Twin Cellular Module Router
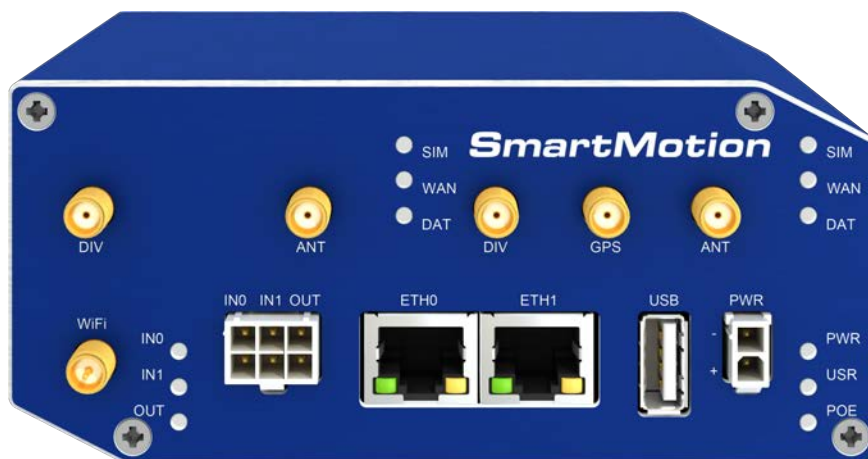
SmartMotion ST352

USER MANUAL

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Used symbols

⚠️ *Danger* – Information regarding user safety or potential damage to the router.

❗ *Attention* – Problems that can arise in specific situations.

ℹ️ *Information, notice* – Useful tips or information of special interest.

GPL licence

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

techSupport@advantech-bb.com.

Please see http://ep.advantech-bb.cz/devzone for more information.

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1. Safety Instructions

> **Please, observe the following instructions:**

- The router must be used in compliance with all applicable international and national laws and in compliance with any special restrictions regulating the utilization 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 / or a breach of applicable regulations. Unauthorized modifications or use of unapproved accessories may void the warranty.

- The router can not be opened.

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

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

- Power supply must not exceed 60 V DC max.

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

- Only routers with appropriate certification and labelling should be used in locations where flammable and explosive materials are present, including gas stations, chemical plants, or locations in which explosives are used. We remind users of the duty to observe the restrictions concerning the utilization of radio devices at such places.

- Switch off the router when travelling by plane. Utilization of the router on a plane may endanger the operation of the plane or interfere with the mobile telephone network, and may be unlawful. Failure to observe these instructions may result in the suspension or cancellation of telephone services for the respective client and / or may result in legal sanctions.

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

- The router may cause interference when used in close proximity to TV sets, radio receivers or personal computers.

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

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2. Product Disposal Instructions

The WEEE (Waste Electrical and Electronic Equipment: 2012/19/EU) directive was introduced to ensure that electrical/electronic products are recycled using the best available recovery techniques in order to minimize impact on the environment. This product contains high quality materials and components which can be recycled. At the end of it's life this product MUST NOT be mixed with other commercial waste for disposal. The device contains the battery. Remove the battery from the device before disposal. The battery in the device needs to be disposed apart accordingly. Check the terms and conditions of your supplier for disposal information.

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3. Router Description

SmartMotion ST352 is an industrial cellular router intended for wireless communication in mobile networks that make use of LTE, HSPA+, UMTS, CDMA, EDGE or GPRS technology. The router is equipped with two independent cellular modules for backed up communication. That's why SmartMotion router is the ideal solution for the systems with high reliability needed. The position of the first module is reserved for LTE technology with frequency bands 800, 900, 1800, 2100 and 2600 MHz. The second position is equipped with a module supporting LTE technology with the same frequency bands. Due to the high speed of data transfer and the previously mentioned high reliability of communication is this router an ideal solution for specialized M2M devices and IoT as well as for wireless connection of traffic and security camera systems, individual computers, LAN networks, automatic teller machines (ATM) and other self-service terminals.

The standard configuration includes two Ethernet 10/100 ports, one USB 2.0 Host port, two binary inputs and one output (I/O connector). The device also has four readers for 3 V and 1.8 V SIM cards, which are located on the rear panel of the router. The router also includes a microSD card port that supports up to 64 GB card storage (32 GB in the case of SDHC cards). The router can be equipped with a WiFi module, but this must be part of the initial configuration – it cannot be added to the router at some point in the future. The router can be equipped with PoE PD (Power over Ethernet – Powered Device), which allows the router to be powered via Ethernet. It can also be equipped with PoE PSE (Power over Ethernet – Power Source Equipment), which lets the router power other devices via Ethernet.

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

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 which are started on various actions. It is possible to create up to four different configurations for the same router. These configurations can be switched whenever necessary via Web interface, SMS or binary input status. 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.

The router also supports additional software like R-SeeNet for permanent traffic monitoring of routers.

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Examples of possible applications

- mobile office
- fleet management
- security system
- telematic

- telemetric
- remote monitoring
- vending and dispatcher machines

3.1 Usage of the Router

The router is primarily intended for these four basic situations:

I. Access to the Internet from LAN
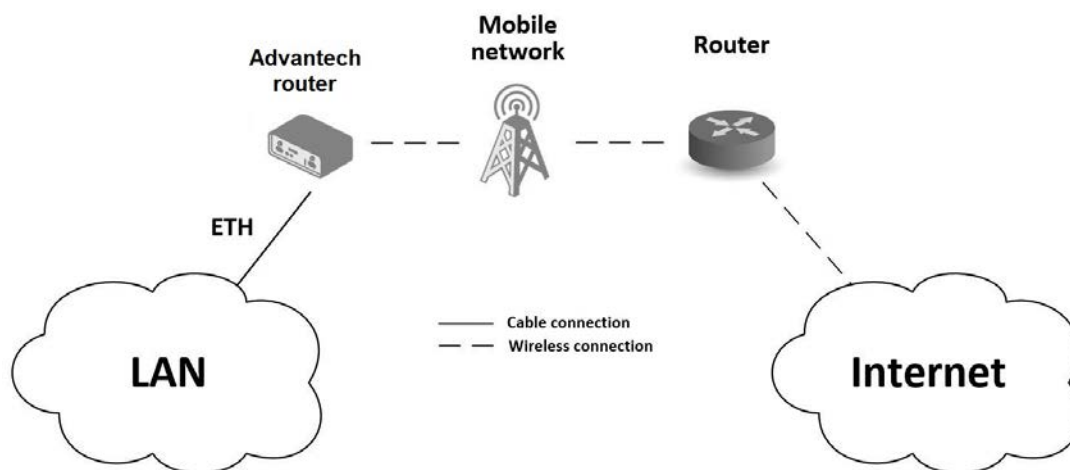
Figure 1: Access to the Internet from LAN

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II. Backed up access to the Internet (from LAN)
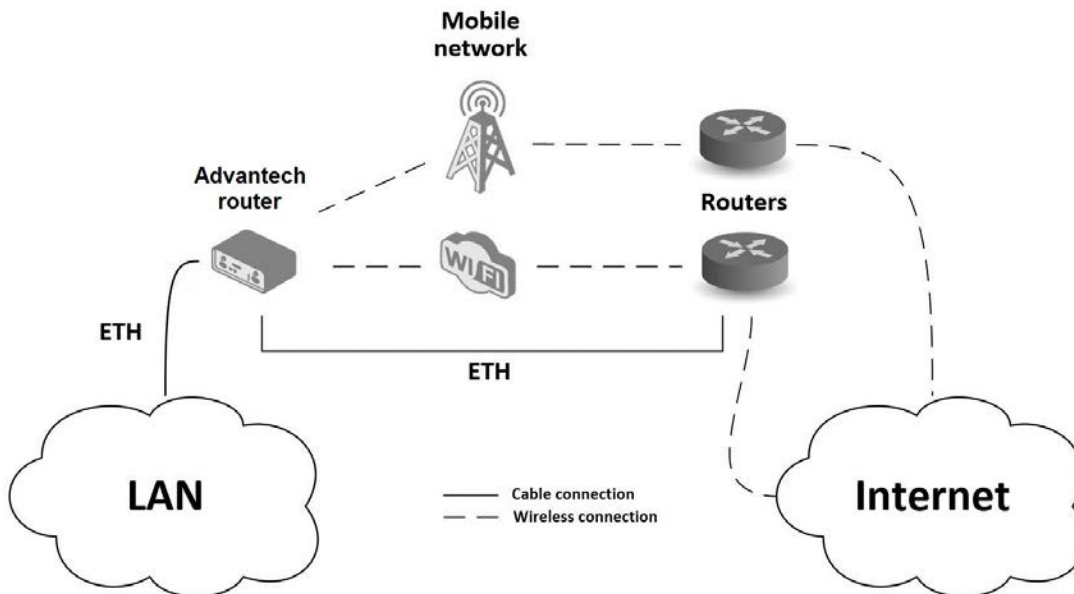
Figure 2: Backed up access to the Internet

III. Secure networks interconnection or using VPN
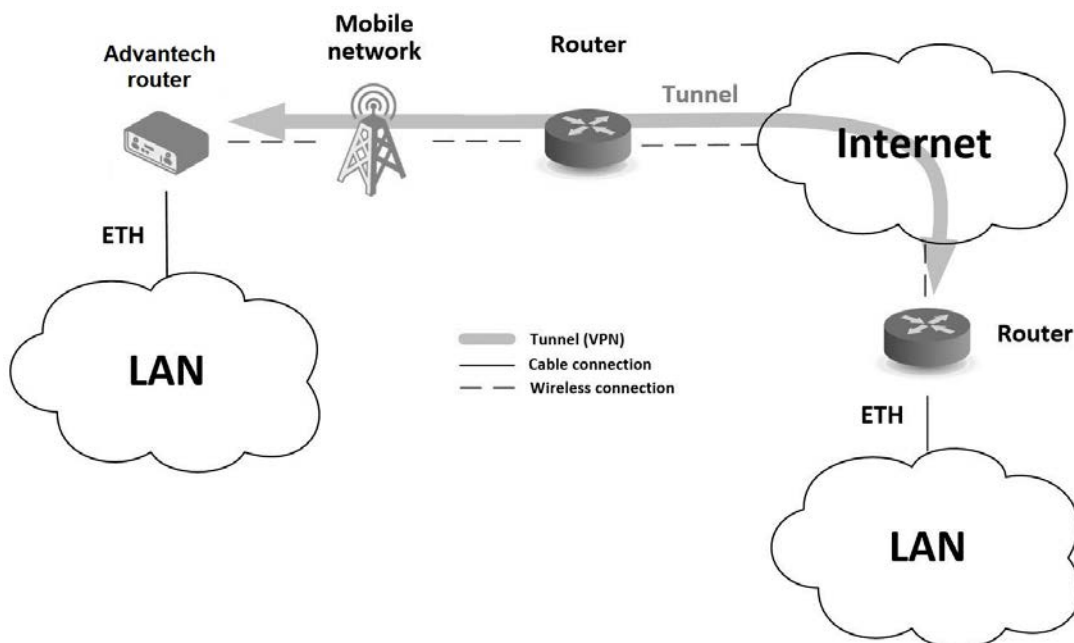
Figure 3: Using VPN tunnel

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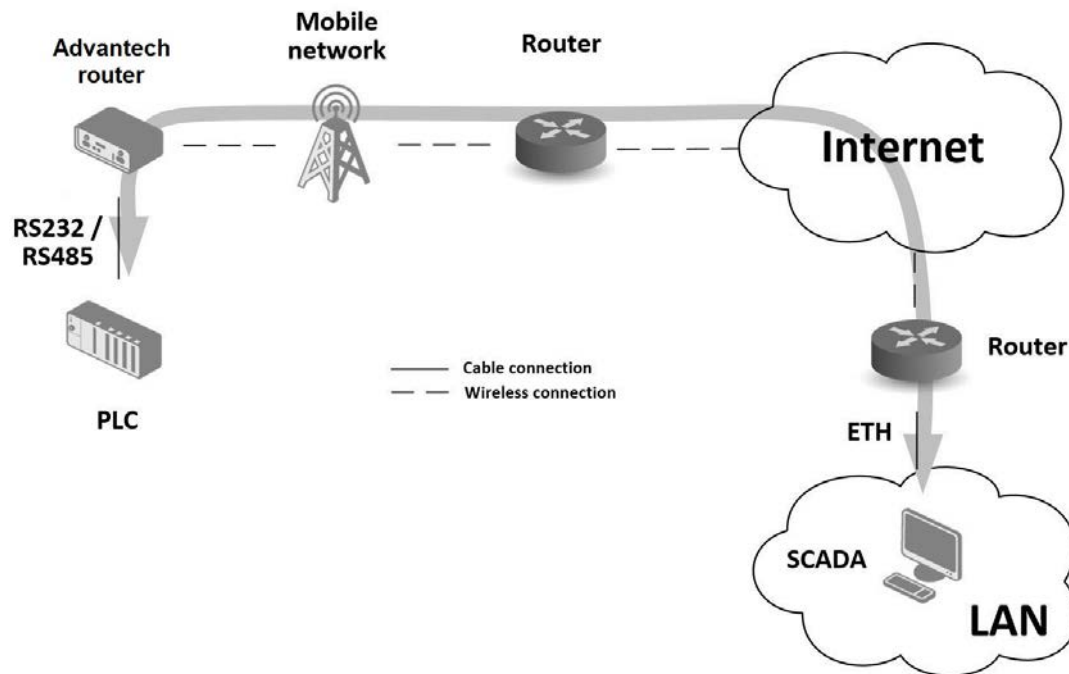
IV. Serial Gateway

Figure 4: Serial Gateway

4. Contents of Package

Basic delivered set of router includes:

- Router,
- Power supply,
- Crossover UTP cable,
- Up to five external antennas,
    - 4x Terminal antenna for standard LTE
    - 1x WiFi antenna (**if router contains WiFi module**)
- Loose power and I/O connector (+8 pins[1]),
- Clip for the DIN rail,
- Paper start guide.

Figure 5: Contents of package

> ⚠️ Temperature range for power supply is reduced to 0 °C to +40 °C!

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[1]These pins are designed for cables with a diameter from 0.2 to 0.8 mm^2

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5. Router Design

5.1 Router versions

SmartMotion ST352 router is supplied in the following versions (see table below). All versions are available in a metal box. All versions are available with PoE PD (Power over Ethernet – powered device) so you can power the router from both ETH0 and ETH1 interfaces, or with PoE PSE (power source equipment) so you can power other devices by the router.

Router versions	SIM	BIN	BOUT	USB	SD	ETH	WiFi
Basic version	4 x	2 x	1 x	1 x	1 x	2 x	
Version with WiFi module	4 x	2 x	1 x	1 x	1 x	2 x	1 x

Table 1: Router versions

Figure 6: Basic version

Figure 7: Version with WiFi module

5.2 Delivery identification

Trade name	Type name	Description
SmartMotion ST352	SmartMotion	Router in a metal box

Table 2: Delivery identification

Figure 8: Label example

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5.3 Order codes

Order codes overview is shown in the table below.

Product Name	Order code	Features – interfaces
ST352	BB-ST3520x0yz*	2x LTE module, 2x ETH, 1x USB, 2x BI, 1x BO, 1x microSD reader, 4x SIM reader
ST352	BB-ST3521x0yz*	2x LTE module, 2x ETH, 1x USB, 2x BI, 1x BO, 1x microSD reader, 4x SIM reader, WiFi

Table 3: Order codes overview

> ⚠ * Replace the letters "x", "y" and "z" with the values from the following tables:

Letter "x" – Power over Ethernet (PoE)

Power over Ethernet (PoE)	Number "x" in code
Version without PoE	0
PoE PSE – Power Source Equipment – powers other devices	8
PoE PD – Powered Device – can be powered via Ethernet	9

Table 4: Power over Ethernet

Letter "y" – type of the router box

Type of box	Number "y" in code
Metal	2

Table 5: Type of router box

Letter "z" – type of the power supply connector

Type of power supply	Number "z" in code
International (4 plugs)	5
Without accessories	0

Table 6: Type of power supply

Examples of complete order code:

Order code	Features – interfaces	Box	Power supply
BB-ST35208020	2x LTE module, 2x ETH, 1x USB, 2x BI, 1x BO, 1x microSD reader, 4x SIM reader, PoE PSE	metal	none
BB-ST35219020	2x LTE module, 2x ETH, 1x USB, 2x BI, 1x BO, 1x microSD reader, 4x SIM reader, WiFi, PoE PD	metal	none
BB-ST35210020	2x LTE module, 2x ETH, 1x USB, 2x BI, 1x BO, 1x microSD reader, 4x SIM reader, WiFi	metal	none

Table 7: Examples of order code

You can use the order codes configurator on the www.bb-smartcellular.eu web pages.

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5.4   Basic dimensions of the router box
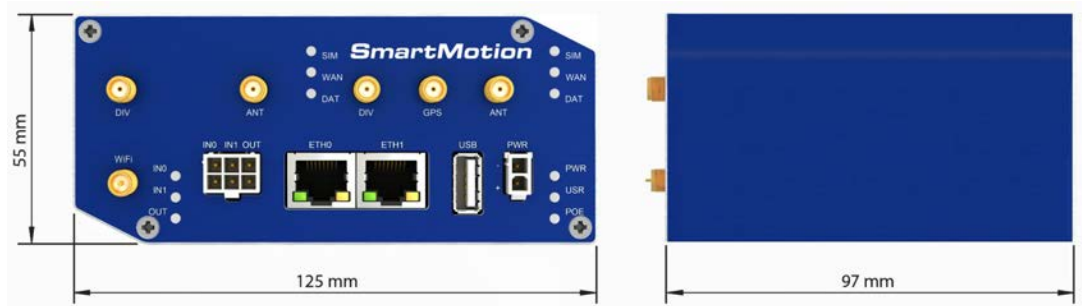
Figure 9: Basic dimensions of the router box

5.5   Mounting recommendations

- Possibility to be put on a work surface,
- DIN rail EN 60715 with included metal clip.

For the most of applications with a built-in router in a switch board it is possible to recognize two kinds of environments:

- No public and industry environment of low voltage with high interference,
- Public environment of low voltage without high interference.

For both of these environments it is possible to mount router to a switch board, the following there is no need to have examination immunity or issues in connection with EMC according to EN 61439-1:2011.

> ⚠ **Attention:** If the negative pole of the router is grounded, there is no protection against reversed polarity!

> ⚠ Compliance of EN 61439-1:2011 specification it is necessary to observe next assembly of the router to the switch – board:

- For whip antennas we recommend to observe a distance of 6 cm from cables and metal surfaces on every side due to the elimination of interference. While using an external antenna except for the switch-board it is necessary to fit a lightening conductor.

- Before mounting a router on sheet-steel we recommend using a "cable" antenna.

- For every cables we recommend to bind the bunch, we recommend for this use:

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– Length of the bunch (combination of power supply and data cables) can be maximum 1.5 m. If the length of data cables exceeds 1.5 m or in the event of, the cable leads towards the switch – board. We recommend installing over – voltage protectors (surge suppressors).

– With data cables they mustn't carry cables with reticular tension ∼ 230 V/50 Hz.

- Sufficient space must be left before individual connectors for handling of cables,

- For correct function of the router we recommend to use in the switch-board earth-bonding distribution frame for grounding of power supply of router, data cables and antenna.

5.6 Removal from the DIN rail

The DIN rail clip is suitable for a DIN rail according to EN 60715 standard only. The default position of metal rail clip, which is used for mounting the router on a DIN rail, is shown in the following figure. Its position can be changed on some models (back or bottom). When changing the position of the DIN rail clip, tighten the screws with max. 0.4 Nm torque.

Figure 10: Default position of metal DIN rail clip

To remove the router from the DIN rail, push the router down lightly, so the bottom part of the DIN rail clip (hitched to the DIN rail) gets out of the rail and then pull out the bottom part of the router away from the DIN rail.
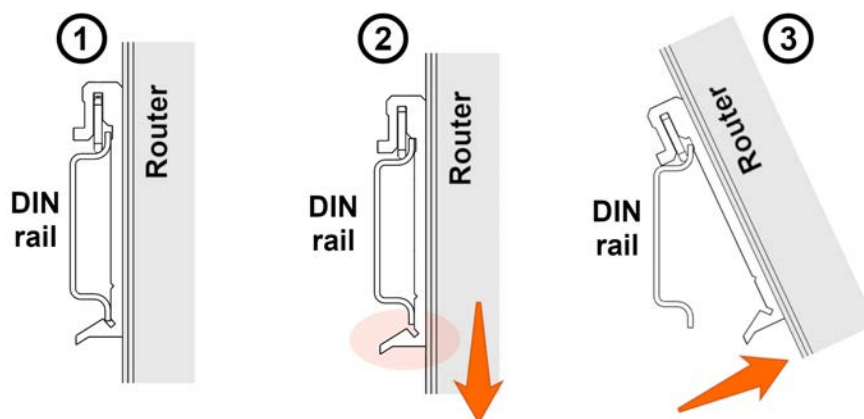
Figure 11: Removal from the DIN rail

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5.7   Description of the rear panel

The rear panel contains only four SIM cards readers (*SIM1*, *SIM2*, *SIM3* and *SIM4*), microSD card reader (*SD*) and *RST* button used to restore default configuration and reboot the SmartMotion router.

5.8   Description of the front panel

On the front panel is the following:

Caption	Connector	Description
PWR	2-pin	Connector for the power supply
ETH0	RJ45	Connector for connection into the computer network, PoE (only for PoE PSE or PoE PD versions)
ETH1	RJ45	Connector for connection into the computer network, PoE (only for PoE PSE or PoE PD versions)
ANT	2x SMA	Connector for main antenna
DIV	2x SMA	Connector for diversity antenna
GPS	SMA	Connector for GPS antenna
WiFi	R-SMA	Connector for WiFi antenna (**only for versions with WiFi module!**)
USB	USB-A 2.0 Host	Connector for connection of USB devices to the router. Supports devices with PL-2303 and FTDI USB/RS232 converters.
I/O	6-pin	Connector for connection of the binary inputs and output

Table 8: Front panel description

Figure 12: SmartMotion front panel

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5.8.1 Status indication

There are nine LED indicators on the front panel to provide router status information. Each ETH port has two additional LEDs that provide information about the port status.

Caption	Color	State	Description
PWR	Green	Blinking On Fast blinking	Router is ready. Starting of the router. Updating firmware.
USR	Yellow	—	Function of this LED diode can be selected by user.
POE	Yellow Green	On Blinking On Blinking Off	PSE: insufficient power supply via PWR connector. PSE: overload (device takes much power)/short circuit[1] PoE PD versions: The voltage present in ETH port. PSE: correct power supply via PWR connector. PSE: The device is powered via one of the ETH ports. PD: The voltage not present in ETH port. PSE: disabled (not enabled on any of ETH ports).
SIM	Green Yellow	On (Green color) On (Yellow color)	The first SIM card is active. The second SIM card is active.
WAN	Yellow	Fades out 1x/5 s Fades out 1x/2 s Fades out 1x/1 s	Signal strength is good. Signal strength is fair[2]. Signal strength is poor[3]. For value ranges of signal strength see *Configuration manual*, chapter *Mobile WAN Status*.
DAT	Red	Blinking	Communication in progress on radio channel.
IN0	Green	On	Binary input no. 0 is active.
IN1	Green	On	Binary input no. 1 is active.
OUT	Yellow	On	Binary output is active.
ETH0 ETH1	Green	On Off	Selected 100 Mbps. Selected 10 Mbps.
ETH0 ETH1	Yellow	On Blinking Off	The network cable is connected. Data transmission. The network cable is not connected.

Table 9: Status indication

The status indication of the WAN LED is updated every 10 seconds.

---

[1] Additionally it can indicate a device without PoE support connected on the other side of the cable. In this case the indication is caused by low impedance (lower than 500 Ω) of the device without PoE support. This can be solved by disabling the PoE PSE feature on the relevant ETH port in the router's Web interface, see *Configuration manual* [2].

[2] Or the difference between neighbouring cells is exactly 3 dBm.

[3] Or the difference between neighbouring cells is smaller than 3 dBm.

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5.8.2 Power connector PWR

Panel socket 2-pin.

Pin number	Signal mark	Description
1	GND(-)	Negative pole of DC supply voltage
2	VCC(+)	Positive pole of DC supply voltage (+10 to +60 V DC)

Table 10: Connection of power connector
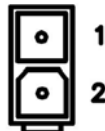
Figure 13: Power connector

Unit has to be supplied by a power supply specified as a Limited Power Source (LPS) according to clause 2.5 of IEC/UL 60950-1 or CEC/NEC Class 2 source of supply as defined in the Canadian Electrical Code, CSA C22.1 and National Electrical Code, ANSI/NFPA 70. If the power supply/cable provided with device is not used, always use the cables with minimum wire size (nominal cross section) 0.5 square mm for power supply.

The power supply for the router must be between +10 V to +60 V DC supply. Protection against reversed polarity without signaling is built into the router. **Note:** The protection against reversed polarity is lost if the negative pole is grounded!

The router can be put into low power mode using a special command `lpm`. It can then be awakened, for example, by an activity on binary input or using an internal timer. Consumption in LPM mode may vary depending on the configuration of the router.

Circuit example:
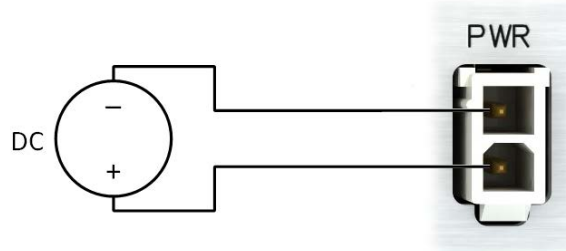
Figure 14: Connection of power supply

Note for PoE: See Chapter 5.8.7 for information on how PoE versions of the router impact the power supply usage. The power supply for a PoE PSE router has to meet other specific requirements.

In applications requiring low power consumption (such as solar power - not 7/24 mode) is strictly recommended to use "LPM" mode prior to powering down the entire router.

5.8.3   Antenna connector ANT, DIV, GPS and WiFi

Main, diversity and GPS antennas are connected to the router using the SMA connector on the front panel. There is also available R-SMA antenna connector through which the additional antenna can be connected, if the router is equipped with WiFi module.

Both of *ANT* connectors are used to connect the main antennas to the router. To connect the diversity antenna are used antenna connectors *DIV*. The fifth connector (*GPS*) is intended for GPS antenna (router supports active GPS antenna). R-SMA connector named *WiFi* is designed for connection of WiFi antenna (available only for versions with WiFi module).

> The router can not operate without connected main antennas marked as *ANT*!

For connection the antenna is used SMA connector. The antenna is connected by screwing this antenna to the SMA connector on the front panel of the router (see figure below).
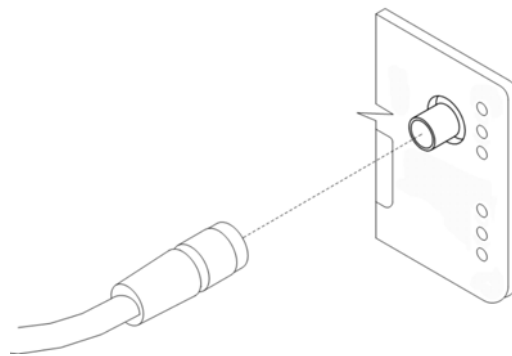
Figure 15: Connecting of the antenna

Diversity antenna improves radio features of the router at low signal strength.

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5.8.4 SIM card reader

Four SIM card readers for 3 V and 1.8 V SIM cards are placed on the rear panel of the router. For getting the router to work is necessary to insert an activated SIM card with an un-blocked PIN code. The SIM cards might be of different adjusted APN (Access Point Name).

Supported type of SIM cards: **Mini SIM** (2FF), dimensions 25.0 x 15.0 x 0.76 mm.

Changing the SIM card:

- Before handling of the SIM card disconnect the router from power supply!
- Use a plastic opening tool, or your fingernail, to press the SIM card slightly deeper into its slot until you hear a click.
- After the click, release the card and it will pop out of its slot.
- Remove the SIM card and push any other SIM card into the slot until it clicks in place.
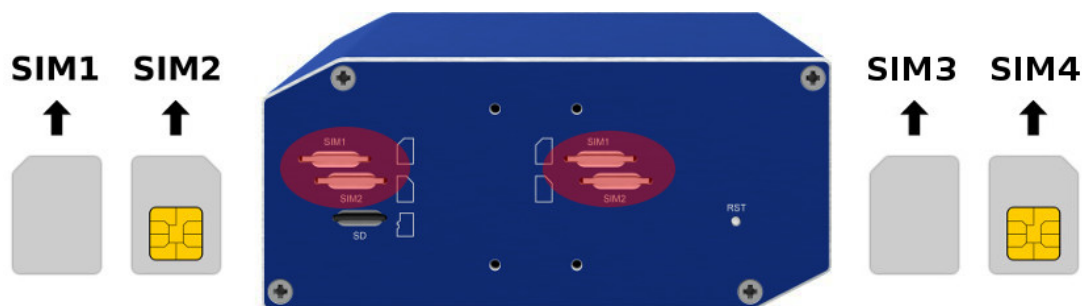
Figure 16: SIM cards

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5.8.5 MicroSD card reader

The microSD card reader is located on the rear panel of the router (the third slot). This card reader allows the router to operate with microSD memory cards. The technical specifications are stated in the table below.

Technical specifications of microSD card		
Supported technologies		SDHC, SDXC
Supported capacity	SDHC	up to 32 GB
	SDXC	from 32 GB to 64 GB
Supported microSD card filesystems		vfat, ext2, ext3, ext4*

Table 11: Technical specifications of microSD card

* Supported only with *Ext4_tools* User Module installed in the router.

> **Changing the microSD card:**
>
> - Using the flat end of a spudger, or your fingernail, press the microSD card slightly into its slot until you hear a click.
> - After hearing this click, release the card and it will pop out of its slot.
> - Remove the microSD card and push any other microSD card into the slot until it clicks into place.

Figure 17: MicroSD card

Mounting microSD card to the system: To use the microSD card in the Linux system of the router, it is necessary to mount it. Use `dmesg` command to see the name of recently connected device (E. g. `mmcblk0:  p1`) and then use `mount` command. Example:
```
mount /dev/mmcblk0p1 /mnt
```

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5.8.6 Ethernet Ports (ETH0 and ETH1)

Panel socket RJ45.

Pin	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	DC+	PoE power + (if it's equipped by PoE)	
5	DC+	PoE power + (if it's equipped by PoE)	
6	RXD-	Receive Data – negative pole	Input/Output
7	DC-	PoE power - (if it's equipped by PoE)	
8	DC-	PoE power - (if it's equipped by PoE)	

Table 12: Connection of Ethernet connector
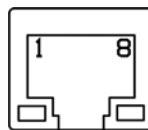
Figure 18: Ethernet connector

The crossover UTP cable (Ethernet cable) plugs into the RJ45 connector labeled as ETH0 or ETH1 (see figure below).
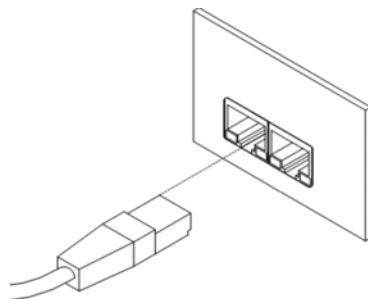
Figure 19: Connection of Ethernet cable

The insulation strength of Ethernet ports from each other and from the rest of the router (grounding) is dependent on the router version:

Router Version	Insul. Strength from Router	Insul. Strength between Ports
Without PoE	1.5 kV	1.5 kV
PoE PD	1.5 kV	none
PoE PSE	none	none

Table 13: Insulation strength of Ethernet ports

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5.8.7 Power over Ethernet (PoE)

On the router models with PoE, the PoE+ standard IEEE 802.3at-2009 and PoE standard IEEE 802.3af-2003 are supported in both Ethernet ports (ETH0, ETH1). The PoE PD version allows the router to be powered over the Ethernet by another PoE PSE device. The PoE PSE version also allows the router to power other devices over the Ethernet.

PoE PD
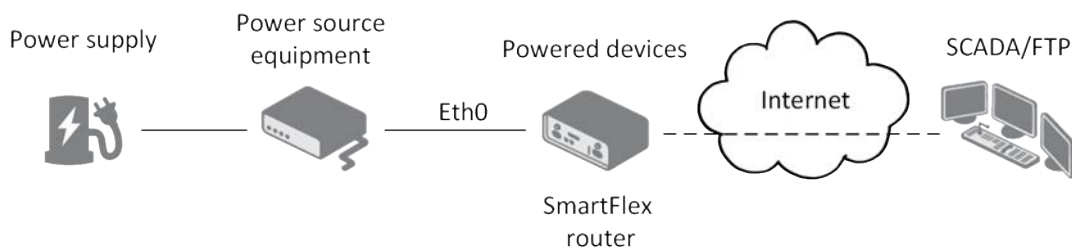
Figure 20: PoE PD usage

The PoE PD parameters can be found in Chapter 7.8. The POE LED on the front panel of the router lights up green when voltage is present in an Ethernet port so the user knows the router can be PoE powered. You can still power the router with this connector even if the router is powered with PoE (in PoE PD version), but the input voltage must be higher than 15 V DC. If the input voltage is lower than 15 V DC and the PoE voltage is present (PoE LED green on), the router will still be powered from the Ethernet connector via PoE.

Note: You can not power the router via the ETH2 ports on the SWITCH router version. The PoE PD is available on the ETH0 and ETH1 ports only.

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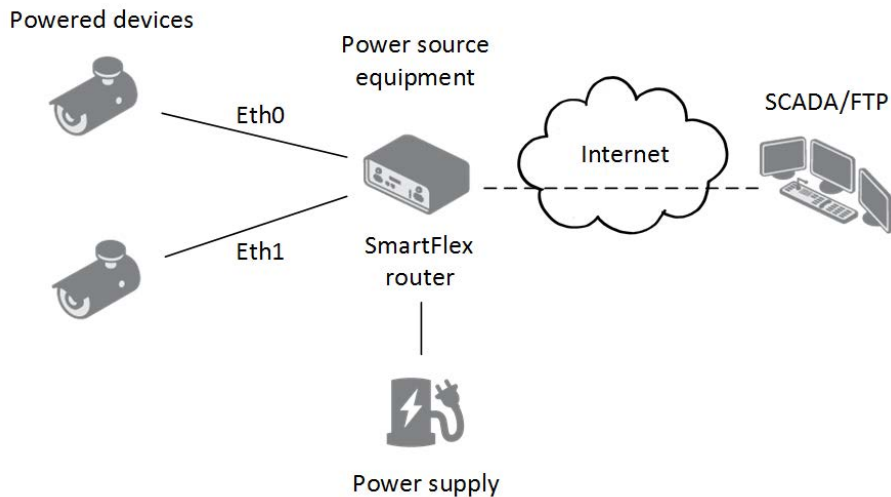
PoE PSE

Figure 21: PoE PSE usage

> The power supply used with the PoE PSE router has to provide voltage from 44 to 57 V DC and the output power has to be at least 65 W for full PoE+ use (Class 4) in both Ethernet ports (ETH0 and ETH1).

The PoE PSE parameters can be found in Chapter 7.8. The PoE state is indicated by the POE LED on the front panel of the router, see Chap. 5.8.1. When sufficient voltage (44 to 57 V) and power is available is indicated by the green light. A yellow POE LED indicates insufficient power or voltage through the PWR connector. When a device is being powered from the router, the POE LED is will show blinking green. Yellow blinking is shown for an overload (the powered device is using too much power) or a short circuit (incorrect wiring of the cable or of the device without PoE support).

You can enable or disable the PoE PSE feature separately on the ETH0 and ETH1 ports via the Web interface of the router. This can be found in the *LAN* configuration pages (*Primary* for ETH0, *Secondary* for ETH1). When PoE PSE is enabled, you can find the current, voltage, power and power class information on the *General* page of the router's Web interface. See the *Configuration manual* [2]. Via SSH or in scripts you can use the Shell command `pse`.

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5.8.8 USB Port

Panel socket USB-A.

Pin	Signal mark	Description	Data flow direction
1	+5 V	Positive pole of 5 V DC supply voltage, 0.5 A	
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 14: Connection of USB connector

Figure 22: USB connector

The USB port is disabled on overload to prevent its damage (connected device is trying to get too high current). The port is enabled again after reboot of the router.

Mounting USB flash drive to the system: To use the USB flash drive in the Linux system of the router, it is necessary to mount it. Use `dmesg` command to see the name of recently connected device (E. g. `sda: sda1`) and then use `mount` command. Example:
`mount /dev/sda1 /mnt`

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5.8.9 I/O Port

Panel socket 6-pin.

Pin	Signal mark	Description
1	IN0	Binary input 0
2	IN0	Binary input 0
3	IN1	Binary input 1
4	IN1	Binary input 1
5	OUT	Binary output
6	OUT	Binary output

Table 15: Connection of I/O port
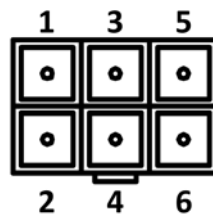
Figure 23: I/O connector

The I/O user Interface is designed for the processing of binary input and control (setting) of binary output. Binary output is open in the default configuration. The isolation strength is 1.5 kV. The pins are isolated from each other with the same strength.

The input circuits are bipolar and allow connection as needed with common plus or minus (according to the connection of an external voltage).

Binary inputs

- Characteristics of inputs:

logical 0 / 1*	Voltage	Current	Web interface status
log. 1 max	3 V	0.4 mA	Off
log. 0 min	5 V	0.7 mA	On
log. 0 type	12 V	2 mA	On
log. 0 max	60 V	7 mA	On

Table 16: Characteristics of inputs

* The binary input status in the Shell is returned via `io get bin0` or `io get bin1`.

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- Binary inputs connection example:

Figure 24: Binary inputs connection

Binary output

- Binary output parameters:
  - 60 V AC / 300 mA
  - 60 V DC / 300 mA

- The current of the binary output is limited by a resettable fuse (300 mA).
- Binary output connection example:
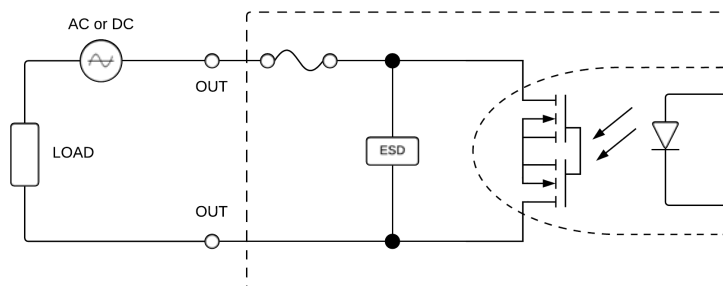
Figure 25: Binary output connection

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5.8.10 Reset

When the *PWR* LED starts flashing on the front panel, it is possible to restore the default configuration of the router by pressing the *RST* button on the rear pane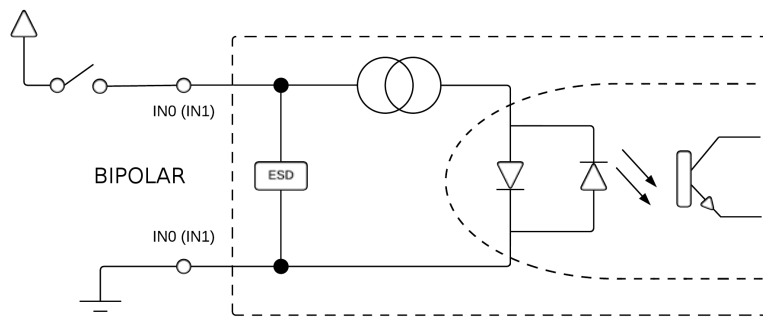l. After pressing this button the default configuration will be restored and the router will reboot (after which the green LED will be on).

In order to press the *RST* button it is necessary to use a narrow screwdriver or any other small tool.
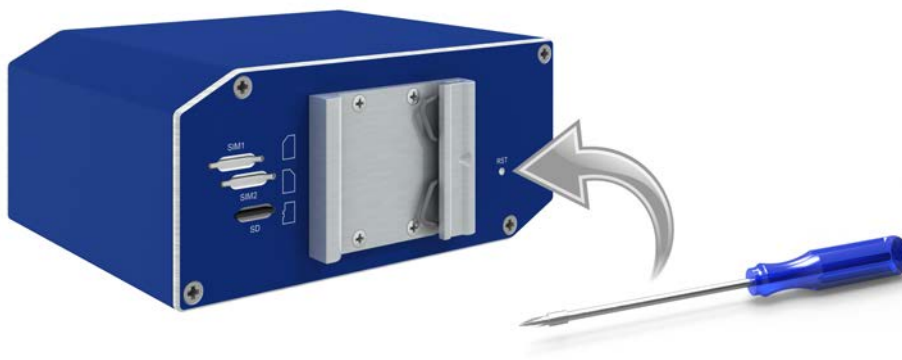
Figure 26: Router reset

Before resetting the router, it is recommended to back up the router configuration settings (see *Configuration manual*) because resetting the router will return all configuration settings to their default states.

It is important to distinguish between the router reset and reboot.

Action	Router behavior	Invoking events
Reboot	Turns off and then turns on the router	Disconnect and reconnect the power, press the *Reboot* button in the web configuration
Reset	Restores the default configuration and reboots the router	Press the *RST* button

Table 17: Description of router reset and restart

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6. First Use

6.1 Connecting the router before first use

Before putting the router into operation it is necessary to connect all components which are required to run your applications. Don't forget to insert SIM card.

> ⚠️ The router can not operate without connected antenna, SIM card and power supply. If the antenna is not connected, router can be damaged.
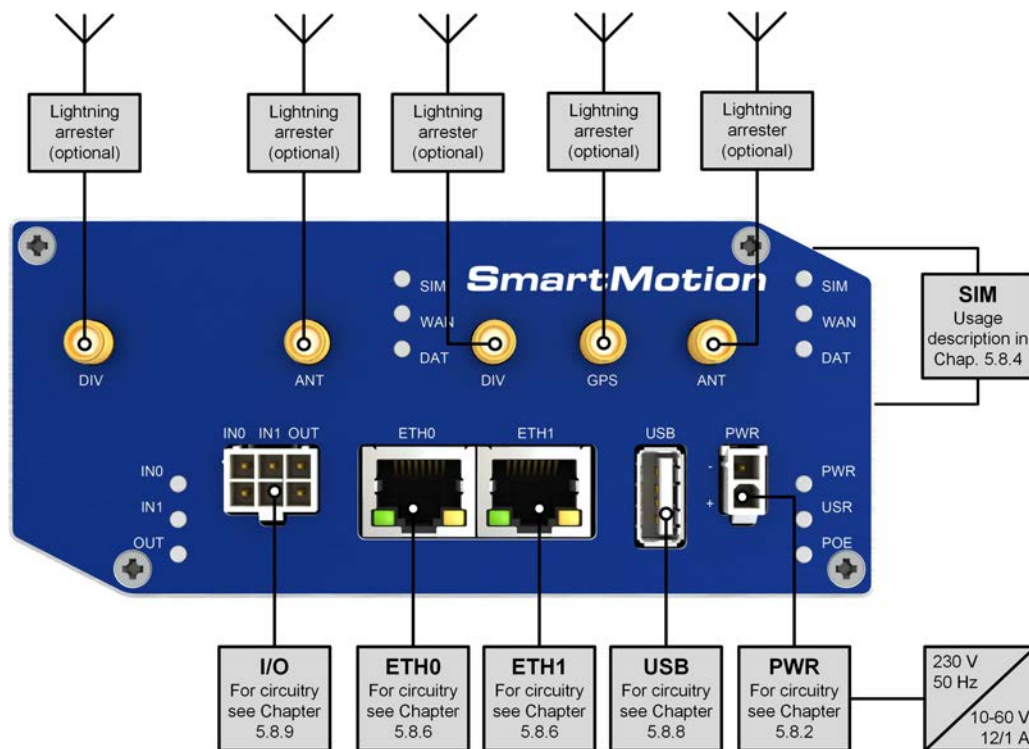
Figure 27: Router connection

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6.2 Start

The router is put into operation when the power supply is connected to this router. By default, the router will automatically start to log on to the default APN. DHCP server will start to assign addresses for devices on the Ethernet port ETH0. Router behavior can be changed via the web interface. This is described in detail in the *Configuration manual for SmartMotion routers*.

6.3 Configuration

⚠ **Attention!** If no SIM card is inserted in the router, it is not possible to operate. Inserted SIM card must have activated data transmission.

6.3.1 Configuration over web browser

For status monitoring, configuration and administration of the router is available a web interface which can be accessed by entering the IP address of the router into the web browser. The default IP address of the router is 192.168.1.1. **Attention, it is necessary to use HTTPS protocol for secure communication over a network!**
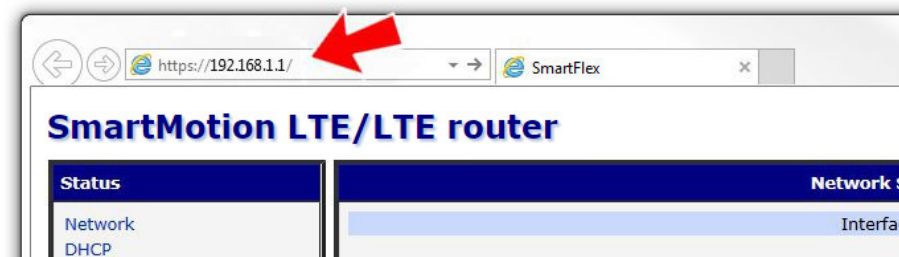
Figure 28: Entering the IP address of the router

Configuration may be performed only by the user "root" with default password "root".

Figure 29: Entering login information

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After successfully entering login information user gains access to the router via his internet browser.

Figure 30: Router web interface

A detailed description of the router settings via the Web interface can be found in the document *Configuration manual for SmartMotion routers*.

7. Technical Parameters

7.1 Basic parameters

SmartMotion Router		
Temperature range	Operating Storage	-40 °C to +75 °C -40 °C to +85 °C
Cold start	-35 °C -40 °C	Data transfers via mobile network are available immediately Data transfers via mobile network are available approximately in five minutes after the start of the router. Everything else is functional immediately.
Humidity	Operating Storage	0 to 95 % relative humidity non condensing 0 to 95 % relative humidity non condensing
Altitude	Operating	2000 m / 70 kPa
Degree of protection		IP30
Supply voltage		10 to 60 V DC
Battery for RTC		CR1225
Consumption	Idle Average Peak Sleep mode	2.5 W 4 W 11 W 10 mW
Dimensions		55 x 97 x 125 mm (DIN 35 mm, EN 60715)
Weight	Metal box	approximately 420 g (depends on the version)
Antenna connectors		5x SMA – 50 Ω 1x R-SMA – 50 Ohm (**only for versions with WiFi module!**)
User interface	2x ETH USB I/O Micro SD	Ethernet (10/100 Mbps) USB 2.0 6-pin panel socket SDHC, SDXC

Table 18: Basic parameters

7.2   Standards and regulations

The router complies with the following standards and regulations.

Standards and regulations	
Telecom and emission for the 1st module	ETSI EN 301 511 V12.5.1, ETSI EN 300 440 V2.1.1, ETSI EN 301 908-1 V11.1.1, ETSI EN 301 908-2 V11.1.1, ETSI EN 301 908-13 V11.1.1
Telecom and emission for the 2nd module	ETSI EN 300 328 V2.1.1, ETSI EN 301 893 V2.1.1
EMC	ETSI EN 301 489-1 v1.9.2, ETSI EN 301 489-1 V2.1.1, Draft ETSI EN 301 489-19 V2.1.0, Draft ETSI EN 301 489-52 V1.1.0, ETSI EN 301 489-17 V3.1.1
Safety	EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013 + AC:2011, EN 62311:2008
E-Mark – EMC for devices in transportation	E-Mark homologation number: 10R – 04 8180

Table 19: Standards and regulations

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7.3 Type tests and environmental conditions

Phenomena	Test	Description	Test levels
ESD	EN 61000-4-2	Enclosure contact Enclosure air	± 6 kV (crit. A) ± 8 kV (crit. A)
RF field AM modulated	EN 61000-4-3	Enclosure	20 V/m (crit. A) (80 – 2700 MHz) 3 V/m (crit. A) (2700 – 6000 MHz)
Fast transient	EN 61000-4-4	Signal ports Power ports Ethernet ports	± 2 kV (crit. A) ± 2 kV (crit. A) ± 2 kV (crit. A)
Surge	EN 61000-4-5	Ethernet ports Power ports I/O ports	± 2 kV (crit. B), shielded cab. ± 0,5 kV (crit. B) ± 1 kV, L to L (crit. A) ± 2 kV, L to GND (crit. A)
RF conducted	EN 61000-4-6	All ports	10 V/m (crit. A) (0,15 – 80 MHz)
Radiated emission	EN 55022	Enclosure	Class B
Conducted emission	EN 55022	DC power ports Ethernet ports	Class B Class B
Power frequency magnetic field	EN 61000-4-8	Enclosure	160 A/m (crit. A)
Dry heat	EN 60068-2-2	+75 °C, 40 % rel. humidity	
Cold	EN 60068-2-1	-40 °C	
Damp heat	EN 60068-2-78	95 % rel. humidity (+40 °C)	
Temperature variation	EN 60068-2-14 Nb	-40 °C / +70 °C, 3 h / 3 h, 2 cycles, 3 K/min	

Table 20: Type tests and environmental conditions

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7.4   Technical parameters of both of cellular modules

Technical parameters of both of cellular modules	
LTE parameters	Bit rate 100 Mbps (DL) / 50 Mbps (UL) 3GPP rel. 8 standard Supported bandwidths: 5 MHz, 10 MHz, 20 MHz Supported frequencies: B20 (800 MHz), B8 (900 MHz), B3 (1800 MHz), B1 (2100 MHz), B7 (2600 MHz) Max power – typical 23 dBm
HSPA+ parameters	Bit rate 42 Mbps (DL) / 5,76 Mbps (UL) 3GPP rel. 7 standard UE CAT. 1 to 6, 8, 10, 12, 14 3GPP data compression Supported frequencies: B8 (900 MHz), B3 (1800 MHz), B1 (2100 MHz) Max power – typical 24 dBm
UMTS parameters	PS bit rate 384 kbps (DL) / 384 kbps (UL) CS bit rate 64 kbps (DL) / 64 kbps (UL) W-CDMA FDD standard Supported frequencies: B8 (900 MHz), B3 (1800 MHz), B1 (2100 MHz) Max power – typical 24 dBm
GPRS/EDGE parameters	Bit rate 237 kbps (DL) / 59,2 kbps (UL) GPRS multislot class 10, CS 1 to 4 EDGE multislot class 12, CS 1 to 4, MCS 1 to 9 Supported frequencies: 900 / 1800 MHz Max power – typical 26–33 dBm
GPRS/EDGE power classes	EGSM 900: Class 4 (33 dBm) GSM 1800: Class 1 (30 dBm) EDGE 900: Class E2 (27 dBm) EDGE 1800: Class E2 (26 dBm)

Table 21: Technical parameters of both of cellular modules

Antenna Requirements

- VSWR – <2:1 (Antenna input impedance response as function of frequency. This shows the antenna resonances and its bandwidth).

- SMA – 50 Ω

- For good diversity performance, the primary and secondary antennas should have different polarizations.

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7.5   Technical parameters of GPS

GPS specifications	
Antenna	SMA 50 Ω – active
Protocols	NMEA 0183 v3.0
Frequency	1575.42 MHz
Sensitivity	Tracking: -161 dBm* Acquisition (Assisted): -158 dBm** Acquisition (Standalone): -145 dBm**
Acquisition time	Hot start: 1 s Warm start: 29 s Cold start: 32 s
Accuracy	Horizontal: < 2m (50 %); < 5 m (90 %) Altitude: < 4 m (50 %); < 8 m (90 %) Velocity: < 0.2 mps

Table 22: Technical parameters of GPS

* Tracking sensitivity is the lowest GPS signal level for which the device can still detect an in-view satellite 98 % of the time when in sequential tracking mode.

** Acquisition sensitivity is the lowest GPS signal level for which the device can still detect an in-view satellite 50 % of the time.

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7.6   Technical parameters of WiFi

WiFi	
Antenna connector	R-SMA – 50 Ω
Supported WiFi band	2.4 GHz, 5 Ghz
Standards	802.11a, 802.11b, 802.11g, 802.11n
2.4 GHz supported channels	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
5 GHz supported channels [1]	36, 38, 40, 42, 44, 46, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 149, 153, 157, 161, 165
Type of device	Access point, station
Max. clients in AP mode	10
WiFi TX Output Power	17,3 dBm
WiFi RX Sensitivity	-96,3 dBm

Table 23: Technical parameters of WiFi

7.7   Technical parameters of I/O port

• Characteristics of inputs:

logical 0 / 1*	Voltage	Current	Web interface status
log. 1 max	3 V	0.4 mA	Off
log. 0 min	5 V	0.7 mA	On
log. 0 type	12 V	2 mA	On
log. 0 max	60 V	7 mA	On

Table 24: Characteristics of inputs

* The binary input status in the Shell is returned via `io get bin0` or `io get bin1`.

• Binary output parameters:
    – 60 V AC / 300 mA
    – 60 V DC / 300 mA

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[1] The number of supported channels depends on selected Country Code.

7.8   Technical Parameters of Power over Ethernet (PoE)

Standards IEEE 802.3at-2009 (PoE+) and IEEE 802.3af-2003 (PoE) are supported. Cabling needed is Category 5, up to 12.5 Ω. It is possible to use a passive PoE injector.

PoE PD: parameters for opposite PSE	
Input voltage range	42.5 – 57 V
Power available	25.50 W
Maximum current	600 mA

Table 25: PoE PD: parameters for opposite PSE

PoE PSE parameters	
Power supply needed	44 – 57 V, 65 W
Power available	2x 25.50 W (ETH0, ETH1)

Table 26: PoE PSE parameters

7.9   Other Technical Parameters

Other technical parameters	
CPU power	2 DMIPS per MHz
Flash memory	256 MB
RAM	512 MB
M-RAM	128 kB

Table 27: Other technical parameters

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8. Recommended Literature

[1] Advantech B+B SmartWorx: **Start Guide for SmartMotion**,
[2] Advantech B+B SmartWorx: **Configuration Manual for SmartMotion Routers**,
[3] Advantech B+B SmartWorx: **Commands and Scripts for v2 and v3 Routers**.

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9. Troubleshooting

⚠️

If you cannot connect to the router from your PC, your network card may be configured in such a way that it is not possible to connect to the router. Take one or more of the following steps in order to solve the problem:

- Make sure your PC's network card is configured to obtain the IP address form the DHCP server (by default the DHCP server is running in the router).
- Set the communication rate to 10 MB/s in the properties of your network card.
- Connect the router to the PC via Switch.
- Connect the router to the PC, start the router first and then start the PC after the router's initialization.

9.1   FAQ

✍ **The router reboots itself and the Ethernet connection fails.**

- *The router will not work well without an antenna. Keep the antenna as far as possible from the power supply.*

✍ **Ethernet connection fails or is not establishing.**

- *It is possible to turn auto negotiation off and set a rate and duplex manually on the Ethernet interface of the router. Available on "LAN Configuration" page in the router.*

✍ **Mobile WAN connection fails.**

- *Check the signal power ("Mobile WAN status" page). If the signal power is weak, you will have to use a better antenna. If the neighbouring cells have a similar signal strength, you will need to use a directional antenna. For proper operation, the signal levels have to be good.*
- *Try to enable automatic ping from the router, which will check the connection when there are no data running and in the case of a failed ping, restart the connection. This can be done on the "Mobile WAN Configuration" page in the router in the "Check connection" section. "Enable + bind" option is to ensure the ping goes always through Mobile WAN network interface.*

✍ **Mobile WAN connection cannot be established.**

- *Check the "Mobile WAN Configuration" – APN, name, password and IP address (all can be blank).*
- *Try to enter the SIM card PIN – verify that the SIM card has the PIN code entered. Available on "Unlock SIM Card" page in the "Administration" section.*

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- *In a private APN it is not recommended to get the DNS settings from operator (on "Mobile WAN" page)*
- *Go to "System Log" page in "Status" section and observe where the error occurs.*

✍ **I cannot connect from the Internet to the device behind the router. I have NAT enabled.**

- *The device's gateway has to be configured so it points to the router.*

✍ **I can't access my Web server placed behind the router over NAT.**

- *The remote HTTP access to the router has to be disabled on "NAT Configuration" page in the router. Also enable "Send all remaining incoming packets to default server" feature and fill in the IP address of your Web server. On the Web server, the default gateway has to be the IP address of the router.*

✍ **DynDNS doesn't work.**

- *With private APN this will not work.*
- *If the same IP address is recorded in your canonic name as a dynamically assigned address, it means that the operator is using NAT or a firewall.*
- *You can verify NAT using ping to your server with static address and then compare with router's IP address.*
- *You can verify a Firewall by accessing remotely to the router's Web interface.*
- *The operator may not provide the address of DNS server and without DNS server's address it is impossible to connect to the dyndns.org server. The following messages will be shown in the System Log:*
  - *DynDNS daemon started*
  - *Error resolving hostname: no such file or directory*
  - *Connect to DynDNS server failed*

✍ **L2TP or IPSec isn't establishing.**

- *Check the "System Log" page for error messages.*

✍ **IPSec tunnel establishes but the communication does not run.**

- *Probably there are bad routing rules defined in the connected devices, or the default gateway.*

✍ **I switched the router to offline mode by SMS message, but the router is in online mode after reboot.**

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

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✍ **Serial communication is not working.**

- *Verify that the router model supports serial communications. Also verify the serial communication settings. To do so, open the router's configuration menu via the web browser, select the appropriate "Expansion Port" from "Configuration" part of the menu and verify the settings.*

✍ **Is the router Cisco compatible? Can I use the Cisco configuration?**

- *No, the Firmware in the router (Conel OS) is based on Linux with BusyBox. Thus the Cisco configuration cannot be used. But network connections are defined by standards so connecting the router to the Cisco or other networking devices is possible and will be compatible.*

✍ **FTP or SFTP does not work**

- *FTP will work on v2 routers only. You can use SFTP on all routers to transfer files to/from the router. If having troubles with FTP on v2 routers, make sure you have FTP enabled: "Configuration" section, "Services", "FTP". Then you can connect with any client on port 21 with name and password same as for the Web interface. If having troubles with SFTP, make sure you have SSH enabled: "Configuration" section, "Services", "SSH". Then you can connect with any client on port 22 with name and password same as for the Web interface.*

✍ **How can I connect to the router's command line? (SSH, Telnet)**

- *You can use SSH on all routers or Telnet on v2 routers only. SSH is enabled by default, but you can verify in Web interface in "Configuration" section, "Services", "SSH". Then connect with any SSH client on port 22 of the router. User and password is the same as for the Web interface. Telnet on v2 routers can be enabled here: "Configuration" section, "Services", "Telnet".*

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10. Customers Support

10.1 Customer Support for NAM

E-mail: support@advantech-bb.com
Web: www.advantech-bb.com

10.2 Customer Support for Europe

E-mail: iiotcustomerservice@advantech.eu
Web: www.advantech-bb.com

10.3 Customer Support for Asia

E-mail: icg.support@advantech.com.tw
Web: www.advantech.com

Upkeep – Advices:

- The SIM-card must be handled carefully as with a credit card. Don't bend, don't scratch on this and do not expose to static electricity.

- During cleaning of the router do not use aggressive chemicals, solvents and abrasive cleaners!

CE Hereby, Advantech B+B SmartWorx s.r.o. company declares that the radio equipment narrated in this user's guide is in compliance with EU Directive **2014/53/EU**.

The full text of the EU Declaration of Conformity is available at the following internet address: www.advantech-bb.cz/eudoc

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