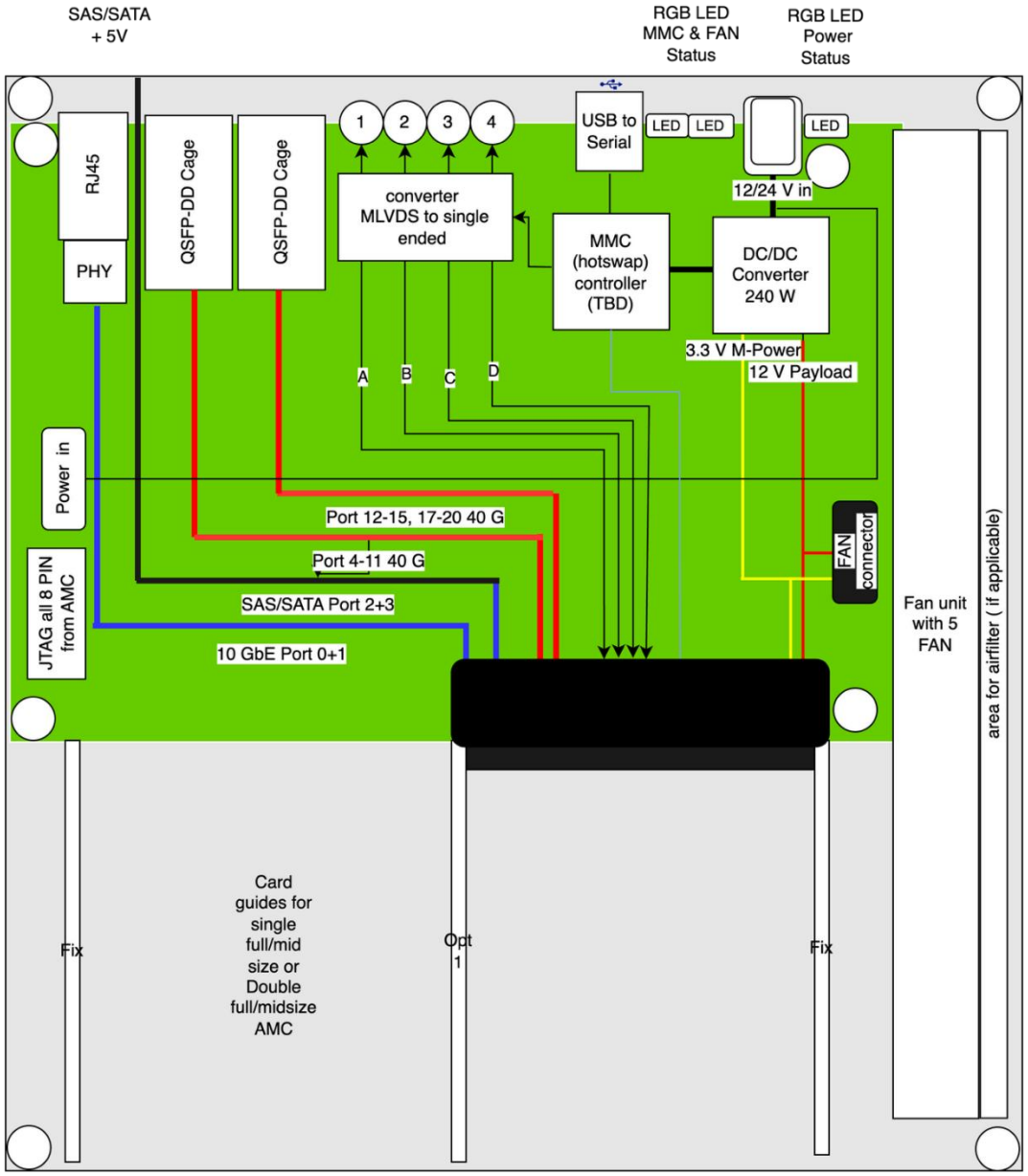
With the current prototype version, the **NATIVE-Discovery** ***does not yet support hot-swapping***. So before inserting or extracting an AMC, the system must be shut down completely to prevent damage.

Hot-swapping will be implemented with the production model.

4. HARDWARE

The following diagram shows the main components of the **NATIVE-Discovery**.

Figure 4 – Block Diagram



4.1. Rear Panel LEDs and Connectors

The **NATIVE-Discovery** rear panel features several status LEDs; the behaviour is described in the table below.

Figure 5 – Rear Panel

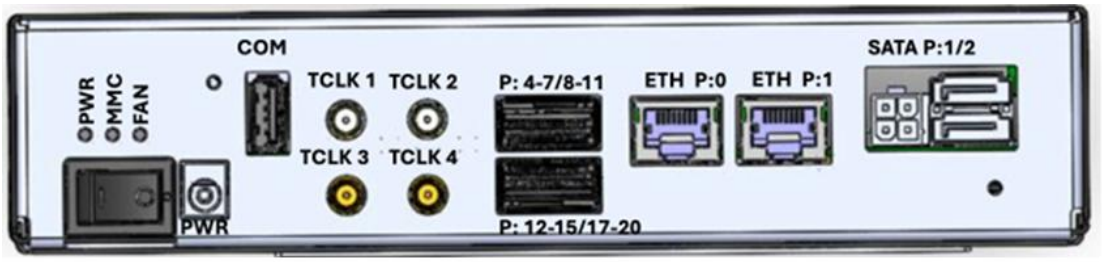


Table 2 – LED Functionality

LED	Color	Behaviour	Function
PWR	RGB	tbd	Reflects system power status
MMC	RGB	tbd	Reflects MMC Status
FAN	RGB	tbd	Reflects Fan Status

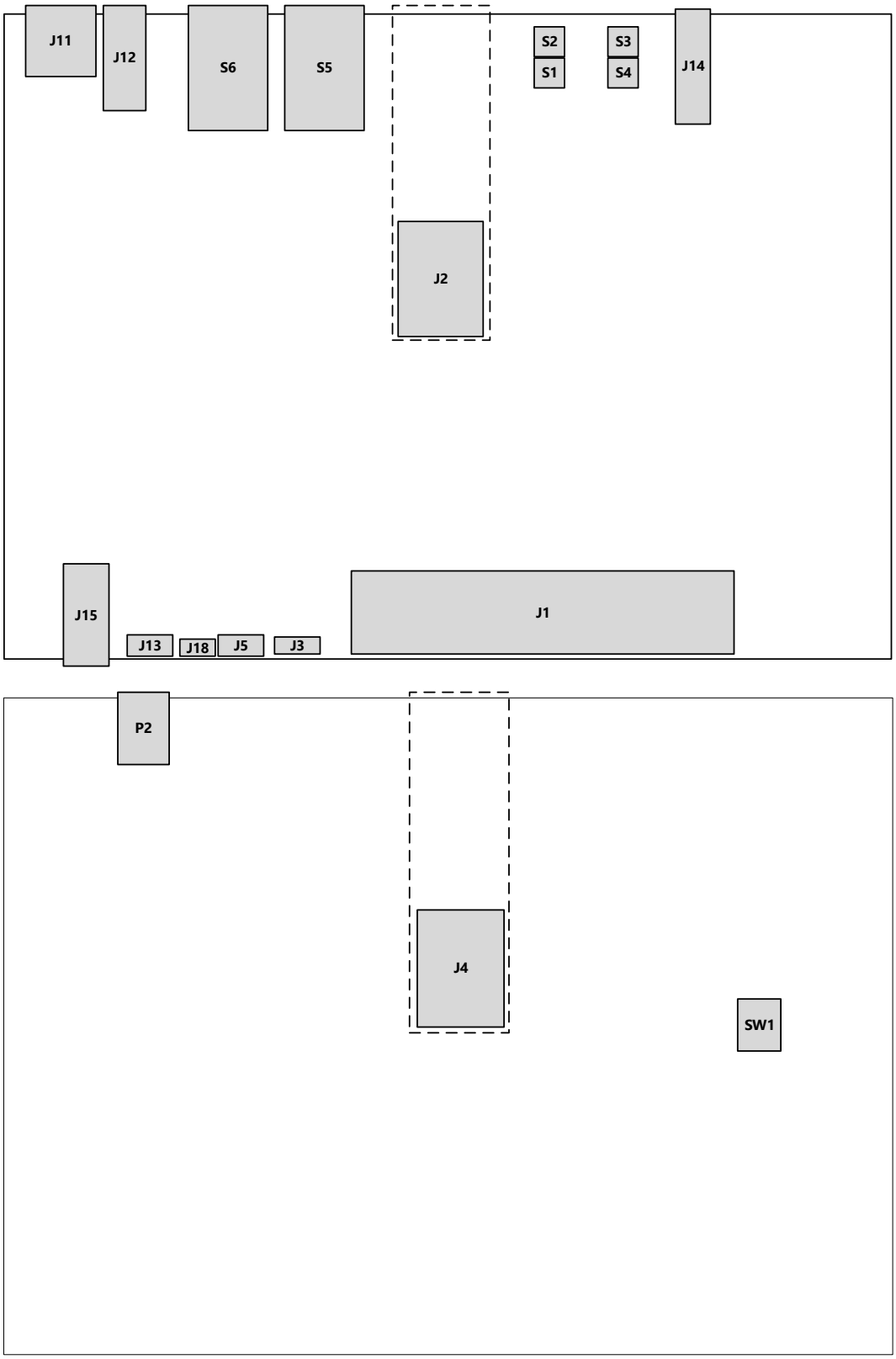
LED description will be detailed with production model.

The following table lists the connectors and their functionality. Their location is shown on the diagrams below; the pin assignments of the bold labelled connectors are described in the following paragraphs.

Table 3 - Connectors

Label	Location	Type	Description
J1	Internal	Yamaichi MTCA	AMC Connector
J2	Rear panel	QSFP-DD	AMC Port 4-7 / 8-11: 8 lanes for PCIe Gen4 or 10G/40G/100G Ethernet
J3	**Internal**	**2x7 Pin Header**	**AMC JTAG Connector**
J4	Rear Panel	QSFP-DD	AMC Port 12-15 / 17-20: 8 lanes for PCIe Gen4 or 10G/40G/100G Ethernet
J5	**Internal**	**1x5 Pin Header**	**Atmel Programming Header**
J11	Rear Panel	Dual Port SATA	AMC Port 2/3
J12	**Rear Panel**	**Mini ATX**	**5V power supply for external SATA drives**
J13	**Internal**	**1x6 Pin Header**	**GPIO Header**
J14	Rear Panel	USB3.2 Type A	COM / UART interface
J15	**Internal**	**Mini ATX**	**24V DC In**
J18	**Internal**	**2x3 Header**	**IPMI Debug Connector**
P2	Rear Panel	Main Power	18-36VDC
S1-S4	Rear Panel	4x SMA	TCLK 1-4 (TCLK A-D -> single-ended); direction managed by MMC
S5/S6	Rear Panel	2x RJ45	AMC Port 0/1: Ethernet
SW1	**Internal**	**6x DIP-SW**	**For operation in unmanaged mode**
SW2	External	Toggle switch	Main Power Switch

Figure 6 – Connector Location Diagrams Top and Bottom



4.1.1. J3: AMC JTAG Header

Connector J3 features a JTAG interface for the AMC.

Table 4 – J3: AMC JTAG Header

Pin #	Signal	Signal	Pin #
1	nc	3V3_MP_A	2
3	GND	TMS_MCH_1	4
5	GND	TCK_MCH_1	6
7	GND	TDO_MCH_1	8
9	GND	TDI_MCH_1	10
11	GND	nc	12
13	SGND	TRSTn_MCH_1	14

4.1.2. J5: Atmel Programming Header

Connector J5 features a programming interface for the Atmel microcontroller.

Table 5 – J5: Atmel Programming Header

Pin #	Signal	Signal	Pin #
1	PDI_DATA	3V3_MP_A	2
3	PDI_CLK	nc	4
5	GND		

4.1.3. J12: Mini ATX Connector

Connector J12 features an external power supply for SATA drives.

Table 6 – J12: Mini ATX Connector

Pin #	Signal	Signal	Pin #
1	5V	GND	2
3	GND	12V_PP_B	4
5	GND		

4.1.4. J18: IPMI Debug Connector

Connector J18 features an IPMI debug interface.

Table 7 – J2: Microcontroller Programming Header

Pin #	Signal	Signal	Pin #
1	AMC_SCL	nc	2
3	AMC_SDA	GND	4
5	nc	3V3_MP_A	6

4.1.5. SW1: DIP Switch

Dip Switch SW1 is used for operation in unmanaged mode. The following table describes the settings.

Table 8 – Fan Speed Setting

DIP-SW 1_1	DIP-SW 1_2	Fan Mode
OFF	OFF	OFF
ON	OFF	25%
OFF	ON	50%
ON	ON	75%

4.2. Cooling Unit

The **NATIVE-Discovery** features an integrated Cooling Unit with five fans, which are controlled by a temperature sensor and managed by the onboard IPMI controller. They can be speed controlled or operate in one of three speed steps alternatively. For more information, please refer to chapter 5.2 Fan Speed and Temperature Management.

Cold air is taken from the right side and pushed through the system. Thus, a cooling power of 120W for the AMC at an operating temperature of +55°C (short term) is ensured. Please note that this information is valid under optimal conditions only, which includes closed housing and managed fan control. If the fan speed is set via DIP switch or if sliding cover(s) are open, the AMC temperature must be supervised by the user manually!

The fan unit is easily removable for maintenance purposes.

5. OPERATION

5.1. System Start-up

After power-up and self-initialization, the IPMI controller provides payload power to the AMC. With the current prototype version, hot-swapping functionality is not supported yet, so the system must be shut down completely before inserting or extracting an AMC!

5.2. Fan Speed and Temperature Management

The **NATIVE-Discovery** supports two possible ways of fan speed control: managed cooling power via IPMI controller or manual setting of the fan speed via DIP switch.

Please note that the first option will be implemented in the production version and currently manual fan speed is supported only.

Settings of the DIP switch are described in chapter 4.1.5 SW1: DIP Switch.

6. SPECIFICATIONS AND COMPLIANCES

6.1. Internal Reference Documentation

- http://www.nateurope.com

6.2. External Reference Documentation

- Atmel ATxmega128 Microcontroller Datasheet, Rev. 2467XS–AVR–06/11

6.3. Standards Compliance

- PICMG AMC.0 Rev. 2.0/3.0*
- PICMG µTCA.0 Rev. 3
- CE, RoHS
- EN55032:2015, EN 55024:2010+A1:2015, EN IEC 62368-1:2020 + A11:2020

6.4. 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, poly-brominated 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. semi-conductor 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 paid to the production cycle, so that wherever and whenever possible RoHS components are used with N.A.T. hardware products already.

*High Speed Fat Pipes under validation

6.5. 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 Commission 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.

6.6. Compliance to CE Directive

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

6.7. 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.

6.8. Abbreviation List

Table 9 – Abbreviation List

Abbreviation	Description
AC	Alternating Current
AMC	Advanced Mezzanine Card
BIOS	Basic Input/Output System
BMC	Base Management Controller
CLI	Commend Line Interface
CPU	Central Processing Unit
COM	Communication Port
EEPROM	Electrically Erasable Programmable Read Only Memory
eMCH	Embedded MCH
FLASH	Non-Volatile Memory
FRU	Field Replaceable Unit
FTP	File Transfer Protocol
GbE	Gigabit Ethernet
GUI	Graphical User Interface
HS	Hot-Swap
I^2C	Inter-Integrated Circuit
IP	Internet Protocol
IPMB	Intelligent Platform Management Bus
IPMI	Intelligent Platform Management Interface
JRE	Java Runtime Environment
LAN	Local Area Network
µC/MCU	Microcontroller (Unit)
MCH	µTCA Carrier Hub
µTCA	Micro Telecommunications Computing Architecture
OS	Operating System
RMCP	Remote Management Control Protocol
SDR	Sensor Data Repository
SEL	System Event Log
SMS	System Management Software
SNMP	Simple Network Management Protocol
SRAM	Static Random Access Memory
UDP	User Datagram Protocol
VAC	Volt Alternating Current
TCKL	Telecom Clock
USB	Universal Serial Bus

7. DOCUMENT'S HISTORY

Table 10 – Document's History

Rev	Date	Description	Author
0.9	07.07.2025	• Preliminary release according to prototype status	se