NAT-MCH-RTM-ComEx
Type6 ComExpress Module carrier in MicroTCA.4 RTM form factor
Technical Reference Manual V1.0
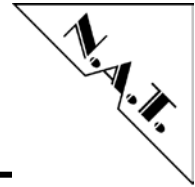**HW Revision 1.1**

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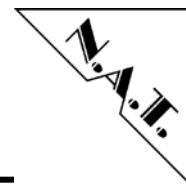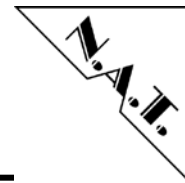

Table of Contents

List of Tables

List of Figures

Conventions

If not otherwise specified, addresses and memory maps are written in hexadecimal notation, identified by *0x*.

Table 1 gives a list of the abbreviations used in this document:

Table 1:   List of used abbreviations

Abbreviation	Description
b	Bit, binary
B	byte
AMC	Advanced Mezzanine Card
ASIC	Application Specific Integrated Circuit
CPU	Central Processing Unit
FPGA	Field Programmable Gate Array
µTCA	Micro Telecommunications Computing Architecture
PCI	Peripheral Component Interconnect
PCIe	PCI Express
RAM	Random Access Memory
RTM	Rear Transition Module
ROM	Read Only Memory
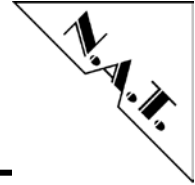
1 Introduction

The **NAT-MCH-RTM-ComEx** is a type 6 COM Express module carrier in a MicroTCA.4 RTM (Rear Transition Module) form factor. This RTM is compatible to the NAT-MCH-M4 but is available as a full-size module.

These special RTM is providing the option to have a full user accessible CPU that has connectivity to the MicroTCA fabric switches (Ethernet and PCIe) and all common face plate interfaces as a normal AMC. Since the **NAT-MCH-RTM-ComEx** is filling the gap behind the MCH which is available in most MTCA.4 systems there is no need for a separate AMC slot.

The user can choose between a wide spread of vendors providing type 6 ComExpress modules. This allows choosing the processor architecture and performance that fits best to the application.
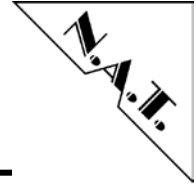
2 Overview

2.1 Major Features

- Compatible to type 6 ComExpress modules in Mini, Compact and Basic form factor
- COMExpress Interfaces:
    - Connectivity to MCH PCIe switch (x4 PCIe GenIII)
    - Ethernet MAC for connectivity to the MCH gigabit Ethernet switch
    - Com Express 1000Base-T Ethernet at face plate
    - Dual SATA connectivity to SATA devices on MCH
    - Dual Display port interface at face plate
    - Four USB 3.0 at face plate
- Micro SD Card slot
- Mini PCIe slot (including UID/SIM card slot)
- Bios Flash
- RMMC (Rear Transition Module Management Controller)
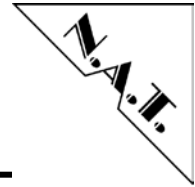
2.2 Block Diagram

The following figure shows a detailed block diagram of the **NAT-MCH-RTM-ComEx**.

Figure 1:   **NAT-MCH-RTM-ComEx – Block Diagram**
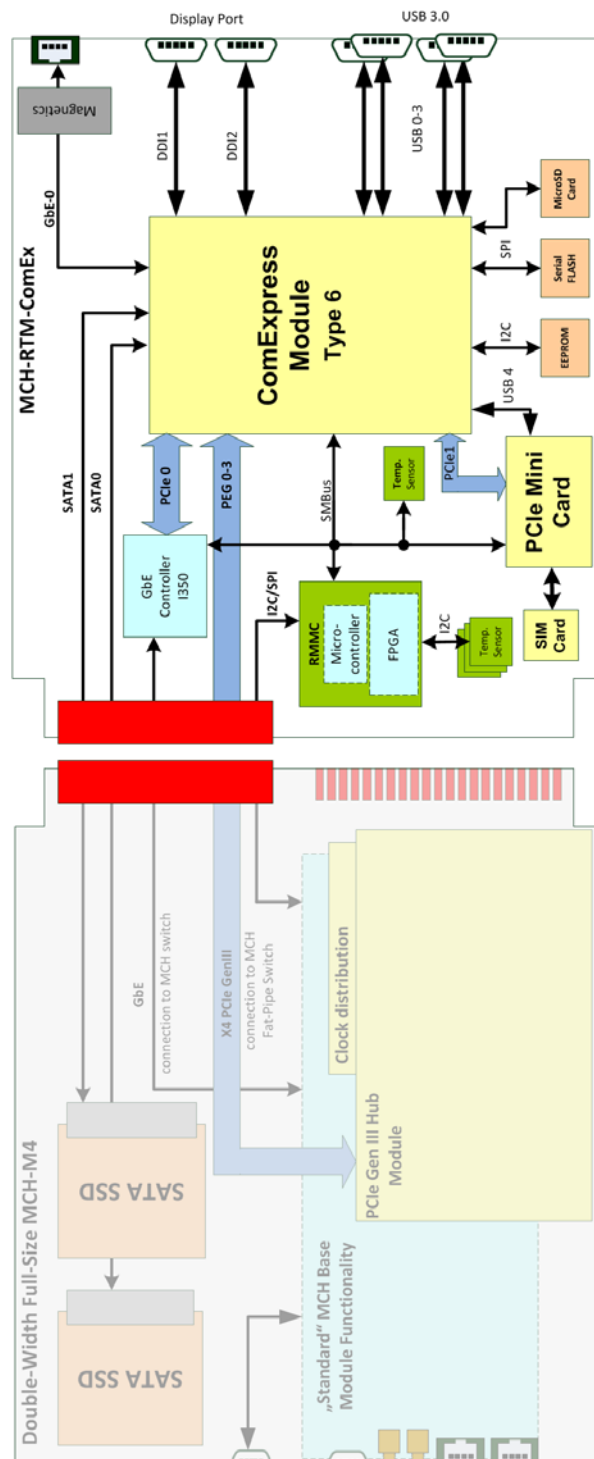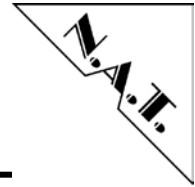
2.3 Location Overview

The position of important components is shown in the following location overview. Depending on the board type it might be that the board does not include all components named in the location diagram.

Figure 2:   NAT-MCH-RTM-ComEx – Location diagram – Top
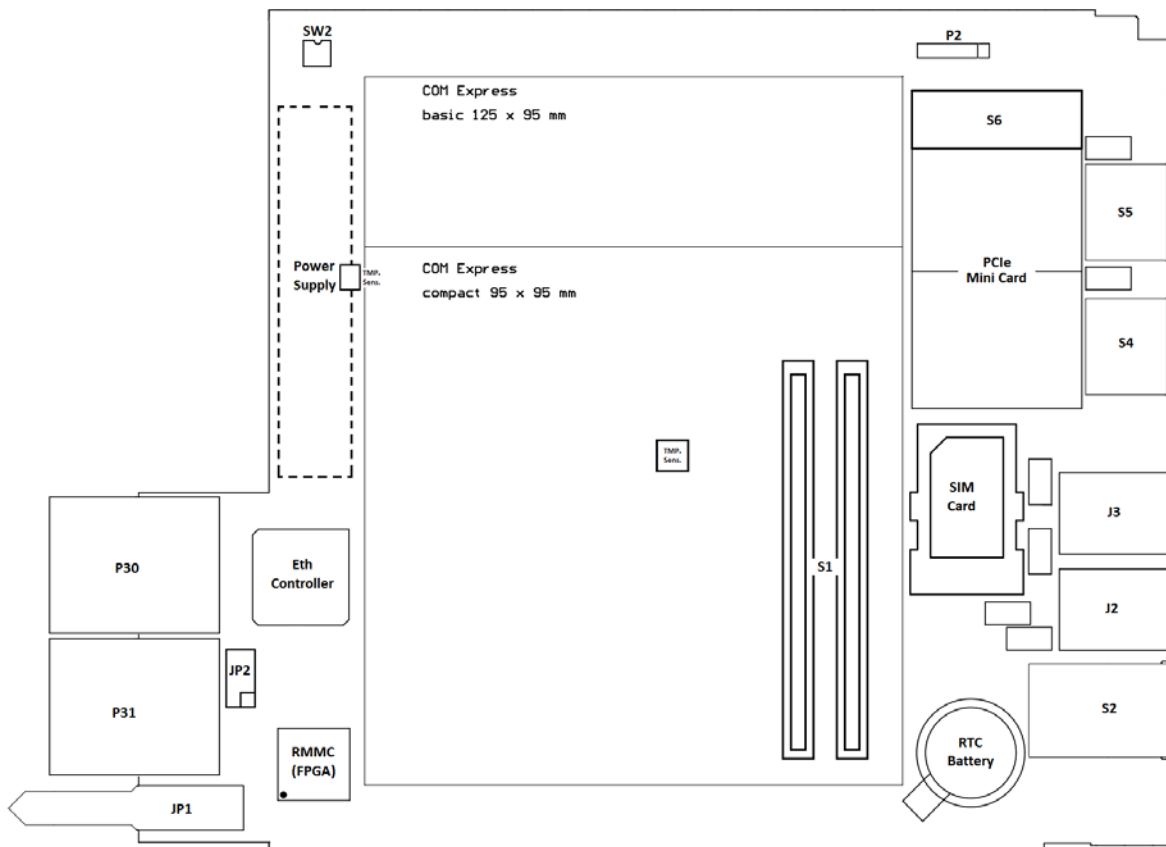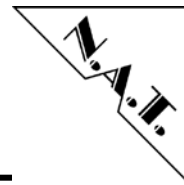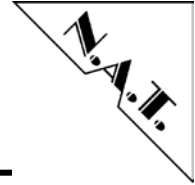
Figure 3: **NAT-MCH-RTM-ComEx – Location diagram – Bottom**
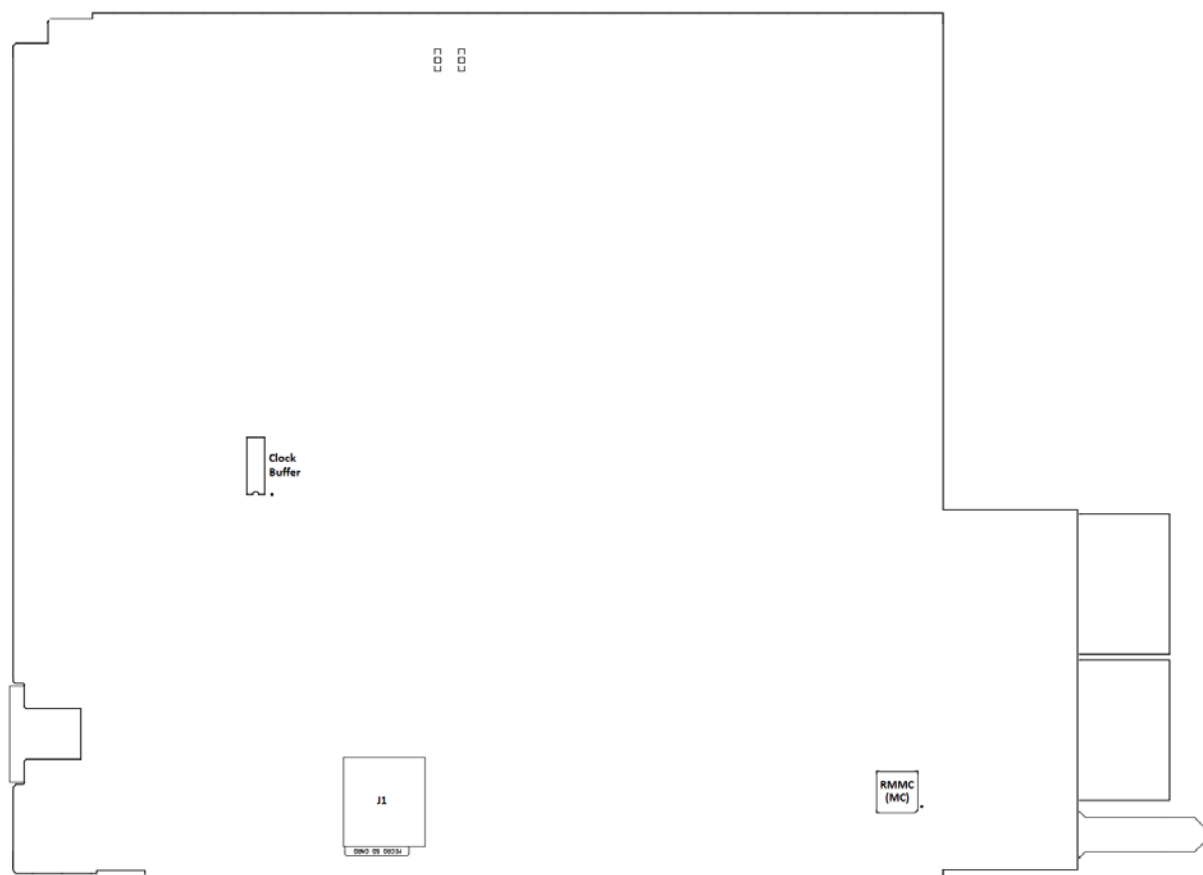
3 Board Features

The **NAT-MCH-RTM-ComEx** offers a number of features, which are described in the following paragraphs.

3.1 Type 6 COM Express Board support

The **NAT-MCH-RTM-ComEx** supports standard PICMG® COM.0 Rev. 2.1 Type 6 Mini, Compact or Basic Modules. COM Express Modules are offered by various vendors supporting different CPU architectures, performance grades, memory size and operating systems.

3.2 COM Express Interfaces

The **NAT-RTM-ComEx** supports the following interfaces available at the standard COM Express type 6 connector.

3.2.1 Connectivity to MCH PCIe Switch

PEG 0-3:
The **NAT-MCH-RTM-ComEx** connects the PEG (x4 PCIe) interface via the zone 3 RTM connector to the MCH. To provide connectivity to the PCIe (Gen III) Fat Pipe switch.

PCIe 0:
The **NAT-MCH-RTM-ComEx** connects the PCIe 0 interface to an Intel I350 Ethernet controller to provide gigabit Ethernet connectivity to the MCH fabric Ethernet switch.

PCIe 1:
The **NAT-MCH-RTM-ComEx** connects the PCIe 1 interface to a PCI Express® Mini Card slot.

3.2.2 Com Express Ethernet Interface

The **NAT-MCH-RTM-ComEx** connects the GbE 0 interface directly via a RJ45 Jack (and the required magnetics) to the face plate.

3.2.3 Dual SATA Connectivity

The **NAT-MCH-RTM-ComEx** connects the SATA 0 and SATA 1 interfaces directly via the Zone 3 connector to the MCH.

3.2.4 Dual Display Port

The **NAT-MCH-RTM-ComEx** connects the DDI interfaces 1/2 to displayport connectors accessible at the face plate.

3.2.5 USB Interfaces

USB 0-3:
The **NAT-MCH-RTM-ComEx** connects the USB 0-3 interfaces to USB 3.0 Type A connectors accessible at the face plate.

USB 4:
The **NAT-MCH-RTM-ComEx** connects the USB 4 interface to the same PCI Express® Mini Card slot as the PCIe 1 interface.

3.3 Micro SD Card

The **NAT-MCH-RTM-ComEx** connects the GPIO/SDIO signals to a Micro SD card slot.

3.4 BIOS FLASH

The **NAT-MCH-RTM-ComEx** connects the SPI interface to a serial flash. This provides an additional/optional BIOS source.

3.5 I²C Interface

The **NAT-MCH-RTM-ComEx** connects the I^2C interface to a Carrier EEPROM (24C08).

3.6 RMMC via SM-Bus

The **NAT-MCH-RTM-ComEx** connects the SM Bus to all SM Bus capable devices that are on board. Amongst others it is connected to the RMMC which allows the COM Express module to report on-board temperatures to the RMMC. This enables the MTCA shelf manager to take these temperatures into account for the fan control.

4 Hardware

4.1 Front Panel and LED

The **NAT-MCH-RTM-ComEx** module is equipped with 2 LEDs integrated in the RJ45 Ethernet jack. They are directly driven by the Com Express GBE0_LINK#/ GBE0_LINK100#/ GBE0_LINK1000n and GBE0_ACT# signals.

Additionally the module contains the standard AMC LEDs consisting of a blue Hot Swap LED, a red fault indication LED and an orange/green general purpose status LED controlled by the RMMC.

User Led 1-3 are also connected to the RMMC but can be controlled by the user via a register interface.

Figure 4:   NAT-MCH-RTM-ComEx – Front Panel View
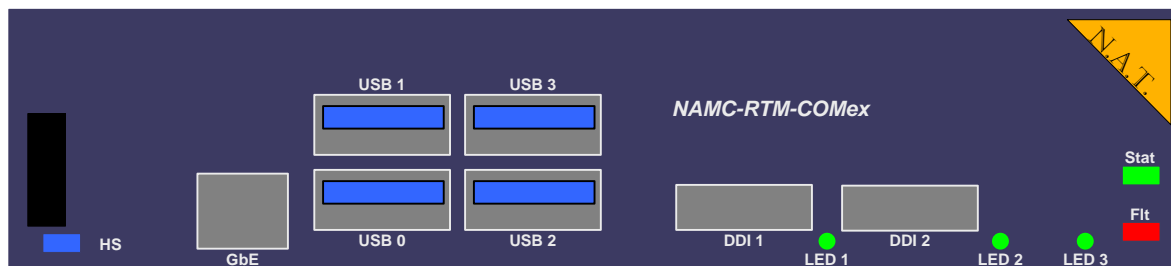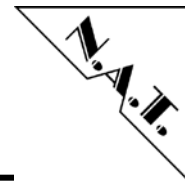
4.2 Connectors and Switches

Figure 5: NAT-MCH-RTM-ComEx – Connector and Switch Location – Top
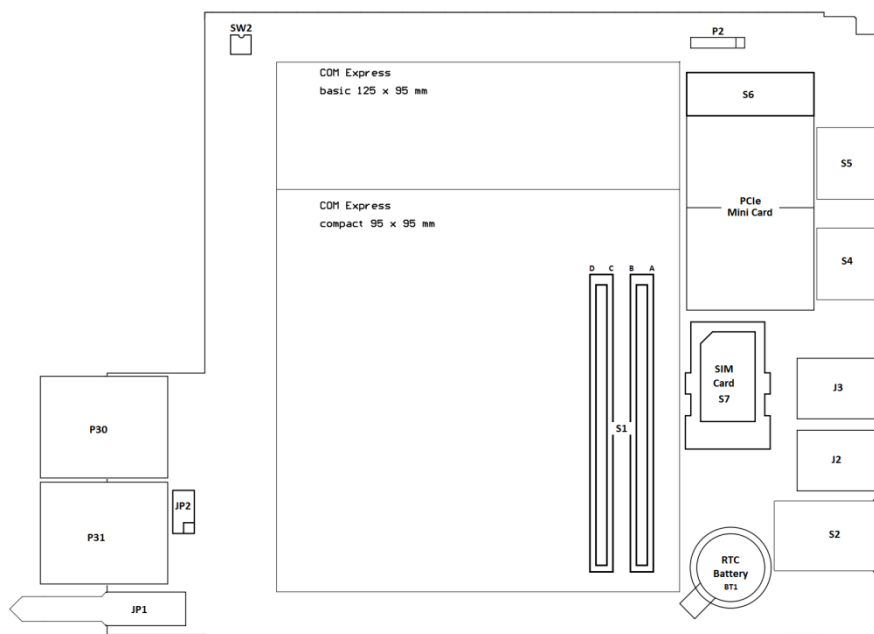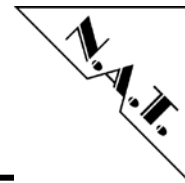
Figure 6: NAT-MCH-RTM-ComEx – Connector and Switch Location – Bottom
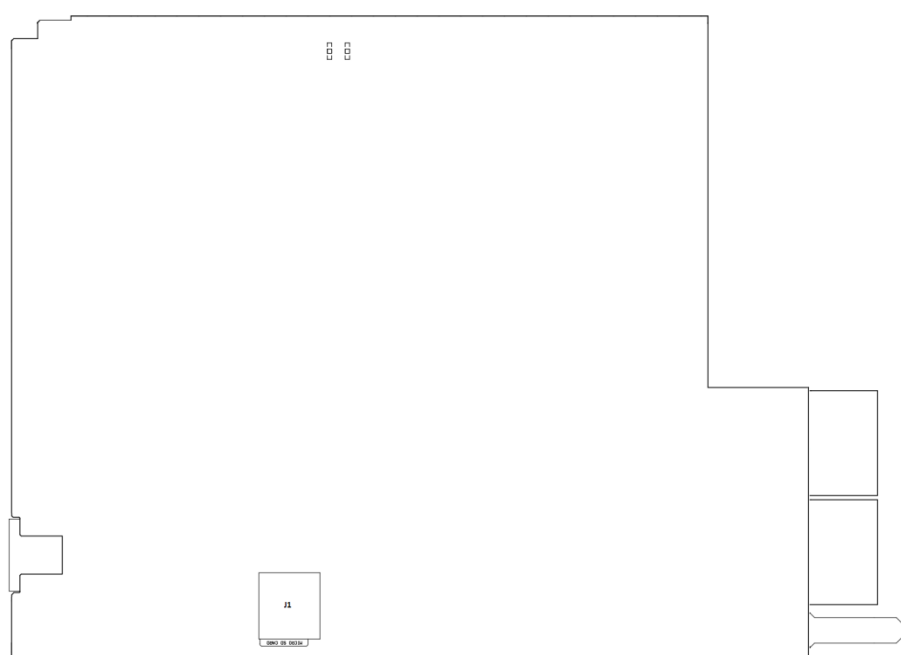
Please refer to the following tables to look up the connector pin assignment of the **NAT-MCH-RTM-ComEx**

4.2.1 S1 (A-D): COM Express connector
S1 connects between the Com Express module and the **NAT-MCH-RTM-ComEx**

Table 2:   **S1 (A/B): COM Express Connector – Pin Assignment**

Pin #	AMC-Signal	AMC-Signal	Pin #
A1	GND	GND	B1
A2	GBE0_MDI3-	GBE0_ACT#	B2
A3	GBE0_MDI3+	NC	B3
A4	GBE0_LINK100#	NC	B4
A5	GBE0_LINK1000#	NC	B5
A6	GBE0_MDI2-	NC	B6
A7	GBE0_MDI2+	NC	B7
A8	GBE0_LINK#	NC	B8
A9	GBE0_MDI1-	NC	B9
A10	GBE0_MDI1+	NC	B10
A11	GND	GND	B11
A12	GBE0_MDI0-	PWRBTN#	B12
A13	GBE0_MDI0+	SMB_CK	B13
A14	GBE0_CTREF	SMB_DAT	B14
A15	SUS_S3#	SMB_ALERT#	B15
A16	RTM_SATA0-Tx+	RTM_SATA1-Tx+	B16
A17	RTM_SATA0-Tx-	RTM_SATA1-Tx-	B17
A18	SUS_S4#	SUS_STAT#	B18
A19	RTM_SATA0-Rx+	RTM_SATA1-Rx+	B19
A20	RTM_SATA0-Rx-	RTM_SATA1-Rx-	B20
A21	GND	GND	B21
A22	NC	NC	B22
A23	NC	NC	B23
A24	SUS_S5#	PWR_OK	B24
A25	NC	NC	B25
A26	NC	NC	B26
A27	BATLOW#	WDT	B27
A28	ATA_ACT#	NC	B28
A29	NC	NC	B29
A30	NC	NC	B30
A31	GND	GND	B31
A32	NC	NC	B32
A33	NC	I2C_CK	B33
A34	BIOS_DIS0#	I2C_DAT	B34
A35	THRMTRIP#	THRM#	B35
A36	NC	NC	B36
A37	NC	NC	B37
A38	NC	NC	B38
A39	USB4-	NC	B39
A40	USB4+	NC	B40
A41	GND	GND	B41
A42	USB2-	USB3-	B42
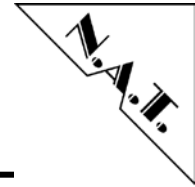
Pin #	AMC-Signal	AMC-Signal	Pin #
A43	USB2+	USB3+	B43
A44	USB_2_3_OC#	USB_0_1_OC#	B44
A45	USB0-	USB1-	B45
A46	USB0+	USB1+	B46
A47	VCC_RTC	NC	B47
A48	EXCD0_PERST#	NC	B48
A49	EXCD0_CPPE#	SYS_RESET#	B49
A50	NC	CB_RESET#	B50
A51	GND	GND	B51
A52	NC	NC	B52
A53	NC	NC	B53
A54	SD_DATA0	SD_CMD	B54
A55	NC	NC	B55
A56	NC	NC	B56
A57	GND	SD_WP	B57
A58	NC	NC	B58
A59	NC	NC	B59
A60	GND	GND	B60
A61	NC	NC	B61
A62	NC	NC	B62
A63	SD_DATA1	SD_CD#	B63
A64	PCIE_TX1+	PCIe1-Rx+	B64
A65	PCIE_TX1-	PCIe1-Rx-	B65
A66	GND	WAKE0#	B66
A67	SD_DATA2	WAKE1#	B67
A68	PCIE_TX0+	PCIe0-Rx+	B68
A69	PCIE_TX0-	PCIe0-Rx-	B69
A70	GND	GND	B70
A71	NC	NC	B71
A72	NC	NC	B72
A73	NC	NC	B73
A74	NC	NC	B74
A75	NC	NC	B75
A76	NC	NC	B76
A77	NC	NC	B77
A78	NC	NC	B78
A79	NC	NC	B79
A80	GND	GND	B80
A81	NC	NC	B81
A82	NC	NC	B82
A83	NC	NC	B83
A84	NC	+5V	B84
A85	SD_DATA3	+5V	B85
A86	RSVD	+5V	B86
A87	RSVD	+5V	B87
A88	PCIe_CLK_REF+	BIOS_DIS1#	B88
A89	PCIe_CLK_REF-	NC	B89
A90	GND	GND	B90
A91	SPI_POWER	NC	B91
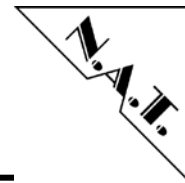
Pin #	AMC-Signal	AMC-Signal	Pin #
A92	SPI_MOSI	NC	B92
A93	SD_CLK	NC	B93
A94	SPI_CLK	NC	B94
A95	SPI_MISO	NC	B95
A96	TPM_PP	NC	B96
A97	TYPE10#	SPI_CS#	B97
A98	SER0_TX	NC	B98
A99	SER0_RX	NC	B99
A100	GND	GND	B100
A101	SER0_TX	NC	B101
A102	SER0_RX	NC	B102
A103	LID#	SLEEP#	B103
A104	+12V	+12V	B104
A105	+12V	+12V	B105
A106	+12V	+12V	B106
A107	+12V	+12V	B107
A108	+12V	+12V	B108
A109	+12V	+12V	B109
A110	GND	GND	B110

Table 3:   S1 (C/D): COM Express Connector – Pin Assignment

Pin #	AMC-Signal	AMC-Signal	Pin #
C1	GND	GND	D1
C2	GND	GND	D2
C3	USB0_SSRX-	USB0_SSTX-	D3
C4	USB0_SSRX+	USB0_SSTX+	D4
C5	GND	GND	D5
C6	USB1_SSRX-	USB1_SSTX-	D6
C7	USB1_SSRX+	USB1_SSTX+	D7
C8	GND	GND	D8
C9	USB2_SSRX-	USB2_SSTX-	D9
C10	USB2_SSRX+	USB2_SSTX+	D10
C11	GND	GND	D11
C12	USB2_SSRX-	USB2_SSTX-	D12
C13	USB2_SSRX+	USB2_SSTX+	D13
C14	GND	GND	D14
C15	NC	DDI1_AUX+	D15
C16	NC	DDI1_AUX-	D16
C17	RSVD	RSVD	D17
C18	RSVD	RSCD	D18
C19	NC	NC	D19
C20	NC	NC	D20
C21	GND	GND	D21
C22	NC	NC	D22
C23	NC	NC	D23
C24	DDI1_HPD	RSVD	D24
C25	NC	RSVD	D25
C26	NC	DDI1_PAIR0+	D26
C27	RSVD	DDI1_PAIR0-	D27
C28	RSVD	RSVD	D28
C29	NC	DDI1_PAIR1+	D29
C30	NC	DDI1_PAIR1-	D30
C31	GND	GND	D31
C32	DDI2_AUX+	DDI1_PAIR2+	D32
C33	DDI2_AUX-	DDI1_PAIR2-	D33
C34	DDI2_DDC_AUX_SEL	DDI1_DDC_AUX_SEL	D34
C35	RSVD	RSVD	D35
C36	NC	DDI1_PAIR3+	D36
C37	NC	DDI1_PAIR3-	D37
C38	NC	RSVD	D38
C39	NC	DDI2_PAIR0+	D39
C40	NC	DDI2_PAIR0-	D40
C41	GND	GND	D41
C42	NC	DDI2_PAIR1+	D42
C43	NC	DDI2_PAIR1-	D43
C44	NC	DDI2_HPD	D44
C45	RSVD	RSVD	D45
C46	NC	DDI2_PAIR2+	D46
C47	NC	DDI2_PAIR2-	D47
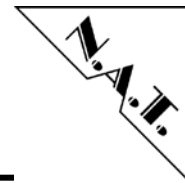
Pin #	AMC-Signal	AMC-Signal	Pin #
C48	RSVD	RSVD	D48
C49	NC	DDI2_PAIR3+	D49
C50	NC	DDI2_PAIR3-	D50
C51	GND	GND	D51
C52	PEG_RX0+	PEG_TX0+	D52
C53	PEG_RX0-	PEG_TX0-	D53
C54	TYPE0#	PEG_LANE_RV#	D54
C55	PEG_RX1+	PEG_TX1+	D55
C56	PEG_RX1-	PEG_TX1-	D56
C57	TYPE1#	TYPE2#	D57
C58	PEG_RX2+	PEG_TX2+	D58
C59	PEG_RX2-	PEG_TX2-	D59
C60	GND	GND	D60
C61	PEG_RX3+	PEG_TX3+	D61
C62	PEG_RX3-	PEG_TX3-	D62
C63	RSVD	RSVD	D63
C64	RSVD	RSVD	D64
C65	NC	NC	D65
C66	NC	NC	D66
C67	RSVD	GND	D67
C68	NC	NC	D68
C69	NC	NC	D69
C70	GND	GND	D70
C71	NC	NC	D71
C72	NC	NC	D72
C73	GND	GND	D73
C74	NC	NC	D74
C75	NC	NC	D75
C76	GND	GND	D76
C77	RSVD	RSVD	D77
C78	NC	NC	D78
C79	NC	NC	D79
C80	GND	GND	D80
C81	NC	NC	D81
C82	NC	NC	D82
C83	RSVD	RSVD	D83
C84	GND	GND	D84
C85	NC	NC	D85
C86	NC	NC	D86
C87	GND	GND	D87
C88	NC	NC	D88
C89	NC	NC	D89
C90	GND	GND	D90
C91	NC	NC	D91
C92	NC	NC	D92
C93	GND	GND	D93
C94	NC	NC	D94
C95	NC	NC	D95
C96	GND	GND	D96
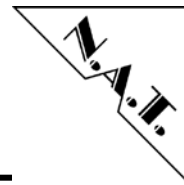
Pin #	AMC-Signal	AMC-Signal	Pin #
C97	RSVD	RSVD	D97
C98	NC	NC	D98
C99	NC	NC	D99
C100	GND	GND	D100
C101	NC	NC	D101
C102	NC	NC	D102
C103	GND	GND	D103
C104	+12V	+12V	D104
C105	+12V	+12V	D105
C106	+12V	+12V	D106
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C109	+12V	+12V	D109
C110	GND	GND	D110
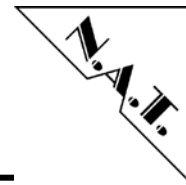
4.2.2 P30/P31: Zone3 RTM Connector

P30 and P31 are the MicroTCA.4 Zone3 Connectors connecting the **NAT-MCH-M4**

Table 4:   P30: Zone3 RTM Connector – Pin Assignment

Col→ Row↓	GND	F	E	GND	D	C	GND	B	A
10	GND	RTM_PCIe3-Tx_N	RTM_PCIe3-Tx_P	GND	RTM_Tx_CLK_N	RTM_Tx_CLK_P	GND	RTM_Tx_CLK_P	RTM_Tx_CLK_N
9	GND	RTM_PCIe3-Tx_N	RTM_PCIe3-Tx_P	GND	SATA1_DSS	SATA0_DSS	GND	NC	NC
8	GND	RTM_PCIe2-Tx_N	RTM_PCIe2-Tx_P	GND	RTM_SATA1-Tx_N	RTM_SATA1-Tx_P	GND	NC	NC
7	GND	RTM_PCIe2-Tx_N	RTM_PCIe2-Tx_P	GND	RTM_SATA1-Tx_N	RTM_SATA1-Tx_P	GND	RTM_SPISEL2n	RTM_SPISEL1n
6	GND	RTM_PCIe1-Tx_N	RTM_PCIe1-Tx_P	GND	RTM_SATA0-Tx_N	RTM_SATA0-Tx_P	GND	RTM_MOSI	RTM_MISO
5	GND	RTM_PCIe1-Tx_N	RTM_PCIe1-Tx_P	GND	RTM_SATA0-Tx_N	RTM_SATA0-Tx_P	GND	RTM_SPICLK	RTM_ENn
4	GND	RTM_PCIe0-Tx_N	RTM_PCIe0-Tx_P	GND	RTM_ETH0-Tx_N	RTM_ETH0-Tx_P	GND	NC	NC
3	GND	RTM_PCIe0-Tx_N	RTM_PCIe0-Tx_P	GND	RTM_ETH0-Tx_N	RTM_ETH0-Tx_P	GND	NC	NC
2	GND	RTM_TDI	RTM_TMS	GND	RTM_SCL	RTM_MP	GND	RTM_PWR	RTM_PWR
1	GND	RTM_TDO	RTM_TCK	GND	RTM_SDA	RTM_PS#	GND	RTM_PWR	RTM_PWR
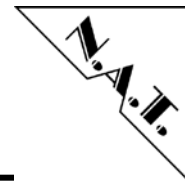
Table 5:   P31: Zone3 RTM Connector – Pin Assignment

Col→ Row↓	GND	F	E	GND	D	C	GND	B	A
10	GND	NC	NC	GND	NC	NC	GND	NC	NC
9	GND	NC	NC	GND	NC	NC	GND	NC	NC
8	GND	NC	NC	GND	NC	NC	GND	NC	NC
7	GND	NC	NC	GND	NC	NC	GND	NC	NC
6	GND	NC	NC	GND	NC	NC	GND	NC	NC
5	GND	NC	NC	GND	NC	NC	GND	NC	NC
4	GND	NC	NC	GND	NC	NC	GND	NC	NC
3	GND	NC	NC	GND	NC	NC	GND	NC	NC
2	GND	NC	NC	GND	NC	NC	GND	NC	NC
1	GND	NC	NC	GND	NC	NC	GND	NC	NC

Please note: by default P31 is not assembled!

4.2.3 S6: PCI Express Mini Card Connector

The PCI Express Mini Card connector S6 connects to the Com Express PCIe1 and USB4 Interface.

Table 6:   S6: PCI Express Mini Card – Pin Assignment

Pin#	Signal	Signal	Pin#
1	WAKE#	+3.3Vaux	2
3	COEX1	GND	4
5	COEX2	+1.5V	6
7	CLK_REQ#	UIM_PWR	8
9	GND	UIM_DATA	10
11	REFCLK-	UIM_CLK	12
13	REFCLK+	UIM_RESET	14
15	GND	UIM_VPP	16
Mechanical Key			
17	UIM_C8	GND	18
19	UIM_C4	W_DISABLE#	20
21	GND	PCIEMC_PERST#	22
23	PCIe1-Rx_N	+3.3Vaux	24
25	PCIe1-Rx_P	GND	26
27	GND	+1.5V	28
29	GND	SMB_CLK	30
31	PCIe1-Tx_N	SMB_DATA	32
33	PCIe1-Tx_P	GND	34
35	GND	USB4_N	36
37	GND	USB4_P	38
39	+3.3Vaux	GND	40
41	+3.3Vaux	NC (LED_WWAN#)	42
43	GND	NC (LED_WLAN#)	44
45	Reserved	NC (LED_WPAN#)	46
47	Reserved	+1.5V	48
49	Reserved	GND	50
51	Reserved	+3.3Vaux	52
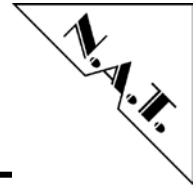
4.2.4 J1: Micro SD Card Slot

J1 connects directly to the Com Express module SD Card (or GPIO) interface and offers the option to use Micro SD Cards as removable Flash Memory on the **NAT-MCH-RTM-ComEx** board.

Table 7:   J1: Micro SD Card slot – Pin Assignment

Pin #	Signal	Signal	Pin #
1	SD_DAT2	SD_DAT3	2
3	SD_CMD	+3.3V	4
5	SD_CLK	GND	6
7	SD_DAT0	SD_DAT1	8

4.2.5 JP2: FPGA Programming Connector

The FPGA Programming Connector JP2 allows updating the FPGA. It is not assembled and for development use only.

Table 8:   JP2: FPGA Programming Connector – Pin Assignment

Pin #	Signal	Signal	Pin #
1	+3.3V	FPGA_TDO	2
3	FPGA_TDI	NC	4
5	FPGA_JTAGEN	FPGA_TMS	6
7	GND	FPGA_TCK	8
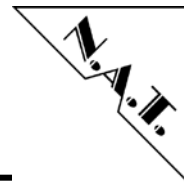
4.2.6 P2: Serial Console Debug Connector

Connector P2 offers access to the Com Express module Serial Console interface.

Please note: An external level translator has to be connected if the interface shall be connected e.g. to a RS232 interface!

Table 9:   P2: Serial Console Debugging Connector – Pin Assignment

Pin #	Signal
1	GND
2	SER0_RX
3	SER0_TX
4	+3.3V
5	NC

4.2.7 S2: RJ45 Ethernet

Connector S2 offers direct access to a 10/100/1000-BaseT Ethernet interface of the Com Express module.

Table 10:   S2: RJ45 Ethernet Connector – Pin Assignment

Pin #	Signal	Signal	Pin #
1	GBE0_MDI0_P	GBE0_MDI0_N	2
3	GBE0_MDI1_P	GBE0_MDI1_P	4
5	GBE0_MDI2_P	GBE0_MDI2_P	6
7	GBE0_MDI3_P	GBE0_MDI3_P	8

4.2.8 J2: Dual USB3.0 Connector

Connector J2 is the first of two dual USB3.0 Type A connectors accessible via the face plate. This connector is directly connected the Com Express module USB0 and USB1 interface.

Table 11:   J2-A: USB Connector – Pin Assignment

Pin #	Signal	Signal	Pin #
1	USB0_VBUS	USB0_SSRX_N	5
2	USB0_N	USB0_SSRX_P	6
3	USB0_P	USB0_GND_D	7
4	USB0_GND	USB0_SSTX_N	8
		USB0_SSTX_P	9

Table 12:   J2-B: USB Connector – Pin Assignment

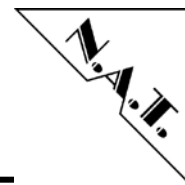| Pin #	Signal	Signal	Pin #
10	USB1_VBUS	USB1_SSRX_N	14
11	USB1_N	USB1_SSRX_P	15
12	USB1_P	USB1_GND_D	16
13	USB1_GND	USB1_SSTX_N	17
		USB1_SSTX_P	18

4.2.9 J3: Dual USB3.0 Connector

Connector J3 is the second of two dual USB3.0 Type A connectors accessible via the face plate. This connector is directly connected the Com Express module USB2 and USB3 interface.

Table 13:   J3-A: USB Connector – Pin Assignment

Pin #	Signal	Signal	Pin #
1	USB2_VBUS	USB2_SSRX_N	5
2	USB2_N	USB2_SSRX_P	6
3	USB2_P	USB2_GND_D	7
4	USB2_GND	USB2_SSTX_N	8
		USB2_SSTX_P	9

Table 14:   J3-B: USB Connector – Pin Assignment

Pin #	Signal	Signal	Pin #
10	USB3_VBUS	USB3_SSRX_N	14
11	USB3_N	USB3_SSRX_P	15
12	USB3_P	USB3_GND_D	16
13	USB3_GND	USB3_SSTX_N	17
		USB3_SSTX_P	18

4.2.10 S4: Display Port Connector

Connector s4 is the first of two Display Port connectors accessible via the face plate. This connector is directly connected to the Com Express module DDI1 interface.

Table 15:   S4: Display Port Connector – Pin Assignment

Pin #	Signal	Signal	Pin #
1	C_DDI1_PAIR0_P	GND	2
3	C_DDI1_PAIR0_N	C_DDI1_PAIR1_P	4
5	GND	C_DDI1_PAIR1_N	6
7	C_DDI1_PAIR2_P	GND	8
9	C_DDI1_PAIR2_N	C_DDI1_PAIR3_P	10
11	GND	C_DDI1_PAIR3_P	12
13	DDI1_DDC_AUX_SEL	DDI1_CONFIG2	14
15	DDI1_AUX_P	GND	16
17	DDI1_AUX_N	DDI1_HPD	18
19	GND	DDI1_PWR(+3.3V)	20

4.2.11 S5: Display Port Connector

Connector J5 is the second of two Display Port connectors accessible via the face plate. This connector is directly connected to the Com Express module DDI2 interface.

Table 16:   S5: Display Port Connector – Pin Assignment

Pin #	Signal	Signal	Pin #
1	DDI2_PAIR0_P	GND	2
3	DDI2_PAIR0_N	DDI2_PAIR1_P	4
5	GND	DDI2_PAIR1_N	6
7	DDI2_PAIR2_P	GND	8
9	DDI2_PAIR2_N	DDI2_PAIR3_P	10
11	GND	DDI2_PAIR3_P	12
13	DDI2_DDC_AUX_SEL	DDI2_CONFIG2	14
15	DDI2_AUX_P	GND	16
17	DDI2_AUX_N	DDI2_HPD	18
19	GND	DDI2_PWR(+3.3V)	20

4.2.12 SW1: Hot Swap Switch

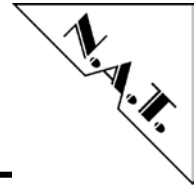Switch SW1 is used to support hot swapping of the module. It conforms to PICMG AMC.0.

4.2.13 DIP SW2: TBD

The table below gives an overview of the operating parameters configurable via DIP SW2. Details are given in the following subchapters.

Table 17:   DIP SW2 – Pin Assignment - Overview

| Switch	Function
1	tbd
2	tbd

5 NAT-MCH-RTM-COMEX Programming Notes

## 5.1 Register Description General Control and Status Registers

Table 18:   Register Description – General Control and Status Registers

0x00	Product ID							
0x01	PCB Version (from Atmel EEPROM)							
0x02	FW_Version							
0x03	FPGA Version (copy of reg 0x11)							
0x04-0x0F	Reserved							
0x10	FPGA-PCB-Version							
0x11	FPGA-Version							
0x12	DEVEL-Version							
0x13	debug register							
0x14	amc_led1_ctrl_reg							
0x15	amc_led2_ctrl_reg							
0x16	usr_led_ctrl_reg1							
0x17	usr_led_ctrl_reg2							
0x18	usr_led_ctrl_reg3							
0x19	misc_ctrl_reg							
0x1A	ce_stat_reg							
0x1B	ce_ctrl1_stat_reg							
0x1C	ce_ctrl2_stat_reg							
0x1D	ce_ctrl1_set_reg							
0x1E	ce_ctrl2_set_reg							
0x1F	pcie_mc_reg							
0x20	i350_ctrl_stat_reg							
0x21	i350_ctrl_set_reg							
0x22	dp_port_reg							
0x23	usb_stat_reg							
0x24	usb_ctrl_reg							
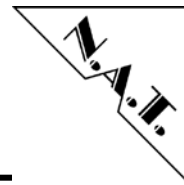
0x25-0x27	Reserved
0x28	CE_TMP0
0x29	CE_TMP1
0x2A	CE_TMP2
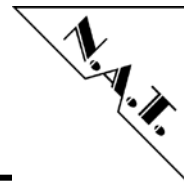
5.1.1 *PRODUCT_ID – 0x00*

Bit	Name	Description	Default	Access
7..0	PROD_ID	Product Id to identify type of RTM	0x28	Read Only

5.1.2 *PCB_VERS – 0x01*

Bit	Name	Description	Default	Access
7..0	PCB_VERS	PCB version determined by level of unused pins hardcoded on PCB	HW init	Read Only

5.1.3 *FW_VERSION – 0x02*

Bit	Name	Description	Default	Access
7..0	PCB_VERS	PCB version determined by level of unused pins hardcoded on PCB	HW init	Read Only

5.1.4 *FPGA_VERS – 0x03*

Bit	Name	Description	Default	Access
7..0	FPGA_VERS	FPGA version	na	Read Only

TBD
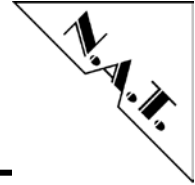
6 Board Specification

Table 19:   NAT-MCH-RTM-ComEx Features

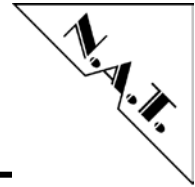|	
Processor	The **NAT-MCH-RTM-ComEx** can host any type 6 Com Express module
Form Factor	MCH RTM, double width full size
Front-I/O	1x RJ45 Ethernet, 4x USB 3.0 2x Display Port
Removable FLASH	Micro-SD-Card slot
Firmware	-
Power Consumption (without ComExpress-Module)	12V / 1.0A max.
Operating Temperature	0°C − +55°C with forced cooling
Storage Temperature	-40°C - +85°C
Humidity	10% − 90% rh non-condensing
Standards compliance	PICMG AMC.0 Rev. 2.0 PICMG AMC.1 Rev. 1.0 PICMG AMC.2 Rev. 1.0 (Type E2) PCI Express Base Specification Rev. 1.1 PICMG SFP.0 Rev. 1.0 (System Fabric Plane Format) IPMI Specification v1.0 Rev. 1.0 PICMG µTCA.0 Rev. 1.0 PICMG µTCA.4 Rev. 1.0
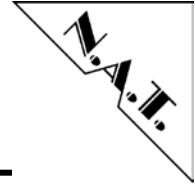
7 Installation

7.1 Safety Note

To ensure proper functioning of the **NAT-MCH-RTM-ComEx** during its usual lifetime take the following precautions before handling the board.

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

- Before installing or uninstalling the **NAT-MCH-RTM-ComEx** read this installation section
- Before installing or uninstalling the **NAT-MCH-RTM-ComEx**, read the Installation Guide and the User's Manual of the MCH used, or of the uTCA system the board will be plugged into.
- Before installing or uninstalling a COM Express Module on the **NAT-MCH-RTM-ComEx** or both in a rack:
  - Check all installed boards and modules for steps that you have to take before turning on or off the power
  - Take those steps
  - Finally turn on or off the power if necessary.
  - Make sure the part to be installed / removed is hot swap capable, if you don't switch off the power.
- Before touching integrated circuits ensure to take all require precautions for handling electrostatic devices.
- Ensure that the **NAT-MCH-RTM-ComEx** is connected to the MCH with the connector completely inserted.
- When operating the board in areas of strong electromagnetic radiation ensure that the module
  - is bolted the front panel or rack
  - and shielded by closed housing

7.2 Installation Prerequisites and Requirements

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

7.2.1 Requirements
The installation requires only
- a MicroTCA.4 backplane and a **NAT-MCH-M4** for connecting the **NAT-MCH-RTM-ComEx**
- power supply
- cooling devices

7.2.2 Power supply
The power supply for the **NAT-MCH-RTM-ComEx** must meet the following specifications:
- required for the module:
  - +12V / 1.0A max. (the required power of the mounted Com Express Module must be added!!!)

7.2.3 Automatic Power Up
In the following situations the **NAT-MCH-RTM-ComEx** will automatically be reset and proceed with a normal power up.
- The voltage sensor generates a reset
  - when +12V (RTM PP) voltage level drops below 10V
  - when +3.3V (RTM MP) voltage level drops below 3.08V
- The MCH signals a Reset.
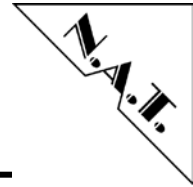
7.3 Statement on Environmental Protection

7.3.1 Compliance to RoHS Directive

Directive 2002/95/EC of the European Commission on the "Restriction of the use of certain Hazardous Substances in Electrical and Electronic Equipment" (RoHS) predicts that all electrical and electronic equipment being put on the European market after June 30th, 2006 must contain lead, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE) and cadmium in maximum concentration values of 0.1% respective 0.01% by weight in homogenous materials only.

As these hazardous substances are currently used with semiconductors, plastics (i.e. semiconductor packages, connectors) and soldering tin any hardware product is affected by the RoHS directive if it does not belong to one of the groups of products exempted from the RoHS directive.
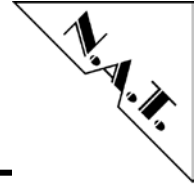
Although many of hardware products of N.A.T. are exempted from the RoHS directive it is a declared policy of N.A.T. to provide all products fully compliant to the RoHS directive as soon as possible. For this purpose since January 31st, 2005 N.A.T. is requesting RoHS compliant deliveries from its suppliers. Special attention and care has been paid to the production cycle, so that wherever and whenever possible RoHS components are used with N.A.T. hardware products already.

7.3.2 Compliance to WEEE Directive

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

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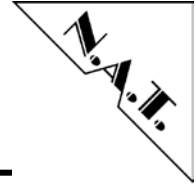Compliance to the CE directive is declared. A 'CE' sign can be found on the PCB.

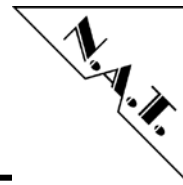### 7.3.4 Product Safety
The board complies with EN60950 and UL1950.
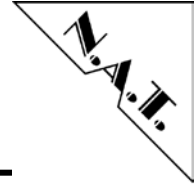
8 Known Bugs / Restrictions

Appendix A: Reference Documentation

Appendix B: Document's History

Revision	Date	Description	Author
0.9d	12.07.2013	initial revision	ks
1.0	16.07.2013	Adapted to new layout	se