Relio™ R1 Edge Industrial Computer

User Manual | Relio™ R1 Edge

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Introduction

Overview

The **Relio™ R1 Edge Industrial Computer** is an exceptionally Rugged embedded computer for operating in harsh environments. The R1 Edge's fanless and nearly cableless structure ensures durability over long-term use. Built using the PICMG COM Express architecture, Sealevel has partnered with the leading COM Express module manufacturers to ensure our customers benefit from the best in the industry.

The R1 Edge is the latest addition to the industry-leading Relio embedded computer line. The R1 Edge incorporates the newest generation of industrial processors and a modernized video interface with versatile communication options like (2) 2.5 Gigabit Ethernet ports, Cellular 4G LTE, WI-FI 6E, and (2) RS-232/422/485. The R1 Edge features (1) USB C port, (2) locking USB 3.1 ports, (2) locking USB 2.0 ports, (2) DisplayPorts, Audio Line-In/Out 3.5mm ports, and an extreme, wide operating temperature range of up to -40°C to +60°C.

The R1 Edge has an extremely rugged, anodized aluminum enclosure combined with intentional thermal management for unmitigated performance under environmental extremes. The fanless, solid-state design, combined with locking SeaLATCH USB connectors, ensures shock and vibration tolerance as well as long-term reliability.

With a robust and flexible I/O mix, this Edge industrial computer is capable of managing a variety of data inputs to interface with legacy systems and the most advanced peripherals. The embedded computer's COM Express architecture gives manufacturers a technology migration path to easily change, and upgrade, the CPU functionality without a complete system redesign or replacement.

Inside the R1 Edge, a M.2 SATA III SSD slot provides solid-state storage ranging from 128GB to 1TB. The R1 Edge is compatible with windows 10 IoT Enterprise, Windows 11 Pro, RHEL 8.6, Ubuntu Server 22.04, Ubuntu Desktop 20.04 and most other Linux distributions based on Kernel 6.7 or newer. The system is also Windows 11 IoT-ready to provide maximum flexibility for evolving customer-specific software applications. Sealevel's SeaCOM hardware driver is included to provide system I/O, serial application code samples assist with custom application development and complete support documentation expedites configuration.

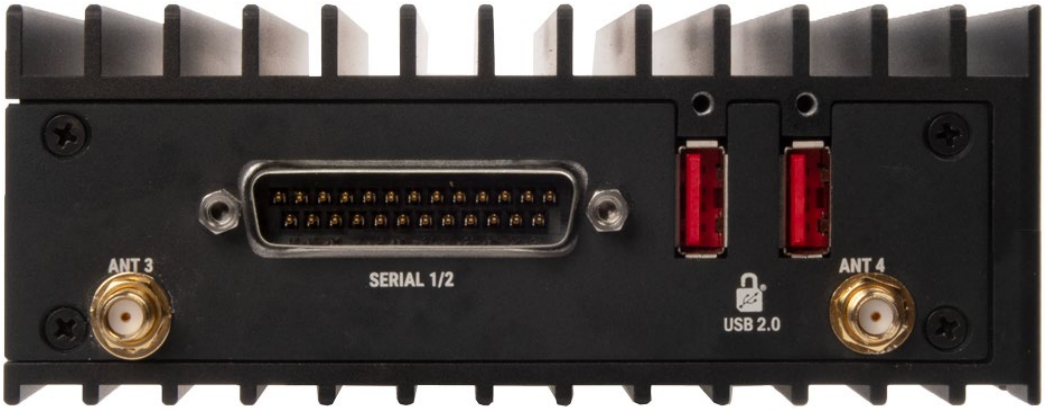
Features

- Wide operating temperature range up to -40°C to 60°C
- 18-36VDC input with locking 2-position connector
- 6.6” (L) x 5.0” (W) x 1.9” (H) dimensions
- (2) 2.5 Gigabit (10/100/1000/2500 BaseT) Ethernet Ports
- (2) USB 3.1 SeaLATCH Charging Ports
- (2) USB 2.0 SeaLATCH Ports
- (1) USB C Port
- (2) Video DisplayPort 1.2 Connectors
- (2) Full RS-232/422/485 Ports
- (1) M.2 SATA III SSD Interface (configurable 128GB – 1TI
- (1) M.2 4G LTE Cellular w/ 2 Antennas (optional feature)
- (1) M.2 Wi-Fi 6E w/ 2 Antennas (optional feature)
- (2) Audio Line-In/Out 3.5mm Ports

(2) Video
(2) Gigabit (10/100/1000/2500 BaseT) Ethernet Por
(2) USB 3.1 SeaLATCH USB Charging Port
(1) USB Type C (USB 3.1) Charging Port
(1) Audio Line – In
(1) Audio Line – Out

R1 Edge Antennas	
SMA	**FUNCTIONS**
ANT1	Wi-Fi Main
ANT2	Wi-Fi Aux
ANT3	Cellular Main
ANT4	Cellular Aux

(1) 18-36VDC input with Locking 2 POS Connector
(2) SMA for Wi-Fi 6E Antennas



(2) DB25 Dual RS-232/485 Ports (via CA203)
(2) USB 2.0 SeaLATCH Ports
(2) SMA for Cellular Modem Antennas

Before You Get Started

What's Included

The R1 Edge is shipped with the following items. If any of these items are missing or damaged, please contact Sealevel for replacement.

- **Relio™ R1 Edge Industrial Computer System**
- **2-POS terminal block for power input**
- **Installation instructions including compliance and rating information**
- **DB25 Female to two DB9 Males 3 FT Serial Cable (CA203)**

Advisory Conventions

Warning
The highest level of importance used to stress a condition where damage could result to the product, or the user could suffer serious injury.

Important
The middle level of importance used to highlight information that might not seem obvious or a situation that could cause the product to fail.

Note
The lowest level of importance used to provide background information, additional tips, or other non-critical facts that will not affect the use of the product.

Optional Items

Depending upon your application, you are likely to find one or more of the following items useful with the R1 Edge. All items can be purchased from our website (www.Sealevel.com) or by calling our Sales team at (864) 843-4343.

Cables

CAT5 Patch Cable, 7’ In Length (Part# CA246)	
Standard 7' CAT5 Unshielded Twisted Ethernet Pair Patch Cable (RJ45) with blue jacket.	
CAT5 Patch Cable, 10' In Length (Part# CA247)	
Standard 10’ CAT5 Unshielded Twisted Pair Ethernet Patch Cable (RJ45) with blue jacket.	
SeaLATCH USB 2.0 Type A to USB 2.0 Type B, 72” Length - Device Cable (Part# CA355)	
The CA355 is a 72” USB device cable with Sealevel’s SeaLatch locking USB type A and type B connectors. The metal thumbscrew on each connector provides a secure metal-to-metal connection to devices with SeaLatch USB ports.	
SeaLATCH USB Type A to USB Type B, 5 Meter Length - Device Cable (Part# CA355-5M)	
The CA355-5M is a 5 meter (16 feet) USB device cable with Sealevel’s SeaLatch locking USB type A connector and standard type B connector. The metal thumbscrew on the type A connector provides a secure metal-to-metal connection to devices with SeaLatch USB ports.	
SeaLATCH USB Type A to SeaLATCH USB Type B, 72” Length - Device Cable (Part# CA332)	
The CA332 is a 72” USB device cable with Sealevel’s SeaLatch locking USB type A and type B connectors. The metal thumbscrew on each connector provides a secure metal-to-metal connection to devices with SeaLatch USB ports.	

SeaLATCH USB Type A to SeaLATCH USB Type B, 5 Meter Length - Device Cable (Part# CA332-5M)	
The CA332-5M is a 5 meter (16 feet) USB device cable with Sealevel's SeaLatch locking USB Type A and B connectors. The metal thumbscrew on the type A connector ensures secure connection.	
USB Type A to SeaLATCH USB Type B, 72" Length – Device Cable (Part# CA356)	
The CA356 is a 72" USB device cable that securely connects USB device port (metal thumbscrew lock) to a host computer. The CA356 is USB 2.0 compliant and is compatible with USB 1.1 and 1.0 devices.	
SeaLATCH USB 3.1 Type A and SeaLATCH USB 3.1 Type B Device Cable, 78" (Part# CA746)	
The CA746 is a USB 3.1 device cable with SeaLATCH USB type A and SeaLATCH type B connectors. The metal thumbscrew on each connector provides a secure metal-to-metal connection to devices with SeaLATCH USB ports.	
SeaLATCH USB 3.1 Type A and USB 3.1 Type B Device Cable 78" (Part# CA747)	
The CA747 is a USB 3.1 device cable with SeaLATCH USB type A and standard type B connectors. The metal thumbscrew on the SeaLATCH connector provides a secure metal-to-metal connection to devices with SeaLATCH USB ports.	
USB 3.1 Type A and SeaLATCH USB 3.1 Type B Device Cable 78" (Part# CA748)	
The CA748 is a USB device cable with standard USB type A and SeaLATCH type B connectors. The metal thumbscrew on the SeaLATCH connector provides a secure metal-to-metal connection to devices with SeaLATCH USB ports.	

Loopback Adapter

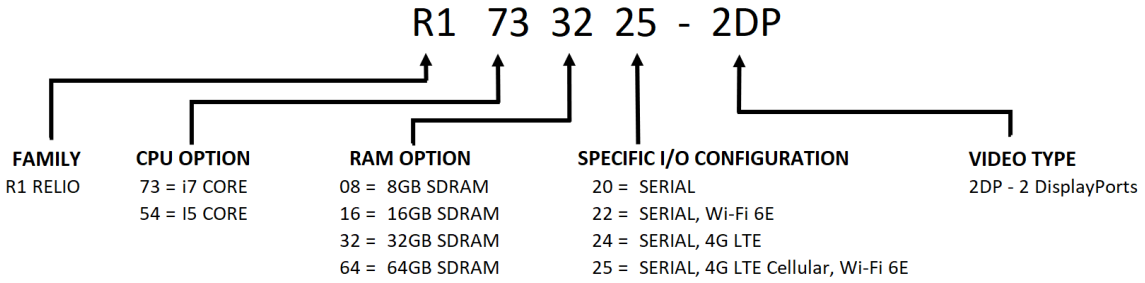
DB9 Female Serial Loopback Adapter (Part# LB101)	
The LB101 is compatible with RS232, RS422, and 4-wire RS485 modes. Only the data pins are looped back.	

Power Supply

100-240VAC to 24VDC @ 2.7A , Desktop Power Supply (Part# TR152)	
The TR152 is a desktop (brick style) power supply rated for 100-240VAC input and 24VDC output at 2.7 amps. The cable has tinned leads for use with products that have screw terminals for input power.	

Technical Description

R1 Edge Part Number Breakdown



Sample of Orderable R1 Edge Part Numbers

Part Number	COM Express Module	COM Express Module Description	RAM
R17308xx-2DP	congatec TC570	Type 6 Compact Module with INTEL i7 1185GRE CPU	8GB DDR4 3200
R17316xx-2DP	congatec TC570	Type 6 Compact Module with INTEL i7 1185GRE CPU	16GB DDR4 3200
R17332xx-2DP	congatec TC570	Type 6 Compact Module with INTEL i7 1185GRE CPU	32GB DDR4 3200
R17364xx-2DP	congatec TC570	Type 6 Compact Module with INTEL i7 1185GRE CPU	64GB DDR4 3200
R15408xx-2DP	congatec TC570	Type 6 Compact Module with INTEL i5 1145GRE CPU	8GB DDR4 3200
R15416xx-2DP	congatec TC570	Type 6 Compact Module with INTEL i5 1145GRE CPU	16GB DDR4 3200
R15432xx-2DP	congatec TC570	Type 6 Compact Module with INTEL i5 1145GRE CPU	32GB DDR4 3200
R15464xx-2DP	congatec TC570	Type 6 Compact Module with INTEL i5 1145GRE CPU	64GB DDR4 3200

System Description

The following I/O connectors use industry standard pin outs for maximum compatibility.

Function	Connector Type
Digital Video Output	DisplayPort 1.2
10/100/1000/2500 (Gigabit Ethernet) Network Connections	RJ45
Dual RS-232/422/485 Serial Ports	DB25 (Proprietary Breakout to 2x DB9 via CA203)
USB 2.0 Port (480 Mbps)	USB Type A (High Retention)
USB 3.1 Port (5 Gbps)	USB Type A (7.5W Charging)
USB 3.1 Port (5 Gbps)	USB Type C (15W Charging)
Audio Line In/Out	3.5mm Headphone jacks
SIM	Micro SIM card Carrier
Wi-Fi 6E	Internal M.2
4G LTE Cellular Modem	Internal M.2

R1 Edge Peripheral Port Specifications

M.2 DEVICES	M.2 PORT
Cellular	M.2 Key B Socket 2 size 3042 or 3052* - PCIe, USB 3.1 Gen1, USB 2.0
SSD	M.2 Key B Socket 2 size 2242 - SSD- SATA
Wi-Fi	M.2 Key E Socket 1 size 2230 - PCIe Socket 1 - No support for SDIO

* The cellular slot can accommodate 3052 sized cards from the factory

COM Express Module/RAM Configuration Options

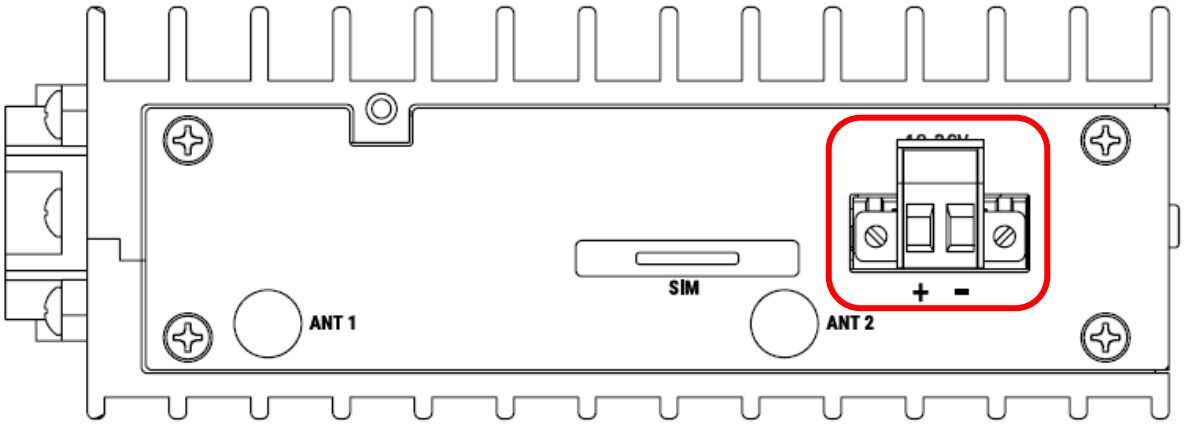
The R1 Edge Industrial Computer is compatible with compact form factor Type 6 COM Express modules. COM Express is a widely supported implementation of Computer on Module (COM) design. The COM Express architecture reduces the complexity, cost and time required for computer system design by combining the processing, memory, video, Ethernet and USB functionality in a small, highly integrated module. COM Express modules installed on a carrier board that provides the application specific I/O and external connectors best suited for the system requirements.

Our COM Express carrier boards leverage Sealevel's I/O and communication expertise, providing carrier board and full system solutions as rapidly as possible.

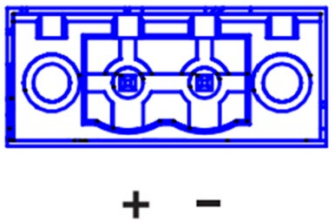
The R1 Edge Industrial Computer is available in a variety of configurations, see the Sealevel website for all configurations: **Sealevel website - Relio™ R1 Edge Industrial Computers**

Power Input

The system is designed to operate from 18VDC up to 36VDC. The current draw varies across this range; it is heavily dependent on the COM Express module, peripheral devices and installed software. The main power input is via a 2-pos 5.08mm locking plug connector (SL#104456). The power source must be suitable for the maximum ambient temperature at the installation. For a list of power requirements, see the Technical Specifications section.



CKT #	Signal	Name
1	+	Positive DC Power
2	-	Negative DC Power (GND)

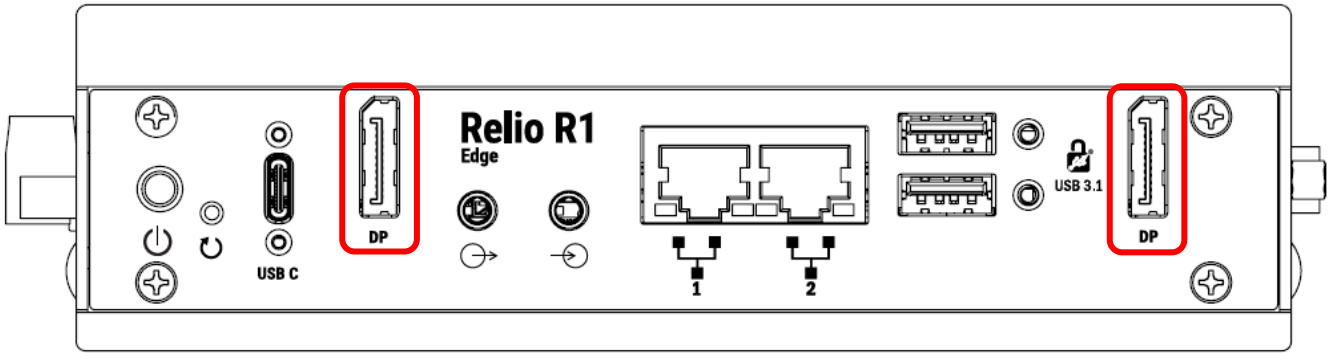


18-36VDC Input with Locking 2-Pos Connector

Ensure the power source that you will be using can supply the power listed over the entire operational temperature range of your environment.

DisplayPort

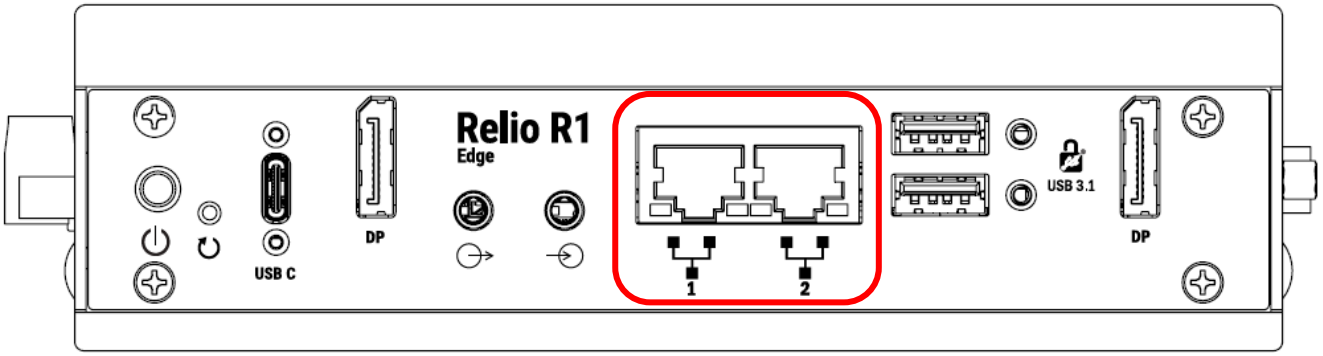
The system has two video DisplayPort connectors.



Video DisplayPort Connectors

Ethernet

The system has two 10/100/1000/2500 BaseT Ethernet Network ports.



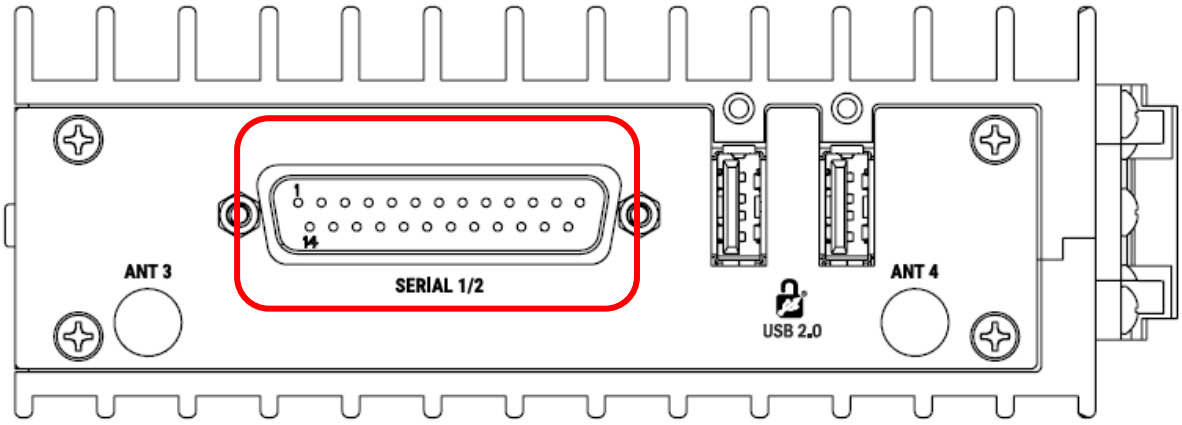
2.5 Gigabit (10/100/1000/2500 BaseT) Ethernet Ports

Serial Port

The R1 Edge has two independently configurable serial ports with support for RS-232, RS-422, 2-Wire / Half Duplex RS-485, and 4-Wire / Full Duplex RS-485 serial interfaces.

The two serial ports are combined into a single DB25 connector on the side of the R1 Edge and are intended to be used with the CA203 breakout cable, which splits the DB25 connector into two DB9 ports.

Please refer to the 'Serial Interface Selection' section for more detailed information on supported configuration options.



DB25 Dual RS-232/422/485 Port (via CA203)

RS-232/422/485 Pinout

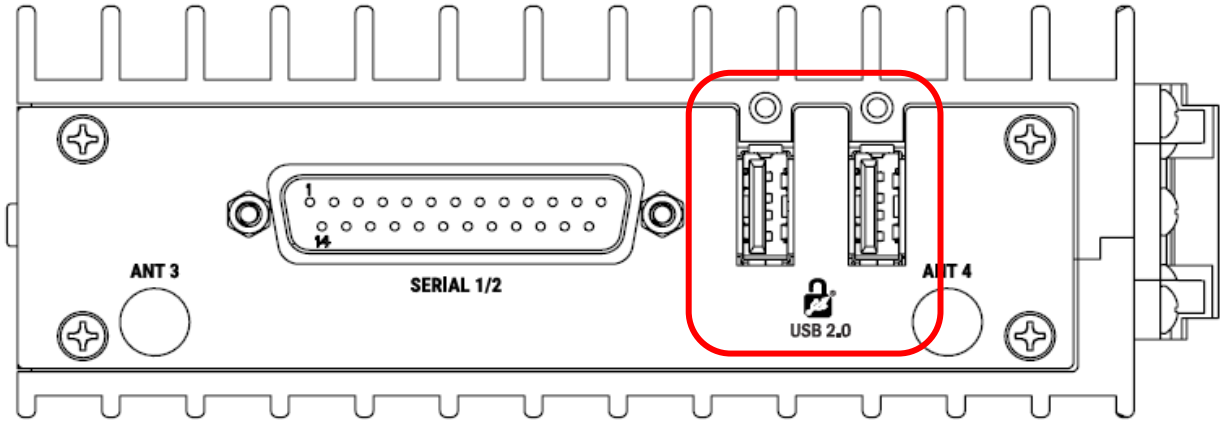
CA203 pinout - DB25 to 2x DB9 breakout cable

Port 1				
	Signal Name			
DB9	RS232	RS485 (4-wire) & RS422	RS485 (2-wire)	DB25
1	DCD	TX-	Data-	3
2	RXD	TX+	Data+	1
3	TXD	RX+	N/A	4
4	DTR	RX-	N/A	7
5	GND	GND	GND	9
6	DSR	RTS-	N/A	6
7	RTS	RTS+	N/A	5
8	CTS	CTS+	N/A	2
9	RI	CTS-	N/A	8

Port 2				
	Signal Name			DB25
DB9	RS232	RS485 (4-wire) & RS422	RS485 (2-wire)	
1	DCD	TX-	Data-	13
2	RXD	TX+	Data+	11
3	TXD	RX+	N/A	14
4	DTR	RX-	N/A	17
5	GND	GND	GND	10
6	DSR	RTS-	N/A	16
7	RTS	RTS+	N/A	15
8	CTS	CTS+	N/A	12
9	RI	CTS-	N/A	18

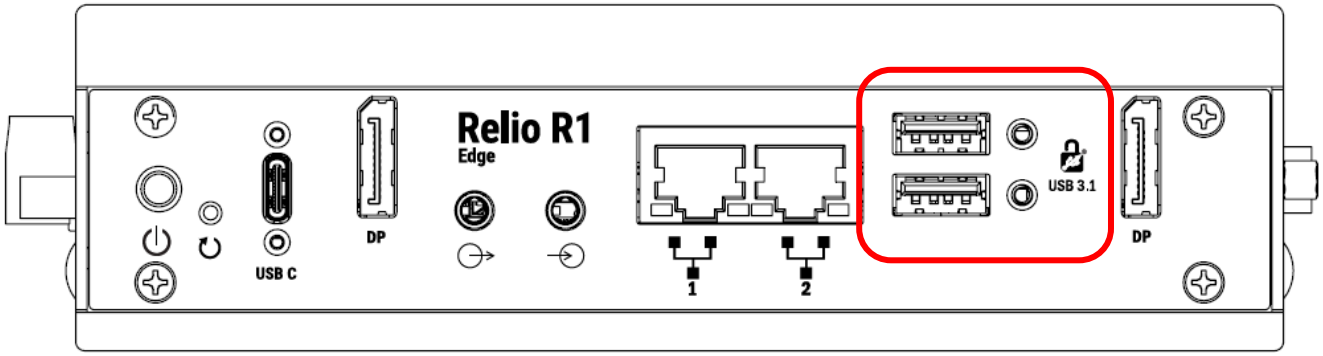
USB 2.0 and USB 3.1 Ports

The USB 2.0 ports are equipped with high retention connectors that are designed with a minimum of 15 N withdrawal force. These connectors are indicated by an orange insert within the connector. For situations where accidental disconnection of the USB cable must be prevented, the system has two USB 2.0 ports equipped for SeaLATCH USB cables. SeaLATCH cables have a thumbscrew that provides a secure metal-to-metal connection preventing accidental disconnection.



USB 2.0 SeaLATCH Ports

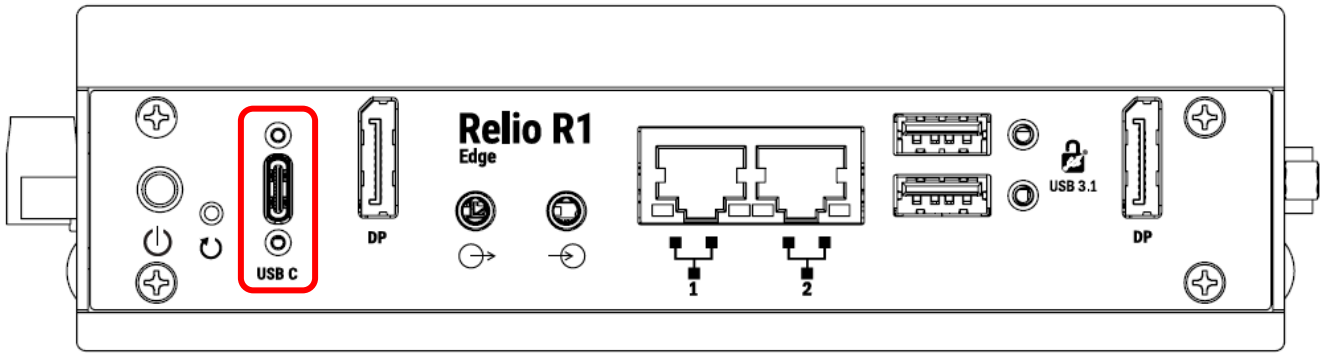
The R1 Edge has two USB 3.1 ports with SeaLATCH support. The USB 3.1 ports are identified with a blue insert within the connector and are capable of supplying up to 7.5W of power.



USB 3.1 SeaLATCH USB Ports

USB 3.1 Type C Port

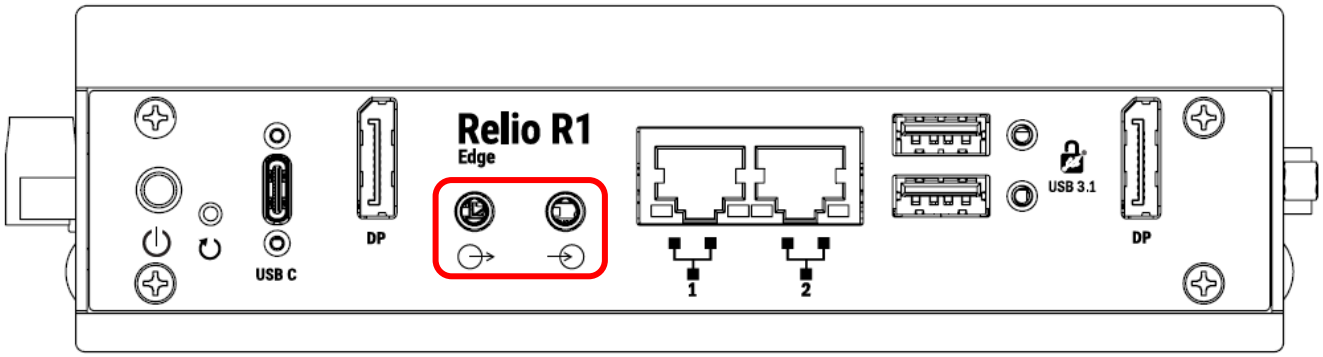
The R1 Edge has one USB 3.1 Type C port with screw latches capable of supplying up to 15W of power.



USB 3.1 Type C Port

Audio Lines (In & Out)

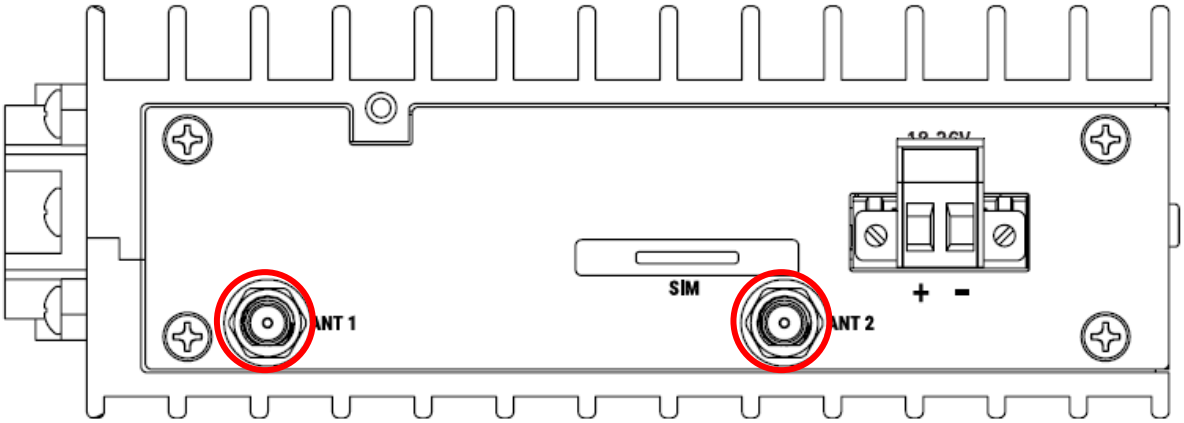
The system has one Stereo 3.5mm line-level input port and one Stereo 3.5mm line-level output port.



Out (left) & In (right)

Wi-Fi Operation

The R1 Edge can be ordered with an option to support 802.11 ax/ WLAN/ Wi-Fi communications. The Wi-Fi 6E module operates in the 2.4GHz, 5GHz, and 6GHz frequency range and is capable of 2.4Gbps communication.



SMA for Wi-fi 6E Antennas (ANT 1 – MAIN, ANT 2 – AUX)

The R1 Edge with Wi-Fi 6E (WLAN) has the following specs:

Interface	PCIe M.2
Chipset	Intel AX210 Wi-Fi 6E
Supported Protocols	802.11(a/b/d/g/n/ac/ax)
Supported Frequencies	2.4GHz/5GHz/6GHz
Max Data Rates	574 Mbps at 2.4GHz 2.4 Gbps at 5GHz and 6GHz
Temperature	-40°C to 60°C wide operating temperature range

Please contact sales for more information about R1 Edge models with Wi-Fi connectivity.

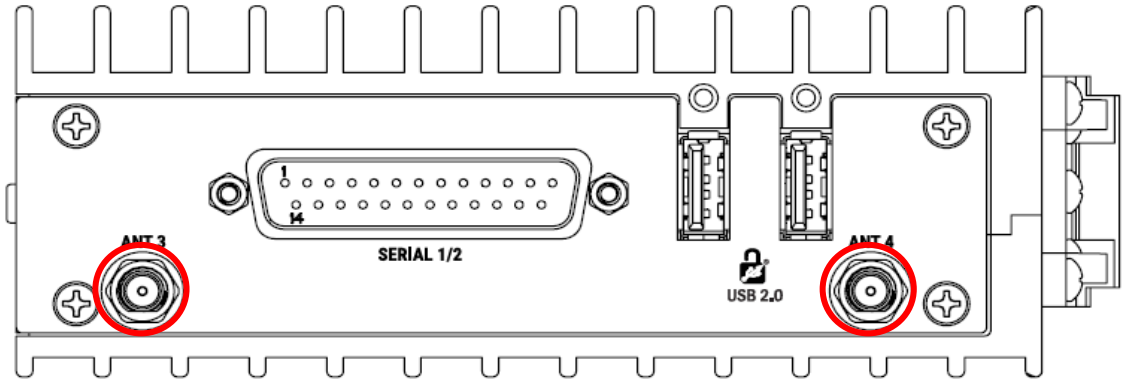
Cellular Operation

The R1 Edge can be ordered with an option to support a 4G LTE cellular communications. The Cellular modem is the Semtech EM7565 4G LTE M.2 module. The EM7565 is a Cat-12 global carrier modem capable of up to 600Mbps download / 150Mbps upload speeds.

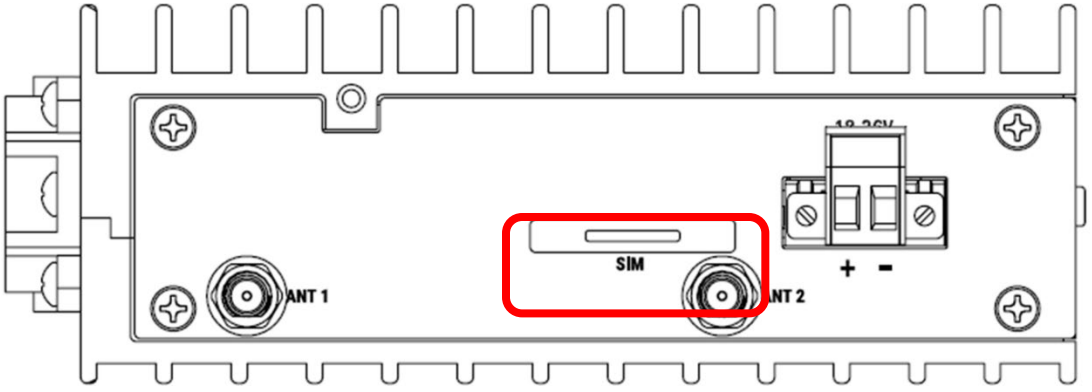
The R1 Edge with 4G LTE cellular connectivity has the following specs:

Interface:	M.2 (USB 3.1, USB 2.0 High Speed) socket type 2
Chipset:	EM7565
Carriers:	AT&T, SouthernLINC, T-Mobile, Telus, Verizon, US Cellular or any carrier using these bands
Bands:	B1-B5, B7-B9, B12-B13, B18-B20, B26, B28, B29, B32, B66
Max Data Rate:	600Mbps Download / 150Mbps Upload
Temperature:	-40°C to 60°C wide operating temperature range
3G network fallback:	Not supported

Please contact sales for more information about R1 Edge models with cellular connectivity.



SMA for Cellular Modem Antennas(ANT 3 – MAIN, ANT 4 – AUX)



Sim Card Slot

System Set-Up

The Base R1 Edge Industrial Computer system does not include a solid-state drive or operating system. These are added at the time of purchase and will be installed by Sealevel's experienced technicians. The OS and all necessary software drivers are preinstalled at the factory.

If you need to install the operating system yourself, you will also need to install the applicable drivers. Some drivers apply to the hardware on the COM Express module; some are for devices present on the carrier board. The following table lists the devices that will require drivers.

Driver and Software Info / Downloads

Device/Function	Model	Vendor	Windows	Linux
COM Express Module	TC570	Congatec	TC570 Product Page	
Chipset	500 Series PCH-LP	Intel	Link	N/A
Integrated Graphics	Xe Gen 12	Intel	Link	i915
Ethernet 1	I225	Intel	Link	igc (Kernel 5.8)
Ethernet 2	I226	Intel	Link	Igc (Kernel 5.10)
4G Modem	EM7565	Sierra Wireless	Link*	qmi_wwan (Kernel 4.15)
Wi-Fi	AX210	Intel	Link	Iwlwifi (Kernel 5.1)
Audio	HDA Codec	Tempo Semiconductor	Link	N/A
Serial Ports	XR17V352	Sealevel	SeaCOM	8250_exar: (Kernel 6.7) **

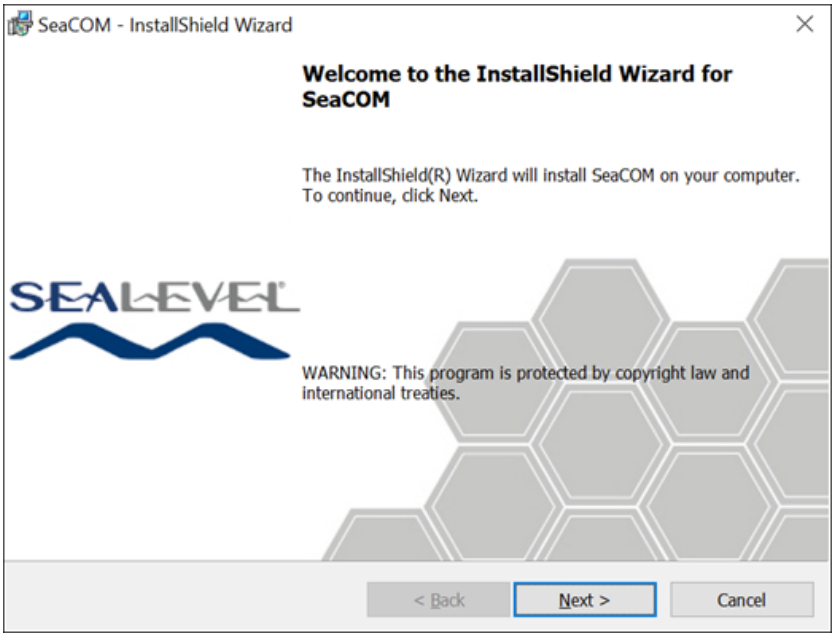
* Requires registration

** Supported in older kernels, but may require additional patches for full functionality of the serial ports, depending on your use case and distribution. Distributions mentioned previously (in the overview section) are known to have all patches needed for basic functionality.

SeaCOM Windows Installation

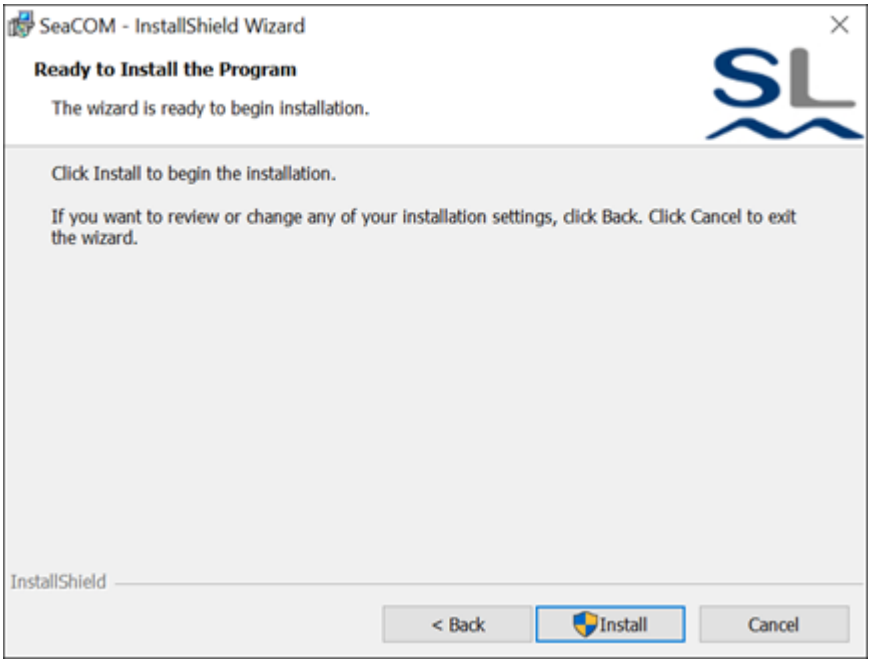
To install Sealevel software, you must log in as an administrator or have administrator privileges.

1. Open Windows Explorer and navigate to the downloaded Sealevel software. For example: C:\Downloads\SS030705.exe
2. If you are using Windows Vista or newer operating systems, right-click on the installer executable and choose 'Run as Administrator'. If you are using an operating system prior to Windows Vista, double click on the executable to launch the InstallShield wizard and initiate the driver installation.
3. Once opened Select 'Next' as demonstrated in the image below.

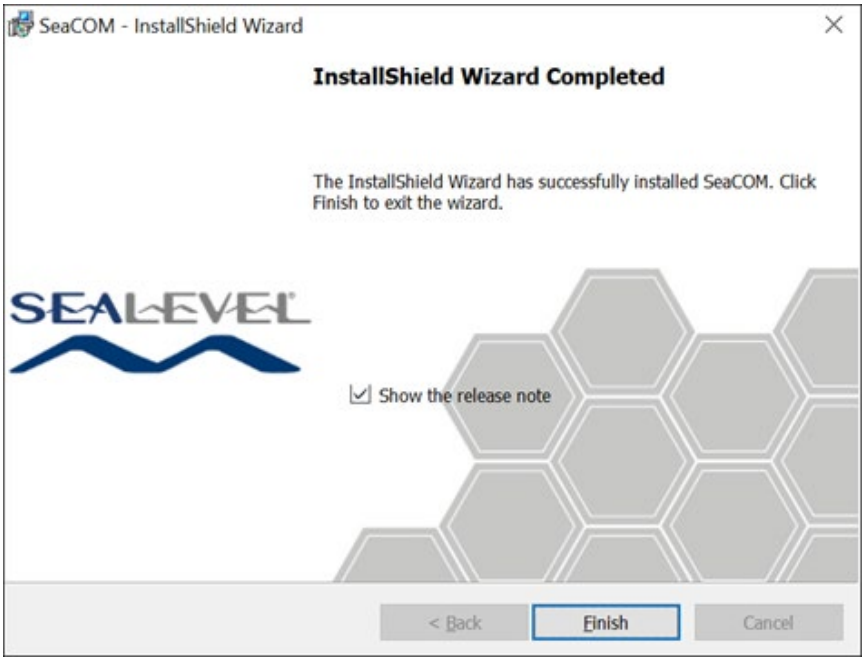


4. When the ‘License Agreement’ window appears, accept the terms and click ‘Next’ to continue. If you do not accept the terms of the agreement, the wizard will stop.

5. When the ‘Ready to Install the Program’ window appears, click the ‘Install’ button to install the software onto the hard drive of your computer. Some versions of Windows will halt the installation and provide you with a dialog box which will ask you for permission for the installer to make changes to your computer. Click on the button to continue installation of your Sealevel software.



6. Click ‘Finish’ to complete the installation of SeaCOM onto your PC.



7. If prompted, reboot your computer for changes to take effect.

Upgrading to the current SeaCOM driver

1. Uninstall the currently loaded driver SeaCOM driver found in the Control Panel.

2. Navigate to the Device Manager and remove the Sealevel hardware by right clicking on the line item and choosing **Uninstall**. This includes both of the COM ports as well as the adapter within the Muli-Port Serial Adapter category.

3. Select “Delete Driver Software” (if shown)

4. In the Device Manager under **Action**, choose **Scan for Hardware Changes**. This will prompt the installation of the adapter and associate it with the newly installed SeaCOM driver.

5. Download and install the current driver using the Instructions from the section above.

Hardware Installation

For full installation instructions, please refer to the Installation Guide provided with your R1 Edge. If you do not have the installation guide readily available, contact our sales team at sales@Sealevel.com. They can also provide you with 3D model images, and compliance certifications for the R1 Edge.

Installation Considerations

The R1 Edge Industrial Computer system is a fanless, solid state computer that relies on thermal conduction to move heat from internal components to the outside of the enclosure. The lid is designed as a finned heat sink to increase overall surface area. Three main cooling methods can be used to optimize removal of heat from the system.

1. Airflow
2. Thermal conduction through mounting
3. Computer orientation

Airflow over the lid provides the most effective heat removal of these three options. It is optimal to mount the computer in an area that has either natural or forced airflow to constantly remove heat from the enclosure.

Mounting the computer to a large thermally conductive surface (such as an I-Beam, steel cabinet or other large metal surface) allows heat to travel through the enclosure and be dissipated into the large structure.

- Only technically qualified personnel are permitted to install the equipment.
- Do not use the system with visible damage to any part of the unit or cable connection.
- Reduced Air Flow - Installation of the equipment should be such that the natural airflow around the equipment is not compromised.

- Thermal derating – Installation of the system in vertical orientation is preferred for thermal performance. Forced airflow or derating of the maximum operating temperature may need to be considered in horizontal mounting orientation.

System Operations

Power and Reset buttons

Power ON:

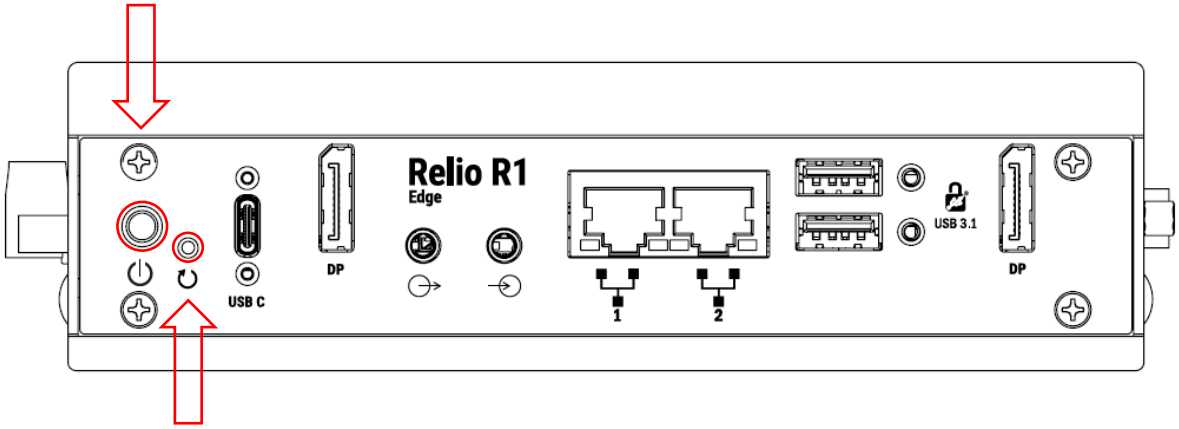
Press and hold the power button for at least 1 second, or until the Green power LED turns ON, then release the power button.

Power OFF:

Press and hold the power button for 5 seconds or longer. This will cut power to the COM module.

Power Reset:

Press and hold the reset button for 3 approximately seconds.



Power Button (on the Left) and Reset Button (on the Right)

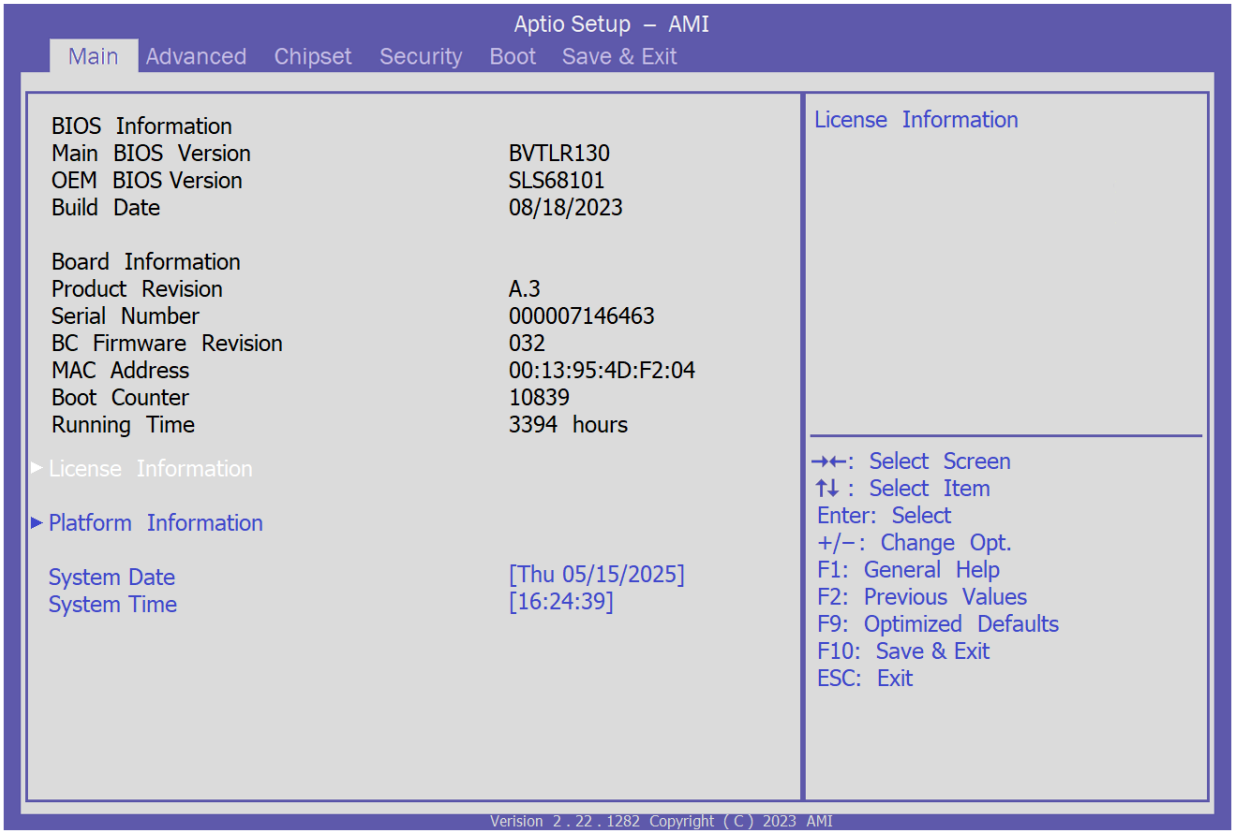
BIOS Configuration

Press the Delete Button to access the BIOS configuration screen.

Press **F11** to access the boot device selection screen
Press **F2** or **Delete** to access the BIOS configuration screen

To load the factory defaults:

1. Press Delete (Enter the BIOS configuration screen)
2. Press F9 (Load Factory Defaults)
3. Press F10 (Save and Exit)



The above screen shot is a representation of the current BIOS configuration and is subject to change.

Serial Communication Ports

Features of the serial ports include:

- Two independent software selectable and configurable serial ports (RS-232/422/485)
- Software selectable RS-485 termination and biasing
- Data rate exceeding 1Mbps.
- Automatic RS-485 direction control on Windows operating systems and Linux kernel 6.7+
- Software selectable 250K slew rate limiting to minimize electromagnetic interference
- Sealevel's SeaCOM enhanced serial driver for Windows

The R1 Edge has two high speed serial communication ports supporting data rates of over 1Mbps. On Windows, these ports are software selectable between RS-232/RS-485 electrical interfaces, while on Linux the electrical interface is selected via the hardware dip switches.

In general, the RS-485 interface port is used for communication with equipment up to 4000 ft. away from the computer or in noisy environments. The RS-485 2-wire mode is optimized for "Multi-Drop" or "Party-line" operations selecting data from multiple peripherals (as many as 32 unit load devices can be connected on an RS-485 bus).

In RS-485 mode, our special auto-enable feature allows the RS-485 ports to be viewed by the operating system as a COM port. This allows the software application to utilize the serial port for RS-485 communication without the need to control the direction of data between the master and slave device. Our on-board hardware automatically handles the RS-485 driver enable.

Linux applications must set SER_RS485_ENABLED to use the Automatic RS-485 direction control feature.

Software selection features are not available on Linux. Features are instead selected via hardware dip-switches. See the Serial Interface Selection section for detailed selection options.

Clock Modes and Baud Rates

The R1 Edge serial ports derive a 125MHz clock from the PCI express link for the Baud Rate Generator (BRG), which is divided by a clock prescaler (1 or 4) and a 16-bit clock divisor to obtain a sampling clock of 16X, 8X, or 4X the serial data rate. The optimal divisor is automatically selected by the driver. This allows for a large range of baud rates, with most baud rates within the +/- 2% bit rate error tolerance of serial communication.

Serial Interface Configuration

The serial port configuration differs depending on whether you are using Windows or Linux, but available features/modes are the same between the two.

Linux / Hardware Dip-Switches

On Linux, Serial Interface selection is done via the dip switches located on the system board. Refer to the steps below to access the dip-switches:

1) Power off the unit and remove all terminal blocks.
2) Remove the screws nearest to the antenna connectors on each side of the unit.
3) Remove the screws on the front of the unit that are nearest to the screws you just removed. These are the 'bottom' screws when reading the "Relio R1" logo on the front plate.
4) Turn the unit over and remove the screws going through the enclosure.
5) Carefully lift the bottom section of the enclosure.

Description of Dip-Switches

Valid Electrical Modes

6) The dip-switches will be located on the opposite side from the serial ports, near the M.2 SSD and sim card slot.

Switch	Default	Description
Mode0	OFF	Electrical Mode selection
Mode1	OFF	Electrical Mode selection
TERM	OFF	Enables RS-485 120 ohm termination
SLEW	OFF	Enable 250kbps Slew Rate limit
NU/PD	**N/A**	NOT USED / PULL DOWN

Mode0	Mode1	Mode
OFF	OFF	RS-232 (Default)
ON	ON	2-wire RS-485
OFF	**ON**	4-wire RS-485
ON	OFF	RS-422

Refer to the descriptions of each option in the following "Selection via Software" section for additional information on the functionality of each option.

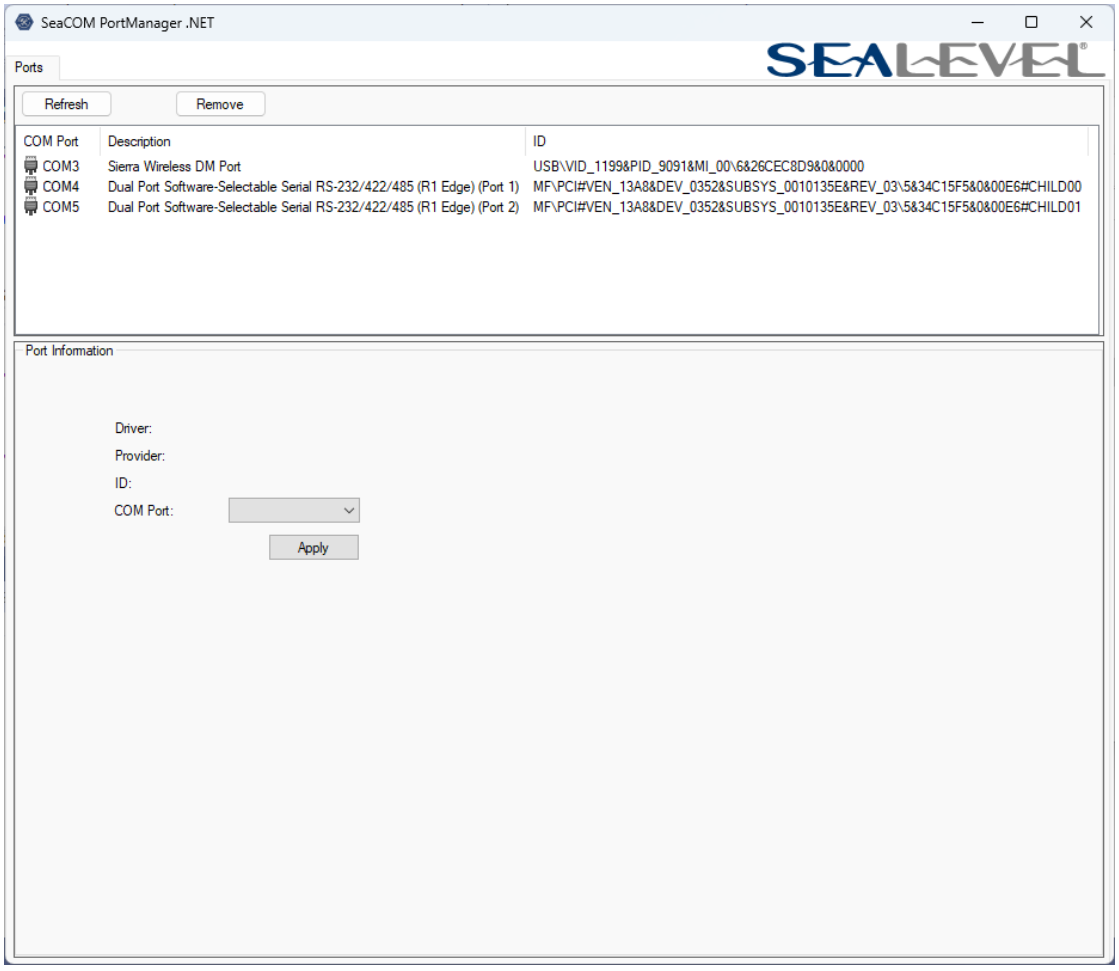
Windows / Software Selection

Access to and configuration of the serial ports is provided by Sealevel's SeaCOM driver and port management software.

The COM ports must be closed by all applications before configuration

The Port Manager application in the SeaCOM suite of communication utilities is used to set the Interface Mode and Options for the Serial Ports of the computer. For the COM Port(s) to be configured, they must be closed in other applications that control them before the Port Manager utility can configure them. Likewise, other applications cannot open the COM Ports while they are open in the SeaCOM Port Manager.

The Port Manager utility will open with the COM Ports listed on the left side of the window and COM1 configuration in the top window. COM 1 is an internal serial port that is not accessible externally to the computer. The external Serial Ports available on the R1 Edge Industrial Computer are COM3 and COM4.



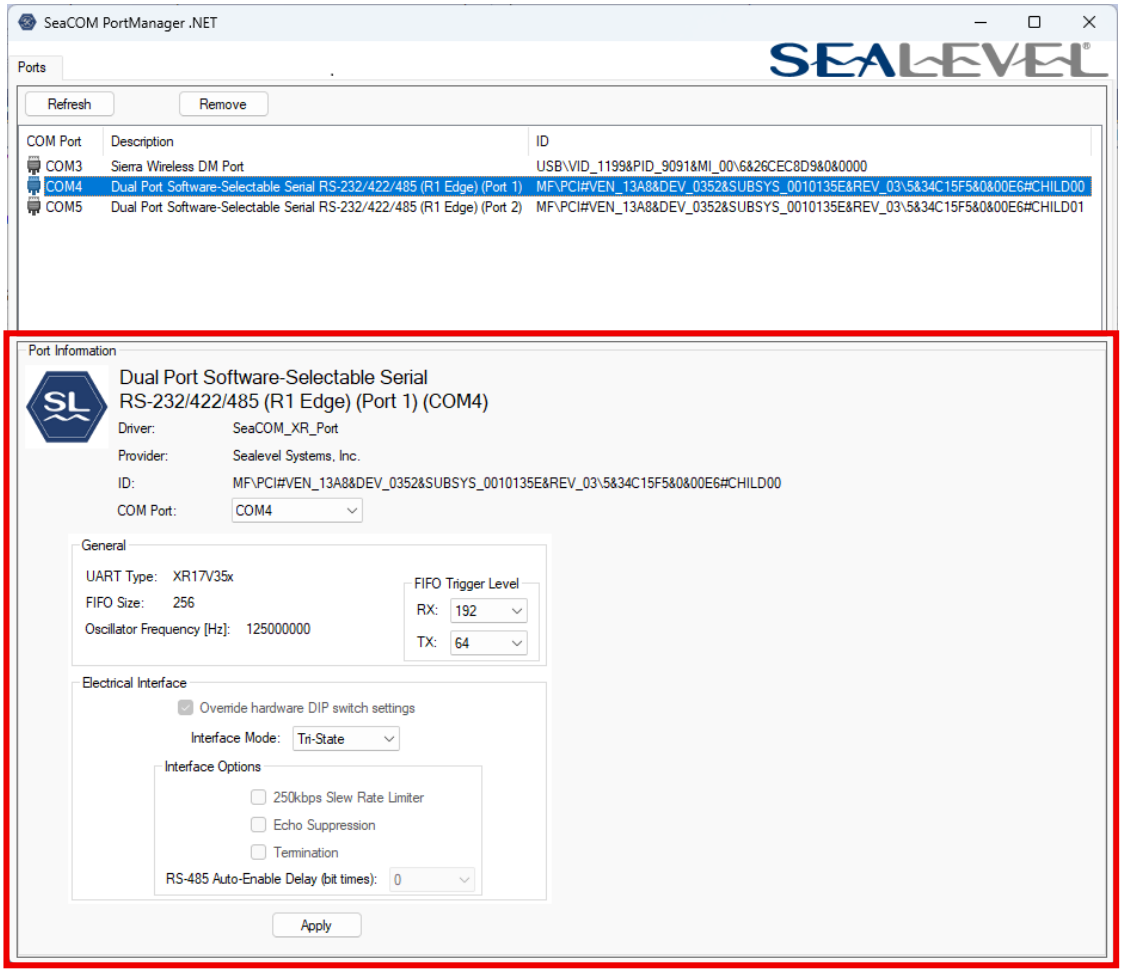
*Initial Start **Screen for Port Manager***

COM Port Configuration

The right-side window of the Port Manager is the configuration box. The COM Port to be configured is selected by clicking on the desired COM Port option in the left side window. This will display the current COM Port Electrical Interface settings. The first time the Port Manager is used, the configuration will be Tri-State, all other boxes unchecked, and RS-485 Auto-Enable delay set to 0. The settings are stored when applied and displayed with subsequent uses of Port Manager.

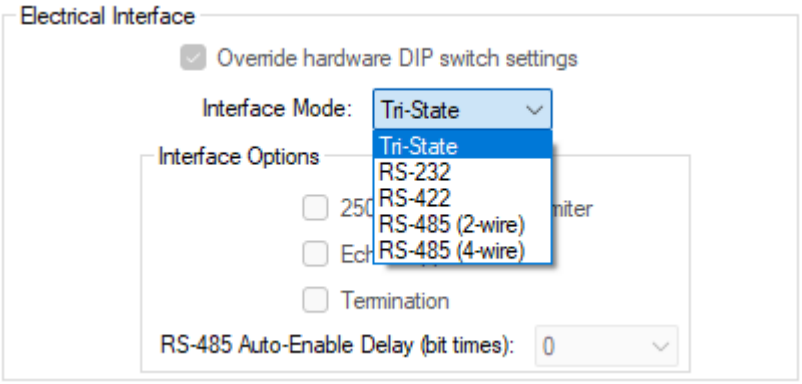
The changed settings will be activated when the Apply button at the bottom of the configuration box is clicked. This also closes the port, allowing other applications to open it.

COM3 Configuration example



In the Electrical Interface section, the Interface Mode option is used to set the protocol for COM Port selected. The choices are:

- Tri-State — No external signal communication
- RS-232 — Single ended signaling, full-duplex, point-to-point serial communication
- RS-485 (2-wire) — Differential, half-duplex, multidrop serial communication
- RS-485 (4-wire) — Differential, full-duplex, multidrop serial communication



Electrical Interface section

RS-485 Auto-Enable / Direction Control

RS-485 is ideal for multi-drop or network environments like that used by Seal/O modules. RS-485 requires a tristate line driver IC that will allow the electrical presence of the driver to be removed from the line when not transmitting data. This is known as Tri-State or High-Impedance mode.

Only one line driver may be active at a time on a bus, and the other driver(s) must be tri-stated. Under Windows, configuring the port for RS-485 automatically configures the port to automatically control the transmit enable of the transceiver (DTR output). Under Linux, applications must set SER_RS485_ENABLED after configuring the port for RS-485 for the same effect.

This causes the RS-485 data transmission driver to leave tristate at the start of a transmission, allowing it to transmit data. It then automatically re-enters tri-state when data transmission is completed so other drivers can transmit on the line.

Linux Users: The relevant RS485 Auto Enable support was added in kernel 6.7. Please contact Sealevel Technical Support to confirm compatibility and/or information on any required patches if you intend to use RS485 on a kernel version prior to 6.7.

Slew Rate Limiting

Slew Rate Limiting (250kbps) helps minimize the generation of electromagnetic interference. It slows the rise and fall times of the data transitions where higher baud rates are not required. This can be used for any baud rate of 250kbps or lower.

Receiver Biasing

The transceiver utilized in the R1 Edge supports fail-safe biasing, eliminating the need for manual Pull-Up and Pull-Down bias management.

Line Termination Selection

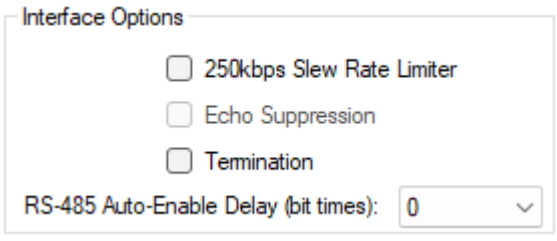
In a multi-drop network, the Master device on the RS-485 bus is typically physically located in the middle of the bus to maximize signal strength and reliability and therefore does not have a termination resistor, whereas devices on the ends of a bus require a termination resistor to eliminate data reflection.

When the end device is the R1 Edge Industrial Computer you will need to set the built in 120-ohm resistor between each RS-485 input pair.

On Windows, line termination is configured via the termination checkbox in Port Manager, whereas on Linux line termination is configured via the TERM dip-switch.

RS-485 Auto-Enable Delay

RS-485 Auto-Enable Delay is an additional configuration setting available only via software selection. It provides a 0 to 15 bit-time delay that is inserted after the end of the last stop-bit of the last transmitted character. This delay controls when to automatically disable the RS-485 transmitter and place it in the Tri-State (high impedance) condition. This delay may be useful in long-cable networks.



Interface Options section

Technical Specifications

Environmental Specifications

Specification	Operating	Storage
Temperature Range	TC570 i5/i7 -40° C to 60° C (-40°F to 140° F)	-40° C to 85° C (-40° F to 185° F)
Humidity Range	10 to 90% R.H. Non-Condensing	10 to 90% R.H. Non-Condensing

Mechanical Dimensions

Length	6.64 inches	16.87 cm
Width	5.00 inches	12.70 cm
Height	1.90 inches	4.83 cm

Power Consumption

Absolute Operating Range:	**18-36VDC**
DC Current Rating (Dependent on COM Express Module, input voltage and load)	**700mA – 2800 mA**
Power Usage:	**TC570 Intel i5 1145GRE Module**: 25W nominal/ 50W max **TC570 Intel i7 1185GRE Module**: 25W nominal / 50W max

Manufacturing

All Sealevel Systems Printed Circuit boards are built to UL 94V0 rating and are 100% electrically tested. These printed circuit boards are solder mask over bare copper or solder mask over tin nickel.

MTBF (Telcordia SR-332, Issue 4 calculation prediction method)

Mean Time Between Failure	239931 hours (with LTE/WiFi options installed)	At 25° C ambient (ground benign)

Operating Temperature Range

Part Number	COM Express Module	Operating Temperature Range	Comment
R173xxxx-2DP	congatec TC570	-40°C to +60 °C	Requires Industrial Temperature M.2
R154xxxx-2DP	congatec TC570	-40°C to +60 °C	Requires Industrial Temperature M.2

Appendix A – Troubleshooting Serial Communication Issues

Ensure that the Sealevel Systems SeaCOM software has been installed on the machine, so that the necessary files are in place to complete the installation. To confirm installation, click on the Windows 'Start' button and then select 'All Programs.' You should see the 'SeaCOM' program folder listed.

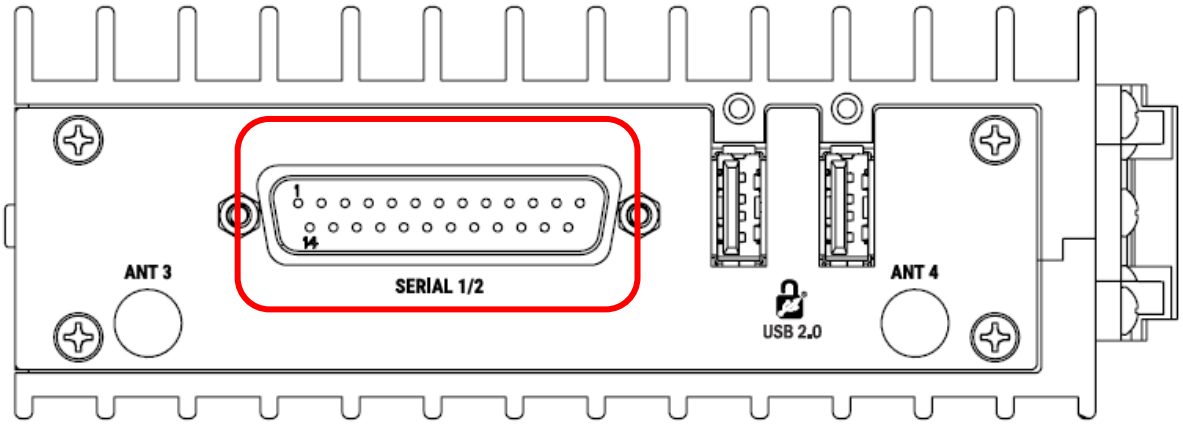
Verify the device diver has loaded successfully. To confirm this, right click on the Start Menu, then click on the Device Manager and expand the Ports (COM & LPT) section. You should see 2 COM ports.

Always use the Sealevel Systems diagnostic software when troubleshooting a problem. This will eliminate any software issues from the equation.

Bit Error Rate Test (BERT) for Asynchronous Serial

The R1 Edge has two multi-interface serial ports supporting RS232, RS422, and both 2-wire and 4-wire RS485. One way to verify operation of the serial ports is to utilize the BERT function of our WinSSD utility to verify communication between the two ports using the procedure described below.

1. Connect the CA203 breakout cable to the DB25 connector.



DB25 Dual RS-232/422/485 Port (via CA203)

2. Connect the two DB9 serial ports according to the electrical interface you intend to test. Refer to the diagrams below for how each electrical interface should be connected together.

RS232

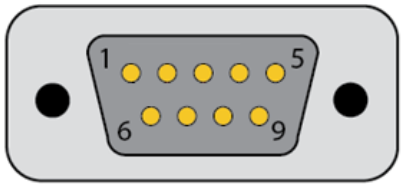
Port 1			Port 2	
Signal	Pin		Pin	Signal
TXD	3	→	2	RXD
RXD	2	←	3	TXD

RS422 & 4-wire RS485

Port 1			Port 2	
Signal	Pin		Pin	Signal
TX-	1	→	4	RX-
TX+	2	→	3	RX+
RX+	3	←	2	TX+
RX-	4	←	1	TX-

2-wire RS485

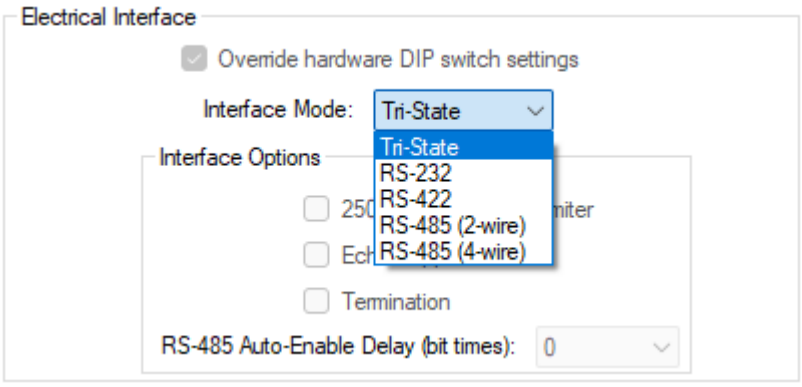
Port 1			Port 2	
Signal	Pin		Pin	Signal
Data-	1	←→	1	Data-
Data+	2	←→	2	Data+



3. Click on the Start Menu and navigate to Sealevel Systems – SeaCOM and launch the PortManager utility.

4. Select one of the COM ports and click on the Electrical Interface dropdown.

5. Select the Electrical Interface according to how you have wired the port and Click Apply.

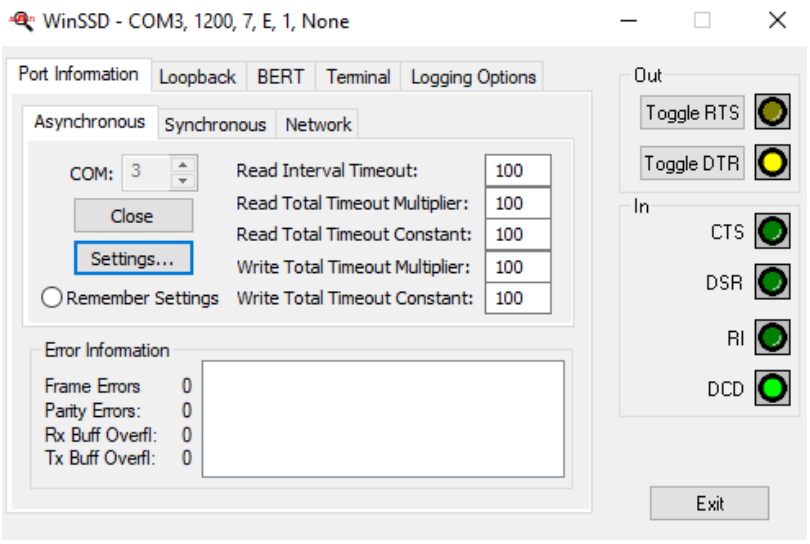


6. Repeat steps 4 and 5 for the other COM port.

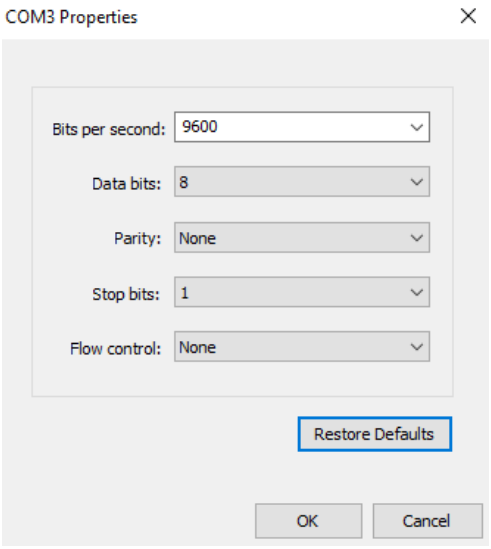
7. Click on the Start Menu and navigate to Sealevel Systems – SeaCOM and launch WinSSD.

8. On the 'Port Information' tab, select the associated COM port and click the 'Open' button.

9. The COM port is now open. Click the 'Settings' button to open the COM Port Properties dialog box. This will allow the Port Settings to be altered.



10. Change your parameters to 9600 bits per second, 8 data bits, no parity, 1 stop bit, and no flow control, as pictured below.



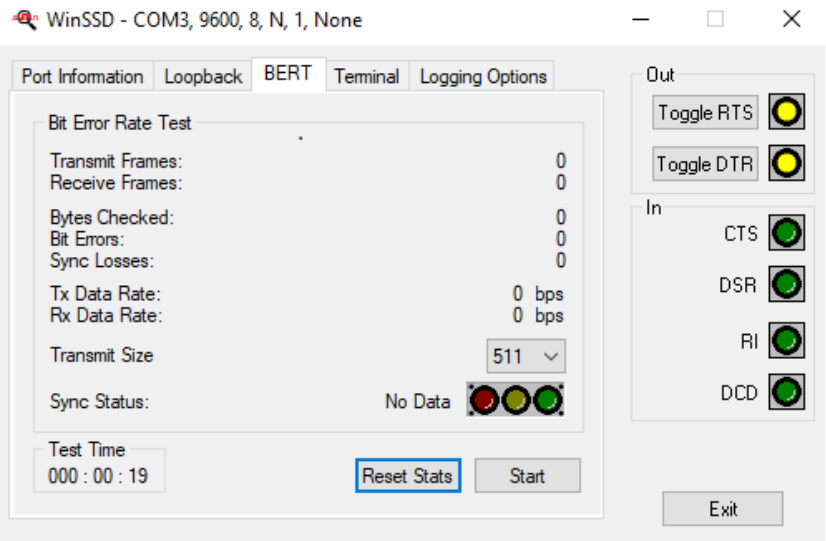
11. Click 'Apply' and 'OK.'

12. In the main WinSSD window, click on the 'BERT' tab (Bit Error Rate test).

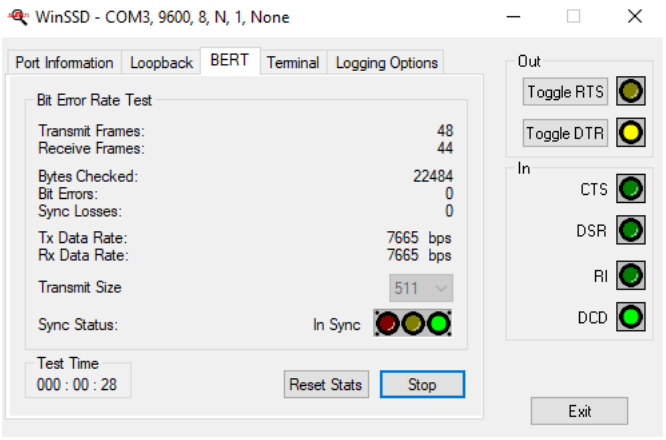
13. Repeat steps 7-12 to open another instance of WinSSD on the other COM port. Unless stated otherwise, the rest of the steps should be taken on both of the WinSSD windows.

14. Click on the 'Start' button.

If using 2-wire RS485: Only click 'Start' on one instance of WinM.2. 2-wire RS485 is half-duplex so we cannot run the BERT test simultaneously on both ports.



15. If the COM port is properly working, the green Sync Status light will glow, and the Transmit Frames and Receive Frames will increase. The Tx and Rx Data Rates will show the calculated data rate.

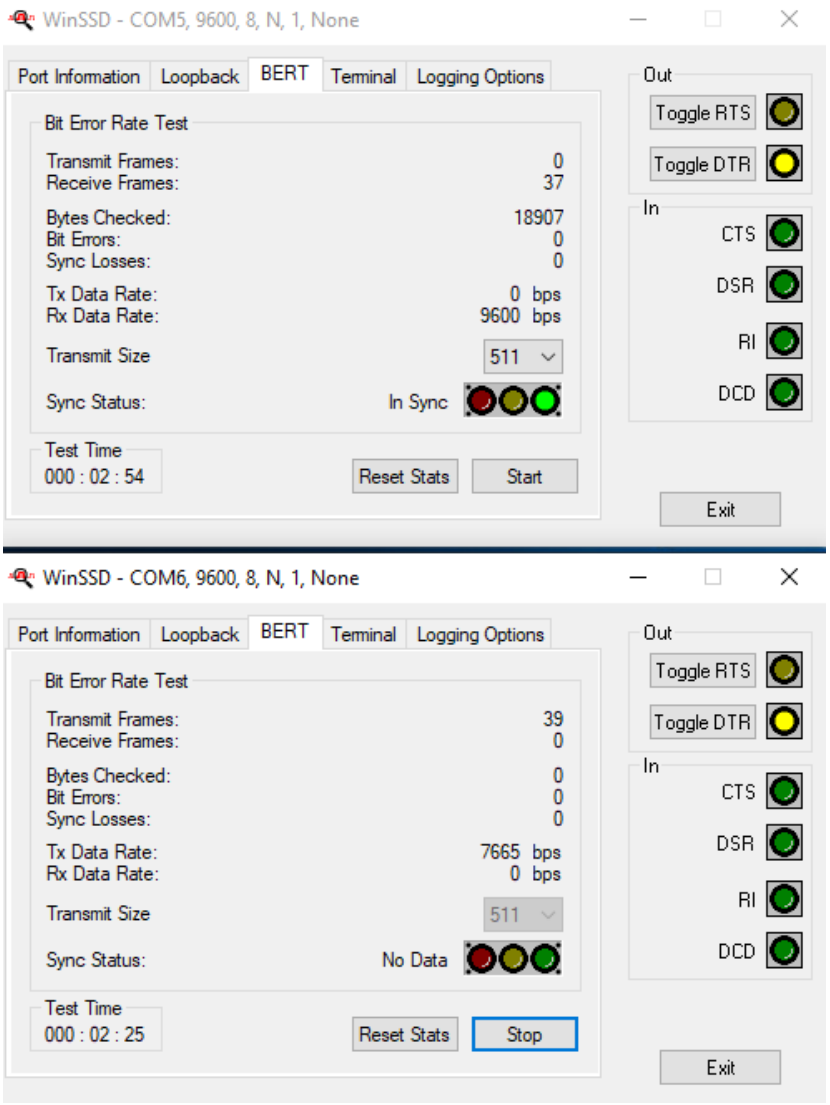


Passing RS232/422/4-wire RS485 test

If using 2-wire RS485: Only one instance of WinSSD will show TX or RX at a time. When you press start on one WinSSD window you should see it appear on the other, as shown in the image below.

Passing 2-Wire RS485 test WinSSD at the top of the image is transmitting.

16. (**2-wire RS485 only**) Click on the 'Stop' button, then press 'Start' on the other WinSSD window.



Passing 2-wire RS485 test – WinSSD at the bottom of the image is transmitting.

Appendix B – How To Get Assistance

Begin by reading the Trouble Shooting Guide in Appendix A. If assistance is still needed, please see below.

When calling for technical assistance, please have your user manual and current adapter settings. If possible, please have the system ready to run diagnostics.

Sealevel Systems provides an FAQ section on its web site. Please refer to this to answer many common questions. This section can be found at http://www.Sealevel.com/faq.asp.

Sealevel Systems maintains a web page on the Internet. Our home page address is www.Sealevel.com. The latest software updates, and newest manuals are available via our web site.

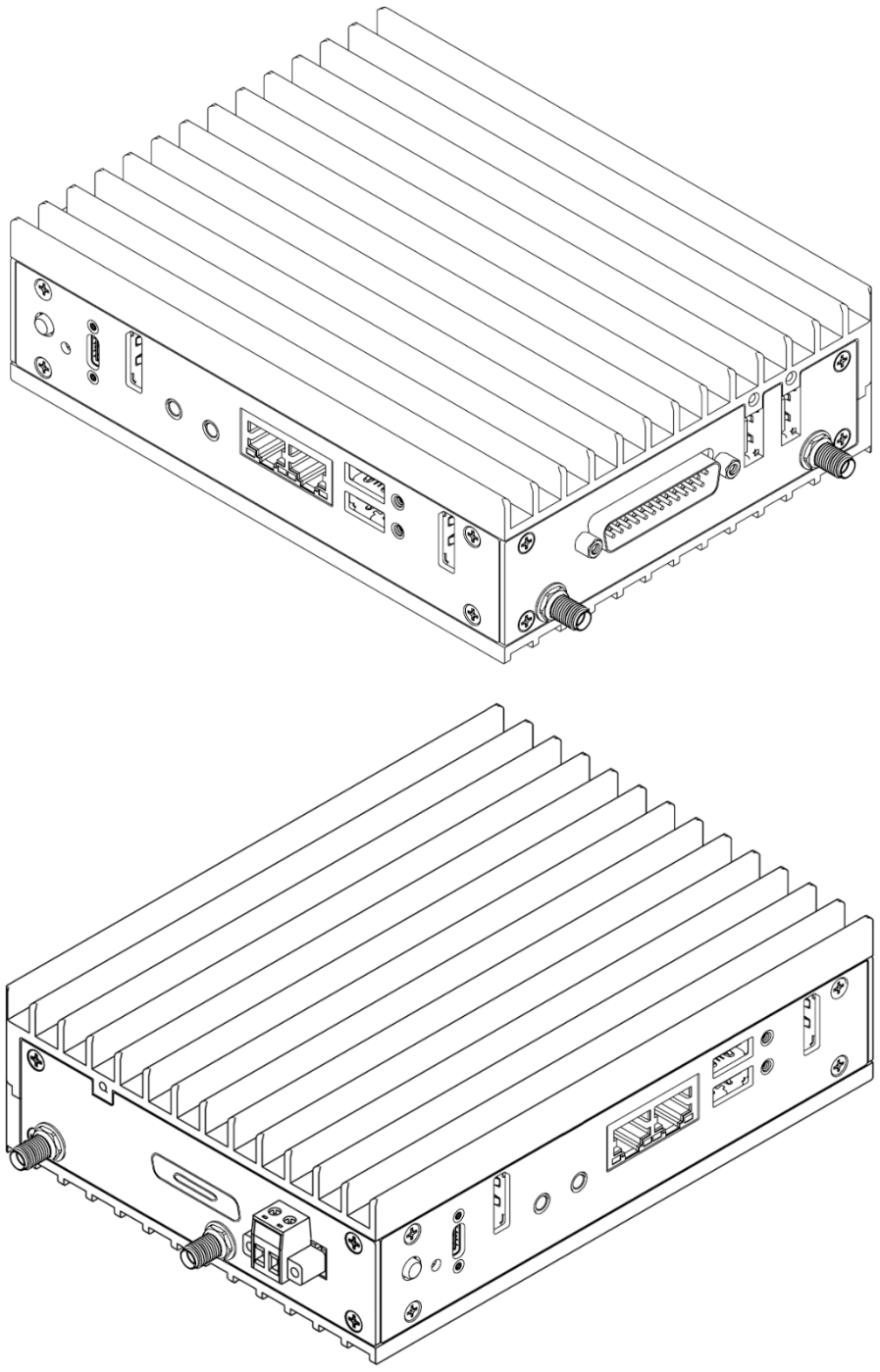
Technical support is available Monday to Friday from 8:00 AM to 5:00 PM Eastern Time. Technical support can be reached at (864) 843-4343. For email support contact support@sealevel.com.

RETURN AUTHORIZATION MUST BE OBTAINED FROM SEALEVEL SYSTEMS BEFORE RETURNED MERCHANDISE WILL BE ACCEPTED. AUTHORIZATION CAN BE OBTAINED BY CALLING SEALEVEL SYSTEMS AND REQUESTING A RETURN MERCHANDISE AUTHORIZATION (RMA) NUMBER.

Appendix C – CAD References

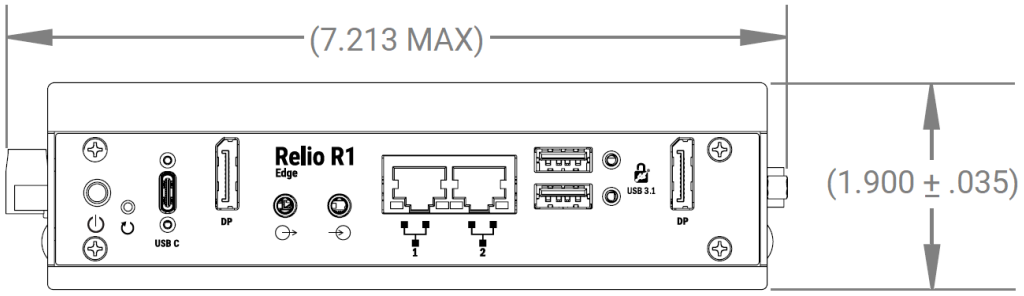
Isometric Views

Wi-Fi 6E Version (Top) / 4G LTE Cellular Version (Bottom)

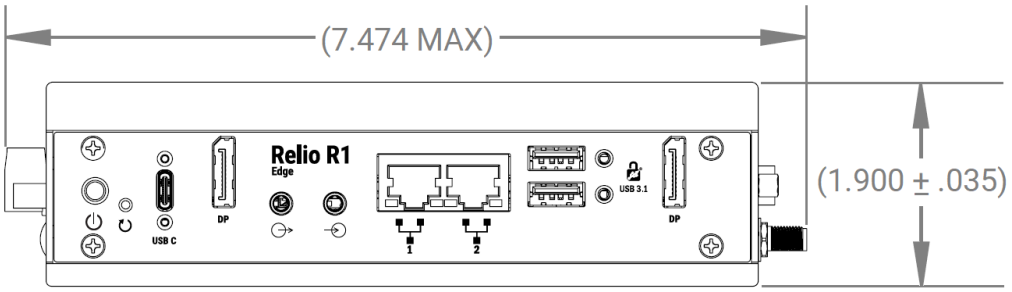


Front Panel I/O Connectors

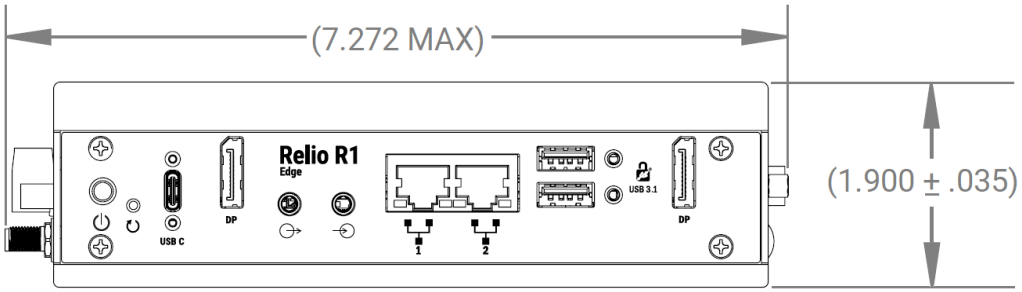
Base



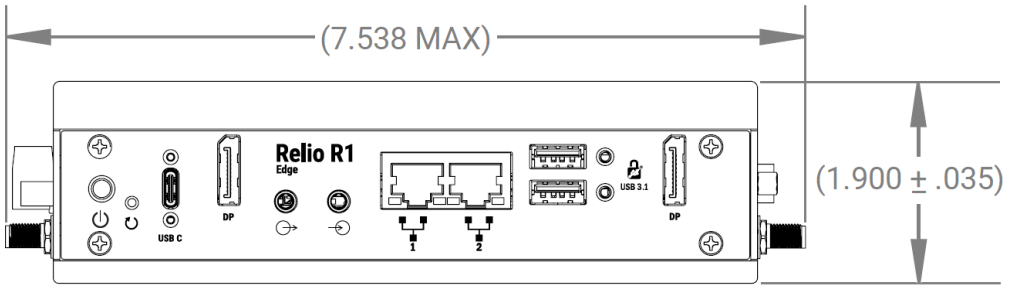
4G LTE Cellular



Wi-Fi 6E

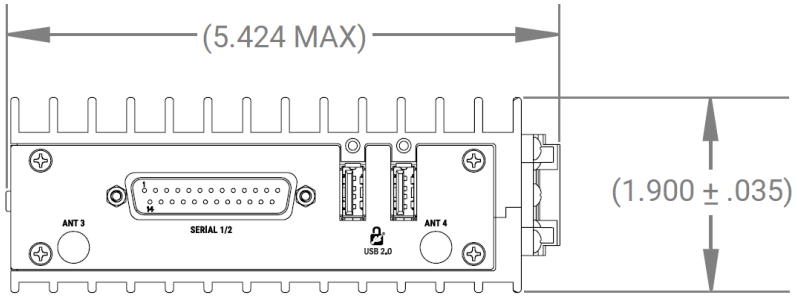


4G LTE Cellular & Wi-Fi 6E

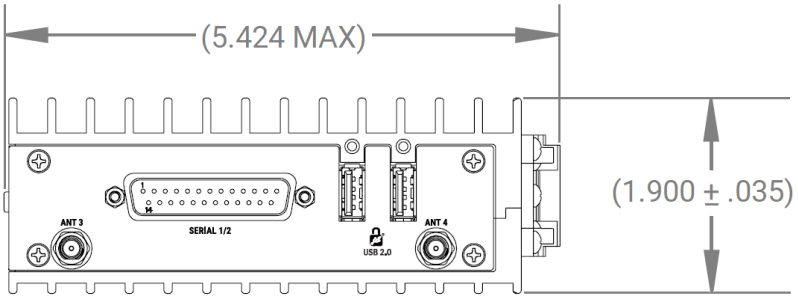


Right Panel I/O Connectors

Base

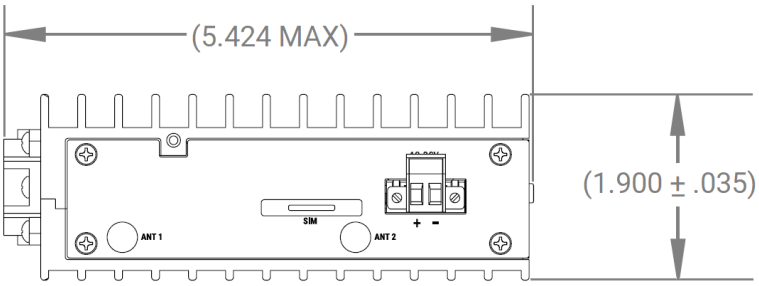


4G LTE Cellular, 4G LTE Cellular & Wi-Fi 6E

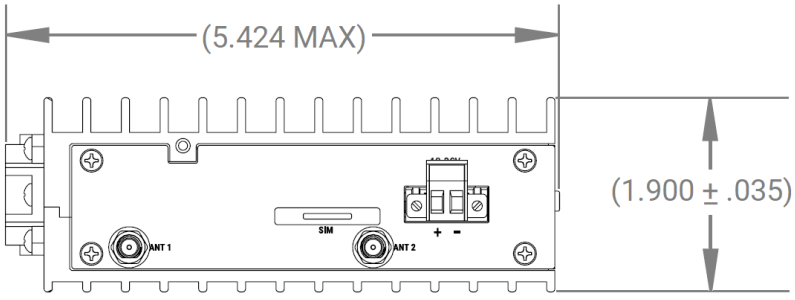


Left Panel I/O Connectors

Base



Wi-Fi 6E, 4G LTE Cellular & Wi-Fi 6E



Appendix D – Compliance Notices

Federal Communications Commission (FCC) Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

ISED Canada

- **CAN ICES-003(A) / NMB-003(A)**

Wi-Fi Warnings

The R1 Edge contains WiFi module AX210.

FCC ID: PD9AX210NG
IC: 1000M-AX210NG

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Only antennas supplied with the system are authorized for operation with the equipment.

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

High-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

This equipment complies with FCC/IC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

This is a Class A Product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures to prevent or correct the interference.

Always use cabling provided with this product if possible. If no cable is provided or if an alternate cable is required, use high quality shielded cabling to maintain compliance with FCC/EMC directives.

4G LTE Cellular

The R1 Edge contains the Sierra Wireless EM7565.

FCC ID: N7NEM75
IC: 2417C-EM75

The R1 Edge complies with the Sierra Wireless EM7565 Singular Modular Approval.

This device is to be used only for mobile and fixed applications; and must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter evaluation procedures as documented in the EM7565 filing and the radios and antennas included with the R1 Edge. End-users are provided an antenna with installation instructions. No other antennas other than those supplied are to be used with the R1 Edge device. The R1 Edge is not to be operated within 20cm of the human body to insure RF exposure compliance.

The R1 Edge device further restricts the EM7565 modular cert by limiting the use of certain bands. The allowed bands and bandwidths are as follows:

B1/B2/B3/B4/B5/B7/B8/B9/B12/B13/B18/B19/B20/B26/B28/B29/B32/B66 and
1.4MHz/3MHz/5MHz/10MHz/15MHz/20MHz.

The integrator responsible for the FCC compliance is:

Sealevel Systems, Inc.
2779 Greenville Hwy.
Liberty, SC 29657
1-864-843-4343
support@Sealevel.com

Wireless-radio compliance information

R1 Edge models equipped with wireless communications comply with the radio frequency and safety standards of any country or region in which it has been approved for wireless use.

Appendix E - Handling Instructions

Electrostatic Discharges (ESD)

A sudden electrostatic discharge can destroy sensitive components. Proper packaging and grounding rules must therefore be observed. Always take the following precautions:

- Transport boards and cards in electrostatically secure containers or bags.
- Keep electrostatically sensitive components in their containers, until they arrive at an electrostatically protected workplace.
- Only touch electrostatically sensitive components when you are properly grounded.
- Store electrostatically sensitive components in protective packaging or on anti-static mats.

Grounding Methods

The following measures help to avoid electrostatic damages to the device:

- Cover workstations with approved antistatic material. Always wear a wrist strap connected to a properly grounded workplace.
- Use antistatic mats, heel straps, and/or air ionizers for more protection.
- Always handle electrostatically sensitive components by their edge or by their casing.
- Avoid contact with pins, leads, or circuitry.
- Turn off power and input signals before inserting and removing connectors or connecting test equipment.
- Keep work area free of non-conductive materials such as ordinary plastic assembly aids and Styrofoam.
- Use field service tools such as cutters, screwdrivers, and vacuum cleaners that are conductive.

Appendix F – Electrical Interface

RS-232

Quite possibly the most widely used communication standard is RS-232. This implementation has been defined and revised several times. It is often referred to as RS-232 or EIA/TIA-232. The IBM PC computer defined the RS-232 port on a 9-pin D-sub connector, and subsequently, the EIA/TIA approved this implementation as the EIA/TIA-574 standard. This standard is defined as the 9-Position Non-Synchronous Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange. Both implementations are in widespread use and will be referred to as RS-232 in this document.

RS-232 is capable of operating at data rates up to 20K bps at distances less than 50 ft. The absolute maximum data rate may vary due to line conditions and cable lengths. RS-232 is a single-ended or unbalanced interface, meaning that a single electrical signal is compared to a common signal (ground) to determine binary logic states. The RS-232 and the EIA/TIA-574 specification define two types of interface circuits: Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE).

RS-485

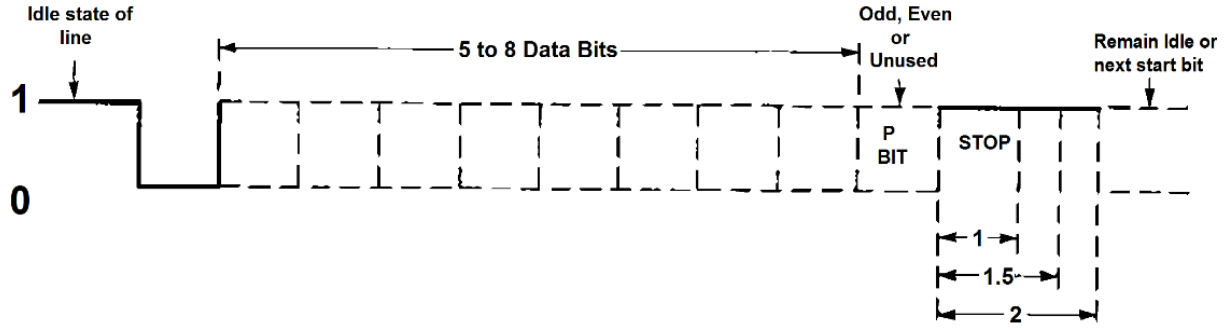
RS-485 is backward compatible with RS-422; however, it is optimized for party-line or multi-drop applications. The output of the RS-485 driver is capable of being Active (enabled) or Tri-State (disabled). This capability allows multiple ports to be connected in a multi-drop bus and selectively polled. RS-485 allows cable lengths up to 4000 feet and data rates up to 10 Megabits per second. The signal levels for RS-485 are the same as those defined by RS-422.

RS-485 has electrical characteristics that allow for 32 drivers and 32 receivers to be connected to one line. This interface is ideal for multi-drop or network environments. RS-485 tri-state driver (not dual-state) will allow the electrical presence of the driver to be removed from the line. Only one driver may be active at a time, and the other driver(s) must be tri-stated. RS-485 can be cabled in two ways: two wire and four wire mode. Two wire mode does not allow for full duplex communication and requires that data be transferred in only one direction at a time. For half-duplex operation, the two transmit pins should be connected to the two receive pins (Tx+ to Rx+ and Tx- to Rx-). Four wire mode allows full duplex data transfers. RS-485 does not define a connector pin-out or a set of modem control signals. RS-485 does not define a physical connector.

Appendix G – Asynchronous Communications

Serial data communications imply that individual bits of a character are transmitted consecutively to a receiver that assembles the bits back into a character. Data rate, error checking, handshaking, and character framing (start/stop bits) are pre-defined. They must correspond at both the transmitting and receiving ends.

Asynchronous communications are the standard means of serial data communication for PC compatible and PS/2 computers. The original PC was equipped with a communication (COM) port that was designed around an 8250 Universal Asynchronous Receiver Transmitter (UART). This device allows asynchronous serial data to be transferred through a simple and straightforward programming interface. A starting bit followed by a pre-defined number of data bits (5, 6, 7, or 8) defines character boundaries for asynchronous communications. The end of the character is defined by the transmission of a pre-defined number of stop bits (usually 1, 1.5, or 2). An extra bit used for error detection is often appended before the stop bits. The diagram below demonstrates asynchronous communication bits.



The parity bit is a simple method of determining if a data bit has been lost or corrupted during transmission. There are several methods for implementing a parity check to guard against data corruption. Common methods are called (E)ven Parity or (O)dd Parity. Sometimes parity is not used to detect errors on the data stream. This is referred to as (N)o parity. Because each bit in asynchronous communications is sent consecutively, it is easy to generalize asynchronous communications by stating that each character is wrapped (framed) by pre-defined bits to mark the beginning and end of the serial transmission of the character. The data rate and communication parameters for asynchronous communications have to be the same at both the transmitting and receiving ends. The communication parameters are baud rate, parity, number of data bits per character, and stop bits (i.e., 9600,N,8,1).

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