NATIVE-C8

8U MTCA CHASSIS

DESIGNED BY N.A.T. GMBH

TECHNICAL REFERENCE MANUAL V1.2

HW REVISION 1.0

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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-C8's** technical features and functional capabilities.

Preface

General information about this document

Introduction

Abstract on the **NATIVE-C8's** main functionality and application field

Quick Start

Important information and mandatory requirements to be considered before operating the **NATIVE-C8** for the first time

Chassis Design

Detailed information on the overall design features and detailed description of the individual parts

Backplane

Details about Backplane topology, supported signal standards, and Carrier Number

Cooling Unit

Information on Cooling Unit, Air Filter, and Fans

Shelf Dimensions

Technical Drawing of the **NATIVE-C8**

Specifications and Compliances

Detailed list of specifications, abbreviations, datasheets of components referred to in this document; and standards the **NATIVE-C8** complies to

Document's History

Revision record

Note:

It is assumed, that the **NATIVE-C8** is handled by qualified personnel only!

2. INTRODUCTION

The **NATIVE-C8** is a 8U MTCA system with 12 double mid-size (alternatively 10 single mid-size) AMC slots and can be operated with two double full-size MCHs.

It can be powered by up to two double full-size Power Modules. A further Power Module can have a height of 9HP when an optional JTAG module is mounted in the dedicated slot, or even 12 HP without JTAG module.

The **NATIVE-C8** backplane includes point-to-point and fabric connections between AMCs and MCHs. Moreover, it features radial IPMB-L from both MCH slots to all AMC slots, and bused IPMB-0 among MCHs, PMs, and CUs.

The chassis is equipped with two hot-swap Cooling Units, which are accessible from the front, and an Air Filter.

Table 1 – Technical Data

Physical Dimensions	
	• Height: 352.80 mm (8U) • Width w/o mounting brackets: 482.60 mm (19") • Depth: 197 mm • Depth with front cable tray: 257 mm • Weight (completely assembled): 17 kg
Slots (max. Configuration)	
MCH	• 2x MCH, double-width, full-size (max. power: 80W): **NAT-MCH-PHYS/-PHYS80** or any compliant carrier hub
PM	• 2x/3x* Power Module, double-width, full-size: **NAT-PM-AC600D**, **NAT-PM AC1000,** or any compliant power module *without JTAG module, the 3rd PM can even have a height of 12HP
AMC	• 12x AMC, double-width, mid-size (max. power: 80W/slot) ***or*** • 10x AMC, single-width, mid-size (max. power: 80W) ***optional splitting kits required***
JTAG	• 1x double compact-size JSM module (optional)
Backplane	
	• AMC Port 0: 1 GbE routed between MCH1 and each AMC • AMC Port 1: 1 GbE routed between MCH2 and each AMC • AMC Ports 2/3: Point-to-point connection between AMCs • AMC Ports 4-7: Fat-Pipe between MCH1 and each AMC • AMC Ports 8-11: Fat-Pipe between MCH2 and each AMC • TCLKA, TCLKB, FCLKA: between MCH1 and each AMC (MCH1 CKL1, CKL2, CKL3) • TCLKC, TCLKD: between MCH2 and each AMC (MCH2 CKL1, CKL2) • AMC Ports 12-15: point-to-point connections • AMC Ports 17-20: bussed connections • JTAG: between optional JSM, MCH1/2, PM1/2/3, CU1/2, and each AMC • Radial IPMB-L from both MCH slots to all AMC slots • Bused IPMB-0 among MCHs, PMs, and CUs • FRU EEPROM • Replaceable backplane
Cooling Units	
Fans	• 2x Cooling Units (hot-swappable) • 3 temperature-controlled 12 VDC fans with 224 cfm (380 m^3/h) each • Smart Fan Controller • Front accessible air inlet filter
EMMC	• CU is fully managed and hot-swappable • Monitors fan power for early failure detection • Air filter removed detection
Environmental Conditions	
	• Ambient temperature: +5°C to +45°C • Ambient temperature (short term): +5°C to +55°C • Humidity: 5% to 95% non-condensing
Compliance	
	• EN 55022 Class B • Telcordia NEBS GR-78-CORE • VG 95373-15 • PICMG AMC.0 • PICMG MTCA.0

Order Codes	
NATIVE-C8	• Please refer to our website for current ordering options.

3. QUICK START

To ensure proper functioning of the **NATIVE-C8** during its usual lifetime, take the following precautions before handling the board.

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 connectors to ensure proper contact when inserting modules into the **NATIVE-C8**.

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

3.2. Mechanical Requirements

For operation, the **NATIVE-C8** requires Cooling Units (included), an MCH, and one Power Module (separate order items).

Before installing or uninstalling modules in the **NATIVE-C8**, read the Installation Guide, the User's Manual, and/or Technical Reference Manual of the modules.

Check all installed boards and modules for steps that must be taken before turning on or off the power. After taking those steps, turn on or off the power if necessary.

Make sure, parts to be installed / removed are hot-swap-capable, if you do not switch off the power.

Ensure that all modules are connected to the **NATIVE-C8** with the connector completely inserted.

3.2.1. Ensuring Proper Airflow

Install the system in an open rack whenever possible. If installation in an enclosed rack is unavoidable, ensure that the rack 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.

Use filler panels to cover all empty chassis slots to prevent fan air from escaping out of the front of an open slot. The filler panels should include an airflow baffle that extends to the backplane.

3.2.2. Shelf Grounding Connection

The **NATIVE-C8** is intended to be grounded. Ensure that the shelf ground terminals are connected to Protective Earth (PE) of the building. The chassis provides a shelf ground terminal at the front side with two M6 bolts to connect a double-lug shelf ground terminal cable.

Important: Static electricity can harm delicate components inside the shelf. It is mandatory to wear an ESD wrist strap before exchanging any part or electric component!

3.3. Voltage Requirements

3.3.1. Power supply

The power consumption of the **NATIVE-C8** depends on the number and variants of installed Power Modules and AMCs.

3.3.2. Hot-Swap

The **NATIVE-C8** supports hot-swapping, which means that hot-swap-capable modules can be inserted or extracted during normal system operation without affecting other modules.

Make sure to follow the procedure ***exactly*** to prevent the module or the system from damage!

Insertion of a hot-swap-capable Module

- Ensure the module supports hot-swapping
- Ensure that the hot-swap-handle of the module is in "unlock"-position (pulled out)
- Push the module carefully into the dedicated connector until it is completely inserted
- The blue HS-LED turns solid on
- With pushing the hot-swap-handle to "lock"-position, the HS-LED starts blinking and the IPMI-Controller of the **NATIVE-C8** backplane detects the board
- If the information provided by the module is valid, the **NATIVE-C8** backplane enables payload power and the blue HS-LED turns off

Extraction of a hot-swap-capable Module

- Pull the hot-swap-handle in "unlock"-position
- The blue HS-LED starts blinking
- The IPMI-Controller of the **NATIVE-C8** backplane disables payload power
- The HS-LED turns solid on
- Pull the module carefully out of the **NATIVE-C8**

4. CHASSIS DESIGN

The assembly rooms for AMCs, MCHs, and PMs are arranged vertically and provide the option to accommodate the following modules:

- Up to 12 double mid-size AMCs. With optional available splitting kits, 10 single mid-size AMCs can be operated.
- 2 double full-sized (6HP) Power Modules (**NAT-PM-AC600D**, **NAT-PM-AC1000,** or any compliant PM).
- 1 further double-width Power Module with 12HP (without JTAG module). If the dedicated JTAG slot is populated, the 3rd Power Module is allowed to have an height of 9 HP.
- 2 MCHs (**NAT-MCH-PHYS/-PHYS80**, or any compliant MCH)
- 1 double compact-size JTAG module

Figure 1 – NATIVE-C8 Front View

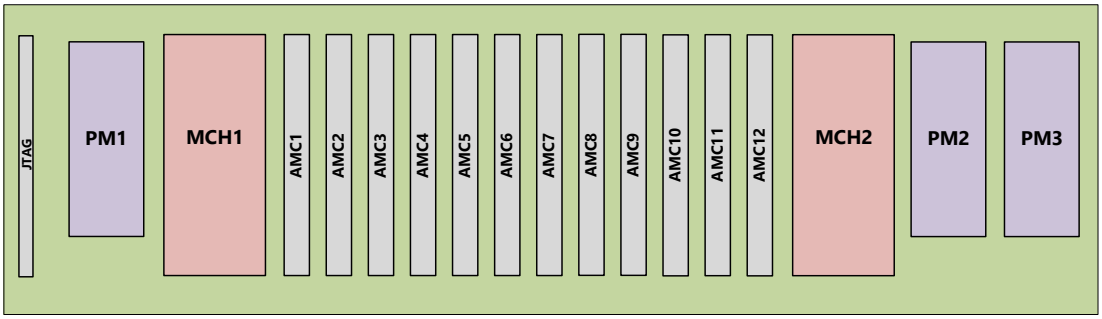
1. ESD Wrist Strap Terminal
2. Top Cooling Unit
3. Cable Tray
4. Shelf Ground Terminal
5. MicroTCA Backplane
6 Air Filter
7. Bottom Cooling Unit

Note: The picture above shows an alarm module, which is no longer included in the current Cooling Unit.

5. BACKPLANE

The connector and pin assignment is shown below.

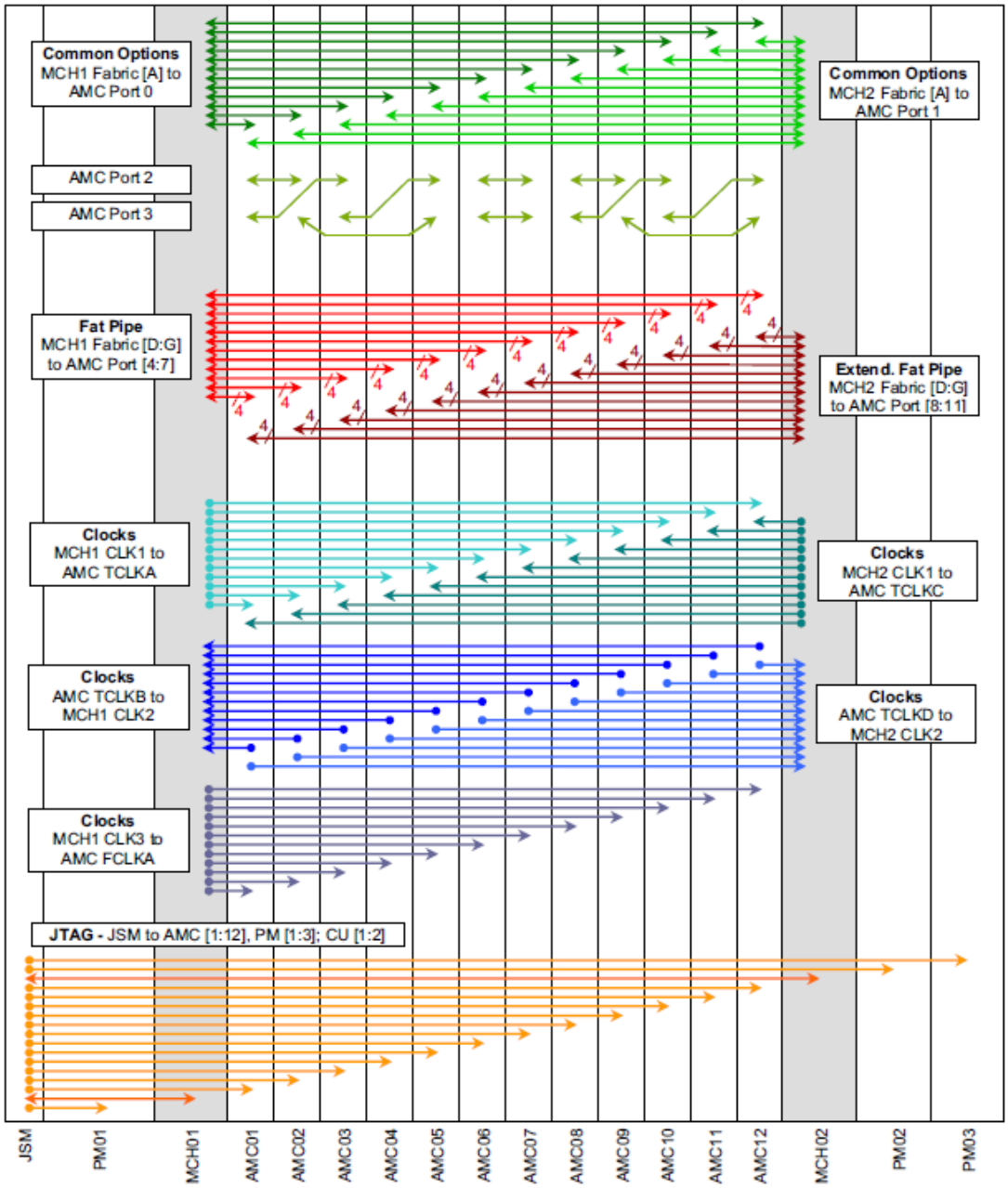
Figure 2 – Slot Assignment NATIVE-C8



5.1. Topology

The backplane topology is illustrated in the following figure.

Figure 3 – Backplane Topology



5.2. Fabric Interfaces

Ports 0–3 – Common Options Region

- MCH1 Fabric A is routed to all AMC slots Port 0 in a radial configuration
- MCH2 Fabric A is routed to all AMC slots Port 1 in a radial configuration
- AMC Ports 2 and 3 are direct slot-to-slot connections to support CPU/HDD configurations

Ports 4-11 – Fat Pipe Region

- MCH1 Fabric [D:G] are routed to all AMC slots Port [4:7] in a radial configuration
- MCH2 Fabric [D:G] are routed to all AMC slots Port [8:11] in a radial configuration

5.3. Synchronization Clock Interfaces

Synchronisation clock topology in accordance with AMC.0 R2.0, especially for the use of PCIe AMC modules in accordance with AMC0 R2.0 that expect the FabricCLK on FCLKA.

Fully redundant telecom clock architecture with TCLKA, TCLKB, TCLKC, TCLKD.

5.4. Intelligent Platform Management Bus (IPMB)

MicroTCA uses an Intelligent Platform Management Bus (IPMB) for management communications, split into IPMB-L and IMPB-0. Both busses are electrically and logically separated from each other.

- IPBM-L (Local IPMB) connects the AMCs and the MCHs with a radial topology. It is non-redundant.
- The IPMB among the MCHs, the PMs, and the CUs is called IPMB-0. For improved reliability, it consists of two busses, referenced to as IPMB-0A and IPMB-0B; both of them routed in a bussed configuration.

5.5. JTAG

The **NATIVE-C8** offers a dedicated JTAG slot for a double compact-size JTAG module.

By this module, all MCHs, PMs, AMCs, and CUs in the system are accessible via JTAG.

5.6. Carrier FRU EEPROM

Two EEPROMs on the Backplane are connected to each MCH by I^2C. Their I^2C-Address is 0xA4.

5.7. Carrier Number

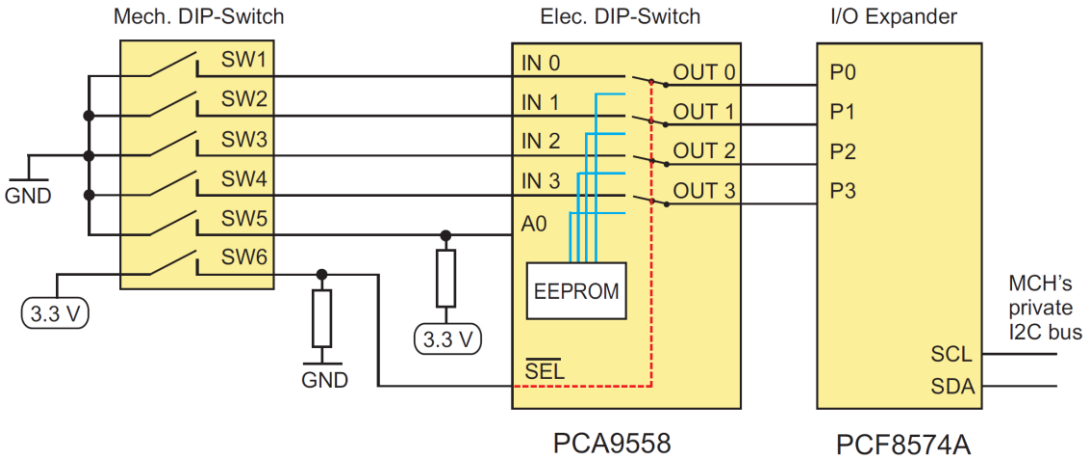
If two or more MicroTCA Shelfs are combined, it is mandatory for each MCH to have its own unique Carrier Number, ranging from 1 to 16 in its MicroTCA Shelf.

For this purpose, a mechanical and electronic (PCA9558) DIP switch, and a PCF8574A I^2C I/O expander are located on the Backplane. Either of the switches can be used for setting the Carrier Number.

Note: Switch ON = logic 0

Switch OFF = logic 1

Figure 4 – Carrier Number Switches



The mechanical DIP switch is connected to the input of the electronic DIP switch. If the SEL signal (SW6) is a logic 0, the electronic DIP switch will select the data from the internal EEPROM to drive the output pins, when the SEL signal is a logic 1, the electronic DIP switch will select the signal from the mechanical DIP switch to drive on the output pins.

Figure 5 – Carrier Number: Mechanical DIP Switch

Switch #	Default	Function
1 – 4	OFF	Set the Carrier Number SW1 = Bit 0 With default 0000, the resulting Carrier Number is "1"
5	OFF	Change I²C-Address of electronic DIP Switch: ON: I²C-Address = 9C OFF: I²C-Address = 9E (default)
6	OFF	Selection whether to set Carrier Number with mechanical or electronic DIP switch: ON: mechanical DIP switch active OFF: electronic DIP switch active (default)

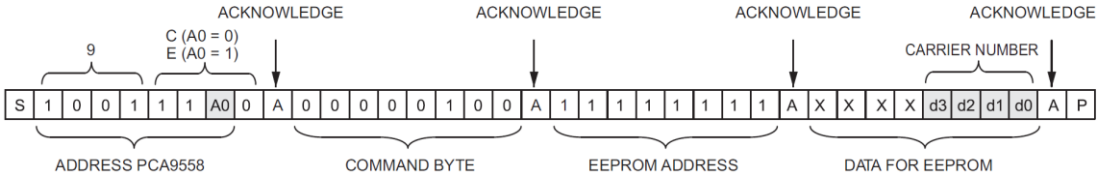
The electronic DIP switch is connected to the lower four bits of the I/O lines of the PCF8574A I²C I/O expander, which connects to the MCH's private I²C bus. The MCH reads the DIP switch setting from the I/O expander, **adds one**, and uses the result as its Carrier Number.

Figure 6 – Carrier Number: I²C-Addresses

Item	I²C Address
PCA9558 – DIP Switch	0x9E or 0x9C
PCF8574A – I/O expander	0x3E

To change the Carrier Number with the electronic DIP switch, the following I²C command must be sent to the electronic DIP switch's EEPROM:

Figure 7 – Setting Carrier Number via Electronic DIP Switch



6. COOLING UNIT

The **NATIVE-C8** is equipped with two front-accessible Cooling Units, which are locked into the chassis by two captive knurled screws.

Figure 8 – Cooling Unit

Two connectors for intelligent Cooling Units are located on the upper and lower side of the backplane.

Figure 9 – Cooling Unit Connector

Table 2 – Cooling Unit Connector: Pin Assignment

Pin	A	B	C
1	+12V	+12V	+12V
2	+12V	+12V	+12V
3	+12V	+12V	GND
4	GND	GND	GND
5	3.3V MP	CU_ENABLE	CU_PRESENT
6	IPMB0_SCL_A	IPMB_SDA_A	IPMB_SCL_B
7	IPMB_SDA_B	GA0	GA1
8	GA2	GND	GND
9	GND	GND	GND
10	nc	nc	nc
11	nc	nc	nc
12	GND	GND	GND
13	Air Filter Present	GND	GND
14	nc	nc	nc
15	nc	nc	nc
16	nc	nc	nc

6.1. Fan Tray

Every Fan Tray contains three 12 VDC fans, each with a performance of 224 cfm (380 m^3/h).

A hot-swap push button is used to provide hot-swap functionality. Once the operator pushes the hot-swap switch, the **NAT-MCH** is informed that the Cooling Unit is about to be removed. The blue Hot-Swap LED is turned to solid ON, when the Cooling Unit can safely be extracted.

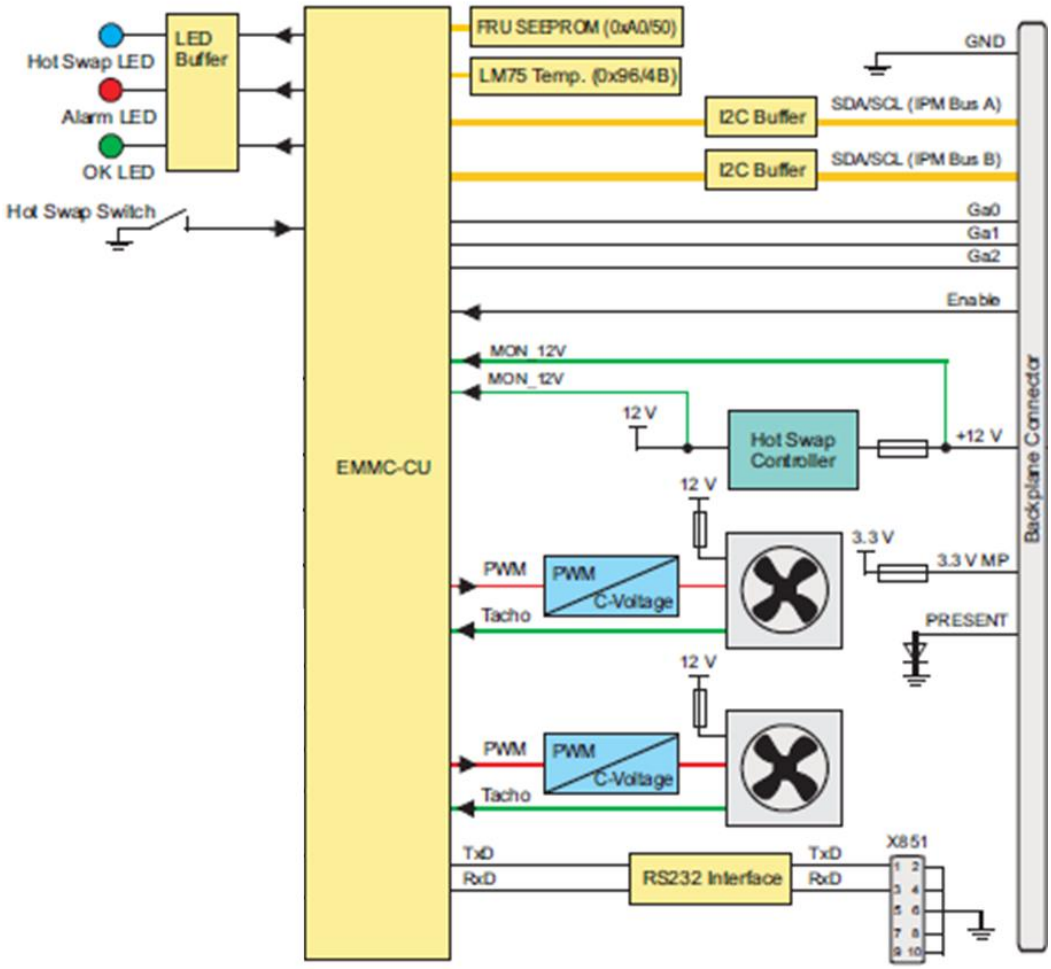
Table 3 – LED Functionality

LED	Colour	Status	Function
OK	Green	OFF	No power to the Cooling Unit
		Solid ON	Normal operation
⚠	Red	Solid ON	Attention Status (error condition)
HS	Blue	OFF	In use
		Short blinking	Preparing for extraction
		Solid ON	Ready to remove

6.2. Smart Fan Controller with EMMC

A Schroff MicroTCA Smart Fan Controller (SFC) is located on each Cooling Unit, which controls fan speed and provides hot-swap functionality. The SFC has an Enhanced Module Management Controller (EMMC) onboard, that communicates with the Carrier Manager over IPMB-0.

Figure 10 – Smart Fan Controller Block Diagram



Every five seconds the IPMI command GET_DEVICE_ID is sent to the **NAT-MCH** to check the connection. If after five consecutive attempts no acknowledge is received, the EMMC sets the Cooling Unit to Local Mode and increases the fan speed to the maximum.

Figure 11 – Cooling Units: I^2C-Addresses

Item	I^2C Address
Upper Cooling Unit	0xAA
Lower Cooling Unit	0xA8

6.3. SFC Serial Interface

The Smart Fan Controller owns a serial interface for debugging and firmware update option.

Figure 12 – SFC Serial Interface

Figure 13 – Pin Assignment SFC Serial Interface

Pin	Signal
1	TxD
3	RxD
2,4,6,8,10	GND

6.4. Air Filter

The **NATIVE-C8** features an Air Filter, which is also accessible from the front. The filter meets the requirements of the Telcordia Technologies Generic Requirements GR-78-CORE specification.

Figure 14 – Air Filter

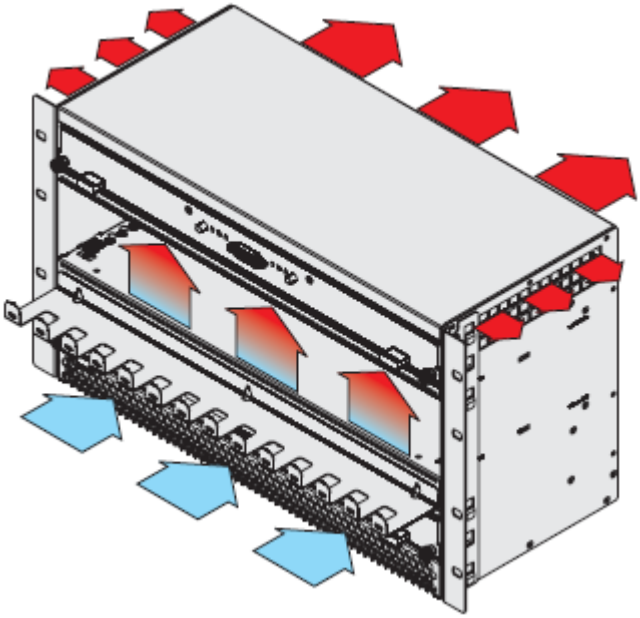
1. Filter Element
2. Handle
3. Spring Mounted Ball Lock
4. Filter Tray

It can be removed by pulling the air filter's handle. To re-install, push the air filter into the guide rails at each side of the shelf until the spring mounted ball lock engage.

6.5. Air Flow Direction

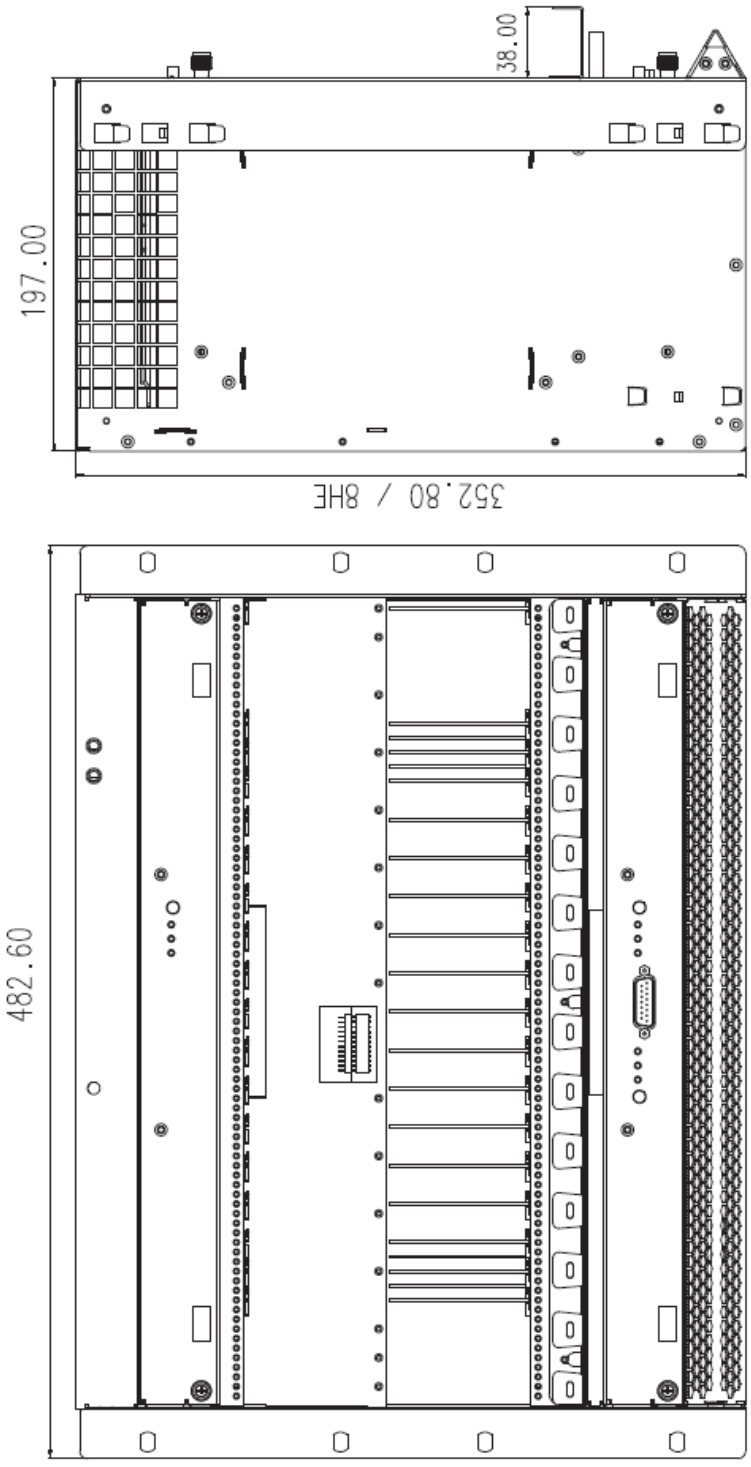
As illustrated by the picture below, air flow direction is from bottom-front to top.

Figure 15 – Airflow Direction



7. SHELF DIMENSIONS

Figure 16 – Shelf Dimensions



8. SPECIFICATION AND COMPLIANCES

8.1. Internal Reference Documentation

Find the latest documentation on our website: https://www.nateurope.com

- **NAT-PM-AC600D/AC1000**
- **NAT-MCH-PHYS/-PHYS80** Technical Reference Manual
- **NAT-MCH** User's Manual

8.2. External Reference Documentation

- Texas Instruments PCF8574A I/O Expander
  https://www.ti.com/lit/ds/symlink/pcf8574a.pdf?ts=1640255883644&ref_url=https%253A%252F%252Fwww.google.com%252F
- NXP PCA9558 Electronic DIP Switch
  https://www.nxp.com/docs/en/data-sheet/PCA9558.pdf

8.3. Standards Compliance

- Telcordia NEBS GR-78-CORE
- PICMG AMC.0
- PICMG MTCA.0

8.4. Compliance to RoHS Directive

According to RoHS-Directive 2017/2102/EU, the **NATIVE-C8** complies to EN 50581:2012

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.

8.5. 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.

8.6. Compliance to EMC Directive

According to Electromagnetic Compatibility (EMC) Directive 2014/30/EU, the **NATIVE-C5/-R5** complies to

VG 95373-15

A 'CE' sign can be found on the product and/or the packing.

8.7. Compliance to REACH

The REACH EU regulation 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.

8.8. Abbreviation List

Table 4 – Abbreviation List

Abbreviation	Description
AMC	Advanced Mezzanine Card
CFM	Cubic Feet per Minute
CPU	Central Processing Unit
CU	Cooling Unit
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMMC	Enhanced Module Management Controller
FCLK	Fabric Clock
FRU	Field Replaceable Unit
GbE	Gigabit Ethernet
HDD	Hard Disk Drive
HS	Hot Swap
I^2C	Inter-Integrated Circuit
I/O	Input/Output
IPMB	Intelligent Platform Management Bus, I^2C-Type
IPMI	Intelligent Platform Management Interface
JTAG	Joint Test Action Group
µTCA/MTCA	Micro Telecommunications Computing Architecture
MCH	MTCA Carrier Hub
PCIe	Peripheral Component Interconnect Express
PM	Power Module
SAS	Serial Attached SCSI
SATA	Serial Advanced Technology Attachment
SFC	Smart Fan Controller
TCKL	Telecom Clock
U	Rack **U**nit (height)
VDC	Unit: Volts – Direct Current

9. DOCUMENT'S HISTORY

Table 5 – Document's History

Rev	Date	Description	Author
1.0	16.04.2009	• Initial Version	Schroff GmbH
1.1	4.10.2018	• Adaption to N.A.T.-Layout • Deleted chapter 3.7 due to redundancy • Deleted Chapter 4.9 and other Telco alarm related items • Deleted Chapter 6 • Minor corrections (e.g., typos)	Se/vd
1.2	20.10.2022	• Update to current layout • Reworked whole document	se