

RS4 – Rugged MiPiOS[®] Unmanaged Ethernet Switch



Configuration example

User Manual

RS4 – Rugged MIPIOS® Unmanaged Ethernet Switch

The RS4 is a rugged, IP67 stand-alone unmanaged Fast Ethernet switch. It provides eight Ethernet channels on M12 connectors.

The switch supports full-duplex and half-duplex operation with auto-negotiation, high-speed non-blocking store-and-forward switching, Quality of Service (QoS) support with four traffic classes IEEE 802.1p and three-level 802.1x security. The switch is fault tolerant and restores itself on its own: If a link is temporarily unavailable, frames can be sent via backup/redundant links (link aggregation) and no data loss occurs. Its built-in test mechanisms make the RS4 an even more reliable component in the communication system.

By using an application-specific configuration EEPROM, the RS4 can act similarly to a managed switch with fixed settings. This enables features untypical for unmanaged models like 802.1p priority and port based priority, port based VLAN or IEEE 802.1q VLAN IDs. Additionally, a service port is accessible at the front panel on an M12 connector, enabling authorized personnel to configure the switch via an SPI interface.

The RS4 is a member of the MIPIOS family of extremely rugged IP67 compliant products designed for Ethernet connectivity and highly demanding applications, e.g., for redundancy systems.

The industrial-grade unit is fully compliant with EN 50155 railway standard. All components inside the enclosure are specified for -40..+85°C operation, thus enabling the device for EN 50155 class Tx operation. Additionally, the device is e1 certified by the German Federal Motor Transport Authority. Convection cooling is sufficient. There are no socketed components, hardening the box against shock and vibration. The internal electronics are prepared for conformal coating.

The Ethernet switch is prepared for wall or DIN-rail mounting.

Technical Data

Switch Fabric Key Features

- Eight 10/100Base-T ports at front panel
 - Electrical isolation: 1500 Vrms
- Auto-negotiation
- High-speed non-blocking, store-and-forward switching
- 8K MAC address lookup table with automatic learning and aging
- QoS (Quality of Service) support with 4 traffic classes (IEEE 802.1p tagged frames)
- Layer 2 switching
- Back pressure or IEEE802.3x flow control
- Automatic MDI/MDI-X crossover (all ports)

Layer 2 Features

- TCP/IP (IPv4, IPv6)
- Transparent bridging
- QoS (DiffServ) and 802.1p traffic prioritization queuing, polishing, shaping
- VLAN-aware bridging

Security Features

- MAC based access list (ACL) for traffic filtering
- Rate-limiting and storm control to prevent packet flooding from malicious peers

Supported Ethernet Standards

- Transparent bridging: IEEE 802.1d, 2004
- VLAN: IEEE 802.1q Rev D5.0, 2005
- Port based VLANs: IEEE 802.1q Rev D5.0, 2005
- Link aggregation: IEEE 802.3ad, 2005
- Priority based switching: IEEE 802.1p

Service Interface

- M12 connector at front
- SPI interface for external SPI programmer

Front I/O

- 8 Ethernet ports via M12 connectors
- 1 service interface via M12 connector
- 1 power input via M12 connector
- Link and activity Ethernet status LEDs (2 per channel)
- Status LEDs for power and reset

Electrical Specifications

- Power input
 - Nominal input voltage 24 VDC (9 to 36 V) according to EN50155
- EN50155 power interruption class S2
- Isolation (according to EN50155)
 - 1500 Vrms
- Power consumption: 5 W
- MTBF: Approx. 200,000 h (tbc.) @ 40°C according to IEC/TR 62380 (RDF 2000)

Mechanical Specifications

- Dimensions: 220 mm x 130 mm x 70 mm (without connectors)
- Prepared for wall or DIN-rail mounting with special mounting plates (available separately)
- Weight: 1.9 kg

Environmental Specifications

- Temperature range (operation):
 - -40..+70°C (+85°C) with up to 85°C for 10 minutes according to class Tx (EN50155)
 - Airflow: natural convection
- Temperature range (storage): -40..+85°C
- Relative humidity (operation): max. 95% non-condensing
- Relative humidity (storage): max. 95% non-condensing
- Altitude: -300 m to + 3,000 m
- Climatic tests according to EN68068
- Shock and vibration tested according to EN61373
- IP67 compliant
- Conformal coating on request

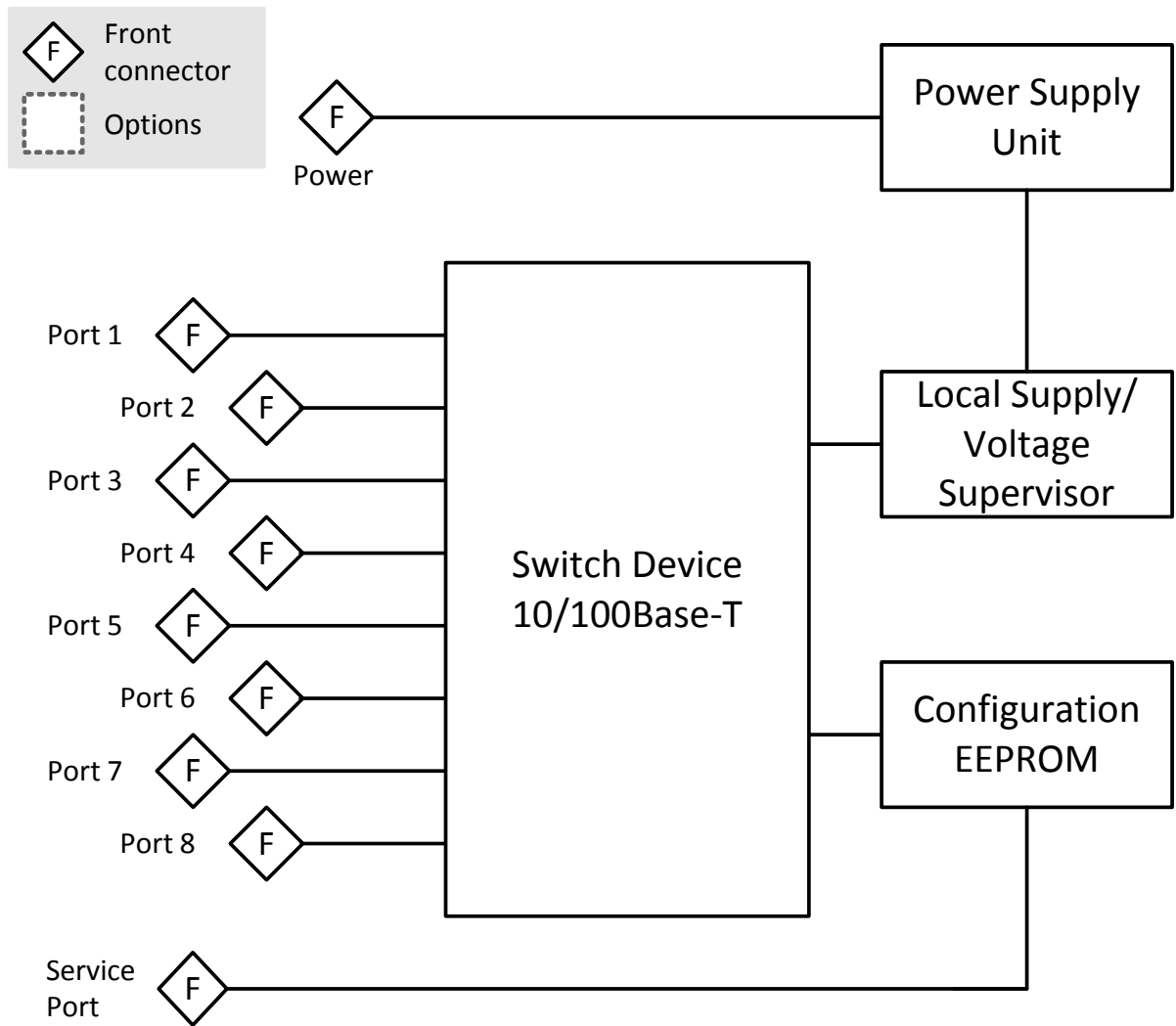
Safety

- PCBs manufactured with a flammability rating of 94V-0 by UL recognized manufacturers

EMC

- Tested according to the following railway standards:
 - EN50121 (radio disturbance)
 - EN61000-4-2 (ESD)
 - EN61000-4-4 (burst)
 - EN61000-4-5 (surge)
- Conforming to e1 requirements of the German Federal Motor Transport Authority
- Tested according to the following automotive standards:
 - CISPR25/CISPR16 (radiated emission)
 - ISO7637-2 (conducted emission – power line)
 - ISO7637-2 (conductive immunity – power line)
 - ISO7637-3 (capacitive immunity – signal line)
 - ISO11452-2, ISO11452-5 (radiation immunity)
 - EN50121 (radio disturbance)

Block Diagram



Configuration Options

Ethernet Switch Functions / Mechanical Specifications

- 4 Ethernet ports

Electrical Specifications

- Other nominal input voltages: 36, 48, 72, 96 or 110 VDC
 - Wide input range (according to EN50155): $0.7 \times \text{nominal voltage} < \text{nominal voltage} < 1.25 \times \text{nominal voltage}$

**Please note that some of these options may only be available for large volumes.
Please ask our sales staff for more information.**



For available standard configurations see [online data sheet](#).

Product Safety



Electrostatic Discharge (ESD)

Computer boards and components contain electrostatic sensitive devices. Electrostatic discharge (ESD) can damage components. To protect the board and other components against damage from static electricity, you should follow some precautions whenever you work on your computer.

- Power down and unplug your computer system when working on the inside.
- Hold components by the edges and try not to touch the IC chips, leads, or circuitry.
- Use a grounded wrist strap before handling computer components.
- Place components on a grounded antistatic pad or on the bag that came with the component whenever the components are separated from the system.
- Store the board only in its original ESD-protected packaging. Retain the original packaging in case you need to return the board to MEN for repair.

About this Document

This user manual describes the hardware functions of the switch and connection of peripheral devices. It also provides additional information for special applications and configurations of the unit.

The manual does not include detailed information on individual components (data sheets etc.). A list of literature is given in the appendix.

History

Issue	Comments	Date
E1	First issue	2010-11-26
E2	Removed mention of SIL4 from product description	2010-12-13

Conventions



This sign marks important notes or warnings concerning proper functionality of the product described in this document. You should read them in any case.

italics

Folder, file and function names are printed in *italics*.

bold

Bold type is used for emphasis.

monospace

A monospaced font type is used for hexadecimal numbers, listings, C function descriptions or wherever appropriate. Hexadecimal numbers are preceded by "0x".

hyperlink

Hyperlinks are printed in blue color.



The globe will show you where [hyperlinks](#) lead directly to the Internet, so you can look for the latest information online.

IRQ#
/IRQ

Signal names followed by "#" or preceded by a slash ("/") indicate that this signal is either active low or that it becomes active at a falling edge.

in/out

Signal directions in signal mnemonics tables generally refer to the corresponding board or component, "in" meaning "to the board or component", "out" meaning "coming from it".



Vertical lines on the outer margin signal technical changes to the previous issue of the document.

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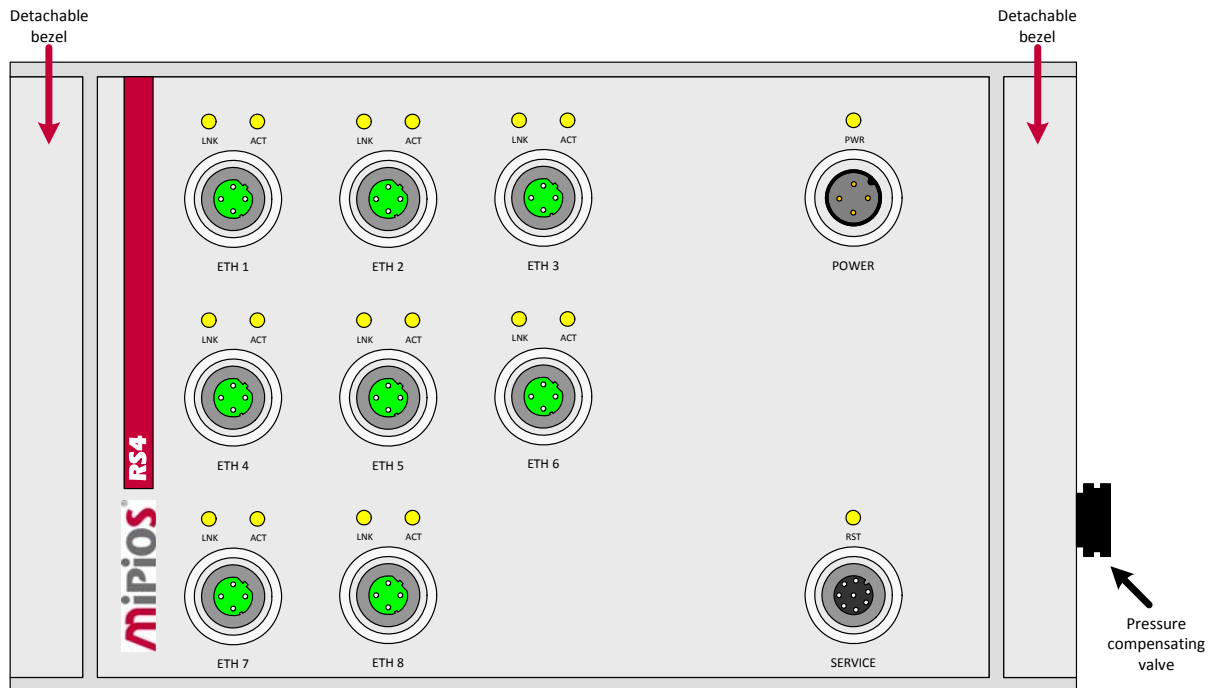
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1 System Overview

1.1 Layout of the RS4

Figure 1. The RS4 - front view



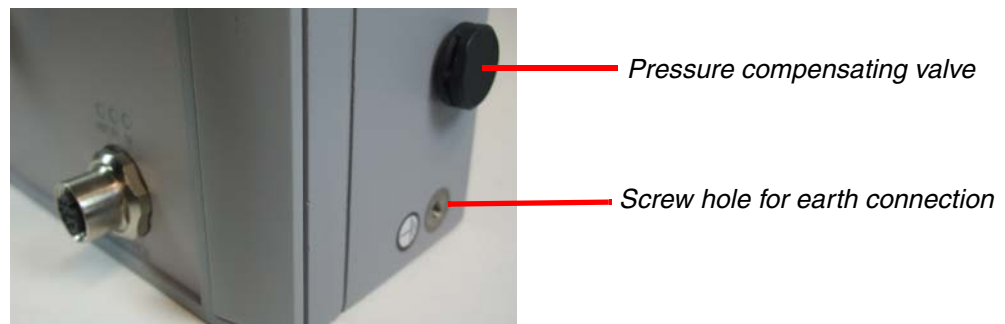
1.2 Pressure Compensating Valve

The sealed housing of the RS4 makes a pressure compensating valve necessary to prevent stress on the unit's housing seals. Its hydrophobic and oleophobic ePTFE membrane protects from the unit's interior from water and common automotive fluids and resists blocking after contact with common automotive fluids. It protects against contamination from dirt, dust, salt and road debris (down to 0.07 μm).

1.3 Earth Connection

An earth connection can be established via the respective screw hole on the right side of the unit (below the pressure compensating valve). Use an M4 screw.

Figure 2. Earth connection and pressure compensating valve



1.4 Interfaces

1.4.1 Power Input

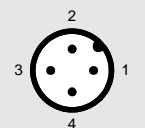
The RS4 usually comes with an internal 24 VDC nom. (9 to 36 V) wide-range power supply led to a 4-pin M12 connector. RS4 models with other input voltage ranges are also available from MEN to suit individual projects' needs.

The internal power supply is EN50155 compliant which implies that it has a built-in power-on threshold of $0.7 \times U_n = 16.8$ V. Once the unit is turned on, the input voltage may drop as low as 9 V.

Connector types:

- 4-pin M12 connector, male, A-coded (CONEC "SAL-12-FSH4-P12-9" 43-01066)
- Mating connector: e.g., CONEC "SAL-12-RK4-2/A1" 43-10020

Table 1. Pin assignment of the power supply 4-pin M12 connector

	Pin	Name	Description
	1	+VBAT	Positive input
	2	+VBAT	Positive input
	3	-VBAT	Negative input
	4	-VBAT	Negative input

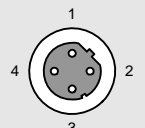
1.4.2 Ethernet Interface

Eight Fast Ethernet ports are available on 4-pin female M12 connectors.

Connector types:

- 4-pin M12 connector, female, D-coded (CONEC "SAL-12D-FKH4.2-P12-9" 43-01248)
- Mating connector: e.g., Harting 21032811405 R410925

Table 2. Pin assignment of the Ethernet 4-pin M12 connectors

	Pin	Name	Description
	1	TX+	Transmitter positive output
	2	RX+	Receiver positive input
	3	TX-	Transmitter negative output
	4	RX-	Receiver negative input


1.4.3 Service Interface (SPI)

The service connector features an interface for an external SPI programmer for maintenance purposes. It is to be used by authorized personnel only. Please [contact MEN](#) if you need a switch with a non-standard configuration.

Connector types:

- 8-pin M12 connector, female, A-coded (CONEC "SAL-12-FKH8-P12-9" 43-01064)
- Mating connector: e.g., CONEC "SAL-12S-RS8-2/G3" 43-10980

Table 3. Pin assignment of the service interface 8-pin M12 connector

	Pin	Name	Description
	1	-	Not used
	2	SPI_MOSI	SPI data in
	3	SPI_MISO	SPI data out
	4	GND	Ground
	5	-	Not used
	6	SPI_CLK	SPI clock
	7	-	Not used
	8	SPI_CS	SPI chip select



1.5 Ethernet Switch

The RS4 uses a manageable 8-port 10/100Base-T switch component, the Marvell 88E6095. The switch provides 10/100 Mb/s configuration possibility on each of the eight Ethernet ports.

It is also possible to configure each port in half-duplex or full-duplex.

The device characteristics are:

- 8 external ports configurable as 10/100 Mb/s
- MII interface
- Each external port is configurable in half-duplex or full-duplex mode
- Non-blocking wire speed switching
- Store-and-forward mode
- Auto negotiation
- Port mirroring
- Port monitoring
- Flow control
- VLAN support
- Automatic MDI/MDI-X crossover (all ports)
- Port based frame prioritization

1.5.1 Configuration of the Switch

The RS4 loads the following standard configuration for all ports at startup:

Table 4. Default switch configuration at startup

Setting	Default
Duplex mode	Full Duplex
Port speed	Auto-Negotiate
VLAN (port-based)	Off
QoS (Quality of Service)	Off
Port mirroring and port monitoring	Off
Port trunking	Off

By using a customer-specific configuration EEPROM, the RS4 can act similarly to a managed switch with fixed settings. Please [contact MEN](#) if you need a switch with a non-standard configuration.

1.6 Front Panel Status LEDs

The standard RS4 features a total of 18 status LEDs at its front panel: Sixteen for the Ethernet port status (two for each port), one for the power supply status and one for the reset status. The LEDs act as described in the following tables.

Table 5. Ethernet port status LEDs



LED	Description
 LNK	Ethernet link status (ON = link established)
 ACT	Ethernet traffic activity status (ON = Ethernet traffic running)

Table 6. Power supply status LED



LED	Description
 PWR	Input power status (ON = valid range)

Table 7. Service port LED

LED	Description
 RST	Reset LED (ON = reset active)

2 Mounting Options

2.1 Mounting the RS4

The RS4 is designed for mounting using one of two mounting plates, a DIN-rail mounting plate or a wall-mounting plate (available separately from MEN). To attach the unit to the mounting plate, remove the detachable bezel at the sides of the front panel to access the four holes (two on each side) reserved for the necessary screws as pictured above and below.

Figure 3. Mounting the RS4 to the DIN-rail mounting plate

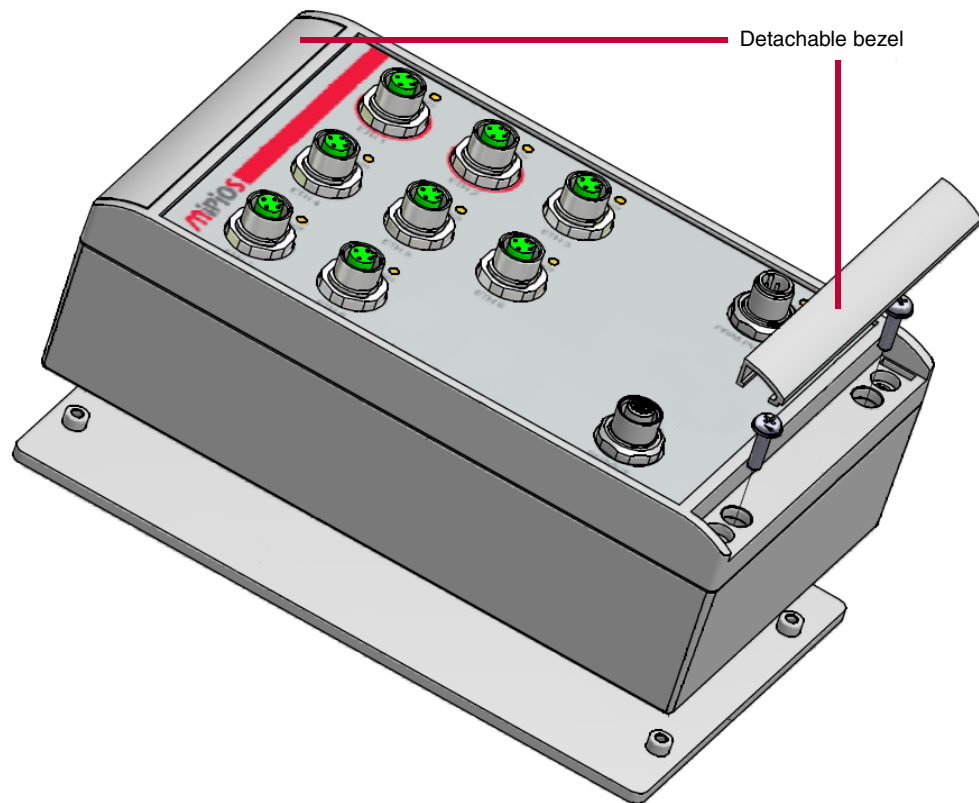
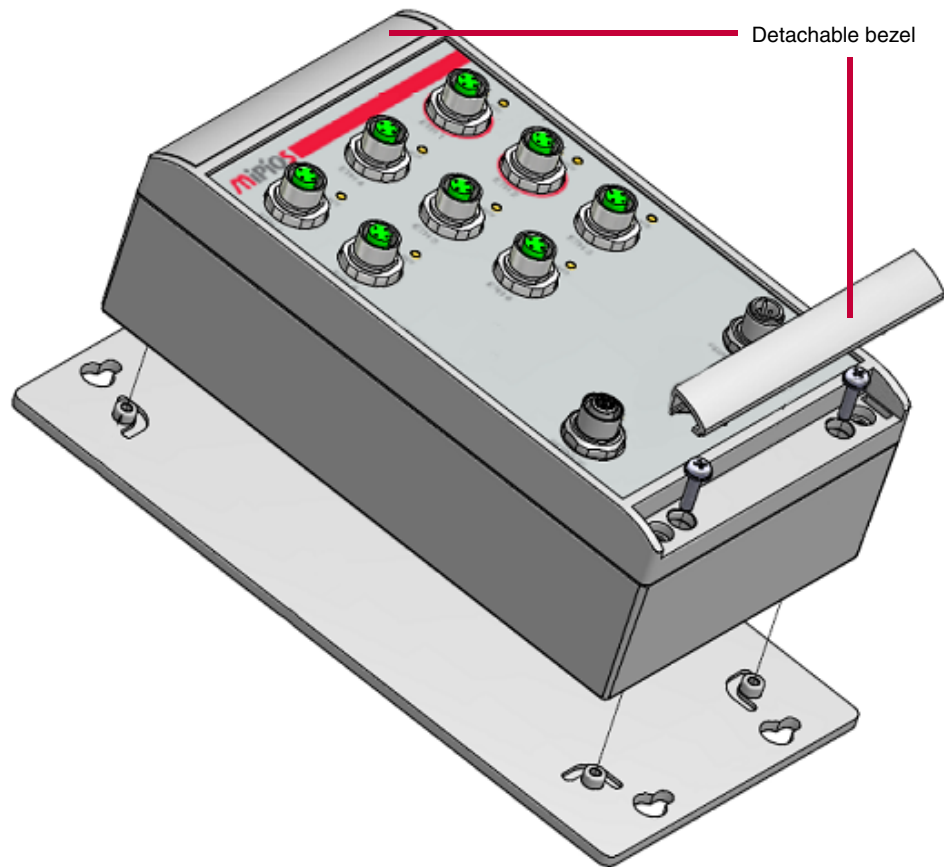


Figure 4. Mounting the RS4 to the wall-mounting plate



Make sure to use the following screw types in the process.

To fix the RS4 to the mounting plate:

- 4 DIN 7985 M4 x 20mm, A2 screws
- 4 M4 washers

To fix the wall-mounting plate to the wall:

- 4 DIN7985 M5 x min. 12mm, A2 screws
- 4 M5 washers

3 Appendix



3.1 Literature and Web Resources

- RS4 data sheet with up-to-date information and documentation:
www.men.de/products/06RS04-.html

3.2 Finding out the Board's Article Number, Revision and Serial Number

MEN user documentation may describe several different models and/or hardware revisions of the RS4. You can find information on the article number, the board revision and the serial number on two labels attached to the board.

- **Article number:** Gives the board's family and model. This is also MEN's ordering number. To be complete it must have 9 characters.
- **Revision number:** Gives the hardware revision of the board.
- **Serial number:** Unique identification assigned during production.

If you need support, you should communicate these numbers to MEN.

Figure 5. Label giving the board's article number, revision and serial number

