Hardware Manual

LTE Industrial Connectivity Gateway

ICR-1645

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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 – Useful tips or information of special interest.

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1. Product Overview

1.1 Product Introduction

The ICR-1645 series industrial connectivity gateway is designed for wireless communication, connecting IP devices and serial buses to cellular networks. It is ideal for M2M and IoT applications such as kiosks, industrial PCs, HMIs, traffic controllers, meters, UPS systems, and more. The **LTE** Cat.4 peak **downlink** data rate is around **150 Mbps**, with an **uplink** peak data rate of **50 Mbps**.

The ICR-1645 router features five Fast Ethernet ports (1x WAN + 4x LAN) and optional digital I/O (1x DI, 1x DO) and Serial (**1x RS232** + **1x RS485**) connectivity. Optional WiFi 5 or GNSS can be included. The gateway supports **VPN** tunnel creation with various protocols for secure communications and provides diagnostic functions, including automatic monitoring and restart of connections, and a hardware watchdog to monitor router status.

Based on the ICR-OS operating system, the gateway's open Linux platform allows for extensive programming of customer software applications in **Python, C/C++**. It supports uploading of certain Router Apps to extend firmware functionalities, with a free app library available for customers to enhance specific router functionalities.

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 Usage Examples

Cellular Internet Access

- This example demonstrates a common scenario where the cellular router facilitates access from a local LAN to the Internet via the cellular network.
- This functionality is not available on LAN routers lacking a cellular interface.

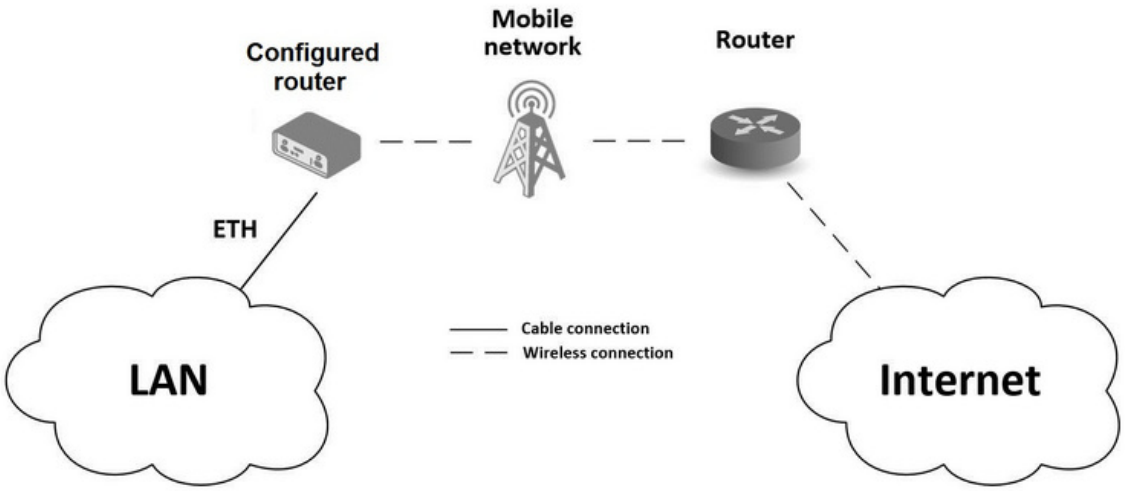

Figure 1: Cellular Internet Access

Backup for Internet Access

- This example showcases how a cellular router's Internet access can be backed up.
- Backup options include PPPoE connections, Ethernet wired connections or WiFi.

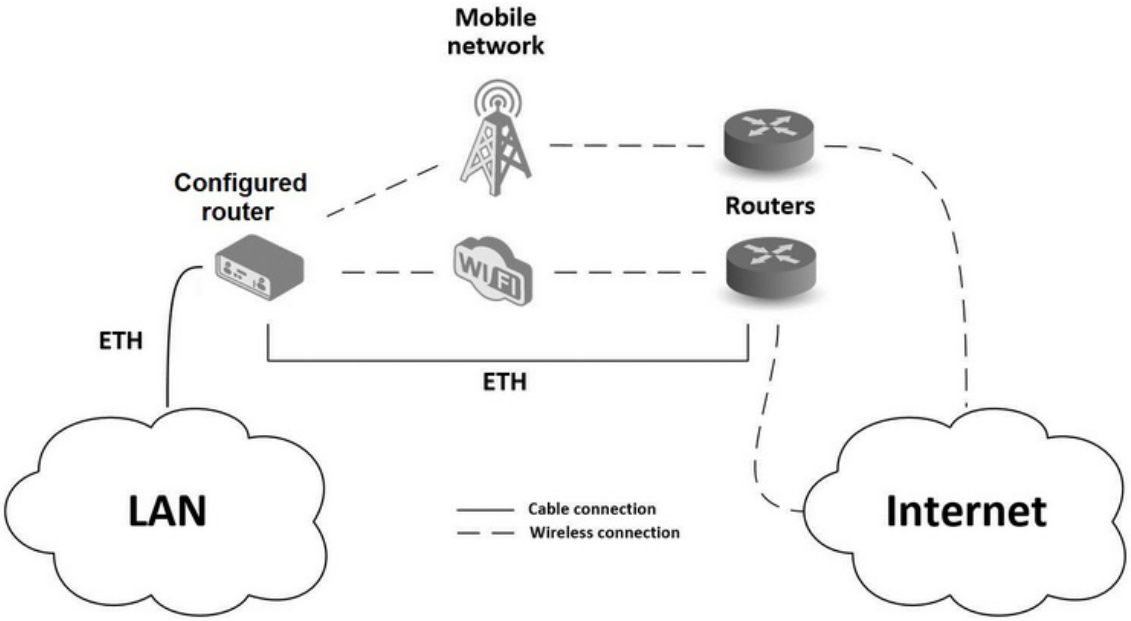

Figure 2: Backup for Internet Access

VPN Networks Interconnection

- This example highlights the establishment of a secure VPN tunnel for interconnecting the configured Advantech router with a router in a remote network, facilitated via the Internet.
- The configured router connects to the Internet using the cellular network.

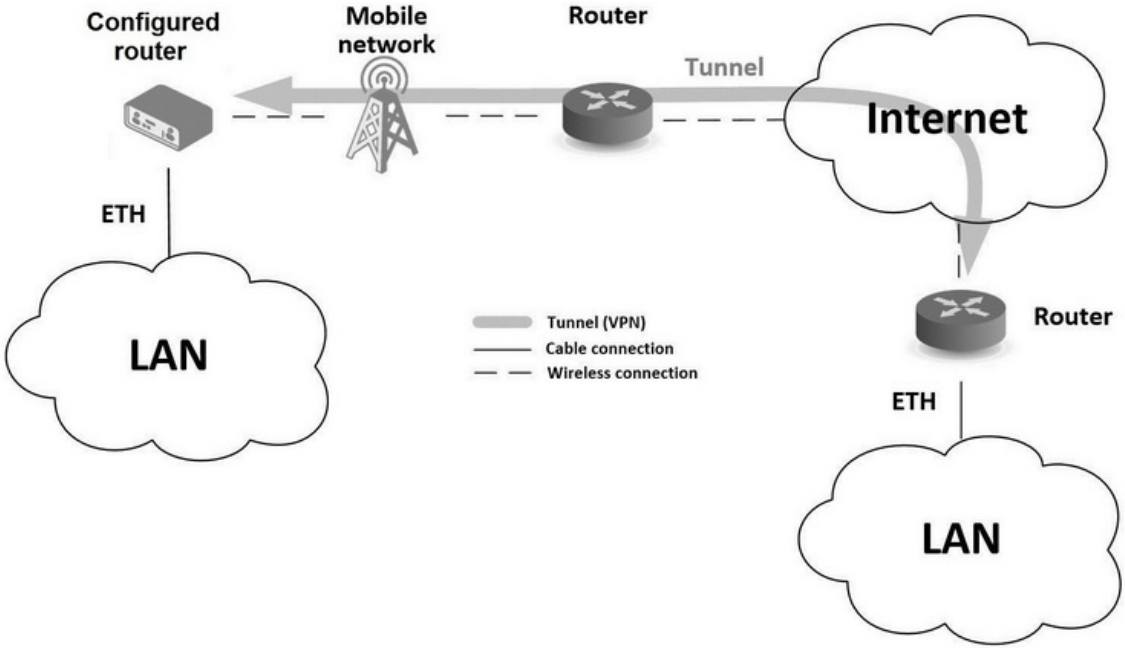

Figure 3: VPN Networks Interconnection

Serial Gateway

- This example depicts a scenario where the configured Advantech router grants access to a PLC device interfaced serially with the router.
- The PLC device, accessible over the entire Internet network, can be controlled from a remote local network, such as one running a SCADA system.
- This functionality is exclusive to routers equipped with a serial interface.

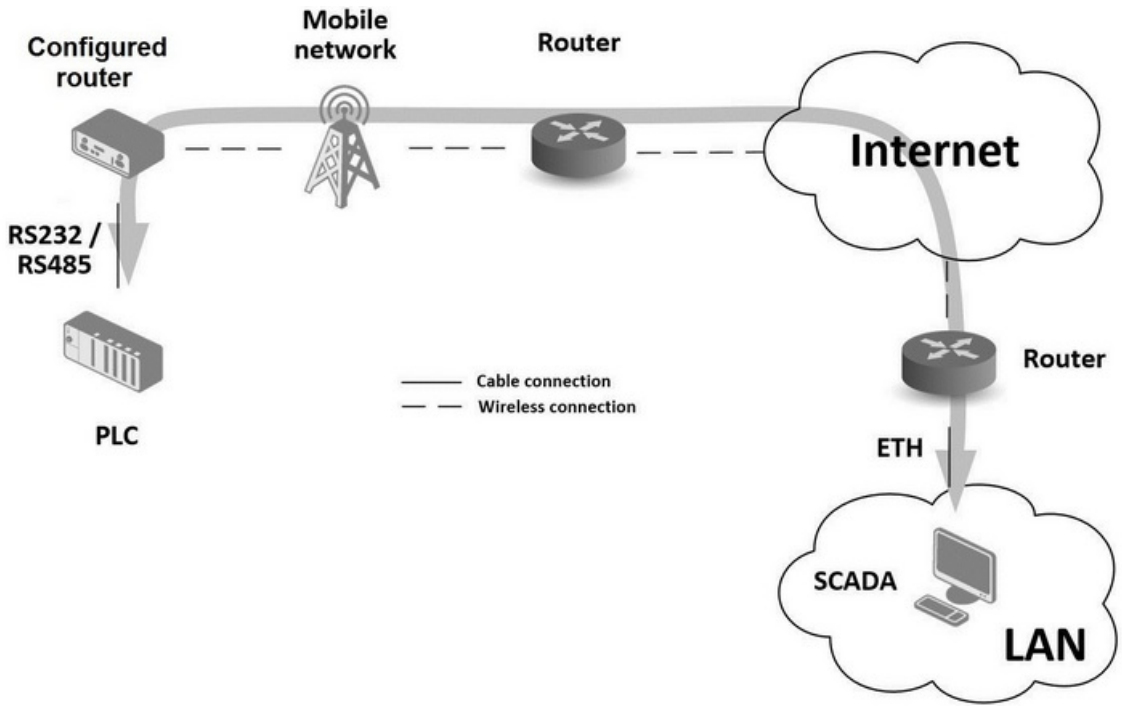

Figure 4: Serial Gateway

1.3 Hardware Overview

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

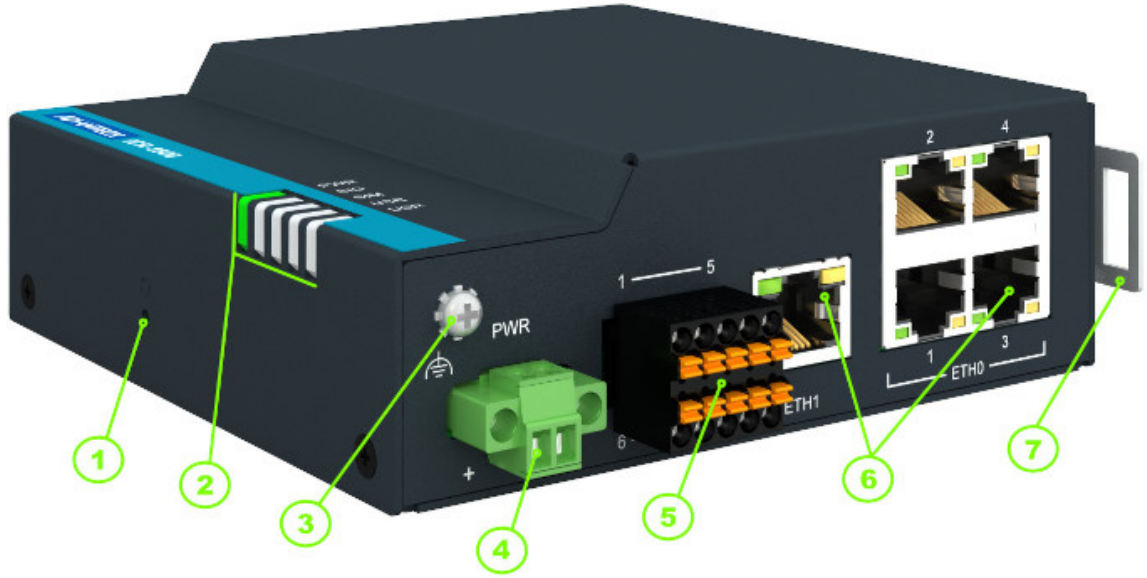

Figure 5: Router Hardware Overview – Front View

#	Item/Caption	Type	Description
1	RST	—	Button to reboot the router or restore default settings; see Chapter 2.8.
2	LEDs	—	Status LED indicators; see Chapter 2.7.
3	GND Screw	M3	Ensure proper grounding; refer to Chapter 2.4.
4	PWR	2-pin terminal	Power supply socket; see Chapter 2.4.
5	Serial & I/O	10-p term.	1 RS232, 1 RS485, 1 digital input, and 1 digital output interfaces. See Chapter 2.6 for serial interface details, Chapter 3.8 for I/O parameters, and Chapter 3.9 for serial interface parameters.
6	ETH0, ETH1	RJ45	1 Gb Ethernet LAN interfaces; see Chapter 2.3.
7	DIN Clip	—	DIN mounting clip, not included as standard accessories, can be ordered optionally; see Chapter 1.9.

Table 1: Router Hardware Overview – Front View

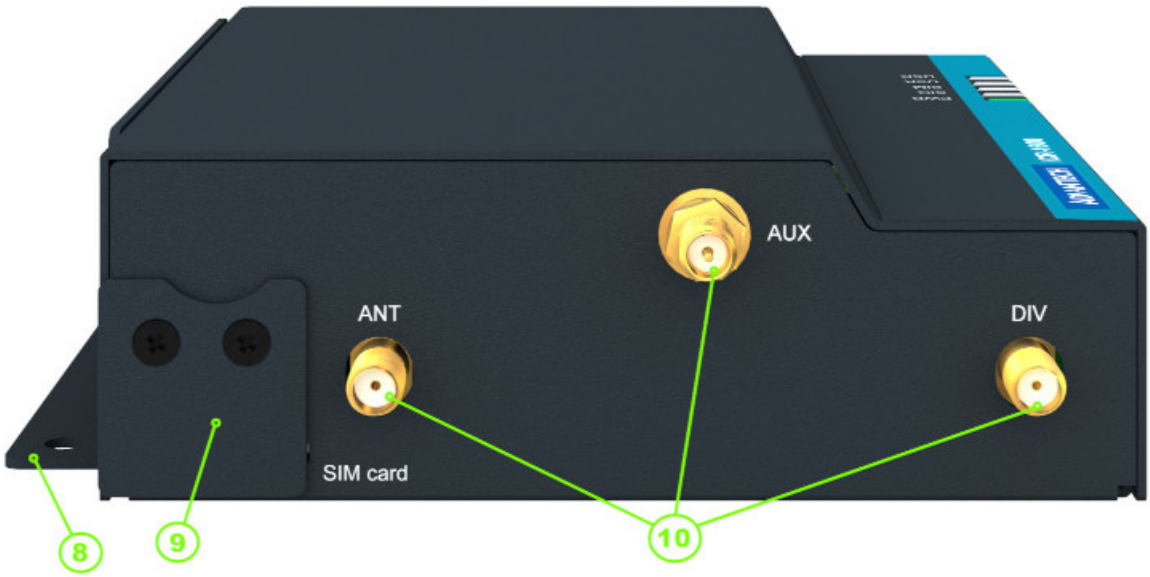

Figure 6: Router Hardware Overview – Rear View

#	Item/Caption	Type	Description
8	Wall Clip	—	Wall mounting clip, included as standard accessories; see Chapter 1.8.
9	SIM Slots	Micro SIM	Two Micro SIM card slots; details in Chapter 2.1.
10	ANT, AUX and DIV	—	Connectors for both the main and diversity antennas of the cellular module. Refer to Chapter 2.2 for details, Chapter 3.4 & 3.5 for cellular module parameters.

Table 2: Router Hardware Overview – Rear View

1.4 Order Codes

Order codes overview is shown in the table below.

Order code	Configuration
ICR-1645-EU-A	LTE Connectivity Gateway with 5 x Gigabit Ethernet ports and 1xRS232+1xRS485+1xDI+1xDO ports for **EMEA**, certified with CE/UKCA.
ICR-1645W-EU-A	LTE Connectivity Gateway with 5 x Gigabit Ethernet ports and 1xRS232+1xRS485+1xDI+1xDO ports, **WiFi** for **EMEA**, certified with CE/UKCA.
ICR-1645G-EU-A[1]	LTE Connectivity Gateway with 5 x Gigabit Ethernet ports and 1xRS232+1xRS485+1xDI+1xDO ports, **GNSS** for **EMEA**, certified with CE/UKCA.
ICR-1645-CN-A	LTE Connectivity Gateway with 5 x Gigabit Ethernet ports and 1xRS232+1xRS485+1xDI+1xDO ports for **China**.
ICR-1645W-CN-A	LTE Connectivity Gateway with 5 x Gigabit Ethernet ports and 1xRS232+1xRS485+1xDI+1xDO ports, **WiFi** for **China**.
ICR-1645G-CN-A[1]	LTE Connectivity Gateway with 5 x Gigabit Ethernet ports and 1xRS232+1xRS485+1xDI+1xDO ports, **GNSS** for **China**.

Table 3: Order Codes Overview

[1] Availability may vary. Please consult your local sales representative for more information.

1.5 Package Contents

The standard set of the router includes the following items, as listed in the table below:

Item#	Description	Figure	Q'ty
1	Router		1 pc
2	Wall Mount Kit (packed in accessory box, including 4 screws of type M3 x 5L)		1 pc
3	2-pin terminal block for power supply (installed on the router)		1 pc
4	10-pin terminal block for Serial and IO (installed on the router)		1 pc
5	LTE Antennas (packed in accessory box)		2 pc
6	WiFi Antenna (packed in accessory box, WiFi model only)		1 pc
7	Printed *Quick Start Guide Leaflet*		1 pc

Table 4: Contents of Package

1.6 Product Dimensions

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

Basic Set

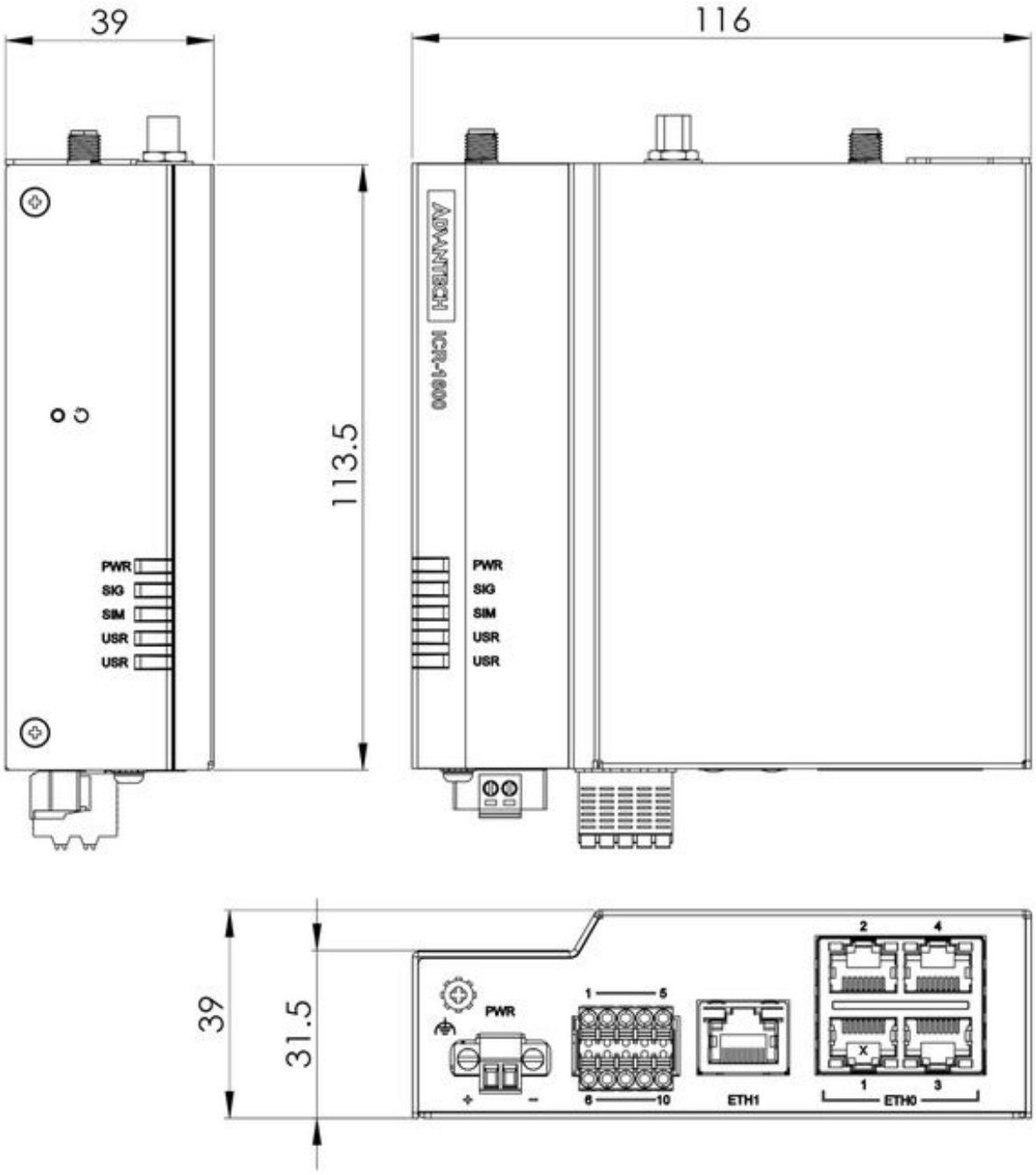

Figure 7: Router Dimensions – Front, Top and Right view for basic set

Variant with Wall Mounting Clip

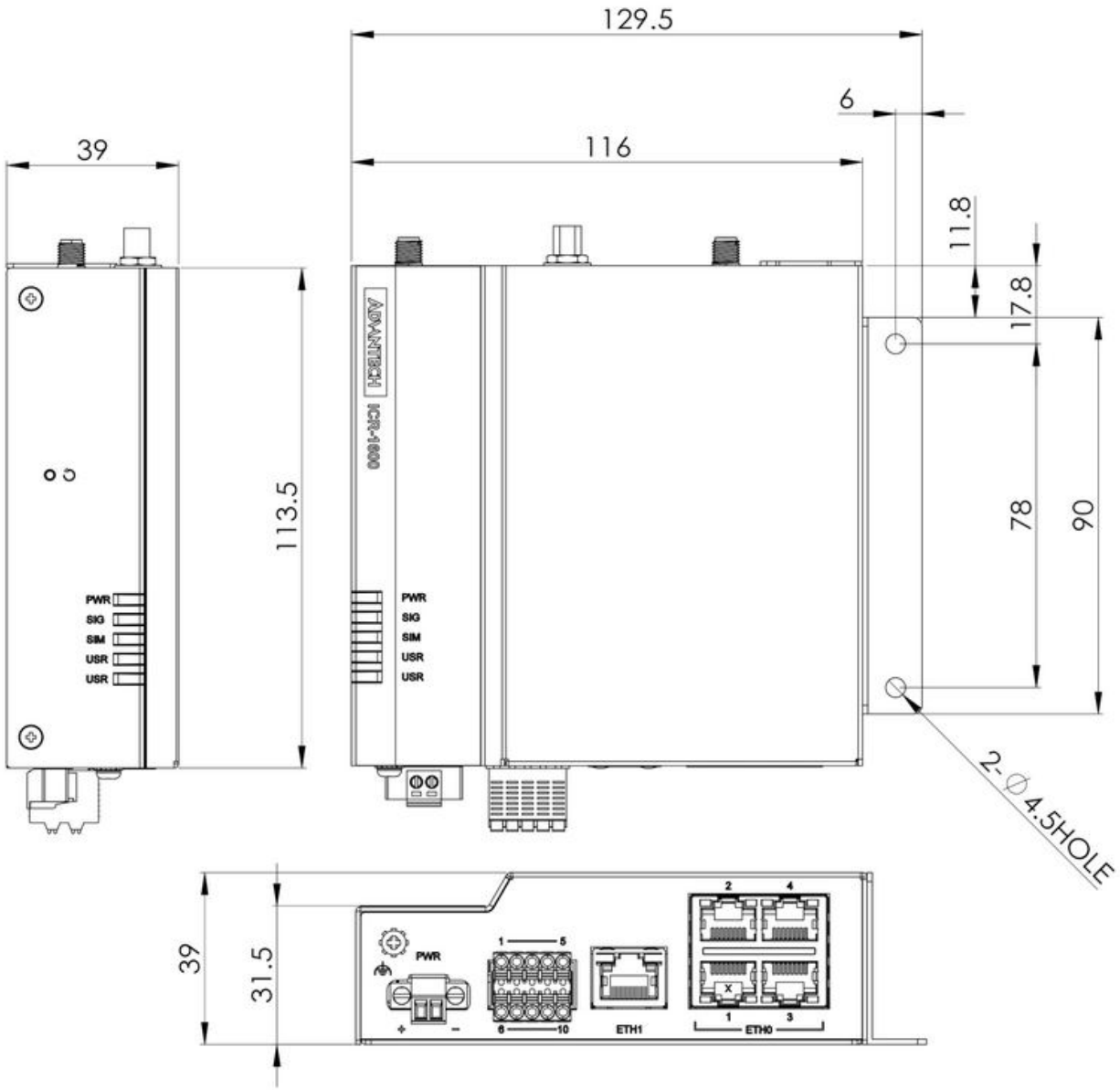

Figure 8: Router Dimensions – Front, Top and Right view with Wall Mounting holder

Variant with DIN Rail Clip

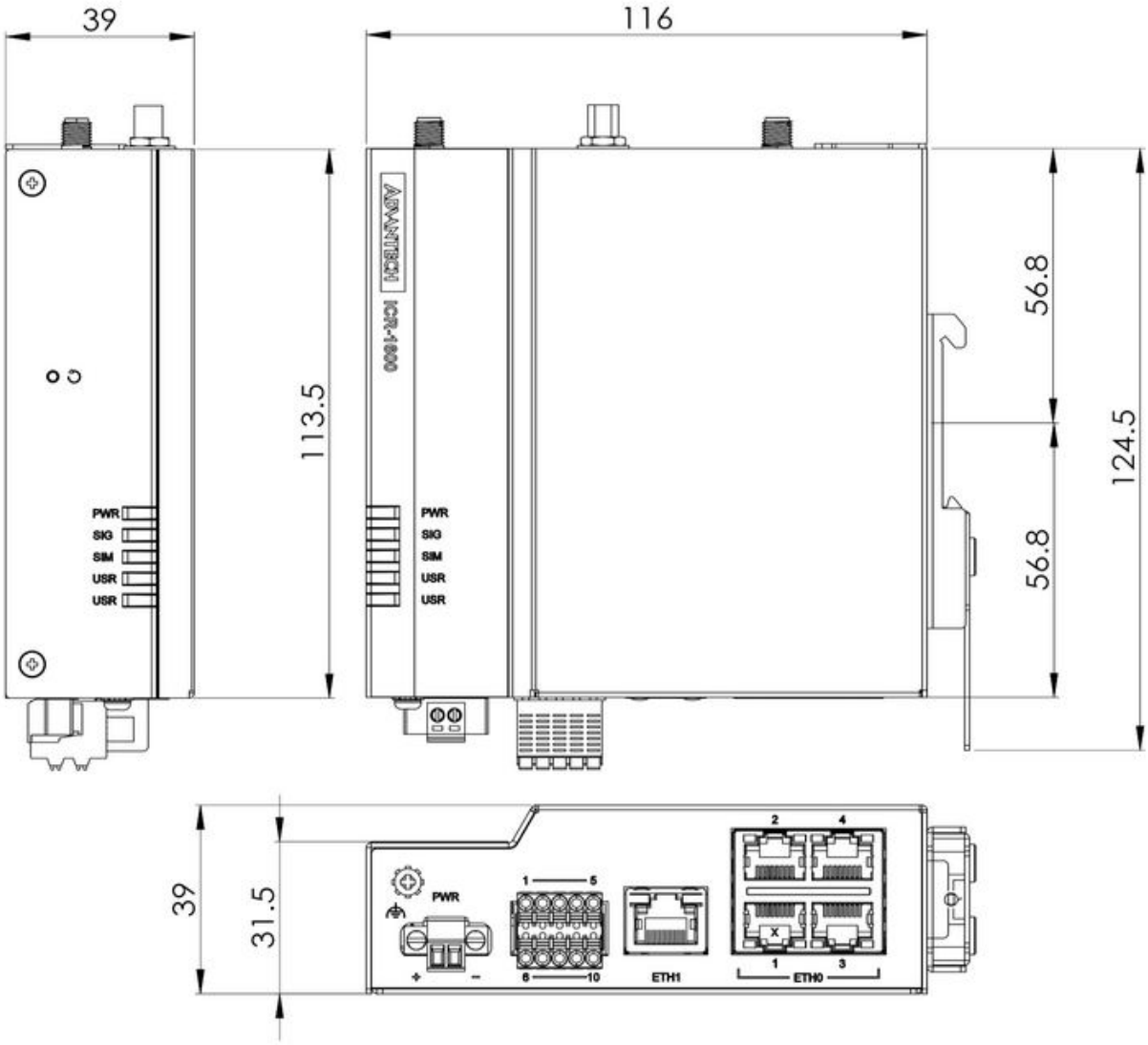

Figure 9: Router Dimensions – Front, Top and Right view with DIN holder

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.

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 2.4).

1.8 Wall Mounting

The wall mounting clip is included as a standard accessory (packed in the accessory box, including 4 screws of type M3 x 5L).

The router can be affixed to a wall or another surface using the wall mounting clip. The delivered wall mounting clip can be assembled to the router as shown in Figure 10.

The wall mounting clip features two holes with a diameter of 4.5 millimeters for screw placement. For precise mounting dimensions, refer to Figure 8 in Chapter 1.6.

When attaching the wall mounting clip, tighten the screws with a maximum torque of 0.6 Nm (6 kg.cm).

Figure 10: Wall Mounting Clip

1.9 DIN Rail Mounting

The DIN rail mounting clip is not included as a standard accessory; it can be ordered separately under P/N OPT1-DIN-ICR1X-00.

You can attach the DIN rail clip to the router for mounting it onto a DIN rail that complies with the 60715 standards. The default position of the clip is depicted in Figure 11. If necessary, the clip can also be rotated into all four positions.

When attaching the clip, use 4 screws of type M3 x 5L, and tighten the screws with a maximum torque of 0.6 Nm (6 kg.cm).

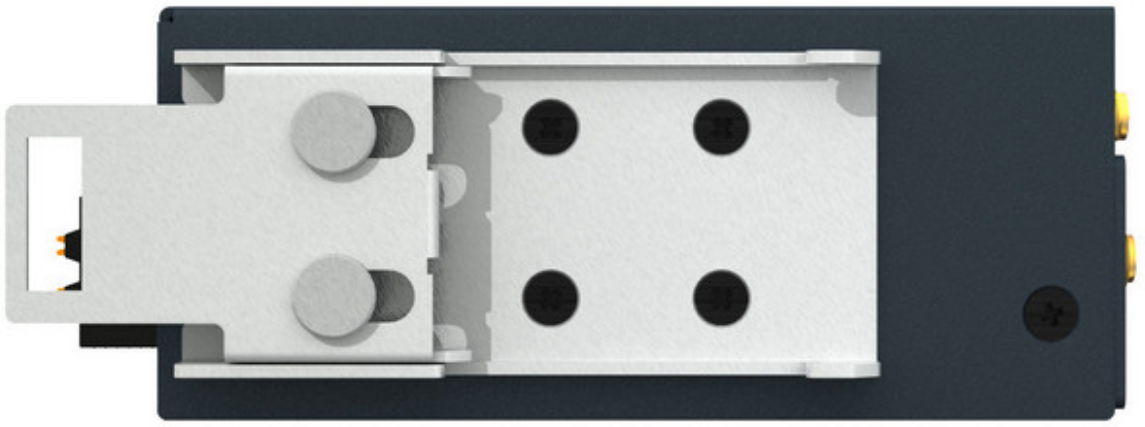

Figure 11: Default Position of the DIN Rail Clip

1.10 Product Label

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

Figure 12: 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.

- Before putting the router into operation, ensure that all components required for running your applications are connected. Refer to Chapter *1.3 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 1.3 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*).

Type of SIM card: Micro SIM (3FF) 15.0 × 12.0 × 0.76 mm.

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 13: SIM Cards Insertion

2.2 Antennas Interfaces

The ANT and DIV SMA female connectors are intended for connecting the main and diversity cellular antennas to the router.

Additionally, SMA/RP-SMA[1] female connectors labeled *AUX* are provided for connecting GNSS/WiFi antennas on models that support WiFi or GNSS.

Do not run the router without connected cellular antennas as the energy from the transmission is effectively reflected by the open end and can damage the equipment.

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 and one ETH1 Ethernet interfaces. The pinout of the socket is shown in Figure 14 and described in Table 5.

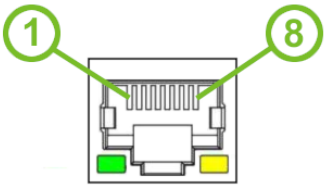

Figure 14: Ethernet Connector Pinout of RJ45 Socket

Pin	10base-T & 100base-T	1000base-T
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+)
5	—	BI_DC- (BiDirectional pair C-)
6	Rx- (Receive Data-)	BI_DB- (BiDirectional pair B-)
7	—	BI_DD+ (BiDirectional pair D+)
8	—	BI_DD- (BiDirectional pair D-)

Table 5: Ethernet Connector Pinout Description of RJ45 Socket

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

[0]SMA female for GNSS, RP-SMA female for WiFi

2.4 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 6: Power connector pinout

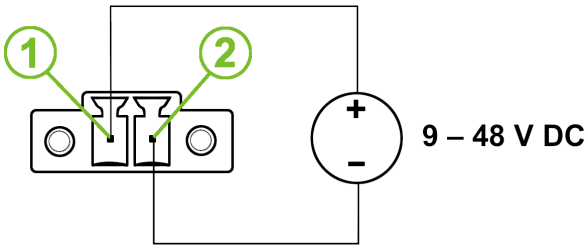

Figure 15: Power Connector Pinout

The required power supply voltage for the router ranges between +9 V and +48 V DC. Refer to the connection scheme in Figure 15 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.

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.

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, 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 16. The maximum tightening torque for the grounding screw is 0.6 Nm (6 kg.cm).

Figure 16: Position of the Grounding Screw

2.5 DIN & DOUT Interfaces

The pins of I/O interface are physically connected to the 10-pin terminal block panel socket. The pinout of the I/O interface is described in Figure 17 and Table 7.

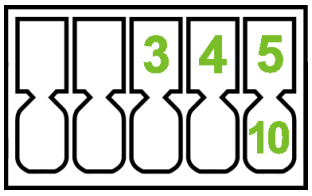

Figure 17: I/O Connector Pinout

Pin	Signal mark	Description
3	BIN	Digital input
4	BOUT	Digital output
5,10	GND	Ground (common negative pole)

Table 7: I/O Ports Pinout

The I/O interface is not electrically isolated from the router.

The I/O user interface is designed for digital input processing and digital output control. For detailed electrical parameters see Chapter 3.8. The functional scheme of connection for the digital input and digital output is in Figure 18.

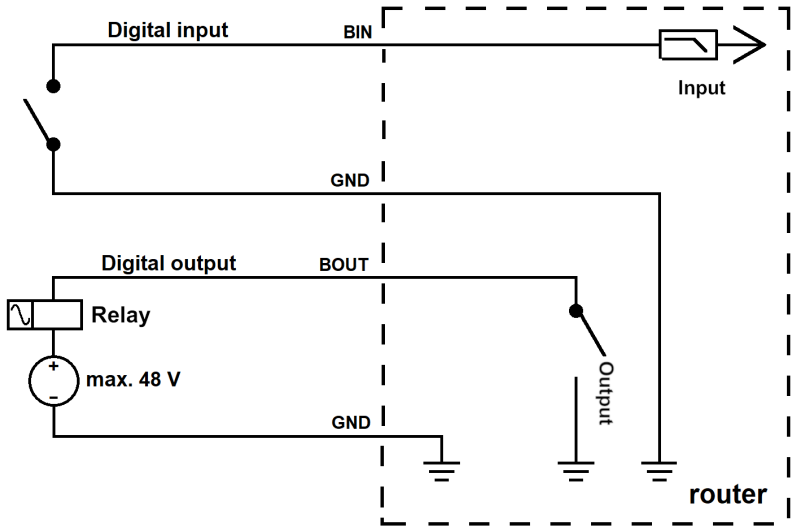

Figure 18: Functional Scheme of the Digital Interface

2.6 Serial Interfaces

Two independent serial interfaces are connected to the 10-pin terminal block panel socket.

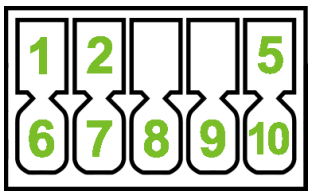

Figure 19: Serial Connector Pinout

The RS232 interface can be configured on the web GUI by navigating to *Configuration* → *Expansion Port 1*. For the pinout, refer to Table 8. .

Pin	Signal mark	Description
6	TXD	OUT
7	RXD	IN
8	RTS	OUT
9	CTS	IN
10	GND	GROUND

Table 8: Connection of RS232

The RS485 interface can be configured on the web GUI by navigating to *Configuration* → *Expansion Port 2*. For the pinout, refer to Table 9.

Pin	Signal mark	Description
1	D (+)	IN/OUT
2	D (-)	IN/OUT
5	GND	GROUND

Table 9: Connection of RS485

The serial interfaces are not eletrically isolated from the router.

2.7 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	Green Green Off	On Blinking Off	Powered up, the system is booting up. System is ready and operating normally. No power.
	SIG	Green Orange Red Off	On / blinking On / blinking On / blinking Off	Good cellular signal. Fair cellular signal. Poor cellular signal. No cellular link.
	SIM	Green Orange Green Orange Red Off	Blinking Blinking On On Fast blinking Off	SIM 1 is selected, waits for data connection. SIM 2 is selected, waits for data connection. Connects through SIM 1. Connects through SIM 2. Missing SIM card or PIN code problem. No SIM card is selected.
	USR	Green	—	The function of this LED is user-defined.
	ETH0 ETH1	Green Green	On Off	Selected 1 Gbps bit rate. Selected 100/10 Mbps bit rate.
	ETH0 ETH1	Yellow Yellow Yellow	On Brief off blinks Off	The network cable is connected. Data transmission. The network cable is not connected.

Table 10: LED Status Indication

The following describes when *USR* is defined as Serial or WiFi:

	Caption	Color	State	Description
	Serial/USR	Green Off	Blinking Off	Serial Port 1 TX/RX transmitting data. No RS232/RS485 data.
	WiFi/USR	Green Green Off	On Blinking Off	AP or STA mode is selected. Transmitting data. No AP or STA mode is selected.

Table 11: LED Status Indication

2.8 Reset Functions

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

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		Description
Temperature range	Operating Storage	-30 °C to +75 °C (-22 °F to +167 °F) -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
Consumption for non-WiFi / WiFi version	Idle Average Maximum	2.7 W / 3.6 W 3.7 W / 4.8 W 5.5 W / 6.8 W
Dimensions of device (w/o clips)		116 × 39 × 113.5 mm (4.56" × 1.53" × 4.47")
DIN rail clip specification		DIN 30 mm (DIN clip is an optional)
Weight		ICR-16XX: 470 g (1.04 lbs) (excl. accessories below) LTE Antenna: 25.2 g (0.06 lbs) Wall-mount bracket: 50 g (0.11 lbs) WiFi Antenna 7.8 g (0.02 lbs)

Table 12: Basic Parameters

3.2 Standards and Regulations

Parameter	Description
Radio	EN 301 908-1, EN 301 908-2, EN 301 908-13, EN 301 908-25,EN 303 413, EN 300 328, EN 301 893
EMC	EN 301 491-1, EN 301 489-17, EN 301 489-19, EN 301 489-52, EN 610000-6-2, EN 610000-6-3, EN 55032, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6
Safety	EN 62368-1
Mechanical	EN 60529, EN 60068-2-27, EN 60068-2-64
Climatic	EN 60068-2-1, EN 60068-2-2, EN 60068-2-14, EN 60068-2-78
National	CE, UKCA for ICR-16xx-EU SRRC, NAL for ICR-16xx-CN
Environmental	REACH, RoHS3 and WEEE compliant

Table 13: Standards and Regulations

3.3 Type Tests and Environmental Conditions

Phenomena	Test	Description	Test levels
ESD	EN 61000-4-2	Enclosure contact	± 8 kV (crit. B)
RF field AM modulated	EN 61000-4-3	Enclosure	3 V/m (crit. A) (80 – 1000 MHz)
Fast transient	EN 61000-4-4	Signal ports Power ports Ethernet ports	± 0.5 kV (crit. A)
Surge	EN 61000-4-5	Ethernet ports Power ports	± 0.5 kV (crit. B), ± 1 kV (crit. B) open circuit
RF conducted	EN 61000-4-6	All ports	3 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 %, 12 h - 12 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, -30 °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 14: Type Tests and Environmental Conditions

3.4 Parameters of Cellular Module for ICR-16xx-EU

Parameter	Description
Antenna	• Connector type: SMA • Impedance: 50 Ω
LTE parameters	• LTE Cat.4, 3GPP Rel.11 • FDD bands: B1 (2100 MHz), B3 (1800 MHz), B7 (2600 MHz), B8 (900 MHz), B20 (800 MHz), B28A (700MHz) • TDD bands: B38 (2600 MHz), B40 (2300 MHz), B41 (2500 MHz) • Bit rates: up to 150 Mbps (DL), 50 Mbps (UL)
HSPA+/UMTS parameters	• Supported frequencies: B8 (900 MHz), B1 (2100 MHz) • Bit rates: up to 42 Mbps (DL) / 5.76 Mbps (UL)
EDGE/GPRS parameters	• Supported frequencies: B8 (900 MHz), B3 (1800 MHz) • Bit rates: up to 296 kbps (DL) / 236.8 kbps (UL)

Table 15: Technical Parameters of Cellular Module

3.5 Parameters of Cellular Module for ICR-16xx-CN

Parameter	Description
Antenna	• Connector type: SMA • Impedance: 50 Ω
LTE parameters	• LTE Cat.4, 3GPP Rel.11 • FDD bands: B1 (2100 MHz), B3 (1800 MHz), B5 (850 MHz), B8 (900 MHz) • TDD bands: LTE-TDD Bands: B34 (2000MHz), B38 (2600 MHz), B39 (1900MHz), B40 (2300 MHz), B41 (2500 MHz) • LTE-FDD transfer rate: 150 Mbps (DL), 50 Mbps (UL) • LTE-TDD transfer rate: 130 Mbps (DL), 30 Mbps (UL)
HSPA+/UMTS parameters	• WCDMA Bands: B1/B8 • WCDMA transfer rate: 384 kbps (DL/UL) • TD-SCDMA Bands: B34/B39 • TD-SCDMA transfer rate: 2.4 Mbps (DL), 2.2 Mbps (UL)
EVDO/CDMA Parameters	• CDMA800 • Transfer rate EVDO: 3.1 Mbps (DL), 1.8 Mbps (UL)
EDGE/GPRS parameters	• Supported frequencies: EGSM900/ DCS1800 • GPRS transfer rate: 107 kbps (DL), 85.6 kbps (UL) • EDGE transfer rate: 296 kbps (DL), 236.8 kbps (UL)

Table 16: Technical Parameters of Cellular Module

3.6 Parameters of GNSS (for ICR-16xxG only)

Parameter	Description
GNSS Systems	GPS, Galileo, QZSS, GLONASS, and BDS
Antenna	Connector type: SMA Input impedance: 50 Ω Supports active or passive antenna
Features	Protocol: NEMA 0183
Frequency	GPS: 1575.42±1.023 MHz Galileo: 1575.42±2.046 MHz QZSS: 1575.42 MHz GLONASS: 1597.5–1605.8 MHz BDS: 1561.098±2.046 MHz
Sensitivity (autonomous)	Acquisition: -146 dBm Reacquisition: -157 dBm Tracking: -157 dBm
Acquisition time (autonomous)	Cold start: 35.0 s Warm start: 26.0 s Hot start: 2.5 s
Accuracy	2.5 m

Table 17: Technical Parameters of GNSS

3.7 Parameters of WiFi (for ICR-16xxW only)

Parameter	Description
Antenna Connectors	R-SMA - 50 Ω
Supports WiFi bands	2.400 – 2.4835 GHz 5.150 – 5.850 GHz
Standards	IEEE: 802.11b, 802.11b/g, 802.11b/g/n, 802.11a, 802.11an, 802.11ac
2.4 GHz supported channels	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
5 GHz supported channels	36, 40, 44, 48, 149, 153, 157, 161, 165
Type of Device	Access point (AP) Station (STA)
Security – Standards	WPA, WPA2, WPA3, 802.1X
Security – Encryption	WEP, TKIP, AES
AP maximum users	Access Point mode: up to 16 clients max

Table 18: Technical Parameters of WiFi

3.8 Parameters of I/O Ports

Electrical characteristics of the digital input are in Table 19. 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]	Status[2]
1	Open
0	Short to ISO_GND

Table 19: Electrical Characteristics of Digital Input

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

3.9 Parameters of Serial Interfaces

Supported parameters of the RS232 and RS485 interfaces, which can be configured on Web GUI in *Configuration* → *Expansion Port 1* resp. *Configuration* → *Expansion Port 2* menu items, are in Table 20.

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

Table 20: Parameters of Serial Interfaces

[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 21.

Parameter	Description
CPU architecture	ARM Cortex-A7
CPU frequency	1.2 GHz
CPU power	1.9 DMIPS/MHz
Flash memory	512 MB of eMMC • ≈ 60.5 MB for Router Apps • ≈ 26.7 MB for customer data
RAM size	256 MB
Watchdog	Yes

Table 21: System Configuration

Appendix A: Troubleshooting

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.
- **Caution!** 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-1600 Configuration Manual

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

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

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