RCP-1000 Series

COMPUTING PLATFORM FOR RAILWAY APPLICATIONS

INSTALLATION MANUAL

Revision: **1.0** | Date: **11.12.2025**

DISCLAIMER

Copyright

SAFETY INFORMATION

Electrical Safety

	**WARNING** The device can be operated with voltages over 75 V DC. Incorrect handling risks causing a fatal electrical shock. Before connecting the power supply, connect the device to protective earth.

General advice

- Only qualified personnel is allowed to install, operate and maintain the devices.
- Please take safety precautions against electrostatic discharge (ESD).
- Access to the devices may only be granted to qualified personnel.
- To prevent the risk of electric shock, turn off the external power supply and remove the power supply cable from the electrical outlet before handling or disassembling the system.
- When adding or removing devices to or from the system, ensure that the power cables for the devices are unplugged before the signal cables are connected.
- Make sure that your power supply is set to the correct voltage in your area. If you are not sure about the voltage of the electrical outlet you are using, contact your local power company.
- If the power supply is broken, do not try to fix it by yourself. Contact a qualified service technician or your retailer.

Operation Safety

	**WARNING** The device can become very hot during operation (> 80 ° C). Make sure it is protected from accidental contact. The device must be installed so that it is not accessible to children. To prevent burns, switch off the device and allow to cool down for half an hour before disassembling or working on it.

- Before installing the device and connecting cables to it, carefully read the related manuals.
- Before using the device, make sure all cables are correctly connected and the power cables are not damaged. If you detect any damage, contact your dealer immediately.
- Avoid dust, humidity, and temperature extremes. Do not place the product in any area where it may become wet.
- Place the product on a stable surface.
- If you encounter technical problems with the product, contact a qualified service technician or your retailer.

Radio Frequency Exposure Statement

At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.

RECYCLING

Please recycle packaging environmentally friendly:

Packaging materials are recyclable. Please do not dispose packaging into domestic waste but recycle it.

Please recycle old or redundant devices environmentally friendly:

Old devices contain valuable recyclable materials that should be reutilized. Therefore please dispose old devices at collection points which are suitable.

EU DECLARATION OF CONFORMITY

Westermo Eltec GmbH herewith declares that the device is compliant to the basic requirements of the directive 2014/53/EU. The full text of the EU declaration of conformity is available in the Download Center on www.eltec.com and at the product support section on www.westermo.com.

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 ABOUT THIS DOCUMENT

This installation manual is intended only for system developers and integrators; it is not intended for end users.

It describes the hardware functions of the product, connection of peripheral devices and integration into a system. Additional information on special applications and the configuration of the product is available for download in a separate configuration manual at the Download Center on www.eltec.com and at the product support section on www.westermo.com.

2 OVERVIEW

2.1 PRODUCTS

This installation manual comprises all information to set-up the following products.

Figure 1 **Picture of RCP Base System, no extension modules**

Figure 2 **Picture of RCP Medium System, up to 2x extension modules**

Figure 3 **Picture of RCP Large System, up to 7x extension modules**

3 HARDWARE

The RCP-1000 Series is a rugged and modular computing platform purpose-built for onboard vehicle applications. Its scalable architecture supports a range of preassembled extension modules, allowing for versatile configurations tailored to specific market requirements. This modular design not only ensures flexibility but also enables rapid system customization and accelerated time to market.

3.1 DEVICE CONNECTORS

3.1.1 POWER SUPPLY MODULE CONNECTORS

The RCP system can be powered by a DC power source connected to the internal power supply via an M12 connector. The nominal input voltage can vary between 24 V and 110 VDC. The electrical power can be supplied to the device using the M12 A-coded male power connector, labeled PWR IN.

Figure 4 **Frontpanel power supply module**

Table 1 shows the pin-assignment of the power supply connector.

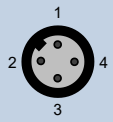
	PIN	SIGNAL NAME	DESCRIPTION
	1	+VIN	Supply voltage, positive terminal
	2	+VIN	Supply voltage, positive terminal
	3	-VIN	Supply voltage, negative terminal
	4	-VIN	Supply voltage, negative terminal

Table 1 **Pin Assignment of Power Supply Connector (PWR)**

3.1.2 CPU MODULE ETHERNET INTERFACES

The 3x LAN-ports of the RCP are utilizing M12 X-coded female connectors with the pin-assignment as shown in Table 2. Mating connectors are available from several manufacturers.

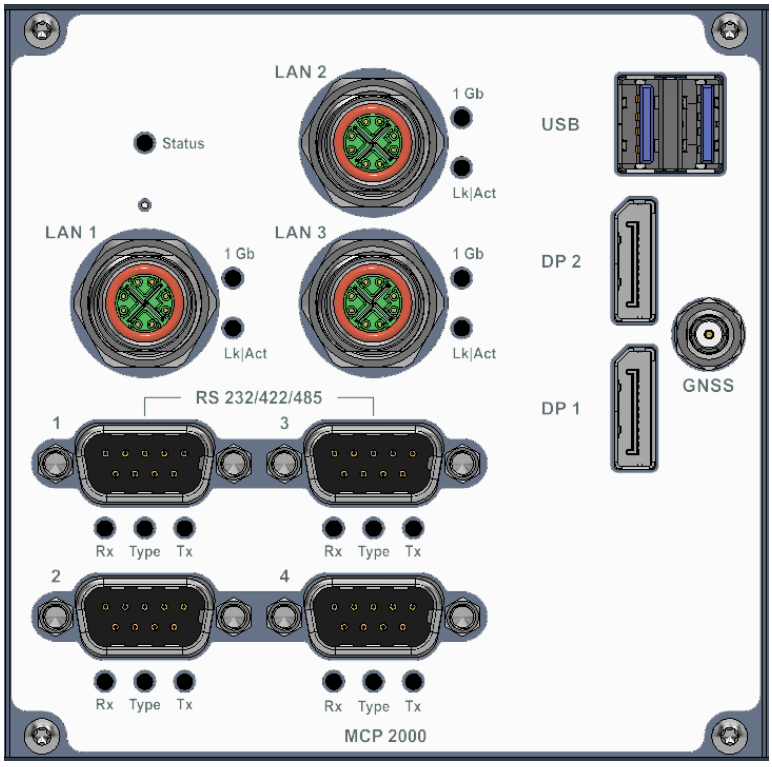


Figure 5 **Frontpanel CPU module with ETH ports**

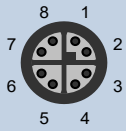
	PIN	SIGNAL NAME	DESCRIPTION
	1	D1+	First data line plus
	2	D1−	First data line minus
	3	D2+	Second data line plus
	4	D2−	Second data line minus
	5	D4+	Fourth data line plus
	6	D4−	Fourth data line minus
	7	D3−	Third data line minus
	8	D3+	Third data line plus

Table 2 **Pin Assignment of M12 Ethernet Connectors (LAN 1/2)**

3.1.3 CPU MODULE SERVICE PORT AND SERIAL INTERFACES

The RCP is equipped with 4x RS232 / 422 / 485 interfaces over D-Sub 9 male connectors and the first serial port is reserved as a service port, which cannot be used for RS485. To use the remaining 3x RS485 ports the TX / RX pair pins must be shorted externally in the connector cable (Pin 2 + 3 / Pin 7 + 8).

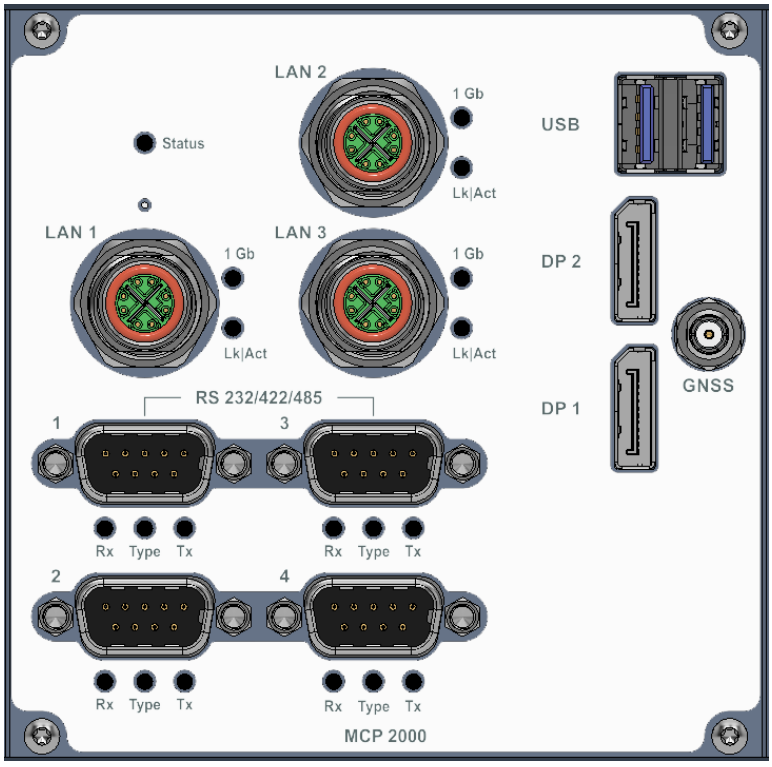


Figure 6 **Frontpanel CPU module with service console port and serial interfaces**

Table 3 shows the pin assignment of the serial interfaces.

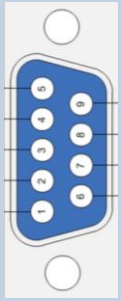
	PIN	SIGNAL NAME RS232	SIGNAL NAME RS422	SIGNAL NAME RS485	DESCRIPTION
	1	-	-	-	-
	2	Rx	RxD−	-	Receive data−
	3	TX	TxD−	D−	Transmit data− / Data(A) −
	4	-	-	-	-
	5	GND	GND	GND	Common ground
	6	-	-	-	
	7	RTS	TxD+	D+	Transmit data+ / Data(B)+
	8	CTS	RxD+	-	Receive data+
	9	+5V	+5V	+5V	Supply voltage

Table 3 **Pin Assignment of Serial Interface Connectors (RS232 / 422 / 485)**

Note RS422:
RS422 is a point-to-point serial communication standard designed for high-speed and robust data transfer. Unlike RS232, RS422 uses differential signaling, which provides better noise immunity and allows for faster transmission rates. However, it does not support hardware handshaking, as the typical handshake pins are repurposed for differential data lines (TxD+ / TxD− and RxD+ / RxD−).

To establish a proper RS422 connection:

- TxD± must be connected to the corresponding RxD± of the remote device.
- A common ground reference between the two devices is required.
- For higher baud rates (>115 kBaud) or cable lengths over 10 meters, a termination resistor of 100–150 Ω between RxD+ and RxD− at the receiver is recommended to reduce signal reflections.
- For short-distance connections, a standard null modem cable may be sufficient.

Note RS485:
RS485 supports multipoint communication on a shared bus, requiring proper termination to ensure signal integrity and maintain a defined idle state when no device is transmitting.

RS485 installation notes:

- Termination resistors must be placed at both ends of the bus.
- The termination voltage can be externally supplied. When the RCP system is the final node in the bus chain, it can provide this voltage via Pin 9 of the DB9 connector.
- To enable this feature, a hardware bridge (jumper) must be closed on the system's serial controller (default: open).
- Since the RS485 standard does not define specific termination voltages or resistor values, it is common practice to use +5 V with resistor values similar to the diagram below (e.g., 120 Ω termination + pull-up/pull-down resistors). The exact values are not critical.

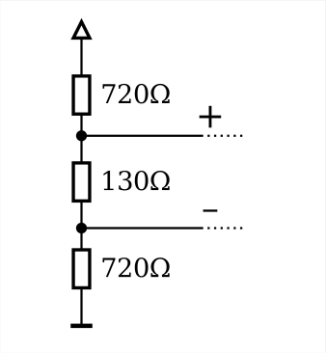


Figure 7 **RS485 termination**

3.1.4 CPU MODULE PERIPHERAL DEVICE INTERFACES

The RCP system provides high-speed peripheral connectivity through 2x USB 3.0 Type-A ports and 2x DisplayPort 1.2 interfaces. These ports are located on the front I/O panel and are designed for direct connection to external devices such as input peripherals, storage media, external monitors, and HMI components.

The USB 3.0 ports support data rates of up to 5 Gbps and are backward compatible with USB 2.0/1.1 devices. They are ideal for connecting external keyboards, mice, flash drives, and other USB-compatible peripherals.

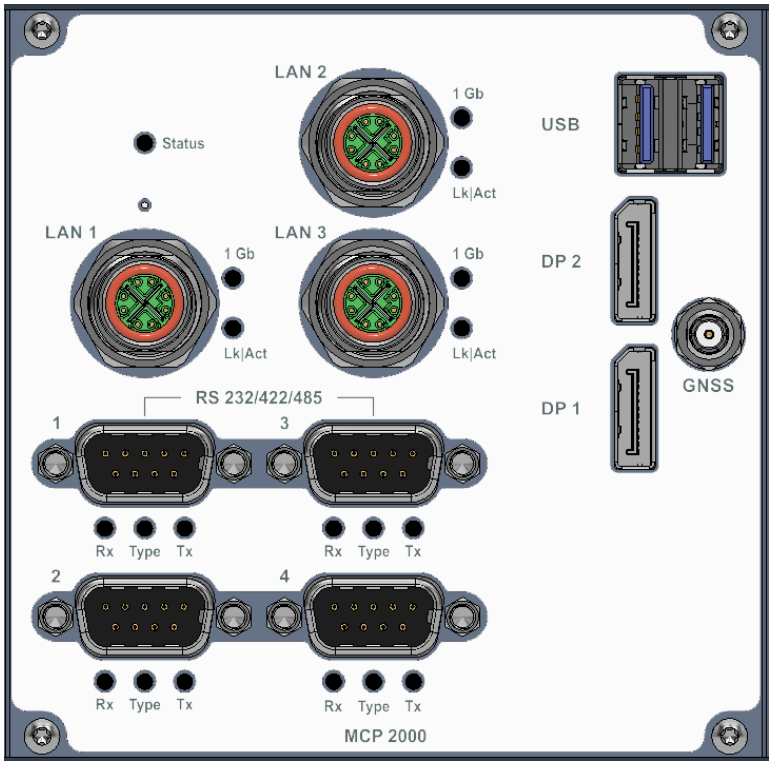


Figure 8 **Frontpanel CPU module with USB 3.0 and DisplayPort 1.2**

Table 4 shows the pin assignment of the USB connectors.

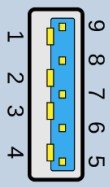
	PIN	SIGNAL NAME	DESCRIPTION
	1	VBUS	+5 VDC power supply
	2	D–	USB 2.0 differential pair (–)
	3	D+	USB 2.0 differential pair (+)
	4	GND	Common ground
	5	SSRX–	SuperSpeed receiver differential (–)
	6	SSRX+	SuperSpeed receiver differential (+)
	7	GND	Common ground
	8	SSTX–	SuperSpeed transmitter differential (–)
	9	SSTX+	SuperSpeed transmitter differential (+)

Table 4 **Pin Assignment of USB 3.0 Connectors**

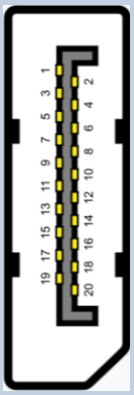
The RCP system includes two DisplayPort 1.2 outputs, supporting resolutions up to 3840 × 2160 (4K UHD) @ 60Hz. These interfaces are suitable for high-resolution external monitors and industrial display panels.

Caution: Use certified DisplayPort cables to ensure signal integrity, especially for 4K displays or long-distance connections.

Features:

- Multi-Stream Transport (MST) for daisy-chaining multiple displays
- Audio signal transmission support
- HDCP 1.3 and DPCP content protection compatible

Table 5 shows the pin assignment of the DisplayPort 1.2 connectors.



PIN	SIGNAL NAME	DESCRIPTION
1	ML_Lane 0 (p)	Main lane 0 positive
2	GND	Common ground
3	ML_Lane 0 (n)	Main lane 0 negative
4	ML_Lane 1 (p)	Main lane 1 positive
5	GND	Common ground
6	ML_Lane 1 (n)	Main lane 1 negative
7	ML_Lane 2 (p)	Main lane 2 positive
8	GND	Common ground
9	ML_Lane 2 (n)	Main lane 2 negative
10	ML_Lane 3 (p)	Main lane 3 positive
11	GND	Common ground
12	ML_Lane 3 (n)	Main lane 3 negative
13	CONFIG1	Connected to ground
14	CONFIG2	DP_PWR return
15	AUX CH (p)	Auxiliary channel positive
16	GND	Common ground
17	AUX CH (n)	Auxiliary channel negative
18	HPD	Hot Plug Detect
19	DP_PWR	Power for adapter
20	GND	Common ground

Table 5 **Pin Assignment of DisplayPort 1.2 Connectors**

3.1.5 MVB BUS MODULE INTERFACE (ESD+ / EMD)

The RCP system supports the Multifunction Vehicle Bus (MVB) communication compliant with ESD+ / EMD electrical interface specifications, commonly used in railway environments for deterministic, real-time train control communication. The MVB interface is optimized for Train-wide control networks (TCN) / Car-to-car communication and Real-time data exchange between onboard control units. Each MVB module provides two D-Sub 9 connectors (1x male, 1x female), enabling convenient loop-through wiring.

Standards supported:

- EMD (Electrical Medium Distance) / distances up to 200 meters
- ESD+ (Electrical Short Distance) / distances up to 20 meters

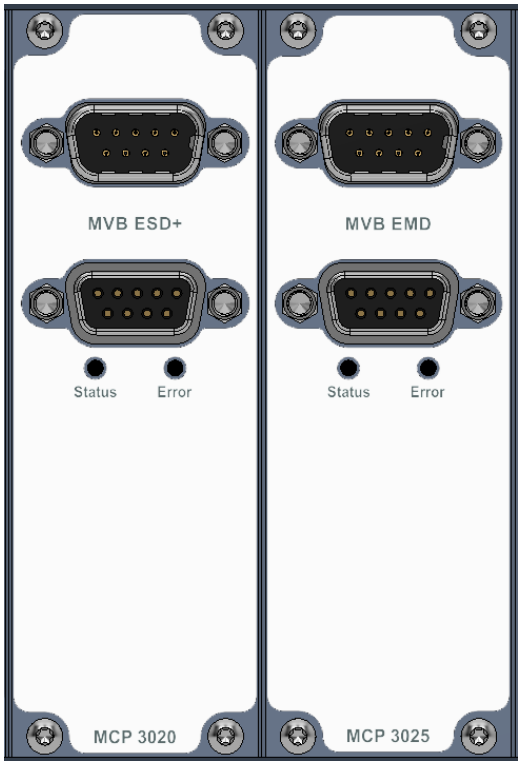


Figure 9 **Frontpanel MVB modules**

Table 6 shows the pin assignment of both female/male MVB EMD connectors.

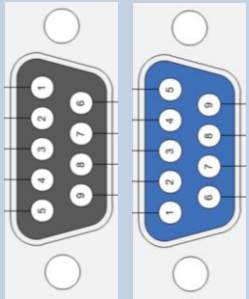
	PIN	SIGNAL NAME MVB EMD	DESCRIPTION	Line
	1	ADP	Data_P	from Line A
	2	ADN	Data_N	from Line A
	3	-	-	-
	4	BDP	Data_P	from Line B
	5	BDN	Data_N	from Line B
	6	ATP	Termination_P	from Line A
	7	ATN	Termination_N	from Line A
	8	BTP	Termination_P	from Line B
	9	BTN	Termination_N	from Line B

Table 6 **Pin Assignment of MVB EMD Connectors**

Table 7 shows the pin assignment of both female/male MVB ESD+ connectors.

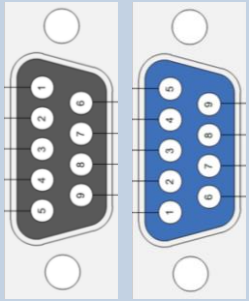
	PIN	SIGNAL NAME MVB ESD+	DESCRIPTION	Line
	1	ADP	Data_P	from Line A
	2	ADN	Data_N	from Line A
	3	-	-	-
	4	BDP	Data_P	from Line B
	5	BDN	Data_N	from Line B
	6	AGND	GND	from Line A
	7	BGND	GND	from Line B
	8	A5V	5V	from Line A
	9	B5V	5V	from Line B

Table 7 **Pin Assignment of MVB ESD+ Connectors**

Note:

The male and female D-Sub 9 connectors support pass-through wiring to simplify bus installation and minimize cable effort. No active bus termination is required on the interface side.

3.1.6 CAN MODULE INTERFACE

The system provides support for the Controller Area Network (CAN) interface according to ISO 11898-2 (High-Speed CAN), widely used in industrial and railway automation for robust, real-time communication between embedded systems. The CAN interface is suitable for a range of industrial and rail-based applications, including communication with vehicle control units (VCU), monitoring and diagnostics of subsystems, and integration of sensors and actuators in vehicles.

Each CAN module provides two D-Sub 9 connectors (1x male for input, 1x female for output), providing compatibility with standard cabling and connector layouts used in rolling stock applications, enabling convenient loop-through wiring.

Note: Ensure that the CAN network is terminated properly at both ends to avoid signal reflections and communication errors.

Installation Notes:

- Use twisted pair CAN cabling with proper impedance (typically 120 Ω).
- Terminate the CAN bus at both ends with 120 Ω resistors.
- Connect the shield to ground at one location only to avoid ground loops.

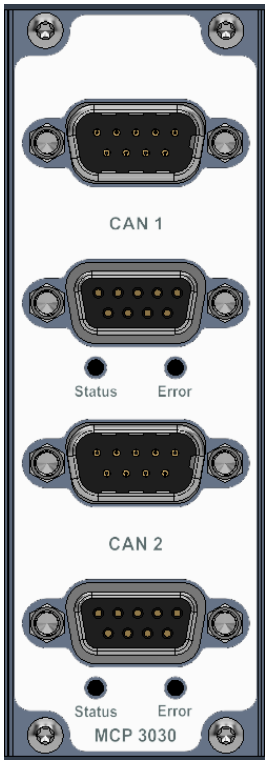


Figure 10 **Frontpanel CAN module**

Table 8 shows the pin assignment of both female/male CAN connectors.

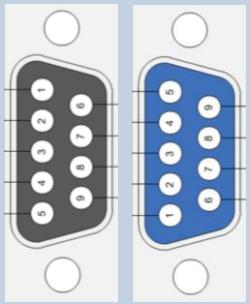
	PIN	SIGNAL NAME MVB ESD+	DESCRIPTION
	1	-	-
	2	CAN_L	CAN data line (low)
	3	GND	Signal ground
	4	-	-
	5	-	-
	6	-	-
	7	CAN_H	CAN data line (high)
	8	-	-
	9	-	-

Table 8 **Pin Assignment of CAN Connectors**

3.1.7 ANTENNA CONNECTORS

The QLS antenna connectors are located at the front panel of each module. Besides the GNSS connector on the CPU module, each radio interface module connector is labeled from A1 to A4. Depending on the specific radio interface, not all antenna connectors are currently in use; some are reserved for future interfaces such as 5G and Wi-Fi 7. Their functionalities depend on the model type described in Table 9 below.

When connecting an antenna to the QLS connector, make sure that you hear a 'click' sound confirming proper mounting.

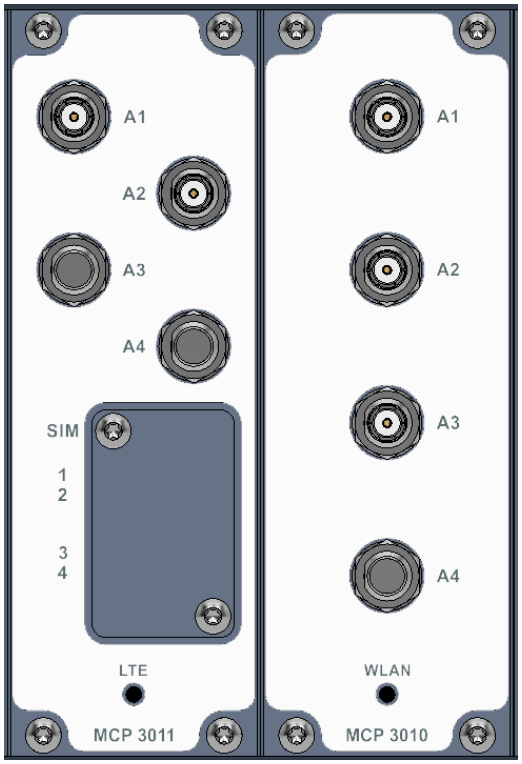


Figure 11 **Frontpanel LTE and Wi-Fi modules**

MODELS	ANTENNAS			
RCP with WLAN	WLAN A1	WLAN A2	WLAN A3	not used A4
RCP with LTE	LTE main A1	LTE aux. A2	not used A3	not used A4
RCP with 5G	5G A1	5G A2	5G A3	5G A4
RCP with Wi-Fi 7 Dual concurrent	WLAN 1 A1	WLAN 1 A2	WLAN 2 A3	WLAN 2 A4

Table 9 **Antenna assignment per wireless interface**

To remove an antenna, it has to be gently pulled from the basis of the connector with one hand, while the other hand is holding the antenna. Alternatively, a screwdriver can be used as a lever arm at the basis of the antenna to facilitate the removal, as illustrated below.

STEP 1	STEP 2
Place the screwdriver between the connector and the device	Rotate and/or push the screwdriver while pulling the antenna
	

3.2 LED INDICATORS

The LEDs on the front panel of the RCP system provide quick indication of the device status.

3.2.1 POWER STATUS LED

LED COLOR	STATE	DESCRIPTION
Green	On	Device is receiving correct input power
Green	Off	Device is not powered

Table 10 **Power Status LED**

3.2.2 SYSTEM STATUS LED

LED COLOR	STATE	DESCRIPTION
Red	On	System is not booted yet
Green	On	System booted in standard mode
Orange	On	System booted in emergency mode
Off	Off	System is off

Table 11 **System Status LED**

3.2.3 LAN STATUS LED (10/100 M | 1000 M)

LED COLOR	STATE	DESCRIPTION
Green Yellow	On On	1000 Mbit/s link established
Green Yellow	On Off	10/100 Mbit/s link established
Green Yellow	Blinking Off	Indicates 10/100 Mbit/s data transfer
Green Yellow	Blinking On	Indicates 1000 Mbit/s data transfer
Green Yellow	Off Off	No 100 Mbit/s (resp. 1000 Mbit/s) link

Table 12 **LAN Status LED**

3.2.4 WIRELESS MODULE STATUS LED

LED COLOR	STATE	DESCRIPTION
Green	On	Indicates module is in use
Green	Toggle	Indicates data transfer on module
Green	Off	Indicates module is inactive

Table 13 **Wireless Module Status LED**

3.2.5 MVB MODULE STATUS LED

LED COLOR	STATE	DESCRIPTION
Green	Off	Indicates module is inactive
Green	Toggle	Indicates data transfer on module
Green	On	Normal operation mode

Table 14 **MVB Module Status LED**

3.2.6 MVB MODULE ERROR LED

LED COLOR	STATE	DESCRIPTION
Red	On	MVB Bus Error
Red	Off	No error pending

Table 15 **MVB Module Error LED**

3.2.7 CAN MODULE STATUS LED

LED COLOR	STATE	DESCRIPTION
Green	Off	Indicates module is inactive
Green	Toggle	Indicates data transfer on module
Green	On	Normal operation mode.

Table 16 **CAN Module Status LED**

3.2.8 CAN MODULE ERROR LED

LED COLOR	STATE	DESCRIPTION
Red	On	CAN Bus Error
Red	Off	No error pending

Table 17 **CAN Module Error LED**

3.3 RESET SWITCH

The RCP system is equipped with a hidden reset switch behind the front panel close to LAN 1. The button is accessible with a straightened paper clip pushed through the little hole on the front panel. The effect of pressing the reset switch depends on the duration of its activation, as indicated in Table 18 below. The timing behavior is only valid, if the device has completly booted (after approx. 1 min).

The following table describes the functions of the reset switch.

HOLD TIME	STATUS LED BEHAVIOR	ACTION
< 2 seconds	Blinking	System reboot
2-5 seconds	Blinking stops	No action
5-10 seconds	Blicking fast	Factory reset
> 10 seconds	Blinking stops	No action

Table 18 **Reset Switch Behavior**

3.4 SIM CARDS

The RCP provides 4 SIM slots per modem. Only one slot per modem can be active at any time. To install SIM cards, the small front plate of the RCP has to be removed using a suitable torx 8 screwdriver. After installing the SIM cards, the small front plate can be closed and the screws tightened to a maximum torque of 0.55 Nm.

Note: Switching between SIM slots takes about 30 seconds, slot 1 being preselected at power up. If you plan to use only one SIM card for a given modem, it is advisable to use slot 1 to avoid slot switching delay during the boot phase.

The drawing in Figure 12 shows the SIM slot assignment with a closed / opened SIM panel.

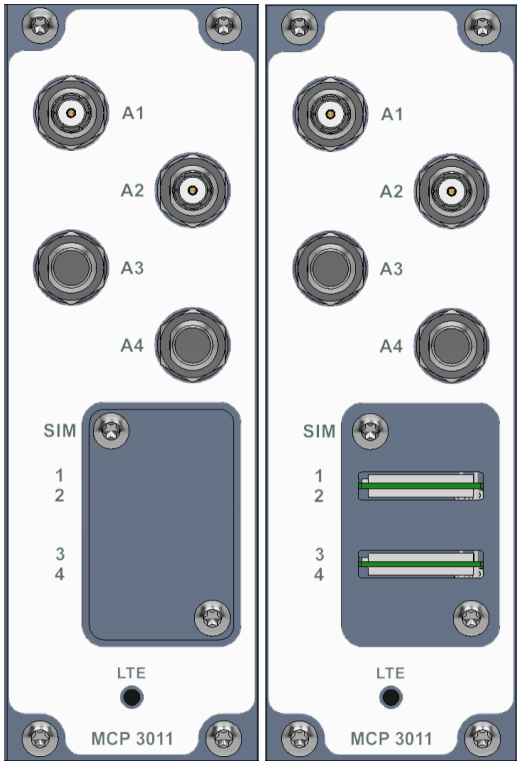


Figure 12 **SIM Slot Assignment per Modem of the RCP**

Important: Do not change the SIM cards when the device is powered since there is a danger of touching the main voltage when the device is open.

4 MOUNTING

This product uses convection cooling. Ensure it's installed within the specified ambient temperature range by avoiding airflow obstructions. Install it where natural airflow isn't blocked, with sufficient spacing. At high ambient temperatures, mount the product on a metallic base plate to improve heat dissipation by increasing the surface area.

When mounting the RCP-1000, please take into account the following aspects:

- Do not install the device close to any sources of heat, such as radiators or heat registers.
- Keep the device away from any liquids and avoid exposure to dripping or splashing. The protection class of the housing is IP40.
- The housing provides various mounting options with DIN-Rail build-in and shown below. The DIN-Rail, wall mount and 19 inch rack mounting options are available as accessories.

The drawing in Figure 13 shows the outer dimensions of the housing, including the DIN-Rail mounting option.

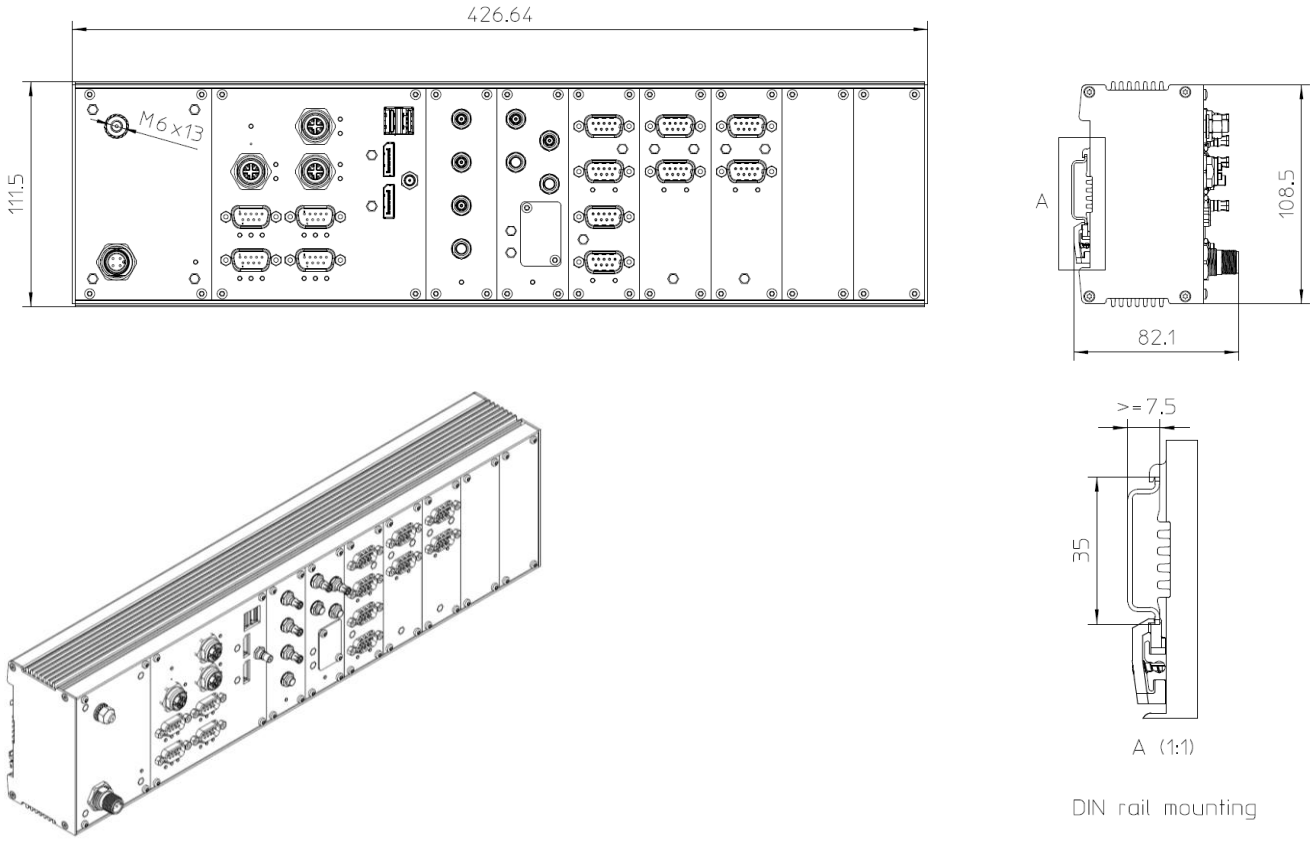


Figure 13 **Dimensions of the RCP Large Model as an example**

4.1 CONNECTING AN EARTHING CABLE

The M6 earthing stud on the side of the device for protective earth connection is essential for the device security. Carry out the following steps to connect an earthing cable:

- Use an earthing cable with a cross-section of at least 2.5 mm² and a wire end sleeve with eyelet suitable for a 6 mm threaded bolt.
- Mount the earth cable as shown in Figure 14.
- Fasten the cable by tightening the nut to the required torque (recommended according to EN60947-1 are 3 Nm).

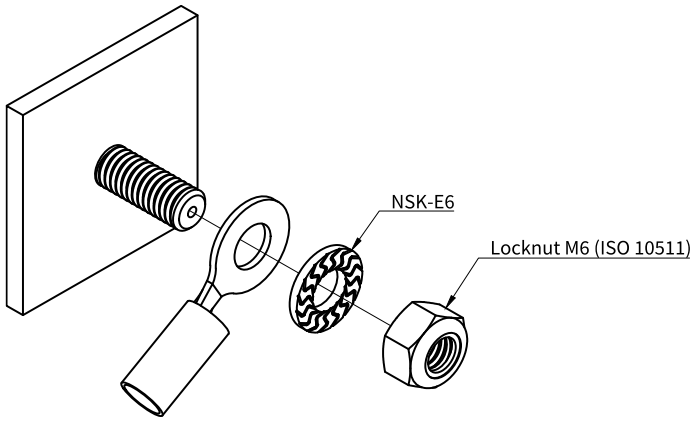


Figure 14 **Earth Cable Mounting on Earth Stud**

4.2 ELECTRICAL CONNECTION

1. Make sure the device is properly grounded.
2. Establish a connection to the network by plugging a M12 patch cable to one of the front panel M12 connectors.
3. Connect the desired number of antennas to the device. Each radio/modem can use up to four antennas for maximal performance.
4. In case of using a local power supply, the appropriate wiring (see Table 1) must be established to connect the power line to the device.
5. Make sure that the voltage of the power supply conforms to the voltage on the type plate.
6. Ensure that the power supply is grounded correctly and that the power cable is intact and undamaged. Do not switch on the system if there are damages on the power cable or plug.
7. Use power cables which are approved for the power supply in your country.
8. The device itself has no on/off switch, it starts as soon as it is supplied with power.