SPECTRE Router
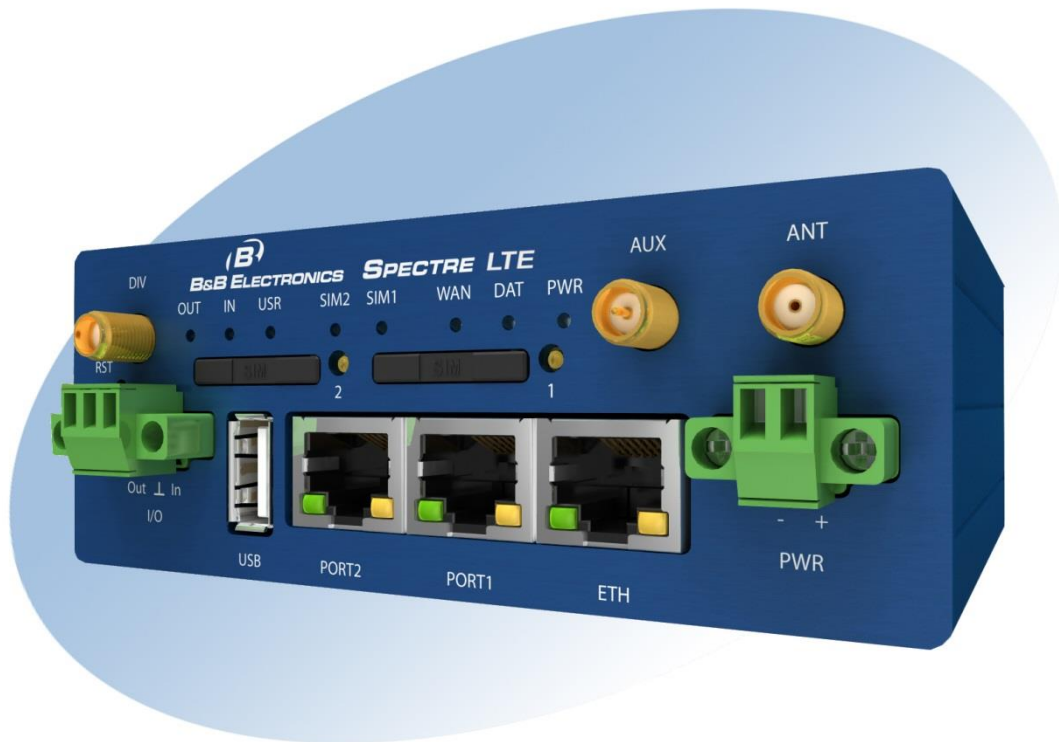
USER MANUAL

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Document: SPECTRE User Manual R5_1414m

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.*

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FIGURE LIST

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ABOUT

GPL license

Source codes under GPL license are available free of charge by sending an email to support@bb-elec.com.

Router version

The properties and settings associated with the cellular network connection are not available in non-cellular 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.

2.0 SAFETY INSTRUCTIONS

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'ENVIRONMEMENT 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.

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

Input voltage must not exceed 30v 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.

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.

3.0 ROUTER DESCRIPTION

3.1 DESCRIPTION

The SPECTRE Cellular industrial router is 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.

The standard configuration includes one 10/100 Ethernet port, one USB Host port, one binary Input/output (I/O) port and dual SIM card holders. Network redundancy is provided by the second SIM card holder. It also contains 2 auxiliary 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
- Documentation CD
- Quick Start Guide
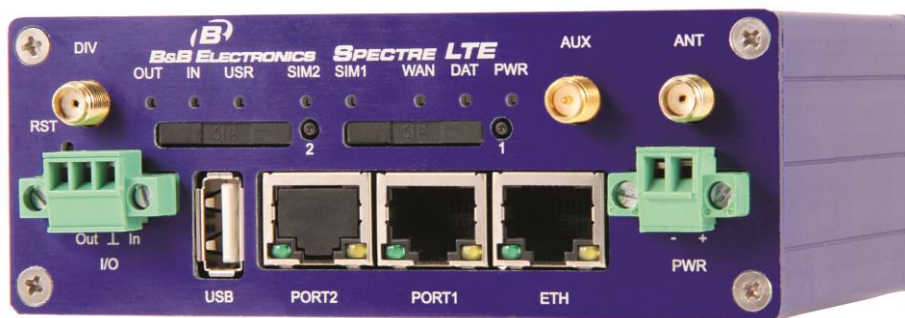
Fig. 1: SPECTRE LTE router

3.4   MODEL NUMBERS

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

Auxiliary Port Functions (Model Dependent):

The Ports Can Be Connected As Follows:	
PORT 1	RS-232, RS485/422, ETHERNET, CNT, XC-SW (in combination with PORT 2)
PORT 2	RS-232, RS485/422, XC-SW (together with PORT 1)

Table 1: Auxiliary port possibilities

SPECTRE 3G Wireless Routers Auxiliary 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	No connect	Ethernet
RT3G-311	Ethernet	Ethernet
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	No connect
RT3G-310-W	Ethernet	No connect
RT3G-320-W	RS-232	No connect
RT3G-330-W	12-bit I/O (AI, DI, DO)	No connect
RT3G-340-W	RS-422/485	No connect
Note: "-W" Models Are Wi-Fi enabled		

Table 2: SPECTRE 3G model numbers

SPECTRE LTE Wireless Routers (Verizon) Auxiliary 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	No connect	Ethernet
RTLTE-311-VZ	Ethernet	Ethernet
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	No connect
RTLTE-310-W-VZ	Ethernet	No connect
RTLTE-320-W-VZ	RS-232	No connect
RTLTE-330-W-VZ	12-bit I/O (AI, DI, DO)	No connect
RTLTE-340-W-VZ	RS-422/485	No connect
Note: "-W" Models Are Wi-Fi enabled		

Table 3: SPECTRE LTE model numbers for Verizon

SPECTRE LTE Wireless Routers (AT&T) Auxiliary 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	No connect	Ethernet
RTLTE-311-AT	Ethernet	Ethernet
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	No connect
RTLTE-310-W-AT	Ethernet	No connect
RTLTE-320-W-AT	RS-232	No connect
RTLTE-330-W-AT	12-bit I/O (AI, DI, DO)	No connect
RTLTE-340-W-AT	RS-422/485	No connect
Note: "-W" Models Are Wi-Fi enabled		

Table 4: SPECTRE LTE model numbers for AT&T

SPECTRE LTE Wireless Routers (Sprint) Auxiliary Ports		
Model No.	Port 1	Port 2
RTLTE-300-SP	No connect	No connect
RTLTE-302-SP	No connect	RS-232
RTLTE-304-SP	No connect	RS-422/485
RTLTE-310-SP	No connect	Ethernet
RTLTE-311-SP	Ethernet	Ethernet
RTLTE-322-SP	RS-232	RS-232
RTLTE-324-SP	RS-232	RS-422/485
RTLTE-330-SP	12-bit I/O (AI, DI, DO)	No connect
RTLTE-300-W-SP	No connect	No connect
RTLTE-310-W-SP	Ethernet	No connect
RTLTE-320-W-SP	RS-232	No connect
RTLTE-330-W-SP	12-bit I/O (AI, DI, DO)	No connect
RTLTE-340-W-SP	RS-422/485	No connect
Note: "-W" Models Are Wi-Fi enabled		

Table 5: SPECTRE LTE model numbers for Sprint

3.5   DIMENSIONS

Basic dimensions, metal box
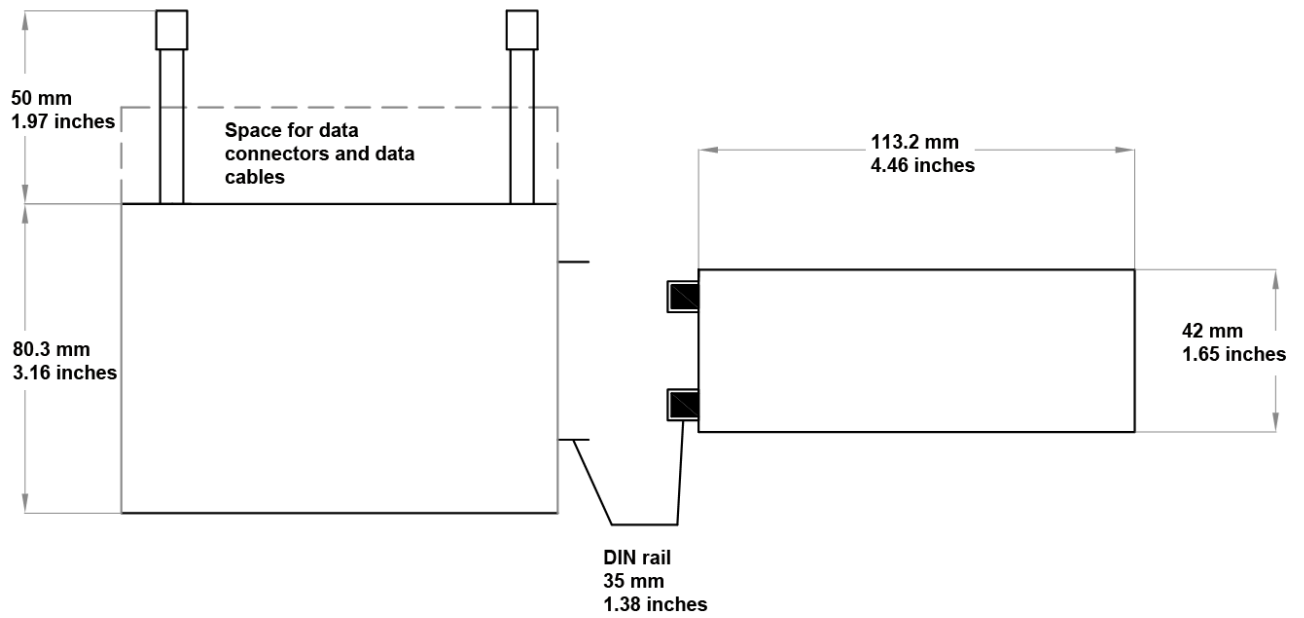
Fig. 2: Basic dimensions, metal box

4.0 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.
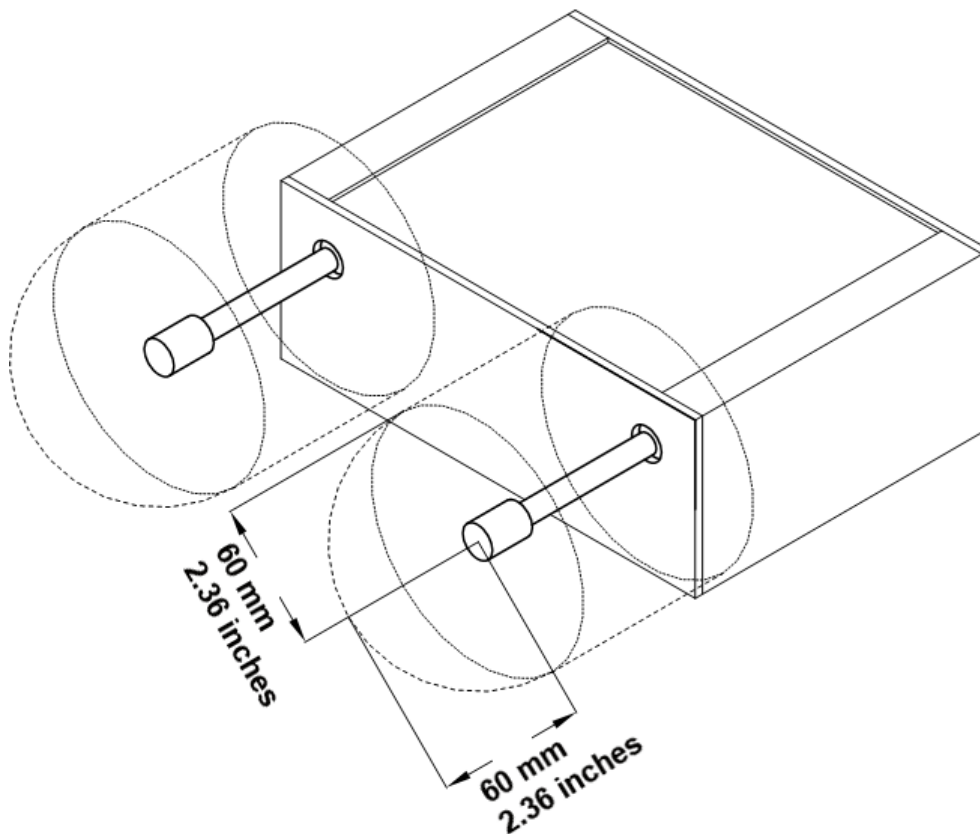
Fig. 3: Space around antenna

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.
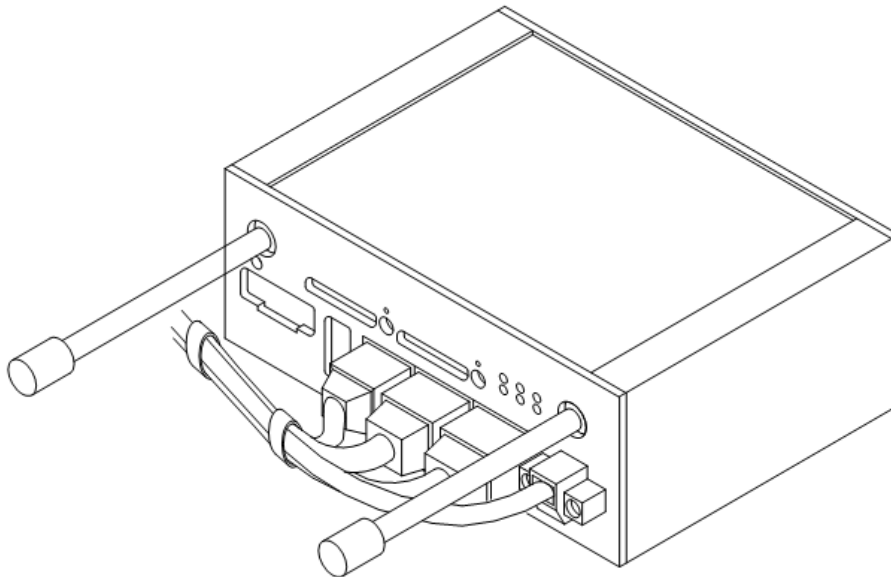
Fig. 4: Cable routing

Leave enough space around the connectors for the handling of cables.
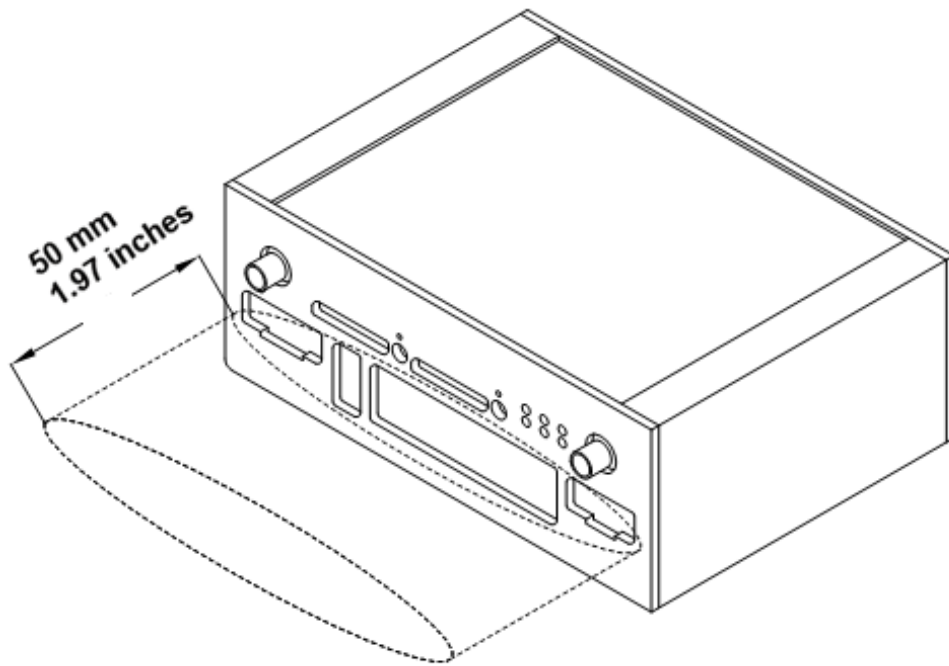
Fig. 5: Space in front of connectors

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

Fig. 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 DUIN rail.
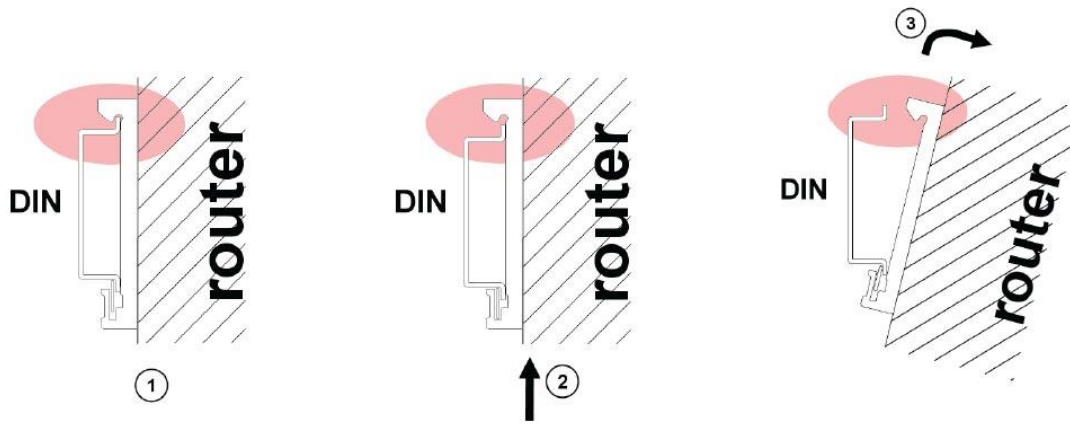
Fig. 7: Removing the router

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 I/O
PORT 2	RJ45	RS-232/422/485 or ETHERNET
ANT	SMA	Main cellular antenna.
DIV	SMA	Diversity cellular antenna.
AUX	RP-SMA	Wi-Fi antenna.
USB	USB-A Host	USB connector.
I/O	3-pin	Binary input and output.
SIM1	-	SIM card holder.
SIM2	-	SIM card holder 2

Table 6: Front panel description
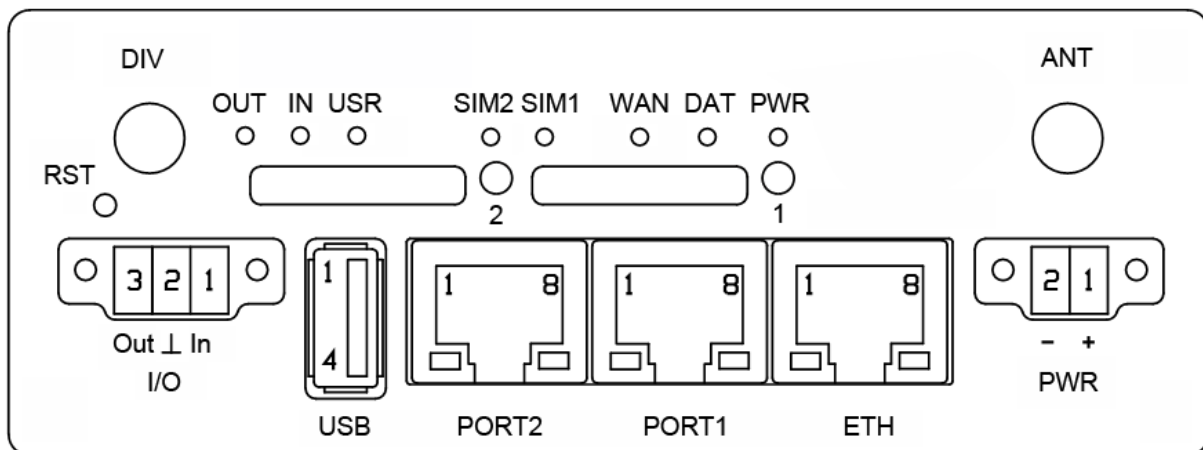
Fig. 8: Front panel SPECTRE LTE
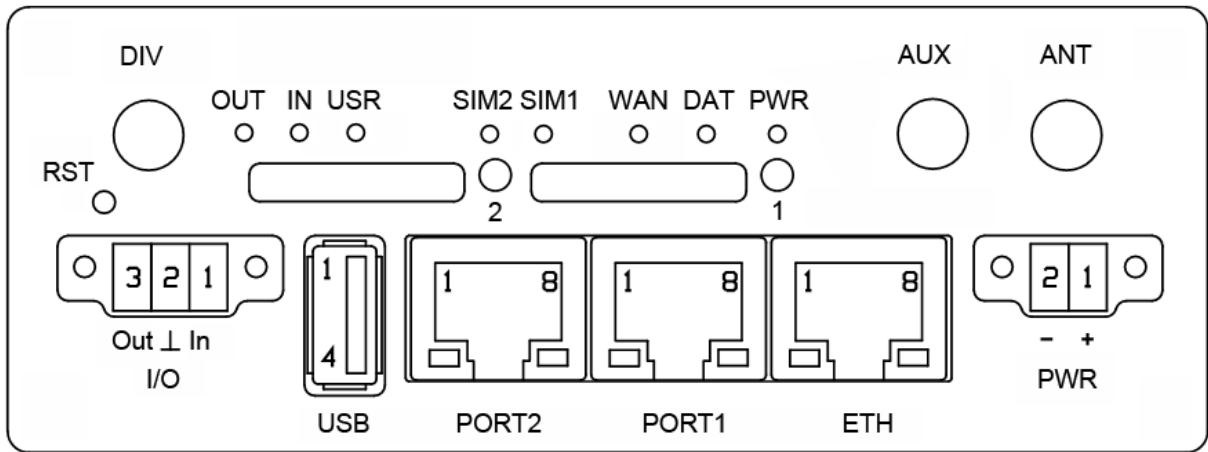
Fig. 9: Front panel SPECTRE LTE with Wi-Fi

5.2   STATUS INDICATORS

Label	Color	State	Description
PWR	Green	Blinking On	Router is ready Router is initializing.
WAN	Red	Blinking	Communication in progress
DAT	Yellow	Flashing	PPP connection established
		1 x flash per second	Signal strength is from −50 dBm to −69 dBm
		2 x flash per second	Signal strength is from −70 dBm to −89 dBm or the difference between neighboring cells is exactly 3 dBm
		3x flash per second	Signal strength is from −90 dBm to −113 dBm or the difference 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 Slowly Blinking Quickly Off	The network cable is connected Data transmission Firmware Update 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.	
SIM1	Yellow	On	SIM card 1 is active
SIM2	Yellow	On	SIM card 2 is active

Table 7: Router status indication

5.2.1 AUXILIARY PORT STATUS INDICATORS

5.2.1.1 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

5.2.1.2 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

5.2.1.3 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

5.2.1.4 RS-485/422 Ports

LED PORT INDICATOR	
Green LED	Blinks on Receive data
Yellow LED	Blinks on Transmit data

Table 11: RS-485/422 LED status indication

5.2.1.4 Wi-Fi

LED PORT INDICATOR	
Green LED	Indicates Wi-Fi Power On
Yellow LED	Always Off

Table 12: 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 13: Connection of power connector
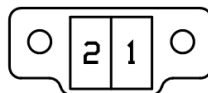
Fig. 10: Power connector

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

The power consumption during receiving is 2.3W. The peak power consumption during data sending is 5.5W. For correct operation, the power source must be able to supply a peak current of 1A.

The power cable connects to the router via locking screws. (See Fig. 21)
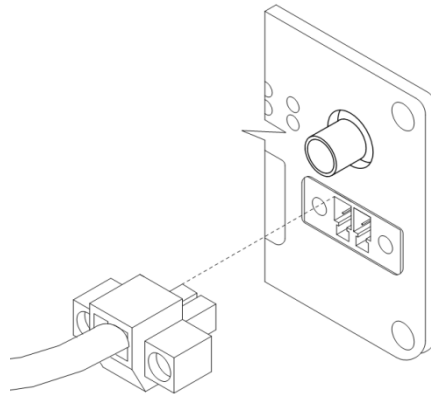
Fig. 11: Connection of power supply connector

Circuit example:
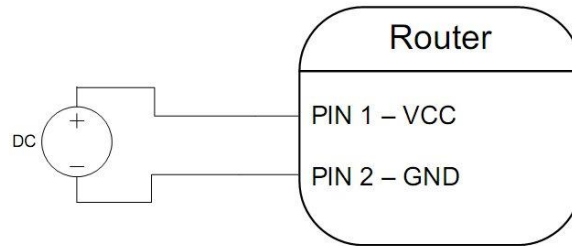
Fig. 12: Connection of power supply

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**. This antenna improves the receive sensitivity of the router and should be used in areas with weak signal strength.

On SPECTRE Cellular routers with Wi-Fi, a third antenna is connected to the **AUX** antenna connector on the front panel.

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

Example of antenna:

Fig. 13: External antenna

Connect the antenna's SMA connector to the router's SMA connector. (See figure below).
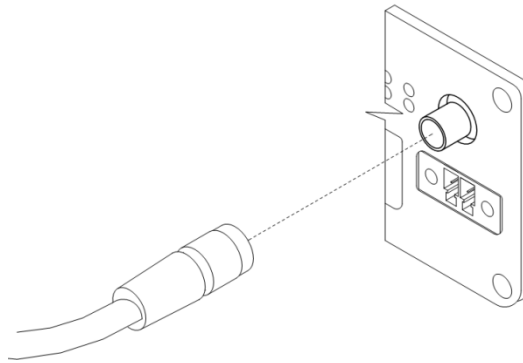
Fig. 14: Connecting the antenna

The diversity antenna improves the wireless features of the router

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:

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 Fig. 25)
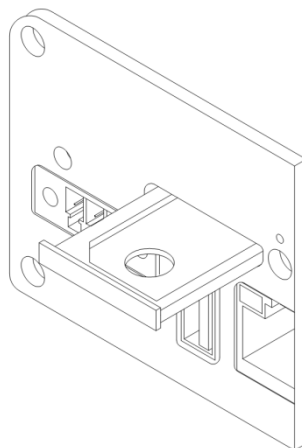
Fig. 15: Ejected SIM card holder

5.6   ETHERNET PORT

PANEL SOCKET RJ45

Pin No.	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 14: Ethernet connector
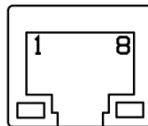
Fig. 16: Ethernet connector

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

Ethernet cable plugs into the RJ45 connector labeled as ETH.
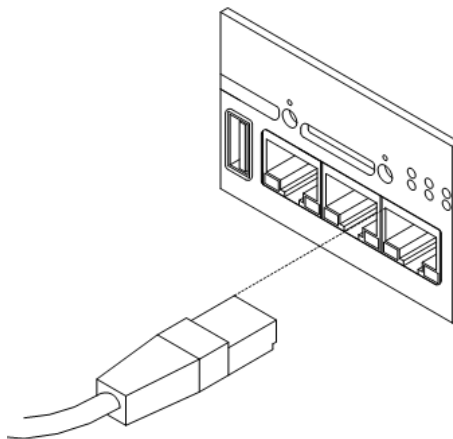
Fig. 17: Ethernet cable connection

The Ethernet router connection:
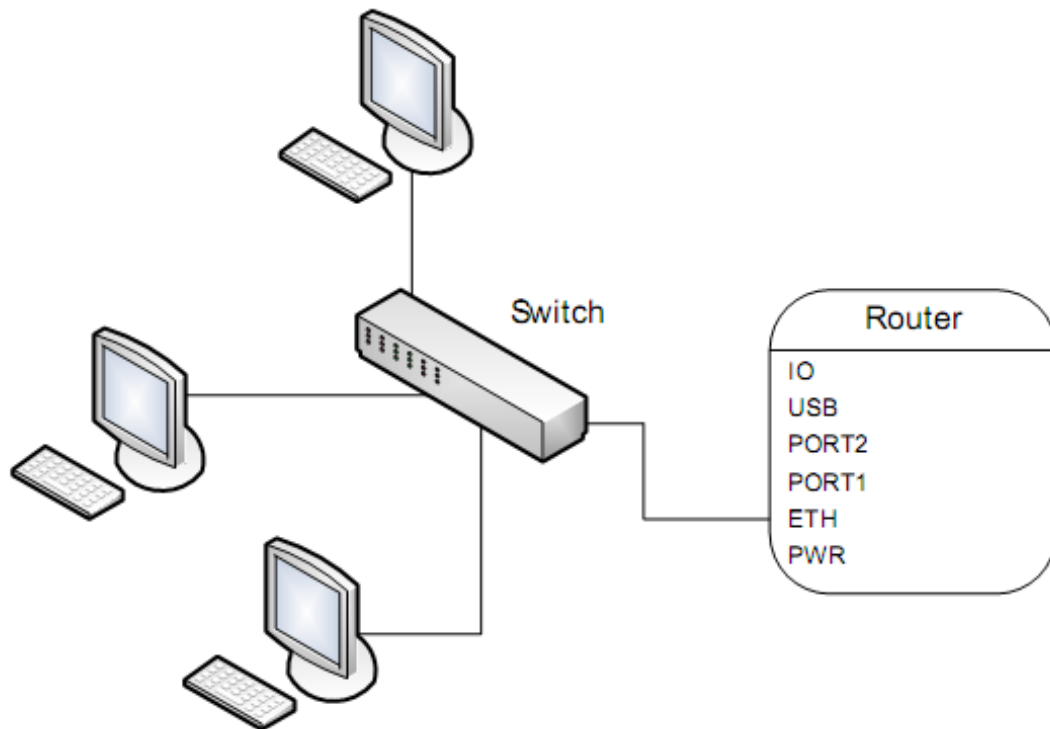
Fig. 18: Example of router connection

5.7   ETHERNET PORT

Port 1

Port One may configured for Ethernet, serial communications (RS-232/485/422), or (I/O – CNT) based on the router model number. Port Two may be configured for serial communications (RS-232/485/422), or (I/O – CNT). Either port can be fitted with internal switch XC-SW.

Port 2

Port 2 may be configured for serial communications (RS-232/485/422), or (I/O – CNT). Either port can be fitted with internal switch XC-SW.

5.7.1 RS-232 PORTS

The RS-232 port is configured as a Data Communication Equipment (DCE). A KD2 adapter cable can be used to convert the RJ-45 connector to a standard DB9 serial connector.
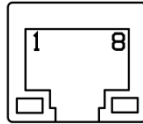
Fig. 19: RS-232 port connector

Pin No.	Signal Mark	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	Output
5	GND	Signal ground	
6	RXD	Receive Data	Output
7	CD	Carrier Detect	Output
8	TXD	Transmit Data	Input

Table 15: RS-232 connector pinout

Example of connecting a meter to the router:
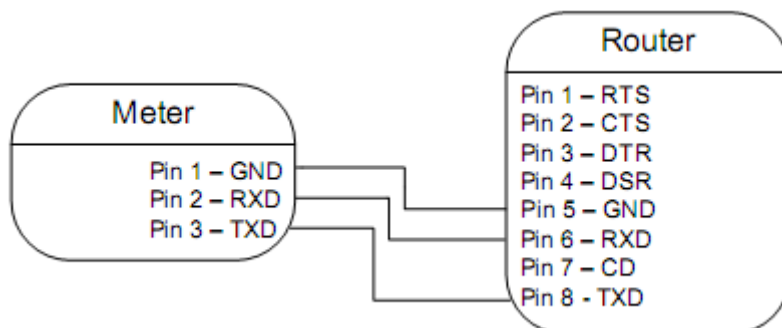
Fig. 20: Meter connection to router

Example of a PC connection to the router:
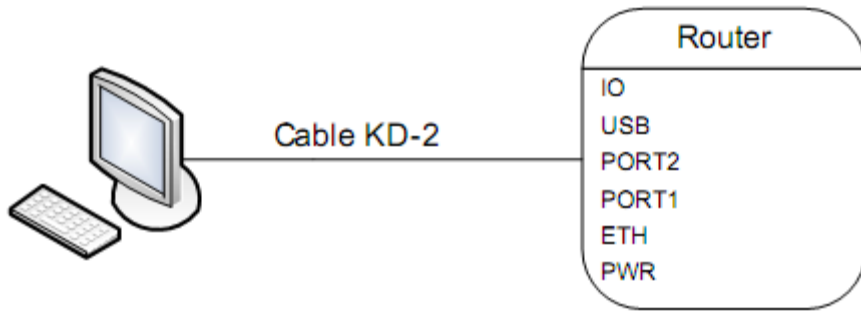
Fig. 21: PC connection to router

- Cable KD2 is connected to serial port PC (example COM1)

Example of the RS-232 equipment connection to router (possibility to use all RS-232 ports):
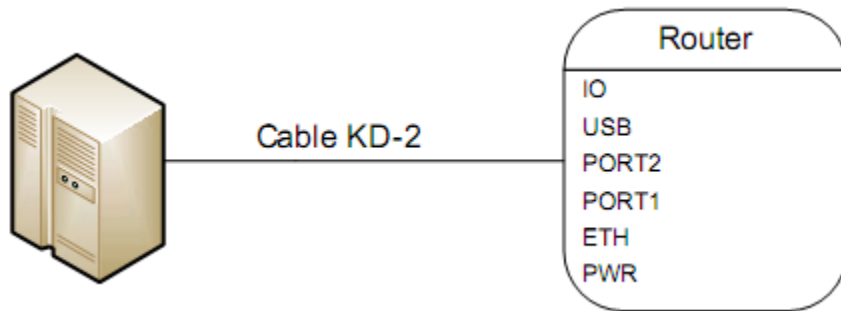
Fig. 22: RS-232 equipment connection to router

5.7.2   RS-485/422 PORTS

The RS-485/422 ports can be powered using the internal 3.3V 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 RS485/RS422 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 picture 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.
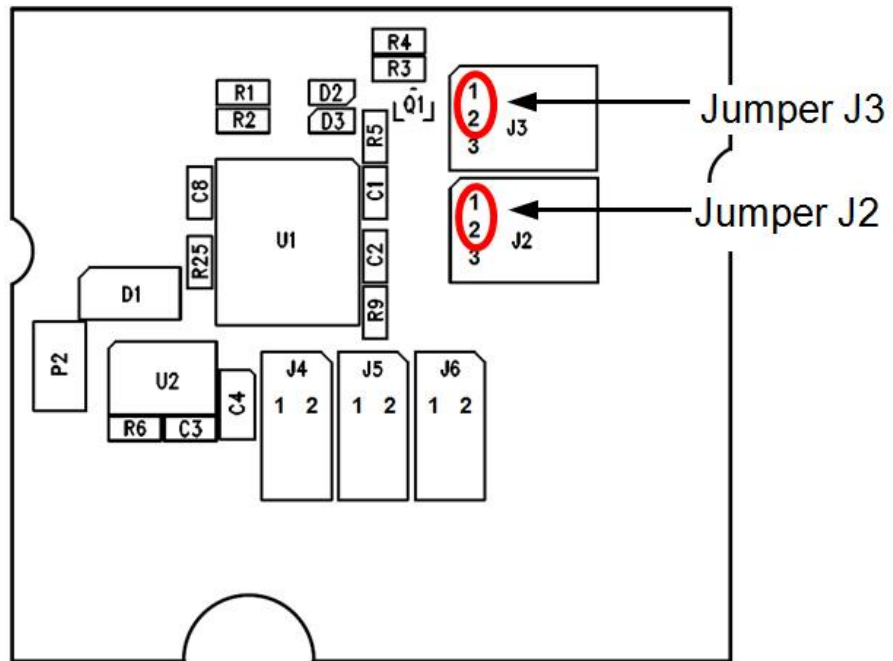
Fig. 23: Jumper Position for external power supply

Jumper J4 and J5
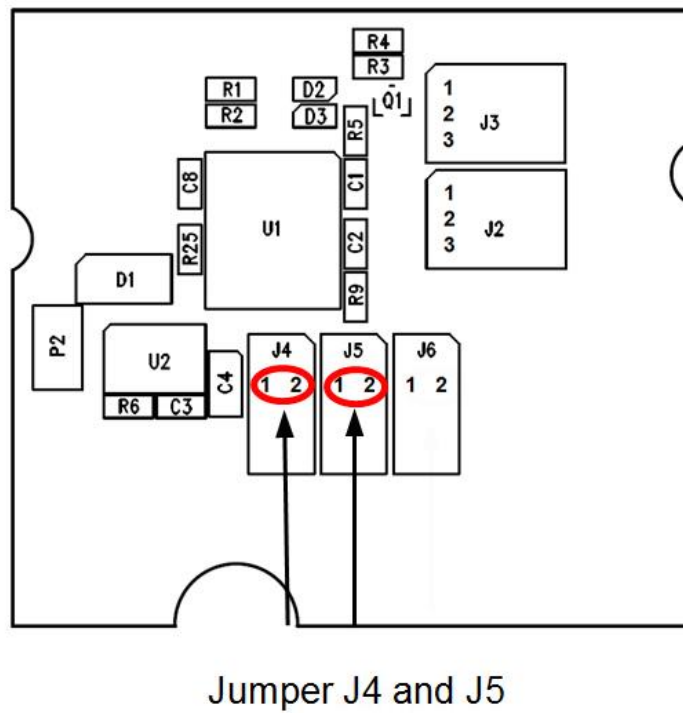
Fig. 24: Jumper position for RS-485
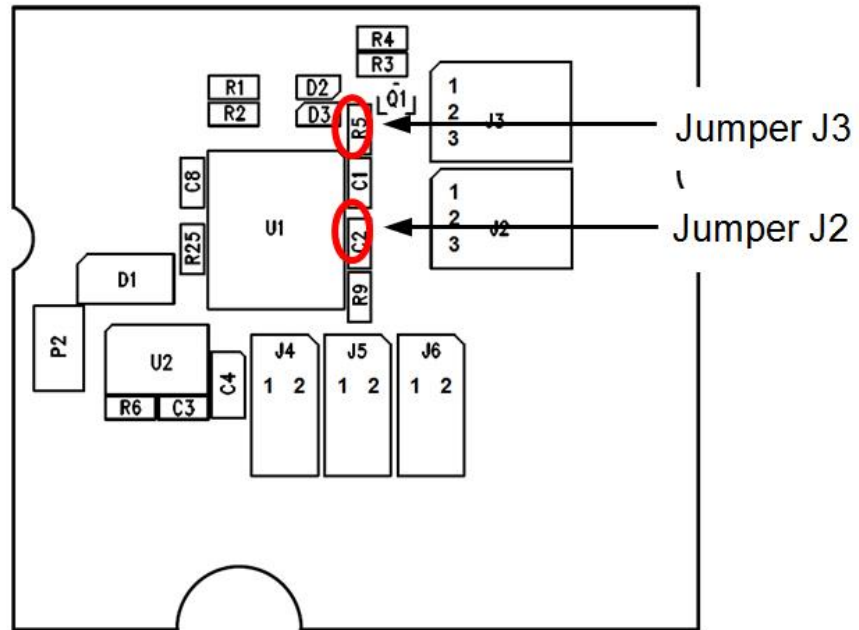
Fig. 25: Jumper position for internal power supply
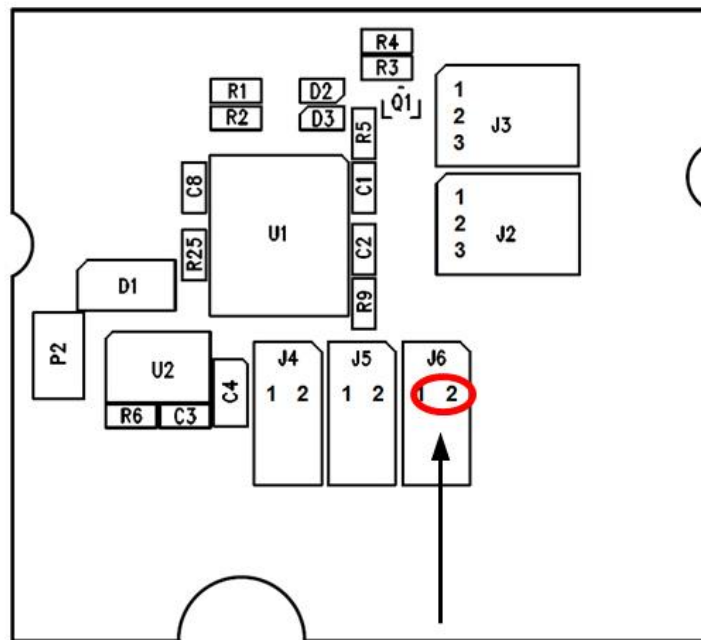
Fig. 26: Jumper position for RS-422

Connector Pinout
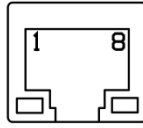
Fig. 27: RS-485/422 connector

RS-485 Mode			
Pin No.	**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 16: Connector pinout in RS-485 mode

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

Note: 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.
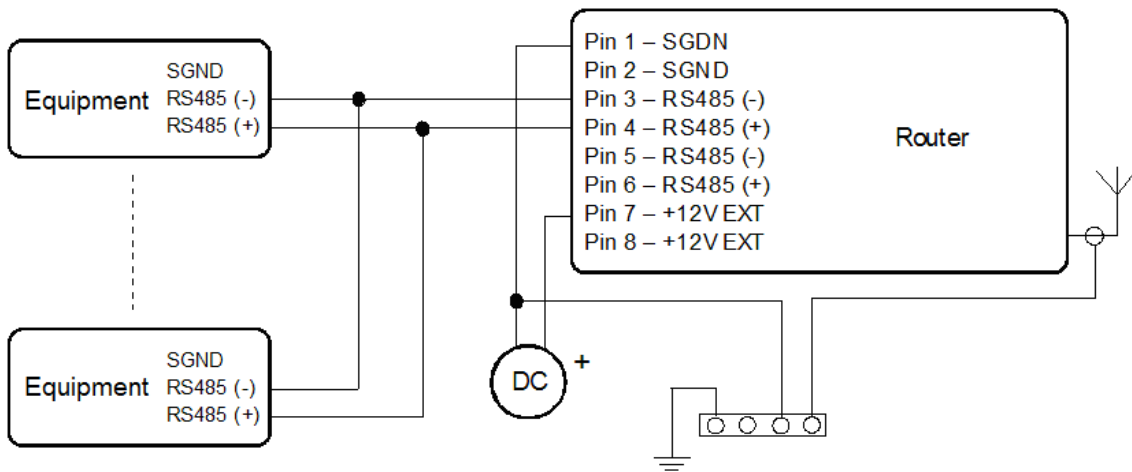
Fig. 28: Connection to the router with data cable length less than 10 m
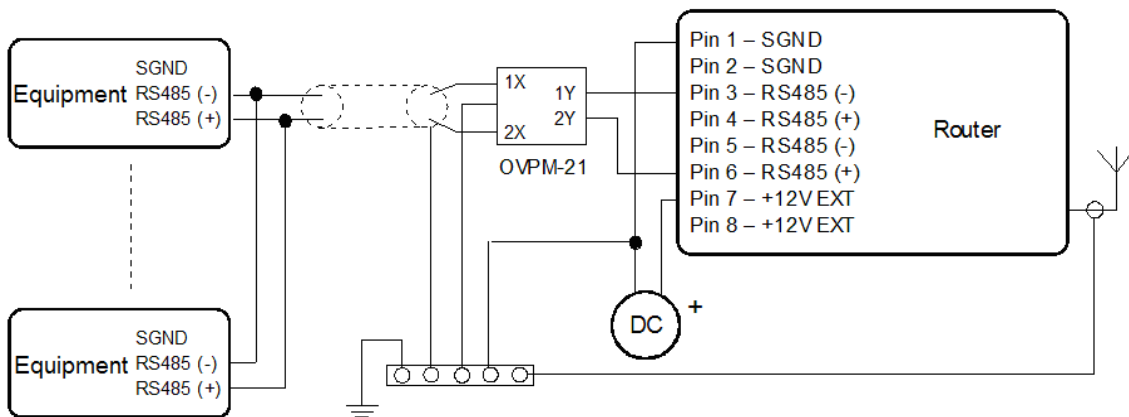
Fig. 29: Connection to the router with data cable length more than 10 m

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

RS-422 Mode			
Pin No.	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	+12V EXT	External power supply	
8	+12V EXT	External power supply	

Table 17: 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.
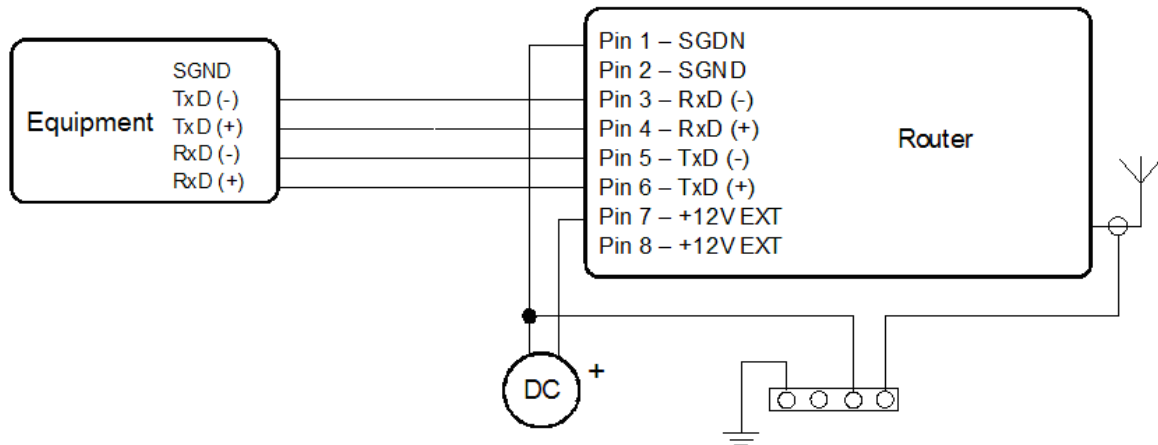
Fig. 30: Connection to the router with data cable length less than 10 m
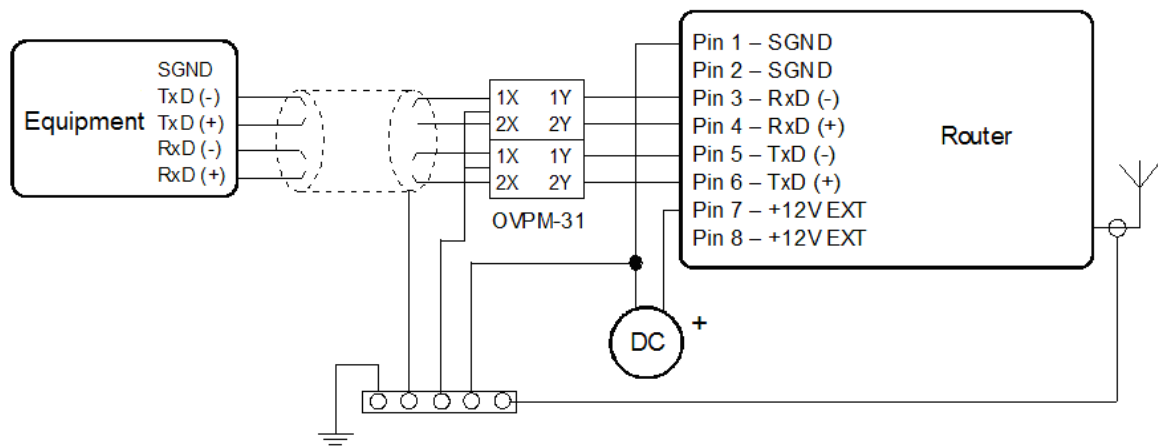
Fig. 31: Connection to the router with data cable length more than 10 m

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

5.7.3 I/O PORT

The I/O port user interface (CNT) 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.

5.7.3.1 ANALOG INPUTS

The analog current inputs have a range from 0 to 20mA. 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:

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

where the constants are programmed into memory by the user.

5.7.3.2 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 8uA or 20mA using a jumper on the module board.

5.7.3.3 COUNTER INPUT

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

5.7.3.4 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 (log. 1), the transistor is on and will connect the output signal to ground (GND). The output transistor is rated at 100 mA and 30V.

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

5.7.3.5   SELECTING THE BINARY INPUT CURRENT

The input threshold for detecting a logic 1 can be set at either 8uA or 20mA 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 8µA. A threshold current value of 20mA has a higher resistance to noise on the input but also dissipates more power.

Fig. 32: CNT I/O board

5.7.3.6 INPUT/OUTPUT CONNECTOR

Pin No.	Signal Mark	Description	Data Flow Direction
PANEL SOCKET RJ45			
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 18: Input/Output connector pinout
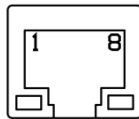
Fig. 33: CNT connector

Typical connection of the I/O port circuits:
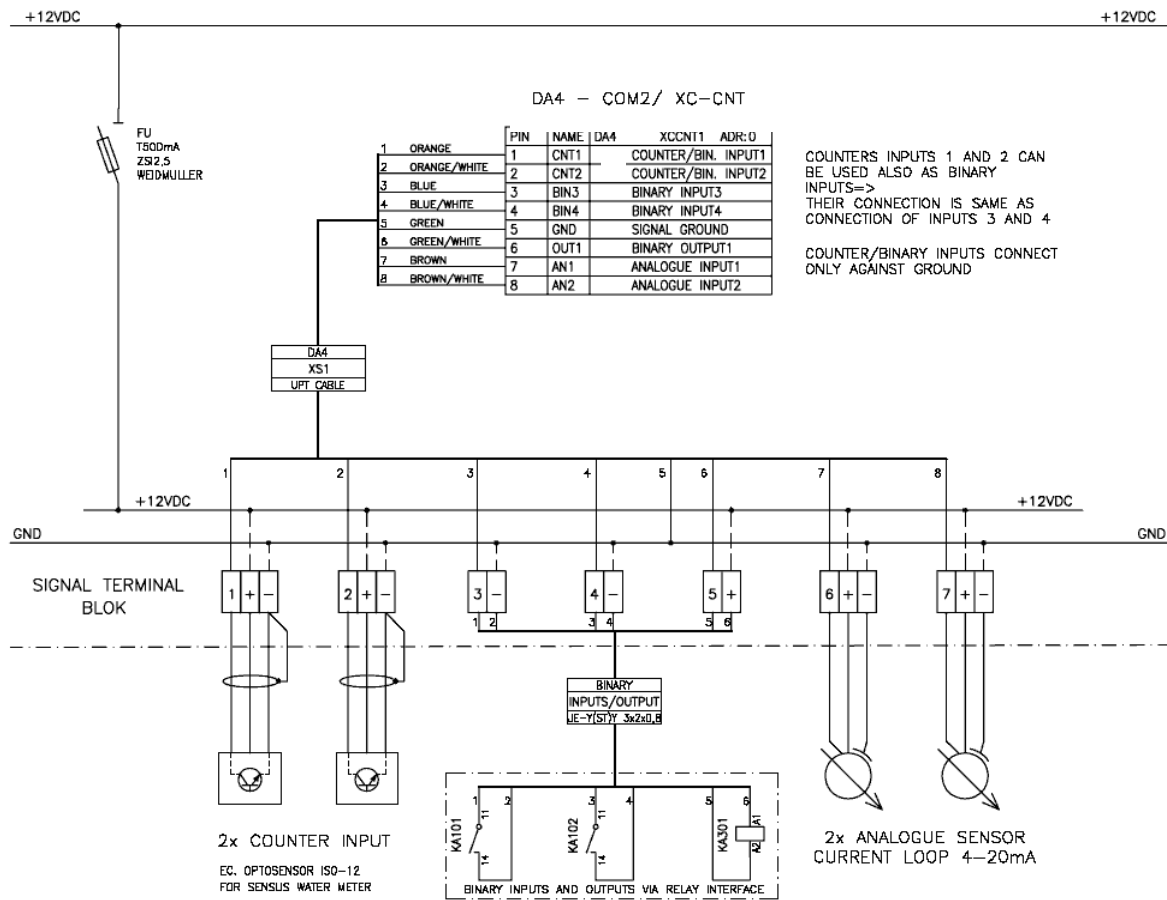
Fig. 34: Connection of the I/O Port circuitry

The 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 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).

ADDRESS SPACE		
Address	**Access**	**Description**
0x0000	R/-	Firmware type
0x0001	R/-	Upper 16 bits of firmware version
0x0002	R/-	Lower 16 bits of firmware version
0x0003	R/-	Supports firmware characteristics • bit 0 – Analog input AN1 • bit 1 – Analog 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 – Full duplex counter CNT1/CNT2
0x0004	R/-	Maximum log entries in buffer
0x0005	R/W	Marker of log launching and alarms work
0x0006	R/W	Upper 16 bits of current time in seconds, numbered from 1/1/1970
0x0007	R/W	Lower 16 bits of current time in seconds, numbered from 1/1/1970
0x0008	R/W	Upper 16 bits of log entry timestamp
0x0009	R/W	Lower 16 bits of log entry timestamp
0x000A	R/-	Alarm actual status
0x0100	R/-	Binary input status
0x0200	R/W	Binary output status
0x0300	R/-	Recalculate value of analog input AN1 (with sign)
0x0400	R/-	Recalculate value of analog input AN2 (with sign)
0x0500	R/W	Upper 16 bits of counter CNT1 value
0x0501	R/W	Lower 16 bits of counter CNT1 value
0x0502	R/-	Prompt frequency CNT1
0x0503	R/-	Average frequency CNT1
0x0504	R/-	Minimum frequency CNT1
0x0505	R/-	Maximum frequency CNT1

0x0601	R/W	Upper 16 bits of counter CNT2 value
0x0601	R/W	Lower 16 bits of counter CNT2 value
0x0602	R/-	Prompt frequency CNT2
0x0603	R/-	Average frequency CNT2
0x0604	R/-	Minimum frequency CNT2
0x0605	R/-	Maximum frequency CNT2
0x0F00	R/-	0x0000 always
0x0F01	R/-	0x0000 always
0x0F02	R/-	Upper 16 bits of seconds, number from 1.1.1970
0x0F03	R/-	Lower 16 bits of seconds, number from 1.1.1970
0x0F04	R/-	Alarms status • bit 0 – active level on input BIN1 • bit 1 – active level on input BIN2 • bit 2 – active level on input BIN3 • bit 3 – active level on input BIN4 • bit 4 – analog input lower limit overrun AN1 • bit 5 – analog input upper limit overrun AN1 • bit 6 – analog input lower limit overrun AN2 • bit 7 – analog input upper limit overrun AN2 • bit 8 – limit frequency overrun CNT1 • bit 9 – limit frequency overrun CNT2
0x0F05	R/-	Binary inputs status • bit 0 – level on input BIN1 • bit 1 – level on input BIN2 • bit 2 – level on input BIN3 • bit 3 – level on input BIN4 • bit 6 – level on output BOUT1
0x0F06	R/-	Recalculate AN1 value (with sign)
0x0F07	R/-	Recalculate AN2 value (with sign)
0x0F08	R/-	Upper 16 bits CNT1
0x0F09	R/-	Lower 16 bits CNT1
0x0F0A	R/-	Prompt frequency CNT1
0x0F0B	R/-	Average frequency CNT1
0x0F0C	R/-	Minimal frequency CNT1
0x0F0D	R/-	Maximal frequency CNT1
0x0F0E	R/-	Upper 16 bits of counter CNT2 value
0x0F0F	R/-	Lower 16 bits of counter CNT2 value
0x0F10	R/-	Prompt frequency CNT2

0x0F11	R/-	Average frequency CNT2
0x0F12	R/-	Minimal frequency CNT2
0x0F13	R/-	Maximal frequency CNT2
0x1000	R/-	1. log – upper 16 bits of log number
0x1001	R/-	1. log – lower 16 bits of log number
0x1002	R/-	1. log – upper 16 bits of time stamps
0x1003	R/-	1. log – lower 16 bits of time stamps
0x1004	R/-	1. log – alarms status
0x1005	R/-	1. log – binary inputs status
0x1006	R/-	1. log – recalculate value AN1 (with sign)
0x1007	R/-	1. log – recalculate value AN2 (with sign)
0x1008	R/-	1. log – upper 16 bits CNT1
0x1009	R/-	1. log – lower 16 bits CNT1
0x100A	R/-	1. log – prompt frequency CNT1
0x100B	R/-	1. log – average frequency CNT1
0x100C	R/-	1. log – minimal frequency CNT1
0x100D	R/-	1. log – maximal frequency CNT1
0x100E	R/-	1. log – upper 16 bits of counter CNT2 value
0x100F	R/-	1. log – lower 16 bits of counter CNT2 value
0x1010	R/-	1. log – prompt frequency CNT2
0x1011	R/-	1. log – average frequency CNT2
0x1012	R/-	1. log – minimal frequency CNT2
0x1013	R/-	1. log – maximal frequency CNT2
0x1100	R/-	2. log
0x1200	R/-	3. log
...	R/-	...
0xEF00	R/-	224. log
0xF000	-/W	Samples stores period [min]
0xF001	-/W	Allowed: • bit 0 – active level on input BIN1 • bit 1 – active level on input BIN2

		• bit 2 – active level on input BIN3 • bit 3 – active level on input BIN4 • bit 4 – analog input AN1 lower limit overrun • bit 5 – analog input AN1 upper limit overrun • bit 6 – analog input AN2 lower limit overrun • bit 7 – analog input AN2 upper limit overrun • bit 8 – limit frequency CNT1 overrun • bit 9 – limit frequency CNT2 overrun
0xF100	-/W	Binary inputs negative logical • bit 0 – input BIN1 • bit 1 – input BIN2 • bit 2 – input BIN3 • bit 3 – input BIN4
0xF200	-/W	Binary outputs normal level • bit 0 – output OUT1
0xF201	-/W	Feeder – impulse number on input BIN1/CNT1
0xF202	-/W	Feeder – impulse length on output OUT1 [1/8 sec]
0xF300	-/W	AN1 – samples 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)

0xF306	-/W	bits 7-3:
		   AN1 – metering circuit switch time
		   • 0 → 1/64 sec
		   • 1 → 2/64 sec
		   • ...
		   • 30 → 31/64 sec
		bits 2-0:
		   AN1 – samples number for average
		   • 0 → 1 sample
		   • 1 → 2 samples
		   • 2 → 4 samples
		   • 4 → 8 samples
		   • 5 → 16 samples

0xF400	-/W	AN2 – samples 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 – metering circuit switch time
		     • 0 → 1/64 sec
		     • 1 → 2/64 sec
		     • ...
		     • 30 → 31/64 sec
		bits 2-0:
		   AN2 – samples number for average
		     • 0 → 1 sample
		     • 1 → 2 samples
		     • 2 → 4 samples
		     • 4 → 8 samples
		     • 5 → 16 samples

0xF500	-/W	CNT1 – multiplicative constant
0xF501	-/W	CNT1 – upper limit
0xF502	-/W	CNT1 – time of limit overrun [sec]
0xF503	-/W	CNT1 – time for metering reset [sec]
0xF600	-/W	CNT2 – multiplicative constant
0xF601	-/W	CNT2 – upper limit
0xF602	-/W	CNT2 – time of limit overrun [sec]
0xF603	-/W	CNT2 – time for metering reset [sec]
0xFFFF	-/W	Switch main supply off on set time [min]

Table 19: MODBUS input/output address space

5.8   USB PORT

PANEL SOCKET USB-A			
Pin No.	Signal Mark	Description	Data Flow Direction
1	+5V	Positive pole of 5V 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 20: Connection of USB connector

Fig. 35: USB connector

Example of connecting devices with a serial interface to the USB router:
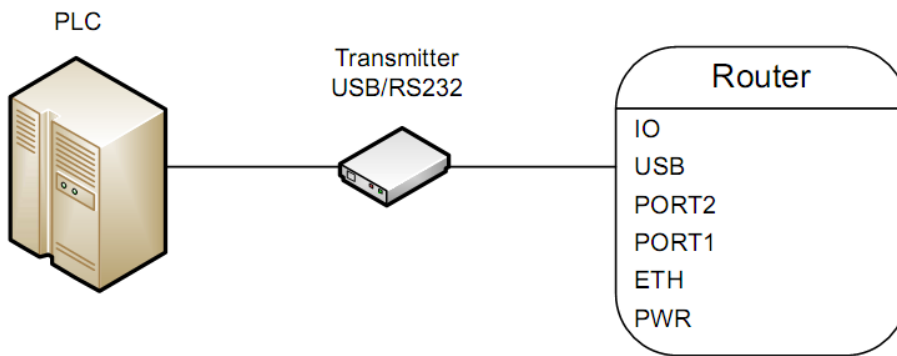
Fig. 36: USB connector

Connecting a USB flash drive to the USB router:
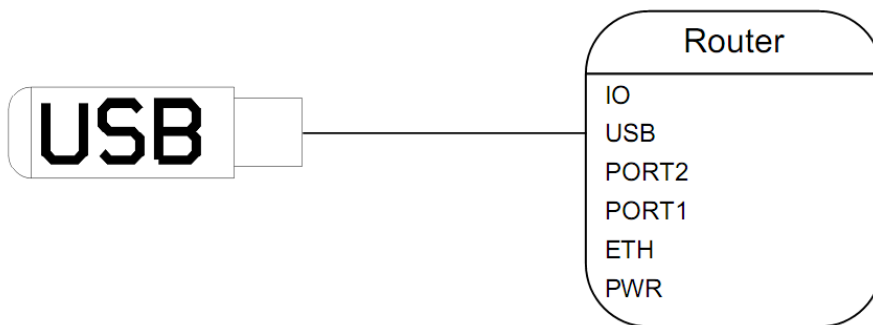
Fig. 37: Connecting a USB memory stick to the router

5.9   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 21: I/O port connection
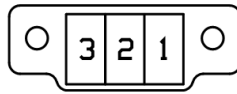
Fig. 38: I/O connection

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.
(See Fig. 35)
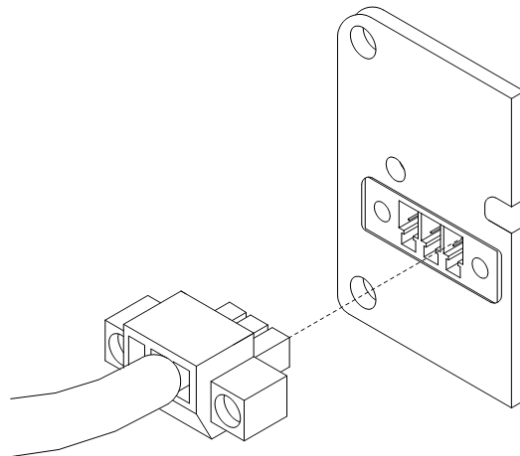
Fig. 39: Connection I/O cable

Circuit example of a binary input or output connected to the router:
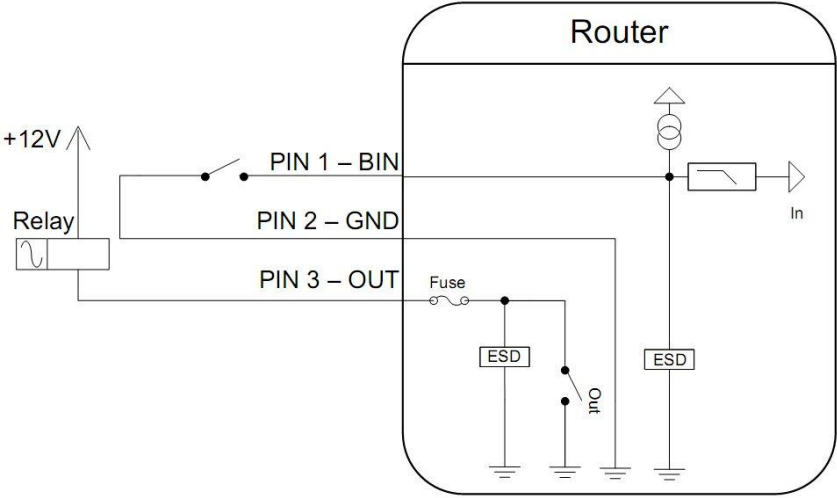
Fig. 40: Connection of binary input and output of router

6.0 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.
		Press the **reboot** button in the Web configuration page.
Reset	Restore the factory default configuration and reboot the router.	Press RST button.

Table 22: 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 Fig. 37)
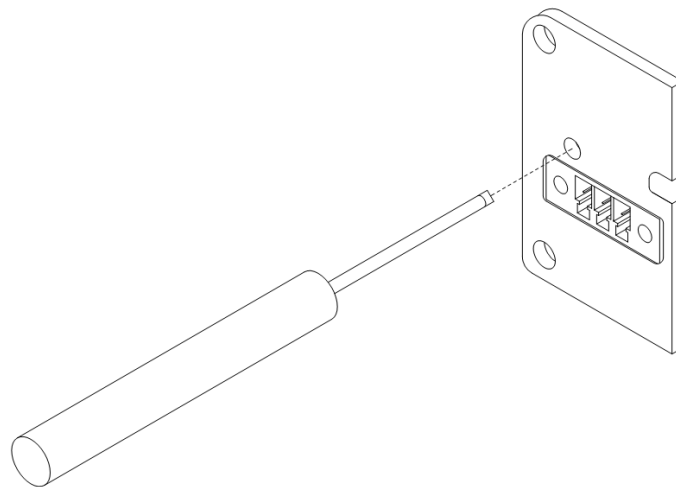
Fig. 41: Router reset

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.

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.

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 or Telnet interface, as described in the configuration manual.

The power consumption during receiving is 2.3W. 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.

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".

A detailed description of configuring the router via the Web interface can be found
in the configuration manual

Configuration over Telnet
Monitoring of status, configuration and administration of the router can be performed by means of the Telnet 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 can be found in the configuration manual.

7.3 TECHNICAL PARAMETERS

SPECTRE CELLULAR ROUTER		
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 $+60^{\circ}$ C
	Storage	-40° C to $+85^{\circ}$ C
Protection		IP20
Supply voltage		10 to 30 V DC Class 2 Power Supply Only
Consumption	Receive Mode Transmit: GPRS Transmit: UMTS/HSDPA/EVDO	2.3 W to 3.5 W (GPRS transmission) to 5.5 W (UMTS/HSDPA/LTE transmission)
Dimensions		42x76x113 mm (DIN 35mm)
Weight		280 g
Antenna connector		SMA– 50 Ohm
SIM Card Interface		1.8V and 3.3V Mini-SIM Cards
User interface	ETH USB PORT 1 PORT 2	Ethernet (10/100 Mbit/s) USB 2.0 type A host Model Dependent Model Dependent

Table 23: General specifications

CELLULAR MODE	
LTE parameters	Bit rate 100 Mbps (DL) / 50 Mbps (UL) 3GPP rel. 8 standard Supported bandwidth: 5 Mhz, 10 Mhz, 20 Mhz
HSPA+ parameters	bit rate 21.1 Mbps/5,76 Mbps 3GPP rel. 7 standard UE CAT. 1 to 6, 8, 10, 12, 14 Data compress 3GPP
UMTS parameters	PS bitrate – 384/384 kbps CS bitrate – 64/64 kbps W-CDMA FDD standard
GPRS parameters	bit rate 236 kbps/236kbps **GPRS** multi-slot class 10, CS 1 to 4 **EGPRS** multi-slot class 10, CS 1 to 4, MCS 1 to 9
Transmit power	**UMTS/HSUPA/HSDPA/HSPA+** - (20dBm) **EGSM900/GSM850** - Class 4 (33dBm) **GSM1800/1900** - Class 1 (30dBm)
Supported channels	**GSM/GPRS/EDGE:** 850Mhz, 900Mhz, 1800Mhz, 1900Mhz **UMTS/HSDPA/HSUPA/HSPA+:** 800Mhz, 850Mhz, 900Mhz,1900Mhz, 2100Mh **LTE:** 800/900/1800/2100/2600 Mhz

Table 24: Cellular module specifications

32b ARM Microprocessor	
Memory	512 Mb DDR SDRAM 128 Mb FLASH 1 Mb MRAM
Interface	Serial interface RS-232 Ethernet interface 10/100Mbit/s USB 2.0 interface

Table 25: Processor specifications

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

Table 26: I/O port specifications

WI-FI Specifications			
Power supply	Internal		+3,3V
Environment	Operating temperature		-15 .. +65 C
	Storage temperature		-20 .. +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
		11g, 54Mbps	-70 dBm
		(HT20) 11n, MSC7	-66 dBm
		(HT20) 11n, MSC7	-62 dBm
	TX Output power	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		2,4GHz

Table 27: Wi-Fi specifications

8.0 TROUBLESHOOTING

8.1 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.*

9.0 CUSTOMER SUPPORT

Up to date information product information is on the website:

http://www.bb-elec.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.

B&B Electronics hereby declares that 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".

CE Declaration of consistency was issued and may be viewed on the accompanying CD or acquired from the manufacturer.