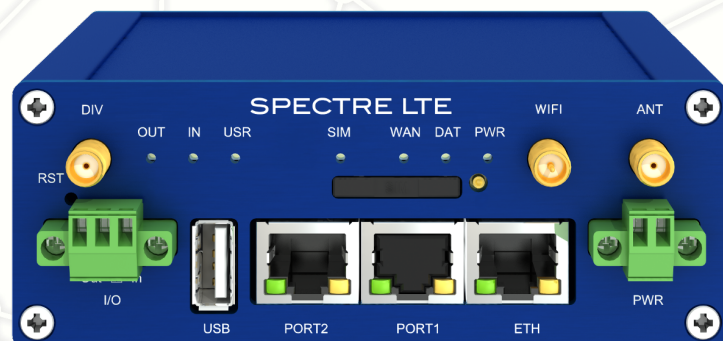


Cellular and Wired Routers **SPECTRE LTE, 3G, RT**

USER'S MANUAL



International Headquarters

B&B Electronics Mfg. Co. Inc.

707 Dayton Road
Ottawa, IL 61350 USA

Phone (815) 433-5100 – **General Fax** (815) 433-5105

Websites

www.bb-elec.com
bb-smartsensing.com
support@bb-elec.com

European Headquarters

B&B Electronics

Westlink Commercial Park
Oranmore, Co. Galway, Ireland

Phone +353 91-792444 – **Fax** +353 91-792445

Websites

www.bb-europe.com
techsupport@bb-elec.com

Document: SPECTRE_User_Manual

issued on June 25, 2015 in CZ, Conel s.r.o., Sokolska 71, 562 04 Usti nad Orlici, Czech Republic

© 2015 B&B Electronics Mfg. Co. Inc. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photography, recording, or any information storage and retrieval system without written consent. Information in this manual is subject to change without notice, and does not represent a commitment on the part of B&B Electronics Mfg. Co. Inc.

B&B Electronics Mfg. Co. Inc. shall not be liable for incidental or consequential damages resulting from the furnishing, performance, or use of this manual.

All brand names used in this manual are the registered trademarks of their respective owners. The use of trademarks or other designations in this publication is for reference purposes only and does not constitute an endorsement by the trademark holder.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following 2 conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Contents

| | |
|--|-----------|
| 1 About | 1 |
| 2 Safety Instruction | 2 |
| 2.1 Compliance | 2 |
| 2.2 Product Disposal Instructions | 3 |
| 3 Router Description | 4 |
| 3.1 Description | 4 |
| 3.2 Examples of Possible Applications | 4 |
| 3.3 Contents of Package | 5 |
| 3.4 Model Numbers | 5 |
| 3.5 Dimensions | 8 |
| 4 Mounting Recommendations | 9 |
| 5 User Interfaces | 12 |
| 5.1 Connectors | 12 |
| 5.2 Status Indicators | 13 |
| 5.2.1 Expansion Port Status Indicators | 14 |
| Ethernet Ports | 14 |
| RS-232 Ports | 15 |
| I/O Ports | 15 |
| RS-485/422 Ports | 15 |
| Wi-Fi | 15 |
| SmartMesh IP | 15 |
| 5.3 Power Connector | 16 |
| 5.4 Antenna Connector | 17 |
| 5.5 SIM Card Reader | 18 |
| 5.6 Ethernet Port | 18 |
| 5.7 Port 1 | 19 |
| 5.8 Port 2 | 19 |
| 5.9 USB Port | 20 |
| 5.10 I/O Port | 20 |
| 5.11 Expansion Ports Information | 22 |
| 5.11.1 RS-232 Ports | 22 |
| 5.11.2 RS-485/422 Ports | 23 |
| Connector Pinout in RS-485 mode | 24 |
| Connector Pinout in RS-422 mode | 25 |
| 5.11.3 12-bit I/O (AI, DI, DO) Port | 27 |

| | |
|--|-----------|
| Analog Inputs | 27 |
| Binary Input | 27 |
| Counter Input | 27 |
| Binary Output | 27 |
| Selecting the Binary Input Current | 28 |
| Input/Output Connector | 28 |
| MODBUS ASCII Configuration and Address Space | 29 |
| 6 Reset or Reboot | 36 |
| 7 First Use | 37 |
| 7.1 Starting the Router | 38 |
| 7.2 Configuring the Router | 38 |
| Configuration over Web browser | 38 |
| Configuration over Telnet or SSH | 39 |
| 8 Technical Parameters | 40 |
| 9 Troubleshooting | 45 |
| 9.1 FAQ | 45 |
| 10 Customer Support | 46 |

List of Figures

| | | |
|----|--|----|
| 1 | Contents of Package | 5 |
| 2 | Basic dimensions, metal box | 8 |
| 3 | Space around antenna | 9 |
| 4 | Cable routing | 10 |
| 5 | Space in front of connectors | 10 |
| 6 | DIN rail clip | 11 |
| 7 | Removing the router from the DIN rail | 11 |
| 8 | SPECTRE LTE front panel example, model RTLTE-304 | 12 |
| 9 | SPECTRE 3G front panel example, model RT3G-340-W | 13 |
| 10 | SPECTRE RT front panel example, model ERT311 | 13 |
| 11 | Power connector | 16 |
| 12 | Connection of power supply connector | 16 |
| 13 | Connection of power supply | 16 |
| 14 | Connecting the antenna | 17 |
| 15 | Ejected SIM card holder | 18 |
| 16 | Ethernet connector | 19 |
| 17 | Ethernet cable connection | 19 |
| 18 | USB connector | 20 |
| 19 | I/O connector | 20 |
| 20 | Connection of binary input and output of router | 21 |
| 21 | RS-232 port connector | 22 |
| 22 | Meter connection to router | 22 |
| 23 | Jumper position for external power supply (left) and internal power supply (right) | 23 |
| 24 | Jumper position for RS-485 (left) and for RS-422 (right) | 23 |
| 25 | RS-485/422 connector | 24 |
| 26 | RS-485: Connection to the router with data cable length less than 10 m | 24 |
| 27 | RS-485: Connection to the router with data cable length more than 10 m | 25 |
| 28 | RS-485/422 connector | 25 |
| 29 | RS-422: Connection to the router with data cable length less than 10 m | 26 |
| 30 | RS-422: Connection to the router with data cable length more than 10 m | 26 |
| 31 | Threshold select using jumper on the board | 28 |
| 32 | 12-bit I/O (CNT) connector | 28 |
| 33 | Typical connection of the 12-bit I/O port circuitry: | 29 |
| 34 | Router reset | 36 |
| 35 | Connecting the router before the first use | 37 |
| 36 | Accessing the router Web interface | 38 |
| 37 | Router Web interface | 39 |

List of Tables

| | | |
|----|---|----|
| 1 | Expansion port possibilities | 5 |
| 2 | SPECTRE LTE model numbers for Verizon | 6 |
| 3 | SPECTRE LTE model numbers for AT&T | 7 |
| 4 | SPECTRE 3G model numbers | 7 |
| 5 | SPECTRE RT Ethernet Router | 8 |
| 6 | Front panel description | 12 |
| 7 | Router status indication | 14 |
| 8 | Ethernet LED status indication | 14 |
| 9 | RS-232 LED status indication | 15 |
| 10 | I/O Port LED status indication | 15 |
| 11 | RS-232 LED status indication | 15 |
| 12 | Wi-Fi LED status indication | 15 |
| 13 | Wi-Fi LED status indication | 15 |
| 14 | Connection of power connector | 16 |
| 15 | Ethernet connector | 18 |
| 16 | Connection of USB connector | 20 |
| 17 | I/O port connection | 20 |
| 18 | Connection of RS-232 connector | 22 |
| 19 | Connector pinout in RS-485 mode | 24 |
| 20 | Connector pinout in RS-422 mode | 25 |
| 21 | 12-bit Input/Output connector pinout | 28 |
| 22 | MODBUS input/output address space | 35 |
| 23 | Ways to reset or restart the router | 36 |
| 24 | General specifications | 40 |
| 25 | SPECTRE LTE AT cellular module specifications | 41 |
| 26 | SPECTRE LTE VZ cellular module specifications | 42 |
| 27 | SPECTRE 3G cellular module specifications | 42 |
| 28 | Processor specifications | 42 |
| 29 | I/O port specifications | 42 |
| 30 | Wi-Fi Specifications | 43 |
| 31 | SmartMesh IP 802.15.4e Radio Specifications | 44 |

1. About

Used Symbols



Danger – important notice, which may have an influence on the user's safety or the function of the device.



Attention – notice on possible problems, which can arise in specific cases.



Information, notice – information, which contains useful advice or special interest.

GPL License

Source codes under GPL license are available free of charge by sending an email to:

support@bbelec.com

Router Version

The properties and settings associated with the cellular network connection are not available in noncellular SPECTRE RT routers.

PPPoE configuration is only available on SPECTRE RT routers. It is used to set the PPPoE connection over Ethernet.

Declared Quality System

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.



2. Safety Instruction

2.1 Compliance



PLEASE OBSERVE THE FOLLOWING INSTRUCTIONS:

THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, DIVISION 2, GROUPS A, B, C, AND D HAZARDOUS LOCATIONS, OR NON-HAZARDOUS LOCATIONS ONLY.

WARNING – EXPLOSION HAZARD – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN REMOVED OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

WARNING – EXPLOSION HAZARD – SUBSTITUTION OF ANY COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

CET ÉQUIPEMENT EST CONVENABLE EN CLASSE 1, DIVISION 2, GROUPES A, B, C, ET D ENDROITS DANGEREUX OU ENDROITS NON DANGEREUX SEULEMENT.

AVIS – RISQUE D'EXPLOSION – NE DÉCONNECTEZ PAS L'ÉQUIPEMENT, SAUF SI L'ALIMENTATION A ÉTÉ COUPÉE OU SI L'ENVIRONNEMENT EST CLASSÉ NON DANGEREUX.

AVIS – RISQUE D'EXPLOSION - SUBSTITUTION DE TOUTE COMPOSANTE RISQUERAIT LA QUALITÉ POUR CLASSE 1, DIVISION 2.

These devices are open-type devices that are to be installed in an enclosure suitable for the environment.

The router must be used in compliance with all applicable international and national laws and in compliance with any special restrictions regulating the use of the router in prescribed applications and environments.

To prevent possible injury and damage to appliances and to ensure compliance with all relevant provisions, use only the original accessories. Unauthorized modifications or the use of unapproved accessories may result in damage to the router and a breach of applicable regulations. Unauthorized modifications or use of unapproved accessories may void the warranty.

Turn off the router and disconnect it from power supply before handling of the SIM card.



Caution! The SIM card could be swallowed by small children.

Input voltage must not exceed 30 V DC max.

Do not expose the router to extreme ambient conditions. Protect the router against dust, moisture and high temperature.

The router should not be used in locations where flammable and explosive materials are present, including gas stations, chemical plants, or locations in which explosives are used.

Switch off the router when travelling by plane. Use of the router in a plane may endanger the operation of the plane or interfere with the mobile telephone network, and may be unlawful.

When using the router in the close proximity of personal medical devices, such as cardiac pacemakers or hearing aids, proceed with heightened caution.

The router may cause interference when in the close proximity of tv sets, radio receivers or personal computers.

It is recommended to create an appropriate copy or backup of all the important settings that are stored in the memory of the device.

2.2 Product Disposal Instructions

The WEEE (Waste Electrical and Electronic Equipment: 2002/96/EC) directive has been introduced to ensure that electrical/electronic products are recycled using the best available recovery techniques to minimize the impact on the environment. This product contains high quality materials and components which can be recycled. At the end of its life, this product **MUST NOT** be mixed with other commercial waste for disposal. Check the terms and conditions of your supplier for disposal information.

3. Router Description

3.1 Description

The SPECTRE Cellular and Ethernet industrial routers are used to wirelessly connect Ethernet equipment and other devices to the Internet or intranet. Thanks to the high data transfer speed of up to 100 Mbit/s download (LTE models) and 50 Mbit/s upload (LTE models), it is an ideal wireless solution for traffic and security camera systems, individual computers, LAN networks, automatic teller machines (ATM) and other self-service terminals. Data transfer speed of 3G models is up to 14.4 Mbit/s download and up to 5.76 Mbps upload on HSPA+ network.

The standard configuration includes one 10/100 Ethernet port, one USB Host port, one binary Input/output (I/O) port and one SIM card holder (LTE models). 3G models include second SIM card holder providing network redundancy. It also contains 2 expansion ports for connecting to other types of networks such as RS-232, RS-485/422, Digital/Analog I/O, or they can be configured to provide additional switched Ethernet ports. The function of each port is dependent upon the specific router model.

Configuration of the router may be done via a password-protected Web interface. The router supports the creation of VPN tunnels using IPsec, OpenVPN and L2TP to ensure safe communication. The Web interface provides detailed statistics about the router's activities, signal strength, etc. The router supports DHCP, NAT, NAT-T, DynDNS, NTP, VRRP, control by SMS, and many other functions.

The router provides diagnostic functions which include automatically monitoring the PPP connection, automatic restart in case of connection losses, and a hardware watchdog that monitors the router status. The user may insert Linux scripts to control various router functions and create up to four different configurations for the same router. These configuration files can include different SMS functionality and binary input configurations. You may switch between different configurations whenever necessary. The router can automatically upgrade its configuration and firmware from your central server. This allows for mass reconfiguration of numerous routers at the same time.

3.2 Examples of Possible Applications

- Mobile office
- Fleet management
- Security system
- Telematics
- Telemetrics
- Remote monitoring
- Vending and dispatcher machines

3.3 Contents of Package



The basic router package includes:

- Router
- Power supply
- Crossover UTP cable
- External antennas
- Clips for the DIN rail
- Quick Start Guide



Figure 1: Contents of Package

3.4 Model Numbers

Standard Features on SPECTRE Routers: 10/100 Ethernet, USB Host Port, Binary I/O Port, Dual SIM Card slots

Expansion Port Functions (Model Dependent):

| The Ports Can Be Connected As Follows: | |
|--|--|
| PORT 1 | ETHERNET, SWITCH (together with PORT 2), RS-232, RS-485/422, 12-bit I/O (AI, DI, DO) |
| PORT 2 | SWITCH (together with PORT 1), RS-232, RS-485/422, Wi-Fi, SmartMesh IP |

Table 1: Expansion port possibilities

| SPECTRE LTE Wireless Routers (Verizon): Expansion Ports | | |
|--|-------------------------|-------------------|
| Model No. | Port 1 | Port 2 |
| RTLTE-300-VZ | No connect | No connect |
| RTLTE-302-VZ | No connect | RS-232 |
| RTLTE-304-VZ | No connect | RS-422/485 |
| RTLTE-310-VZ | Ethernet | No connect |
| RTLTE-311-VZ | Ethernet (SWITCH) | Ethernet (SWITCH) |
| RTLTE-312-VZ | Ethernet | RS-232 |
| RTLTE-314-VZ | Ethernet | RS-422/485 |
| RTLTE-322-VZ | RS-232 | RS-232 |
| RTLTE-324-VZ | RS-232 | RS-422/485 |
| RTLTE-330-VZ | 12-bit I/O (AI, DI, DO) | No connect |
| RTLTE-300-W-VZ | No connect | Wi-Fi |
| RTLTE-310-W-VZ | Ethernet | Wi-Fi |
| RTLTE-320-W-VZ | RS-232 | Wi-Fi |
| RTLTE-330-W-VZ | 12-bit I/O (AI, DI, DO) | Wi-Fi |
| RTLTE-340-W-VZ | RS-422/485 | Wi-Fi |
| RTLTE-350-VZ | No connect | SmartMesh IP |
| RTLTE-351-VZ | Ethernet | SmartMesh IP |
| RTLTE-352-VZ | RS-232 | SmartMesh IP |
| RTLTE-354-VZ | RS-422/485 | SmartMesh IP |

Table 2: SPECTRE LTE model numbers for Verizon

| SPECTRE LTE Wireless Routers (AT&T): Expansion Ports | | |
|---|-------------------------|-------------------|
| Model No. | Port 1 | Port 2 |
| RTLTE-300-AT | No connect | No connect |
| RTLTE-302-AT | No connect | RS-232 |
| RTLTE-304-AT | No connect | RS-422/485 |
| RTLTE-310-AT | Ethernet | No connect |
| RTLTE-311-AT | Ethernet (SWITCH) | Ethernet (SWITCH) |
| RTLTE-312-AT | Ethernet | RS-232 |
| RTLTE-314-AT | Ethernet | RS-422/485 |
| RTLTE-322-AT | RS-232 | RS-232 |
| RTLTE-324-AT | RS-232 | RS-422/485 |
| RTLTE-330-AT | 12-bit I/O (AI, DI, DO) | No connect |
| RTLTE-300-W-AT | No connect | Wi-Fi |
| RTLTE-310-W-AT | Ethernet | Wi-Fi |

To be continued on the next page

Continued from the previous page

| SPECTRE LTE Wireless Routers (AT&T): Expansion Ports | | |
|---|-------------------------|---------------|
| Model No. | Port 1 | Port 2 |
| RTLTE-320-W-AT | RS-232 | Wi-Fi |
| RTLTE-330-W-AT | 12-bit I/O (AI, DI, DO) | Wi-Fi |
| RTLTE-340-W-AT | RS-422/485 | Wi-Fi |
| RTLTE-350-AT | No connect | SmartMesh IP |
| RTLTE-351-AT | Ethernet | SmartMesh IP |
| RTLTE-352-AT | RS-232 | SmartMesh IP |
| RTLTE-354-AT | RS-422/485 | SmartMesh IP |

Table 3: SPECTRE LTE model numbers for AT&T

| SPECTRE 3G Wireless Routers: Expansion Ports | | |
|---|-------------------------|-------------------|
| Model No. | Port 1 | Port 2 |
| RT3G-300 | No connect | No connect |
| RT3G-302 | No connect | RS-232 |
| RT3G-304 | No connect | RS-422/485 |
| RT3G-310 | Ethernet | No connect |
| RT3G-311 | Ethernet (SWITCH) | Ethernet (SWITCH) |
| RT3G-312 | Ethernet | RS-232 |
| RT3G-314 | Ethernet | RS-422/485 |
| RT3G-322 | RS-232 | RS-232 |
| RT3G-324 | RS-232 | RS-422/485 |
| RT3G-330 | 12-bit I/O (AI, DI, DO) | No connect |
| RT3G-300-W | No connect | Wi-Fi |
| RT3G-310-W | Ethernet | Wi-Fi |
| RT3G-320-W | RS-232 | Wi-Fi |
| RT3G-330-W | 12-bit I/O (AI, DI, DO) | Wi-Fi |
| RT3G-340-W | RS-422/485 | Wi-Fi |
| RT3G-350 | No connect | SmartMesh IP |
| RT3G-351 | Ethernet | SmartMesh IP |
| RT3G-352 | RS-232 | SmartMesh IP |
| RT3G-354 | RS-422/485 | SmartMesh IP |

Table 4: SPECTRE 3G model numbers

| SPECTRE RT Ethernet Routers: Expansion Ports | | |
|--|-------------------|-------------------|
| Model No. | Port 1 | Port 2 |
| ERT310 | Ethernet | No connect |
| ERT311 | Ethernet (SWITCH) | Ethernet (SWITCH) |
| ERT312 | Ethernet | RS-232 |
| ERT314 | Ethernet | RS-422/485 |
| ERT351 | Etherent | SmartMeshIP |

Table 5: SPECTRE RT Ethernet Router

3.5 Dimensions

Basic dimensions, metal box:

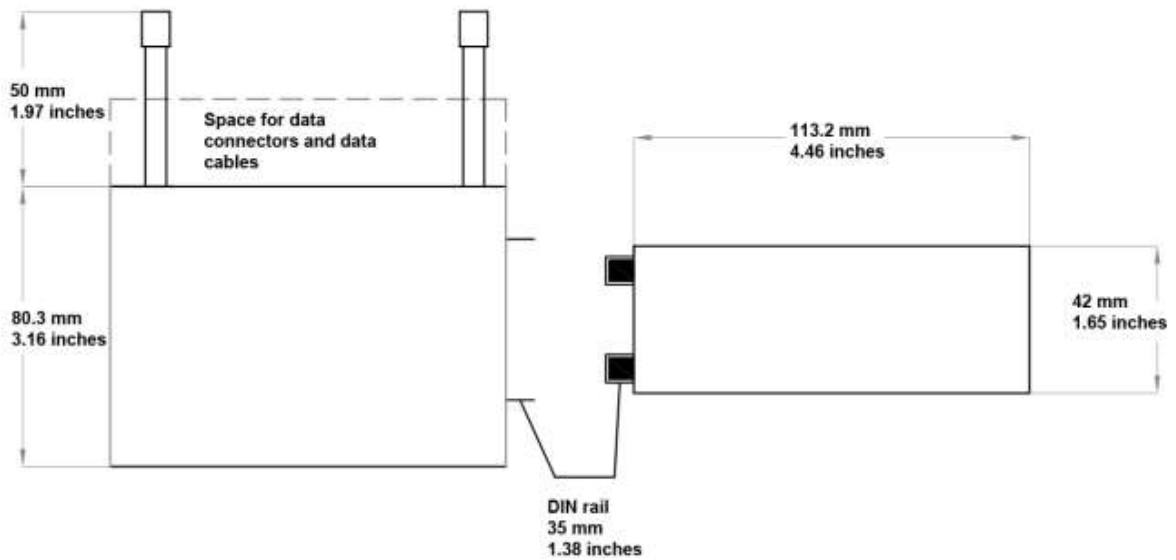


Figure 2: Basic dimensions, metal box

4. Mounting Recommendations



- The router may be placed on a work surface.
- Clips are included for mounting the router on a standard DIN rail.

The router may be installed in an industrial instrument panel.



For best performance, please consider the following guidelines:

- When using the supplied whip antennas, maintain a distance of 6 cm from cables and metal surfaces on every side. When using an external antenna, unless in a switch-board, it is necessary to fit a lightning conductor
- When mounting a router on sheet steel we recommend using an external antenna.
- If the router is installed in a metal instrument enclosure, an external antenna must be used and it must be mounted outside of the metal enclosure.

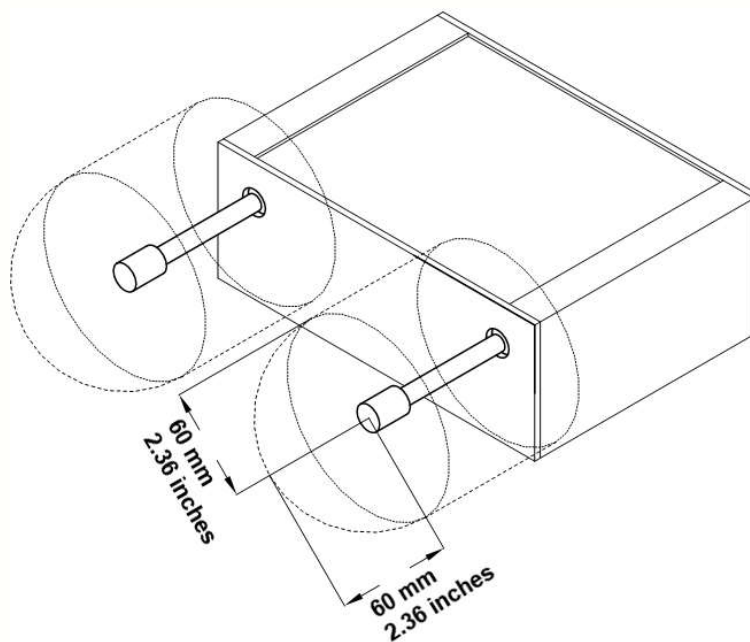


Figure 3: Space around antenna

We recommend binding the cables together to avoid coupling noise onto the cables.

1. Length: The combination of power supply and data cables can be a maximum of 1.5 meters.
2. If the length of the data cables exceeds 1.5 meters or if the cable leads towards the switch panel, we recommend installing overvoltage protectors (surge suppressors).
3. Do not bundle the data cables with 120/230V power cables.
4. All wiring to sensors should use shielded twisted pairs.

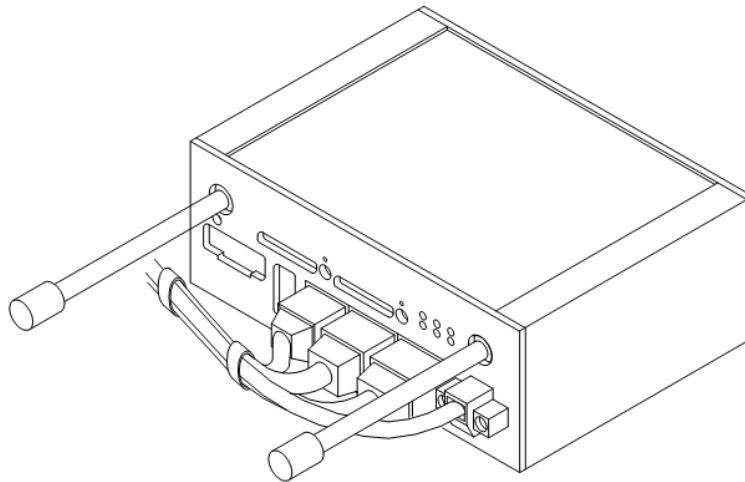


Figure 4: Cable routing

Leave enough space around the connectors for the handling of cables.

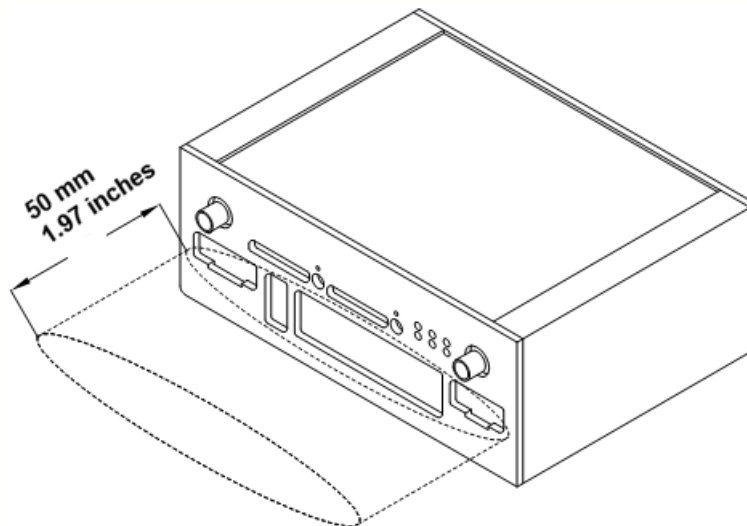


Figure 5: Space in front of connectors

We recommend using the switch panel's earth-bonding distribution frame for grounding the router's power supply, data cables and antenna.

Removing from DIN rail

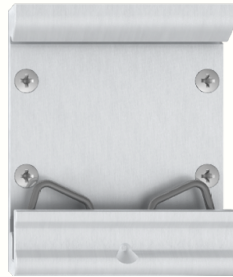


Figure 6: DIN rail clip

This is the default position of the DIN rail clip. To remove the router from the DIN rail, push the router up slightly, so that the top part of the clip disengages, and then gently slide the router off the DIN rail.

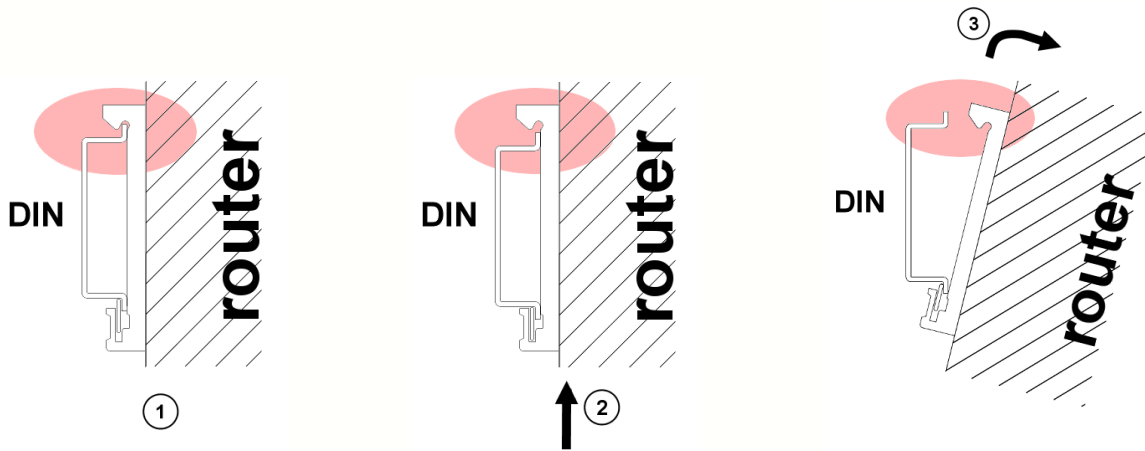


Figure 7: Removing the router from the DIN rail

5. User Interfaces

5.1 Connectors

| Front Panel | | |
|-------------|---------------|---|
| Label | Connector | Description |
| PWR | 2-pin | Power supply |
| ETH | RJ45 | Connection to the local computer network |
| PORT 1 | RJ45 | RS-232/422/485, ETHERNET, or 12-bit I/O |
| PORT 2 | RJ45 | RS-232/422/485 or ETHERNET |
| ANT | SMA | Main cellular antenna (LTE and 3G models only) |
| DIV | SMA | Diversity cellular antenna (LTE models only) |
| GPS | SMA | GPS antenna (LTE models only) |
| AUX | SMA RP-SMA | 3G models (on the left): DIV/GPS all models (on the right): SmartMesh IP antenna |
| WIFI | RP-SMA | Wi-Fi antenna (LTE and 3G models only) |
| USB | USB-A Host | USB connector |
| I/O | 3-pin | Binary input and output |
| SIM | - | SIM card holder (LTE models only) |
| SIM1 | - | SIM card holder (3G models only) |
| SIM2 | - | SIM card holder 2 (3G models only) |

Table 6: Front panel description



Figure 8: SPECTRE LTE front panel example, model RTLTE-304

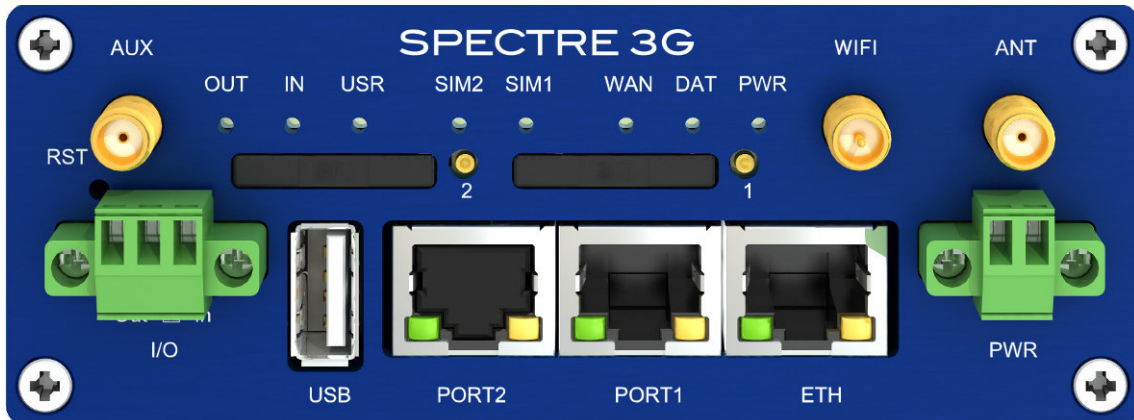


Figure 9: SPECTRE 3G front panel example, model RT3G-340-W

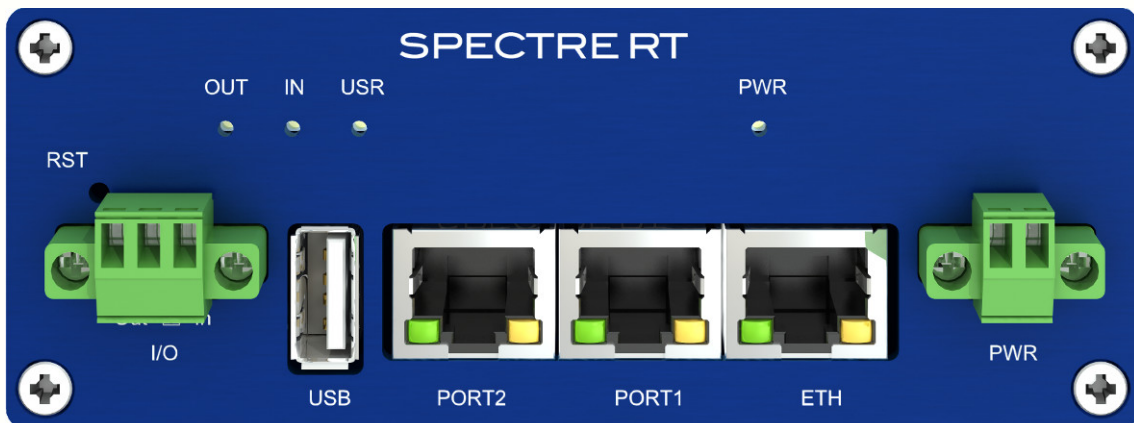


Figure 10: SPECTRE RT front panel example, model ERT311

5.2 Status Indicators

| Caption | Color | State | Description |
|---------|-------|---------------------------------|--|
| PWR | Green | Blinking On Fast blinking | Router is ready Starting of the router Updating firmware |
| DAT | Red | Blinking | Communication in progress on radio channel |

To be continued on the next page

Continued from the previous page

| Caption | Color | State | Description |
|---------|--------|---|--|
| WAN | Yellow | flashing 1x flash per sec. 2x flash per sec. 3x flash per sec. | PPP connection established. Signal strength is from -50 dBm to -69 dBm. Signal strength is from -70 dBm to -89 dBm or the difference between neighboring cells is exactly 3 dBm. Signal strength is from -90 dBm to -113 dBm or difference the between neighboring cells is smaller than 3 dBm. |
| USR | Yellow | Function selected by user | |
| OUT | Green | On | Binary output active |
| IN | Green | On | Binary input active |
| ETH | Green | On Off | Selected 100 Mbit/s Selected 10 Mbit/s |
| ETH | Yellow | On Blinking Off | The network cable is connected Data transmission The network cable is not connected |
| PORT | Green | LED functions for different router configurations appear in the charts below. | |
| PORT | Yellow | LED functions for different router configurations appear in the charts below. | |
| SIM | Yellow | On | SIM card is active (LTE models only) |
| SIM1 | Yellow | On | SIM card 1 is active (3G models only) |
| SIM2 | Yellow | On | SIM card 2 is active (3G models only) |

Table 7: Router status indication

5.2.1 Expansion Port Status Indicators

Ethernet Ports

| LED Port Indicator | |
|--------------------|--|
| Green LED | On: selected 100 Mbit/s Off: selected 10 Mbit/s |
| Yellow LED | On: the network cable is connected Blinking: data transmission Off: the network cable is not connected |

Table 8: Ethernet LED status indication

RS-232 Ports

| LED Port Indicator | |
|--------------------|-------------------------|
| Green LED | Blinks on Receive data |
| Yellow LED | Blinks on Transmit data |

Table 9: RS-232 LED status indication

I/O Ports

| LED Port Indicator | |
|--------------------|--------------------------|
| Green LED | Indicates binary input 0 |
| Yellow LED | Indicates binary input 1 |

Table 10: I/O Port LED status indication

RS-485/422 Ports

| LED Port Indicator | |
|--------------------|-------------------------|
| Green LED | Blinks on Receive data |
| Yellow LED | Blinks on Transmit data |

Table 11: RS-232 LED status indication

Wi-Fi

| LED Port Indicator | |
|--------------------|--------------------------|
| Green LED | Indicates Wi-Fi Power On |
| Yellow LED | Always Off |

Table 12: Wi-Fi LED status indication

SmartMesh IP

| LED Port Indicator | |
|--------------------|---------------------------------|
| Green LED | Indicates SmartMesh IP Power On |
| Yellow LED | Always Off |

Table 13: Wi-Fi LED status indication

5.3 Power Connector

| 2-Pin Panel Socket | | |
|--------------------|-------------|--|
| Pin number | Signal mark | Description |
| 1 | VCC (+) | Positive input of DC supply voltage (+10 to +30 VDC) |
| 2 | GND (-) | Negative input of DC supply voltage |

Table 14: Connection of power connector

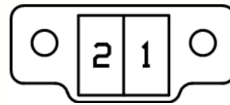


Figure 11: Power connector

The router requires a +10 V to +30 V DC supply. Protection against reversed polarity is built into the router.

The power consumption in receive mode is 2.3 W (LTE models) or 2.6 W (3G models). The peak power consumption during data sending (or communication running on RT models) is 5.5 W. For correct operation, the power source must be able to supply a peak current of 1 A.



The power cable connects to the router via locking screws. (See figure below.)

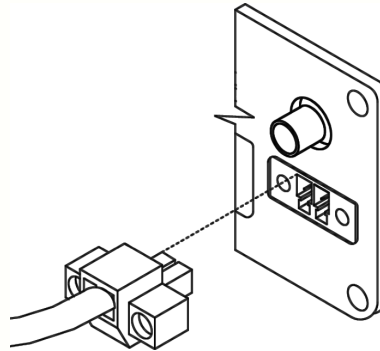


Figure 12: Connection of power supply connector



Circuit Example:

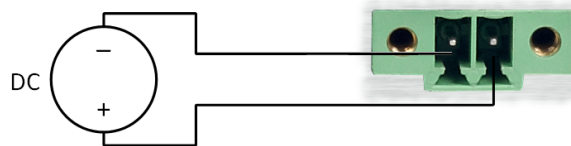


Figure 13: Connection of power supply

5.4 Antenna Connector

The two large cellular antennas are connected to the router using the standard SMA antenna connectors on the front panel. The main cellular antenna connection is labeled **ANT**. The router cannot operate without a main antenna. The receive diversity antenna connection is labeled **DIV** or **AUX** for 3G models). This antenna improves the receive sensitivity of the router and should be used in areas with weak signal strength.



SPECTRE LTE: There are always connectors ANT and DIV for main and diversity cellular antenna. The antenna connector in the middle is based on the model number: There is GPS antenna connector as a standard, WIFI antenna connector (RP-SMA) for Wi-Fi models and AUX connector (RP-SMA) for SmartMesh IP models.

SPECTRE 3G: There are always connectors AUX and DIV for main antenna and diversity/GPS antenna (the GPS mode is chosen internally by activating the GPS User Module in the router). There can be antenna connector in the middle based on the model number: WIFI antenna connector (RP-SMA) for Wi-Fi models and another AUX connector (RP-SMA) for SmartMesh IP models.

SPECTRE RT: There is not any antenna connector as a standard. Based on the model number there can be AUX connector (RP-SMA) for SmartMesh IP antenna.

The AUX connector on the Wi-Fi and SmartMesh IP units is a reverse-polarity SMA connector and should only be used with the smaller Wi-Fi/SmartMesh IP antenna. Do not attempt to connect the cellular antennas to this connector as it can damage the connector and the antennas.



The router can not operate without main antenna ANT connected!



Connect the antenna's SMA connector to the router's SMA connector. (See figure below).

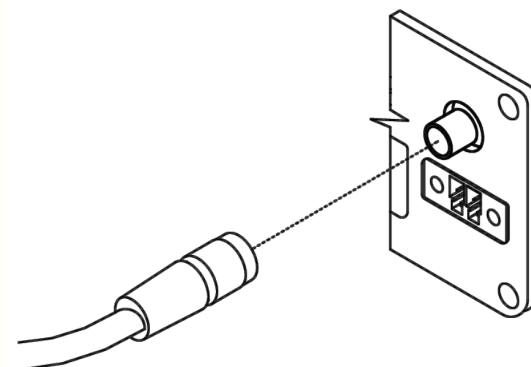


Figure 14: Connecting the antenna

5.5 SIM Card Reader

The SIM card reader supports 3 V and 1.8 V Mini-SIM cards. It is located on the front panel of the router. The router will not operate on UMTS or LTE networks unless an activated SIM card with an unblocked PIN is in the reader. The SIM cards may use different access point names (APN).

Changing the SIM card:



Disconnect the router from power supply before handling the SIM card!

Press the small button on the right hand side of the SIM reader slot to eject the SIM card holder. Insert the SIM card into the holder and slide it in the reader. (See figure bellow.)

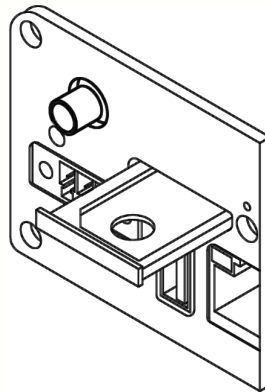


Figure 15: Ejected SIM card holder

5.6 Ethernet Port

| Panel Socket RJ45 | | | |
|-------------------|-------------|-------------------------------|---------------------|
| Pin Number | Signal mark | Description | Data Flow Direction |
| 1 | TXD+ | Transmit Data – positive pole | Input/Output |
| 2 | TXD– | Transmit Data – negative pole | Input/Output |
| 3 | RXD+ | Receive Data – positive pole | Input/Output |
| 4 | — | — | |
| 5 | — | — | |
| 6 | RXD– | Receive Data – negative pole | Input/Output |
| 7 | — | — | |
| 8 | — | — | |

Table 15: Ethernet connector

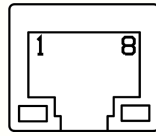


Figure 16: Ethernet connector



ATTENTION! The Ethernet port is not POE (Power over Ethernet) compatible!

Ethernet cable plugs into the RJ45 connector labeled as ETH. (See figure below.)

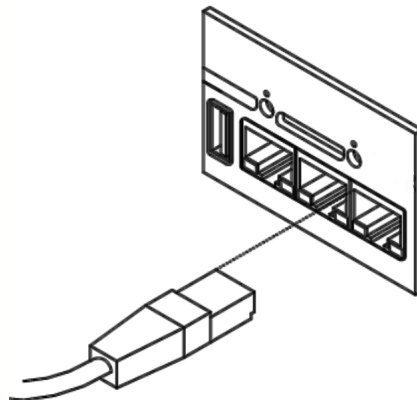


Figure 17: Ethernet cable connection

5.7 Port 1

Based on the model number (see chapter 3.4), the expansion PORT 1 may be configured for:

- Ethernet (same as in chapter 5.6 but plug into PORT1)
- SWITCH (together with PORT 2)
- serial communications RS-232 (see chapter 5.11.1) and RS-485/422 (see chapter 5.11.2)
- 12-bit I/O (AI, DI, DO), see chapter 5.11.3

5.8 Port 2

Based on the model number (see chapter 3.4), the expansion PORT 2 may be configured for:

- SWITCH (together with PORT 1)
- serial communications RS-232 (see chapter 5.11.1) and RS-485/422 (see chapter 5.11.2)
- Wi-Fi (connector PORT2 used for indication only – see chapter 5.2.1)
- SmartMeshIP (connector PORT2 used for indication only – see chapter 5.2.1)



Note: Wi-Fi and SmartMesh IP are wireless – RJ45 connector is used for indication only. (See chapter 5.2.1.)

5.9 USB Port

| Panel Socket USB-A | | | |
|--------------------|-------------|--|---------------------|
| Pin No. | Signal mark | Description | Data Flow Direction |
| 1 | +5 V | Positive pole of 5 V DC supply voltage | |
| 2 | USB data – | USB data signal – negative pole | Input/Output |
| 3 | USB data + | USB data signal – positive pole | Input/Output |
| 4 | GND | Negative pole of DC supply voltage | |

Table 16: Connection of USB connector



Figure 18: USB connector

5.10 I/O Port

| 3-Pin Panel Socket | | | |
|--------------------|-------------|---------------|---------------------|
| Pin No. | Signal mark | Description | Data Flow Direction |
| 1 | BIN0 | Binary input | Input |
| 2 | GND | Signal ground | |
| 3 | OUT0 | Binary output | Output |

Table 17: I/O port connection

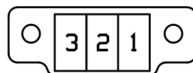


Figure 19: I/O connector

The user interface I/O is for the processing of binary input signals and for control (settings) of binary output signals. Binary output is not switched to ground in the default configuration.

The maximum load for the binary output is 30V / 100mA. The constant current supplied by the binary input is 3 mA.

Connect the cable's I/O connector to the router's I/O port and tighten locking screws.

Circuit example of a binary input or output connected to the router:

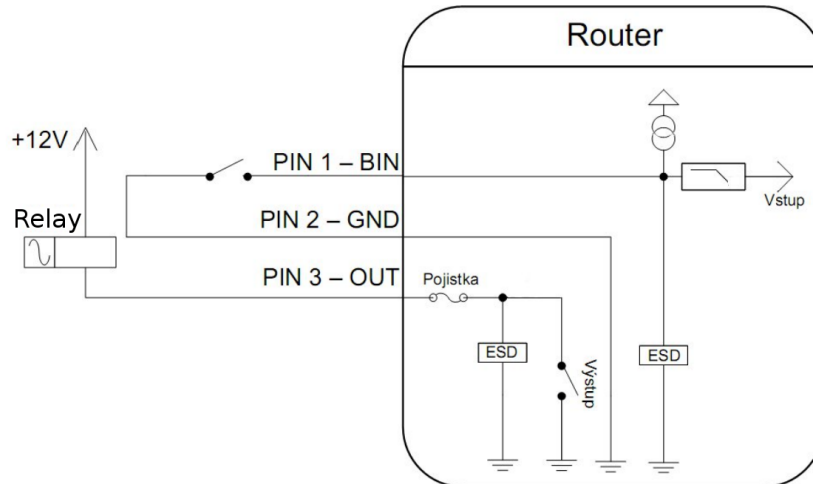


Figure 20: Connection of binary input and output of router

5.11 Expansion Ports Information

5.11.1 RS-232 Ports

The RS-232 port is configured as a Data Communication Equipment (DCE). The interface is connected to RJ45 connector PORT1 or PORT2 (based on the router model number). An adapter cable can be used to convert RJ-45 connector to a standard DB9 serial connector. The RS-232 port is protected against bus overload.

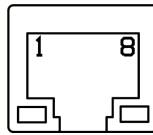


Figure 21: RS-232 port connector

| Panel socket RJ45 (RS-232 – DCE – Data Communication Equipment) | | | |
|---|--------|--|-----------|
| Pin | Signal | Description | Direction |
| 1 | RTS | Request To Send | Input |
| 2 | CTS | Clear To Send | Output |
| 3 | DTR | Data Terminal Ready | Input |
| 4 | DSR | Data Set Ready – connect to +3 V through R 330 Ohm | Output |
| 5 | GND | Signal ground | |
| 6 | TXD | Transmit Data | Output |
| 7 | CD | Carrier Detect | Output |
| 8 | RXD | Receive Data | Input |

Table 18: Connection of RS-232 connector



Example of connecting a meter to the router:

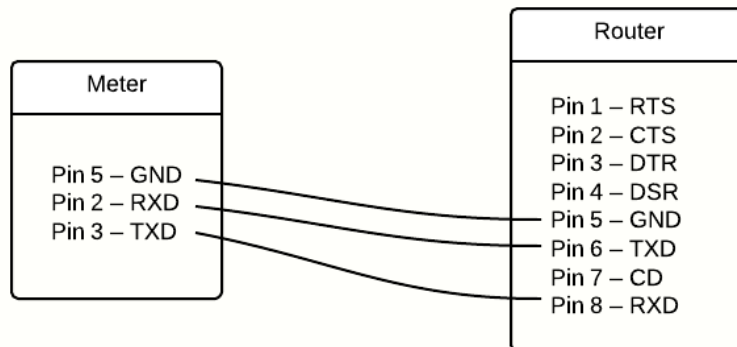


Figure 22: Meter connection to router

5.11.2 RS-485/422 Ports

The RS-485/422 ports can be powered using the internal 3.3 V supply or by connecting an external power supply to the port connector. External or internal power is selected by jumpers J2 and J3 on the RS-485 module daughter board. To use internal power, place jumpers J2 and J3 across pins 2 and 3. To select external power, jumpers J2 and J3 must be on pins 1 and 2.

Interface behavior of module Expansion port RS-485/RS-422 can be made by wiring Jumpers J4, J5 and J6 on the RS-485 module select the mode of the port – either RS-485 or RS-422 mode. If RS485 is required, jumpers J4 and J5 must be connected and jumper J6 disconnected. If RS422 is required, jumpers J4 and J5 must be disconnected and jumper J6 connected. Jumper placement can be seen in the pictures below (RS-485 module is viewed from the top).



Internal power supply should only be used in the event that it is not possible to provide an external power supply. If internal power supply used, RS-485/422 port will not be galvanically separated.

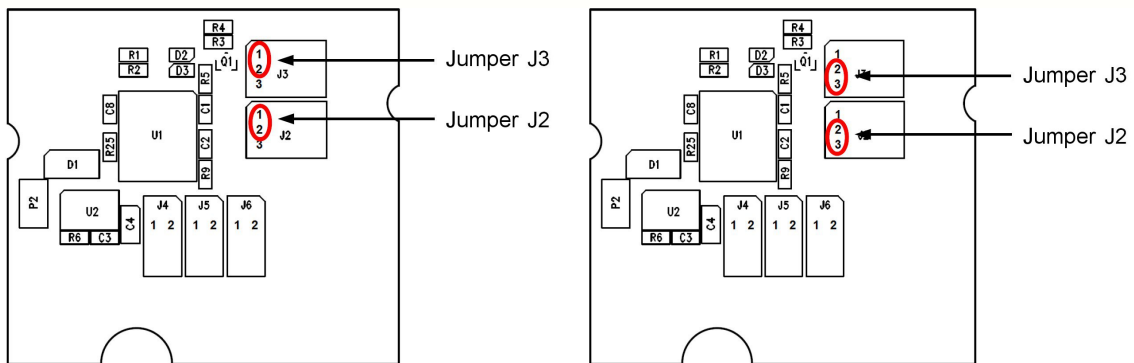


Figure 23: Jumper position for external power supply (left) and internal power supply (right)

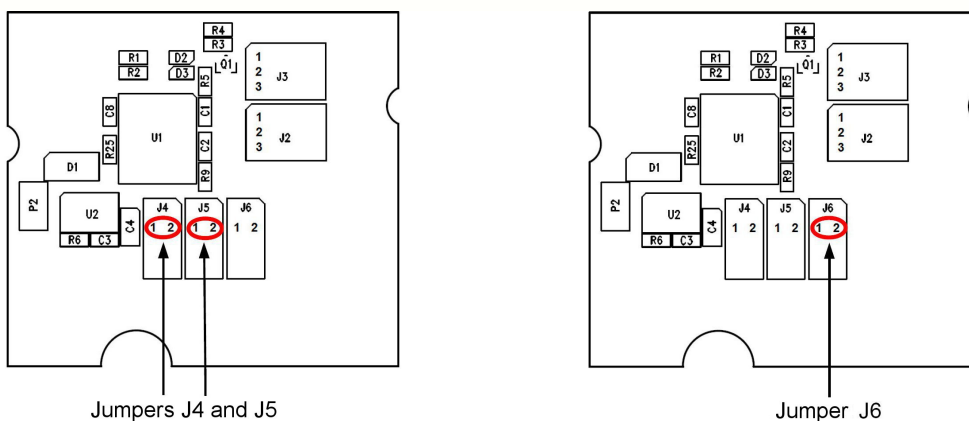


Figure 24: Jumper position for RS-485 (left) and for RS-422 (right)

Connector Pinout in RS-485 mode

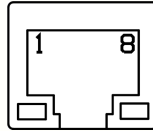


Figure 25: RS-485/422 connector

| Panel socket RJ45 (RS-485 Mode) | | | |
|---------------------------------|-------------|--------------------------|---------------------|
| Pin | Signal mark | Description | Data flow direction |
| 1 | GND | Signal and supply ground | |
| 2 | GND | Signal and supply ground | |
| 3 | TxRx- | RS485 B (-) | Input/Output |
| 4 | TxRx+ | RS485 A (+) | Input/Output |
| 5 | TxRx- | RS485 B (-) | Input/Output |
| 6 | TxRx+ | RS485 A (+) | Input/Output |
| 7 | +12 V EXT | External power supply | |
| 8 | +12 V EXT | External power supply | |

Table 19: Connector pinout in RS-485 mode

! ATTENTION! The power supply is selected on the module board using the jumpers.

In RS-485 mode, pins 3 and 5 and pins 4 and 6 are internally shorted together.

If galvanic separation is required, the converter must use an external power supply.

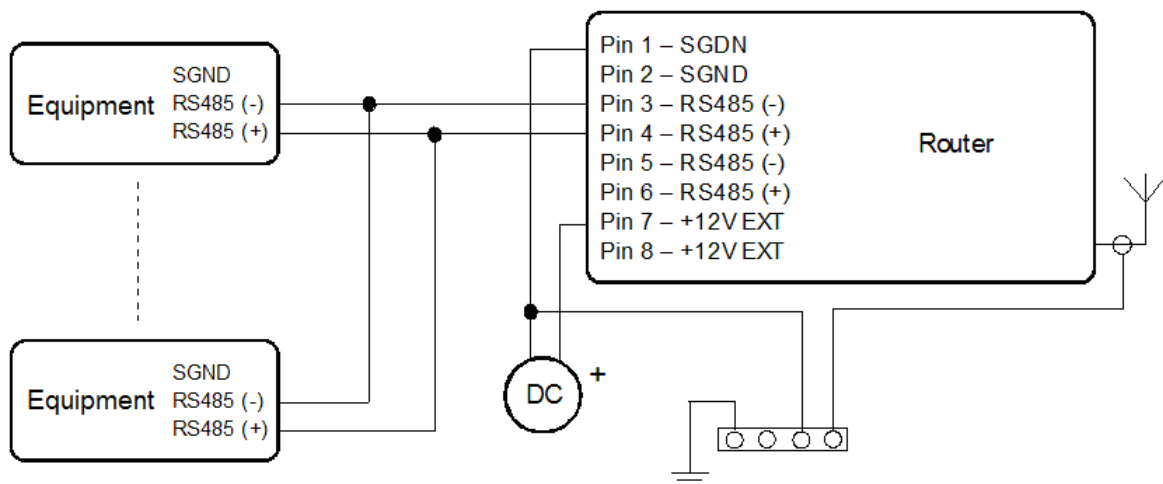


Figure 26: RS-485: Connection to the router with data cable length less than 10 m

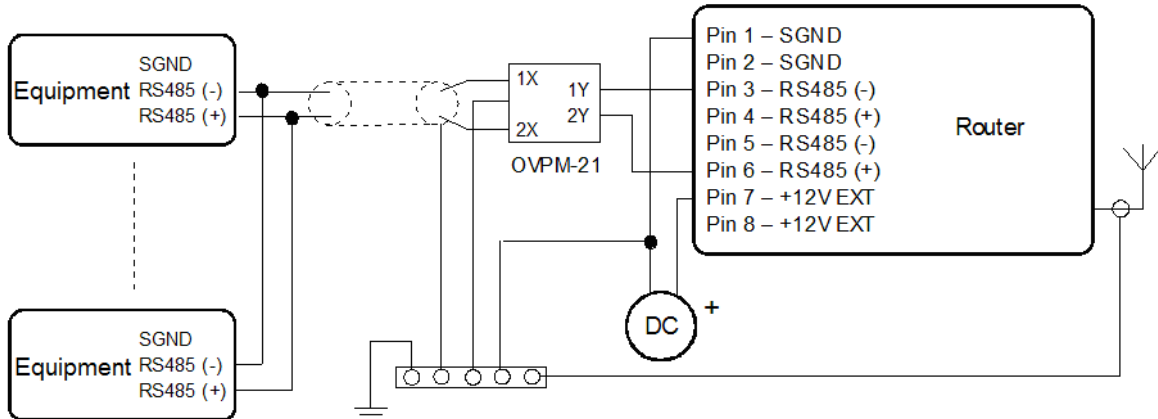


Figure 27: RS-485: Connection to the router with data cable length more than 10 m



With an RS-485 data cable longer than 10m, it is necessary to use overvoltage protection on the router side!

Connector Pinout in RS-422 mode

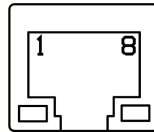


Figure 28: RS-485/422 connector

| Panel socket RJ45 (RS-422 Mode) | | | |
|---------------------------------|-------------|--------------------------------|---------------------|
| Pin | Signal mark | Description | Data flow direction |
| 1 | SGND | Signal and power supply ground | |
| 2 | SGND | Signal and power supply ground | |
| 3 | RxD- | Receive data (-) | Output |
| 4 | RxD+ | Receive data (+) | Output |
| 5 | TxD- | Transmit data (-) | Input |
| 6 | TxD+ | Transmit data (+) | Input |
| 7 | +12 V EXT | External power supply | |
| 8 | +12 V EXT | External power supply | |

Table 20: Connector pinout in RS-422 mode



ATTENTION! The power supply is selected on the module board using the jumpers.

If galvanic separation is required, the converter must use an external power supply.

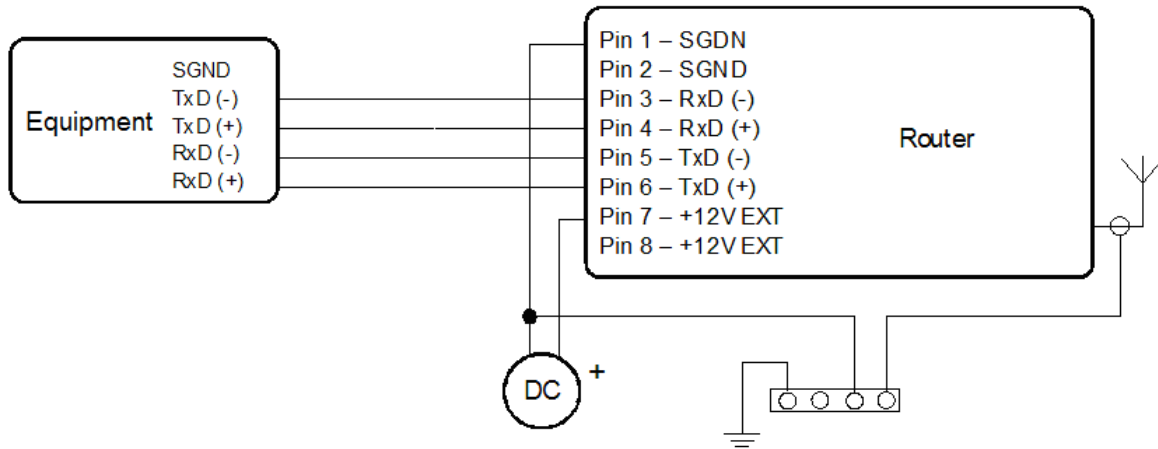


Figure 29: RS-422: Connection to the router with data cable length less than 10 m

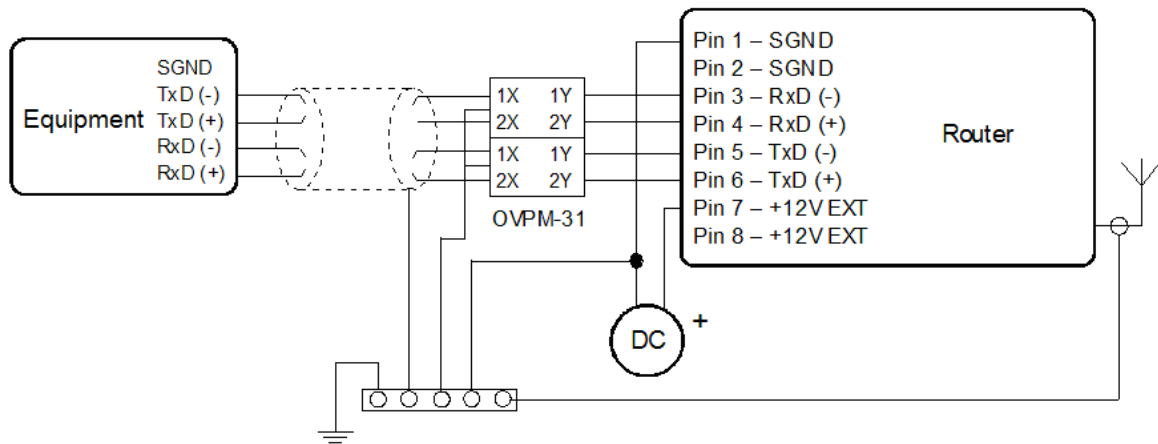


Figure 30: RS-422: Connection to the router with data cable length more than 10 m



With a RS422 data cable more than 10m long, it is necessary to use overvoltage protection on the router side!

5.11.3 12-bit I/O (AI, DI, DO) Port

The 12-bit I/O port user interface (also referred to as CNT port – counter) is used to monitor analog and binary input signals and to control binary output signals. The interface has 6 inputs and 1 output. Two of the inputs can be configured as binary counter inputs or general purpose binary inputs. There are also 2 dedicated binary inputs, 2 analog current inputs, and 1 open-collector output. The options for the I/O port are configured by writing to register values on the I/O board using the **MODBUS ASCII** protocol.

The unit can periodically store the values of the inputs in memory. These log entries can be read by reading the individual memory locations. Up to 224 log entries may be stored. The logging interval can range from 1–65535 minutes.

Analog Inputs

The analog current inputs have a range from 0 to 20 mA. The input impedance is 100 Ω and the ADC resolution is 12 bits. The averaging and sampling period may be adjusted by the user. Also, alarms thresholds may be set for each input. The ADC value stored in memory is calculated using the following equation:

$$\text{ADC Value} = ((12b \text{ value} + \text{addit. constant}) * \text{multiplic. constant})/1000$$

where the constants are programmed into memory by the user.

Binary Input

The binary input is sampled 8x per second with a sampling period of 1/64 seconds. The active level for each binary input may be set to either a logic 0 or logic 1. The inputs may be configured to generate an alarm when they become active. The input threshold for detecting a logic 1 can be set at either 8 μ A or 20 mA using a jumper on the module board.

Counter Input

The counter inputs have a maximum input frequency of 100 Hz. The minimum input pulse width is 1 ms. The counter input may be configured to generate an alarm when a threshold is reached.

Binary Output

The binary output is a transistor with an open collector output. In the inactive state (logic 0) the transistor is off. In the active state (logic 1), the transistor is on and will connect the output signal to ground (GND). The output transistor is rated at 100 mA and 30 V.

The output may be configured to generate a pulse from 125 to 8000 ms in length. It is also possible to configure the unit so that the output will become active when counter 1 (CNT1) reaches a threshold.

Selecting the Binary Input Current

The input threshold for detecting a logic 1 can be set at either 8 μA or 20 mA using a jumper on the module board. When jumper J4 is shorted, the threshold current level is 20 mA. When jumper J4 is not shorted, the threshold current level is 8 μA . A threshold current value of 20mA has a higher resistance to noise on the input but also dissipates more power.

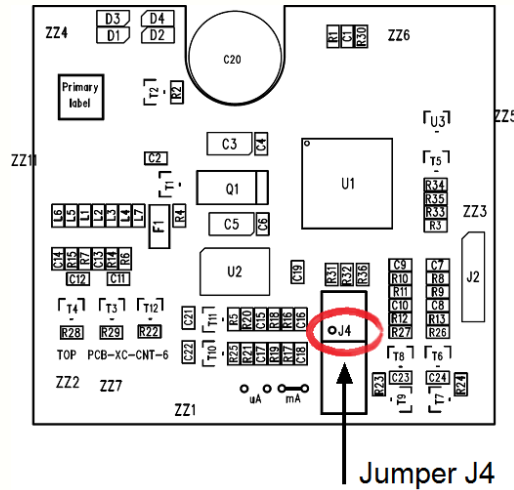


Figure 31: Threshold select using jumper on the board

Input/Output Connector

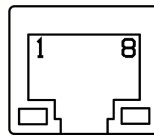


Figure 32: 12-bit I/O (CNT) connector

| Panel socket RJ45 (12-bit I/O) | | | |
|--------------------------------|-------------|--------------------------------|---------------------|
| Pin | Signal mark | Description | Data flow direction |
| 1 | BIN1/CNT1 | Binary input/counter input | Input |
| 2 | BIN2/CNT2 | Binary input/counter input | Input |
| 3 | BIN3 | Binary input | Input |
| 4 | BIN4 | Binary input | Input |
| 5 | GND | Signal ground | |
| 6 | OUT1 | Binary output (open collector) | Output |
| 7 | AN1 | Analog current input | Input |
| 8 | AN2 | Analog current input | Input |

Table 21: 12-bit Input/Output connector pinout

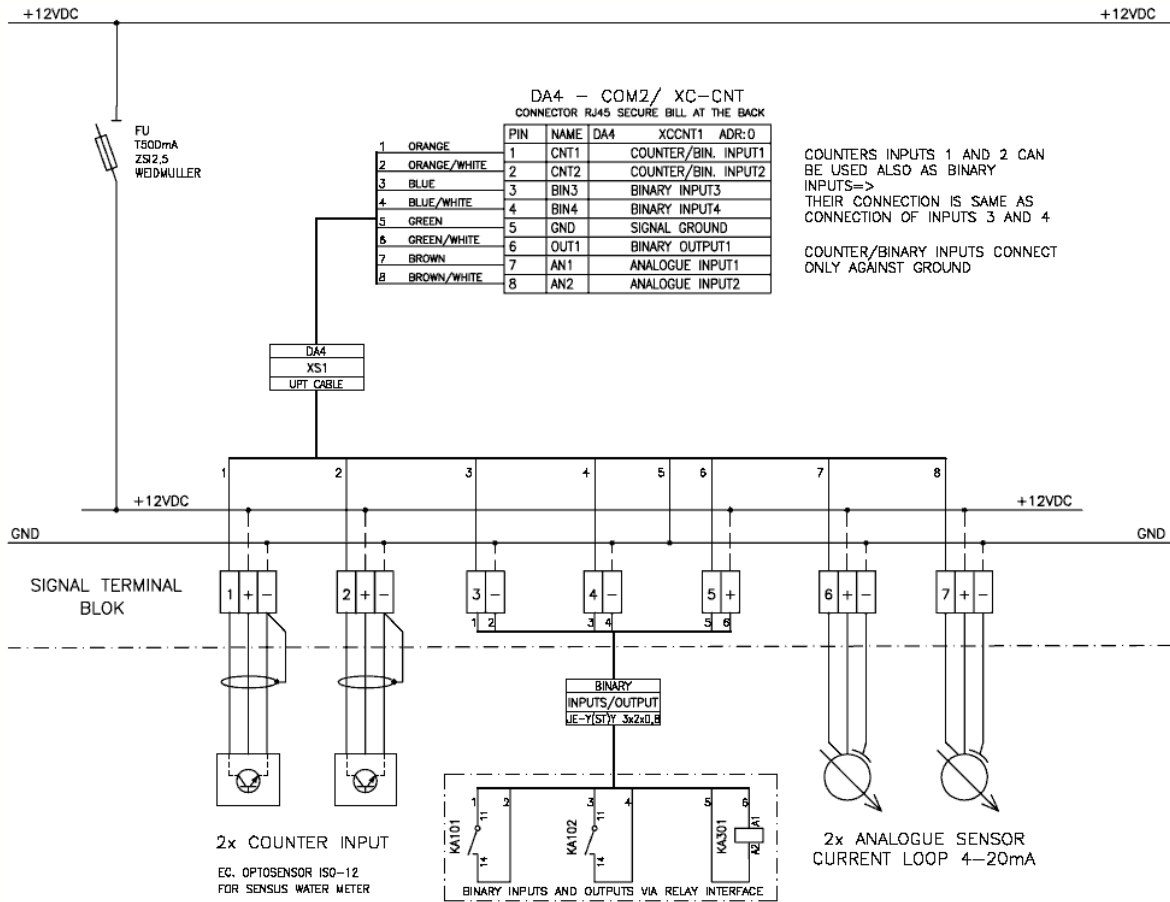


Figure 33: Typical connection of the 12-bit I/O port circuitry:

MODBUS ASCII Configuration and Address Space

The 12-bit I/O Port registers are read and written using MODBUS ASCII slave protocol over serial port 1. Using this protocol, it is possible to configure the 12-bit I/O board, read the input status, and control the output. The I/O port communicates at 9600 baud, 8 bits, no parity, and 1 stop bit (8N1). MODBUS input/output address space in the table below:

| Address | Access | Description |
|---------|--------|-----------------------------------|
| 0x0000 | R/- | Type of firmware |
| 0x0001 | R/- | Upper 16 bits of firmware version |
| 0x0002 | R/- | Lower 16 bits of firmware version |

To be continued on the next page

Continued from the previous page

| Address | Access | Description |
|---------|--------|---|
| 0x0003 | R/- | Supported firmware characteristics: <ul style="list-style-type: none"> • bit 0 – analogue input AN1 • bit 1 – analogue input AN2 • bit 2 – counter input CNT1 • bit 3 – counter input CNT2 • bit 4 – binary input BIN1 • bit 5 – binary input BIN2 • bit 6 – binary input BIN3 • bit 7 – binary input BIN4 • bit 8 – binary output OUT1 • bit 9 – automatic feeder control • bit 10 – fullduplex counter CNT1/CNT2 |
| 0x0004 | R/- | Maximal number of entries in the cache memory |
| 0x0005 | R/W | Sign of logging start and alarm evaluation |
| 0x0006 | R/W | Upper 16 bits of the number of seconds since January 1, 1970 |
| 0x0007 | R/W | Lower 16 bits of the number of seconds since January 1, 1970 |
| 0x0008 | R/W | Upper 16 bits of the current log number |
| 0x0009 | R/W | Lower 16 bits of the current log number |
| 0x000A | R/- | Current alarm status |
| ... | | |
| 0x0100 | R/- | Status of the binary inputs |
| ... | | |
| 0x0200 | R/W | Status of the binary outputs |
| ... | | |
| 0x0300 | R/- | Recalculate value of AN1 analogue input (with sign) |
| ... | | |
| 0x0400 | R/- | Recalculate value of AN2 analogue input (with sign) |
| ... | | |
| 0x0500 | R/W | Upper 16 bits of CNT1 counter value |
| 0x0501 | R/W | Lower 16 bits of CNT1 counter value |
| 0x0502 | R/- | Prompt CNT1 frequency |
| 0x0503 | R/- | Average CNT1 frequency |
| 0x0504 | R/- | Minimal CNT1 frequency |
| 0x0505 | R/- | Maximal CNT1 frequency |
| ... | | |
| 0x0600 | R/W | Upper 16 bits of CNT2 counter value |

To be continued on the next page

Continued from the previous page

| Address | Access | Description |
|---------|--------|---|
| 0x0601 | R/W | Lower 16 bits of CNT2 counter value |
| 0x0602 | R/- | Prompt CNT2 frequency |
| 0x0603 | R/- | Average CNT2 frequency |
| 0x0604 | R/- | Minimal CNT2 frequency |
| 0x0605 | R/- | Maximal CNT2 frequency |
| ... | | |
| 0x0F00 | R/- | Always 0x0000 |
| 0x0F01 | R/- | Always 0x0000 |
| 0x0F02 | R/- | Upper 16 bits of the number of seconds since January 1, 1970 |
| 0x0F03 | R/- | Lower 16 bits of the number of seconds since January 1, 1970 |
| 0x0F04 | R/- | Alarms status: <ul style="list-style-type: none"> • bit 0 – active level on BIN1 input • bit 1 – active level on BIN2 input • bit 2 – active level on BIN3 input • bit 3 – active level on BIN4 input • bit 4 – exceeded the lower limit of the AN1 analogue input • bit 5 – exceeded the upper limit of the AN1 analogue input • bit 6 – exceeded the lower limit of the AN2 analogue input • bit 7 – exceeded the upper limit of the AN2 analogue input • bit 8 – exceeded the limit frequency of CNT1 • bit 9 – exceeded the limit frequency of CNT2 |
| 0x0F05 | R/- | Status of the binary inputs: <ul style="list-style-type: none"> • bit 0 – level at the BIN1 input • bit 1 – level at the BIN2 input • bit 2 – level at the BIN3 input • bit 3 – level at the BIN4 input • bit 6 – level at the BOUT1 output |
| 0x0F06 | R/- | Recalculate value of AN1 (with sign) |
| 0x0F07 | R/- | Recalculate value of AN2 (with sign) |
| 0x0F08 | R/- | Upper 16 bits of CNT1 |
| 0x0F09 | R/- | Lower 16 bits of CNT1 |
| 0x0F0A | R/- | Prompt CNT1 frequency |
| 0x0F0B | R/- | Average CNT1 frequency |
| 0x0F0C | R/- | Minimal CNT1 frequency |
| 0x0F0D | R/- | Maximal CNT1 frequency |
| 0x0F0E | R/- | Upper 16 bits of CNT2 |
| 0x0F0F | R/- | Lower 16 bits of CNT2 |

To be continued on the next page

Continued from the previous page

| Address | Access | Description |
|---------|--------|--|
| 0x0F10 | R/- | Prompt CNT2 frequency |
| 0x0F11 | R/- | Average CNT2 frequency |
| 0x0F12 | R/- | Minimal CNT2 frequency |
| 0x0F13 | R/- | Maximal CNT2 frequency |
| ... | | |
| 0x1000 | R/- | 1 st log – upper 16 bits of the log number |
| 0x1001 | R/- | 1 st log – lower 16 bits of the log number |
| 0x1002 | R/- | 1 st log – upper 16 bits of the time stamp |
| 0x1003 | R/- | 1 st log – lower 16 bits of the time stamp |
| 0x1004 | R/- | 1 st log – alarms status |
| 0x1005 | R/- | 1 st log – binary inputs status |
| 0x1006 | R/- | 1 st log – recalculate value of AN1 (with sign) |
| 0x1007 | R/- | 1 st log – recalculate value of AN2 (with sign) |
| 0x1008 | R/- | 1 st log – upper 16 bits of CNT1 |
| 0x1009 | R/- | 1 st log – lower 16 bits of CNT1 |
| 0x100A | R/- | 1 st log – prompt CNT1 frequency |
| 0x100B | R/- | 1 st log – average CNT1 frequency |
| 0x100C | R/- | 1 st log – minimal CNT1 frequency |
| 0x100D | R/- | 1 st log – maximal CNT1 frequency |
| 0x100E | R/- | 1 st log – upper 16 bits of CNT2 |
| 0x100F | R/- | 1 st log – lower 16 bits of CNT2 |
| 0x1010 | R/- | 1 st log – prompt CNT2 frequency |
| 0x1011 | R/- | 1 st log – average CNT2 frequency |
| 0x1012 | R/- | 1 st log – minimal CNT2 frequency |
| 0x1013 | R/- | 1 st log – maximal CNT2 frequency |
| ... | | |
| 0x1100 | R/- | 2 nd log – upper 16 bits of the log number |
| 0x1101 | R/- | 2 nd log – lower 16 bits of the log number |
| 0x1102 | R/- | 2 nd log – upper 16 bits of the time stamp |
| : | : | : |
| 0xEF12 | R/- | 224 th log – minimal CNT2 frequency |
| 0xEF13 | R/- | 224 th log – maximal CNT2 frequency |
| ... | | |
| 0xF000 | -/W | Saving period for samples [min] |

To be continued on the next page

Continued from the previous page

| Address | Access | Description |
|---------|--------|--|
| 0xF001 | -/W | Allowed alarms: <ul style="list-style-type: none"> • bit 0 – active level on BIN1 input • bit 1 – active level on BIN2 input • bit 2 – active level on BIN3 input • bit 3 – active level on BIN4 input • bit 4 – exceeded the lower limit of the AN1 analogue input • bit 5 – exceeded the upper limit of the AN1 analogue input • bit 6 – exceeded the lower limit of the AN2 analogue input • bit 7 – exceeded the upper limit of the AN2 analogue input • bit 8 – exceeded the limit frequency of CNT1 • bit 9 – exceeded the limit frequency of CNT2 |
| ... | | |
| 0xF100 | -/W | Negative logic of binary inputs: <ul style="list-style-type: none"> • bit 0 – BIN1 input • bit 1 – BIN2 input • bit 2 – BIN3 input • bit 3 – BIN4 input |
| ... | | |
| 0xF200 | -/W | Normal level of binary outputs: <ul style="list-style-type: none"> • bit 0 – OUT1 output |
| 0xF201 | -/W | Feeder – number of pulses at the BIN1/CNT1 input |
| 0xF202 | -/W | Feeder – pulse length at the OUT1 output [1/8 sec] |
| ... | | |
| 0xF300 | -/W | AN1 – sampling period [sec] |
| 0xF301 | -/W | AN1 – multiplicative constant (with sign) |
| 0xF302 | -/W | AN1 – additive constant (with sign) |
| 0xF303 | -/W | AN1 – hysteresis value (with sign) |
| 0xF304 | -/W | AN1 – lower limit (with sign) |
| 0xF305 | -/W | AN1 – upper limit (with sign) |

To be continued on the next page

Continued from the previous page

| Address | Access | Description |
|---------|--------|---|
| 0xF306 | -/W | Bits 7-3: AN1 – switching time of measurement circuit <ul style="list-style-type: none"> • 0 → 1/64 sec • 1 → 2/64 sec • ⋮ • 30 → 31/64 sec Bits 2-0: AN1 – number of samples for averaging <ul style="list-style-type: none"> • 0 → one sample • 1 → two samples • 2 → four samples • 4 → eight samples • 5 → sixteen samples |
| ... | | |
| 0xF400 | -/W | AN2 – sampling period [sec] |
| 0xF401 | -/W | AN2 – multiplicative constant (with sign) |
| 0xF402 | -/W | AN2 – additive constant (with sign) |
| 0xF403 | -/W | AN2 – hysteresis value (with sign) |
| 0xF404 | -/W | AN2 – lower limit (with sign) |
| 0xF405 | -/W | AN2 – upper limit (with sign) |
| 0xF406 | -/W | Bits 7-3: AN2 – switching time of measurement circuit <ul style="list-style-type: none"> • 0 → 1/64 sec • 1 → 2/64 sec • ⋮ • 30 → 31/64 sec Bits 2-0: AN2 – number of samples for averaging <ul style="list-style-type: none"> • 0 → one sample • 1 → two samples • 2 → four samples • 4 → eight samples • 5 → sixteen samples |
| ... | | |
| 0xF500 | -/W | CNT1 – Multiplicative constant |
| 0xF501 | -/W | CNT1 – Upper limit |
| 0xF502 | -/W | CNT1 – Time of limit exceeded [sec] |
| 0xF503 | -/W | CNT1 – Time for resetting measurement [sec] |
| ... | | |
| 0xF600 | -/W | CNT2 – Multiplicative constant |

To be continued on the next page

Continued from the previous page

| Address | Access | Description |
|---------|--------|--|
| 0xF601 | -/W | CNT2 – Upper limit |
| 0xF602 | -/W | CNT2 – Time of limit exceeded [sec] |
| 0xF603 | -/W | CNT2 – Time for resetting measurement [sec] |
| ... | | |
| 0xFFFF | -/W | Turn off the the main source at the specified time [min] |

Table 22: MODBUS input/output address space

6. Resetting or Rebooting the Router



It is important to distinguish between resetting and rebooting the router.

| Action | Router Behavior | Actions |
|--------|--|---|
| Reboot | Turn off and then turn on router | Disconnect and connect the power. OR Press the reboot button in the Web configuration page (page <i>Reboot</i>). |
| Reset | Restore the factory default configuration and reboot the router. | Press RST button. |

Table 23: Ways to reset or restart the router

After the green LED starts to blink you may restore the router's initial settings by pressing button RST on front panel. The router will restore its factory default configuration and reboot (The green LED will be on).



To reset, use a narrow screwdriver. (See figure below.)

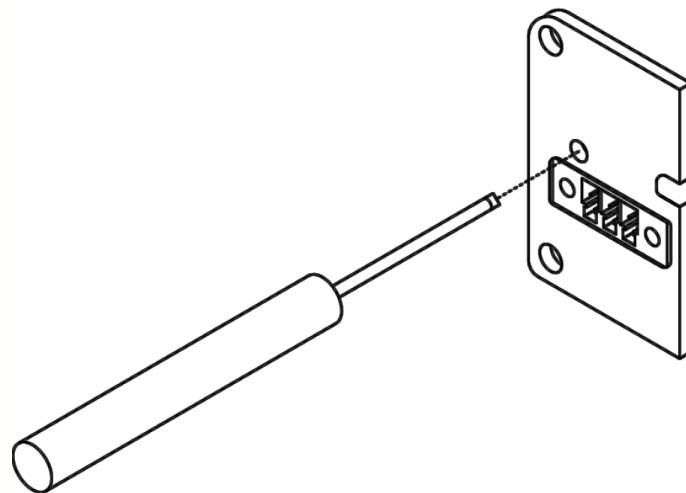


Figure 34: Router reset



We recommend backing up your router configuration before resetting. (See the separate configuration manual). A router reset will erase your configuration and return the router to its default settings.

7. First Use

Before you can set up the router you will need to make all of the necessary connections. The router cannot operate without a connected antenna, SIM card (for UMTS networks), and a power supply.



Operating the router without an antenna can damage the router.

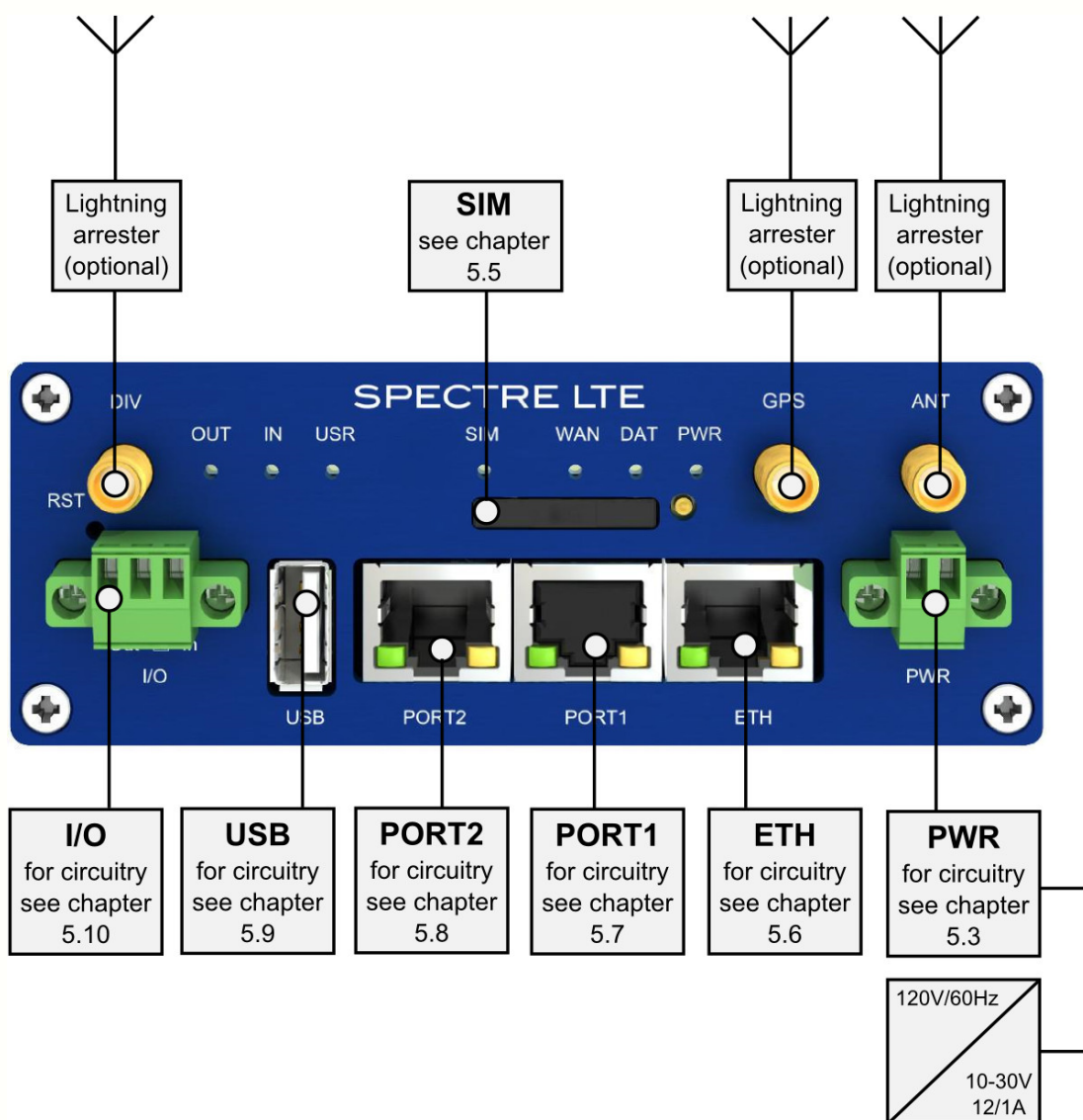


Figure 35: Connecting the router before the first use

7.1 Starting the Router

Connect power to the router. In the default setting the router will start to login automatically to the preset APN. The Ethernet port DHCP server will assign device addresses. The behavior of the router can be modified by means of the Web, Telnet or SSH interface, as described in the *Configuration manual*.

The power consumption in receive mode is 2.3 W (LTE models) or 2.6 W (3G models). The peak power consumption during data transmission is 5.5 W. For correct operation the power source must be able to supply a peak current of 1A.

7.2 Configuring the Router

Attention! The cellular carrier and network must be configured in the router prior to use. For UMTS and LTE networks, the router will not operate without a SIM card. The SIM card must be provisioned for the necessary network (LTE/HSPA+/UMTS/EDGE/GPRS). For 3G CDMA networks, the router is provisioned over-the-air. Refer to the Configuration manual for details on configuring the router based on the cellular carrier and network.

If the router cannot establish a connection to the cellular network, it tries to reconnect. The retry interval prolongs with more retries. First two retries are done after 1 minute. Then the interval prolongs to 2, 8 and 15 minutes. The ninth and every other retry is done in 90 minutes interval.

Configuration over Web browser

Monitoring of the status, configuration and administration of the router can be done via the Web interface. The default IP address of the router is 192.168.1.1. The username is "root". The password is "root".

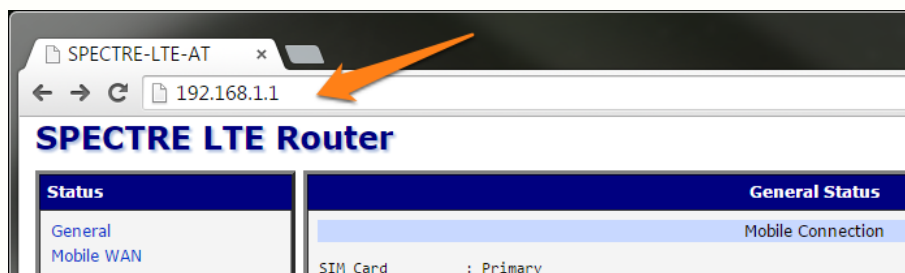


Figure 36: Accessing the router Web interface

A screen that will show up after the login is on the figure 37.

A detailed description of configuring the router via the Web interface can be found in the *Configuration Manual*.

SPECTRE LTE Router

| | |
|---|--|
| Status | General Status |
| <ul style="list-style-type: none"> General Mobile WAN Network DHCP IPsec DynDNS System Log | <div style="background-color: #e6f2ff; padding: 2px;">Mobile Connection</div> <p>SIM Card : Primary IP Address : Unassigned State : Connecting</p> <p>» More Information «</p> |
| Configuration | Primary LAN |
| <ul style="list-style-type: none"> LAN VRRP Mobile WAN PPPoE Backup Routes Firewall NAT OpenVPN IPsec GRE L2TP PPTP DynDNS NTP SNMP SMTP SMS Expansion Port 1 Expansion Port 2 USB Port Startup Script Up/Down Script Automatic Update | <p>IP Address : 10.254.4.4 / 255.255.255.0 MAC Address : 00:0A:14:82:6D:27 Rx Data : 44.2 KB Tx Data : 399.0 KB</p> <p>» More Information «</p> |
| Customization | Peripheral Ports |
| <ul style="list-style-type: none"> User Modules | <p>Expansion Port 1 : XC-CNT Expansion Port 2 : RS-232 Binary Input : Off Binary Output : Off</p> |
| Administration | System Information |
| <ul style="list-style-type: none"> Change Profile Change Password Set Real Time Clock Set SMS Service Center Unlock SIM Card Send SMS Backup Configuration Restore Configuration Update Firmware Reboot | <p>Firmware Version : 5.1.3 (2015-04-24) Serial Number : 6100023 Profile : Standard Supply Voltage : 24.2 V Temperature : 42 °C Time : 2015-04-27 04:39:58 Uptime : 16 days, 0 hours, 29 minutes</p> |

Figure 37: Router Web interface

Configuration over Telnet or SSH

Monitoring of status, configuration and administration of the router can be performed by means of the Telnet or SSH interface. The default IP address of the router is 192.168.1.1. The username is "root". The password is "root". A detailed description of configuring the router via Telnet or SSH can be found in the *Configuration Manual* and *Commands and Scripts Application Note*.

8. Technical Parameters

| SPECTRE Cellular Routers | | |
|---------------------------------|--|---|
| Complies with standards | | EN 301 511, v9.0.2, EN 301 908-1&-2: v3.2.1, ETSI EN 301 489-1 V1.8.1, EN 60950-1:06 ed.2 + A11:09 + A1:10 UL CLASS I, DIV 2, GROUPS A, B, C, AND D |
| Temperature range | Function | -30 °C to +60 °C (LTE models) -30 °C to +70 °C (3G models) -40 °C to +75 °C (RT models) |
| | Storage | -40 °C to +85 °C (all models) |
| Protection | | IP20 |
| Supply voltage | | 10 to 30 V DC Class 2 Power Supply Only |
| Consumption | No communication | 1.6 W (RT models) |
| | Receive Mode Transmit: GPRS Transmit: others | 2.3 W (LTE models), 2.6 W (3G models) up to 3.5 W (GPRS transmission) up to 5.5 W (UMTS/HSDPA/EVDO/LTE, RT models with communication) |
| Dimensions | | 42 x 80.3 x 113.2 mm (DIN 35 mm) |
| Weight | | 280 g |
| Antenna connector | | SMA – 50 Ohm |
| SIM Card Interface | | 1.8 V and 3.3 V Mini-SIM Cards |
| User interface | ETH | Ethernet (10/100 Mbit/s) |
| | USB | USB 2.0 type A host |
| | PORT1 | Model Dependent |
| | PORT2 | Model Dependent |

Table 24: General specifications

| SPECTRE LTE AT Cellular Module | |
|---------------------------------------|---|
| LTE parameters | Bit rate 100 Mbps (DL) / 50 Mbps (UL) 3GPP rel. 8 standard Supported bandwidth: 5, 10; in some bands 1.4, 3, 15, 20 MHz |
| HSPA+ parameters | Bit rate 21.1 Mbps (DL) / 5.76 Mbps (UL) HSDPA data rates up to category 24 HSUPA data rates up to category 6 |
| UMTS parameters | PS bit rate – 384 kbps (DL) / 384 kbps (UL) CS bit rate – 64 kbps (DL) / 64 kbps (UL) W-CDMA FDD standard 3GPP Rel. 5 to 8 |
| GPRS parameters | Bit rate 236 kbps (DL) / 236 kbps (UL) GPRS multislot class 10, CS 1 to 4 EGPRS multislot class 12, CS 1 to 4, MCS 1 to 9 |
| Transmit power | LTE: 23 dBm UMTS/HSUPA/HSDPA/HSPA+: Class 3 (23 dBm) GSM850 CS: Class 4 (32 dBm) GSM900 CS: Class E2 (27 dBm) |
| Supported channels | GSM/GPRS/EDGE: 850/900/1800/1900 MHz UMTS/HSDPA/HSUPA/HSPA+: 800/850/1900/2100 MHz LTE: 700/AWS/2100 Mhz |
| GPS | Standalone mode Assisted mode A-GPS SUPL1.0 1575.42 MHz Protocol NMEA 0183 V3.0 |

Table 25: SPECTRE LTE AT cellular module specifications

| SPECTRE LTE VZ Cellular Module | |
|---------------------------------------|---|
| LTE parameters | Bit rate 100 Mbps (DL) / 50 Mbps (UL) 3GPP rel. 8 standard Supported bandwidth: 5, 10 MHz |
| CDMA parameters | Bit rate 3.1 Mbps (DL) / 1.8 Mbps (UL) |
| Transmit power | LTE: 20 dBm CDMA: 24 dBm |
| Supported channels | CDMA: 800/1900 MHz LTE: 700 Mhz |

Continued on next page

Continued from previous page

| SPECTRE LTE VZ Cellular Module | |
|---------------------------------------|---|
| GPS | Standalone mode 1575.42 MHz Protocol NMEA 0183 V3.0 |

Table 26: SPECTRE LTE VZ cellular module specifications

| SPECTRE 3G Cellular Module | |
|-----------------------------------|--|
| HSPA+ parameters | Bit rate 14.4 Mbps (DL) / 5.76 Mbps (UL) 3GPP standard |
| CDMA parameters | Bit rate 3.1 Mbps (DL) / 1.8 Mbps (UL) |
| GPRS parameters | 3GPP Release 99 (GSM/GPRS) |
| Supported channels | HSPA+/UMTS: 850/900/AWS/1900/2100 MHz EGPRS: 850/900/1800/1900 MHz CDMA: 800/1900 MHz |
| GPS | Assisted Mode |

Table 27: SPECTRE 3G cellular module specifications

| 32b ARM Microprocessor | |
|-------------------------------|---|
| Memory | 512 Mb DDR SDRAM 128 Mb FLASH 1 Mb MRAM |
| Interface | Serial interface RS232 Ethernet interface 10/100 Mbit/s USB 2.0 interface |

Table 28: Processor specifications

| Port IO | | |
|----------------|---------------------------------|---|
| Input/Output | Binary input: Binary output: | Reed contact with trigger level 1.3 up to 1.4 V 120 mA / max. 30 V |

Table 29: I/O port specifications

| Wi-Fi Specifications | | | |
|-------------------------------------|-----------------------|------------------------------|----------------|
| Power supply | Internal | | +3.3 V |
| Environment | Operating temperature | | -15 to +65 °C |
| | Storage temperature | | -20° to +85 °C |
| Standards | Emission | | EN 55022/B |
| | Immunity | | ETS 300 342 |
| | Safety | | EN 60950 |
| | Isolation | | EN 60747 |
| Wi-Fi specifications (802.11 b/g/n) | RX Sensitivity | 11b, 11Mbps | -85 dBm |
| | TX Output power | 11g, 54Mbps (HT20) 11n, MSC7 | -70 dBm |
| | | (HT20) 11n, MSC7 | -66 dBm |
| | | 11b, 11Mbps | 19 dBm |
| | 11g, 54Mbps | 16 dBm | |
| | 802.11n (HT20) | 15 dBm | |
| | 802.11n (HT20) | 15 dBm | |
| Internal Antenna Impedance | | | 50 Ω |
| Frequency band | | | 2,4 GHz |

Table 30: Wi-Fi Specifications

| SmartMesh IP 802.15.4e Radio Specifications | | | | |
|--|--|-------------|---------------------|-------------|
| Parameter | Conditions | Min. | Typ. | Max. |
| Frequency Band | | 2.400 GHz | | 2.4835 GHz |
| Number of Channels | | | 15 | |
| Channel Separation | | | 5 MHz | |
| Channel Clear Frequency | Where k = 11 to 25, as defined by IEEE 802.4.15 | | 2405 + 5*(k-11) MHz | |
| Modulation | IEEE 802.15.4 Direct Sequence Spread Spectrum (DSSS) | | | |
| Raw Data Rate | | | 250 kbps | |
| Range | 25 °C, 50 % RH, +2 dBi Omni-Directional Antenna, Antenna 2 m above ground Indoor: Outdoor: | | 100 m 300 m | |
| Receiver Sensitivity | Packet Data Error Rate (PER) = 1 % | | | -93 dBm |
| Receiver Sensitivity | PER = 50 % | | | -95 dBm |
| Output Power | Delivered to a 50 Ω load | | | |
| High Calibration Setting | | | 8 dBm | |
| Low Calibration Setting | | | 0 dBm | |

Table 31: SmartMesh IP 802.15.4e Radio Specifications

9. Troubleshooting

9.1 FAQ

Q. I have NAT enabled. My equipment is not connecting to the network.

The device's gateway has to be configured as the router.

Q. The router resets itself and the Ethernet connection fails.

The router will not function without an antenna. Keep the antenna as far as possible from the power supply.

Q. I can't access the Web server over NAT.

The remote http access of the router has to be disabled, the default server address has to be your web server and the gateway of the web server has to be the IP of the router.

Q. PPP connection fails. (DAT LED off)

Check signal power. If signal power is weak you will need a better antenna. If the neighboring cells have a similar signal strength, you will need to use a directional antenna. For proper operation, the signal levels have to be in the range from -50dBm to -90dBm. It is necessary to set ping, which will check the connection and, in the case of failed ping, restart the connection.

Q. PPP connection cannot be established. (DAT LED off)

- Recheck GPRS settings - APN, name, password and IP address.
- Try to enter PIN – verify if the SIM card has the PIN code set.
- In a private APN, switch the DNS server send off.
- Switch the system log on and observe where the error occurs.

Q. FTP doesn't function.

Router doesn't support active FTP mode. It supports passive mode only.

Q. RS-232 doesn't function.

Verify that the router supports RS-232 communications. Also verify the RS-232 communication settings. To do so, open the router's configuration menu via the web browser, select the appropriate expansion port and verify the settings in the configuration menu.

Q. L2TP or IPSec isn't establishing.

Check the system log for error messages.

Q. I switched the router to offline mode by SMS message, but the router is in online mode after restart.

SMS messages do not change the router configuration. They remain in effect only until the router is restarted.

10. Customer Support

Up to date product information is on the website:

www.bb-smartsensing.com

For Technical Support:

Call 815-433-5100



Maintenance:

- Handle the SIM card carefully. Do not bend, scratch or expose the card to static electricity.
- Do not clean the router with harsh chemicals, solvents or abrasive cleaners.

RT and 3G models:

B&B Electronics hereby declares that the models RT and 3G of the router described in this user's guide fits all basic demands of directive 1999/5/EC (R&TTE).

Router fits values of coefficient SAR defined by association ICNIRP and values of "About protection of health before non-ionized radiation".



Declaration of conformity was issued and may be acquired from the manufacturer.