LAN Industrial Router

ICR-2701

USER MANUAL

ADVANTECH

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 at `https://icr.advantech.cz/source-code` address.

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1. Product Overview

1.1   Product Introduction

Industrial router ICR-2701 is **LAN Router** & **Edge Computing Gateway** focused on the global market.

The router, which may have a **metal** or **plastic** box, is equipped with two independently configurable **Ethernet ports**, with one **USB 2.0** host interface and with 5 LEDs for status indication.

The router supports **VPN tunnel** creation using various protocols to ensure safe communications. The router provides diagnostic functions which include automatic monitoring of the wireless and wired connections, automatic restart in case of connection losses, and a hardware watchdog that monitors the router status.

With open Linux platform and wide possibilities of programming customer SW applications in **Python**, **C/C++**. The Advantech existing app library **Router Apps** (formerly *User modules*) with apps already developed to enhance specific router functionality including industrial protocol conversions and support of IoT platforms such as **MS Azure**, **Cumulocity**, **ThingWorx**, and others are supported on the router.

Examples of possible applications

- mobile office
- security system
- telematic

- telemetric
- remote monitoring
- vending and dispatcher machines

1.2 Hardware Overview

The router case preview is shown in Figure 1. A short description of hardware parts of the router is listed in Table 1, including the links to the chapters with a detailed description. For a router in a plastic box, the description of the components is similar.
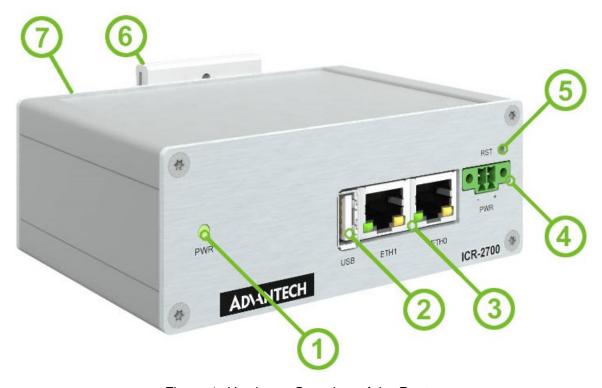
Figure 1: Hardware Overview of the Router

#	Item/Caption	Type	Description
1	LED	-	Status LED indication; see Chapter 2.4.
2	USB	USB-A	USB-A type socket connector; see Chapter 2.3.
3	ETH0, ETH1	RJ45	100 MB Ethernet connection for the firts and second LAN; see Chapter 2.1.
4	PWR	2-pin terminal	Power supply socket; see Chapter 2.2.
5	RST	-	Button to reboot the router or to restore the default configuration; see Chapter 2.5.
6	DIN clip	-	DIN rail clip, included as standard accessories; see Chapter 1.7.
7	Grounding screw	M3	Pay attention to proper grounding of model with metal box; see Chapter 2.2.

Table 1: Hardware Overview of the Router

1.3 Order Codes

Order codes overview is shown in the table below.

Order code	Configuration
ICR-2701	metal box, ETH0, ETH1, USB
ICR-2701**P**	**plastic box**, ETH0, ETH1, USB
ICR-2701**A01**	metal box, ETH0, ETH1, USB, **accessories** with Ethernet cable, two antennas, and **EU power supply**
ICR-2701**PA01**	**plastic box**, ETH0, ETH1, USB, **accessories** with Ethernet cable, two antennas, and **EU power supply**
ICR-2701**A02**	metal box, ETH0, ETH1, USB, **accessories** with Ethernet cable, two antennas, and **UK power supply**
ICR-2701**PA02**	**plastic box**, ETH0, ETH1, USB, **accessories** with Ethernet cable, two antennas, and **UK power supply**

Table 2: Order Codes Overview

1.4 Package Contents

The standard router set includes items listed in Table 1: For other optional accessories, see Table 2.

Item#	Description	Figure	Q'ty
1	Router in metal or plastic box		1 pcs
2	DIN rail clip with screws (screws differ for metal and plastic versions)		1 set
3	2-pin terminal block for power supply (deployed on the router)		1 pcs
4	Printed *Quick Start Guide* notes		1 pcs

Table 1: Contents of Package

Table 2 lists items that may be included as accessories or can be ordered separately. See Chapter 1.3 for more information.

Description	Figure
Ethernet cross cable of length 1.5 m. It can be ordered separately under *BB-KD-ETH* part number.	
Wall mount power supply, 12V/1A with EU plug.It can be ordered separately under *BB-RPS-v2-EU* part number.	
Wall mount power supply, 12V/1A with UK plug.It can be ordered separately under *BB-RPS-v2-UK* part number.	
Wall mount power supply, 12V/1A with US plug.It can be ordered separately under *BB-RPS-v2-US* part number.	

Table 2: Other Accessories

1.5 Product Dimensions

For the dimensions of the product in metal and plastic boxes see the figures below. Note that all sizes are measured in millimeters.

Figure 1: Metal box – Front View

Figure 2: Metal box – Top View
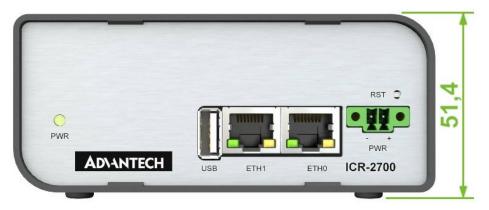
Figure 3: Plastic box – Front View
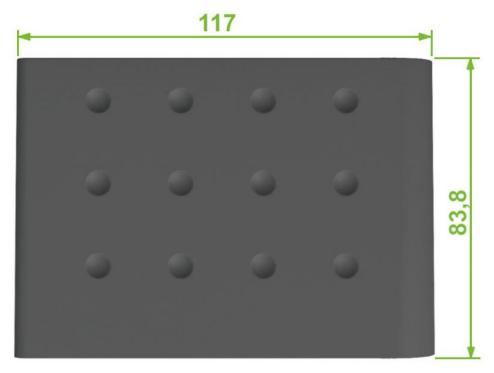
Figure 4: Plastic box – Top View

1.6 Mounting Recommendations

The router can be placed:

- on a flat surface,
- on a DIN rail EN 60715 with the metal DIN rail clip (see Chapter 1.7)

For most applications with a built-in router within a switchboard, it is possible to recognize two kinds of environments:

- A non-public, industry environment of low voltage with high interference,
- a public environment of low voltage and without high interference.

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

> ! In compliance with the EN 61439-1:2011 specification, it is necessary to observe the following assembly instructions for a router attached to a switchboard:

- For whip antennas it is recommended to observe a minimum distance of 6 cm from cables and metal surfaces on every side in order to avoid interference. When using an external antenna separate from the switchboard it is necessary to fit a lightning conductor.

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

- For all cables, we recommend to bind the bunch, and for this we recommend:

  - The length of the bunch (the combination of power supply and data cables) should be a maximum 1.5 m. If the length of data cables exceeds 1.5 m or if the cable is leading towards the switchboard, we recommend installing surge protectors.
  - Data cables must not have a reticular tension of $\sim$ 230 V/50 Hz or $\sim$ 120 V/60 Hz.

- Sufficient space must be left between each connector for the handling of cables,

- To ensure the correct functioning of the router we recommend the use of an earth-bonding distribution frame for the grounding of the grounding screew, see Chapter 2.2.

1.7 DIN Rail Mounting

The DIN rail clip is suitable for a DIN rail according to EN 60715 standard only. There are four possible positions of the clip as shown in Figure 5.

i The DIN rail clip is the same for the metal and plastic router box. It just differs by the crews used.

! When mounting the DIN rail clip, tighten the screws with max. torque of 0.4 Nm.
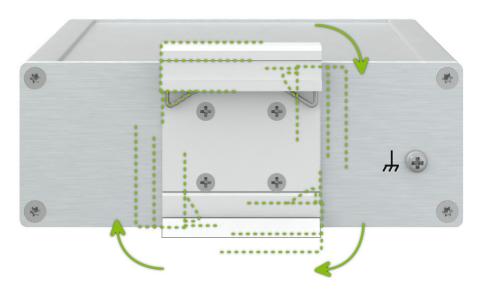
Figure 5: Position of the DIN Rail Clip

To remove the router from the DIN rail it is necessary to lightly push down the router so that the bottom part of the DIN rail clip hitched to the DIN rail get out of this rail and then fold out the bottom part of the router away from the DIN rail, see Figure 6.
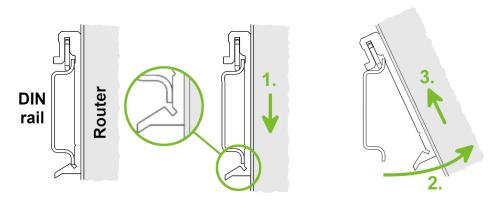
Figure 6: Removing Router from the DIN Rail

1.8 Product Label

An example of the product label, with all the information printed on it, is in the figure below.

Figure 7: Label Example

2. Hardware Functionality

See Chapter 1.2 for the product hardware overwiew. Table 1 lists a short description of the hardware, including the links to the chapters with a detailed description.

2.1 Ethernet Interfaces

The panel socket of RJ45 is used for Ethernet interface. The pinout of the socket is shown in Figure 1 and described in Table 3.

Figure 1: Ethernet Connector Pinout

Pin	Signal mark	Description
1	TXD+	Transmit Data – positive pole
2	TXD-	Transmit Data – negative pole
3	RXD+	Receive Data – positive pole
4	—	—
5	—	—
6	RXD-	Receive Data – negative pole
7	—	—
8	—	—

Table 3: Ethernet Connector Pinout Description

The isolation barrier of the Ethernet ports against the ground is 1500 V.

2.2   Power Supply

The pins of power supply are physically connected to the 6-pin terminal block panel socket located on the left panel. The connection of power supply is shown in Figure 2 and described in Table 4.
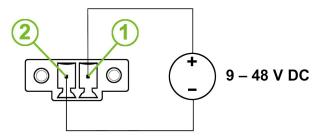
Figure 2: Connection of Power Supply

Pin	Signal mark	Description
1	PWR(+)	Positive pole of DC supply voltage (+9 to +48 V DC)
2	PWR(-)	Negative pole of DC supply voltage

Table 4: Power Supply Pinout

Required power supply voltage for the router is between +9 V and +48 V DC, see the connection scheme on Figure 2. Protection against reversed polarity without signaling is built into the router. For correct operation it is necessary that the power source is able to supply a peak current of 1 A.

> Unit has to be supplied by a power supply specified as a Limited Power Source (LPS) or CEC/NEC Class 2 source of supply.

All metal parts of the router in a metal box, including the box itself, are connected with the negative pole of the power supply (common pole). If recommended for the installation environment, protect the router by grounding it properly by the grounding screw on the right panel, see Figure 3.
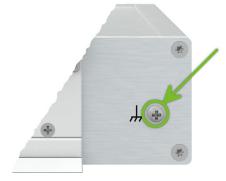
Figure 3: Position of the Grounding Screw

2.3   USB Port

There is one USB 2.0 host port with socket of USB-A type. USB Mass Storages and FTDI serial converters are supported. For a piece of advice, how to fix an unsupported FTDI chip, see the Commands and Scripts application note, chapter *How to Use Unsupported FTDI Chip*.

i 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 the reboot of the router.

Mounting USB Flash Drive to the System

It is necessary to mount the USB flash drive to be able to access it in the system of the router. Follow these steps to mount the drive:

- Use the *dmesg* command to see the list of recently connected devices.

- In the output of the command find out the entry for the microSD card, for example:
  ```
  sda: sda1
  ```

- To mount the card to to *mnt* directory, use the *mount* command:
  ```
  mount /dev/sda1 /mnt
  ```

i For more information about the commands for creating, mounting, checking and unmounting a file system on a USB Flash Drive, see the application note for Ext4_tools router app.

USB Socket Pinouts

USB socket pinouts is described in Figure 4 and Table 5.
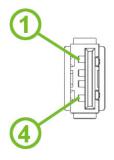
Figure 4: USB Connector Pinnout

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 5: USB Connector Pinnout

2.4   LED Status Indication

There are LED indicators on the front panel of the router to provide router status information. Moreover, ETH connector, has two additional LEDs providing information about the port status.

Caption	Color	State	Description
PWR	Green Green Green	On Blinking Fast blinking	Starting of the router Router is ready Updating firmware
ETH0 ETH1	Green Green	On Off	Selected 100 Mbps bit rate Selected 10 Mbps bit rate
ETH0 ETH1	Orange Orange Orange	On Blinking Off	The network cable is connected Data transmission The network cable is not connected
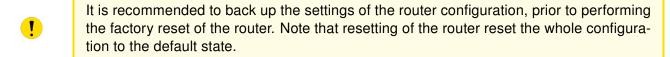
Table 6: LED Status Indication

2.5 Reset Functions

The *RST* button on the front panel can be used in three different situations:

- **Reboot the router**: Hold the *RST* button for less than 4 seconds, the router will be restarted.

- **Factory reset** – restore the default configuration: Hold the *RST* button for more than 4 seconds. The *PWR* LED turns off and on again. We recommend holding down the *RST* button for 1 second after turning on the PWR LED on the front panel.

- **Emergency factory reset** – If the router is unable to boot up due to the bad configuration, turn off the router (disconnect the power supply). Push and hold the *RST* button, turn on the router and hold the *RST* button for at least 10 seconds. This will return the configuration of the router to the default one.

> ⚠️ It is recommended to back up the settings of the router configuration, prior to performing the factory reset of the router. Note that resetting of the router reset the whole configuration to the default state.

ⓘ It is necessary to use a narrow screwdriver or any other small tool to press the *RST* button.

Figure 5: Resetting the Router

Action	Router behavior	Trigger events – options
Reboot	Turns off and then turns on the router	• Disconnect and reconnect the power. • Press the *Reboot* menu item in the web interface. • Press the *RST* button and hold il less than 4 seconds.
Factory Reset	Restores the default configuration and reboots the router	• Hold the *RST* button for more than 4 seconds. • If it does not help (router does not start at all), turn off the router (power supply). Push and hold the *RST* button, then turn on the router and hold the *RST* button for more than 10 seconds.

Table 7: Overview of Router Reboot and Reset

3. First Use
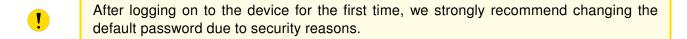
3.1 Powering up the Router

The router will start up when a power supply is connected to it. The DHCP server will assign an addresses to the devices connected through the Ethernet port ETH0.

3.2 Router Configuration

Initial router configuration can be made via a web browser running on your PC. Here you can perform router monitoring, configuration, and administration. First, connect the PC to the default LAN interface described in the *Start Guide* application note [1]. To get the router interface, enter the `https://192.168.1.1` address in a web browser. Please note that usage of the HTTPS protocol for secure communication over the network is required.

There is just the extbf*root* user account created on the router by default. See the **product label** on the router for its **default password**. Log in to the web interface by the *root* user and his password. If logged in successfully, the user will have access to the router web interface, see Figure 6. See the configuration manual [2] of the router for a detailed description and examples of the router configuration.

> ! After logging on to the device for the first time, we strongly recommend changing the default password due to security reasons.

> ! For security reasons, we highly recommend updating the router's firmware to the latest version regularly. Downgrading the firmware to an older version than the production version or uploading firmware intended for a different device may cause the device's malfunction.

> ! All routers have the *WebAccess/DMP* client pre-installed by default. The activated client periodically uploads router identifiers and configuration to the *WebAccess/DMP* server. See the configuration manual [2], chapter *Basic Information -> WebAccess/DMP Configuration*, for more information.
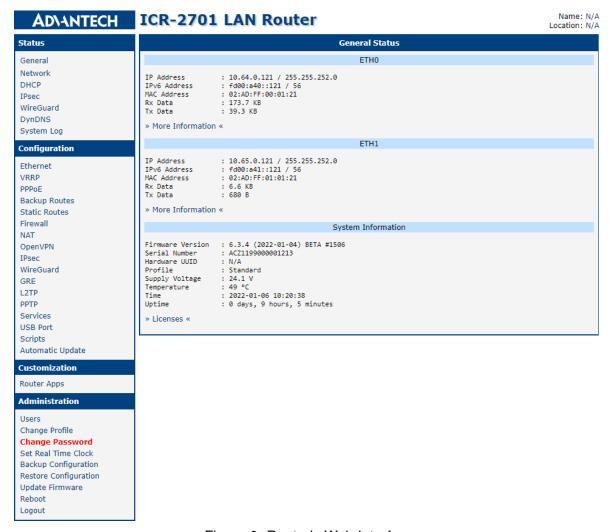
Figure 6: Router's Web Interface

A detailed description of the router settings in the web interface can be found in the configuration manual of the router.

4. Technical Specifications

4.1   Basic Parameters

Router parameters		
Temperature range	Operating Storage	-40 °C to +75 °C -40 °C to +85 °C
Humidity	Operating Storage	5 to 95 % relative humidity non condensing 5 to 95 % relative humidity non condensing
Altitude	Operating	2000 m / 70 kPa
Degree of protection		IP30
Supply voltage		9 to 48 V DC
Battery for RTC		CR1225
Consumption	Idle Average Peak	1.4 W 1.5 W 5.3 W
Dimensions of device w/o clip		113,2 x 80,3 x 42 mm (metal box) 117 x 83,8 x 51,4 mm (plastic box)
DIN rail clip specification		DIN 35 mm, EN 60715
Weight		230 g (metal box) 170 g (plastic box)
Interfaces	ETH0 ETH1 USB	RJ-45 socket for 10/100 Mbps Ethernet RJ-45 socket for 10/100 Mbps Ethernet USB-A socket

Table 8: Basic Parameters

4.2 Standards and Regulations

The router complies with the following standards and regulations:

Standards and regulations	
EMC	EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11, EN 61000-6-2, EN 61000-6-3, EN 55032
Safety	IEC 62368-1, IEEE 802.3
Transportation	E-Mark (E8), homologation number: 10R-06 13493
National	CE, UKCA compliant
Environmental	REACH, RoHS3 and WEEE compliant

Table 9: Standards and Regulations

4.3 Type Tests and Environmental Conditions

Phenomena	Test	Description	Test levels
ESD	EN 61000-4-2	Enclosure	CD ±6 kV, L3 AD ±8 kV, L3
RF field AM modulated	EN 61000-4-3	Enclosure	20 V/m, 80 MHz – 1 GHz, LX 10 V/m, 1 GHz – 6 GHz, L3
Fast transient	EN 61000-4-4	DC ETH - FTP AC/DC	±1 kV, 5/50Tr/Th ns, 100 kHz, L2 ±1 kV, 5/50Tr/Th ns, 100 kHz, L3 ±2 kV, 5/50Tr/Th ns, 100 kHz, L3
Surge	EN 61000-4-5	DC ETH AC/DC	±1 kV,1,2/50(8/20) Tr/Th us L2 ±1 kV,1,2/50(8/20) Tr/Th us L2 ±2 kV,1,2/50(8/20) Tr/Th us L3
RF conducted	EN 61000-4-6	DC ETH AC/DC	10V,0.15-80MHz,80% AM(1kHz),L3 10V,0.15-80MHz,80% AM(1kHz),L3 10V,0.15-80MHz,80% AM(1kHz),L3
Dips & interruptions	EN 61000-4-11	AC/DC	dip 0% 0,5cycle, 0% 1 cycle, 70% 25 cycles, interuption 0% 250 cycles
Radiated emission	EN 55032	Enclosure DC ETH AC/DC	Cl. B,30MHz-1GHz,1GHz-6GHz Class B, 150 kHz – 30 MHz Class B, 150 kHz – 30 MHz Class B, 150 kHz – 30 MHz

Table 10: Type Tests and Environmental Conditions

4.4 System Configuration

The main parametes of the system are listed in Table 11.

Other technical parameters	
CPU architecture	ARM926EJ-S
CPU frequency	600 MHz
CPU power	4,72 DMIPS/MHz
Flash memory	4 MB of NOR 4 096 MB of eMMC • 838 MB for Router Apps • 512 MB for customer data
RAM size	128 MB
Watchdog	HW Watchdog
RTC	Battery Backup RTC
TPM[1]	Trusted Platform Module (TPM) 2.0

Table 11: System Configuration

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[1]Not assembled by default, for a dedicated customer order only.

Appendix A: 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).
> - 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.

✎ **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".*

Appendix B: Customer Support

Customer Support for Europe

Advantech Czech s.r.o.
Sokolska 71
562 04, Usti nad Orlici,
Czech Republic

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

Customer Support for NAM

Advantech B+B SmartWorx
707 Dayton Road
Ottawa, IL 61350 USA

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

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

Appendix C: Regulatory & Safety Information

Safety Notices

! 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.

- **Caution!** This equipment is not suitable for use in locations where children are likely to be present.

- Power supply must not exceed 48 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.

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 to minimize the impact on the environment. This product contains high quality materials and components which can be recycled. At the end of it's life this pro- duct MUST NOT be mixed with other commercial waste for disposal. The device contains a battery. Remove the battery from the device before disposal. The battery in the device needs to be disposed of apart accordingly. Check the terms and conditions of your supplier for disposal information.

Appendix D: Related Documents

[1] Quick Start Guide for v2i Platform
[2] Configuration Manual for v2i Platform

[EP] Product-related documents and applications can be obtained on **Engineering Portal** at `https://icr.advantech.cz/download` address.

UK CA

We, Advantech Czech s.r.o., declare that the radio equipment narrated in this user's manual complies with Radio Equipment Regulations 2017 (**S.I. 2017 No. 1206**) (WiFi version) and with the Electromagnetic Compatibility Regulations 2016 (**S.I. 2016 No. 1091** and **S.I. 2016 No. 1101**) (non-WiFi version).

C€

We, Advantech Czech s.r.o., declare that the radio equipment narrated in this user's manual complies with Directive **2014/53/EU** (WiFi version) and with the essential requirements and other relevant provisions of Directives **2014/30/EU** and **2014/35/EU** (non-WiFi version).

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