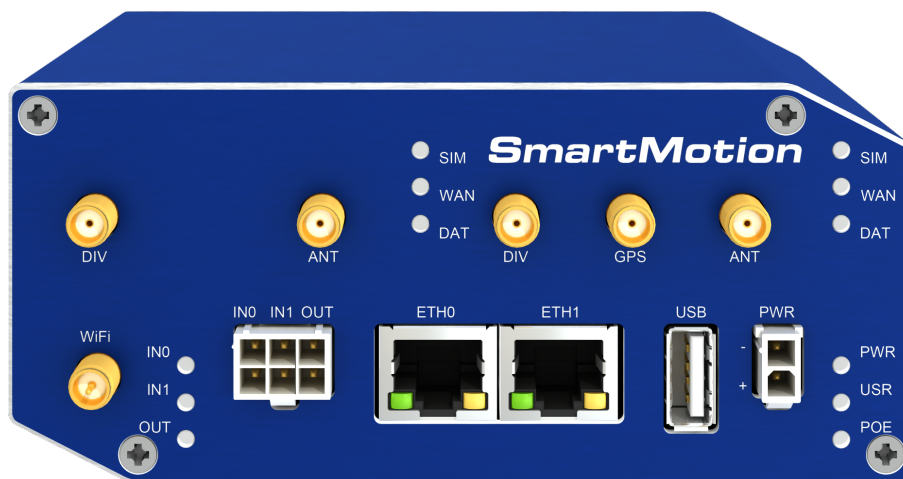


Twin Cellular Module Router

SmartMotion ST355

USER MANUAL



B+B SMARTWORX

Powered by

ADVANTECH

Advantech B+B SmartWorx – Americas

Advantech B+B SmartWorx

707 Dayton Road
Ottawa, IL 61350 USA

Phone +1 (815) 433-5100

Fax +1 (815) 433-5105

Website

www.advantech-bb.com

Advantech B+B SmartWorx – Europe

Advantech B+B SmartWorx s.r.o.

Sokolska 71
562 04, Usti nad Orlici,
Czech Republic

Phone +420 465 524 421

Website

www.advantech-bb.com

© 2016 Advantech B+B SmartWorx s.r.o. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photography, recording, or any information storage and retrieval system without written consent. Information in this manual is subject to change without notice, and does not represent a commitment on the part of Advantech B+B SmartWorx.

Advantech B+B SmartWorx s.r.o. shall not be liable for incidental or consequential damages resulting from the furnishing, performance, or use of this manual.

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

Used symbols



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



Attention – Problems that can arise in specific situations.



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:

cellularsales@advantech-bb.com.



Contents

1	Safety Instructions	2
2	WEEE directive	3
3	Router Description	4
3.1	Usage of the Router	5
4	Contents of Package	8
5	Router Design	9
5.1	Router versions	9
5.2	Delivery identification	9
5.3	Order codes	10
5.4	Basic dimensions of the router box	12
5.5	Mounting recommendations	12
5.6	Removing from the DIN rail	13
5.7	Description of the rear panel	14
5.8	Description of the front panel	14
5.8.1	Status indication	15
5.8.2	Power connector PWR	16
5.8.3	Antenna connector ANT, DIV, GPS and WiFi	17
5.8.4	SIM card reader	18
5.8.5	MicroSD card reader	18
5.8.6	Ethernet Ports (ETH0 and ETH1)	19
5.8.7	Power over Ethernet (PoE)	20
5.8.8	USB Port	22
5.8.9	I/O Port	22
5.8.10	Reset	25
6	First Use	26
6.1	Connecting the router before first use	26
6.2	Start	27
6.3	Configuration	27
6.3.1	Configuration over web browser	27
7	Technical Parameters	29
7.1	Basic parameters	29
7.2	Standards and regulations	30

7.3	Type tests and environmental conditions	31
7.4	Technical parameters of cellular modules	32
7.4.1	Technical parameters of the first cellular module	32
7.4.2	Technical parameters of the second cellular module	33
7.5	Technical parameters of GPS	34
7.6	Technical parameters of WiFi	34
7.7	Technical parameters of I/O port	35
7.8	Technical Parameters of Power over Ethernet (PoE)	35
7.9	Other Technical Parameters	36
8	Recommended Literature	37
9	Troubleshooting	38
9.1	FAQ	38
10	Customers Support	40
10.1	Customer Support for NAM	40
10.2	Customer Support for Europe	40
10.3	Customer Support for Asia	40

List of Figures

1	Access to the Internet from LAN	5
2	Backed up access to the Internet	6
3	Using VPN tunnel	6
4	Serial Gateway	7
5	Contents of package	8
6	Basic version	9
7	Version with WiFi module	9
8	Label examples	9
9	Basic dimensions of the router box	12
10	Default position of DIN holder	13
11	Removing from the DIN rail	13
12	SmartMotion front panel	14
13	Power connector	16
14	Connection of power supply	16
15	Connecting of the antenna	17
16	SIM cards	18
17	MicroSD card	19
18	Ethernet connector	19
19	Connection of Ethernet cable	20
20	PoE PD usage	20
21	PoE PSE usage	21
22	USB connector	22
23	I/O connector	22
24	Binary inputs connection	23
25	Binary output connection	24
26	Router reset	25
27	Router connection	26
28	Entering the IP address of the router	27
29	Entering login information	27
30	Router web interface	28

List of Tables

1	Router versions	9
2	Delivery identification	9
3	Order codes overview	10
4	Power over Ethernet	10
5	Type of router box	10
6	Type of power supply	10
7	Examples of order code	11
8	Front panel description	14
9	Status indication	15
10	Connection of power connector	16
11	Technical specifications of microSD card	18
12	Connection of Ethernet connector	19
13	Insulation strength of Ethernet ports	20
14	Connection of USB connector	22
15	Connection of I/O port	22
16	Characteristics of inputs	23
17	Description of router reset and restart	25
18	Basic parameters	29
19	Standards and regulations	30
20	Type tests and environmental conditions	31
21	Technical parameters of the first cellular module	32
22	Technical parameters of the second cellular module	33
23	Technical parameters of GPS	34
24	Technical parameters of WiFi	34
25	Characteristics of inputs	35
26	PoE PD: parameters for opposite PSE	35
27	PoE PSE parameters	35
28	Other technical parameters	36

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.
- 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. 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.



2. Product Disposal Instructions

The WEEE (Waste Electrical and Electronic Equipment: 2002/96/EC) 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 its life this product **MUST NOT** be mixed with other commercial waste for disposal. Check the terms and conditions of your supplier for disposal information.

3. Router Description

SmartMotion ST355 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 can be equipped with a module supporting LTE technology with frequency bands 450, 800, 1800 a 2600 MHz. 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.



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

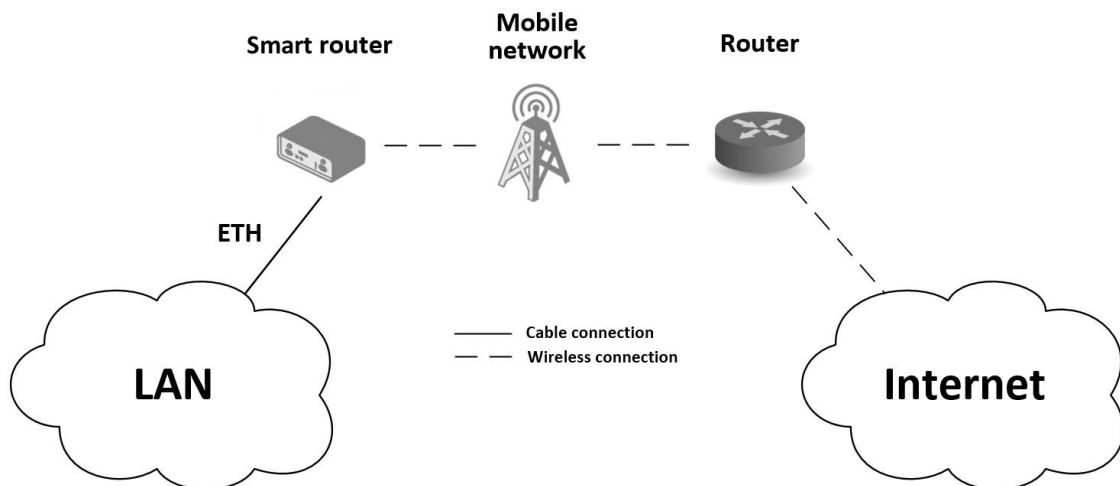


Figure 1: Access to the Internet from LAN

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

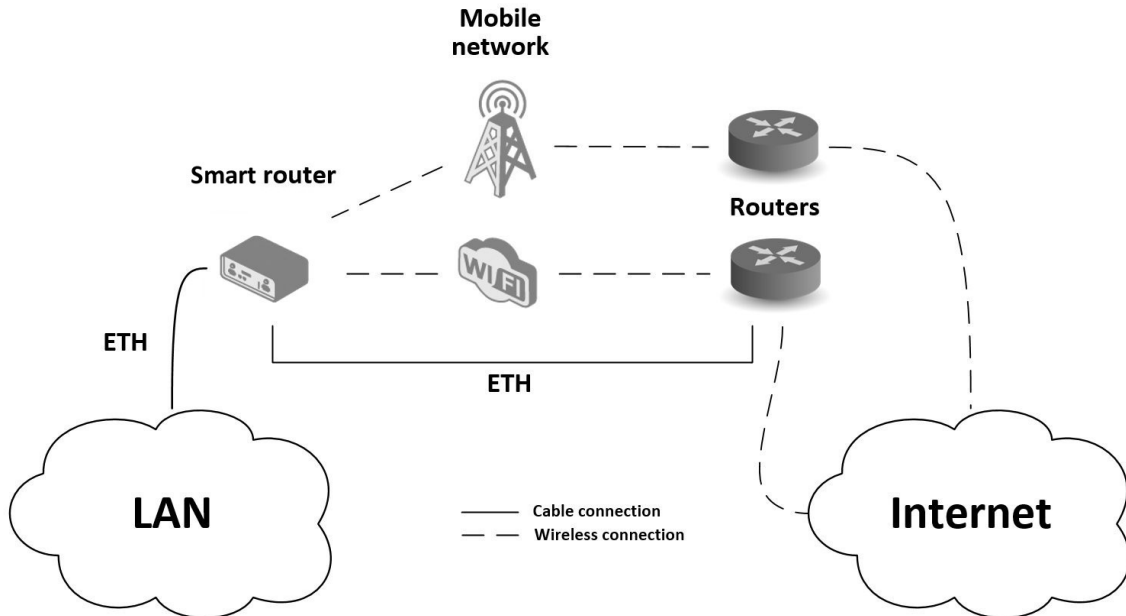


Figure 2: Backed up access to the Internet

III. Secure networks interconnection or using VPN

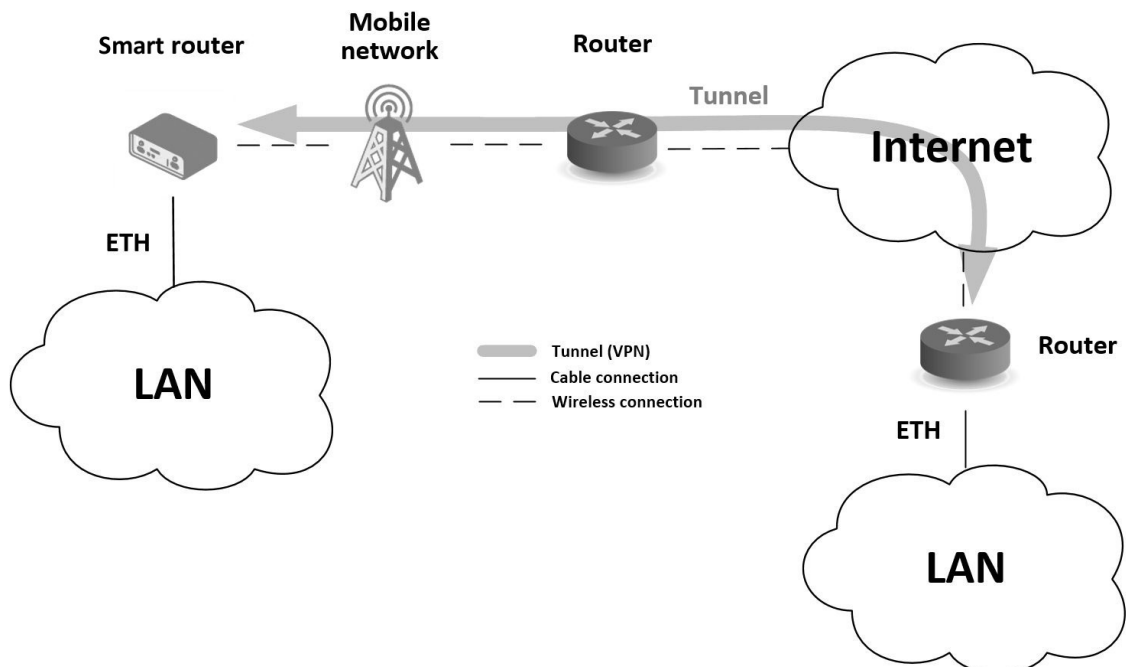


Figure 3: Using VPN tunnel

IV. Serial Gateway

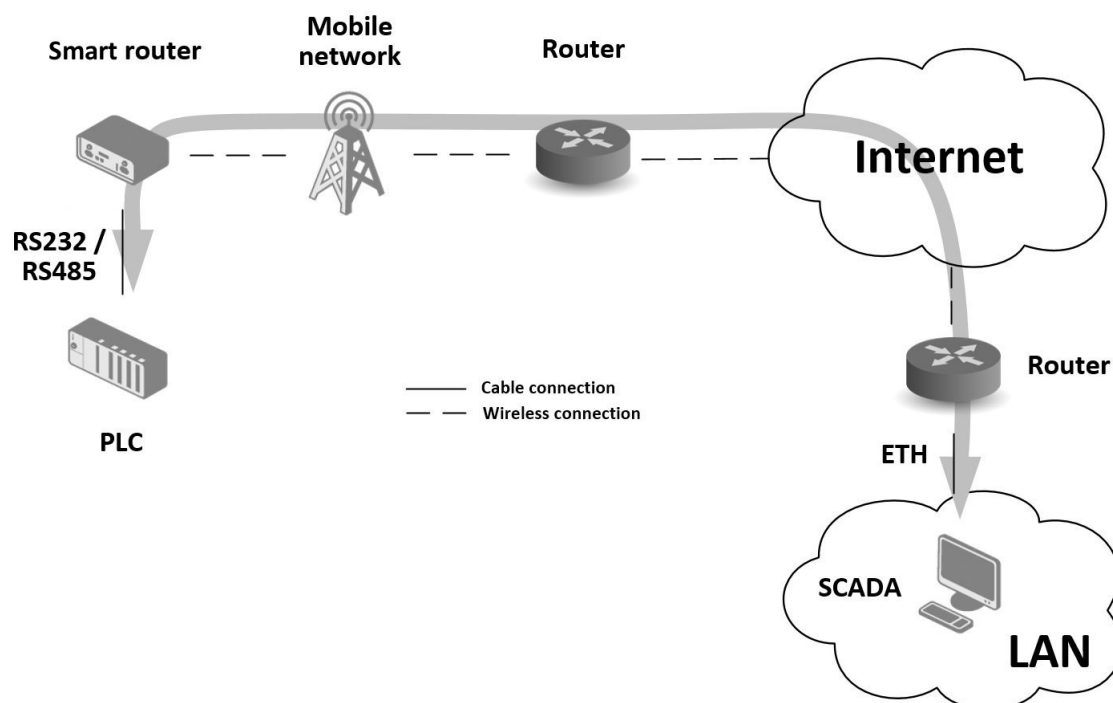


Figure 4: Serial Gateway

4. Contents of Package



Basic delivered set of router includes:

- Router,
- Power supply,
- Crossover UTP cable,
- Up to five external antennas,
 - 2x Terminal antenna for standard LTE
 - 2x Terminal antenna for LTE 450 MHz
 - 1x WiFi antenna (**if router contains WiFi module**)
- Loose power and I/O connector (+8 pins¹),
- 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!

¹These pins are designed for cables with a diameter from 0.2 to 0.8 mm²

5. Router Design

5.1 Router versions

SmartMotion ST355 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	Other
SmartMotion ST355	SmartMotion	Router in a metal box

Table 2: Delivery identification

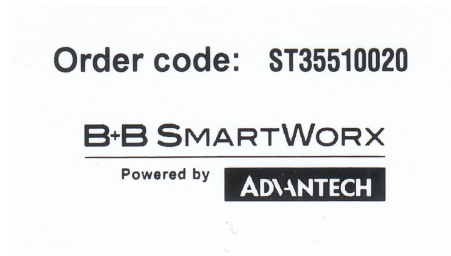


Figure 8: Label examples

5.3 Order codes

Order codes overview is shown in the table below.

Product Name	Order code	Features – interfaces
ST355	ST3520xyz*	2x LTE module (1x LTE 450 MHz), 2x ETH, 1x USB, 2x BI, 1x BO, 1x microSD reader, 4x SIM reader
ST355	ST3521xyz*	2x LTE module (1x LTE 450 MHz), 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
SR35508020	2x LTE module (1x LTE 450 MHz), 2x ETH, 1x USB, 2x BI, 1x BO, 1x microSD reader, 4x SIM reader, PoE PSE	metal	none
SR35519020	2x LTE module (1x LTE 450 MHz), 2x ETH, 1x USB, 2x BI, 1x BO, 1x microSD reader, 4x SIM reader, WiFi, PoE PD	metal	none
SR35510020	2x LTE module (1x LTE 450 MHz), 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.

5.4 Basic dimensions of the router box

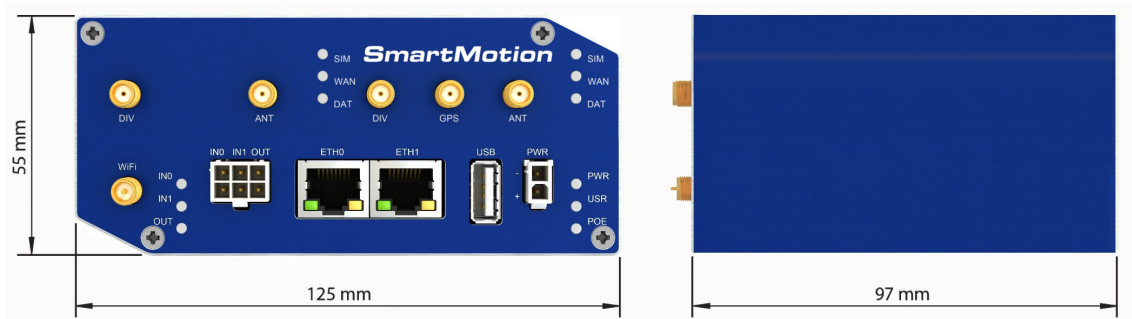


Figure 9: Basic dimensions of the router box

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 lightning 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:

- 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 $\sim 230 \text{ V}/50 \text{ Hz}$.
- 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 Removing from the DIN rail

DIN holder is suitable for DIN rail according to EN 60715 standard only. Default position of DIN holder, which is used for mounting the router on a DIN rail, is shown in the following figure:



Figure 10: Default position of DIN holder

For removing from the DIN rail it is necessary to lightly push upward the router so that the top part of the DIN holder hitched to the DIN rail get out of this rail and then fold out the top part of the router away from the DIN rail.

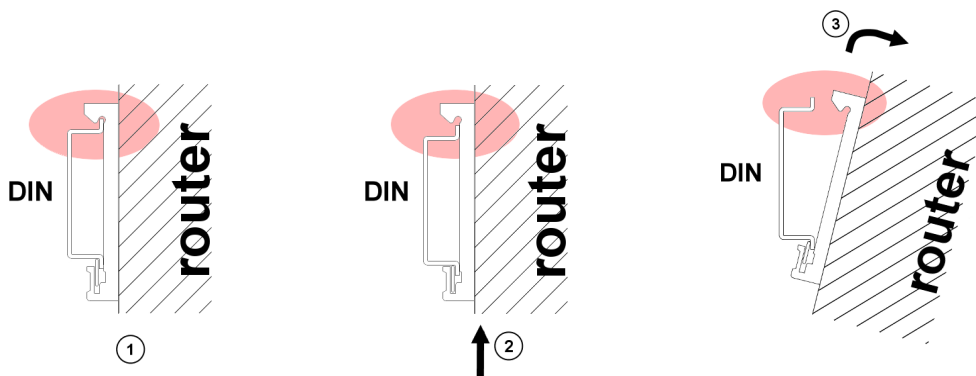


Figure 11: Removing from the DIN rail

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

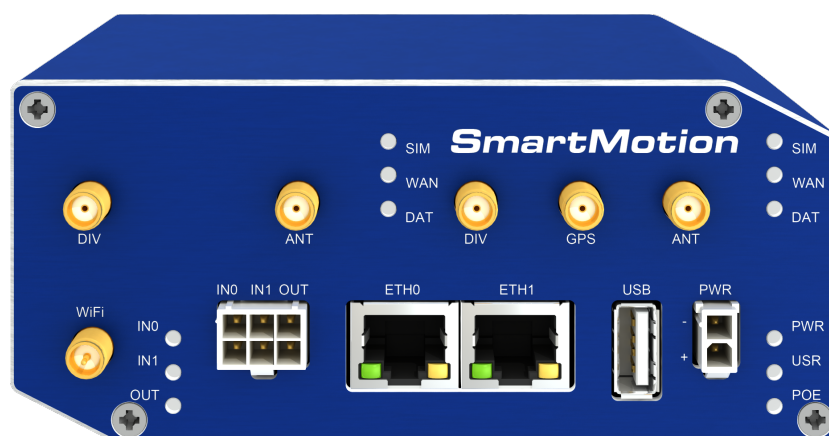


Figure 12: SmartMotion front panel

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* 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	LED goes out 1x per one sec. LED goes out 1x per two sec. LED goes out 1x per five sec.	Signal strength is from -50 dBm to -69 dBm Signal strength is from -70 dBm to -89 dBm or difference between neighbouring cells is exactly 3 dBm Signal strength is from -90 dBm to -113 dBm or difference between neighbouring cells is smaller than 3 dBm
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 Mbit/s Selected 10 Mbit/s
ETH0 ETH1	Yellow	On Blinking Off	The network cable is connected Data transmission The network cable is not connected

Table 9: Status indication

* 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].



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

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

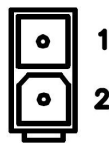


Figure 13: Power connector

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 `1pm`. It can then be awakened, for example, by an activity on binary input or using an internal timer.



Circuit example:

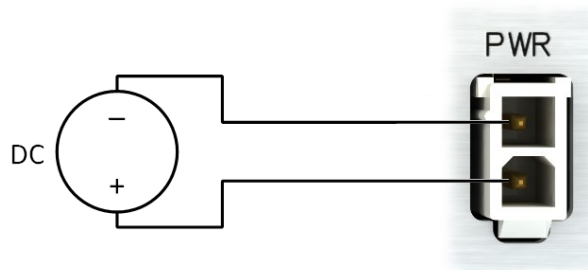


Figure 14: Connection of power supply



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.

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).

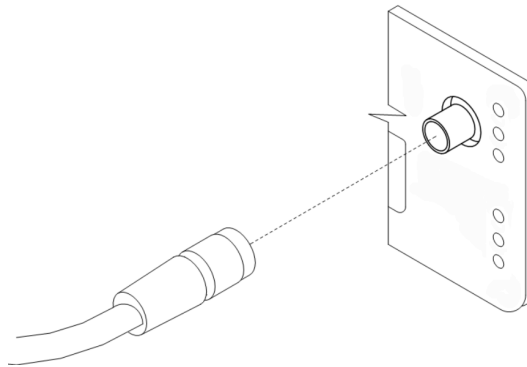


Figure 15: Connecting of the antenna



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

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 unblocked PIN code. The SIM cards might be of different adjusted APN (Access Point Name).

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.

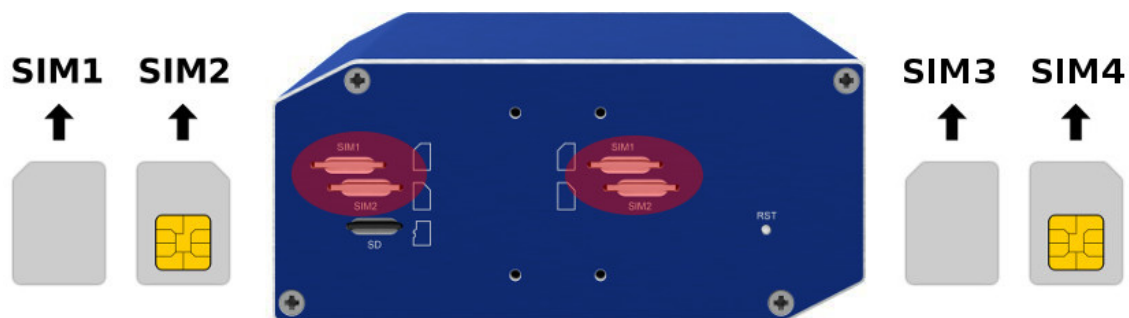


Figure 16: SIM cards

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

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

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

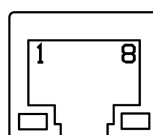


Figure 18: Ethernet connector

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

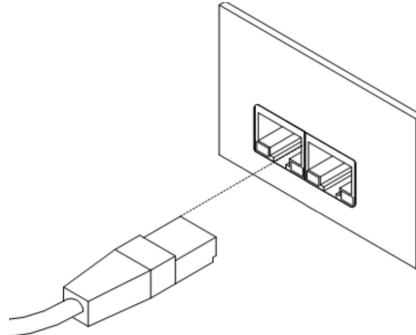


Figure 19: Connection of Ethernet cable



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

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

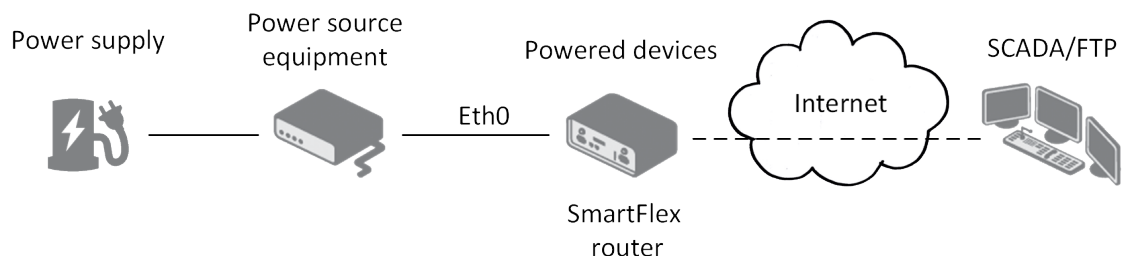


Figure 20: PoE PD usage

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 SWITCH version ETH2 connectors. The PoE PD is available on the ETH0 and ETH1 ports only.

PoE PSE

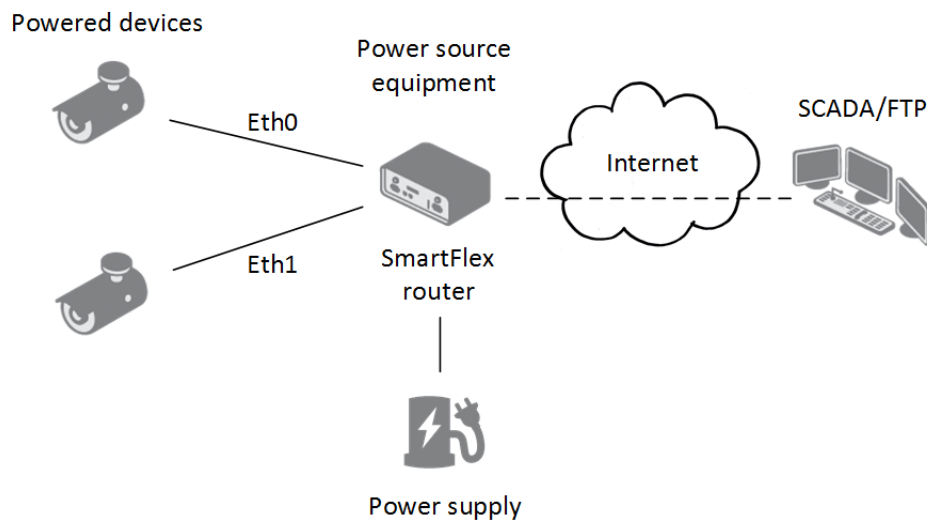


Figure 21: PoE PSE usage



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`.

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.

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

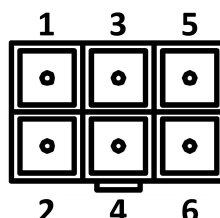


Figure 23: I/O connector

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`.

- Binary inputs connection example:

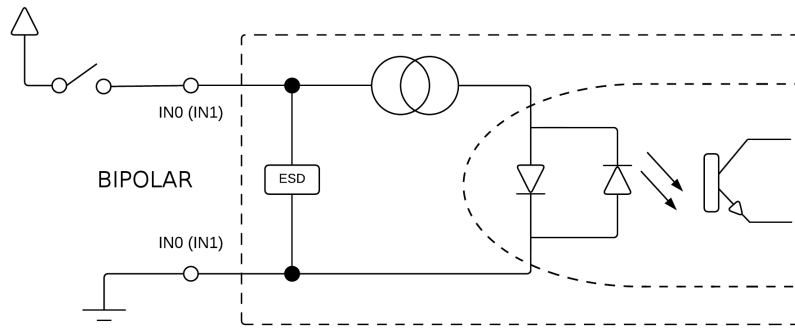


Figure 24: Binary inputs connection

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:

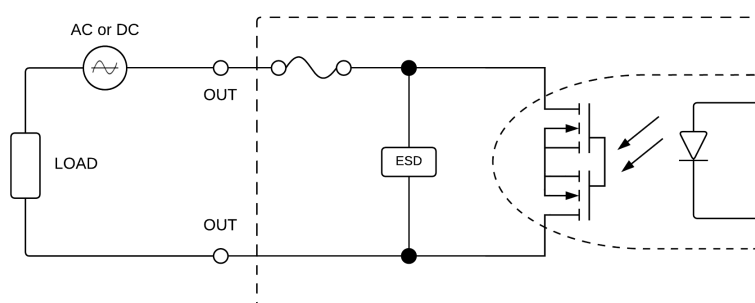


Figure 25: Binary output connection

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 panel. 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.

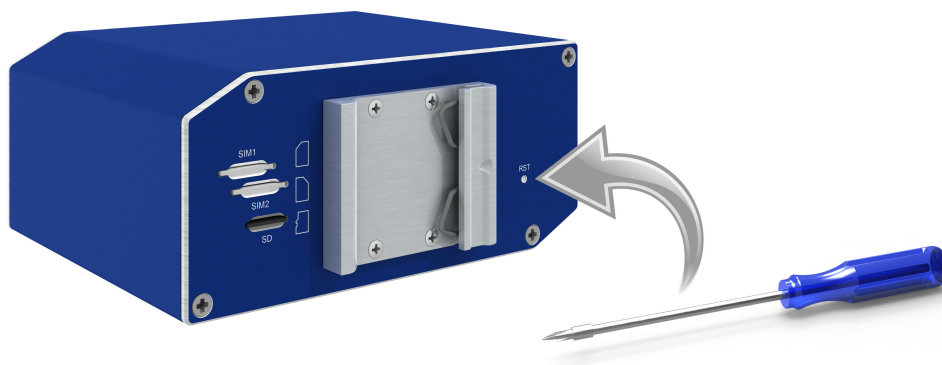


Figure 26: Router reset



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 <i>Reboot</i> button in the web configuration
Reset	Restores the default configuration and reboots the router	Press the <i>RST</i> button

Table 17: Description of router reset and restart

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.

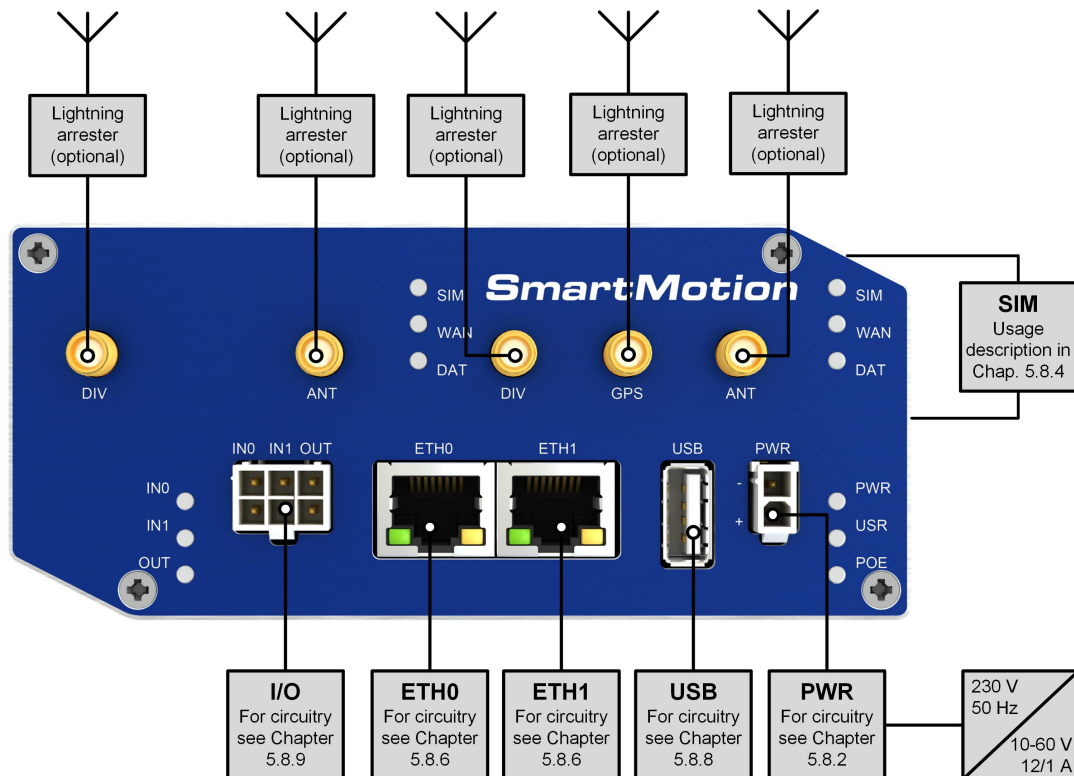


Figure 27: Router connection

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!**

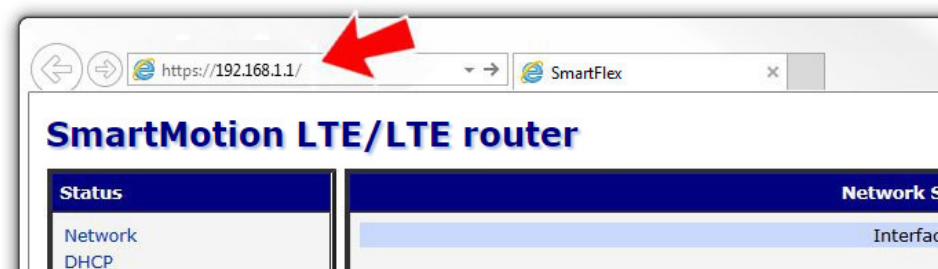


Figure 28: Entering the IP address of the router

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

Figure 29: Entering login information

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

SmartMotion LTE/LTE router

Status	General Status
<ul style="list-style-type: none"> General Mobile WAN WiFi WiFi Scan Network DHCP IPsec DynDNS System Log 	<p>Mobile Connection of 1st Module</p> <p>SIM Card : Primary IP Address : 10.0.7.6 IPv6 Address : Unassigned Rx Data : 580 B Tx Data : 1.3 KB Uptime : 0 days, 7 hours, 25 minutes</p> <p>» More Information «</p> <p>Mobile Connection of 2nd Module</p> <p>SIM Card : Secondary IP Address : Unassigned IPv6 Address : Unassigned State : Preparing</p> <p>» More Information «</p> <p>Primary LAN</p> <p>IP Address : 10.64.0.36 / 255.255.252.0 IPv6 Address : fc00::a40:28 / 118 MAC Address : 00:0A:14:84:1D:30 Rx Data : 1.0 MB Tx Data : 646.2 KB</p> <p>» More Information «</p> <p>Secondary LAN</p> <p>IP Address : 10.65.0.36 / 255.255.252.0 IPv6 Address : Unassigned MAC Address : 00:0A:14:84:1D:31 Rx Data : 0 B Tx Data : 0 B</p> <p>» More Information «</p> <p>WiFi</p> <p>IP Address : Unassigned IPv6 Address : Unassigned MAC Address : 20:C3:8F:F1:BE:73</p> <p>» More Information «</p> <p>System Information</p> <p>Firmware Version : 6.0.0 (2016-04-13) BETA #104 Serial Number : 6201401 Profile : Standard Supply Voltage : 24.3 V Temperature : 38 °C Time : 2016-04-13 08:34:41 Uptime : 0 days, 7 hours, 28 minutes</p>
<p>Configuration</p> <ul style="list-style-type: none"> LAN VRRP Mobile WAN PPPoE WiFi WLAN Backup Routes Firewall NAT OpenVPN IPsec GRE L2TP PPTP DynDNS NTP SNMP SMTP SMS USB Port Scripts Automatic Update 	
<p>Customization</p> <ul style="list-style-type: none"> User Modules 	
<p>Administration</p> <ul style="list-style-type: none"> Users Change Profile Change Password Set Real Time Clock Set SMS Service Center Unlock SIM Card Send SMS Backup Configuration Restore Configuration Update Firmware Reboot Logout 	

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	-20 °C to +60 °C -40 °C to +85 °C
Cold start	-15 °C	Data transfers via mobile network are available immediately
	-20 °C	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
Consumption	Idle	2.5 W
	Average	4 W
	Peak	11 W
	Sleep mode	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 Ohm 1x R-SMA – 50 Ohm (only for versions with WiFi module!)
User interface	2x ETH	Ethernet (10/100 Mbit/s)
	USB	USB 2.0
	I/O	6-pin panel socket

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 v9.0.2, ETSI EN 301 908-1 v5.2.1, ETSI EN 301 908-2 v5.2.1, ETSI EN 301 908-13 v5.2.1, ETSI EN 300 328 v1.8.1
Telecom and emission for the 2nd module	ETSI EN 301 908-1 v6.2.1, ETSI EN 301 908-13 v6.2.1, ETSI EN 301-489-24 v1.5.1, ETSI EN 300 328 v1.8.1
EMC	ETSI EN 301 489-1 v1.9.2, IEC 61000-6-2:2005, IEC 61000-6-3:2006
Safety	EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013, EN 62311:2008
E8 – EMC for devices in transportation	E8 homologation number: 10R – 04 8180

Table 19: Standards and regulations

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	IEC 61000-4-3	Enclosure	20 V/m (crit. A) (80 – 2700 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	+60 °C, 40 % rel. humidity	
Cold	EN 60068-2-1	-20 °C	
Dump heat	EN 60068-2-78	95 % rel. humidity (+40 °C)	

Table 20: Type tests and environmental conditions

7.4 Technical parameters of cellular modules

7.4.1 Technical parameters of the first cellular module

Technical parameters of the first cellular module	
LTE parameters	Bit rate 100 Mbit/s (DL) / 50 Mbit/s (UL) 3GPP rel. 8 standard Supported bandwidths: 5 MHz, 10 MHz, 20 MHz Supported frequencies: 800 / 900 / 1800 / 2100 / 2600 MHz
HSPA+ parameters	Bit rate 42 Mbit/s (DL) / 5,76 Mbit/s (UL) 3GPP rel. 7 standard UE CAT. 1 to 6, 8, 10, 12, 14 3GPP data compression Supported frequencies: 900 / 1800 / 2100 MHz
UMTS parameters	PS bit rate 384 kbit/s (DL) / 384 kbit/s (UL) CS bit rate 64 kbps (DL) / 64 kbps (UL) W-CDMA FDD standard Supported frequencies: 900 / 1800 / 2100 MHz
GPRS/EDGE parameters	Bit rate 237 kbit/s (DL) / 59,2 kbit/s (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
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 the first cellular module

7.4.2 Technical parameters of the second cellular module

Technical parameters of the second cellular module	
LTE parameters	Bit rate 100 Mbit/s (DL) / 50 Mbit/s (UL), UE CAT. 3 3GPP rel. 9 standard Supported bandwidths: 5 Mhz, 10 Mhz, 20 Mhz Supported frequencies: 450 / 800 / 1800 / 2600 MHz Rated Output Power: B3, B7, B20, 31 MIMO (Multi-Input Multi-Output) antenna support
HSPA+ parameters	Bit rate 42 Mbit/s (DL) / 5,76 Mbit/s (UL), UE CAT. 24, 6 3GPP rel. 5, 6, 7, 8 standard Supported frequencies: 900 / 2100 MHz A maximum of ten HS-PDSCH channels
UMTS parameters	PS bit rate 384 kbit/s (DL) / 384 kbit/s (UL) 3GPP rel. 5, 6, 7, 8 standard W-CDMA FDD standard Supported frequencies: 900 / 2100 MHz Rated Output Power: Class 3 (900 MHz and 2100 MHz)
GPRS/EDGE parameters	3GPP rel. 99 standard; Multislot Class 12 Coding schemes CS 1 to 4, MCS 1 to 9 Supported frequencies: 900 / 1800 MHz Rated Output Power GSM/GPRS 900 MHz: Class 4 Rated Output Power GSM/GPRS 1800 MHz: Class 1 Rated Output Power EDGE 900 / 1800 MHz: Class E2

Table 22: Technical parameters of the second cellular module

7.5 Technical parameters of GPS

GPS specifications	
Antenna	50 Ohms – 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 m/s

Table 23: 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.

7.6 Technical parameters of WiFi

WiFi	
Antenna connector	R-SMA – 50 Ohms
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	36, 40, 44, 48, 52, 56, 60, 64, 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 24: 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 25: 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

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 26: 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 27: 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 28: Other technical parameters

8. Recommended Literature

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

9. Troubleshooting



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

- Select the communication rate 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

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

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

 **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.*

 **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.*

 **Mobile WAN connection fails. (DAT LED off)**

- *Check signal power. If the signal power is weak, you will have to use 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 -50 dBm to -90 dBm.*
- *It is necessary to set ping, which will check the connection and, in the case of failed ping, restart connection.*

 **Mobile WAN 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.*

 **Ethernet connection fails or isn't establishing.**

- *It is possible to turn auto negotiation off and set a rate and duplex manually on the Ethernet interface of the router.*

 **DynDNS doesn't function.**

- *With private APN this is not functional.*
- *If the same IP address is recorded in your canonic name as dynamically assigned address, it means that the operator is using NAT or firewall.*
- *Verify NAT using ping to the static server address.*
- *Verify Firewall accessing remotely to the router's Web interface.*
- *The operator may not provide the address of DNS server and without DNS server's adress it is impossible to connect to the dyndns.org server. There will be these messages 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 for error messages.*

 **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.*

 **FTP doesn't function.**

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

 **RS232 doesn't function.**

- *Verify that the router supports RS232 communications. Also verify the RS232 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.*

10. Customers Support

10.1 Customer Support for NAM

Phone: +1-800-346-3119 (Monday – Friday, 7 a.m. to 5:30 p.m. CST)
Fax: +1-815-433-5109
E-mail: support@advantech-bb.com
Web: www.advantech-bb.com

10.2 Customer Support for Europe

Phone: +353 91 792444
Fax: +353 91 792445
E-mail: techSupport@advantech-bb.com
Web: www.advantech-bb.com

10.3 Customer Support for Asia

Phone: +886-2-2792-7818 #1299 (Monday – Friday, 9 a.m. to 5:30 p.m. UTC+8)
Fax: +886-2-2794-7327
E-mail: icg.support@advantech.com.tw
Web: www.advantech.com



Upkeep-advice:

- 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!

Advantech B+B SmartWorx Company hereby declares that the router narrated in this user's guide fits all basic demands of directive 1999/5/EC (R&TTE).

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



Declaration of Conformity was issued and it is possible to find it on the company website (www.bb-smartcellular.eu/download) ¹ or at producer.

¹Please, use the following login information: Username – smartrouters, Password – smartrouters.