1U 4-slot MTCA Shelf

User‘s Manual

Product Number:

11850-029

Doc-No: 63972-397_R1.1

July 2021

R1.0	November 2020	Initial release
R1.1	July 2021	Pinout eCLK Module corrected

Impressum:

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The details in this manual have been carefully compiled and checked - supported by certified Quality Management System to EN ISO 9001/2000

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1 Safety

The intended audience of this User's Manual is system integrators and hardware/software engineers.

1.1 Safety Symbols used in this document

	**Hazardous voltage!** *This is the electrical hazard symbol. It indicates that there are dangerous voltages inside the Shelf.*

	**Caution!** *This is the user caution symbol. It indicates a condition where damage of the equipment or injury of the service personnel could occur. To reduce the risk of damage or injury, follow all steps or procedures as instructed.*

	**Danger of electrostatic discharge!** *The Shelf contains static sensitive devices. To prevent static damage you must wear an ESD wrist strap.*

1.2 General Safety Precautions

	**Warning!** *Voltages over 60 VDC can be present in this equipment. As defined in the PICMG 3.0 Specification, this equipment is intended to be accessed, to be installed and maintained by qualified and trained service personnel only.*

- Use of this product in a manner not specified by the manufacturer may impair the safety protection of this equipment.
- Service personnel must know the necessary electrical safety, wiring and connection practices for installing this equipment.
- Install this equipment only in compliance with local and national electrical codes.
- For additional information about this equipment, see the PICMG MicroTCA Specification (www.picmg.com).

1.3 References and Architecture Specifications

- PICMG® MTCA.0 Specification (www.picmg.com)
- PICMG® AMC® Base Specification (www.picmg.com)

2 Hardware Platform

2.1 Introduction

The 4-slot SCHROFF MicroTCA System is designed to accommodate two double Mid-size AMC modules with RTM and 2 Single Mid-size AMCs for maximum computing power in minimal space.
The integrated eMCH (Embedded MicroTCA Carrier Hub), power supply and cooling unit allow easy servicing.
The SCHROFF MTCA.4 1U System contains power and cooling management mechanisms to ensure a high degree of reliability.
The system components are linked directly to the existing network infrastructure using an 1 GbE switch connected to an 1 GbE uplink.

The System allows the integration of an optional 3rd party eCLK module that routes external clock and trigger signals to the AMC slots.

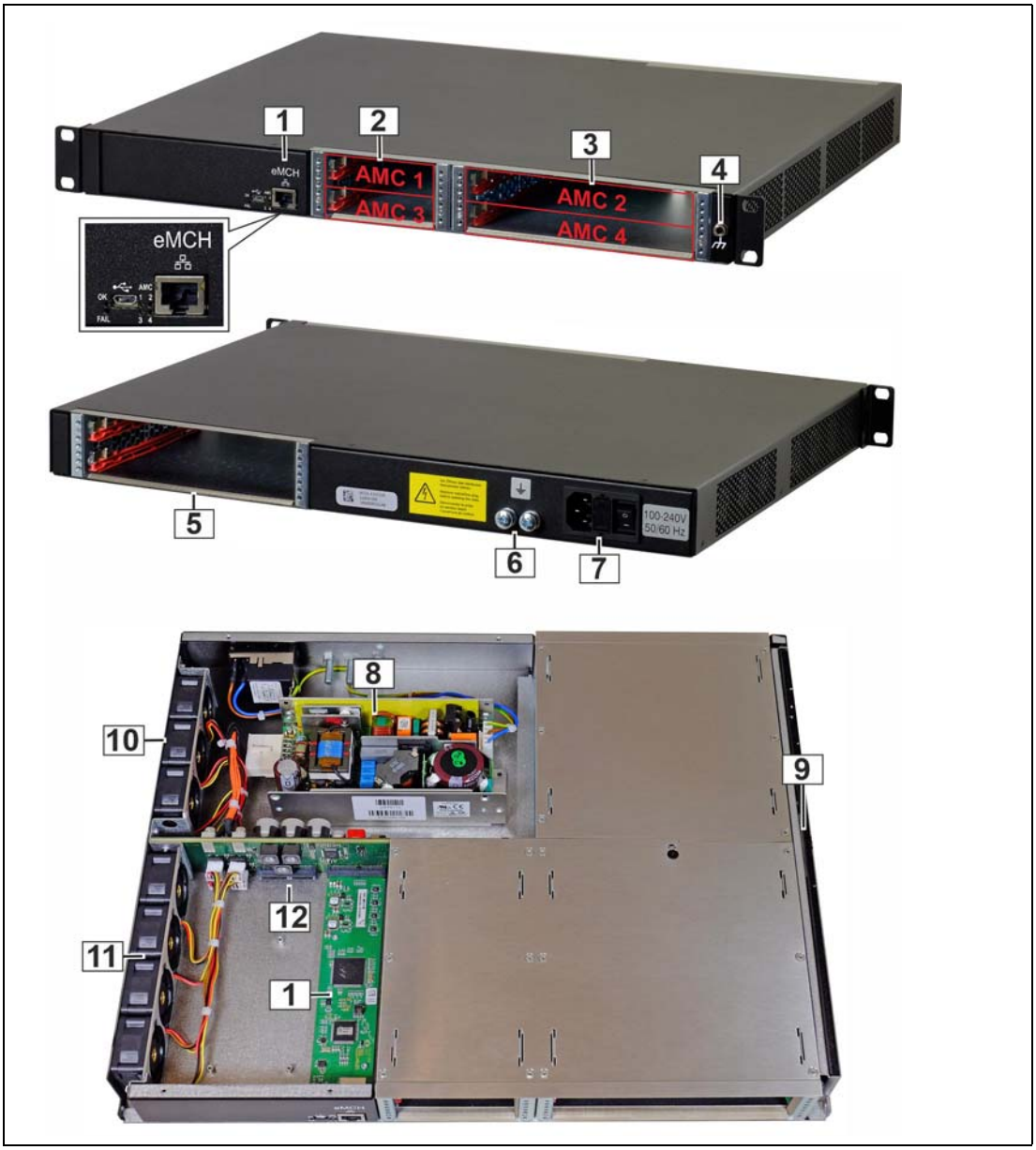
Features:

- Shielded steel case
- 2 AMC Double Mid-size slots with RTM slots
- 2 AMC Single Mid-size slots
- MicroTCA Backplane
- EMCH (Embedded MicroTCA Carrier Hub) with GbE uplink and USB
- Power management controller on the backplane
- Built-in fan unit with MTCA Cooling Unit Management
- Side-to-side cooling with air filter
- Integrated 400 W AC Power Supply with wide range AC input and 12 V DC output.
- AC mains/line module with IEC 60320-C14 connector, integrated mains/line fuses and mains switch
- 1 U height, 19” width, 373 mm depth
- Fat pipe /extended fat pipe lanes prepared for 40 GbE and PCIe Gen3

Note: *To achive a maximum height of 1 U, the card cage is installed rotated by 180°. This must be considered when installing the AMC modules!*

2.2 Front and Rear View

Figure 1: Front and RearView



1	eMCH	7	AC input with Mains/line switch and fuse
2	AMC slots 1 & 3	8	PSU
3	AMC slots 2 & 4	9	Air filter
4	ESD Wrist Strap Terminal	10	Fans rear section
5	RTM slots	11	Fans front section
6	Ground Terminal (Equipotential bonding)	12	Connector for 3rd party eCLK module

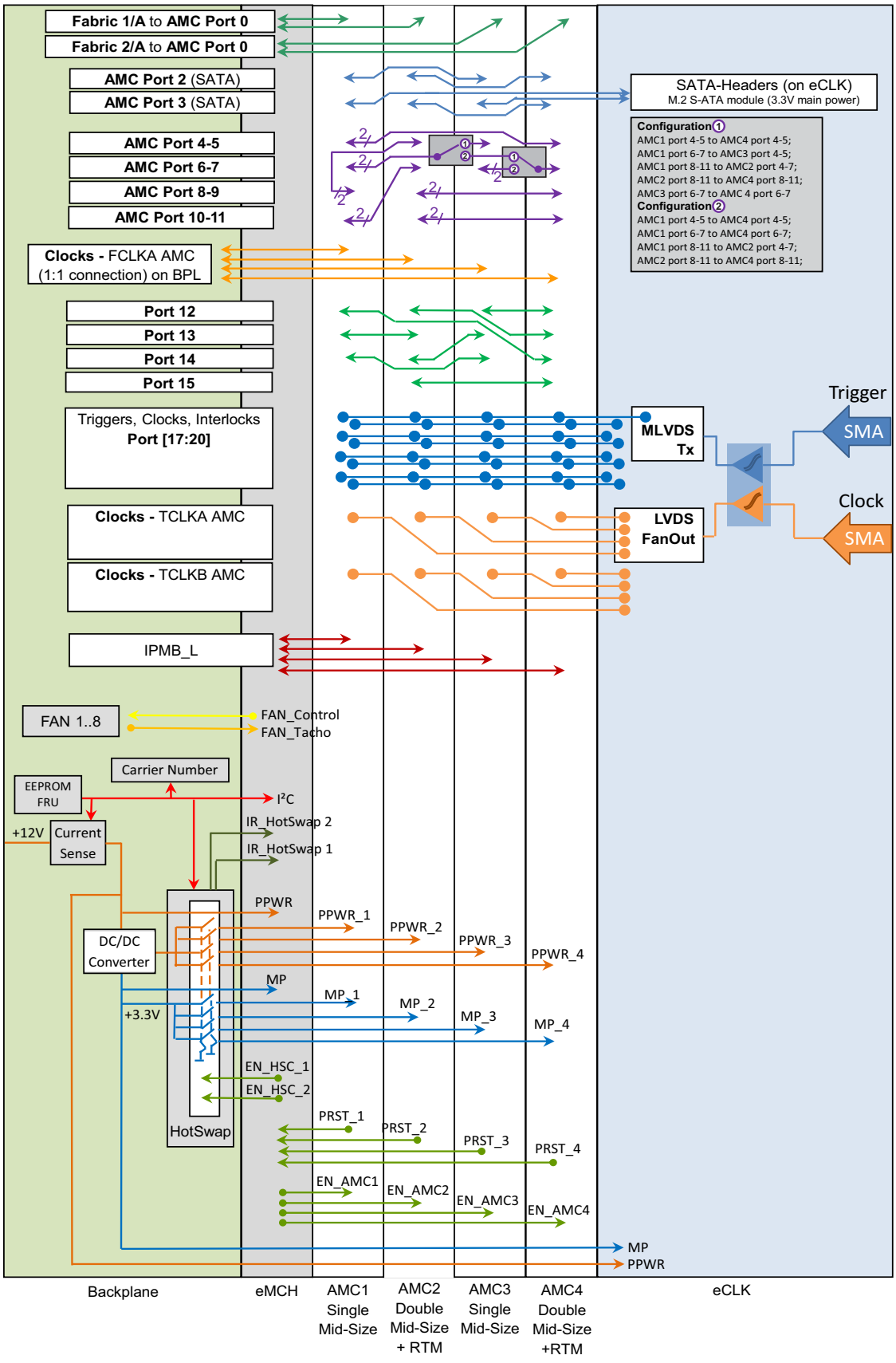
2.3 ESD Wrist Strap Terminal

	**Danger of electrostatic discharge!** *The Shelf contains static sensitive devices. To prevent static damage you must wear an ESD wrist strap.*

The ESD Wrist Strap Terminal (4 mm banana jack) is located right to the card cage.

3 Backplane

3.1 Backplane Topology



3.2 Backplane Features

- GbE Links from MCH to all AMC Slots
- Direct S-ATA / SAS connections:
  - AMC 1 <-> AMC 3: Port 2
  - AMC 2 <-> AMC 4: Port 3
  - AMC 1 & 3: Port 3 <-> SATA Headers on eCLK connector
- Fat pipe and extended fat pipe contains 4 PCIe Gen 3 x4 MUX's that allows the user to select through the eMCH two different fat pipe / extended fat pipe configurations

  Configuration 1
  - AMC1 port 4-5 to AMC4 port 4-5;
  - AMC1 port 6-7 to AMC3 port 4-5;
  - AMC1 port 8-11 to AMC2 port 4-7;
  - AMC2 port 8-11 to AMC4 port 8-11;
  - AMC3 port 6-7 to AMC 4 port 6-7

  Configuration 2
  - AMC1 port 4-5 to AMC4 port 4-5;
  - AMC1 port 6-7 to AMC4 port 6-7;
  - AMC1 port 8-11 to AMC2 port 4-7;
  - AMC2 port 8-11 to AMC4 port 8-11

Note:
As 4 PCIe MUX's are in the fat pipe / extended fat pipe backplane signal lines, only AMC modules that support PCIe on fat pipe / extended fat pipe can be installed.

- FCLK for PCIe Gen3 clock generated on backplane
- eMCH / Backplane provide power and cooling unit functionality

3.3 Intelligent Platform Management Bus (IPMB)

MicroTCA uses an Intelligent Platform Management Bus (IPMB) for management communications.

3.3.1 IPMB-L

Radial IPMB from eMCH to the AMCs.

3.4 Power Management

The integrated power management circuitry on the backplane provides 12 V payload power distribution branches to the AMC Slots. It also generates the 3.3 V management power and distributes it to all slots.

The current to the AMC slots is limited to:

- 8 A (Payload Power)
- 250 mA (Management Power)

3.5 Third party clock module

The system provides a connector and mounting space for a third party clock module.

Clock Module Connector Pinout

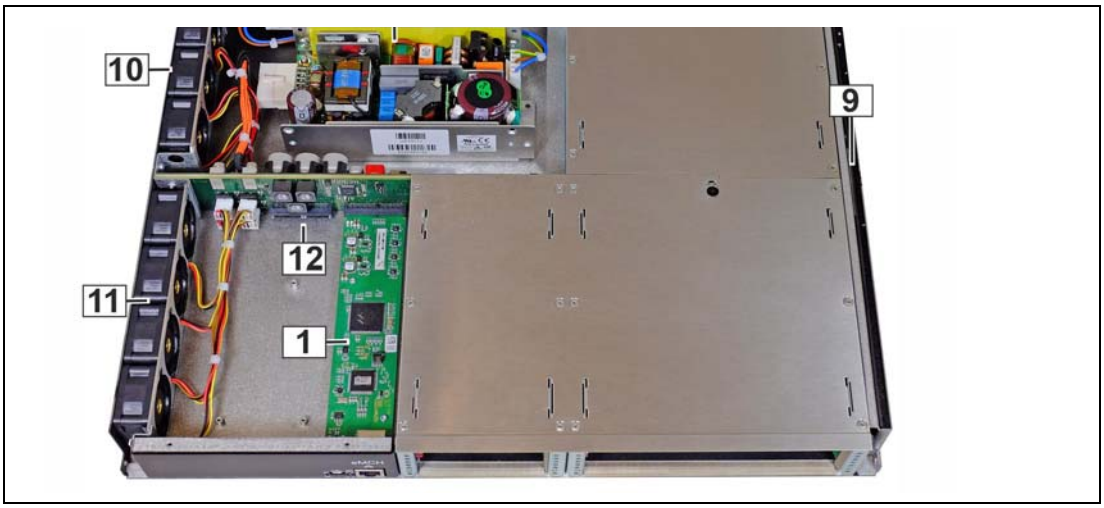
Pin	Signal name	Direction	Functionality/Description	Notes
1	PS1_eClock#	out	Presence signal of the eClock module, active low	
2	GA0 / RFU	passive	Geographic Address 0 / Reserved for	
3	IPMBL-SCL-eClock	inout	IPMB-L clock line	Connect to the eMCH EEPROM FRU I2C line or future IPMBL
4	MP	power	Management Power 3V3	
5	IPMBL-SDA-eClock	inout	IPMB-L data line	Connect to the eMCH EEPROM FRU I2C line or future IPMBL
6	TxFA_eClock+	out	Port 0 (MCH Fabric A) Ethernet link TX +	Configuration Interface from backplane or intelligent eClock connected to Common Options
7	GND		Ground	
8	TxFA_eClock-	out	Port 0 (MCH Fabric A) Ethernet link TX -	Configuration Interface from backplane or intelligent eClock connected to Common Options
9	RxFA_eClock+	in	Port 0 (MCH Fabric A) Ethernet link RX +	Configuration Interface from backplane or intelligent eClock connected to Common Options
10	GND		Ground	
11	RxFA_eClock-	in	Port 0 (MCH Fabric A) Ethernet link RX -	Configuration Interface from backplane or intelligent eClock connected to Common Options
12	TxFB-1-eClock+ / AMC1_TCLKD+	inout	AMC1 port 2 to eClock TX + / TCLKD to AMC1 +	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
13	GND		Ground	
14	TxFB-1-eClock- / AMC1_TCLKD-	inout	AMC1 port 2 to eClock TX - / TCLKD to AMC1 -	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
15	RxFB-1-eClock+ / AMC1_TCLKC+	inout	AMC1 port 2 to eClock RX + / TCLKC to AMC1 +	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
16	TxFB-3-eClock+ / AMC3_TCLKD+	inout	AMC3 port 2 to eClock TX + / TCLKD to AMC3 +	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
17	RxFB-1-eClock- / AMC1_TCLKC-	inout	AMC1 port 2 to eClock RX - / TCLKC to AMC1 -	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
18	TxFB-3-eClock- / AMC3_TCLKD-	inout	AMC3 port 2 to eClock TX - / TCLKD to AMC3 -	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
19	RxFB-3-eClock+ / AMC3_TCLKC+	inout	AMC3 port 2 to eClock RX + / TCLKC to AMC3 +	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
20	GND		Ground	
21	RxFB-3-eClock- / AMC3_TCLKC-	inout	AMC3 port 2 to eClock RX - / TCLKC to AMC3 -	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
22	TxFB-2-eClock+ / AMC2_TCLKD+	inout	AMC2 port 2 to eClock TX + / TCLKD to AMC2 +	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
23	GND		Ground	
24	TxFB-2-eClock- / AMC2_TCLKD-	inout	AMC2 port 2 to eClock TX - / TCLKD to AMC2 -	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
25	RxFB-2-eClock+ / AMC2_TCLKC+	inout	AMC2 port 2 to eClock RX + / TCLKC to AMC2 +	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
26	TxFB-4-eClock+ / AMC4_TCLKD+	inout	AMC4 port 2 to eClock TX + / TCLKD to AMC4 +	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
27	RxFB-2-eClock- / AMC2_TCLKC-	inout	AMC2 port 2 to eClock RX - / TCLKC to AMC2 -	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
28	TxFB-4-eClock- / AMC4_TCLKD-	inout	AMC4 port 2 to eClock TX - / TCLKD to AMC4 -	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
29	RxFB-4-eClock+ / AMC4_TCLKC+	inout	AMC4 port 2 to eClock RX + / TCLKC to AMC4 +	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
30	GND		Ground	
31	RxFB-4-eClock- / AMC4_TCLKC-	inout	AMC4 port 2 to eClock RX - / TCLKC to AMC4 -	Future use for SATA/NVME drive on eClock or intelligent eClock connected to FatPipe
32	MLVDS-19-RX+	inout	Bus LVDS Port 19 RX+	

Pin	Signal name	Direction	Functionality/Description	Notes
33	GND		Ground	
34	MLVDS-19-RX-	inout	Bus LVDS Port 19 RX-	
35	MLVDS-17-RX+	inout	Bus LVDS Port 17 RX+	
36	PP	power	Payload Power 12V	Current Capability 2.8A max (derated to 1.5A)
37	MLVDS-17-RX-	inout	Bus LVDS Port 17 RX-	
38	MLVDS-19-TX+	inout	Bus LVDS Port 19 TX+	
39	PP	power	Payload Power 12V	Current Capability 2.8A max (derated to 1.5A)
40	MLVDS-19-TX-	inout	Bus LVDS Port 19 TX-	
41	MLVDS-17-TX+	inout	Bus LVDS Port 17 TX+	
42	GND		Ground	
43	MLVDS-17-TX-	inout	Bus LVDS Port 17 TX-	
44	MLVDS-20-RX+	inout	Bus LVDS Port 20 RX+	
45	GND		Ground	
46	MLVDS-20-RX-	inout	Bus LVDS Port 20 RX-	
47	MLVDS-18-RX+	inout	Bus LVDS Port 18 RX+	
48	PP	power	Payload Power 12V	Current Capability 2.8A max (derated to 1.5A)
49	MLVDS-18-RX-	inout	Bus LVDS Port 18 RX-	
50	MLVDS-20-TX+	inout	Bus LVDS Port 20 TX+	
51	PP	power	Payload Power 12V	Current Capability 2.8A max (derated to 1.5A)
52	MLVDS-20-TX-	inout	Bus LVDS Port 20 TX-	
53	MLVDS-18-TX+	inout	Bus LVDS Port 18 TX+	
54	GND		Ground	
55	MLVDS-18-TX-	inout	Bus LVDS Port 18 TX-	
56	AMC3_TCLKA+	out	TCLKA from eClock to AMC3 +	
57	GND		Ground	
58	AMC3_TCLKA-	out	TCLKA from eClock to AMC3 -	
59	AMC1_TCLKA+	out	TCLKA from eClock to AMC1 +	
60	GND		Ground	
61	AMC1_TCLKA-	out	TCLKA from eClock to AMC1 -	
62	AMC4_TCLKA-	out	TCLKA from eClock to AMC4 -	
63	GND		Ground	
64	AMC4_TCLKA+	out	TCLKA from eClock to AMC4 +	
65	AMC2_TCLKA-	out	TCLKA from eClock to AMC2 -	
66	GND		Ground	
67	AMC2_TCLKA+	out	TCLKA from eClock to AMC2 +	
68	AMC4_TCLKB-	in	TCLKB from AMC4 to eClock -	
69	GND		Ground	
70	AMC4_TCLKB+	in	TCLKB from AMC4 to eClock +	
71	AMC1_TCLKB-	in	TCLKB from AMC1 to eClock -	
72	GND		Ground	
73	AMC1_TCLKB+	in	TCLKB from AMC1 to eClock +	
74	AMC3_TCLKB+	in	TCLKB from AMC3 to eClock +	
75	GND		Ground	
76	AMC3_TCLKB-	in	TCLKB from AMC3 to eClock -	
77	AMC2_TCLKB+	in	TCLKB from AMC2 to eClock +	
78	GND		Ground	
79	AMC2_TCLKB-	in	TCLKB from AMC2 to eClock -	
80	EN_eClock#	in	Enable signal from MCH, active low	

4 Cooling

4.1 Air Filter

Figure 2: Air Filter



9 Air Filter

4.2 Air filter swap

The system provides a replaceable air filter. The air filter can be pulled out after removing the top cover. The filter meets the requirements of the Telcordia Technologies Generic Requirements GR-78-CORE specification.

4.3 Cooling

The MicroTCA Shelf is equipped with seven 12 VDC fans for cooling the AMC modules and the power supply. The fans are controlled as a group by the EMCH.

The air flow is from the right side to the left side.

4.4 Power Supply

Hazardous voltage!

Parts of the power supply may be exposed with hazardous voltage.
Always remove mains/line connector before carry out any assembly work.

Caution!

The unit is designed in accordance with protection class 1! It must therefore be operated with protective earth/GND connection. Use only a three conductor AC power cable with a protective earth conductor that meets the IEC safety standards!

Caution!

There is a ground terminal at the right side. This ground terminal is only for equipotential bonding. Grounding is achieved through the protective earth conductor of the power cable!

The system has a 400 W open frame AC power supply with wide range AC input and 12 VDC output. The DC output is connected directly to the power management circuitry on the backplane.

The power input is provided by an AC mains/line module with IEC 60320-C14 connector, integrated mains/line fuses, line filter and a mains/line switch.

Fuse value is T6.3AH250V.

Figure 3: AC Input

1 AC Input
2 Mains switch
4 Fuse holder

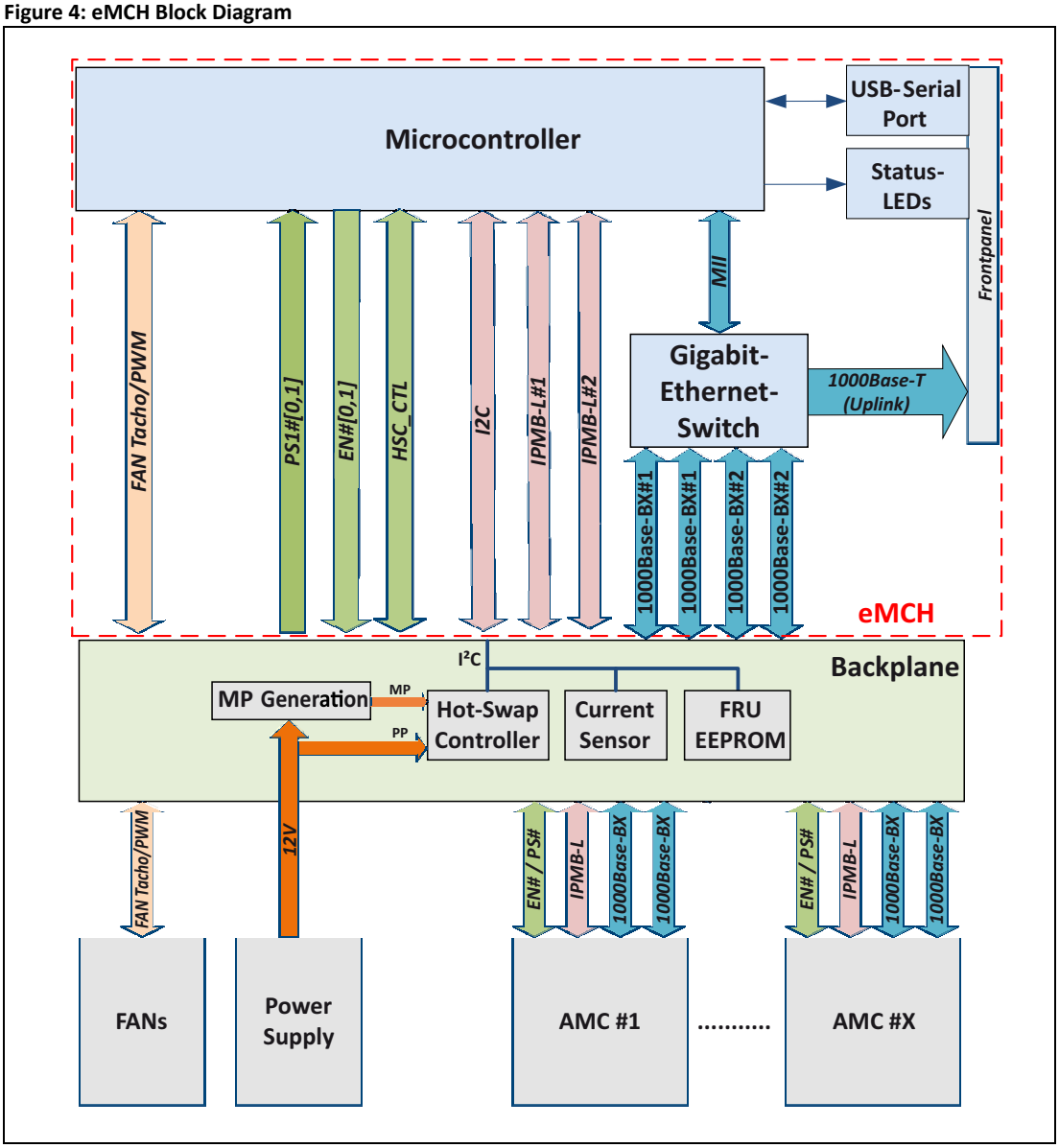
Table 1: Data AC Power Supply

Input voltage	100 - 240 VAC
Mains Frequency	50 / 60 Hz
Output (max.)	400 W
Output voltage	12 V DC
Output voltage ripple and noise	120 mVpp
Operating Temperature	-5° C - +55° C

5 eMCH (embedded MicroTCA Carrier Hub)

The eMCH (embedded MicroTCA Carrier Hub) is intended to provide basic MicroTCA functionality for switching and managing AMC (Advanced Mezzanine Card) modules.
It delivers switching and hub functionality for the system fabric gigabit ethernet (GbE) as defined in the AMC.0 standard series.
Furthermore it supports the typical hot swap management and its transition state machine (M0 to M6) for each AMC module. In addition to that, the embedded MCH monitors and verifies local sensor data of the chassis and installed FRU devices and supplies MicroTCA power and cooling concepts by accessing the chassis integrated power supply and fan coolers.
Remote administration can be done locally over the CLI (Command Line Interface) served by the front USB port.

Figure 4: eMCH Block Diagram



5.1 Front Panel and LEDs

The eMCH front panel consists of 4 status LEDs for the AMCs, and 2 LEDs (OK, FAIL) for the system's operation status. In addition to the LEDs, you can find sockets for a RJ45 plug and a micro USB cable.

Figure 5: EMMC Front Panel

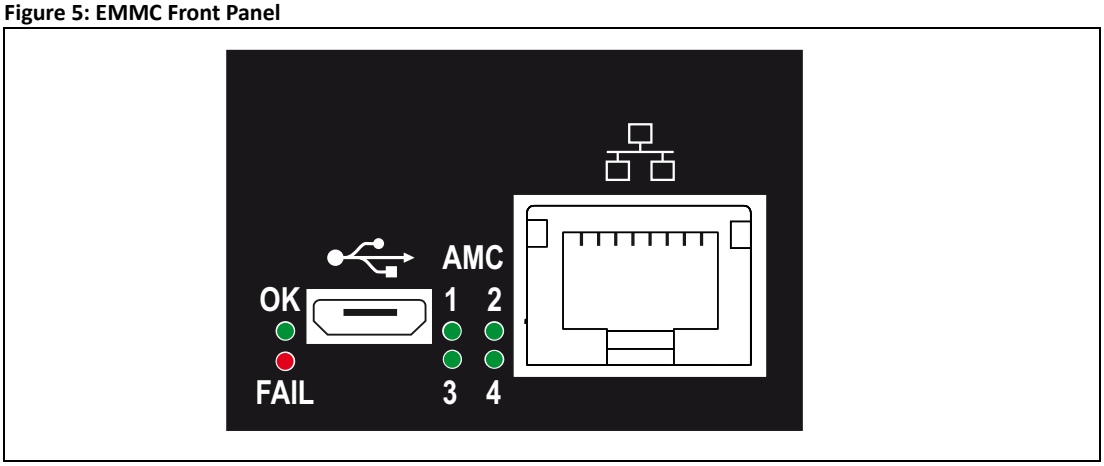


Table 2: EMCH front panel

Type	Function
LED AMC 1....AMC 4	Blink Short: Reading FRU information (M1) Blink Slow: Waiting for HS-Handle being closed (M1) ON: FRU operating state (M4) OFF: No Module installed
LED OK	Blink Slow: - Blink Short: Test Mode ON: Normal operating status. No error OFF:-
LED FAIL	Blink Slow: - Blink Short: - ON: Hard fault OFF: -
Micro USB Type A	Used for virtual COM-Port. Direct connection to PC
RJ45 Gigabit-Ethernet	1000Base-T Uplink for remote control

- Note: When executing the bootloader, all LEDs will be put on.

5.2 Command Line Interface (CLI)

The EMCH is providing a low level command line interface (CLI) which allows to set certain operational parameters and to display run time information from the MCH and the system.

5.2.1 COM-Settings

The CLI can be accessed over the front MicroUSB port. To establish a connection to a host PC, use a serial terminal program e.g. Terra-Term, HTerm, Putty, e.g.

Configure the COM port settings as followed:

Table 3: COM port settings

Baudrate	115200
Data	8 bit
Parity	None
Stop	1 bit
Flow control	None
COM	The devices COM address defined by host

If the terminal is opened, press enter to see if the connection is established successfully. You can now type “help” to see the list of available commands. Press enter to call the previous command again.

NOTE: Depending on your operating system, you need to download and install the FTDI-chip driver manually. Drivers can be downloaded at http://www.ftdichip.com/FTDrivers.htm. Installing the driver automatically by the windows update may take up to a few minutes.

Table 4: Basic CLI Commands

Command	Parameter	Description
bi		**Board Information** Prints the vital product information record (i.e. Serial number, Hardware revision and release codes).
ip	<ip> <netmask> <gateway>	**IP configuration** Configures IP addresses, net mask, broadcast address and gateway. Parameters have to be in dotted representation <x.x.x.x>
ni		**Print network configuration**
ti		**Print task information**
bl		**Starts the bootloader**
show_localsensors		**Show local sensor information of the chassis**
show_fru		**Show all FRU’s**
show_fruinfo	<fru_id>	**FRU contents** Shows the contents of a FRU device selected by <fru_id>. For valid FRU numbers please refer to MTCA R1.0 table 3-3
show_sensorinfo	<fru_id>	**Shows the sensor values of the selected FRU**
show_pm		**Power Module Status** Shows the actual power allocation status for all AMC modules
reboot		**Reboot the eMCH**
password	<old_password> <new_password>	**Changes the web password for accessing the update service**

5.3 Setting the fat pipe / extended fatpipe configurations

The 2 different fat pipe / extended fat pipe configurations are set via a PCIe MUX. For the setting you must open the configuration menue in eMCH.

- Connect your host PC to the USB port and start your terminal program
- Power-up the system (eMCH)
- During the booting process you can see the current configuration

```
eMCH on platform: NATIVE-R1-MINI
Set PCIexpress MUX: 0x00: OK! - Read back: 0x00
```

Note: *The factory default is configuration 1 = 0x00*

Configuration 2 = 0x24

- To change the configuration enter:

```
cfg
```

- and go through the settings list by hitting the RETURN button until you reach the topic “Use alternate PCIexpress configuration“
- Type “y“ and hit RETURN
- Go to the end of the list and save the changes to flash
- Reboot

```
-----------------------------------
CFG: configuration modes
  [ 0] no action
  [ 1] print complete configuration
  [ 2] modify MCH global configuration
  [ 3] modify ShM configuration
  [ 4] modify CM configuration
  [ 5] modify SEL configuration
  [ 6] modify DHCP configuration
  [128] reset to defaults
  [ q] quit and save configuration
Enter configuration mode (RET=q): 2
CFG global parameter:
---------------------
Remote interfaces:
  RMCP access: (BETA STATE)           enabled
  TELNET access:                      enabled
  WEB access:                         enabled
  RMCP session activity timeout minutes: 60 min
  RMCP session activity timeout seconds: 0 sec
```

```
Cooling parameter:
  Default fan level:                    30 %
  Enable alternative cooling scheme:    no
  FAN speed decrease time:              120

Ethernet interfaces:
  Front Uplink (RJ45) enabled           yes
  AMC1 port 0 enabled                   yes
  AMC2 port 0 enabled                   no
  AMC3 port 0 enabled                   yes
  AMC4 port 0 enabled                   no

PCIexpress configuration:               0 (Default)

MCH remote interfaces
  Enable RMCP access (y/n) (RET=y):
  Enable telnet access (y/n) (RET=y):
  Enable WEB access (y/n) (RET=y):
  RMCP session activity timeout minutes: 60 min
  RMCP session activity timeout seconds: 0 sec
    Enter session activity timeout (dec, minutes) (RET=60/
0x3c):
    Enter session activity timeout (dec, seconds) (RET=0/
0x0):
  Enable Telnet daemon inactivity timeout    (y/n) (RET=y):
  Enter telnet activity timeout (dec, minutes) (RET=120/
0x78):

Ethernet interfaces:
  Enable Front Uplink (RJ45) (y/n) (RET=y):
  Enable AMC1 port 0 (y/n) (RET=y):
  Enable AMC2 port 0 (y/n) (RET=n):
  Enable AMC3 port 0 (y/n) (RET=y):
  Enable AMC4 port 0 (y/n) (RET=n):

PCIexpress configuration:
  Use alternate PCIexpress configuration (y/n) (RET=n): y

MCH configuration flags:
  Enable AMC1 unmanaged mode   (y/n) (RET=n):

Cooling parameter:
```

```
  Enable alternative cooling scheme          (y/n) (RET=n):
  FAN speed decrease time (min) (RET=120/0x78):
  Enter default fan level (10-100%) (RET=30/0x1e):

-----------------------------------
CFG: configuration modes
  [ 0] no action
  [ 1] print complete configuration
  [ 2] modify MCH global configuration
  [ 3] modify ShM configuration
  [ 4] modify CM configuration
  [ 5] modify SEL configuration
  [ 6] modify DHCP configuration
  [128] reset to defaults
  [ q] quit and save configuration
Enter configuration mode (RET=q): q
Save config to FLASH? (y/n) (RET=n): y
CFG: configuration saved to FLASH.
CFG: configuration updated

nat>reboot
```

5.4 Firmware Update

The EMCH serves a web based front end to easily upgrade the devices firmware in field. To use this utility, first establish an ethernet link over the EMCH uplink port. If not changed, the standard interface config is as followed:

Table 5: Standard interface configuration

IP address:	192.168.1.138
Netmask:	255.255.255.0
Gateway:	0.0.0.0

Type http://192.168.1.138/ in your web browser or type “bl” in the command line interface to call the bootloader. Your browser should show the index page with a button “call bootloader”. By clicking on this button, a software reset will be triggered and the system will boot into the bootloader. Wait a few seconds and call http://192.168.1.138/ again. The page should have changed slightly and will prompt you to enter a password. By default, the password is “nat”. To leave the bootloader without touching anything, just click on “Leave Bootloader”.

By clicking on “submint” the upload page should open.

Now select a proper firmware image with the file extension “.srec”. Click upload to flash the image into the device memory.

NOTE: The upload process will take a few seconds, please don’t interrupt or close the browser while upgrading.

If succeed, the Message “File Upload Done” is shown. Click on “Reset MCU” to trigger a software reset. The device should now boot into the new firmware.

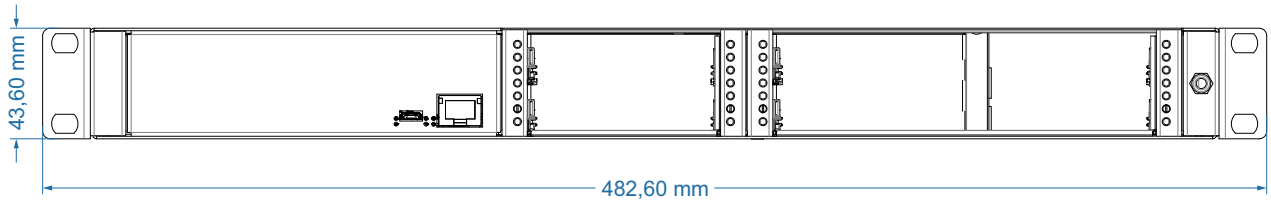
NOTE: If something went wrong during the firmware upgrade (e.g. lost of power or communication during file transfer), the device will boot into the bootloader again instead of loading the firmware. In this case you can easily repeat the firmware upgrade.

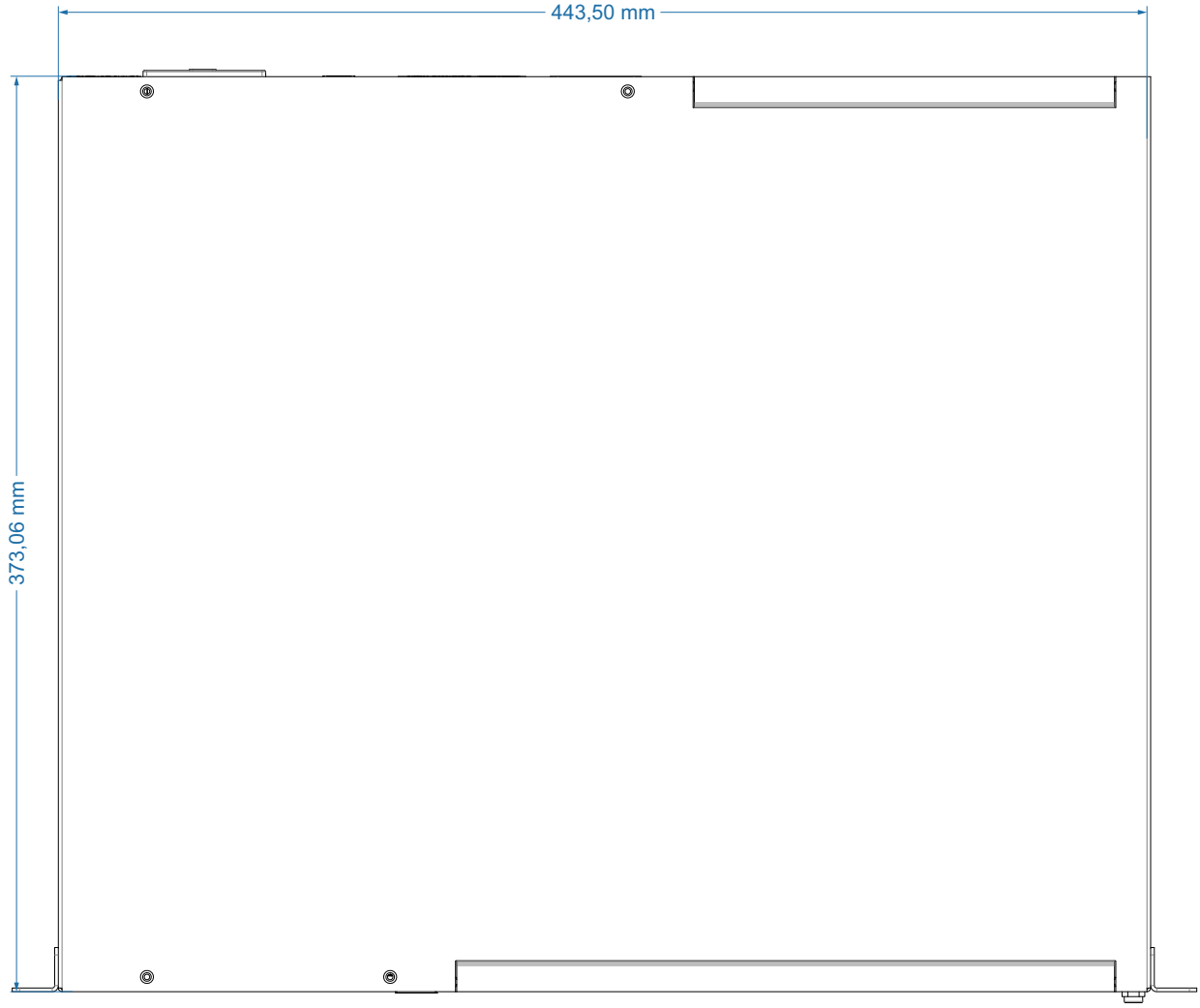
6 Technical Data

Table 6: Technical Data

Physical Dimensions	
Height	43.60 mm (1 U)
Width (with mounting brackets)	482.60 mm (19“)
Width (w.o. mounting brackets)	443.60 mm
Depth	approx. 373 mm
Weight	
Weight completely assembled	approx. 5.8 Kg
Power Supply	
Input Voltage	100 VAC to 240 VAC
Mains Frequency	50 Hz to 60 Hz
Input Current	max. 5.8 A
Input Fuse (2x)	T6.3AH250V
Environmental	
Ambient temperature	-5°C…+45°C (long term)
Ambient temperature	-5°C…+55°C (short term)
Humidity	+5%...+85%, non-condensing

6.1 Dimensions





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