Hardware Manual

5G Industrial Router

ICR-4453

Used symbols

Important

Important — Indicates a risk to personal safety or potential damage to the router. Follow these instructions precisely to prevent injury or equipment damage.

Warning

Warning — Highlights conditions that may cause malfunction, loss of data, or unexpected behavior in specific situations. Read carefully before proceeding.

Info

Info — Provides helpful tips, context, or references that improve understanding but are not strictly required to complete the task.

Code Example

```
Code Example - Copy-pasteable configuration snippets or CLI commands.
```

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1. Product Overview

1.1 Product Introduction

The ICR-4453 is an Ultra-high-speed **5G NR** (New Radio) Router and **Powerful Edge Computing Gateway** focused on the global market.

Thanks to its ultra high-speed data transfer capabilities, offering up to **2.5 Gbps for downloads** and **650 Mbps for uploads**, this router is an ideal solution for demanding IoT applications, including industrial routers and gateways, digital signage, industrial computers, and tablets, among others.

The router, enclosed in a robust metal chassis, is equipped with five **1Gb Ethernet ports**, one **SFP cage**, along with interfaces for **RS232**, **RS485**, and **CAN bus**. It also offers two **digital inputs** and two **digital outputs**.

For maximal performance on the cellular network, the router utilizes **4x4 MIMO** technology. An antenna for **GNSS** can be connected to the router.

The ICR-4453 is positioned as a **LTE Advanced Cat 12** router and a powerful edge computing gateway, tailored for the global market.

Featuring high-speed data transfer rates of up to **600 Mbps for downloads** and **150 Mbps for uploads**, this router is perfectly suited for demanding IoT applications in various industries, including industrial routers and gateways, digital signage, and industrial PCs and tablets.

Two antennas, the primary **ANT** and the diversity **DIV**, are designated for cellular network connectivity. Additionally, an antenna for **GNSS** can be connected to the router. Models equipped with Wi-Fi offer **Wi-Fi** functionality, utilizing **3x3 MIMO** antennas for enhanced wireless performance.

Housed within a robust metal enclosure, the router features two **SIM card slots** for cellular connection redundancy. It is also outfitted with five **1Gb Ethernet ports** and an **SFP cage**, plus interfaces for **RS232**, **RS485**, and **CAN bus**. Furthermore, it provides two **digital inputs** and two **digital outputs** for comprehensive connectivity and control options. A **MicroSD card** slot is included to enhance storage options.

Housed within a robust metal enclosure, the router is equipped with two **SIM card slots** to ensure cellular connection redundancy. It also boasts two **1Gb Ethernet ports**, a **USB 3.0** socket, dual switchable **RS232/RS485** interfaces, four **digital inputs**, and two **digital outputs** for comprehensive connectivity and control options. Additionally, a **MicroSD card** slot is available to expand storage capabilities.

The router features a **Low Power Mode** and a **hardware watchdog** for automated status monitoring and system restarts, supplemented by additional diagnostic functionalities to bolster overall reliability.

Router configuration is accessible through a **secure web interface**, offering detailed insights into the entire configuration, statuses, signal strength, and logs.

Basic features include **two-factor authentication**, **IPv6 Dual Stack**, **DHCP**, **NAT**, **NAT-T**, **DynDNS**, **DNS proxy**, **VLAN**, **QoS**, **NTP**, **VRRP**, **SMS control**, **port forwarding**, and **connection backup**, among others. The router supports various VPN protocols, including **IPSec**, **OpenVPN**, **GRE**, **L2TP**, and **PPTP**, ensuring secure communication.

The router allows for the insertion of **Linux scripts** for automated tasks. It supports the definition of up to **four distinct profiles**, switchable via the web interface, SMS, or digital input.

Router Apps enhance router functionality through custom software programs. For Advantech routers, a diverse array of Router Apps is offered, encompassing categories such as connectivity, routing, services, among others, freely accessible on the Advantech *Router Apps* webpage. Additionally, directly from the router web interface, you can use an **Advantech public server** for the Router App or router firmware installation/update.

Compatibility with Advantech's **remote device management** platform, *WebAccess/DMP*, offers extensive device management and monitoring, ensuring that devices remain up-to-date and secure.

1.2 Hardware Overview

In this chapter, all components of the router case are described, including links to chapters that provide more details.

Figure 1: Router hardware overview – front view

#	Item	Type	Description
1	LEDs	—	Status LED indication; see Chapter 2.12.
2	RST	—	Button to reboot the router or to restore the default configuration; see Chapter 2.13.
3	PWR	2-p term.	Power supply socket; see Chapter 2.6.
4	ETH2	SFP cage	SFP cage socket see Chapter 2.5.
5	ETH1	RJ45	1 Gb Ethernet for the second LAN; see Chapter 2.3.
6	ETH0	RJ45	1 Gb Ethernet switched connection (with four ports) for the first LAN; see Chapter 2.3.
7	USB	USB-A	USB 2.0 host port; see Chapter 2.10.
8	SERIAL & I/O	14-pin terminal	RS232, RS485, CAN bus, digital input, and digital output interfaces. See Chapter 2.8 for more information, Chapter 3.7 for I/O parameters, and Chapter 3.8 for serial interface parameters.
9	ANT0, ANT1, GNSS, ANT2, ANT3	SMA female	Cellular module and GNSS antenna connectors. See Chapter 2.2 for more information, Chapter 3.4 for cellular module parameters, Table 21 for module antenna mapping and Chapter 3.5 for GNSS parameters.
10	WIFI1	RP-SMA female	Connectors for the Wi-Fi antennas. See Chapter 2.2 for more information and Chapter 3.6 for Wi-Fi parameters.

Table 1: Router hardware overview – front view

Figure 2: Router hardware overview – rear view

#	Item	Type	Description
11	Grounding screw	M3	Pay attention to proper grounding; see Chapter 2.6.
12	SIM slots microSD slot	Mini SIM microSD	Two Mini SIM card slots; see Chapter 2.1 for more information and Chapter 3.4 for cellular module parameters. MicroSD card slot; see Chapter 2.11.
13	Wall clips	—	Wall mounting clips, included as standard accessories; see Chapter 1.8.

Table 2: Router hardware overview – rear view

1.3 Order Codes

The table below provides an overview of the order codes.

Order code	Configuration
ICR-4453	5G NR cellular module, Gb ETH SWITCH, GNSS, SFP cage, USB, microSD card slot, RS232, RS485, CAN bus, two digital inputs, two digital outputs, two SIM readers
ICR-4453**S**	5G NR cellular module, Gb ETH SWITCH, GNSS, SFP cage, **PoE PSE**, USB, microSD card slot, RS232, RS485, CAN bus, two digital inputs, two digital outputs, two SIM readers
ICR-4453**W**	5G NR cellular module, Gb ETH SWITCH, GNSS, SFP cage, **dual-band Wi-Fi**, USB, microSD card slot, RS232, RS485, CAN bus, two digital inputs, two digital outputs, two SIM readers
ICR-4453**WS**	5G NR cellular module, Gb ETH SWITCH, GNSS, SFP cage, **PoE PSE**, **dual-band Wi-Fi**, USB, microSD card slot, RS232, RS485, CAN bus, two digital inputs, two digital outputs, two SIM readers
ICR-4453**W1**[1]	5G NR cellular module, Gb ETH SWITCH, GNSS, SFP cage, **dual-band Wi-Fi**, USB, microSD card slot, RS232, RS485, CAN bus, two digital inputs, two digital outputs, two SIM readers
ICR-4453**W1S**[1]	5G NR cellular module, Gb ETH SWITCH, GNSS, SFP cage, **PoE PSE**, **dual-band Wi-Fi**, USB, microSD card slot, RS232, RS485, CAN bus, two digital inputs, two digital outputs, two SIM readers

Table 3: Order code overview

1.4 Product Revisions

For the product revision history of the entire product platform, refer to the table below. Please note that some revisions may not be available for certain order codes. The revision number is printed on both the packaging and product labels.

The router GUI can also display the product revision under *Status → General → System Information → Product Revision*. Please note that the default revision (Rev. 1.0) may not be available here.

Rev.#	Description
1.0	Initial version (revision number not printed on the labels).
2.0	New design of the mainboard and PoE board; see PCN-2023-03 for details.

Table 4: HW revision history

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[1]This product has no E8 certification and has a limited operating temperature range of -40 °C to +60 °C.

1.5 Package Contents

The standard set of router includes items listed in the following table:
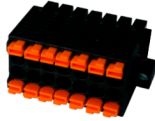
Item#	Description	Figure	Q'ty
1	Router		1 pcs
2	Wall clips for wall mounting (screwed on the router)		2 pcs
3	2-pin terminal block for power supply (deployed on the router)		1 pcs
4	14-pin terminal block for RS232, RS485, CAN BUS, and I/O (deployed on the router)		1 pcs
5	Printed *Quick Start Guide Leaflet*		1 pcs

Table 5: Package contents

1.6 Product Dimensions

For the dimensions of the router see the figures below. Note that all sizes are measured in millimeters.

Variant with Wall Mounting Clip
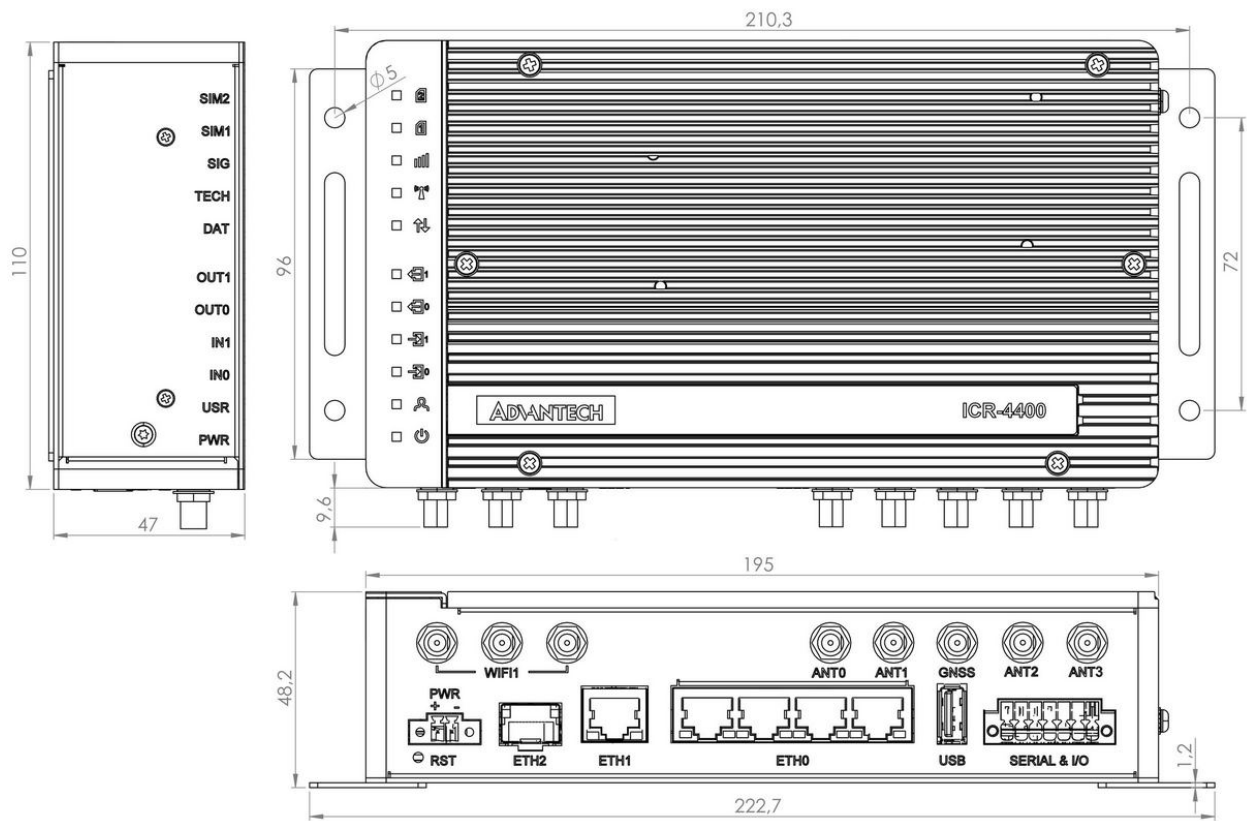
Figure 3: Router dimensions – front, top and right view with wall mounting holder

Variant with DIN Rail Clip
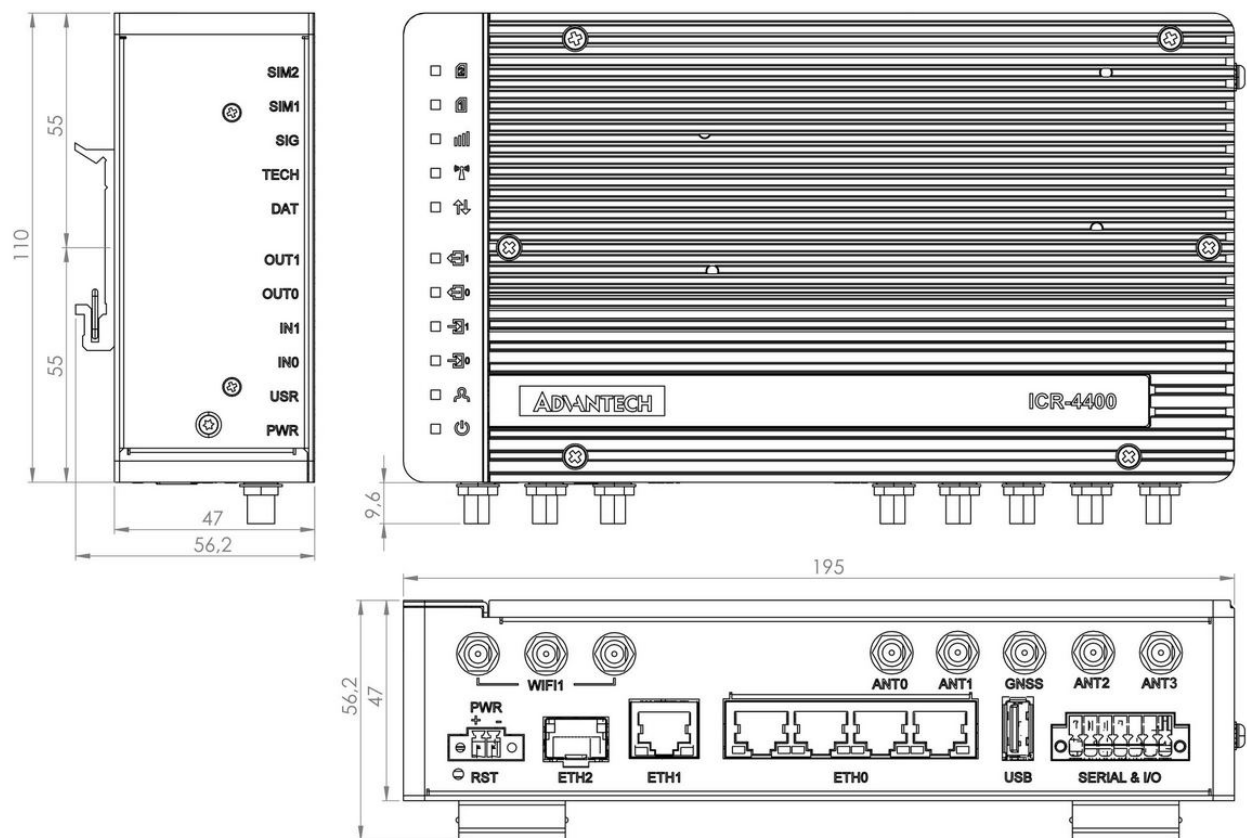
Figure 4: Router dimensions – front, top and right view with DIN holder

1.7 Mounting Recommendations

The router can be placed in the following ways:

- On a flat surface.
- On a wall using the wall mounting clip (refer to Chapter 1.8).
- On a DIN rail EN 60715 with the metal DIN rail clip (refer to Chapter 1.9).

For most applications involving a built-in router within a switchboard, two types of environments are typically encountered:

- A non-public industrial environment with low voltage but high interference.
- A public environment with low voltage and without high interference.

For both of these environments, it's feasible to mount the router to a switchboard, eliminating the need for immunity examination or EMC-related issues as per EN 61439-1:2011 standards.

> **Warning**
>
> To comply with the EN 61439-1:2011 specification, follow these assembly instructions when attaching a router to a switchboard:

- When using whip antennas, maintain a minimum distance of 6 cm from cables and metal surfaces on all sides to avoid interference. If an external antenna is used apart from the switchboard, a lightning conductor is necessary.
- When mounting a router on sheet steel, consider using a cable antenna.

For all cables, it's recommended to bundle them, following these guidelines:

- The combined length of the cable bundle (power supply and data cables) should not exceed 1.5 m. If data cable length surpasses 1.5 m or if the cable runs toward the switchboard, installing surge protectors is advisable.
- Data cables must not be bundled with mains voltage cables (230 V/50 Hz or 120 V/60 Hz).
- Ensure sufficient space is left between each connector for cable handling.
- For proper router functionality, use an earth-bonding distribution frame to ground the grounding screw (refer to Chapter 2.6).

1.8 Wall Mounting

> **Info**
>
> The wall mounting clip is included as a standard accessory with the router.

The router can be affixed to a wall or another surface using the wall mounting clips. Two wall mounting clips are pre-assembled to the router during production and need to be rotated as shown in Figure 5. Each clip features two holes with a diameter of 5 millimeters for screw placement. For precise mounting dimensions, refer to Figure 3 in Chapter 1.6.

> **Warning**
>
> When attaching the wall mounting clip, tighten the screws with a maximum torque of 0.4 Nm.
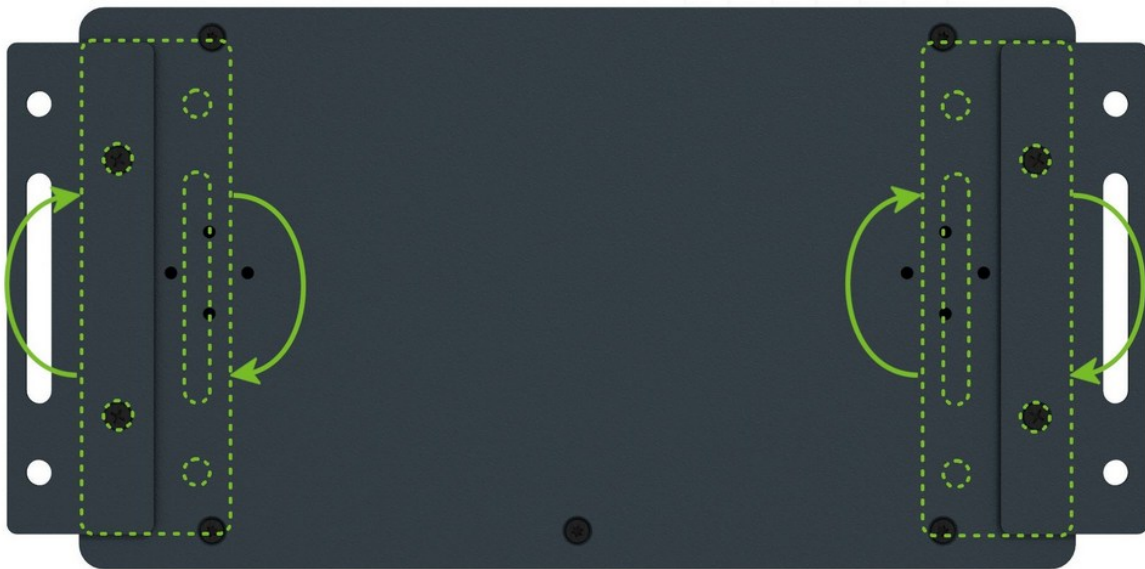
Figure 5: Rotated wall mounting clips

1.9 DIN Rail Mounting

> **Info**
>
> The DIN rail clips are not included as standard accessories with the router. However, they can be ordered using the order code *BB-DIN-ICR32* (two pieces for one router).

You can attach two DIN rail clips to the router for mounting it onto a DIN rail that complies with the 60715 standards. The default position of the clips is depicted in Figure 6. If necessary, the clips can also be rotated vertically.

> **Warning**
>
> When attaching the clips, tighten the screws with a maximum torque of 0.4 Nm.

Figure 6: Default position of the DIN rail clips

To remove the router from the DIN rail, lightly push down on the router to disengage the bottom part of the DIN rail clip from the rail. Then, pivot the bottom part of the router away from the DIN rail, as demonstrated in Figure 7.
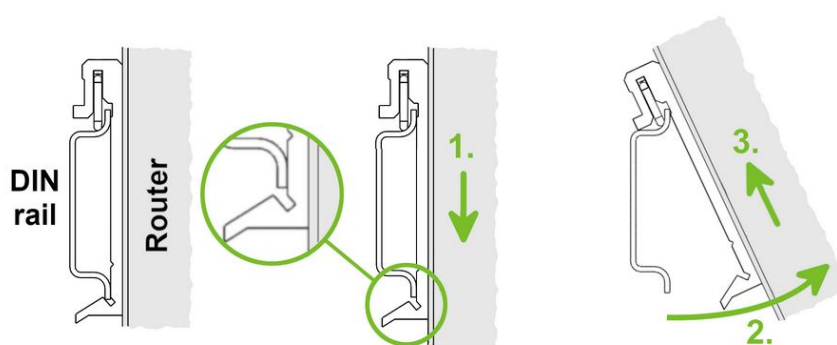
Figure 7: Removing router from the DIN rail

1.10 Product Label

The figure below shows an example of the product labels with all the information printed on them.

Figure 8: Product label

1.11 First Use

You can perform the initial configuration of the router using a web browser on your PC. This interface enables router monitoring, configuration, and administration.

> **Warning**
>
> • Before putting the router into operation, ensure that all components required for running your applications are connected. Refer to Chapter *1.2 Hardware Overview* for an overview of the hardware.
>
> • Do not operate the router without an antenna connected to the main antenna connector. Transmitted energy will be reflected by an open connector, which could potentially damage the equipment.

The procedure for connecting to a new router is described in the *Configuration Manual* [1], Chapter *Introduction → Configuration Environments → Initial Web Configuration GUI Access*. This manual also provides detailed descriptions and examples of router configuration using the web interface.

2. Hardware Functionality

See Chapter 1.2 for an overview of the product's hardware, along with links to chapters offering detailed explanations.

2.1 SIM Card Slots

Slots for two SIM cards are located on the router beneath a metal cover. If you plan to use this device for cellular network communication, insert an activated data-provisioned SIM card into the SIM card slot.
You have the option to install two SIM cards simultaneously for utilizing the switching feature. The SIM cards can have different Access Point Names (APNs) configured. The procedure for changing SIM cards is outlined below. If the SIM requires a PIN, input it in the router's web interface (*Administration → Unlock SIM Card*).

> **Info**
>
> Type of SIM card: Mini SIM (2FF) 25.0 × 15.0 × 0.76 mm.

> **Warning**
>
> **Inserting the SIM card:**
>
> - Always disconnect the router from the power supply before handling the SIM card.
> - Unscrew the two screws on the SIM card cover and remove the cover.
> - To remove an inserted SIM card, use the flat end of a spudger or your fingernail to press the SIM card slightly into its slot until you hear a click. Upon hearing the click, release the card, and it will pop out of its slot.
> - To insert a SIM card, push the card into the slot until it clicks into place.
> - Put the cover back and secure it with the two screws.
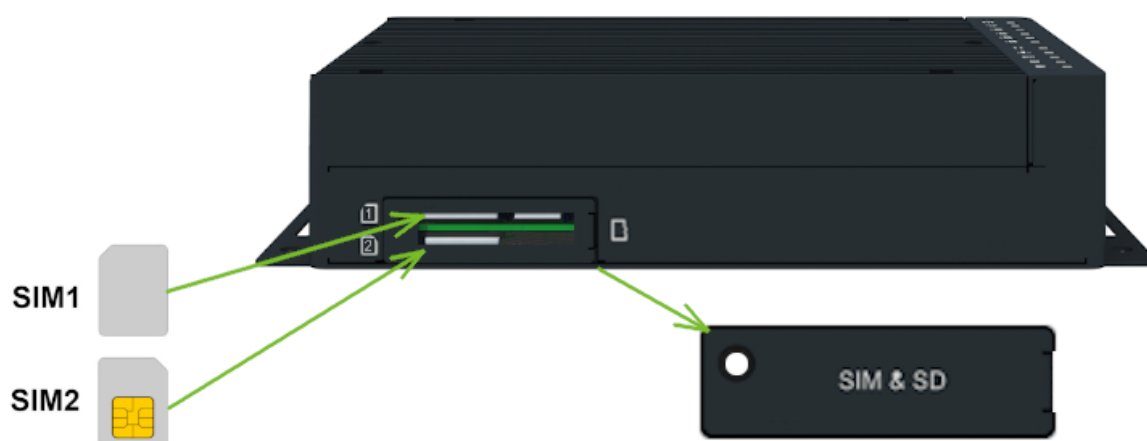
Figure 9: SIM card insertion

2.2 Antennas Interfaces

SMA female connectors (*ANT0*, *ANT1*, *ANT2*, and *ANT3*) are intended for connecting cellular antennas to the router. See Table 21 for module antenna mapping. The GNSS antennas can be connected to the *GNSS*. In addition, RP-SMA female connectors *WIFI1* are available for the connecting the Wi-Fi antennas.

> **Warning**
>
> Always operate the router with a cellular antenna securely connected to the main antenna connector. Transmitting without an antenna attached will cause RF energy to be reflected at the open connector, which can lead to permanent damage to the radio circuitry. Ensure the antenna is properly installed before powering on or transmitting to prevent equipment failure.

> **Info**
>
> Recommended tightening moment for screwing the antenna to the SMA connector is 0.9 Nm.

2.3 Ethernet Interfaces

The RJ45 panel socket is used for four ETH0 (switched) and one ETH1 Ethernet interfaces. The pinout of the socket is shown in Figure 12 and described in Table 6.
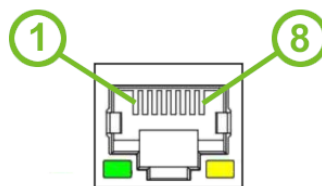
Figure 10: Ethernet connector pinout of RJ45 socket

Pin	10base-T & 100base-T	1000base-T	PoE PSE (Mode B)
1	Tx+ (Transmit Data+)	BI_DA+ (BiDirectional pair A+)	—
2	Tx- (Transmit Data-)	BI_DA- (BiDirectional pair A-)	—
3	Rx+ (Receive Data+)	BI_DB+ (BiDirectional pair B+)	—
4	—	BI_DC+ (BiDirectional pair C+)	PoE PSE+ (positive pole)
5	—	BI_DC- (BiDirectional pair C-)	PoE PSE+ (positive pole)
6	Rx- (Receive Data-)	BI_DB- (BiDirectional pair B-)	—
7	—	BI_DD+ (BiDirectional pair D+)	PoE PSE- (negative pole)
8	—	BI_DD- (BiDirectional pair D-)	PoE PSE- (negative pole)

Table 6: Ethernet connector pinout description of RJ45 socket

> **Info**
>
> • All four ETH0 ports can be used for **PoE PSE** if the router is equipped with this feature. For more information about the PoE, see Chapter 2.4; for technical parameters, see Chapter 3.9.
>
> • The isolation barrier of the Ethernet ports against the ground is 1500 V.

2.4 Power over Ethernet (PoE) PSE

> **Info**
>
> - Available only for models with the PoE PSE feature; see Chapter 1.3 for the order codes.
> - The router supports the *IEEE 802.3af/PoE* (Type 1) and *IEEE 802.3at/PoE+* (Type 2) standards and is Mode B compliant.
> - To control the PoE functionality, you can use the `pse` command. For detailed information, please refer to the *Command Line Interface* application note.

> **Warning**
>
> Please note that the router's power supply must be 48 V DC to operate as the PoE PSE device.

The PoE PSE feature enables the router to provide power to other devices over the Ethernet socket. You can refer to the functional scheme in Figure 11.
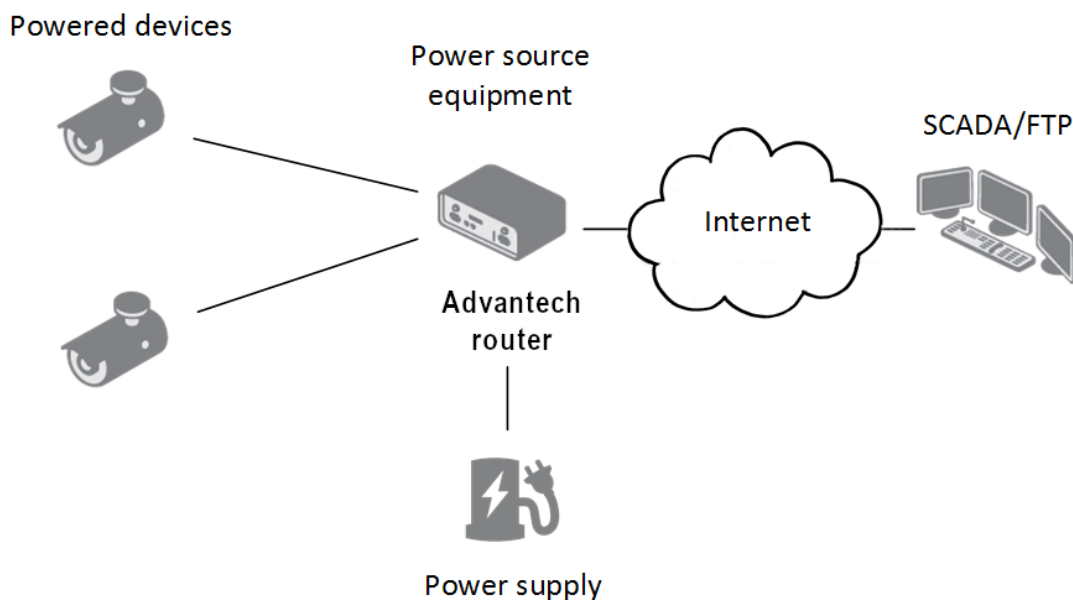
Figure 11: PoE PSE funcional scheme

The PoE PSE feature is supported by all four ETH0 network sockets and can be individually enabled in the *Ethernet* configuration pages. Detailed instructions can be found in the router configuration manual [1], specifically in Chapter *Configuration → Ethernet Configuration*. For information about the Ethernet socket pinout, please refer to Chapter 2.3.

To monitor the current PoE state, navigate to the *General* status page in the GUI. When PoE is enabled and an external device is being powered, you can access information about current, voltage, power, and power class here.

The following table summarizes the PoE parameters.

Item	Value
Required power supply parameters	48 V / up to 135 W
Power available to a PoE device	12.95 W / per port
Required power supply wattage for a PoE device	15.40 W / per port
Power available to a PoE(+) device	25.50 W / per port
Required power supply wattage for a PoE(+) device	30.0 W / per port

Table 7: PoE PSE parameters

PoE Power Budget Examples

Example #1
This example is for the Advantech RPS-ICR4-WR2-PSE power supply, which can supply a power of **65 W**. We will use 15 W as the maximum router power consumption; see Chapter 3.1. You can use this power supply to power:

- up to **three PoE devices** (3×15.4 W + 15 W = 61.2 W < 65 W),

- just **one PoE+ device** (1×30 W + 15 W = 45 W < 65 W).

Example #2
To power four PoE+ devices, you should use a power supply with a minimum rating of 135 W. You can calculate this as follows:

- Required power supply wattage = 4×30 W + 15 W = 135 W.

> **Warning**
>
> Ensure that the power supply you use can provide enough power to cover the required power consumption of all connected PoE devices, including the router itself. We recommend using a power supply with some power reserve.

2.5 SFP Cage

A hot-pluggable (SFP) network interface module with a speed of up to 10 Gbps can be settled into the ETH2 SFP cage.

Installing an SFP Module

To install an SFP module, please refer to Figure 12 and follow these steps:

- If the SFP module is equipped with a bale clasp, ensure it is closed before inserting the SFP module.

- Hold the SFP module with the hardware label facing up.

- Gently insert the SFP module into the ETH2 slot and push it until it securely snaps into place.

Figure 12: SFP module installation

See Table 8 for a list of successfully tested SFP modules on the product.

Model	Manufacturer
SFP-GSM-20K	Advantech
ML-S+31Dout-10	MaxLink
S-3553LC20D	MikroTik
SFP-PLUS-LR10-HPE	Hewlett Packard
SFP-TXCIS	OEM
TXM431-LR(UN)	TP-Link
UF-RJ45-1G	Ubiquiti

Table 8: Tested SFP modules

2.6 Power Supply

A two-pin terminal connector (pitch 3.5 mm) is utilized to power the router. The corresponding connector is included as a standard accessory with the router.

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

Table 9: Power connector pinout
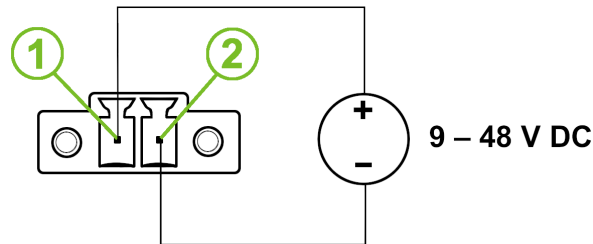
Figure 13: Power connector pinout

The required power supply voltage for the router ranges between +9 V and +48 V DC. Refer to the connection scheme in Figure 13 for proper setup. The router is equipped with built-in protection against reversed polarity, functioning without signaling. To guarantee correct operation, the power source must be capable of providing a sufficient amount of energy, as detailed in the consumption section of Chapter 3.1.

> **Warning**
>
> - Grounding the router using the grounding screw eliminates the protection against reversed polarity. Ensure the negative pole of the DC power supply shares the same voltage reference as the grounding screw. A voltage difference between these points may damage the router, necessitating repairs exclusively by an authorized service center.
>
> - The power voltage for the PoE router version must be 48 V DC for it to function as a PoE PSE device.

All metal parts, including the box, are interconnected with the negative pole of the power supply (common pole). If recommended for the installation environment, protect the router by properly grounding it using the grounding screw, as depicted in Figure 14. The maximum tightening torque for the grounding screw is 1 Nm.

Figure 14: Position of the grounding screw

2.7 Low Power Mode

> **Warning**
>
> In applications requiring low power consumption, such as solar power (not 24/7 mode), it is strongly recommended to use the Low Power Mode (LPM) before shutting down the entire router.

LPM (Low Power Mode) is a router mode in which the router enters a sleep state with minimal power consumption; you can find details about LPM power consumption in Chapter 3.1. The router can be awakened from this mode either by applying a signal to the BIN1 input or after a predefined period of time. To put the router into LPM mode, you can use the `lpm` command; for more information, refer to the *Command Line Interface* application note.

2.8 I/O Port Interfaces

The I/O user interface is designed for digital input processing and digital output control. The pinout of the I/O interface is described in Figure 15 and Table 10. For detailed electrical parameters see Chapter 3.7. The functional scheme of connection for the digital input and digital output is in Figure 16.
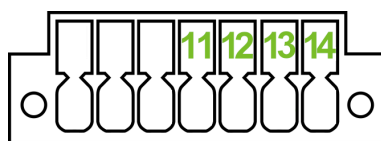
Figure 15: I/O connector pinout

Pin	Signal mark	Description
11	BIN0	The first digital input
12	BOUT0	The first digital output
13	BIN1	The second digital input
14	BOUT1	The second digital output

Table 10: Connection of I/O ports
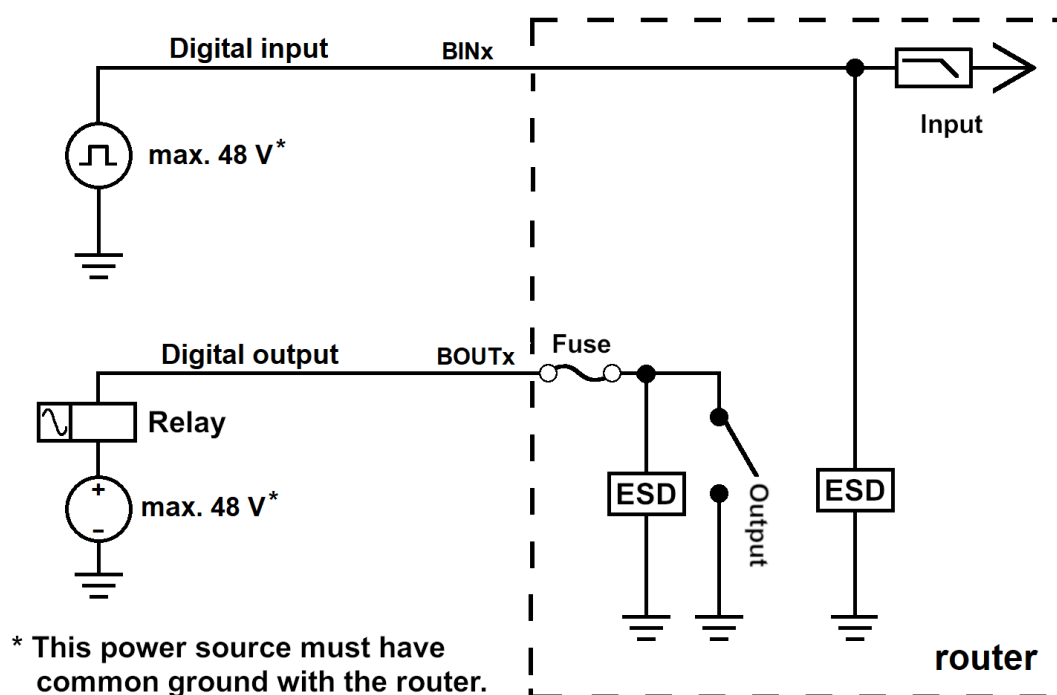
Figure 16: Functional diagram of the digital interface

2.9 Serial Interfaces

The RS232, RS485 CAN serial interfaces together with the two I/O interfaces are physically connected to the 14-pin terminal block panel socket. All these interfaces are not isolated from the router. The pinout of this connector is described in Figure 17 and the tables below.
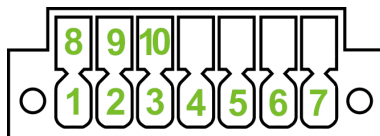
Figure 17: Serial connector pinout

Pin	Signal mark	Description
1	RXD	Received Data
2	CTS	Clear to Send
3	GND	Ground
4	RTS	Request to Send
5	TXD	Transmit Data

Table 11: RS232 connection

Pin	Signal mark	Description
6	CAN_H	CAN High
7	CAN_L	CAN Low

Table 12: Connection of CAN bus

Pin	Signal mark	Description
8	B (+)	In/Out
9	A (-)	In/Out
10	GND	Ground

Table 13: RS485 connection

2.10 USB Port

The router is equipped with a single USB 2.0 host port featuring a USB-A type socket. The pinout details of the USB socket are illustrated in Figure 18 and further described in Table 14.
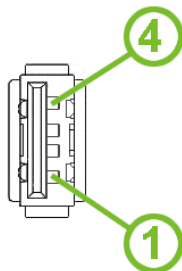
Figure 18: USB connector pinout

Pin 1	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: USB connector pinout

For detailed USB port configuration options, refer to the configuration manual [1], Chapter *Configuration →* *USB Port*.

2.11 MicroSD Card Reader

The microSD card reader is located under the SIM cover on the router. This card reader enables the router to utilize microSD memory cards. The technical specifications are presented in table below.

Supported technologies		SD, SDHC, SDXC
Supported capacity	SDHC SDXC	up to 32 GB from 32 GB to 512 GB
Supported microSD card filesystems		vfat, ext2, ext3, ext4

Table 15: Technical specifications of microSD card

> **Warning**
>
> **Inserting the microSD card:**
>
> - To remove an inserted microSD card, use the flat end of a spudger, or your fingernail, and press the card slightly into its slot until you hear a click. Release the card, and it will pop out of its slot.
> - To insert a microSD card, push the card into the slot with the correct orientation as shown in the picture until it clicks into place.
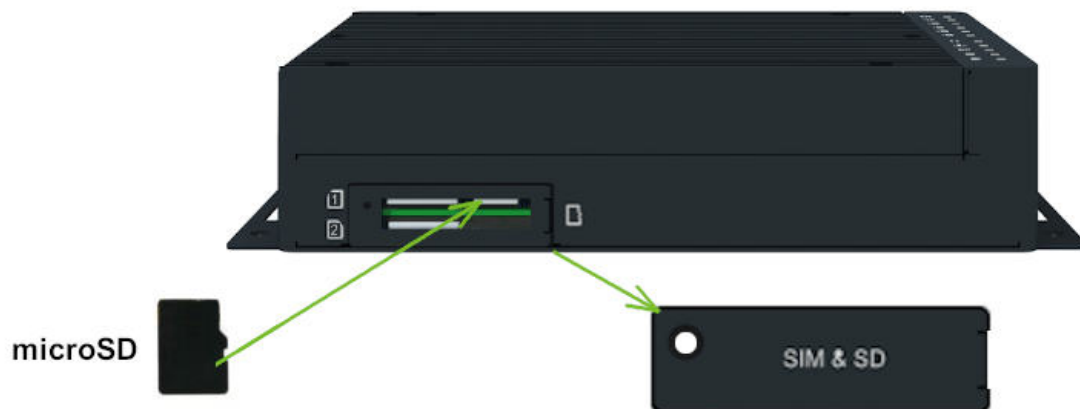
Figure 19: MicroSD card insertion

Mounting microSD Card to the System

To access the microSD card within the router's system, it must be mounted. Follow these steps to mount the card:
- Use the `dmesg` command to view the list of recently connected devices.
- Identify the entry for the microSD card in the command's output, for example:
  `mmcblk0: p1`
- To mount the card to the `/mnt` directory, use the `mount` command:
  `mount /dev/mmcblk0p1 /mnt`

> **Info**
>
> For more information about the commands for creating, mounting, checking, and unmounting a file system on a microSD card, refer to the application note for the *Ext4 Filesystem Utilities* router app.

2.12　LED Status Indication

There are status LEDs on the top side of the router to provide router status information. Moreover, ETH0 and ETH1 connectors, located on the front panel, have two additional LEDs providing information about the port status.

	Caption	Color	State	Description
PWR	PWR	Green Green Green	On Blinking Fast blinking	The router is booting up. The router booted up and is ready. The router firmware is being updated.
USR	USR	Green	—	The function of this LED is user-defined.
IN0	IN0	Green	On	The first digital input is active.
IN1	IN1	Green	On	The second digital input is active.
OUT0	OUT0	Green	On	The first digital output is active.
OUT1	OUT1	Green	On	The second digital output is active.
DAT	DAT	Green	Blinking	Cellular communication is in progress.
SIG	SIG	Green Orange Red	On On On	Good cellular signal. Fair cellular signal. Poor cellular signal.
TECH	TECH	Green Orange Red	On On On	The active SIM uses 5G technology. The active SIM uses 4G technology. The active SIM uses 3G technology.
SIM1	SIM1	Green Red	On Fast blinking	SIM1 is active for the cellular connection. A SIM1 issue (missing card or PIN not entered).
SIM2	SIM2	Green Red	On Fast blinking	SIM2 is active for the cellular connection. A SIM2 issue (missing card or PIN not entered).
ETH	ETH0 ETH1	Green Green	On Off	Selected 1 Gbps bit rate. Selected 100/10 Mbps bit rate.
ETH	ETH0 ETH1	Yellow Yellow Yellow	On Brief off blinks Off	The network cable is connected. Data transmission. The network cable is not connected.

Table 16: LED status indication

2.13 Reset Functions

The *RST* button has multiple functions. For more details, refer to the configuration manual [1], Chapter *Introduction → Device → Reset*.

> **Info**
>
> Use a narrow screwdriver or a small tool to press the *RST* button.

Figure 20: Resetting the router

3. Technical Parameters

3.1 Basic Parameters

Parameter	Conditions	Description
Temperature range	Operating Storage	-40 °C to +75 °C (-40 °F to +167 °F)[1] -40 °C to +85 °C (-40 °F to +185 °F)
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 – 48 V DC
Battery for RTC		CR1225
Consumption for non-Wi-Fi / Wi-Fi version	Idle Average Maximum LPM mode	5.9 W / 6.8 W 6.7 W / 8.8 W 11.3 W / 16.0 W (142 W)[2] 3 mW (170 mW)[3]
Dimensions of device (w/o clips)		195 × 110 × 47 mm (7.68" × 4.33" × 1.85")
DIN rail clip specification		2 pcs of DIN 35 mm, EN 60715
Total weight		1275 g (2.81 lbs)

Table 17: Basic parameters

[1]Models having ICR-4453**W1**x order codes have an operating temperature range of -40 °C to +60 °C.
[2]Maximal power consumption for model with the PoE PSE (for maximal power load on all ETH0 ports).
[3]For device equipped with the PoE PSE.

3.2　Standards and Regulations

Parameter	Description
Radio	ETSI EN 301 908-1, ETSI EN 301 908-2, ETSI EN 301 908-13, ETSI EN 301 908-25, ETSI EN 303 413, ETSI EN 301 893, ETSI EN 300 328
EMC	ETSI EN 301 489-1, ETSI EN 301 489-17, ETSI EN 301 489-19, ETSI EN 301 489-52, EN 55032, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-6-2, EN 61000-6-3
Safety	EN IEC 62368-1, EN IEC 62311, IEEE 802.3
Mechanical	EN 60068-2-27, EN 60068-2-64, EN 60529
Climatic	EN 60068-2-2, EN 60068-2-1, EN 60068-2-14, EN 60068-2-30
Transportation	E-Mark (E8), homologation number: 10R - 06 11459[1]
Cybersecurity	EN 18031-1
National	CE, UKCA compliant
Environmental	REACH, RoHS3 and WEEE compliant

Table 18: Standards and regulations

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[1]Models having ICR-4453**W1**x order codes have no E8 certification.

3.3 Type Testing and Environmental Conditions

Phenomena	Test	Description	Test levels
ESD	EN 61000-4-2	Enclosure contact	± 6 kV (crit. A)
RF field AM modulated	EN 61000-4-3	Enclosure	20 V/m (crit. A) (80 – 1000 MHz) 10 V/m (crit. A) (1 – 6 GHz)
Fast transient	EN 61000-4-4	Signal ports Power ports Ethernet ports	± 1 kV (crit. A) ± 2 kV (crit. A) ± 1 kV (crit. A)
Surge	EN 61000-4-5	Ethernet ports Power ports	± 1 kV (crit. A), shielded cab. ± 1 kV (crit. A)
RF conducted	EN 61000-4-6	All ports	10 V/m (crit. A) (0.15 – 80 MHz)
Radiated emission	EN 55032	Enclosure	Class B
Conducted emission	EN 55032	Signal ports Power ports Ethernet ports	Class B Class B Class B
Dry heat	EN 60068-2-2	Test Bb, storage +85 °C, operation +75 °C	
Cold	EN 60068-2-1	Test Ab, storage -40 °C, operation -40 °C	
Damp heat	EN 60068-2-78	95 % rel. humidity (+40 °C)	
Dry heat, cyclic	EN 60068-2-30	+55 °C / +25 °C, rel. humidity 95 %, 6 h - 6 h	
Dry heat	EN 60068-2-2	Test Bb, storage +85 °C, operation +75 °C	
Thermal shock/ temp. variation	EN 60068-2-14	Test Nb, -40 °C/+75 °C, 3h/3h, 2 cycles, 3 K/min	
Degrees of protection provided by enclosures	EN 60529	IP30	
Vibration, broadband random	EN 60068-2-64	Spectrum A.3 cat 1, breakpoints A.6 cat 1	
Shock	EN 60068-2-27	50 m/s^2, 11 ms, half sine, 10 in each dir.	

Table 19: Type testing and environmental conditions

3.4 Parameters of Cellular Module

Parameter	Description
Antenna	• Impedance: 50 Ω • Connector type: SMA (4 pcs)
5G NR parameters	• 3GPP Rel-15 support • Supported modulations: π/2-BPSK, QPSK, 16QAM, 64QAM and 256QAM modulation for uplink; QPSK, 16QAM, 64QAM and 256QAM for downlink • 2 x 2 MIMO[1] uplink support for n41 • 4 x 4 MIMO downlink for n1, n2, n3, n7, n25, n38, n40, n41, n48, n66, n77, n78, n79 • Supporting SCS 15 kHz[2] and 30 kHz[2] • SA[3] and NSA[3] operation modes on all the 5G bands • Option 3x, 3a, and Option 2 • Supported bands: n71 (600 MHz), n12 & n28 (700 MHz), n20 (EU800 800 MHz), n5 (850 MHz), n8 (900 MHz), n66 (Extended AWS 1700 MHz), n3 (1800 MHz), n2 (1900 MHz), n25 (Extended PCS 1900 MHz), n1 (2100 MHz), n40 (S-Band 2300 MHz), n41 (2500 MHz), n7 & n38 (2600 MHz), n48 & n78 (3500 MHz), n77 (3700 MHz), n79 (4700 MHz) • NSA TDD: max. 2.5 Gbps(DL), max. 650 Mbps (UL) • SA TDD: max. 2.1 Gbps(DL), max. 450 Mbps (UL) • Max. output power: 26 dBm +2/-3 dB (Class 2)
LTE parameters	• 3GPP Rel-15 support (DL Cat 16 / UL Cat 18) • Supported modulations: QPSK, 16QAM, 64QAM and 256QAM (uplink/downlink) • 4 x 4 MIMO downlink for B1, B2, B3, B4, B7, B25, B30, B38, B39, B40, B41, B42, B43, B48, B66 • Supported FDD bands: B71 (600 MHz), B12 & B13 & B14 & B17 & B28 & B29 (700 MHz), B20 (EU800 800 MHz), B5 & B18 & B19 & B26 (850 MHz), B8 (900 MHz), B32 (L-band EU 1500 MHz), B4 (AWS-1 1700 MHz), B66 (1700 MHz), B3 (1800 MHz), B2 (1900 MHz), B25 (Extended PCS 1900 MHz), B1 (2100 MHz), B30 (WCS 2300 MHz), B7 (2600 MHz) • Supported TDD bands: B39 (1900 MHz), B34 (2000 MHz), B40 (2300 MHz), B41 (2500 MHz), B38 (2600 MHz), B42 & B48 (3500 MHz), B43 (3700 MHz), B46 (LAA 5200 MHz) • Bandwidth: 1.4, 3, 5, 10, 15 and 20 MHz RF bandwidth • Bit rates: max. 1.0 Gbps (DL), max. 200 Mbps (UL) • Max. output power: 26 dBm $\pm$2 dB (Class 2)
UMTS parameters	• 3GPP Rel-9 DC-HSDPA, HSPA+, HSDPA, HSUPA and WCDMA • Supported modulations: QPSK, 16QAM and 64QAM • Supported bands: B6 & B19 (800 MHz), B5 (850 MHz), B8 (900 MHz), B4 (AWS A-F 1700 MHz), B3 (1800 MHz), B2 (PCS A-F 1900 MHz), B1 (2100 MHz) • DC-HSDPA: max. 42 Mbps (DL) • HSUPA: max. 5.76 Mbps (DL) • WCDMA: 384 kbps (DL) / 384 kbps (UL) • Max. output power: 24 dBm +1/-3 dB (Class 3)

Table 20: Technical parameters of the cellular module

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[1]Uplink 2 x 2 MIMO is only supported in 5G SA mode.
[2]5G NR FDD bands only support 15 kHz SCS, and NR TDD bands only support 30 kHz SCS.
[3]Supported bandwidth in the NSA and SA modes may differ for each frequency band.

3.4.1 Module Antenna Mapping

SMA	WCDMA	LTE	5G NR			LB (MHz)	MHB (MHz)	n77/n78 (MHz)	n79 (MHz)
			Refarmed	n41	n77/n78/n79				
ANT0	MHB_TRX	MHB_TRX, UHB_PRX[1] MIMO	MHB_TRX, UHB_PRX[1] MIMO	TRX1[2]	PRX MIMO	-	1452-2690	3300-4200	4400-5000
ANT1	LB_TRX	LB_TRX, MHB_DRX MIMO, UHB_PRX[1] MIMO, LAA PRX	LB_TRX, MHB_DRX MIMO, UHB_DRX[1] MIMO	DRX1[2]	DRX MIMO	617-960	1452-2690	3300-4200	4400-6000
ANT2	LB_DRX	LB_DRX, MHB_PRX MIMO, UHB_TRX[1]	LB_DRX, MHB_PRX MIMO, UHB_TRX[1]	TRX0[2]	TRX	617-960	1452-2690	3300-4200	4400-5000
ANT3	MHB_DRX	MHB_DRX, UHB_-DRX[1], LAA_DRX	MHB_DRX, UHB_DRX[1]	DRX0[2]	DRX	-	1452-2690	3300-4200	4400-6000

Table 21: Cellular module antenna mapping

[1]UHB frequency range: 3400-3800 MHz.
[2]NR TRX1 = TX MIMO + PRX MIMO; NR DRX1 = DRX MIMO

3.5 Parameters of GNSS

Parameter	Description
GNSS Systems	GPS, GLONASS, QZSS, BeiDou/COMPASS, Galileo
Antenna	Input impedance: 50 Ω Connector type: SMA Power mode: active antenna support
Features	Protocol: NMEA 0183 Data update rate: 1 Hz
Frequency	GPS/Galileo/QZSS (GPS L1): 1575.42±1.023 MHz GPS/Galileo/QZSS (GPS L5): 1176.45±10.23 MHz Galileo (E1): 1575.42±2.046 MHz QZSS (L1): 1575.42 MHz GLONASS: 1597.5–1605.8 MHz BeiDou/COMPASS 1561.098±2.046 MHz
Sensitivity (autonomous)	Cold Start: -142 dBm Reacquisition: -154 dBm Tracking: -154 dBm
TTFF (autonomous)	Cold start: 36.26 s Warm start: 34.05 s Hot start: 1.22 s
Accuracy (CEP-50) (autonomous)	1.9 m (at open sky)

Table 22: Technical parameters of GNSS

3.6 Parameters of Wi-Fi

Parameter	Description
Short Module Description	Dual Band 2.4/5GHz 3x3 Wi-Fi 5 (802.11ac Wave 1)
Supported Standards	IEEE: 802.11ac compliant & compatible with 802.11a/b/g/n
Antenna Connectors	3x3 MIMO RP-SMA Input impedance: 50 Ω
Data Rate (3x3 MIMO OFDM)	Up to 600 Mbps @ 2.4 GHz Up to 1300 Mbps @ 5 GHz
Frequency Ranges	2.412 – 2.472 GHz 4.920 – 5.825 GHz
Spectrum Widths	20/40MHz @ 2.4GHz 20/40/80MHz @ 5GHz
Modulation Techniques	OFDM: BPSK, QPSK, DBPSK, DQPSK, 16-QAM, 64-QAM, 256-QAM
2.4 GHz supported channels	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
5 GHz supported channels	36, 38, 40, 42, 44, 46, 48, 52, 56, 60, 64, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 149, 153, 157, 161, 165
Type of device	Access point (AP) Station (STA) Multi-role (AP & STA)
Key Features	Spatial Multiplexing, Cyclic-Delay Diversity (CDD), Low-Density Parity Check (LDPC) Codes, Maximal Ratio Combining (MRC), Space Time Block Code (STBC), Dynamic Frequency Selection (DFS), IEEE 802.11d, e, h, i, j, k, r, v time stamp, and w standards
Security – Standards	WPA, WPA2, WPA3, 802.1X
Security – Encryption	WEP, TKIP, AES
Security – EAP Types	EAP–FAST, EAP–TLS, EAP–TTLS, PEAP–GTC, PEAP–MSCHAPv2, PEAP–TLS, LEAP
TX Power (per chain)	Max. 21 dBm @ 2.4 GHz Max. 18 dBm @ 5 GHz

Table 23: Technical parameters of Wi-Fi

3.7 Parameters of I/O Ports

Electrical characteristics of the digital input are in Table 24. Status of the digital input can be retrieved in the router's web interface (on the *General Status* page) or by the `status ports` and `io get` commands, see *Command Line Interface* application note.

Logical[1]	Voltage	Current	Status[2]
1	3 V	0.5 mA	Off
0	5 V	0.8 mA	On
0	12 V	1.6 mA	On
0	48 V	3.4 mA	On

Table 24: Electrical characteristics of digital input

The maximum digital output load is **500 mA** at **48 V**.

3.8 Parameters of Serial Interfaces

Supported parameters of the RS232 and RS485 interfaces, which can be configured in *Expansion Port 1* resp. *Expansion Port 2* menu items, are in Table 25.

Parameter	Description
Baudrate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400.
Data Bits	5, 6, 7, 8.
Parity	none, even, odd.
Stop Bits	1, 2.
Flow Control	none, hardware.

Table 25: Parameters of serial interfaces

3.9 Parameters of PoE

For more information about the PoE PSE feature, including the parameters, see Chapter 2.4.

---

[1]The digital status returned by the `io get` shell command.
[2]The digital status returned by the `status ports` shell command and displayed on the *General Status* page.

3.10 System Configuration

The main parametes of the system are listed in Table 26.

Parameter	Description
CPU architecture	64-bit Quad-Core ARMv8-A (core Cortex-A72)
CPU frequency	1200 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
	  • The remaining space is reserved for the system.

RAM size	1 024 MB
Watchdog	HW watchdog
RTC	Battery backup RTC
TPM	Trusted Platform Module (TPM) 2.0
SIM Slots	2× SIM (Mini SIM – 2FF) 1× Chip SIM (MFF2)[1]

Table 26: System configuration

---

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

Appendix A: Troubleshooting

> **Warning**
>
> If you cannot connect to the router from your PC, your network card may be configured in a way that prevents a connection. Try one or more of the following steps to resolve the issue:
>
> - Ensure your PC's network card is configured to obtain an IP address automatically from a DHCP server (the router's DHCP server is enabled by default).
> - Connect the router to the PC via a network switch.
> - Connect the PC directly to the router, but start the router first and wait for it to initialize completely before starting the PC.

✍ **Ethernet Connection Fails or Is Unstable**

- On the router's *Configuration → LAN* page, you can disable auto-negotiation and manually set a specific link speed and duplex mode. This can resolve compatibility issues with some network devices.

✍ **Mobile WAN Connection Fails or Is Intermittent**

- Check the signal strength on the *Status → Mobile WAN* page. If the signal is weak, a more powerful antenna is required. If neighboring cells have similar signal strength, a directional antenna may be necessary to lock onto the optimal cell tower.
- Enable the connection check feature on the *Configuration → Mobile WAN* page in the *Check connection* section. Select the *Enable + bind* option. This will send periodic pings to check connectivity and restart the connection if it fails. The "bind" option ensures the ping is always sent through the Mobile WAN interface.

✍ **Cannot Establish Mobile WAN Connection**

- Verify all settings on the *Configuration → Mobile WAN* page, including the *APN*, *username*, *password*, and *IP address*. For many public networks, these fields can be left blank.
- Check if the SIM card requires a PIN. If so, enter it on the *Administration → Unlock SIM Card* page.
- For private APN networks, it is often not recommended to obtain DNS server addresses from the operator. Disable this option on the *Configuration → Mobile WAN* page.
- Check the *Status → System Log* for error messages that can help diagnose the issue.

✍ **Cannot Connect to a Device Behind the Router from the Internet (NAT)**

- The device behind the router must be configured to use the router's IP address as its default gateway.

✍ **Cannot Access a Web Server Behind the Router via NAT**

- Remote HTTP access to the router itself must be disabled. This can be done on the *Configuration → NAT* page.
- On the same page, enable the *Send all remaining incoming packets to default server* feature and enter the IP address of your web server.
- Ensure the web server's default gateway is set to the router's IP address.

✍ DynDNS Does Not Work

- DynDNS will not work with a private APN if the router's IP address is not publicly accessible.

- If your DynDNS hostname resolves to the same private IP address that is assigned to the router, it means your mobile operator is using NAT or a firewall, preventing direct connections.

- You can verify operator NAT by pinging a server with a static public IP and comparing the source IP (seen by the server) with the IP address shown on the router's status page.

- You can test for a firewall by trying to access the router's web interface remotely.

- The operator may not be providing DNS server addresses. Without DNS, the router cannot resolve the DynDNS service hostname. The System Log would show errors like:
    - `Error resolving hostname: no such file or directory`
    - `Connect to DynDNS server failed`

✍ L2TP or IPsec Tunnel Fails to Establish

- Check the *Status → System Log* for specific error messages related to the VPN tunnel negotiation.

✍ IPsec Tunnel Establishes, but No Data Is Transferred

- This is typically caused by incorrect routing rules or a misconfigured default gateway on either the client device or the remote network.

✍ Router Reverts to Online Mode After a Reboot, Despite Being Set to Offline via SMS

- State changes made via SMS commands are temporary and do not alter the saved configuration. They remain in effect only until the router is rebooted.

✍ Serial Communication Is Not Working

- Verify that your router model is equipped with a serial port. Check the serial communication settings on the *Configuration → Expansion Port* page.

✍ Is the Router Cisco Compatible?

- No. The router's operating system (ICR-OS) is based on Linux, not Cisco IOS. Therefore, Cisco configuration commands cannot be used.

- However, since all network connections are based on open standards, the router is fully compatible and can be connected to Cisco devices or any other standard networking equipment.

✍ FTP or SFTP Does Not Work

- **FTP** is available on v2 platform routers only. Ensure it is enabled in *Configuration → Services → FTP*. Connect using any FTP client to port 21 with the same username and password as the web interface.

- **SFTP** (SSH File Transfer Protocol) is available on all routers. Ensure SSH is enabled in *Configuration → Services → SSH*. Connect using any SFTP-capable client (like FileZilla or WinSCP) to port 22 with the same credentials as the web interface.

✍ How to Access the Router's Command Line

- You can connect to the router's command line using SSH (all routers) or Telnet (v2 routers only).

- **SSH** is enabled by default. You can verify this in *Configuration → Services → SSH*. Use any SSH client to connect to the router's IP address on port 22.

- **Telnet** can be enabled on v2 routers in *Configuration → Services → Telnet*.

- For both methods, use the same username and password as for the web interface.

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.iiot.ana@advantech.com
Web: www.advantech.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

For your safety and the appropriate operation of the device, please observe the following instructions:

- The router must comply with all applicable international and national laws, including any specific regulations or restrictions concerning its operation in designated applications and environments.

- To avoid personal injury and damage to the device, use only accessories that are approved or supplied by the manufacturer. Unauthorized modifications or the use of non-approved accessories could damage the router, violate regulations, and result in loss of warranty coverage.

- Do not attempt to open the router enclosure under any circumstances.

- Before handling the SIM card, always switch off the router and disconnect it from the power supply.

> **Important**
>
> This equipment is not suitable for use by or near young children. Small children could accidentally swallow the SIM card.

- Ensure that the power supply voltage does not exceed 48 V DC.

- Do not expose the router to harsh environmental conditions. Protect it from dust, moisture, and excessive temperatures.

- Use routers with correct certifications and markings only in areas containing flammable or explosive materials (such as gas stations, chemical plants, or locations with explosives). In these environments, follow all restrictions regarding the use of radio devices.

- When traveling by airplane, always switch off the router. Using the router on board may endanger flight safety, interfere with mobile networks, and violate local regulations. Non-compliance can result in suspension or cancellation of telecommunications services, or legal penalties.

- Take special care when operating the router in close proximity to personal medical devices such as cardiac pacemakers or hearing aids.

- This device may cause interference if used close to television sets, radio receivers, or personal computers.

- Maintain a safe separation distance of at least 20 cm between the router and the human body during operation.

- It is strongly recommended to regularly back up all critical device settings stored in the router's memory.

Product Disposal Instructions

The WEEE directive (Waste Electrical and Electronic Equipment: 2012/19/EU) ensures the environmentally responsible recycling and recovery of electronic products. This device contains high-quality materials and components suitable for recycling. At the end of its life, **do not dispose of this product with ordinary commercial waste**. The router also contains a battery. Remove the battery before disposing of the device, and ensure the battery is disposed of separately and in accordance with local regulations. For detailed information on product and battery disposal, consult your supplier's terms and conditions.

Appendix D: Related Documents

[1] *ICR-4400 Configuration Manual* (see *Documents to download* → *Manuals* section)

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

CE

We, Advantech Czech s.r.o., declare that the radio equipment narrated in this user's manual complies with Directive **2014/53/EU**.

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**).

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