# **Project Documentation** | TMIB V2 Data Sheet

**Project Number:**

**SMS Project Number:**

**Project Title:**
Traffic Management Interface Board V2

**Keyword(s):**
TMIB2 Traffic Management Interface Board NEMA TS1 Loop Detector Output TS2 SDLC

**Date:**
October 9, 2018

**Document:**
TMIB V2 Data Sheet.doc

**Document state:**

| | |
|---|---|
| | In progress |
| | Ready for review |
| X | Released |
| | Outdated |

# 1 User Safety Warning Information

Read the instructions carefully before you start to work.

**Installation**
Please observe the following advices when installing and connecting the devices:

- Only use provided or approved equipment for installation. Use screws with metric thread M3x8.
- Only skilled and instructed persons shall install and connect the devices. Proper experience in working with mains voltage, electrical and electronic devices is required.
- Don't connect the devices directly to mains voltage, instead use the voltage given in the manual.
- Don't wire any connections while power is applied to the device.
- All connectors are pin-coded and fit in only one position.
- Only use fully functional equipment (ladders, aerial work platform, …) when working above ground. Staff shall be capable of working at heights.
- Use caution when installing the devices on or around active roadways. Pay attention to moving traffic.
- Mount the devices carefully to prevent the devices from shifting or dropping.
- Make sure that your installation methods are in accordance with local safety policy and procedures and company practices.

**Technical service**
Only use provided or approved equipment for operation.
Persons other than authorized and approved electrical technicians shall NOT attempt to connect this unit to a power supply, Traffic Management Interface Board and/or other controllers, as there is a risk of electrical shock by unsafe handling of the power source.
Do not attempt to service or repair this unit.

- No user-maintainable parts are contained within the device.
- To avoid electrical shock, do not remove or open the cover.
- Unauthorized opening will void all warranties.
- Smartmicro is not liable for any damages or harms caused by unauthorized attempts to open or repair the device.

**Operation**
Connecting sensors to a TMIB or another controller will not change the transmitted signal.
Do not operate the device if the device itself or any cables are damaged.
It is recommended that only one connection interface is used at a time. The TMIB is not waterproof. It needs to be installed in a cabinet or similar to ensure sufficient rain protection.

# 2 Traffic Management Interface Board Data Sheet

## 2.1 General Information

The Smartmicro TMIB (Traffic Management Interface Board) connects up to four UMRR Radar sensors (traffic detectors) to NEMA TS1 or TS2 cabinets (TMIB rack mount version); or to other traffic controllers (TMIB shelf mount version).

A TMIB set consists of two cards. The TMIB_AB assembly is the control board plus the interface board. This second board contains all surge and overvoltage protection circuitry for four long cables to four sensors, as it is the typical case on an intersection. One TMIB set can replace up to 16 inductive loops (TS1 usage) / up to 64 inductive loops (TS2 SDLC usage, up to four TS2 BIUs replaced).

The data of all four Radar sensors can be accessed conveniently through one single 100Base-TX Ethernet interface.

Rack-mount use:

In a typical (rack mount) installation, the TMIB consists of two NEMA form factor cards: The TMIB_AB assembly consisting of TMIB_A featuring TS1 loop contacts and status LEDs as well as the TMIB_B, which contains the sensor interface connections and the RS485/SDLC bus connectivity for TS2 cabinets. One TMIB can be connected to up to four "Inductive Loop Detector Unit" slots, replacing 16 inductive loops. In addition, up to three TMIB_C expansion cards may be installed. Each TMIB_C card offers four loop detector outputs. In NEMA TS1 installations they can be used to connect additional relay contacts to the traffic cabinet, because each TS1 card is limited to a maximum of four loop detector outputs.

Shelf-mount use:

In a typical (shelf mount) installation, the TMIB_AB assembly resides within an enclosure, offering all interfaces to the user.

The TMIB is well integrated in smartmicro's Easy Mode TMConfigurator software to give the installer a powerful and easy-to-use tool for setup and maintenance.

*Please note: TMIB_A/B/C are not fully fail-safe devices. While a number of steps have been taken to make sure the devices show a fail-safe behavior, this cannot be assured under all conditions. The connected sensors (detectors) do not have 100% detection rate or zero false alarm rate (see data sheet). In case of communication problems, sensor failure, TMIB_A/B/C failure in part or in whole, under certain condition a non-fail-safe behavior may occur.*

## 2.2 General Performance Data

| Parameter | Value |
|---|---|
| **Connectivity** | |
| Supported traffic detectors | UMRR-0Fxxxx or UMRR-0Cxxxx<br>connected by Ethernet, CAN or 4-wire RS485 |
| Supported outputs / interfaces | NEMA TS1 loop detector outputs<br>NEMA TS2 SDLC bus<br>100Base-TX Ethernet |
| Number of detectors per TMIB | Up to 4 |
| Number of virtual loops for NEMA TS2 | Up to 16 per attached UMRR sensor<br>Up to 64 total |
| Number of loops replaced for NEMA TS1 (4 detector slots used) | Up to 16[1] |
| NEMA TS2 Detector BIUs | Up to 4 (Detector BIU 8 thru 11) |
| **Environmental** | |
| Ambient Temperature | NEMA TS2 compliant[2] |
| Humidity | NEMA TS2 compliant |
| Shock | NEMA TS2 compliant |
| Vibration | NEMA TS2 compliant |
| **Mechanical** | |
| Weight TMIB_AB<br>Weight TMIB_C | 410g / 14.5oz |
| Dimensions | See section 0 |
| **Model No.** | **TMIB_AB-02xxyy**<br>**TMIB_C-02xxyy** |
| **General** | |
| Power Supply | 10 ... 30 V DC<br>3.6W typical (TMIB unit excl. detectors) |
| Form factor | NEMA TS1 / TS2 Inductive Loop Detector Unit |

**Figure 1: General Performance Data**

[1] TMIB_C Extension cards required for more than 4 loop detector outputs.

[2] Batteries may have a reduced temperature range from -30°C to +85°C, the buzzer has a reduced temperature range of -30°C to +70°C, RJ50 expansion ports have reduced temperature range from -25°C to +90°C. These constraints do not limit normal operation of the TMIB.

**Device Photographs**


**Figure 2: TMIB_AB assembly.**

Figure 1 shows a typical TMIB_AB set installation, which consists of two cards: TMIB_A featuring TS1 loop contacts and status LEDs as well as the TMIB_B, which contains the sensor interface connections and the RS485/SDLC bus connectivity for TS2 cabinets.

In addition, up to three TMIB_C daughter cards can be connected to a TMIB rack mount installation, each offering four additional TS1 loop contacts. For shelf mount installations, the TMIB_C daughter cards would not be required.

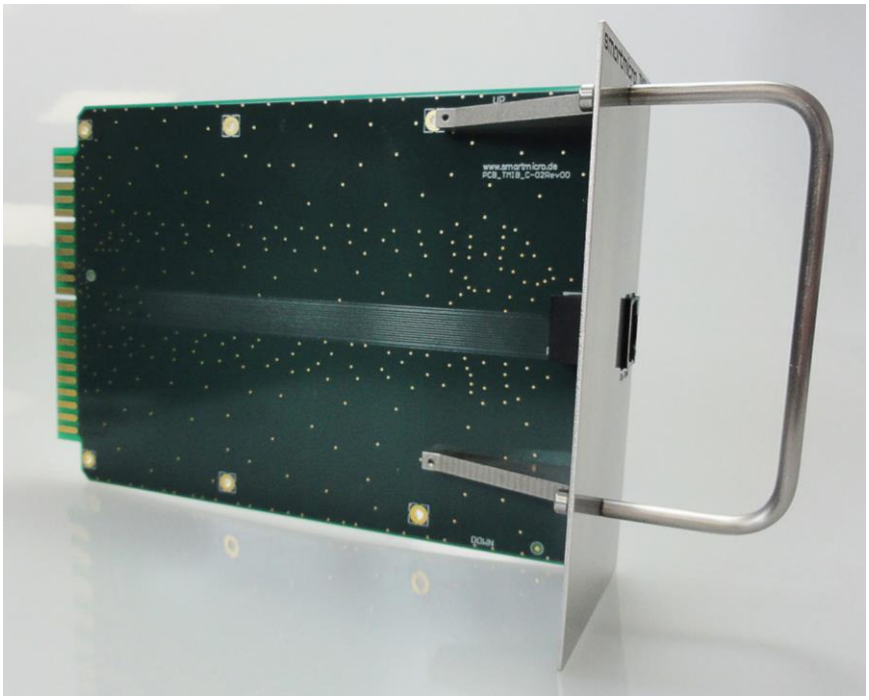


**Figure 3: TMIB_C: TMIB_C**

# 3 Features and Applications

## 3.1 Intersection Applications

NEMA cabinets are typically used to control actuated intersections. They observe the current traffic flow through a set of loop detectors and adopt the red and green phases of the traffic lights accordingly. While loop detectors are dependable and robust, they are also cost and service intensive. UMRR traffic detectors offer cost effective and seamless loop replacement through non-invasive radar technology. In order to connect them to NEMA TS1 or TS2 cabinets, the TMIB is used, which is installed into the detector rack.

### 3.1.1 NEMA TS1 Installations

For NEMA TS1 installations, loop detector outputs are emulated through opto-isolators. The TMIB_AB cards provide four loop detector outputs. Up to 16 loops total can be replaced using TMIB_AB and additional TMIB_C daughter cards - if multiple UMRR-0A sensors shall be connected to one TMIB.

### 3.1.2 NEMA TS2 Installations

For NEMA TS2 installations, all vehicle detections are transmitted over the SDLC serial link. Therefore, only the TMIB itself (TMIB_AB assembly) is needed. Up to four Detector BIUs are supported with a total of 64 virtual loops.

### 3.1.3 Interfaces to Traffic Management Control systems

The TMIB offers on board 100Base-TX Ethernet interface for data retrieval and integration into Traffic Management Control systems.

## 3.2 General purpose applications

A shelf mount version offers the loop detector outputs and digital data interfaces in a boxed design – to support a variety of applications.

## 3.3 On-board diagnostics (BIT)

The TMIB has extensive means of onboard diagnostics through watchdog elements and LEDs on the front panel. General function can be instantly overlooked by Power Good, Heartbeat and Failure LEDs. Detailed diagnostics can be retrieved through data interfaces. The sensor communication link health can be checked by LEDs.

Signaling of error conditions can be adapted to customer requirements.

## 3.4 User interfaces

The TMIB provides the user interfaces displayed in Figure  and Figure .

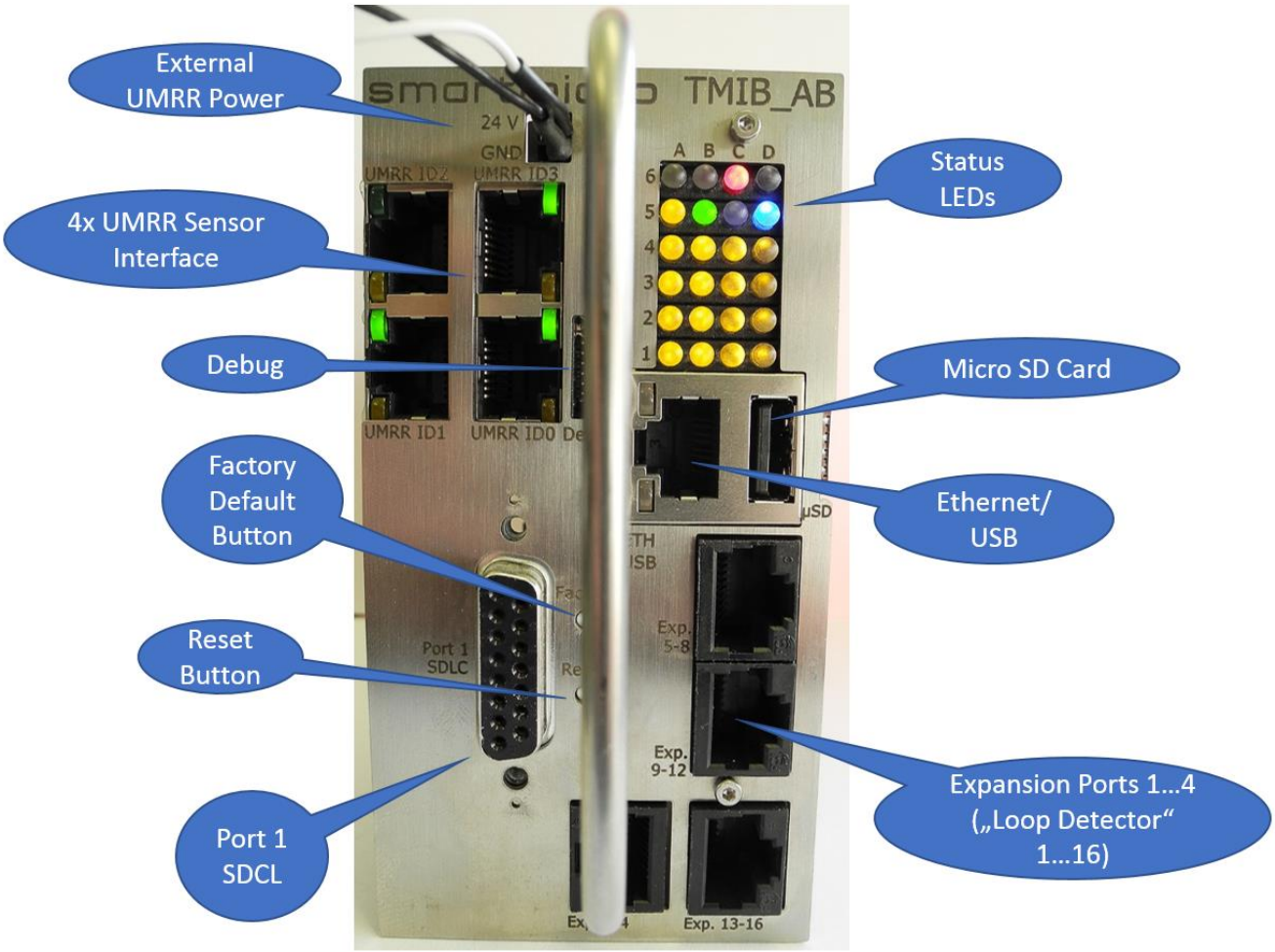



**Figure 4: TMIB User interfaces (front panel)**

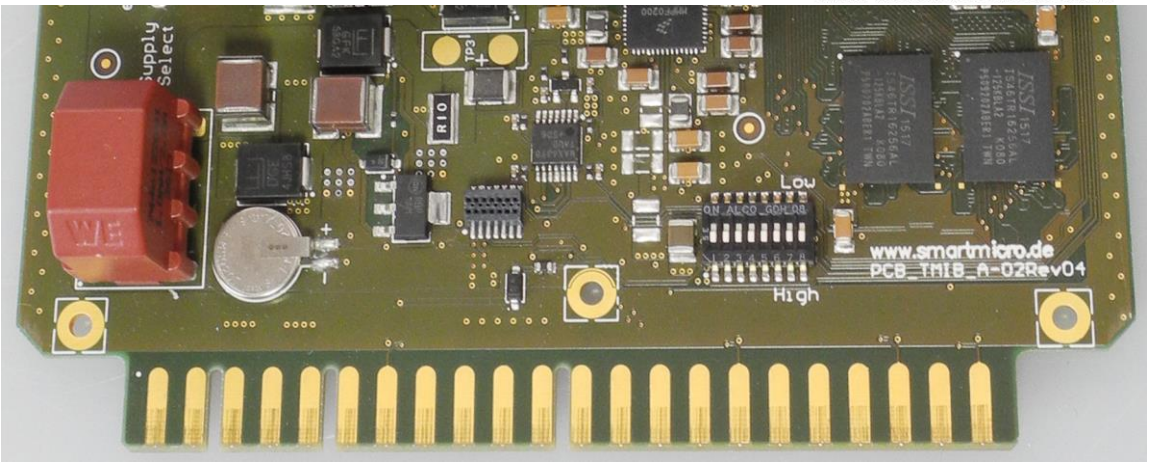



**Figure 5: TMIB User interfaces (rear panel)**

The user interfaces are:

- **Reset Switch** to allow the user to reset the TMIB device
- **Factory Default Button** to set the TMIB back to factory settings.
- **Status LEDs** to display the TS1 and TS2 virtual loops states; also to provide diagnostics information such as Power Good, Heartbeat, Error states, SDLC Activity and others.
- **Relay Expansion** to connect to TMIB_C Relay Expansion cards (NEMA TS1 form factor) or Terminal Block Expansion cards (loop detector output channels 1 .. 16).
- **UMRR Sensor Interface** to connect to UMRR sensors via RS485 (see section 4.1), including communication link health indicator.
- **Debug** for Debugging purposes by smartmicro trained personnel.
- **Micro SD Card** for maintenance and logging.
- **SDLC Port 1** connector.
- **Ethernet** (100Base-TX) interface.
- **USB** connector.
- NEMA TS1 / TS2 style **backplane multipoint pin header** (rack mount version) or Access to Power Supply / 4x loop detector outputs / SDLC (shelf mount version).

Please refer to the TMIB User Manual for detailed functional description.

# 4 Connection Scheme

The TMIB connects to up to four UMRR traffic detectors. It provides them with adequate supply voltage (sourced by the power supply terminal block at the TMIB front panel) and reads the data transmitted from or to all four sensors via CAN bus, Ethernet or 4-wire RS485 data stream. To communicate with NEMA TS1 traffic controllers, the TMIB activates all loop detector outputs corresponding to triggered detection zones defined in the UMRR. In order to support NEMA TS2 systems, the TMIB also sends all assigned loop calls over a SDLC serial link.

The data from the four connected UMRR sensors can be retrieved through 100Base-TX Ethernet interface. Also the setup (alignment, placing of virtual loops etc.) of all four sensors can be conveniently accomplished through the one single Ethernet port.

## 4.1 Connecting four UMRR sensors to a controller through the TMIB

The connection scheme is displayed Figure  in below.


**Figure 6: Connecting four UMRR sensors to a controller through the TMIB**

## 4.1 Connecting UMRRs

The homerun cable of each UMRR traffic sensor is fed to a patch panel inside the traffic cabinet, where it is wired to a short Cat5 cable with RJ-45 connector, which plugs in directly into the sensor interface block of the TMIB_AB assembly.

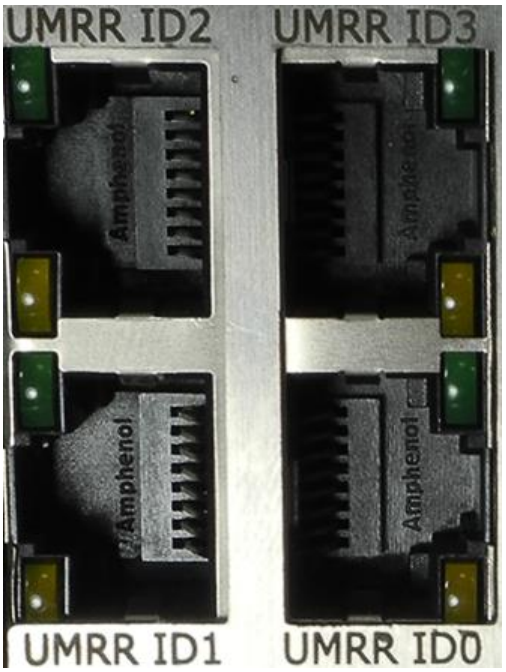



**Figure 7: UMRR sensor interface**

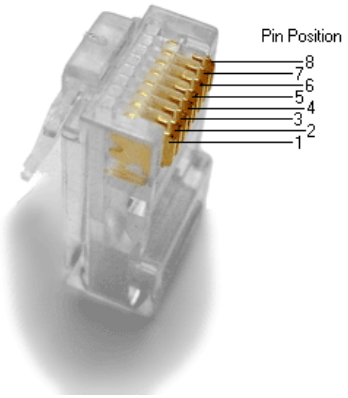


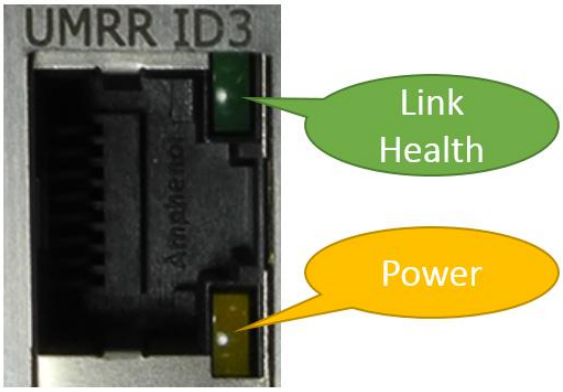

**Figure 8: UMRR sensor connector**

The pin-out for 4-wire RS485 communication is given by **Fehler! Verweisquelle konnte nicht gefunden werden.** shown below. Where standard Cat.6 cables are used at long distance, it is suggested to double up the power pair.

| RJ-45 pin | Signal description | | JBOX pin | Wire color EIA/TIA 568B (World) | Wire color EIA/TIA 568A (Europe) |
|---|---|---|---|---|---|
| 1 | **RS485** | **TX_N** | **5** | **White/orange** | **White-green** |
| 2 | **RS485** | **TX_P** | **6** | **Orange** | **green** |
| 3 | **CAN** | **HIGH** | **11** | **White/green** | **White-orange** |
| 4 | **VCC** | **(+)** | **8** | **Blue** | **Blue** |
| 5 | **GND** | **GND** | **7** | **White/blue** | **White-blue** |
| 6 | **CAN** | **LOW** | **12** | **Green** | **Orange** |
| 7 | **RS485** | **RX_P** | **4** | **White-brown** | **White-brown** |
| 8 | **RS485** | **RX_N** | **3** | **Brown** | **Brown** |

**Figure 9: TMIB Full duplex version pin-out (UMRR-0C or UMRR-0F full-duplex RS485)**

### 4.1.1 Communication Link Health indicator, power health indicator.




If there is no Sensor connected, the green Activity LED will be "on" after booting the TMIB. This helps to connect the sensor.
After connecting a sensor, the green LED will start blinking if data is transferred and stay dark if there's no data transmission.

If the sensor is powered from the TMIB, the yellow LED will be "on" continuously.
If this yellow LED begins to blink, or go "off", please seek further advice from the logfile accessible through the TMIB WEB-GUI. If the yellow power indicator stays "off", the sensor is not powered from the TMIB.

## 4.2 Connecting to the Backplane Connector (shelf mount version)

The Backplane Connector is located at the rear end of the shelf mount TMIB. The pin assignments (

| Pin | Signal description | Signal description | Pin |
|---|---|---|---|
| A | Logic Ground | N.C. | 1 |
| B | Detector Unit DC Supply | N.C. | 2 |
| C | External Reset | N.C. | 3 |
| D | N.C. | N.C. | 4 |
| E | N.C. | N.C. | 5 |
| F | Channel 1 Output (+) | N.C. | 6 |
| H | Channel 1 Output (-) | Channel 1 Status Output | 7 |
| J | N.C. | N.C. | 8 |
| K | N.C. | N.C. | 9 |
| L | Chassis Ground | N.C. | 10 |
| M | N.C. | N.C. | 11 |
| N | N.C. | N.C. | 12 |
| P | N.C. | N.C. | 13 |
| R | N.C. | N.C. | 14 |
| S | Channel 3 Output (+) | N.C. | 15 |
| T | Channel 3 Output (-) | Channel 3 Status Output | 16 |
| U | N.C. | N.C. | 17 |
| V | N.C. | N.C. | 18 |
| W | Channel 2 Output (+) | N.C. | 19 |
| X | Channel 2 Output (-) | Channel 2 Status Output | 20 |
| Y | Channel 4 Output (+) | N.C. | 21 |
| Z | Channel 4 Output (-) | Channel 4 Status Output | 22 |

Table 11) are a 1:1 copy of the NEMA TS1 / TS2 backplane multipoint socket.

An example connector to match the Backplane pins is part # 307-044-500-202 from EDAC Inc.; equipped with 3 polarizing keys part # 306-240-318.

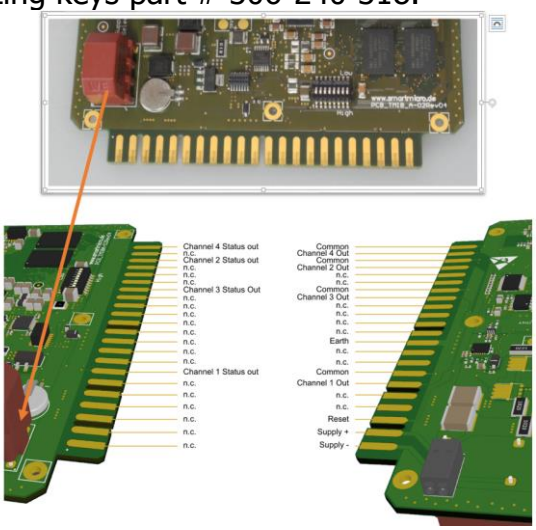



**Figure 10: Pinout TMIB_AB rear connector**

| Pin | Signal description | Signal description | Pin |
|---|---|---|---|

| | | | |
|---|---|---|---|
| **A** | **Logic Ground** | **N.C.** | **1** |
| **B** | **Detector Unit DC Supply** | **N.C.** | **2** |
| **C** | **External Reset** | **N.C.** | **3** |
| **D** | **N.C.** | **N.C.** | **4** |
| **E** | **N.C.** | **N.C.** | **5** |
| **F** | **Channel 1 Output (+)** | **N.C.** | **6** |
| **H** | **Channel 1 Output (-)** | **Channel 1 Status Output** | **7** |
| **J** | **N.C.** | **N.C.** | **8** |
| **K** | **N.C.** | **N.C.** | **9** |
| **L** | **Chassis Ground** | **N.C.** | **10** |
| **M** | **N.C.** | **N.C.** | **11** |
| **N** | **N.C.** | **N.C.** | **12** |
| **P** | **N.C.** | **N.C.** | **13** |
| **R** | **N.C.** | **N.C.** | **14** |
| **S** | **Channel 3 Output (+)** | **N.C.** | **15** |
| **T** | **Channel 3 Output (-)** | **Channel 3 Status Output** | **16** |
| **U** | **N.C.** | **N.C.** | **17** |
| **V** | **N.C.** | **N.C.** | **18** |
| **W** | **Channel 2 Output (+)** | **N.C.** | **19** |
| **X** | **Channel 2 Output (-)** | **Channel 2 Status Output** | **20** |
| **Y** | **Channel 4 Output (+)** | **N.C.** | **21** |
| **Z** | **Channel 4 Output (-)** | **Channel 4 Status Output** | **22** |

**Table 11: Backplane Connector Pin Assignments**

# 5 Mechanical Data

## 5.1 Dimensions of TMIB Assembly (TMIB_AB)

| | |
|---|---|
| Width: | 59,5 mm |
| Length: | 176 mm (PCB) |
| | 213 mm (incl. handle) |
| Height: | 114,3 mm |

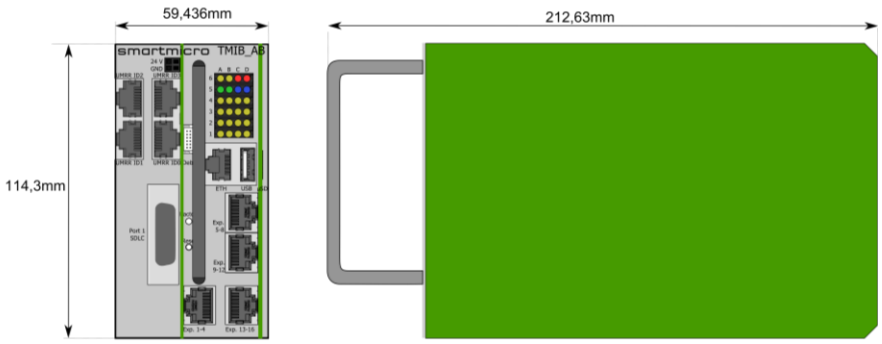



**Figure 12: TMIB_AB assembly mechanical data**

## 5.2 TMIB_C Dimensions

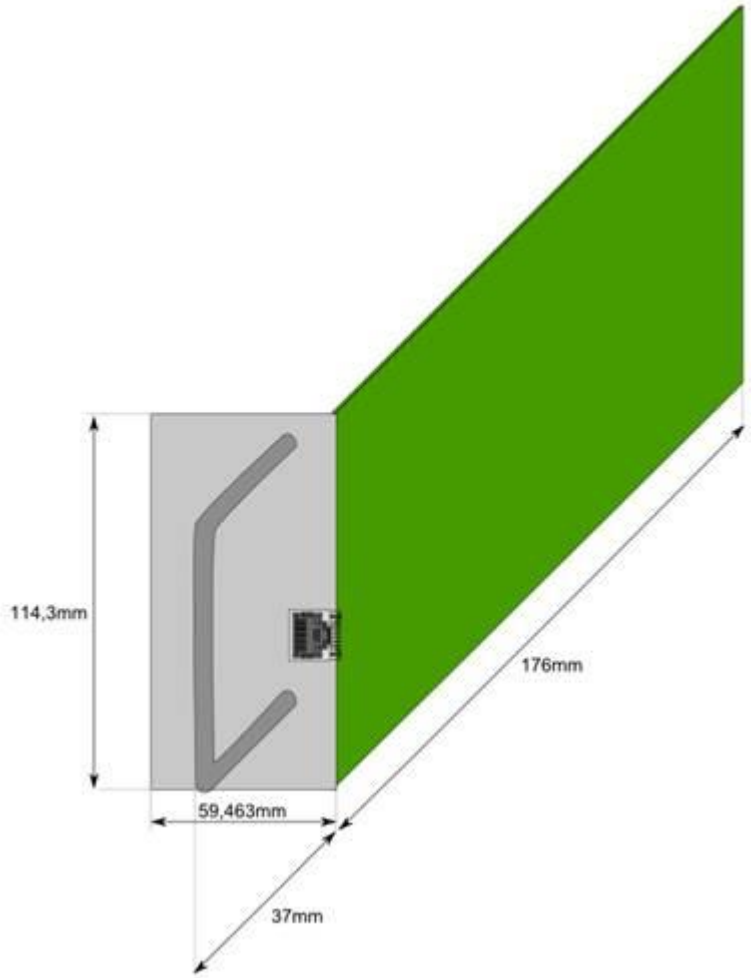



**Figure 13: TMIB_C circuit board**

| | |
|---|---|
| Width: | 59,5 mm |
| Length: | 176 mm (PCB) |
| | 213 mm (incl. handle) |
| Height: | 114,3 mm |

## 5.3 Shelf Mount Housing Dimensions

| | |
|---|---|
| Width: | 119.5 mm |
| Length: | 200 mm |
| Height: | 64 mm |

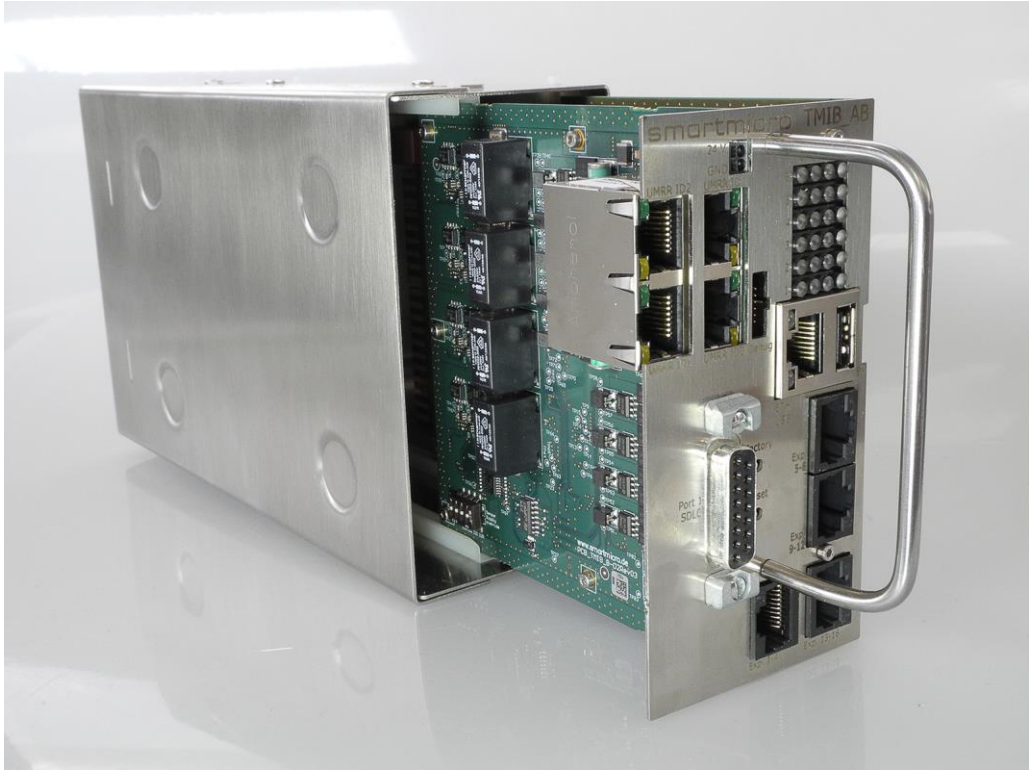



**Figure 14: TMIB_AB in Shelf Mount Housing**

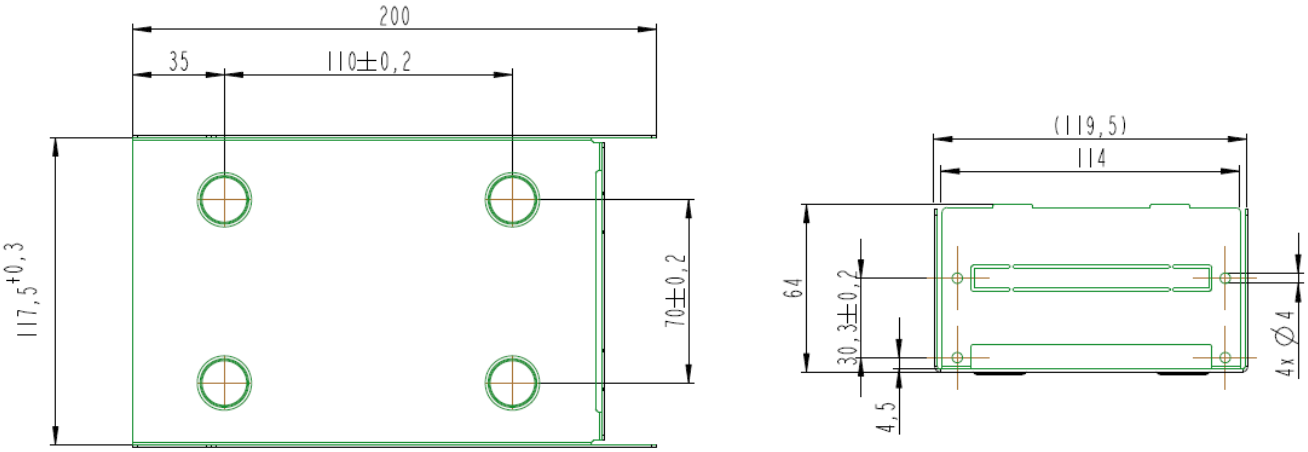



**Figure 15: Dimensions of Shelf Mount Housing**

# 6 Important Legal Disclaimer Notice

All Product, Product specifications and data in this project documentation are subject to change without notice to improve reliability, function, design or otherwise.

The statements, technical information and recommendations contained herein are believed to be accurate as of the date hereof. Smartmicro disclaims any and all liability for any errors, inaccuracies or incompleteness contained in this datasheet or in any other disclosure relating to the Product.

To the extent permitted by applicable law, Smartmicro disclaims (i) any and all liability arising out of the application or use of the Product or the data contained herein, (ii) any and all liability of damages exceeding direct damages, including - without limitation – indirect, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of suitability of the Product for a particular purpose.

Statements regarding the suitability of Products for certain types of applications are based on Smartmicro' knowledge of typical requirements that are often placed on Smartmicro' Products in generic/general applications. Such statements are, however, not binding statements about the suitability of Products for a particular/specific application. It is the customer/user's own responsibility to validate that the Product with the specifications described herein is suitable for use in its particular/specific application. Parameters and performance of the Products may due to particular/specific applications and due to particular/specific surroundings deviate from the statements made herein. Therefore, it is important that customer/user has thoroughly tested the Products and has understood the performance and the limitations of the Products before installing the Products for the final applications or before commercialization. Although Products are well optimized to be used for the intended applications stated herein, it must also be understood by the customer/user that the detection probability may not be 100 % and the false alarm rate may not be zero.

The information provided herein, relates only to the specific Product designated and may not be applicable when such Product is used in combination with other materials or in any process not defined herein. All operating parameters, including typical parameters, must be validated for each customer application by the customer/user's technical experts. Customers using or selling Smartmicro products not expressly indicated for use in such applications do so at their own risk.

This Product specification or data sheet does not expand or otherwise modify Smartmicro terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing by Smartmicro, the Products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Product could result in personal injury or death.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Smartmicro Product names and markings noted herein may be trademarks of their respective owners.

Please note that the application of the Product may be subject to standards or other regulations that may vary from country to country. Smartmicro does not guarantee that the use of Products in the applications described herein will comply with such regulations in any country. It is the customer/user's responsibility to ensure that the use and incorporation of Products complies with the regulatory requirements of their markets.

If any provision of this Disclaimer is, or is found to be, void or unenforceable under applicable law, that will not affect the validity or enforceability of the other provisions of this Disclaimer.

# 7 Contact

**Address:**

smart microwave sensors GmbH
In den Waashainen 1
38108 Braunschweig
Germany

**Phone / Fax numbers:**

Phone: +49-531-39023-0
Fax: +49-531-39023-599

**Web / Email address:**

Web: www.smartmicro.de
www.smartmicrogroup.com
Email: info@smartmicro.de