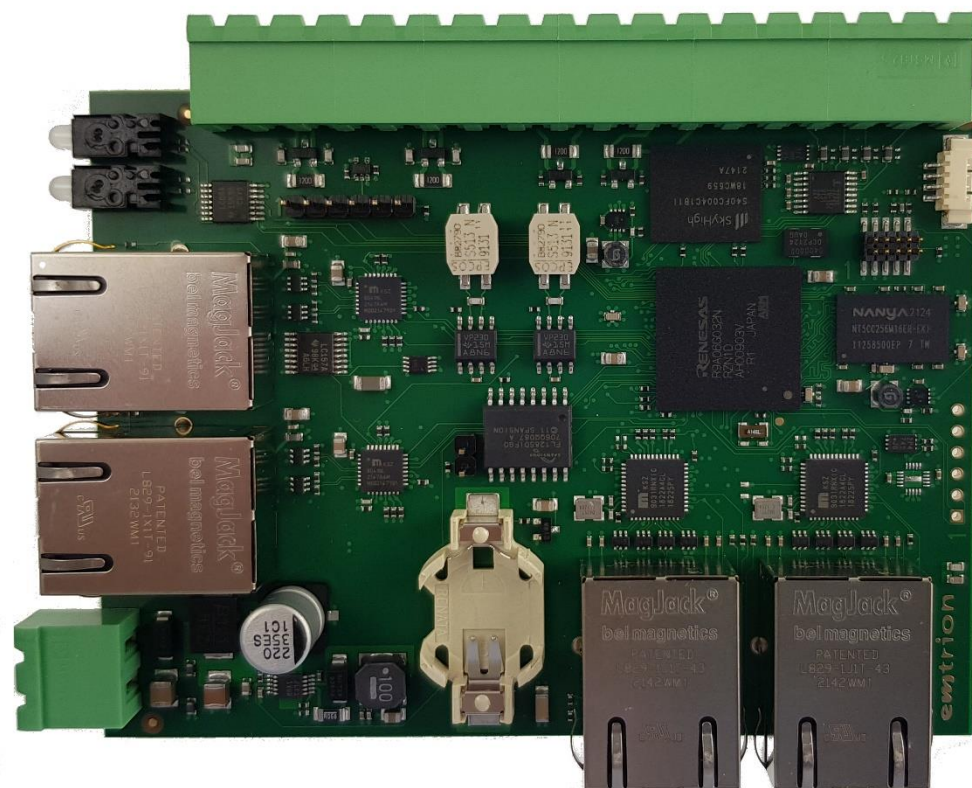


# SBC-RZN1D-3 - Hardware Manual

## Hardware Manual

9 / 29.09.2022



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Revision: **9 / 29.09.2022**

Rev	Date/Signature	Changes
<b>1</b>	14.03.18/Bue	First release
<b>2</b>	07.05.18/Bue	In chapters 2 and 3.3 NOR Flash reduced to 16 MB In chapter 3.5 details of Ethernet interfaces added
<b>3</b>	06.08.18/Bue	Mechanical characteristics in chapters 5 and 6 corrected
<b>4</b>	01.10.18/Bue	Added mating connectors for J4 and J6 in chapter 4.2
<b>5</b>	01.08.19/Wi, Bue	Rebranding changes, COM-RZN1D → SBC-RZN1D, picture of front page updated
<b>6</b>	30.01.20/Bue	In chapters 4.1 and 4.2 names of RJ45 connectors corrected
<b>7</b>	09.06.20/Bue	Pinout of connector J4 in chapter 4.2.4 corrected
<b>8</b>	15.06.21/Bue	EMC characteristics added in chapter 5 eMMC capacity clarified to 4 GB in several chapters Datasheet reference update in chapter 7
<b>9</b>	29.09.22/Bue	Changes for HW Rev -3 added <ul style="list-style-type: none"> <li>• eMMC is connected via 4 data lines</li> <li>• TPM chip in chapter 3.9 changed</li> <li>• 2<sup>nd</sup> EEPROM added in chapter 3.10</li> <li>• LED characteristics changed in chapter 3.11</li> <li>• Picture in chapter 4.1 changed</li> </ul>

## Contents

1	Introduction.....	4
2	Block Diagram.....	5
3	Functional Description .....	6
3.1	Processor.....	6
3.2	DDR3 SDRAM.....	6
3.3	NOR-Flash .....	6
3.4	eMMC .....	6
3.5	Ethernet Interfaces .....	6
3.5.1	Introduction .....	6
3.5.2	100M Interfaces.....	6
3.5.3	1Gb Interfaces.....	7
3.6	Serial Ports.....	7
3.7	CAN .....	7
3.8	RTC .....	7
3.9	TPM .....	7
3.10	EEPROMs.....	7
3.11	LEDs .....	8
3.11.1	Status LEDs .....	8
3.11.2	Activity LEDs.....	8
3.12	USB interface .....	8
3.13	SPI interface .....	8
3.14	Power Supply .....	8
4	Connectors.....	9
4.1	Connector Locations.....	9
4.2	External Connectors.....	10
4.2.1	J6: Power Supply.....	10
4.2.2	J1, J2: RJ45 TCP/IP Connectors .....	10
4.2.3	J8, J9: RJ45 Fieldbus Connectors .....	10
4.2.4	J4: Serial Interfaces.....	11
4.3	Internal Connectors .....	12
4.3.1	J3: SPI .....	12
4.3.2	J5: Console.....	12
4.3.3	J10, JTAG.....	12
4.3.4	J11: USB Device.....	12
5	Technical Characteristics .....	13
5.1	Electrical Specifications .....	13
5.2	Environmental Specifications.....	13
5.3	EMC .....	13
5.4	Mechanical Specifications .....	13
6	Dimensional Drawing of PCB .....	14
7	References.....	15

## 1 Introduction

The SBC-RZN1D module is an industrial communication controller based on the RZ/N1D processor from Renesas.

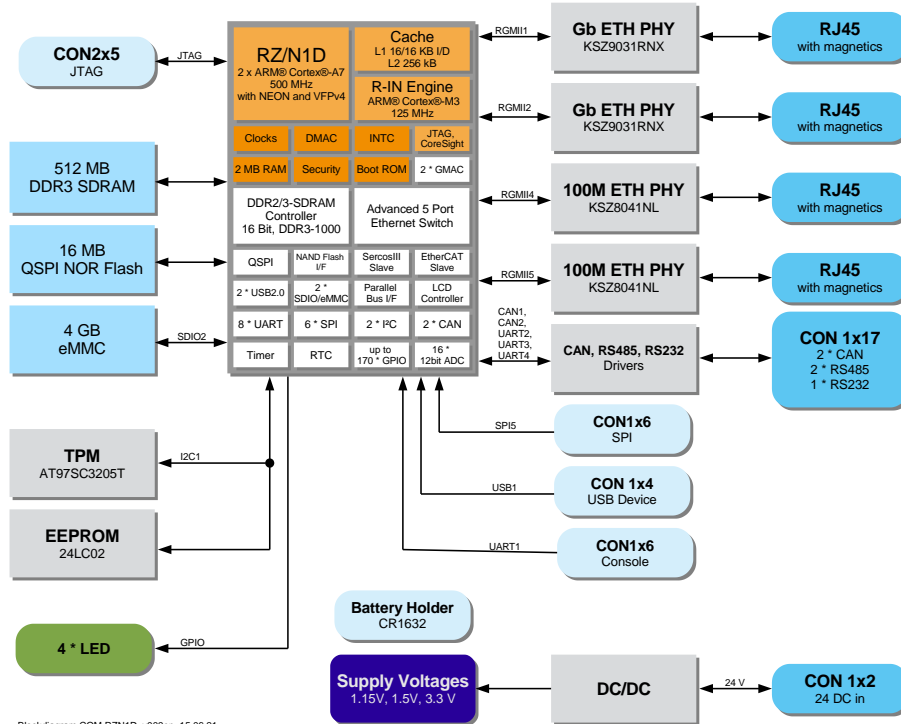
The following table lists the features and interfaces of the SBC-RZN1D communication module:

SBC-RZN1D
512 MByte DDR3-1000 RAM
16 MB QSPI NOR Flash
4 GB eMMC NAND Flash
2 x Gb Ethernet
2 x 100 Mb Ethernet
2 x CAN 2.0B interface
2 x RS485 interface
1 x RS232 interface with RTS/CTS
RTC with optional battery backup
12-36 VDC power supply

The module is available in commercial temperature range -25°C to 70°C and optionally in extended temperature range -40°C to 85°C.

## 2 Block Diagram

The following figure shows the block diagram of the SBC-RZN1D.



## 3 Functional Description

### 3.1 Processor

The SBC-RZN1D module is based on the processor RZ/N1D from Renesas [1]. This is a heterogeneous multi core processor which incorporates a Dual Cortex<sup>®</sup>-A7 CPU at 500 MHz and an additional Cortex<sup>®</sup>-M3 CPU at 125 MHz.

The Cortex<sup>®</sup>-M3 CPU is part of a R-IN Engine for industrial Ethernet communication which additionally includes an Advanced 5 Port Switch, an EtherCAT slave controller, a Sercos III slave controller a HWRTOS GMAC and two GMACs.

Besides the Ethernet interfaces further interfaces are available like CAN 2.0B and UARTs that are used at SBC-RZN1D.

Further details of the processor can be found in the RZ/N1D Reference Manual [1].

### 3.2 DDR3 SDRAM

The module incorporates a 4-Gbit DDR3(L) SDRAM that which is clocked at 500 MHz ((DDR3-1000 mode).

### 3.3 NOR-Flash

A 16 MByte QSPI NOR Flash is connected to the QSPI interface of the RZ/N1D processor. The maximum clock rate of the interface is 66 MHz. The NOR flash is used as boot device.

### 3.4 eMMC

To store the operating system and application data, normally a 4 GByte eMMC is used in the SBC-RZN1D module. It is connected to the SDIO1 interface of the RZ/N1D using 4 data lines.

The storage capacity of the eMMC can be adapted to customer's needs by soldering different chips. Please contact emtrion GmbH if another eMMC capacity is required.

## 3.5 Ethernet Interfaces

### 3.5.1 Introduction

The RZ/N1D processor incorporates five Ethernet interfaces. Four of them are available for users, two are realized as Gbit Ethernet interfaces and two as 100 Mbit Ethernet interfaces.

### 3.5.2 100M Interfaces

The 100M interfaces are connected to the interfaces RGMII4 and RGMII5 of the processor and available at the front. PHYs of type KSZ8041NL are used. They are controlled by the interface MDIO2 of the processor.

The PHY of interface RGMII4 is configured at address 4. Its output LED0 is connected to the input SWITCH\_MII\_LINK[4] of the processor. The interface is available at RJ45 socket J8.

The PHY of interface RGMII5 is configured at address 5. Its output LED0 is connected to the input SWITCH\_MII\_LINK[5] of the processor. The interface is available at RJ45 socket J9.

### 3.5.3 1Gb Interfaces

The two Gb interfaces are connected to the interfaces RGMII1 and RGMII2 of the processor and available at the bottom side. PHYs of type KSZ9031RX are used. They are controlled by an MDIO interface which is comprised by two GPIO pins. GPIO154 is used as MDC and GPIO155 is used as MDIO.

The PHY of interface RGMII1 is configured at address 5. The interface is available at RJ45 socket J2.

The PHY of interface RGMII2 is configured at address 6. The interface is available at RJ45 socket J1.

## 3.6 Serial Ports

The RZ/N1D processor incorporates up to eight serial ports. Three of them are available for users.

The UART3 and UART4 are realized as RS485 interfaces and the UART2 is realized as RS232 interface. All interfaces can be accessed by the pin header J4 at the top of the enclosure.

Besides these interfaces the fourth interface UART1 is available as TTL signals at a pin header that fits to a UART-USB-Cable from FTDI. This interface is used by U-Boot and Linux as console interface.

## 3.7 CAN

The RZ/N1D processor incorporates two CAN controllers, which comply with the ISO11898-1 specification. The CAN protocol specification 2.0B, with standard and extended message frames, is supported. The maximum baud rate is 1Mbps.

Both interfaces can be accessed by the pin header J4 at the top of the enclosure.

## 3.8 RTC

To enable time keeping while the module is powered off the integrated RTC of the processor RZ/N1D can be buffered by a coin cell CR1632. The battery will keep the RTC running for more than 5 years.

## 3.9 TPM

A TPM SE050C from NXP is connected to interface I2C1. The 7-bit address is 0x48.

## 3.10 EEPROMs

An EEPROM 24LC02B is connected to interface I2C1. The EEPROM can store up to 256 bytes configuration data. The 7-bit address of the EEPROM is 0x50.

A second EEPROM AT24C16D is connected to I2C interface CAT\_SCL/CAT\_SDA at GPIO113 and GPIO112 of the processor. The 7-bit address of the EEPROM is 0x50.

### 3.11 LEDs

#### 3.11.1 Status LEDs

Two Dual-colour LEDs D1 and D2 are located at the front. The LEDs are driven by GPIO pins of the processor as following:

LED	Signal
D1-Green	GPIO88
D1-Red	GPIO91
D2-Red	GPIO90
D2-Green	GPIO89

The LEDs are on while the corresponding GPIO is driven high.

The LEDs shine Yellow while both colours, Red and Green, are driven high,.

#### 3.11.2 Activity LEDs

The control of the green LEDs of the RJ45 sockets J8 and J9 at the front can be switched between the LED1 outputs of the connected PHYs and GPIO pins of the processor.

The LED source is selected by GPIO93 as following:

GPIO93	LED in RJ45 socket J8	LED in RJ45 socket J9
low	GPIO137	GPIO136
high	PHY4 LED1	PHY5 LED1

The LEDs are on while the corresponding GPIO is driven high.

### 3.12 USB interface

The interface USB1 is available internally as USB Device for production purposes. It is not available for customers.

### 3.13 SPI interface

The interface SPI5 is available internally at a 6 pin header. It is provided for future use and normally not available for customers.

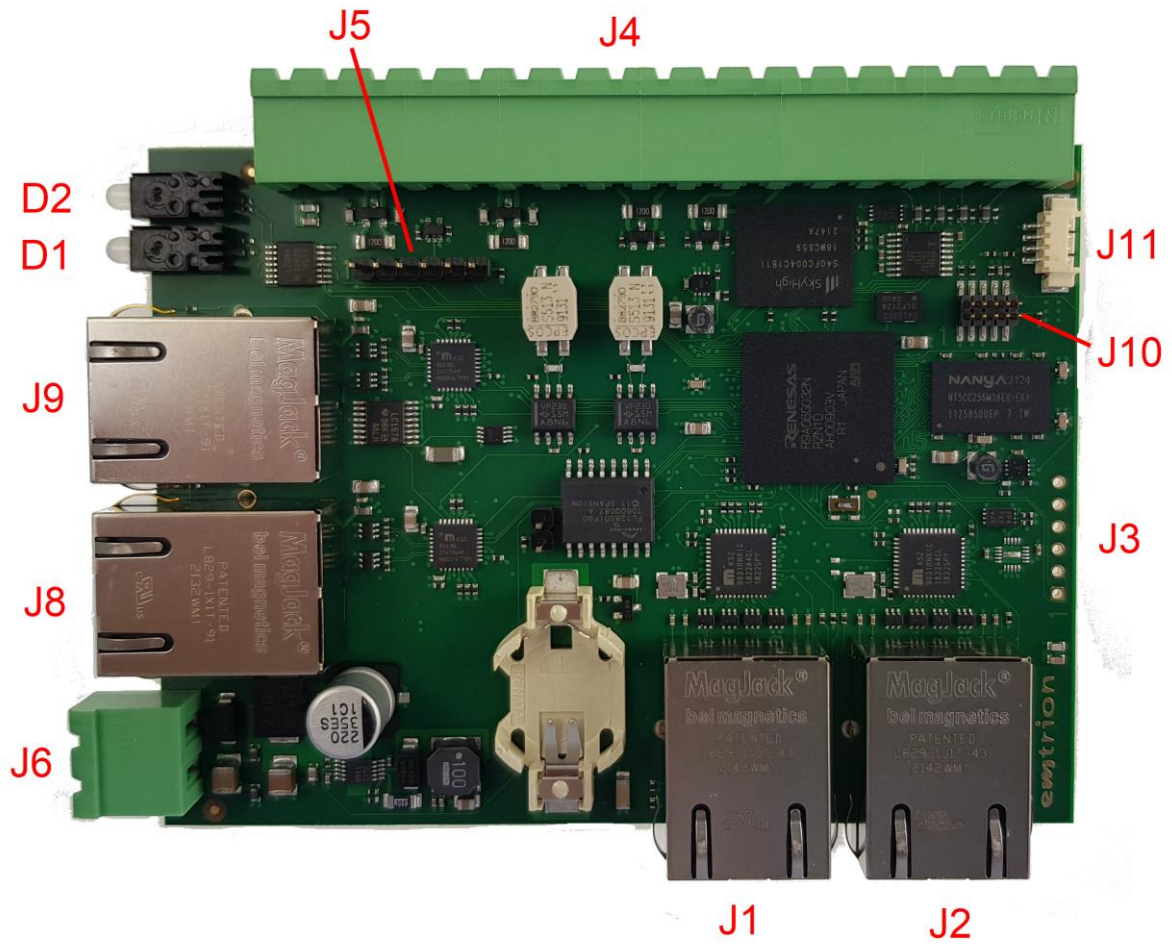
### 3.14 Power Supply

The power consumption of the module is max. 0.2 A at +24V, +/- 50%. The current consumption depends on the software running.



## 4 Connectors

### 4.1 Connector Locations



## 4.2 External Connectors

### 4.2.1 J6: Power Supply

Type Phoenix Contact MSTBA 2,5/2-G

Mating connector: Phoenix Contact: MSTB 2,5/ 2-ST, 1754449

Pin	Signal
1	24 VDC
2	GND

### 4.2.2 J1, J2: RJ45 TCP/IP Connectors

Type 1G BASE-T

Pin	Signal
1	DA+
2	DA-
3	DB+
4	DC+
5	DC-
6	DB-
7	DD+
8	DD-

### 4.2.3 J8, J9: RJ45 Fieldbus Connectors

Type 10/100 BASE-T

Pin	Signal
1	DA+
2	DA-
3	DB+
4	n/c
5	n/c
6	DB-
7	n/c
8	n/c

#### 4.2.4 J4: Serial Interfaces

Type Phoenix Contact MSTBA 2,5/17-G

Mating connector: Phoenix Contact: MSTB 2,5/17-ST, 1754740

Pin	Signal
1	RS232_RxD
2	RS232_TxD
3	RS232_CTS
4	RS232_RTS
5	GND
6	RS485-1_B
7	RS485-1_A
8	GND
9	RS485-2_B
10	RS485-2_A
11	GND
12	CAN-1_H
13	CAN-1_L
14	GND
15	CAN-2_H
16	CAN-2_L
17	GND

## 4.3 Internal Connectors

### 4.3.1 J3: SPI

Type Header 1x6, 2.54 mm (not fit)

Pin	Signal
1	SPI5_SCK
2	SPI5_MOSI
3	SPI5_MISO
4	SPI5_SS#
5	3.3V
6	GND

### 4.3.2 J5: Console

Type Header 1x6, 2.54 mm

Pin	Signal
1	GND
2	n/c
3	n/c
4	UART1_RxD
5	UART1_TxD
6	PU 10k

### 4.3.3 J10, JTAG

Type Header 2x5, 1.27 mm

Pin	Signal	Signal	Pin
1	3.3V	TMS	2
3	GND	TCK	4
5	GND	TDO	6
7	n/c	TDI	8
9	TRST#	RESET#	10

### 4.3.4 J11: USB Device

Type Microlatch

Pin	Signal
1	VBUS
2	DM1
3	DP1
4	GND

## 5 Technical Characteristics

### 5.1 Electrical Specifications

<b>Supply voltage</b>	24V, +/-50%
<b>Current consumption</b>	up to 0.2 A

### 5.2 Environmental Specifications

<b>Ambient temperature</b>	
Open board	-25 ... +85°C
Board mounted in enclosure	-25 ... +60°C
<b>Storage temperature</b>	-40 ... +125°C
<b>Relative humidity</b>	0 ... 95 %, non-condensing

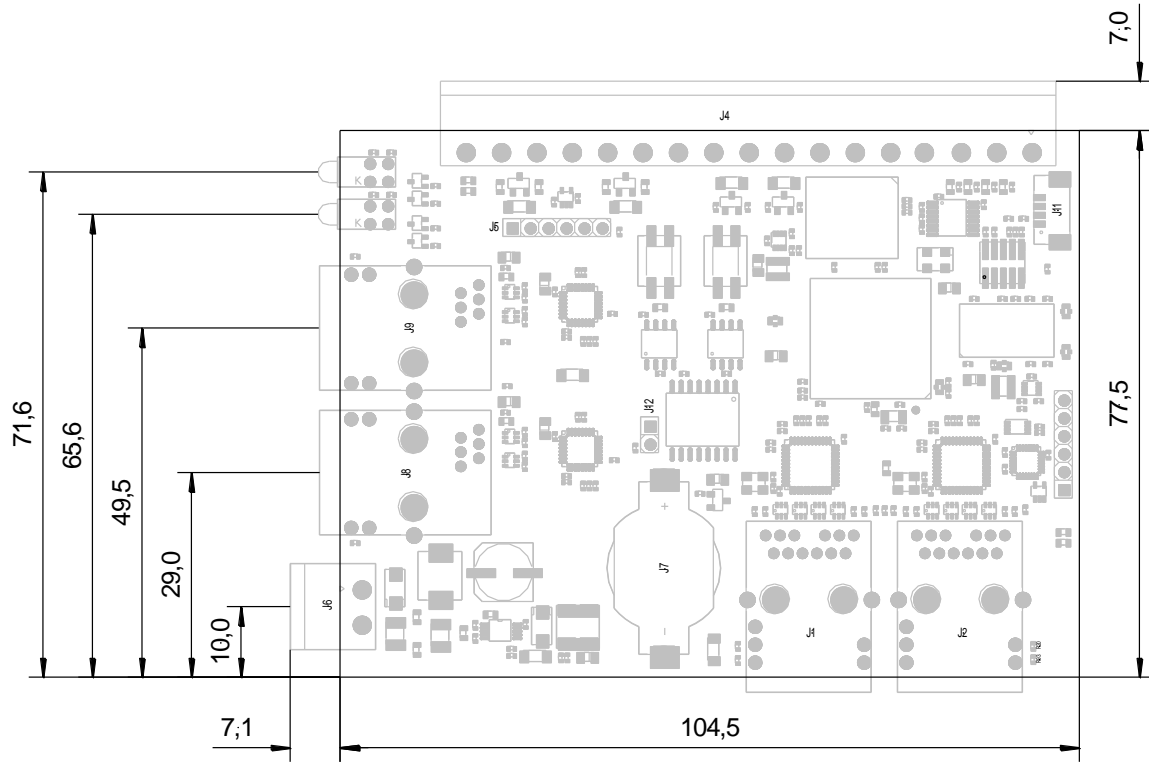
### 5.3 EMC

EN 61000-6-3: 2007
EN 61000-6-2: 2019

### 5.4 Mechanical Specifications

<b>Weight</b>	approx. 80 g
<b>Board</b>	Glasepoxi FR-4, UL-listed, 8 layers
<b>Dimensions</b>	111.6 mm x 84.5 mm x 15.0 mm

## 6 Dimensional Drawing of PCB



## 7 References

- [1] Datasheet  
RZ/N1D Group, RZ/N1S Group, RZ/N1L Group,  
R01DS0323EJ0110, Rev. 1.1, May 29, 2020