



G200 Gateway Hardware User Guide



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Document Revisions

Date	Version Number	Document Changes
06/10/2020	R1.4	First release of the document
10/15/2020	R1.5	Entry of IMEI/SN into portal, change to last 5 digits. Update G200 temp range.



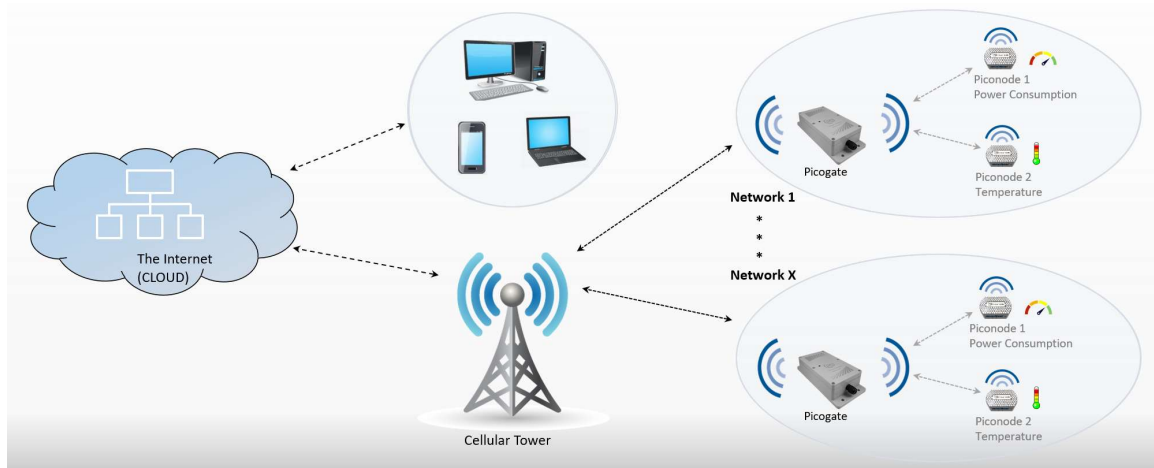
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1 Introduction

This User Guide covers specific hardware features of R9 Technologies model **G200 wireless LTE gateway device**. The gateway device is used to gather data from one or several sensor nodes (using a local wireless sensor network), and will then use an LTE wireless data link to transfer this sensor data to a database located on an internet-based server. The database can be used by customers to view and analyze the gathered sensor information

The G200 device's position in the overall network can be seen in the diagram below. The G200 "Picogate" is the second device from the far-right end of the network diagram, shown below. It gathers sensor information from SN400 sensor devices. This sensor data will, ultimately, be viewed and analyzed on a user's personal computer or smart device using a web-browser. Alerts which are received via SMS text can also be implemented using the R9 web-based system.



An LTE carrier SIM card is installed into the G200 at the factory. The G200 is powered on, by plugging it into an AC power outlet (120V, 60 Hz.). The device will initialize, and then immediately connect to the LTE network, local to your area. To get the G200 device to start collecting and forwarding sensor data, it will have to be "onboarded" into the R9 online portal system. The **R9 Online Portal User Guide** lists specific steps required to onboard your gateway device into the portal system.

The G200 cellular gateway provides two local wireless data networks. These two networks are used to allow sensor data to travel from the sensor node devices, to a web-

based server database. The web server database is where sensor data is stored for later retrieval and analysis by the web portal.

- Wireless data network 1: the sensor network is based on ISM band 915 MHz wireless technology. This network type is very low power, while still providing good range and robustness. This wireless network is used by the sensor node and gateway to transfer sensor data information.
- Wireless data network 2: the LTE cellular network allows the gateway to access and store information on web servers. This network has higher complexity and power requirements, but also higher performance. The gateway forwards sensor data received from the sensor nodes using an LTE link to an internet database.

2 G200 Product Label

The G200 product label located on the rear face of the device will indicate several important parameters. This product label is shown in the picture below.

1. The IMEI ID, circled in red, in the picture below, is unique to each G200 device. The last 5 digits of the IMEI ID will be entered into the online portal system during setup, and is used to identify the G200. Note that the IMEI ID is actually derived from the identifier number of the carrier SIM card. The G200 serial number is also indicated on the label.
2. The complete model number of the G200 device indicates the specific configuration of a particular device variant. Includes optional features installed, such as antenna configuration, DC power supply type, internal battery type, enclosure type, enclosure color, etc.



The standard G200 model number is **G200-HACAAAC**. This part number indicates:

- H – Optional features: no optional features are provisioned (GPS, Accelerometer, BLE radio, digital expansion port).
- A(1) – Antenna configuration: all system antennas are internal and PCB mounted.
- C(1) – Auxiliary serial port configuration: configured for bi-directional mode.
- A(2) - Battery: internal LiPo backup battery is installed.
- A(3) – External USB cable: external USB cable is not installed.
- A(4) – Power Supply: external DC power supply installed, 12V, 2A, 120V, 60Hz.
- C(2) – Enclosure type: Water resistant IP65 rated plastic case, gray color.

This specific part number is the default G200 variant manufactured by R9 Technology, and is suitable for most applications. Consult the factory for more information on available G200 model number variants.

3 Wireless Operating Bands (Antennas)

Sensor Network: The G200 will use only the 915 Mhz ISM band (United States) to wirelessly connect to, and transmit/receive data from the sensor node devices. The frequency range of operation is 902 Mhz to 928 Mhz. The G200 uses a frequency hopping algorithm to minimize generated noise and improve immunity from external RF interference. An 868 Mhz ISM band (European) version of the G200 is also available (G201).

The G200 915 Mhz antenna is PCB mounted and located internally to the enclosure. Note that it is possible to connect an external antenna to the G200 device. This is supported only as an option, and should not be necessary in a typical application.

LTE Data Network: The LTE data network is used by the G200 to wirelessly transmit sensor data from the node devices to internet-based web servers. The G200 uses an LTE category 1 radio for this purpose. The LTE bands of operation are bands 2,4, and 12. Band 2 - 1900 Mhz, Band 4 - Extended AWS 1700/2100 Mhz, Band 12 - 700 Mhz

BLE Radio: The BLE radio is optional, and is not used in a typical system. The BLE radio could be used as a secondary sensor network, or for wireless configuration of the G200 device. The BLE band of operation is 2.4 GHz.

GPS Receiver: The GPS receiver is optional, and is not used in a typical system. The GPS receiver (receive only) operates between the frequencies of 1559 Mhz to 1609 Mhz. These frequencies are in the standard operating band for GPS/GNSS.

4 Power

The gateway does not have an external power switch. The G200 device is powered on by plugging the DC power supply into a 120V, 60 Hz., AC wall outlet. This supply type is used in the United States (220V 50 Hz. will be used in other parts of the world).

POWER ON: When the G200 gateway is plugged into an AC outlet for the first time, the unit will power on, initialize, and finally emit a short, audible chime to indicate it is operating. Also, the front LED will turn RED for a few seconds when the unit is first plugged in. Once the G200 has successfully initialized (20-30 seconds), it will output a short, audible beep, and the LED will start to flash. Note that after initialization, the G200 will remain powered by the battery, even if the AC plug is disconnected from the wall socket.

The G200 gateway provides a single **Lithium Polymer (LiPo) battery** for use as a power backup system. The battery is 3.7V, 2600 mAh (milli-Ampere hour), and will allow the G200 to continue to function if the unit is un-plugged, or AC building power is lost. This battery is not accessible by the customer. The G200 battery powered back-up time duration is dependent on several factors. The two main items that affect battery run-time are the data update rate (minutes or hours) used for the sensor nodes, and the quantity of nodes in the system. Battery back-up run-time is approximately **10 to 20 hours** of operation. The internal battery is not designed to provide extended G200 gateway operation. It allows the gateway to notify the user that a power outage has occurred when AC building power is lost. The system will then continue to function and report sensor data until the G200 gateway battery is depleted. Note: Although the battery capacity is physically 2600 mAh, the battery capacity is de-rated as implemented (less capacity), so that the battery is not stressed and will have a longer operational life.

POWER OFF: The G200 gateway is powered off much like a smart phone. Because it (internally) uses a “OS based file system”, the G200 is **not** instantly powered off, it should be “shut down” to allow proper closing of the internal file system. Note that because it is battery powered, “pulling the plug” on the G200 will not turn the unit off. To power off the G200 device:

- 1 – Remove the DC power supply from the wall socket. The G200 will continue to function normally from battery power.

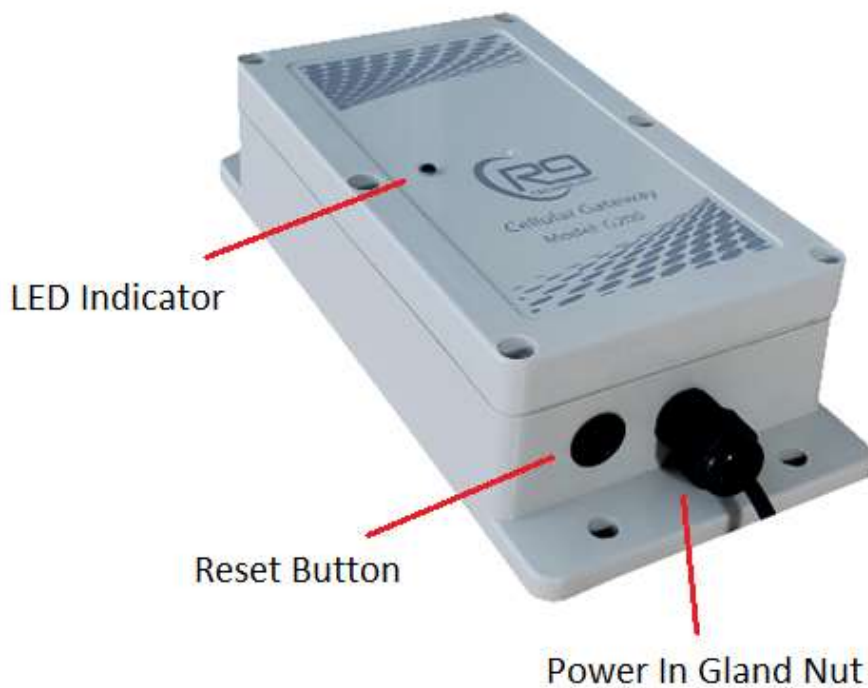
- 2 - “Quick press” the reset button located on the bottom left of the G200. The G200 will make a brief audible chirp, and the LED will start to flash GREEN quickly.

3 – After a few seconds, the LED will change to solid RED. The G200 has actually closed all devices and restarted (re-booted). While the LED is still RED, “quick press” the reset button again. The G200 will now power itself off, and the LED indicator will turn off. The unit is now powered down, and is in “ship mode”.

IMPORTANT: When you first power up the G200 gateway (from an off state), the reset button is in-operable. The reset button will not start to function until after the G200 has successfully initialized. This is indicated by a longer audible beep after 20-30 seconds.

HARD RESET: If there are un-recoverable issues with the G200, first attempt to power-cycle the unit (as indicated above) by pushing the reset button quickly. This reboots the gateway and provides a SOFT RESET of the system, and completely re-initializes the device. If this does not clear a problem, or the device is not responsive, then a HARD RESET will be required. Hold the reset button in for 8 seconds, and then release the reset button. The LED will turn RED in color, and the system has been reset (without shut-down). The unit will power up normally. Do not implement a HARD RESET unless absolutely necessary.

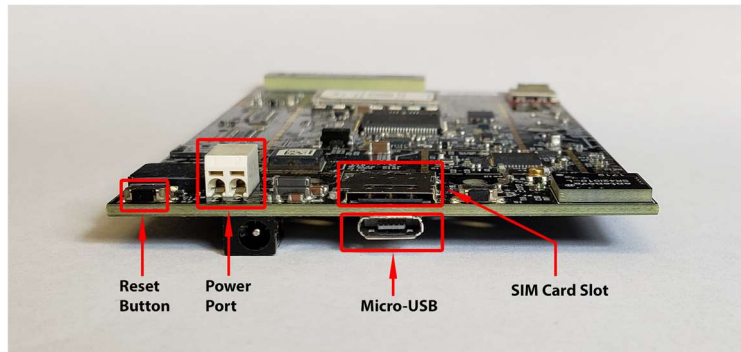
5 Interfaces, Indicators and Buttons



The (standard) IP65, water resistant enclosure variant of the G200 has few external indicators or buttons. This hardens the device against weather exposure and moisture. The only external connections on the (standard) G200 are:

1. Power supply cable (through gland nut)
2. Reset push-button.
3. Tri-color LED indicator (red, green, orange)

Cabling and most protrusions through the case will exit at the bottom of the case to help prevent moisture ingress. Operation of the reset button is discussed in the power section, as it is used to power off the device. LED indicator information is discussed in the paragraph below. There are other interfaces available on the G200 PCB. Some of these interface features may be accessible using external cabling (not installed for typical monitoring application). Remaining PCB interfaces are also listed below.



1. Micro-USB – USB high speed port. USB cable power (5V) can also be used to power the G200 (alternative to standard DC power supply input).
2. SIM Card Slot – SIM card installation is done at the factory.
3. Option: DC Barrel Jack Port – 5V-12V DC power can be input using a DC power supply.
4. Option: Digital expansion port.
5. Option: Serial expansion port.
6. Option: external antenna port (LTE, 915 Mhz ISM, GPS).

LED Indicator: The gateway product provides one external red/green/orange LED indicator to communicate the status of the gateway to a user. The LED sequences through two stages, with a slight time delay (LED out) between stages. The two-stage gateway LED indication sequence loops continuously. Note that during G200 gateway initialization, the LED will at first display red until the G200 processor sets the LED

color. Then the LED will display solid green for a few seconds. Once the G200 is initialized properly, the LED flash status will loop continuously as indicated in the table below.

Gateway LED Stage 1: LTE Connection status (starts after long LED out pause)			
State	Color	Blink Count	Description
1	Green	2	LTE connection good
2	Red	2	LTE not connected
3	Orange	2	LTE portal error- the R9 data portal connection has low through-put or is not connected.
4	Red/Green	Alternating	LTE SIM card not installed
Gateway LED Stage 2 (after short LED out pause): Battery and Charger status			
State	Color	Blink Count	Description
1	Red	2	AC Plug not inserted in wall outlet, or AC power is off
2	Green	2	LiPo battery Charging
3	Green	Solid	LiPo battery full charge
4	Red/Green	Alternating	LiPo battery not installed (not detected)

6 Installation

The gateway device should be installed as high as possible on a wall or beam, and away from large metal objects (for best wireless performance). The gateway should, preferably, be installed on a wood or sheet-rock surface. Concrete, brick, or metal walls and surfaces should be avoided.

If the gateway is installed out-doors, make sure it is not installed in direct sunlight. Install the gateway in a dry, shaded area such as under the eaves of a building. If shade is not available, then the G200 gateway should be installed under a solar shade covering accessory.

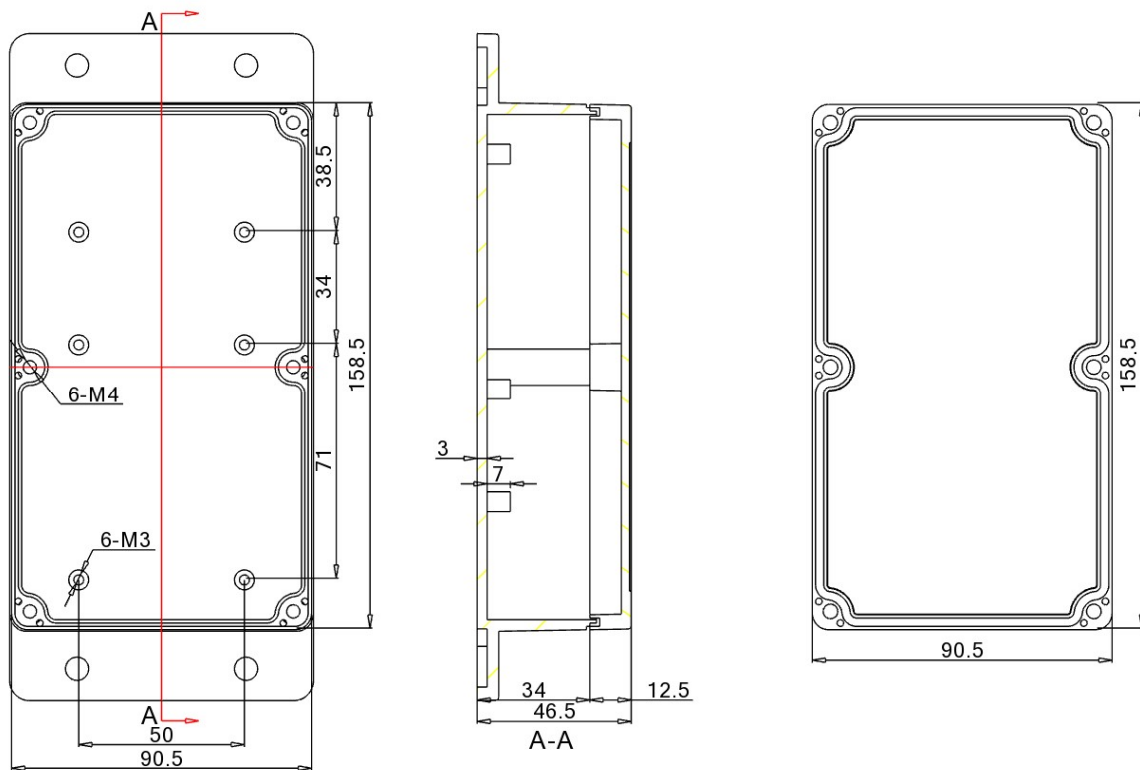
The gateway has four holes on upper and lower flanges for mounting to a surface with screw fasteners. In some installations, it may be preferable to use double sided adhesive foam tape.

The G200 should always be installed with the power supply cable exiting the enclosure downwards (for the first few inches of cable at the least). This prevents moisture from traveling along the cable and into the enclosure. Antennas on the (standard) G200 are located internally to the enclosure. This provides protection from damage and provides for a more robust installation in exposed or mobile applications.

A separate document, the **G200 Installation Guide** is available that covers the installation of the G200 product at a user site.

7 Dimensions

The dimensions of the G200 gateway are shown below. All Dimensions are shown in millimeters (mm).



8 Sales and Warranty Policy

Please download the **Sales Warranty Policy** document from our website at www.r9technology.com. It is located on the "Resources/Documentation" web page.

6 Specifications

- Data service: LTE-Cat 1 (5Mbps Up / 10Mbps Down)
- Integrated LTE cellular antenna
- Integrated 915/868 MHz ISM band antenna and sensor network
- Software-defined radio (SDR) ISM band wireless chipset
- 915 MHz sensor node to gateway data rate 5 Kbps at up to 2km (affected by device orientation, antennas, and local conditions)
- AES128 encryption providing secure sensor node communication
- 128Mbit FLASH storage memory for local data logging applications
- Data service SIM card port (4FF)
- External green/red/orange tri-color LED indicator for unit operation status
- Piezo-based speaker provides audible alarm/alert indication
- Includes internal battery backup, rechargeable Li-ion polymer battery (2600 mAH); Continues operation in power outage conditions
- Supports sleep mode for low power operation, ideal for remote applications
- Power input: 12V DC power supply (included)
- 0 C to 40 C (32 F to 105 F) temperature operating range (limited by on-board lithium polymer battery)
- Overall dimensions: 157 mm length x 91 mm width x 47 mm thickness
- IP65 rated ABS plastic enclosure
- Optional 2.4 GHz sensor node interface allows for maximum flexibility in sensor selection and operation
- Optional GNSS/GPS solution for location services; Internal PCB mounted antenna is standard, external GPS antenna option (using MMCX connector)
- Optional external LTE cellular antenna (using MMCX connector)
- Optional 915 MHz external antenna (using MMCX connector)
- Optional USB 2.0 high-speed port cable for data transfer and/or 5V power input
- Optional RS232 / serial port cable

7 Certifications - United States FCC Statement

Compliance Statement (Part 15.19)

This device complies with 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.

Warning (Part 15.21)

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

FCC Interference Statement (Part 15.105 (b))

NOTE:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement:

This equipment complies with the FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and all persons. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.