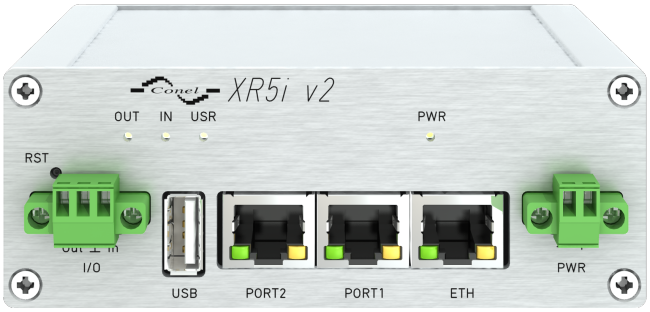
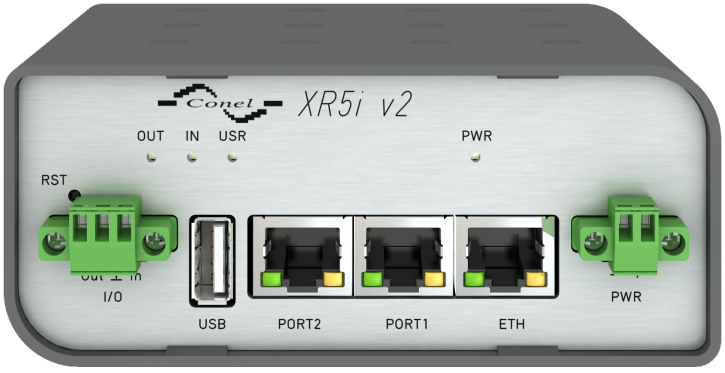
Ethernet Industrial Router

XR5i v2

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.

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 Instruction

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 to health and damage to appliances and to ensure that all the relevant provisions have been complied with, use only the original accessories. Unauthorised modifications or utilization of accessories that have not been approved may result in damage to the router and in a breach of applicable regulations. Unauthorized modifications or utilization of accessories that have not been approved may result in the termination of the validity of the guarantee.
- The router can not be opened.
- It must not be exceeded by the maximum voltage 36 V DC power connector on the router.
- 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 the users of the duty to observe the restrictions concerning the utilization of radio devices at petrol stations, in chemical plants, or in the course of blasting works in which explosives are used.
- When using the router in the close proximity of personal medical devices, such as cardiac pacemakers or hearing aids, you must proceed with heightened caution.
- If it is in the proximity of TV sets, radio receivers and personal computers, the telephone may cause interference.
- It is recommended that you should create an appropriate copy or backup of all the important settings that are stored in the memory of the device.

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.

3. Router Description

Industrial router XR5i v2 is used to a secure connection between two local area networks (LANs) via two ETHERNET interfaces 10/100 and secured tunnel (IPSec, OpenVPN or L2TP). The second option is to use this router for connecting two devices with different serial interface (RS232, RS485, MBUS) alternatively I/O to the local network (LAN). In this configuration, the communication device has an EHTERNET 10/100 and two interfaces that are equipped on the user's request.

XR5i v2 router is standardly equipped with one ETHERNET 10/100 port, one USB A (host) port, one I/O port and two expansion ports. Users can select a second ETHERNET 10/100 port, serial interface RS232, RS485, RS422, MBUS, expansion port with SD card (SDH) or other inputs/outputs (I/O). Industrial XR5i v2 router is supplied either in a plastic or metal casing, based on the requirements of the customer.

Configuration is performed via web interface and protected by password. The router supports creation of VPN tunnels using technologies IPsec, OpenVPN and L2TP to ensure safe communication. Web interface provides detail statistics about the router activities.

Other diagnostic functions ensuring continuous communication include automatic functionality inspection, or hardware Watchdog which monitors the status of the router. With the help of a special window (start up script window) you may insert Linux scripts for various actions. For some applications the key option to create several different configurations for one wireless router, the so-called profiles (maximum of 4), and the option to switch between them (for example via binary input status, web interface, etc.) is essential.

The industrial router XR5i v2 has implemented SNMP protocol for remote management. It is also possible to configure the network in bulk and use any additional software – VPN SmartCluster configurator to easily configure a VPN or a program for monitoring routers in the network R-SeeNet. Industrial XR5i v2 router is enhanced by the ability to create custom functions easy integration of custom software modules.

Examples of possible applications

- security system
- monitoring
- vending and dispatcher machines

4. Contents of Package

Basic delivered set of router includes:

- router,
- power supply,
- crossover UTP cable,
- up to one external antenna,
- clip for the DIN rail,
- paper start guide.

Figure 1: Contents of package

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

As optional accessories can also be supplied the following expansion ports (two boards for Full version):

- RS232, RS485/422, MBUS, ETHERNET, CNT, SWITCH, WIFI, WMBUS or SDH.
- Separation columns for mounting expansion boards are included.

5. Router Design

5.1 Router versions

XR5i v2 router is supplied in the following versions (see table below). All versions are available in plastic or metal box according to customer requirements.

Router versions	Router Box	I/O	USB	PORT1	PORT2	ETH
XR5i v2F	Plastic	1 x	1 x	1 x	1 x	1 x
XR5i v2F SL	Metal	1 x	1 x	1 x	1 x	1 x

Table 1: Router versions

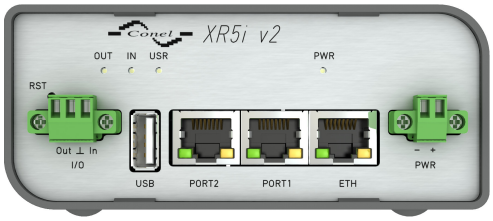

Figure 2: Front panel XR5i v2F

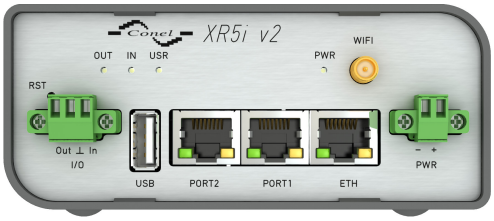

Figure 3: Front panel XR5i v2F with WiFi

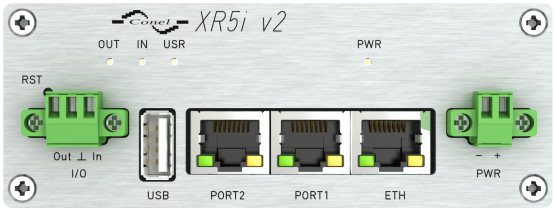

Figure 4: Front panel XR5i v2F SL

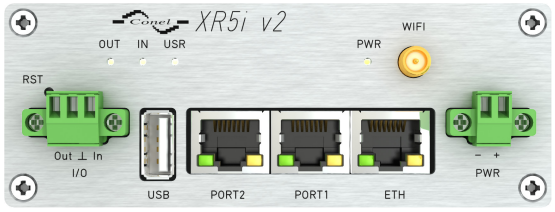

Figure 5: Front panel XR5i v2F SL with WiFi

5.2 Delivery identification

Trade name	Order code[1]	Description
XR5i v2F	BB-XR2F00vw1y	Full version in the plastic box
XR5i v2F SL	BB-XR2F00vw2y	Full version in the metal box

Table 2: Delivery identification

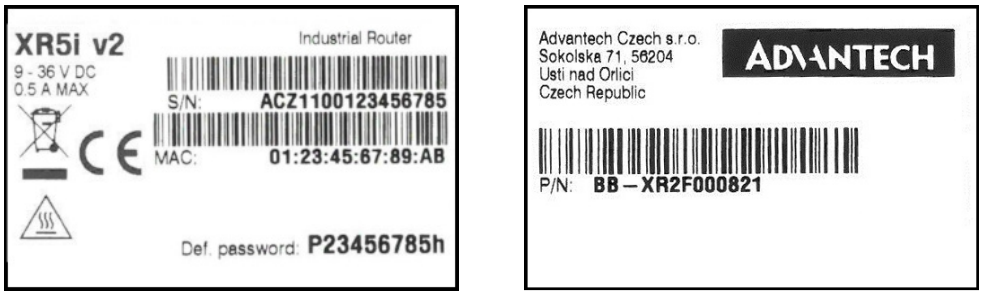

Figure 6: Label examples

[1] Order codes are described in detail in a separate chapter.

5.3 Order codes

5.3.1 Order code structure

Order code has following structure:

BB-XR2F00vwxy, where:

v = port #1,
w = port #2,
x = type of router box,
y = type of power supply.

Letter "v" – port #1

Port type	Letter "v" incode
none	0
ETH	1
RS232	2
RS485	3
RS422	4
MBUS	5
CNT	6
SWITCH	9[2]

Table 3: Type of port #1

Letter "w" – port #2

Port type	Letter "w" in code
none	0
RS232	2
RS485	3
RS422	4
MBUS	5
CNT	6
WiFi	7
WMBUS	8
SDH	9

Table 4: Type of port #2

[2]Occupies both, port #1 and port #2. Available for full version only.

Letter "x" – type of the router box

Type of router box	Letter "x" in code
Plastic	1
Metal	2

Table 5: Type of router box

Letter "y" – type of the power supply

Type of power supply	Letter "y" in code
none	0
Europe	1
UK & Ireland	2
Australia	3
USA	4

Table 6: Type of power supply

5.3.2 Order code examples

Examples of order codes are listed in the table bellow:

Order code	Features – interfaces	Box	Power supply
BB-XR2F000010	1x ETH, 1x USB, 1x I/O,	plastic	none
BB-XR2F002721	1x ETH, 1x USB, 1x I/O, 1x RS232, WiFi	metal	Europe

Table 7: Order code examples

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

5.4 Basic dimensions of the router box

5.4.1 Plastic box

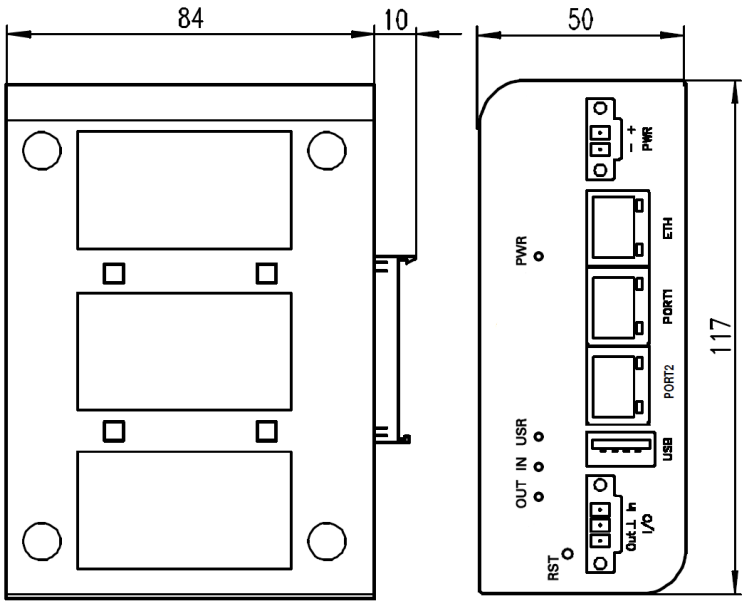

Figure 7: Basic dimensions of plastic box (bottom and front view)

5.4.2 Metal box

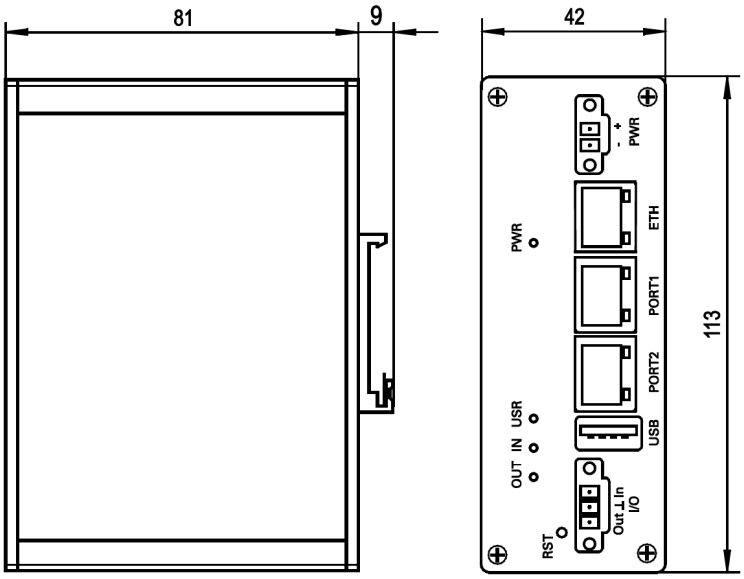

Figure 8: Basic dimensions of metal box (bottom and front view)

5.5 Mounting recommendations

- possibility to be put on a work surface,
- DIN rail EN 60715 with included plastic or 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 60439-1 ed.2:00 + A1:04.

If the negative pole of the router is grounded, there is no protection against reversed polarity!

Compliance of EN 60439-1 ed.2:00 + A1:04 specification it is necessary to observe next assembly of the router to the switch – board:

- 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 V/50 Hz.

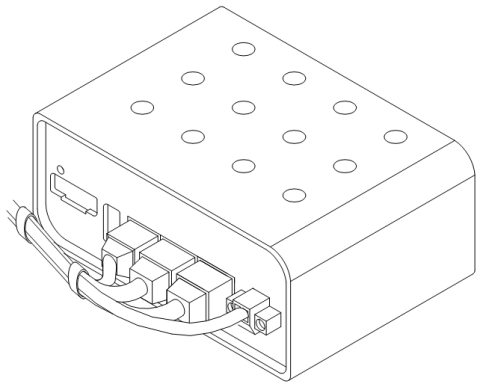

Figure 9: Cable routing (plastic)

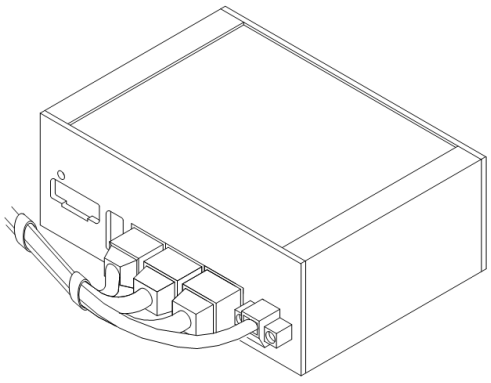

Figure 10: Cable routing (metal)

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

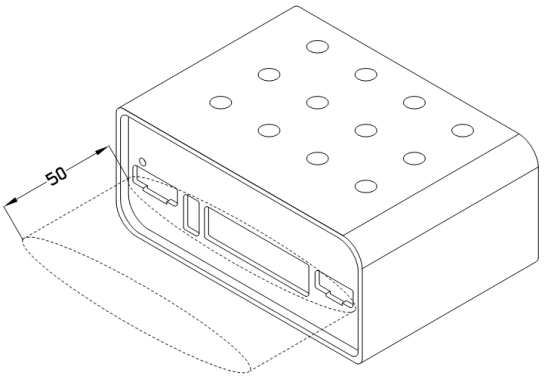

Figure 11: Space in front of connectors (plastic)

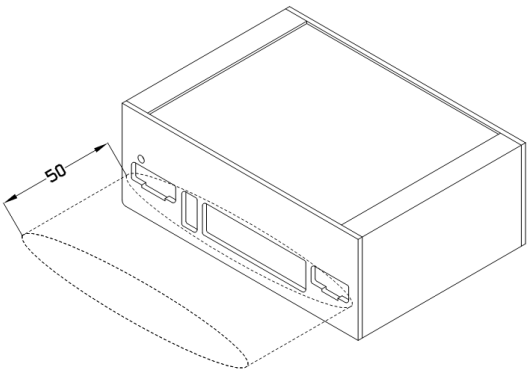

Figure 12: Space in front of connectors (metal)

- 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 plastic or 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 13: Default position of plastic and 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.

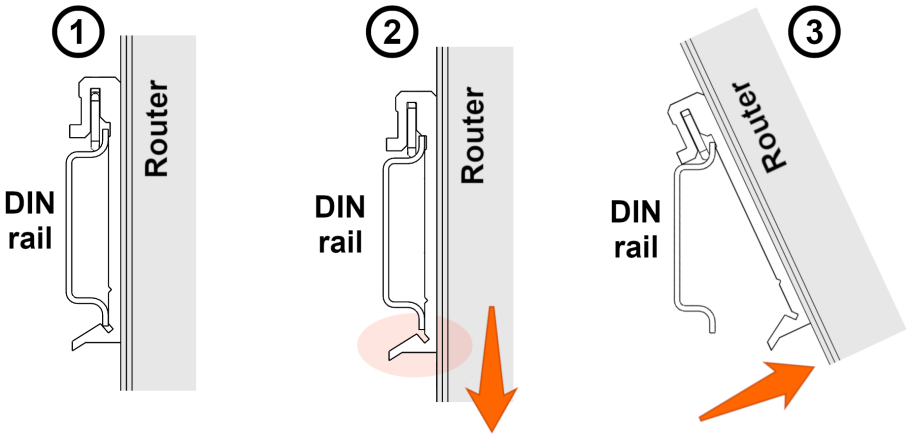

Figure 14: Removal from the DIN rail

5.7 Description of the front panel

On the front panel is the following:

Caption	Connector	Description
PWR	2-pin	Connector for the power supply.
ETH	RJ45	Connector for connection into the local computer network.
PORT1	RJ45	Connector for expansion port RS232, RS458/422, MBUS, ETHERNET, CNT or SWITCH.
PORT2	RJ45	Connector for expansion port RS232, RS485/422, MBUS, SWITCH, WIFI, WMBUS or SDH.
USB	USB-A Host	Connector for connection of USB devices to the router. Supports devices with PL-2303 and FTDI USB/RS232 converters.
I/O	3-pin	Connector for connection of the binary input and output.

Table 8: Front panel description

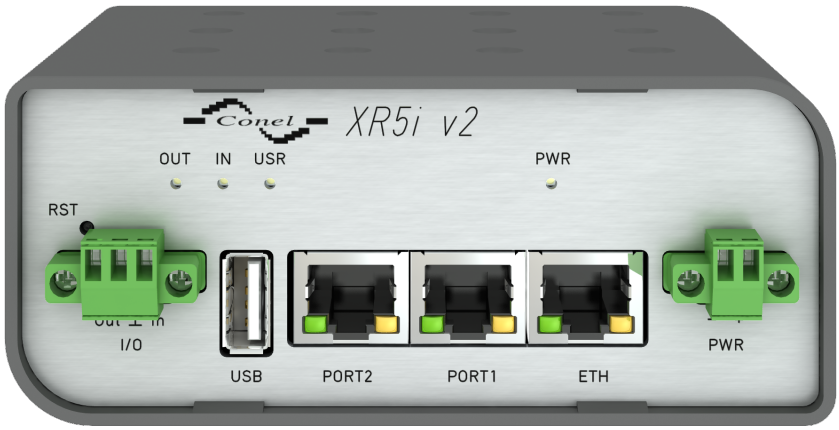

Figure 15: Front panel XR5i v2F

5.7.1 Status indication

About router status inform four LED indicators on the front panel. ETH port, PORT1 and PORT2 have two additional LEDs that provide information about 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	
OUT	Green	On	Binary output active
IN	Green	On	Binary input active
ETH	Green	On Off	Selected 100 Mbit/s Selected 10 Mbit/s
ETH	Yellow	On Blinking Off	The network cable is connected Data transmission The network cable is not connected
PORT	Green	Depends on the expansion port (see user's manual for used port)	
PORT	Yellow	Depends on the expansion port (see user's manual for used port)	

Table 9: Status indication

5.7.2 Power connector PWR

Panel socket 2-pin.

Pin number	Signal mark	Description
1	VCC(+)	Positive pole of DC supply voltage (+9 to +36 V DC)
2	GND(-)	Negative pole of DC supply voltage

Table 10: Connection of power connector

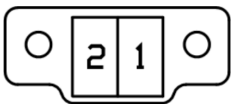

Figure 16: Power connector

Power supply for router is required between +9 V to +36 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 power consumption during receiving is 1.6 W. The power consumption when using WiFi is 1.9 W. The peak power consupmtion during data sending is 2.5 W. However, values of consumption can be increased, if some expansion port is eqquipped. For correct operation it is necessary that the power source is able to supply a peak current of 0.5 A.

Circuit example:

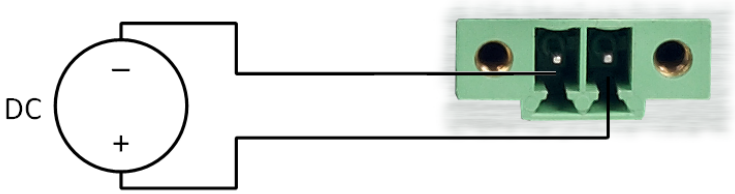

Figure 17: Connection of power supply

The positive pole VCC is marked by a red socket on the power.

All metal parts are connected together with the negative pole of power supply (common pole). However, the router box may not be connected to the negative pole properly.

5.7.3 Ethernet Port ETH

The panel socket RJ45 is used for this interface. The isolation barrier of the Ethernet signal ports against the ground is 1500 V.

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	—	—	
5	—	—	
6	RXD-	Receive Data – negative pole	Input/Output
7	—	—	
8	—	—	

Table 11: Connection of Ethernet connector

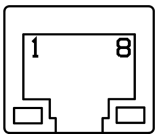

Figure 18: Ethernet connector

ETH port is not PoE (Power over Ethernet) compatible!

Plug Ethernet cable into the RJ45 connector labeled as ETH (see the figure below).

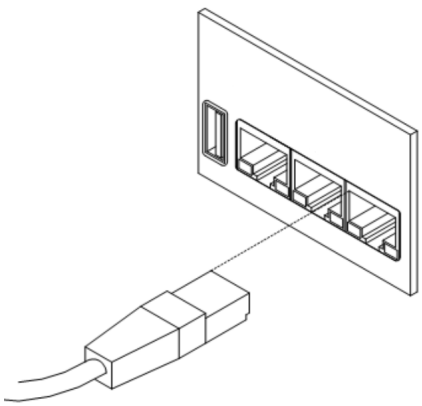

Figure 19: Connection of ethernet cable

5.7.4 PORT1

The PORT1 is equipped on customer's request with one of the offered expansion ports:

- RS232
- RS485
- RS422
- ETHERNET
- MBUS
- CNT
- SWITCH (together with PORT2)

Description and examples of expansion ports connection can be found in user's guide for corresponding expansion port.

Plug cable for the first expansion port into the RJ45 connector labeled as PORT1 (see the figure below).

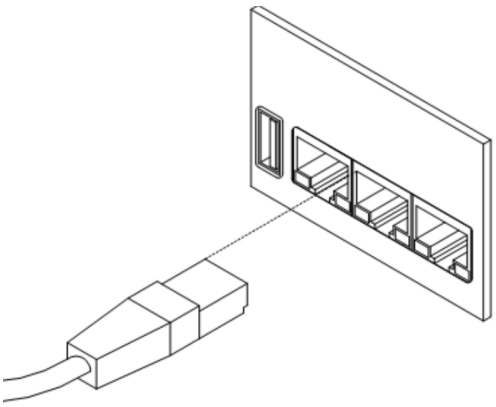

Figure 20: PORT1 cable connection

5.7.5 PORT2

The PORT2 is equipped on customer's request with one of the offered expansion ports:

- RS232
- RS485
- RS422
- MBUS
- SDH
- SWITCH (together with PORT1)
- WIFI
- WMBUS

Description and examples of expansion ports connection can be found in user's guide for corresponding expansion port.

Plug cable for the second expansion port into the RJ45 connector labeled as PORT2 (see the figure below).

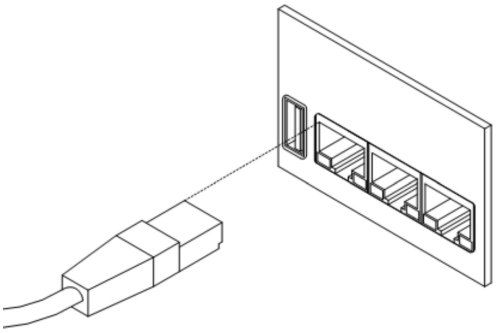

Figure 21: PORT2 cable connection

5.7.6 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 12: Connection of USB connector

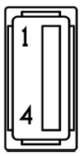

Figure 22: USB connector

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
```

5.7.7 I/O Port

Panel socket 3-pin.

Pin	Signal mark	Description	Data flow direction
1	BIN0	Binary input	Input
2	GND	Signal ground	
3	OUT0	Binary output	Output

Table 13: Connection of I/O port

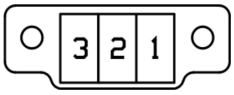

Figure 23: I/O connector

I/O user interface is designed for processing of binary input and control (setting) binary output. Binary output is not switched to ground in the default configuration. Maximum load binary output is 30 V / 100 mA. The constant current supplied by the binary input is 3 mA.

Connect I/O cable into the I/O connector on the front panel of the router and tighten locking screws (see the figure below).

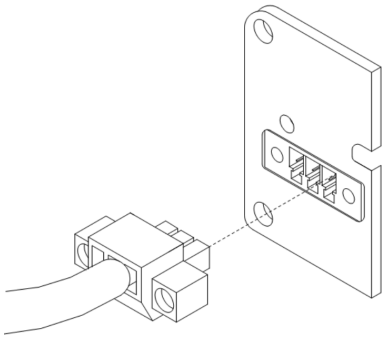

Figure 24: Connection of I/O cable

Example of a circuit describing connection of binary input and output to the router:

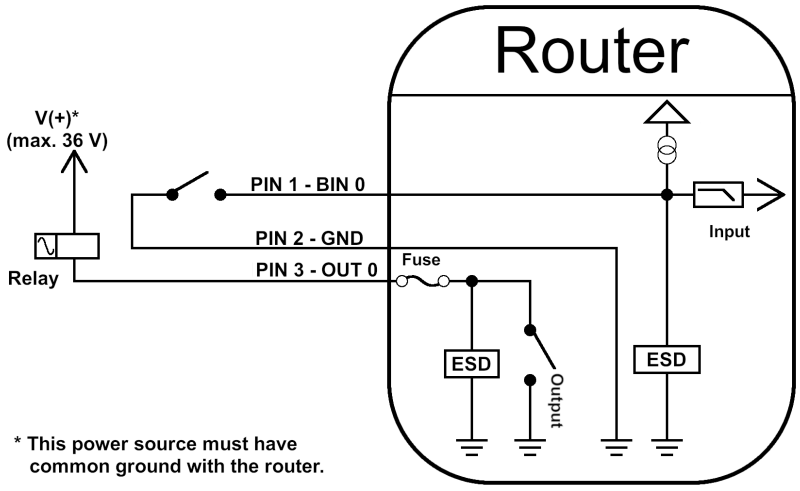

Figure 25: Connection of input and output to the router

5.7.8 Reset

When *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 front panel. After pressing this button the default configuration is restored and then router reboots (green LED will be on).

For pressing the *RST* button could be used a narrow screwdriver.

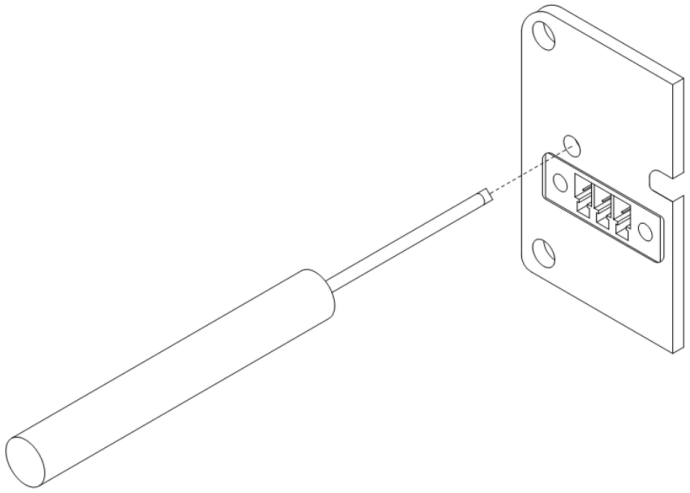

Figure 26: Router reset

We recommend backing up configuration of the router (see *Configuration manual for v2 routers*) because reset of the router sets the configuration to the default state.

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

Action	Router behavior	Invoking events
Reboot	Turn off and then turn on router	Disconnect and connect the power, Press the *Reboot* button in the web configuration
Reset	Restore default configuration and reboot the router	Press *RST* button

Table 14: Description of reset and restart router

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.

The router can not operate without connected power supply.

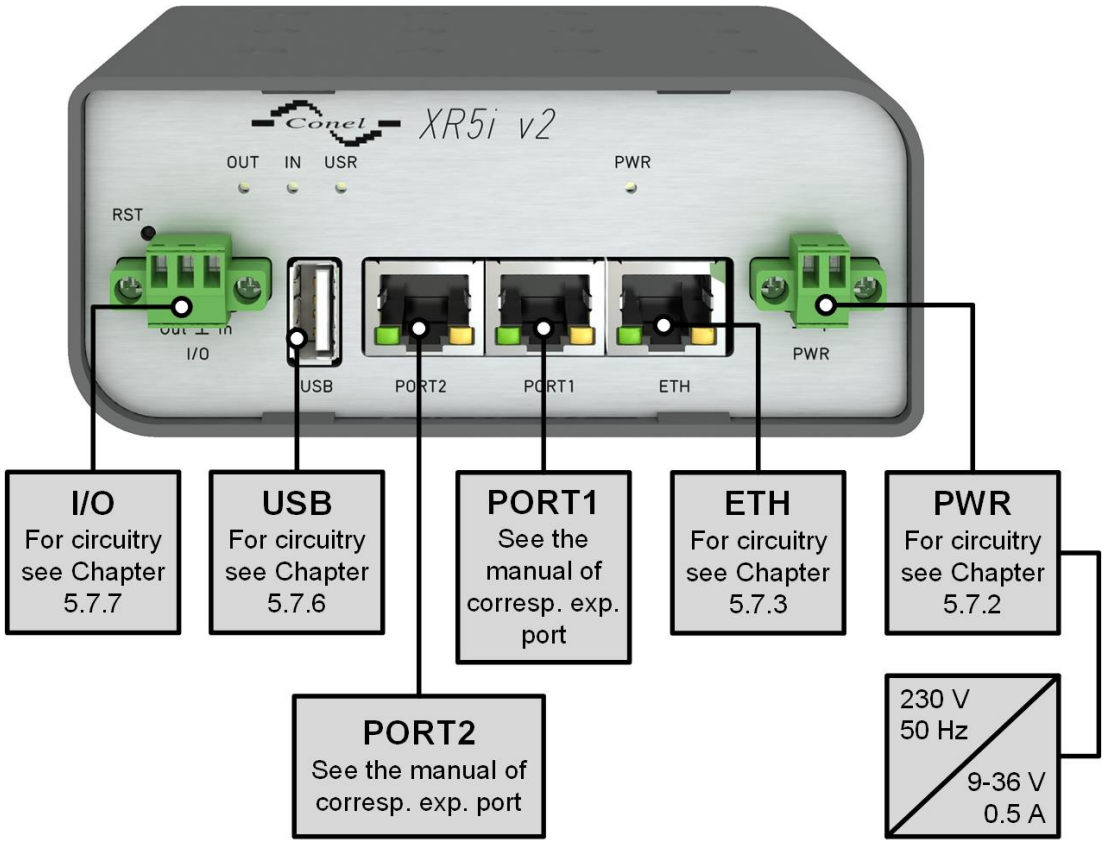

Figure 27: Router connection

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's behavior can be changed via the web interface. This is described in detail in the *Configuration manual for v2 routers*.

The power consumption during receiving is 1.6 W. The power consumption when using WiFi is 1.9 W. The peak power consupmtion during data sending is 2.5 W. However, values of consumption can be increased, if some expansion port is eqquipped. For correct operation it is necessary that the power source is able to supply a peak current of 0.5 A.

6.3 Configuration

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.

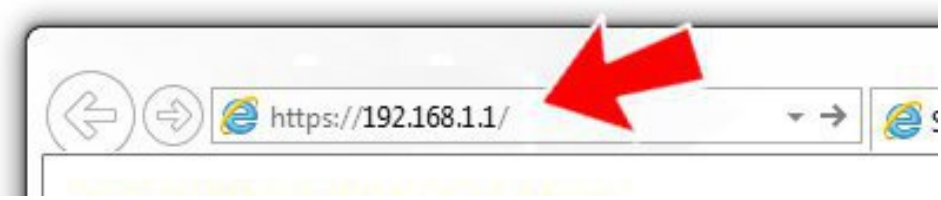

Figure 28: Entering the IP address of the router

Configuration may be performed only by the user "root". The default password is printed on the router's label.[1] Change the default password as soon as possible!

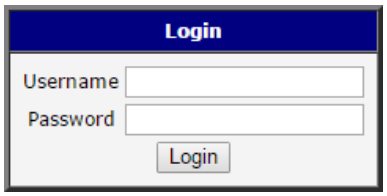

Figure 29: Entering login information

[1] If the router's label does not contain a unique password, use the password "root".

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

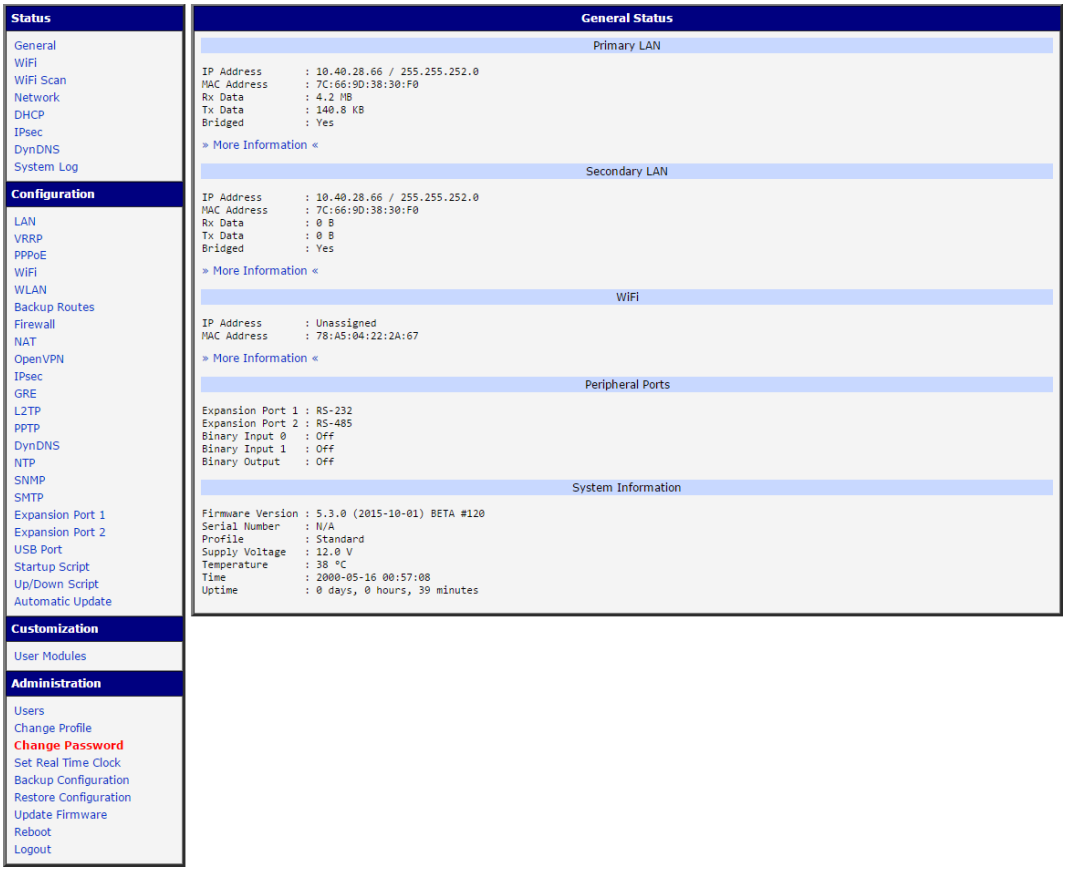

Figure 30: Router web interface

A detailed description of the router settings via the Web interface can be found in the document *Configuration manual for v2 routers*.

6.3.2 Configuration over SSH or Telnet

Device management can be done by accessing the device through the *Secure Shell* (SSH) or the *Telnet* protocol. The default IP address of the device is 192.168.1.1. Standard TCP ports are used, 22 for the *SSH* and 23 for the *Telnet*. Please note, that access is permitted for users of the admin role only and that the *Telnet* protocol is disabled by default. For a detailed description of *SSH* and *Telnet* configuration, see the *Configuration Manual*.

7. Technical Parameters

7.1 Basic parameters

XR5i v2		
Temperature range	Function Storage	-40 °C to +75 °C -40 °C to +85 °C
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		9 to 36 V DC
Battery for RTC		CR1225
Consumption	Idle WiFi Com. Full Com.	1.6 W 1.9 W to 2.5 W
Dimensions		42 x 76 x 113 mm (DIN lišta 35 mm)
Weight		XR5i v2 – 150 g XR5i v2 SL – 280 g
User interface	ETH USB PORT1 PORT2	Ethernet (10/100 Mbps) USB 2.0 Ethernet (10/100 Mbps) On customer's request

Table 15: Basic parameters

7.2 Standards and regulations

The router complies with the following standards and regulations.

Standards and regulations	
EMC	ETSI EN 301 489-1 V2.1.1, ETSI EN 301 489-17 V3.1.1, ETSI EN 301 489-3 V2.1.1
Safety	EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013 + AC:2011

Table 16: Standards and regulations

7.3 Other Technical Parameters

Other technical parameters	
CPU	32b ARM microprocessor 0.25 DMIPS per MHz
Flash memory	16 MB DDR SDRAM
RAM	64 MB
M-RAM	128 kB

Table 17: Other technical parameters

7.4 Technical parameters of I/O port

Binary input and output		
Input/Output	Binary input Binary output	Reed contact with trigger level 1.3 up to 1.4 V 100 mA / max. 30 V

Table 18: Technical parameters of I/O port

7.5 Technical parameters of expansion port

Technical parameters of expansion ports are provided in separate manuals.

8. Related Documents

[1] Advantech Czech: **Start guide for v2 routers**,
[2] Advantech Czech: **Configuration manual for v2 routers**,
[3] Advantech Czech: **User's manual – Expansion port RS232**,
[4] Advantech Czech: **User's manual – Expansion port RS485/422**,
[5] Advantech Czech: **User's manual – Expansion port MBUS**,
[6] Advantech Czech: **User's manual – Expansion port CNT**,
[7] Advantech Czech: **User's manual – Expansion port ETH**,
[8] Advantech Czech: **User's manual – Expansion port SWITCH**,
[9] Advantech Czech: **User's manual – Expansion port WIFI**,
[10] Advantech Czech: **User's manual – Expansion port WMBUS**,
[11] Advantech Czech: **User's manual – Expansion port SD**,
[12] Advantech Czech: **Application note – Expansion port mounting**,
[13] Advantech Czech: **Application note – Programmer guide**.

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.*

✍ **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.**

- *If the same IP address is recorded in your canonic name as a dynamically assigned address, it means that the provider 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.*

✍ **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".*

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:

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

CE Hereby, Advantech Czech 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