



AirLink MG90

Hardware User Guide



SIERRA
WIRELESS®

4118699
Rev 4

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Due to the nature of wireless communications, transmission and reception of data can never be guaranteed. Data may be delayed, corrupted (i.e., have errors) or be totally lost. Although significant delays or losses of data are rare when wireless devices such as the Sierra Wireless modem are used in a normal manner with a well-constructed network, the Sierra Wireless modem should not be used in situations where failure to transmit or receive data could result in damage of any kind to the user or any other party, including but not limited to personal injury, death, or loss of property. Sierra Wireless accepts no responsibility for damages of any kind resulting from delays or errors in data transmitted or received using the Sierra Wireless modem, or for failure of the Sierra Wireless modem to transmit or receive such data.

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Note: Some airlines may permit the use of cellular phones while the aircraft is on the ground and the door is open. Sierra Wireless modems may be used at this time.

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Revision History

Revision number	Release date	Changes
1	May 2016	Document created (Trial release)
2	October 2016	General release Changed recommended fuse to 9A (from 7.5A) Updated factory reset instructions Updated power consumption values Updated LED behavior descriptions (Power, Signal, ALL LEDs) Added Bracket Mount details Added I/O Configuration topic (GPIOs) Updated MTBF Added SMA wrench details Organized radio frequency/Tx power consumption tables by SKUs Updated Battery Replacement/Disposal topic Added topic to boot from USB for software update

Revision number	Release date	Changes
3	February 2017	Updated Table 3-1, General Router Specifications, on page 35: <ul style="list-style-type: none">• Added ACMA RCM certification• Added Conducted Electrical Transients Corrected RS-232 pin directions in Table 3-2, Serial Connector Pin-out, on page 38 Added topic GPIO Breakout Cable
4	June 2018	Updated EU Declaration of Conformity Dead Reckoning support Updated Power Modes—added Inrush current, and Shutdown Delay behavior Updated DC power cable part ID Updated AC adapter details Updated Accessories table—updated AirLink Antennas detail Updated fusing recommendation (10A) Added Alternate Wiring—Shore Power Added note for bootup I/O behavior Corrected references to pin 4 in I/O Configuration topics Added Low-Side Current Sink Output Added Digital Output/Open Drain Updated LED behavior—GNSS LED, chase LEDs REACH compliant; RED certified Added Ingress Protection Rating specification Updated GNSS technology specifications Updated Radio Bands/Conducted Tx Power Updated Wi-Fi Support summary Updated Regulatory Information—updated antenna gain tables, EU directive; added EU Declaration of Conformity

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>> 1: Introduction to the MG90

The Sierra Wireless MG90 is a high performance, multi-network vehicle router developed specifically for mobile applications in public safety, transit, and field services. Together with the AirLink Mobility Manager and the AirLink Connection Manager, it provides a secure, managed, high performance LTE networking solution for the most demanding mission critical applications.

This document applies to MG90 Series routers, including MG90 LTE, MG90 LTE-A, and MG90 LTE-A Pro.

Note: Throughout this document, "MG90" is used to refer to all MG90 Series routers.

Key Features

- Multi-carrier LTE-A Pro WAN connectivity supporting up to 600 Mbps downlink speed
- Cognitive link management system to optimize WAN connections for quality, cost, and performance
- Commercially available to deploy on FirstNet mission critical networks today
- Dual concurrent 802.11ac Gigabit Wi-Fi (3 x 3 MIMO)
- Inertial navigation (Dead Reckoning)
- Precision mobile events reporting at 1 second intervals allows for detailed network and connectivity analysis

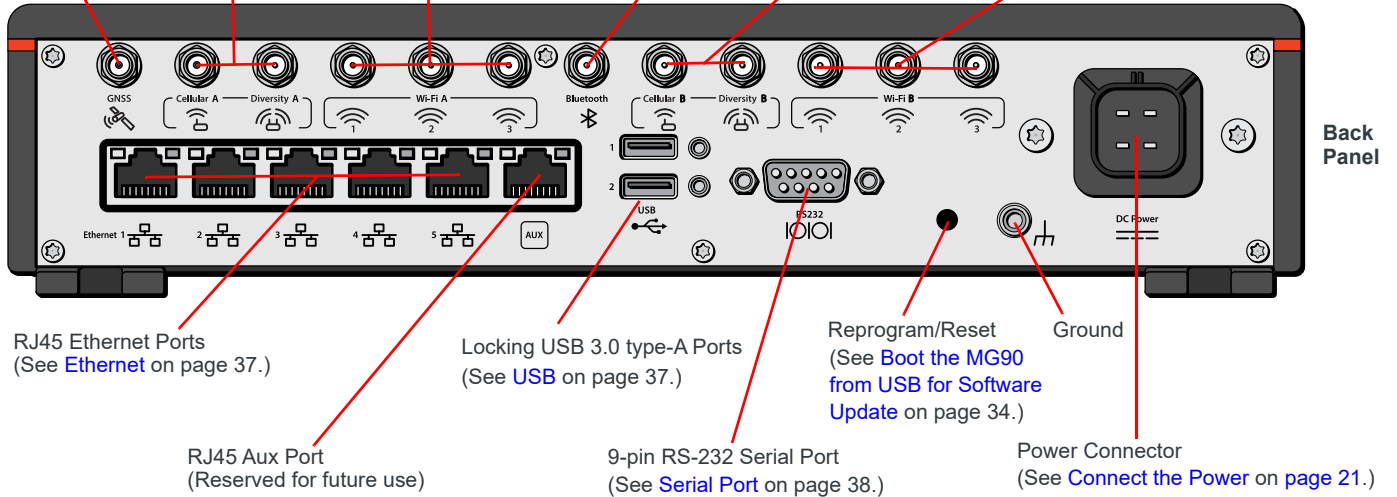
For information on configuring these features, refer to the Sierra Wireless MG90 Software Configuration User Guide available at source.sierrawireless.com.

Description

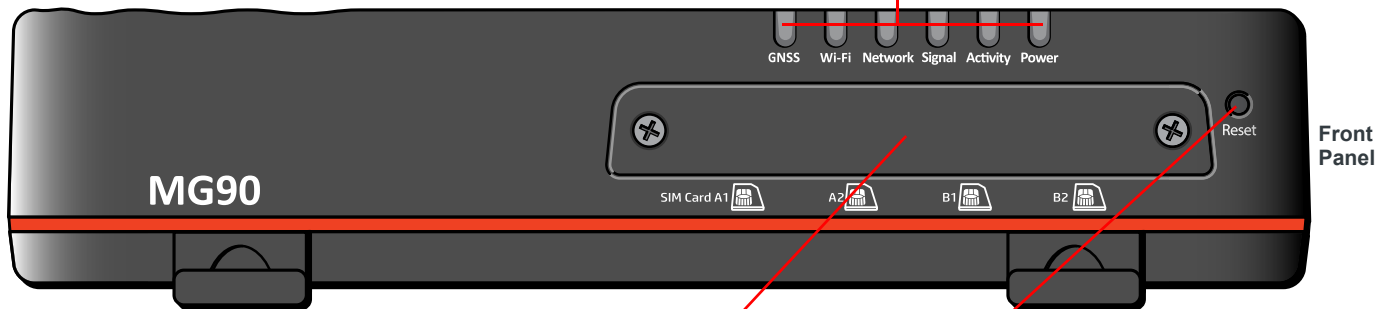
Antenna Connectors

(See [Connect the Antennas](#) on page 19.)

GNSS Cellular A / Diversity A Wi-Fi A (Wi-Fi WAN) (1/2/3) Bluetooth Cellular B / Diversity B Wi-Fi B (Wi-Fi Access Point) (1/2/3)



LEDs (See [LED Behavior](#) on page 30.)



SIM Card holders (See [Insert the SIM Card](#) on page 18)

Reset button (See [Reboot the MG90](#) and [Reset the MG90 to Factory Default Settings](#) on page 34.)

Figure 1-1: MG90 Connectors, LEDs and SIM Card Holder

Power Modes

The Sierra Wireless MG90 has two power modes, as described in [Table 1-1](#).

Table 1-1: MG90 Power Modes

Mode	Ignition	Shutdown Delay	CPU / Radios	Power	Power Consumption ^a		
					Configuration	Typ	Max
On	ON	n/a	ON	Connected	1 Cellular radio	14 W	17 W
	OFF	ON—MG90 remains on until the shutdown delay period expires, then goes to Standby mode.			2 Cellular radios	18 W	21 W
	Inrush current				5 A @ 7V (Averaged over 100 μs)		
Standby	OFF	<ul style="list-style-type: none"> OFF ON, after period has expired 	OFF	Connected	-	-	<135 mW
		<i>Note: Device can be woken from Standby mode by an I/O input or at a configured time.</i>					

a. Power consumption measured at 7V.

Accessories

[Table 1-2](#) lists accessories that are included with the MG90 router or are available for purchase from Sierra Wireless.

Table 1-2: MG90 Accessories^a

Part	Part Number	Description
Included with router purchase		
DC power cable	6001103	10' power cable
SMA wrench	5400017	Used to install antenna cables to MG90
Quick Start Guide	5302198	Basic setup and usage instructions
Available for separate purchase from Sierra Wireless		
AC power adapter for test bench use	6001023	<ul style="list-style-type: none"> Universal adapter Voltage input: 100–240 VAC

Table 1-2: MG90 Accessories^a (Continued)

Part	Part Number	Description
AirLink Antennas	For MG90 antenna packages, visit www.sierrawireless.com and search for "AirLink Antennas".	Antennas for various MG90 configurations. For example: <ul style="list-style-type: none"> • 6-in-1 Antenna (2×LTE, 3×Wi-Fi, 1×GNSS) for main radio and Wi-Fi A • 3-in-1 Antenna (2×LTE, 1×GNSS) • 3-in-1 Antenna (3×Wi-Fi) for Wi-Fi B • 2-in-1 Antenna (2×LTE) for second radio • etc.
Mounting bracket	6001024	Mounting bracket for easy vehicle installation and removal
GPIO Breakout Cable	6001095	RS-232 GPIO breakout cable. See GPIO Breakout Cable on page 60 for details.

a. Subject to change.

Warranty

The MG90 comes with a 3-year warranty, and has an optional 2-year warranty extension.



2: Installation and Startup

This chapter describes:

- How to connect, install and start the MG90
- Front panel LEDs
- I/O functionality

Note: Field wiring and connections in hazardous locations must be connected as per the wiring methods requirement for Class 2 circuits mentioned in the National Electric Code and the Canadian Electric Code.

Note: The MG90 installation must be done by a qualified technician.

Powering the MG90 On

The MG90's factory default configuration enables it to establish a WAN connection if an appropriate SIM card is installed, and the APN is configured correctly.

Note: Additional configuration is always recommended.

To start the MG90:

1. Apply power to the system:
 - If the MG90 has been installed and wired into a vehicle's electrical system, turn on the ignition.
 - If the MG90 is not in a vehicle (for example, on a test bench), use the optional AC power adapter.

The MG90 should fully power up within two minutes. When the MG90 is turning on, the Power LED flashes green, then turns solid green, and other LEDs begin to display their regular behavior. For more information on the LED patterns see [LED Behavior](#) on page 30.

2. If the MG90 does not start automatically, press and release the Reset button on the front panel.
3. Test the unit—Connect a test device (for example, a PC) to the MG90 LAN via:
 - Wi-Fi—An MG90 with factory default settings provides an unsecured Vehicle Wi-Fi access point (AP) broadcasting its own Serial Number as the SSID (e.g. ND60510068011018)
 - Ethernet—Ethernet ports 1–4 (factory default configured for LAN access)

Refer to the AirLink MG90 Software Configuration Guide for configuration/usage instructions.

4. The MG90 is ready for use. However, you should further configure the unit using the sections provided in this document.

Tools and Materials Required

- SIM card(s) (provided by your mobile network operator)—Depending on your device configuration, you will have one or two cellular modems. Each modem can support up to two SIM cards.
- #1 Phillips screwdriver
- Laptop computer with Ethernet cable
- Multi-element antenna(s) appropriate for your MG90. See [Table 1-2](#) on page 10 for suggested antennas.
- SMA wrench (provided with MG90)
- AC or DC power cable (available from Sierra Wireless or use your own custom cable). See [Table 1-2](#) on page 10 for part numbers.
- Optional—9-pin connection cable for the RS-232 port

Caution: *The MG90 has a hardened case for use in extreme environments. If the MG90 is to be used in these environments, make sure to use cables designed and specified for this use to avoid cable failure.*

Installation Overview

The steps for a typical installation are performed as follows:

- [Step 1—Insert the SIM Cards](#) on page 13.
- [Step 2—Mounting and Grounding the MG90 Chassis](#) on page 15.
- [Step 3—Connect the Antennas](#) on page 19.
- [Step 4—Connect the Data Cables](#) on page 21.
- [Step 5—Connect the Power](#) on page 21.
- [Step 6—Check the router operation](#) on page 29.
- [Step 7—Startup and Software Configuration](#) on page 32.

Note: Depending on where you are installing the MG90, you may want to mount the router before connecting the antenna, cables and power.

Step 1—Insert the SIM Cards

The MG90 has four mini-SIM (2FF) card slots—two slots for each radio module (up to two radios). The card slots are located behind a removable plate on the front of the device as shown in [Figure 2-1](#) on page 14.

From left to right, the “SIM Card” slots are:

- A1—First radio module (Cellular A), first SIM
- A2—First radio module (Cellular A), second SIM
- B1—Second radio module (Cellular B), first SIM
- B2—Second radio module (Cellular B), second SIM

If you are using only one SIM card for a radio module, Sierra Wireless recommends that you install it in the module's '1' slot (e.g. SIM Card A1, SIM Card B1).

If the SIM card(s) are not already installed, insert them into the MG90 before connecting any external equipment or power to the unit.

To install the SIM card(s):

1. Use a #1 Phillips screwdriver to remove the SIM card cover (2 screws).

Important: These are 'captive' screws that remain attached to the cover. Do NOT remove them from the door.

2. Orient the SIM card(s), as shown in [Figure 2-1](#) (Gold contacts on the SIM cards face-up).
3. Gently slide the SIM cards into their slots until they click into place.
(To remove a SIM card, press the SIM card in until it clicks, and release it. Gently grip the SIM card and pull it out.)

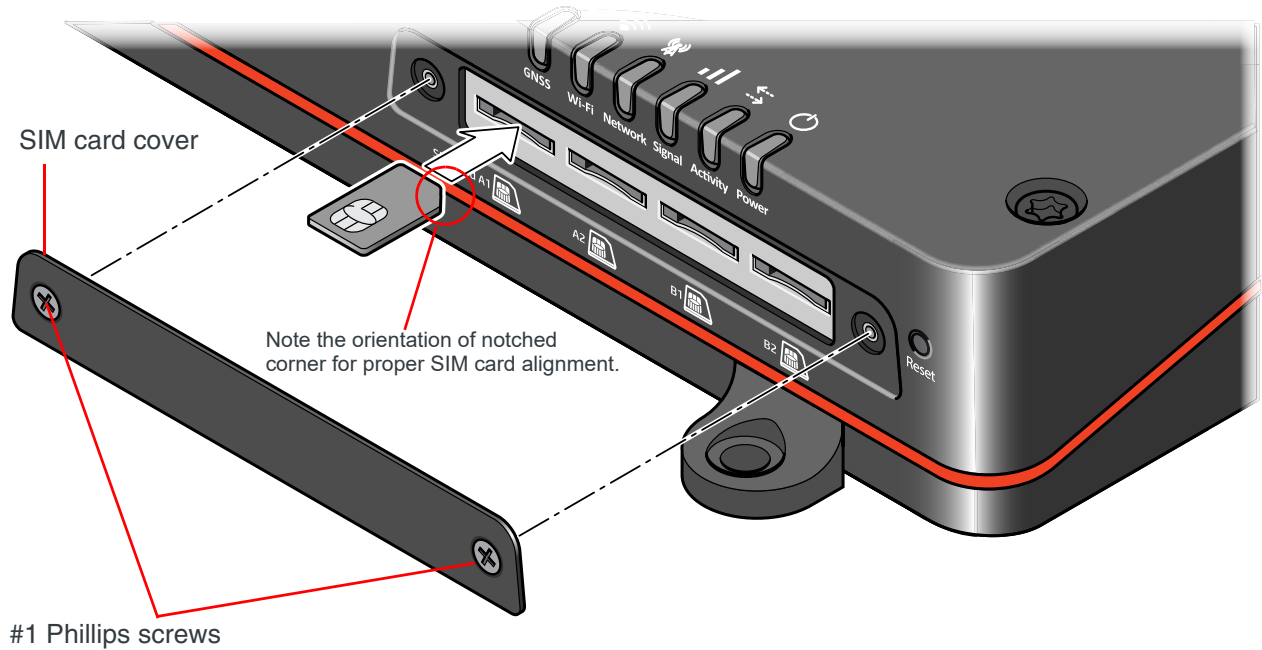


Figure 2-1: Installing the SIM Cards

4. Replace the SIM card cover.

Important: Do not over-tighten the screws. This could strip the threads inside the router, which will prevent the cover from being re-attached.

Step 2—Mounting and Grounding the MG90 Chassis

The MG90 should not be mounted in the driver's area of the vehicle or in areas where it can distract the driver. Mount it in accordance with accepted after-market practices and materials.

While mounting the MG90:

- Make sure the power source is OFF.

Note: See the [Mechanical Specifications](#) on page 53 for the MG90's dimensions.

Mount the router where:

- There is easy access for attaching the cables. Make sure there is sufficient space in front, behind, and above the unit to connect all components and perform maintenance.
Typical locations for installing the MG90 include under the deck lid, or on the floorboard of the vehicle's equipment storage.
- Cables will not be constricted, close to high amperages or exposed to extreme temperatures
- The front panel LEDs are easily visible
- There is adequate airflow
- It is away from direct exposure to the elements, such as sun, rain, dust, etc.
- It will not be hit or come into contact with people, cargo, tools, equipment, etc.

The MG90 has 4 mounting holes/slots, as shown in [Figure 2-2](#). For screw specifications, see [Screw Torque Settings](#) on page 39. For additional mechanical dimension details, see [Figure 3-3](#) on page 53.

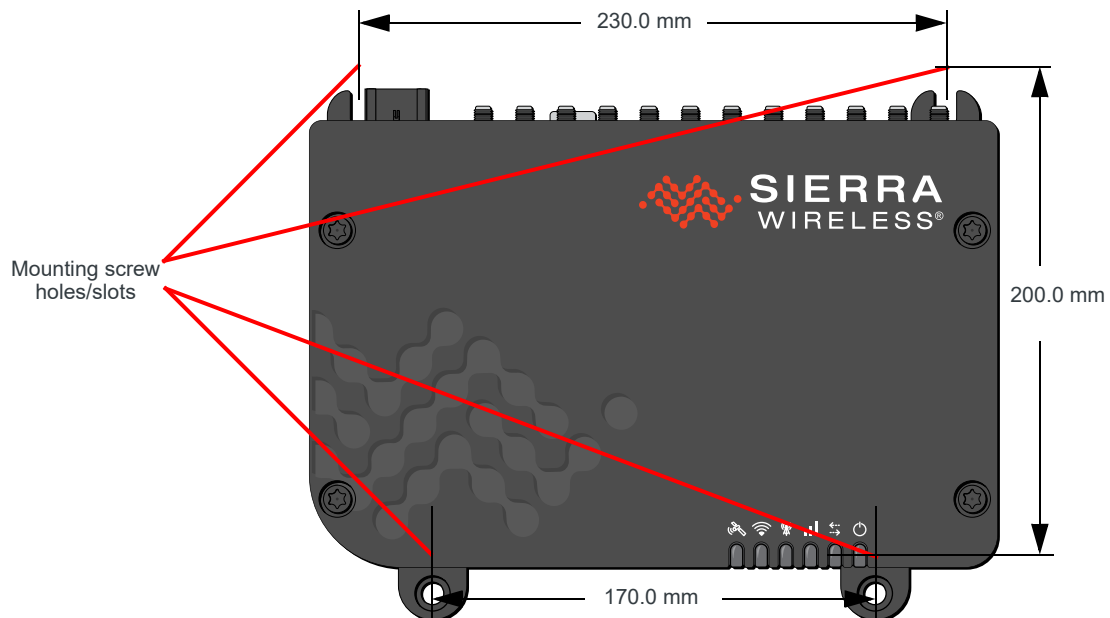


Figure 2-2: MG90 Mounting Slots

Note: When mounting on a an inclined/vertical surface without the optional mounting bracket, the MG90 should be positioned with the antenna ports facing down (or sideways) with the mounting slots resting on mounting posts, as shown in [Figure 2-3](#).

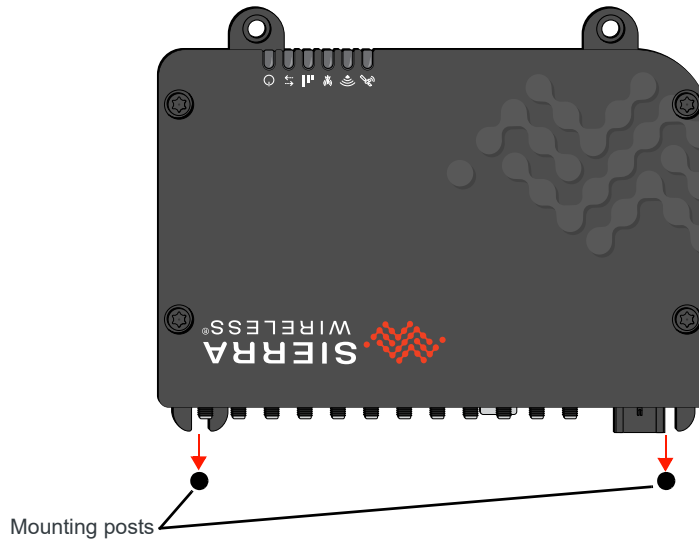


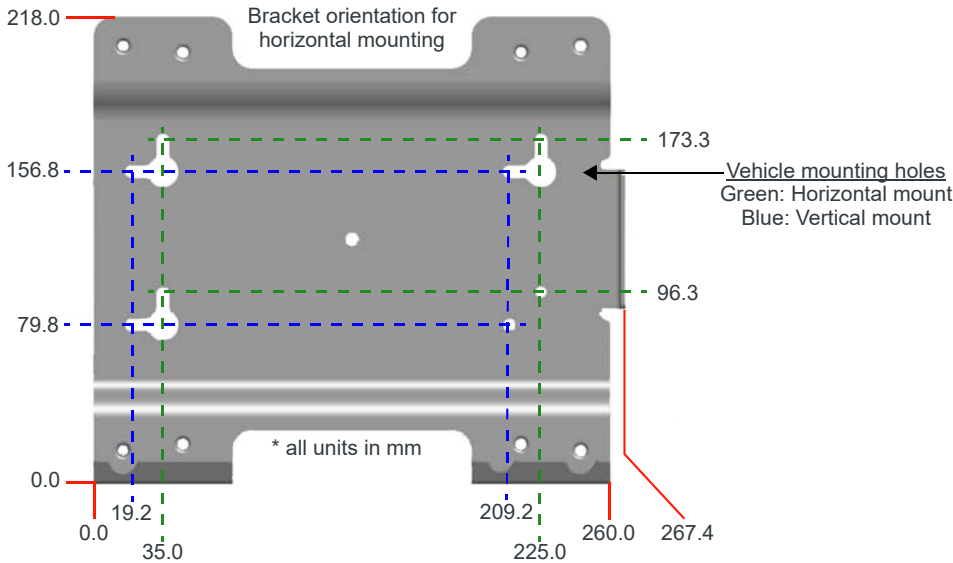
Figure 2-3: Recommended Orientation for Inclined/Vertical Mounting

Flat Surface Mount

If you are mounting the MG90 on a flat surface, use appropriate mounting screws.

Bracket Mount

An optional mounting bracket (Part #6001024) is available from Sierra Wireless for vertical mounting. This bracket comes is supplied with appropriate mounting screws.



- Attach bracket to mounting surface and install MG90:
1. Pre-drill two screws into mounting surface.
 2. Position mounting slots over screws.
 3. Slide bracket down to 'lock' the screws in the tabs.
 4. Secure the bracket with two more screws using appropriate mounting holes.
 5. Position the MG90 as appropriate and secure to mounting bracket using the screws provided with the bracket.

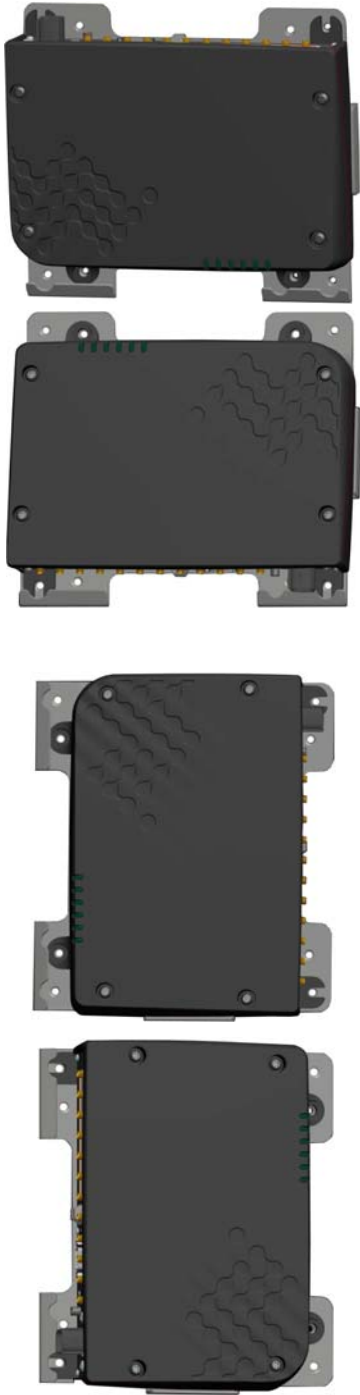
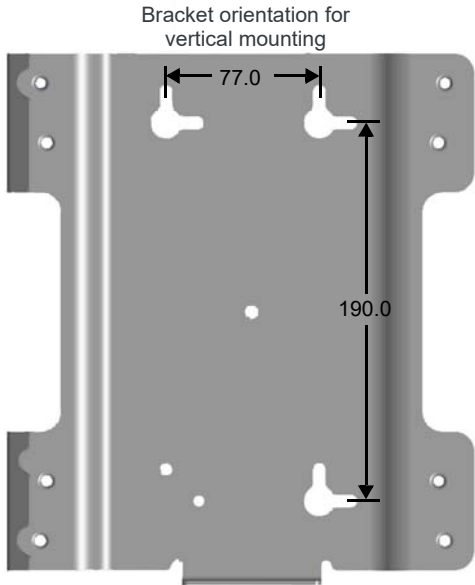


Figure 2-4: MG90 Bracket Mounting Installation Examples

Ground the MG90 Chassis

For DC installations (with a fixed “system” ground reference), Sierra Wireless strongly recommends always grounding the MG90 chassis to this system ground reference.

To ensure a good grounding reference connect one end of a short 18 AWG or larger gauge wire with a ring terminal connector to the ground terminal on the rear panel of the MG90 and connect the other end to the vehicle chassis.

The ground terminal requires an M4x6 mm screw (or longer, depending on the ring terminal connector size.)

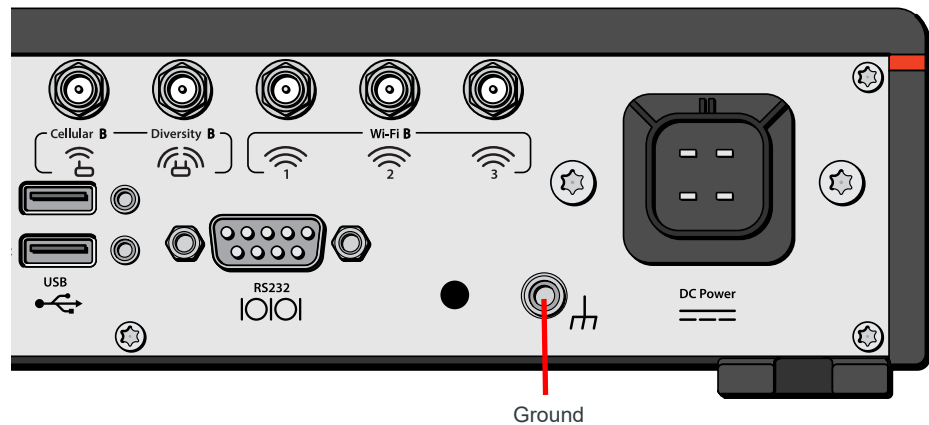


Figure 2-5: Ground Connector (Rear Panel)

Cabling—Best Practices

Separate MG90 antenna, data, and power cables from other wiring in the vehicle and route away from sharp edges.

Cable Strain Relief

Sierra Wireless recommends using cable strain relief for installations in high-vibration environments.

Place the cable strain relief within 200 mm (8") of the MG90 to reduce the mass of cable supported by the power connector under vibration. Ideally, the strain relief mounting for the DC cable should be attached to the same object as the MG90, so both the router and cable vibrate together. The strain relief should be mounted such that it does not apply additional stress on the power connector (i.e. the cable should not be taut and should not pull the power connector at an angle).

Cable Management

Proper cable management eliminates unnecessary installation complications, allows for ease of maintenance, and prolongs cable longevity.

When installing cables, adhere to the following practices:

1. Label each cable that attaches to the MG90. For example: “GNSS”, “Wi-Fi A”, “Ethernet to Device X”.
2. Protect the cables using a proper cable conduit.
3. Secure each cable connected to the MG90 via a permanent fixture.

Step 3—Connect the Antennas

Warning: This router is not intended for use close to the human body. Antennas should be at least 8 inches (20 cm) away from the operator or bystanders.

The MG90 has the following SMA antenna connectors:

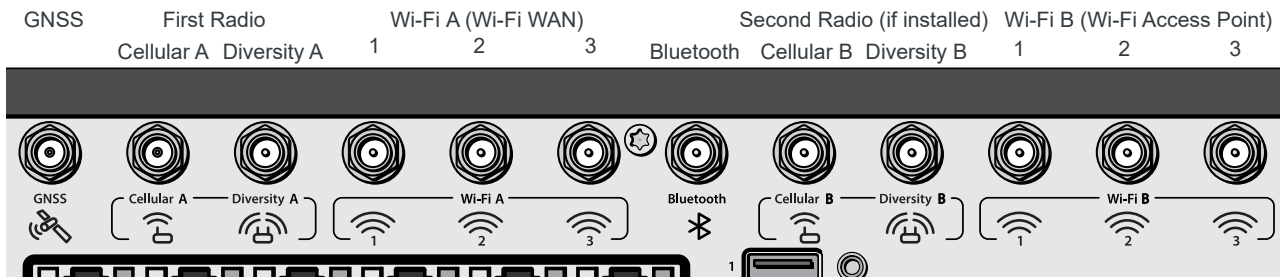


Figure 2-6: Antenna Connectors (Rear Panel)

Table 2-1: Antenna Connector Types

Module	Connectors	Description	Type
Radio	Cellular A	First radio, Rx/Tx	SMA
	Diversity A	First radio, Rx Diversity	SMA
Radio	Cellular B	Second radio, Rx/Tx	SMA
	Diversity B	Second radio, Rx Diversity	SMA
GNSS	GNSS	GNSS	SMA
Wi-Fi	Wi-Fi A 1	<ul style="list-style-type: none"> • Wi-Fi 802.11b/g/n/ac, 3x3 MIMO • Used for Wi-Fi WAN (Default configuration) 	RP-SMA
	Wi-Fi A 2		RP-SMA
	Wi-Fi A 3		RP-SMA
Wi-Fi	Wi-Fi B 1	<ul style="list-style-type: none"> • Wi-Fi 802.11b/g/n/ac, 3x3 MIMO • Used for Wi-Fi access point (Default configuration) 	RP-SMA
	Wi-Fi B 2		RP-SMA
	Wi-Fi B 3		RP-SMA
Bluetooth	Bluetooth	Bluetooth	RP-SMA

For regulatory requirements concerning antennas, see [Maximum Antenna Gain and Collocated Transmitter Radiated Power](#) on page 55.

To install the antennas:

1. Mount the antenna unit(s) on the vehicle (typically multi-element units):
 - Follow the antenna unit’s recommended installation instructions.
 - Use appropriate cable strain relief. (See [Cable Management](#) on page 18.)
 - When mounting antenna unit(s) containing WAN/WLAN cellular antennas, make sure there is at least 20 cm between the antenna(s) and the user or bystanders during normal operation.
 - If the unit includes a GNSS antenna, make sure it has a good view of the sky (at least 90°).

Note: If single-element antennas are installed, refer to [Table A-1](#) on page 59 for recommended antenna separation.

Note: Use the SMA wrench provided to hand-tighten the antennas to the SMA connectors. Do not over-tighten. Recommended torque is 0.6–0.8 Nm (5–7 in-lb), and max torque should not exceed 1.1 Nm (10 in-lb).

2. Connect the cables from the antenna units to their corresponding SMA/RP-SMA connectors on the MG90’s rear panel.
From left to right (as shown in [Figure 2-6](#) on page 19):
 - If used, connect the GNSS antenna to the “GNSS” antenna connector.
 - For the first radio module:
 - Connect the main antenna to the “Cellular A” connector.
 - If used, connect the diversity antenna to the “Diversity A” connector.
 - Connect the Wi-Fi Access Point module’s three antennas to the “Wi-Fi A” connectors.
 - If used, connect a Bluetooth antenna to the “Bluetooth” connector.
 - For the second radio module:
 - Connect the main antenna to the “Cellular B” connector.
 - If used, connect the diversity antenna to the “Diversity B” connector.
 - Connect the Wi-Fi WAN module’s three antennas to the “Wi-Fi B” connectors.

Note: If the antenna unit(s) is located away from the router, keep cables as short as possible to prevent the loss of antenna gain. Route the cables to protect them from damage or being snagged or pulled. There should be no binding or sharp corners in the cable routing. Excess cabling should be bundled and tied off. Make sure the cables are secured so their weight will not loosen the connector from the router over time.

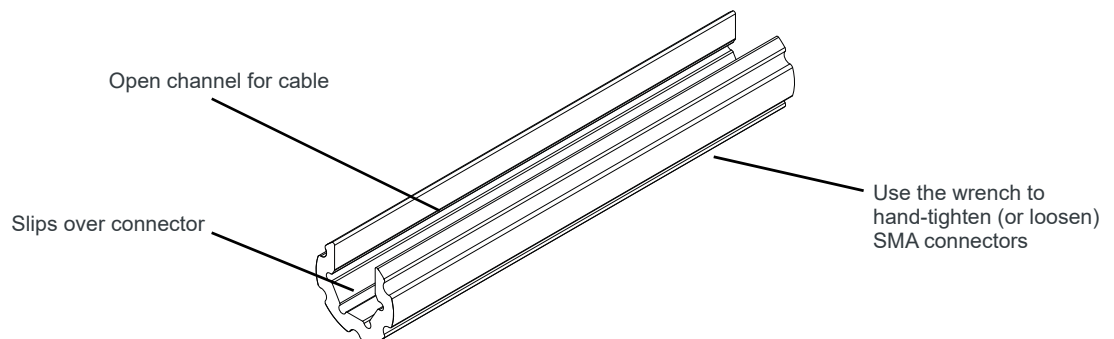


Figure 2-7: SMA Wrench Usage

Step 4—Connect the Data Cables

The MG90 has multiple ports for connecting optional data cables or accessories:

- Ethernet (10/100/1000 Base-T RJ45) ports (5)
 - Use Cat 5e or Cat 6 Ethernet cables to connect up to five devices.
 - Ports 1–4: LAN (Default)
 - Port 5: WAN (Default)
- AUX port reserved for future use
- [USB 3.0 type-A locking ports](#). For USB port details, see [USB](#) on page 37.
 - To connect a USB cable/device:
 - a. Plug the USB cable/device into either USB port.
 - b. If using a USB locking cable, screw the jack screw finger-tight.
- [Serial Port](#) (9-pin RS-232)
 - See [Serial Port](#) on page 38 for cable requirements.

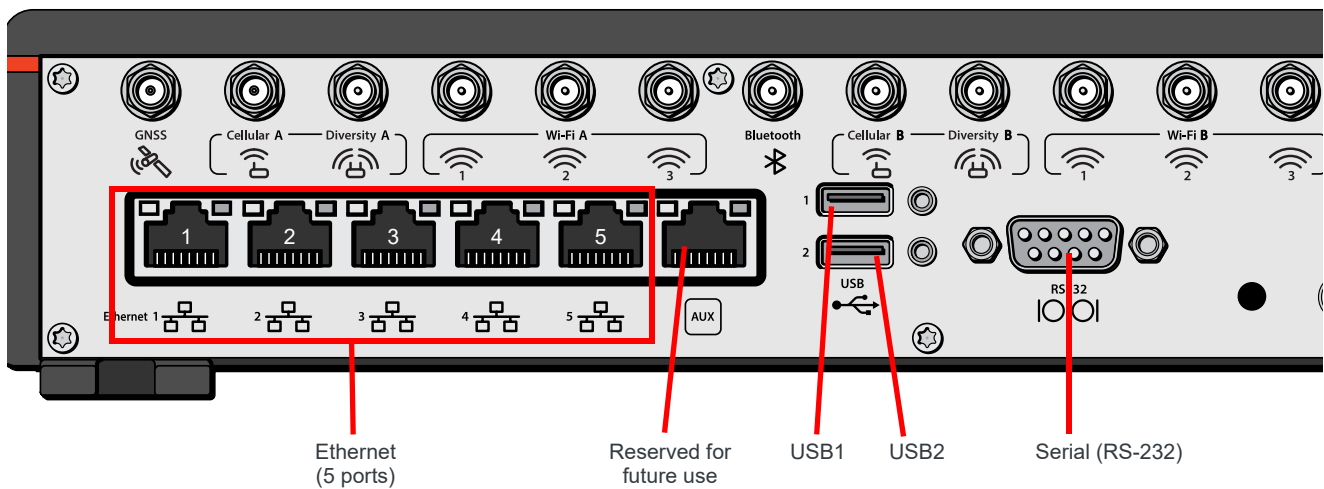


Figure 2-8: Data Cable Connectors (Rear Panel)

Step 5—Connect the Power

The router's power supply cable must be connected to the vehicle's fuse box, and installed along the vehicle wall, always inside the vehicle cabin and must not cross the vehicle's firewall protection. Always follow the vehicle manufacturer's recommendations for electrical accessories connections. All components used in the electrical connection to the vehicle should be UL Listed.

The MG90 comes with a 3 meter (10 ft.) DC power cable.

You can also purchase an optional AC adapter for test bench usage—see [Table 1-2](#) on page 10.

Note: Electrical installations are potentially dangerous and should be performed by personnel thoroughly trained in safe electrical wiring procedures.

The MG90 supports an operating voltage of 7 V–36 V, but since low voltage standby mode is enabled by default, you must supply more than 11 volts at startup.

If you want to operate the router at a lower voltage, you can change the low voltage standby settings once the router is up and running. For more information, refer to the MG90 Software Configuration User Guide.

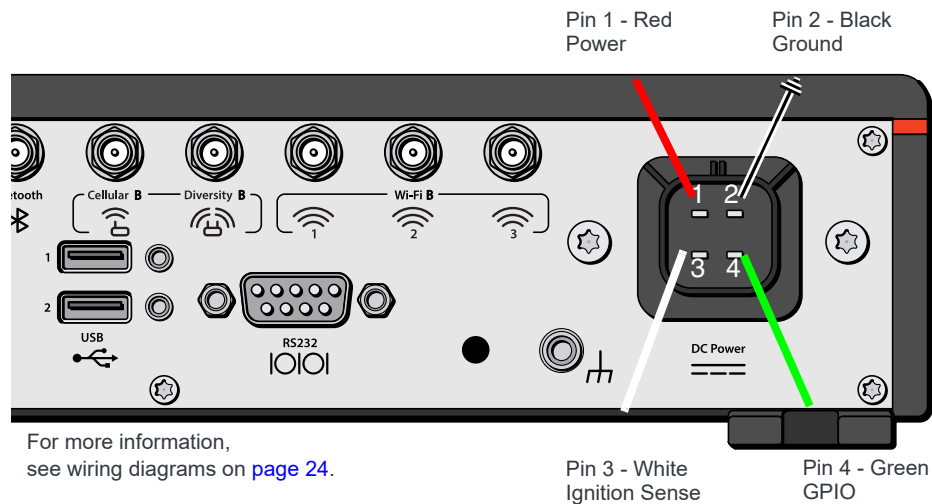
Fusing

For DC installations, Sierra Wireless recommends fusing the power input using a 10 A, fast blow fuse, recommended to have no more than $\pm 10\%$ de-rating over the operating temperature range.

DC Voltage Transients

The MG90 has built-in protection against vehicle transients including engine cranking (down to 5.0V) and load dump, so external power conditioning circuits are not needed. For details, see [Industry Certification for Vehicles](#) on page 35.

MG90 Power Connector



For more information, see wiring diagrams on [page 24](#).

Figure 2-9: DC Power Cable Connections (Colors indicate DC cable wire colors.)

Table 2-2: Power Connector Pin and DC Cable Wires

Pin	Name	Associated DC Cable Wire Color	Description	Type
1	Power	Red	<p><i>Note: If you want to turn the MG90 on/off using a control line, such as a vehicle ignition line, Sierra Wireless strongly recommends that you connect the control/ignition line to Pin 3 and apply continuous power on Pin 1.</i></p> <p>Main power supply for device</p>	PWR
2	Ground	Black	Main device ground	PWR
3	Ignition Sense	White	<p><i>Note: If you do not connect Pin 3 to the ignition, you MUST connect it to the positive terminal of your power supply or battery. If you are using a Sierra Wireless AC adapter, the connection is inside the cable.</i></p> <p>Ignition Sense: Connected to the vehicle ignition or an external switch. The MG90 is off when this pin is either open-circuit or grounded, and on when this pin is connected to power.</p>	I
4	GPIO	Green	General purpose digital input/output. For more information, see I/O Configuration on page 26.	I/O

Connect the Router to the Vehicle's Electrical System

To connect the MG90 router to the vehicle's electrical system:

1. Make sure the vehicle is turned off.
2. Remove the key from the ignition.
3. Disconnect the vehicle's battery:
 - a. Disconnect the negative terminal **first**.
 - b. Disconnect the positive terminal.
4. Connect the black (ground) wire on the DC power cable to the vehicle chassis.
5. Make sure the MG90 is grounded. (See [Step 2—Mounting and Grounding the MG90 Chassis](#) on page 15.)
6. Use a 10 A, fast blow fuse, recommended to have no more than $\pm 10\%$ de-rating over the operating temperature range, to connect the red (power) wire on the DC power cable to the vehicle's fuse box. (See [Figure 2-10](#).)
7. Connect the white wire (ignition) on the DC power cable to the ignition signal from the vehicle.
8. Connect the DC power cable to the MG90.
9. Reconnect the vehicle's battery:
 - a. Connect the positive terminal **first**.
 - b. Connect the negative terminal.

Wiring Diagrams

Recommended Basic Vehicle Installation

For most vehicle installations, Sierra Wireless recommends connecting the white Ignition Sense wire to the vehicle's ignition switch, as shown in [Figure 2-10](#).

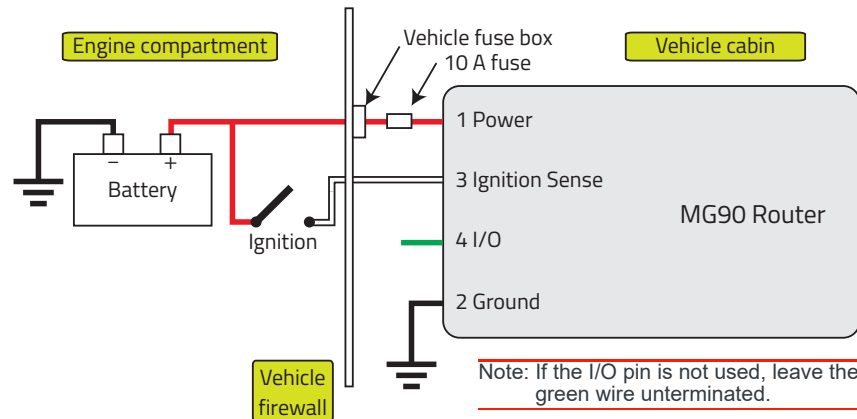


Figure 2-10: Recommended Vehicle Installation

The recommended vehicle installation allows the router to operate with the vehicle. When the vehicle ignition is off, the MG90 is in standby mode. If desired, you can configure a delay between the time the vehicle's ignition shuts off, and the time the router shuts down. A delayed shutdown is especially useful if you want to maintain a network connection while the vehicle's engine is shut off for short periods, such as in a delivery vehicle.

- **Pin 1 (Power)**—Use the DC cable's red wire (Vin+) to connect Pin 1 to the power source. Include a 10 A, fast blow fuse, recommended to have no more than $\pm 10\%$ de-rating over the operating temperature range, in the input power line. Sierra Wireless recommends using a continuous (unswitched) DC power source. Connect the power through the vehicle's fuse box.
- **Pin 2 (Ground)**—Use the DC cable's black wire to connect Pin 2 to the vehicle battery's negative terminal, or ground. See also [Step 2—Mounting and Grounding the MG90 Chassis](#) on page 15.
- **Pin 3 (Ignition Sense)**—Sierra Wireless recommends always using the DC cable's white wire (Ignition Sense wire (Pin 3)) to turn the router off. It should not be turned off by disconnecting the power.
- **Pin 4 (GPIO)**—The DC cable's green wire (GPIO) can remain unconnected if GPIO functionality is not required. Otherwise, connect the GPIO as described in the [I/O Configuration](#) on page 26.

Alternate Wiring—Shore Power

A shore power supply can be used to operate the router while the vehicle is parked (for example, in a maintenance facility), as shown in [Figure 2-11](#).

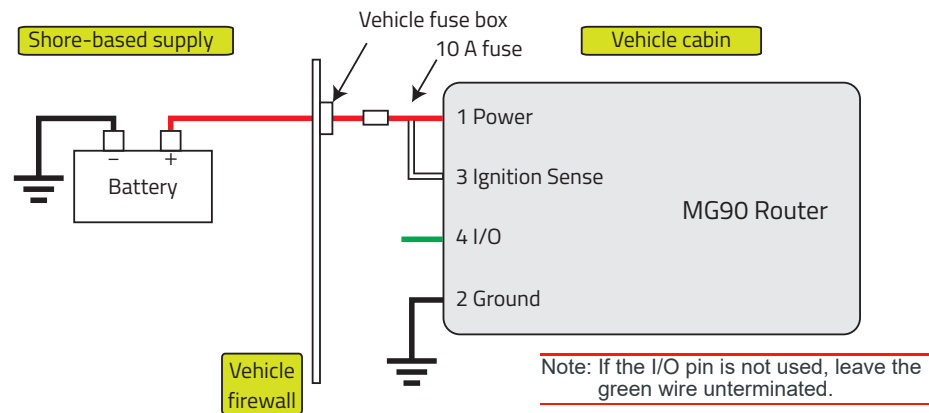


Figure 2-11: Recommended Shore Power Connection

The shore power connection allows the router to operate while the vehicle ignition is off and the vehicle is in a facility (e.g. maintenance bay) with a shore power supply.

- Pin 1 (Power)—Use the DC cable's red wire (Vin+) to connect Pin 1 to the power source. Include a 10 A, fast blow fuse, recommended to have no more than $\pm 10\%$ de-rating over the operating temperature range, in the input power line. Sierra Wireless recommends using a continuous (unswitched) DC power source. Connect the power through the vehicle's fuse box.
- Pin 2 (Ground)—Use the DC cable's black wire to connect Pin 2 to vehicle chassis ground. See also [Step 2—Mounting and Grounding the MG90 Chassis](#) on page 15.
- Pin 3 (Ignition Sense)—Tie the DC cable's white wire (Ignition) to the red wire (Vin+) before the fuse (i.e on the MG90 side).
- Pin 4 (GPIO)—The DC cable's green wire (GPIO) can remain unconnected if GPIO functionality is not required. Otherwise, connect the GPIO as described in the [I/O Configuration](#) on page 26.

I/O Configuration

The MG90 has five pins you can use for digital input/output configuration:

- Pin 4 on the power connector
- Pins 1, 4, 6, and 9 on the RS-232 serial connector

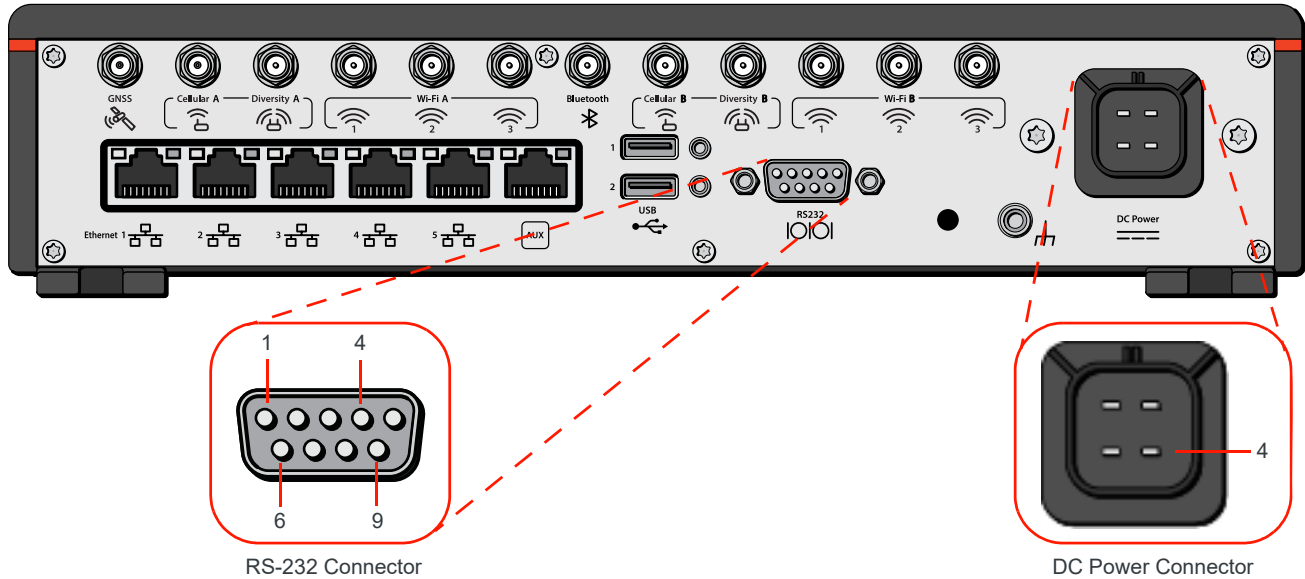


Figure 2-12: I/O Pin-out for RS-232 Connector and Power Connector

You can use these pins as:

- Digital inputs—See [Digital Input](#) on page 26.
- High side pull-ups/dry contact switch inputs—See [High Side Pull-up / Dry Contact Switch Input](#) on page 27.
- Low side current sinks—See [Low-Side Current Sink Output](#) on page 28.
- Digital outputs/open drains—See [Digital Output/Open Drain](#) on page 29.

Note: During bootup, the I/O settings remain in their default state—the internal pull-up resistor is disabled, and output current sink switch is open. After bootup, any custom I/O settings are applied. This may take approximately 30 seconds after the router is restarted or powered on.

Digital Input

You can connect any of the GPIO pins to a digital input to detect the state of a switch, or to monitor an external device such as a motion detector, a remote solar panel, or a remote camera. Digital input can also be used with the standby timer. While in Standby mode, the digital input will not be acted upon if it changes state.

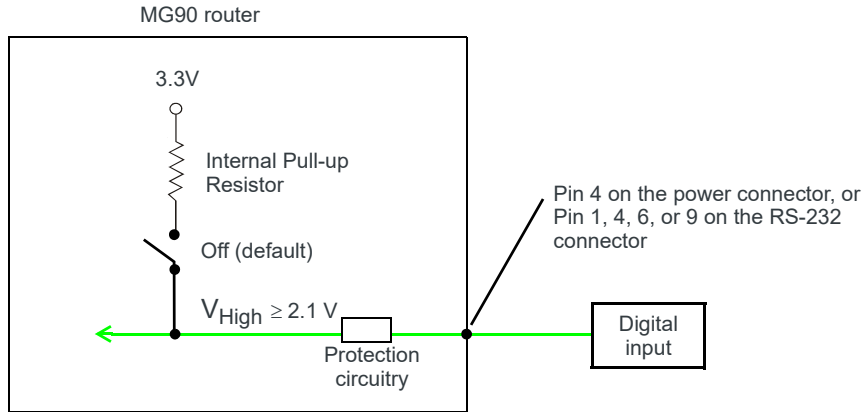


Figure 2-13: Digital Input

Table 2-3: Digital Input^a

Pull-up	State	Minimum	Typical	Maximum	Units
Off	Low	—	—	0.7	V
	High	2.1	3.3	36	V

a. Voltage levels are compatible with 3.3V TTL standard logic families.

High Side Pull-up / Dry Contact Switch Input

You can connect any of the GPIO pins to a dry contact switch, such as an alarm relay. While in Standby mode, the dry contact switch input will not be acted upon if it changes state.

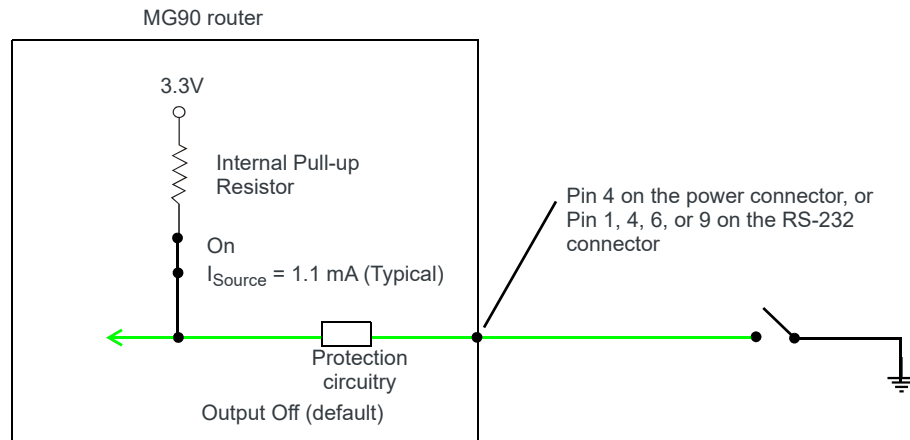


Figure 2-14: High Side Pull-up / Dry Contact Switch Input

Table 2-4: High Side Pull-up / Dry Contact Switch Input

	Minimum	Typical	Maximum	Units	Comments
Source Current	-	1.1	-	mA	Amount of current the external switch must sink

Low-Side Current Sink Output

Any of the GPIO pins can be connected to a low-side current sink output, for example to drive a relay.

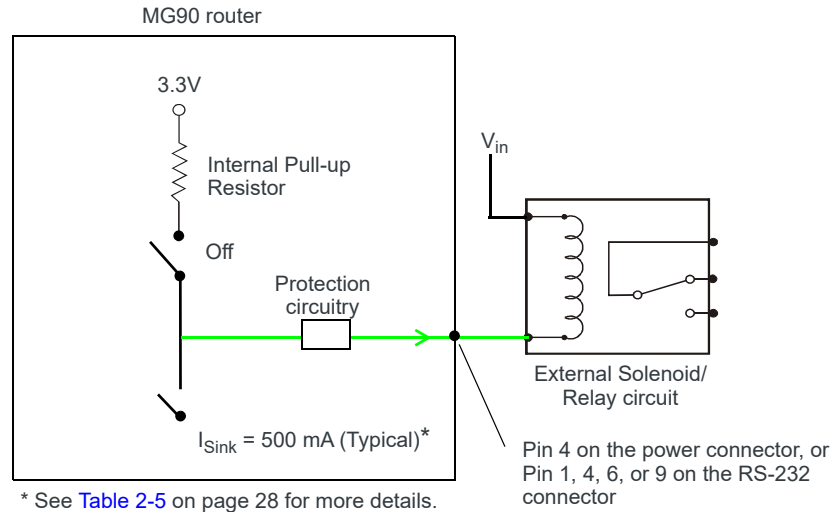


Figure 2-15: Low Side Current Sink

Table 2-5: Low Side Current Sink

Pull-up	State	Typical	Maximum	Units	Comments
Off	On	500	1000	mA	
Off	Off	0	—	mA	V _{in} = 12

Note: The router protection circuitry has a high-impedance (~100 kΩ) path to ground. If the GPIO is connected to 12 V, there will be a small current flow (~120 μA) into the GPIO during bootup. This flow is countered if the internal pull-up resistor (2.2 kΩ) becomes active, and only after bootup. Depending on your application, you may need to install an external pull-up resistor (10 kΩ) to nullify the small input current flow for the first 30 seconds during bootup.

Note: If the GPIO stops working, the overcurrent protection circuitry may have been triggered, which disables the affected GPIO. To reinitialize the GPIO, power-cycle the MG90.

Digital Output/Open Drain

Any of the GPIO pins can be connected to a digital output/open drain, for example to drive an external digital input.

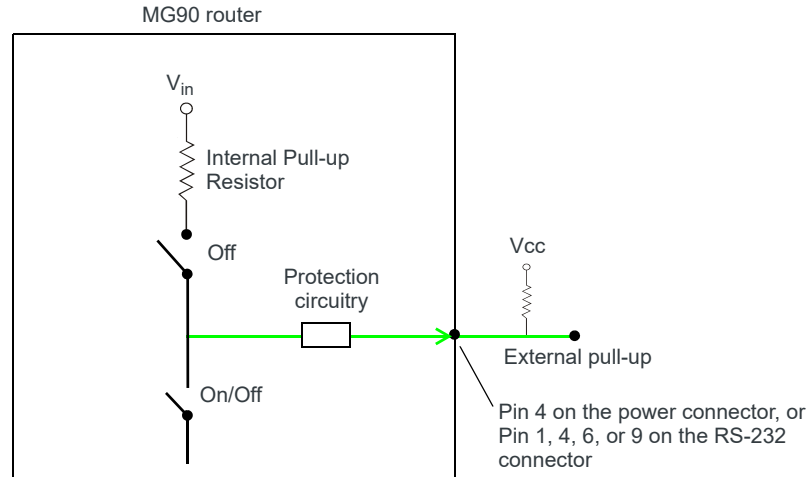


Figure 2-16: Digital Output/Open Drain

Table 2-6: Digital Output / Open Drain

Pull-up	State	Minimum	Typical	Maximum	Units	Comments
Off	Off	Open Circuit	—	—	—	—
	Active Low	—	—	0.5	V	5 mA, ≤ 5 V

Step 6—Check the router operation

1. With the ignition OFF (or AC power unplugged if using an adapter), attach the power cable connector to the power socket on the rear panel of the MG90.
Line up the locking 'key' on the power cord with the corresponding slot on the power socket and fully insert the connector. The lock snaps into place when the cord is correctly inserted. This protects the power cord against accidental disconnection caused by vehicle vibrations.

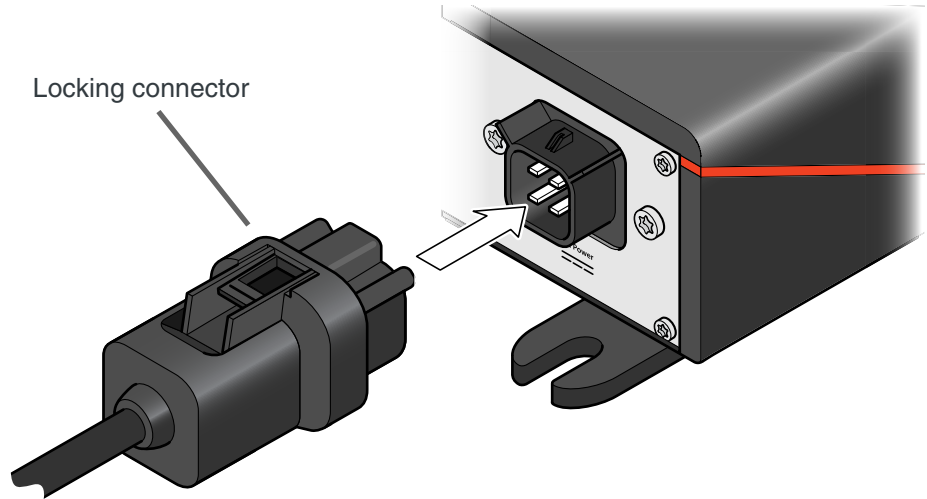


Figure 2-17: Power Cable Locking Connector

2. When power is supplied to the MG90, it powers up automatically. If it does not turn on, make sure that the:
 - Power connector is plugged in and supplying voltage greater than 11 V. Note: Although the MG90 operates in the range 7 V–36 V, low voltage standby mode is enabled by default, so in order to avoid the router powering on in standby mode, ensure that it is supplied with more than 11 V at startup.
 - Ignition Sense (pin 3) is connected to the battery or power source (see [Step 5—Connect the Power](#) on page 21 for details)

LED Behavior

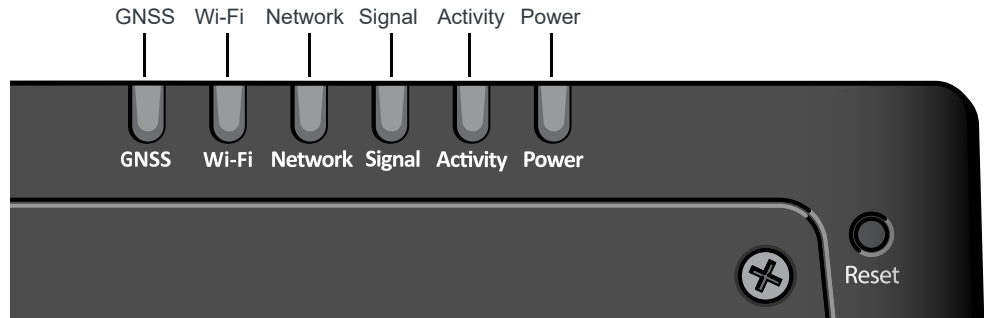


Figure 2-18: MG90 LED Status Indicators (front panel)

Table 2-7: LED Behavior

LED	Color / Pattern	Description
GNSS	Solid Green	Satellite fix is available, and Dead Reckoning is inactive (disabled, or not calibrated)
	Solid Blue	Satellite fix available, and Dead Reckoning is active
	Flashing Blue	No satellite fix is available, and Dead Reckoning is active
	Flashing Amber	No satellite fix is available, and Dead Reckoning is inactive (disabled, or not calibrated)
	Off	GNSS is off/disabled
Wi-Fi	Solid Green	Wi-Fi enabled (any mode), and not connected to an access point
	Flashing Green	Transmitting/receiving over Wi-Fi while not connected to an access point
	Solid Amber	Wi-Fi connected to an access point (i.e. Network state is "Network Ready - Wi-Fi")
	Flashing Amber	Transmitting/receiving over Wi-Fi while connected to an access point
	Off	Wi-Fi is off
Network	Flashing Amber	Connecting to a network
	Flashing Green	Connected to WAN (over cellular, Wi-Fi, or Ethernet)
	Solid Green	Connected to VPN
	Off	No network connection
Signal	<i>Note: If the active WAN link is:</i>	
	<ul style="list-style-type: none"> • Cellular— Signal shown is for the cellular radio for that link. • Other (Wi-Fi, Ethernet, etc.)— Signal shown is for the strongest cellular radio. 	
	Solid Green	Good signal (≥ 85 dBm; equivalent to 4–5 bars)
	Solid Amber	Average signal (≥ -100 dBm, < -85 dB; equivalent to 2–3 bars)
Activity	Red	Poor signal (< -100 dBm; equivalent to 1 bar)
	Flashing Green	Transmitting/receiving over the WAN interface
Power	Off	No WAN activity
	Solid Green	Power is present, normal operation
	Flashing Green	Power is present, MG90 is booting
	Solid Amber	Standby mode
	Flashing Red	<ul style="list-style-type: none"> • Slow blink (1 per second)— Temperature out of operating range (see Temperature (operational) on page 36) • Fast blink (4 per second)— Voltage out of operating range
Off	No power	

Table 2-7: LED Behavior (Continued)

LED	Color / Pattern	Description
ALL LEDS <i>Note: A 'chase' is all LEDS blinking in sequence.</i>	Green LED chase	Radio module update or GNSS firmware update is in progress <hr/> Important: Do not turn off the power while the update is in progress. <hr/>
	Amber LED chase	Software update is in progress <hr/> Important: Do not turn off the power while the update is in progress. <hr/>
	Blue LED chase	MCU firmware update is in progress <hr/> Important: Do not turn off the power while the update is in progress. <hr/>
	Solid White	Factory default reset is in progress When the factory reset finishes, the MG90 will power off and, if AutoPower is enabled (LCI General > Startup tab), will reboot.

Ethernet LEDs

The connector has two LEDs that indicate speed and activity. When looking into the connector:

- Activity—The right LED indicates the link status:
 - Solid Amber—Link
 - Blinking Amber—Activity
 - Off—No link
- Connection Speed—The left LED indicates the Ethernet connection speed:
 - Solid Green—1000 Mbps (Gigabit)
 - Off—10/100 Mbps

Step 7—Startup and Software Configuration

You can configure the MG90 using the browser-based Local Configuration Interface (LCI). The utility presents configuration pages under a series of tabs and sub-tabs.

To access the LCI:

1. Connect a laptop to the router with an Ethernet cable—use any of the Ethernet ports 1–4. (By default, ports 1–4 are configured as LAN connections and port 5 is configured as a WAN connection.).

2. Launch your web browser and go to 172.22.0.1/MG-LCI. (Note that the URL is case-sensitive.)

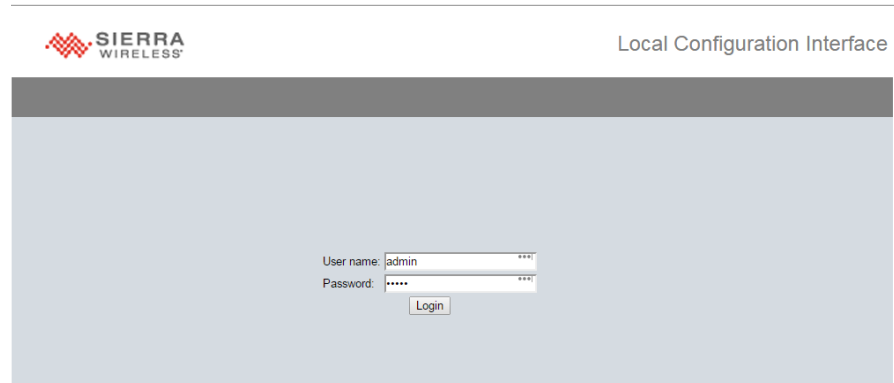


Figure 2-19: LCI Login Screen

3. Enter the default User name and Password, and click Login:
 - User Name: *admin*
 - Password: *admin*
4. Refer to the MG90 Software Configuration User Guide for details on using the LCI to configure your MG90.

In general, when using the LCI:

- Most configuration changes take effect immediately. However, changes related to the serial port take effect only after the MG90 reboots.
 - Your browser's Forward and Back controls can be used to navigate through the LCI.
 - If you make any configuration changes on a screen, you must click Save to save and apply them before changing screens. If you do not click Save, your changes will be lost.
5. When finished configuring the MG90, click the Logout tab to return to the login screen.



Figure 2-20: Log Out of LCI Using Logout Tab

Reboot the MG90

To reboot the MG90:

- On the front of the unit, press and release the Reset button.

Reset the MG90 to Factory Default Settings

To reset the router to the factory default settings:

1. On the front of the unit, press the Reset button for the 'Button Reset Time' configured in the LCI's General > Shutdown tab (factory default is 10 seconds).
2. When all the LEDs turn solid white, release the Reset button.
When the factory reset is complete, the MG90 powers off and, if AutoPower is enabled (LCI General > Startup tab), will reboot.

Boot the MG90 from USB for Software Update

To boot the MG90 from a USB flash drive that is loaded with a software update package (for cases when the MG90 cannot be upgraded OTA (over the air)):

1. Insert the USB flash drive in either USB slot on the back panel.
2. On the back panel, press and hold the Reprogram/Reset button and apply power, then release the button.

>> 3: Specifications

This chapter describes the MG90 router specifications, RF band and Tx power specifications, Wi-Fi support, and mechanical specifications.

Router Specifications

The following table describes general router specifications.

Table 3-1: General Router Specifications

Certification and Interoperability	Emissions/Immunity	<ul style="list-style-type: none"> • FCC • IC • CE (Including EMC Test case for vehicle installation EN301489) • RCM
	Safety	<ul style="list-style-type: none"> • CB Scheme • UL 60950
	Industry Certification for Vehicles	<ul style="list-style-type: none"> • EN 50155 (Rolling stock) • E-Mark (72/245/EEC, 2009/19/EC) • ISO7637-2 • SAE J1455 (Shock & Vibration)
	Environmental Compliance	<ul style="list-style-type: none"> • RoHS 2011/65/EU (RoHS 2) • WEEE • REACH
	GSM/UMTS Certifications	<ul style="list-style-type: none"> • PTCRB • GCF-CC • RED
Reliability	MTBF (Ground Benign, 25°C)— 203,409 hours (23.22 years) MTBF calculations are performed per Telcordia “Reliability Prediction Procedure for Electronic Equipment” document number SR-332, Method 1, Issue 3	

Table 3-1: General Router Specifications (Continued)

Environmental Testing	Vibration (operational)	MIL-STD-810G, test methods 514.6, 527 Composite Wheeled Vehicle
	Shock (operational)	MIL-STD-810G, test method 516.6-I Procedure I—Functional Shock
	SAE J1455 (Shock and Vibration) for heavy-duty vehicles	<ul style="list-style-type: none"> • Vibration: Section 4.10.4.2 Cab Mount • Shock: Section 4.11.3.4 Operational Shock • Electrical: 12 and 24 V systems Section 4.13.1—12 and 24 V Section 4.13.2—SAE J1113-11 Level 3
	Temperature (operational)	MIL-STD-810G, test methods 501.5, 502.5 (-30° to +70°C)
	Temperature (non-operational)	MIL-STD-810G, test methods 501.5, 502.5 (-40° to +85°C)
	Thermal shock	MIL-STD-810G, test method 503.5
	Humidity (operational)	MIL-STD-810G, test method 507.5 5–95% RH, non-condensing
	Ingress Protection (IP) rating	IP64 (if USB connectors are covered)
	Drop (non-operational)	ISTA 2A 2001, test categories 1, 4, 5, and 6
Mobile Network Operator Certification	Product-dependent carrier certifications: <ul style="list-style-type: none"> • Verizon Wireless • AT&T • Bell Mobility • Rogers • Sprint • Telus • Other major network operators pending <p><i>Note:</i> To see available carrier certifications for a specific MG90 product, refer to the product datasheet available on www.sierrawireless.com.</p>	
Network Technology	LTE-A Pro LTE HSPA+	For product-specific lists of supported bands, see Radio Bands/Conducted Tx Power on page 41.

Table 3-1: General Router Specifications (Continued)


Host Interfaces	Antenna connectors	<p>SMA connectors:</p> <ul style="list-style-type: none"> • GNSS (all units) • Cellular A (all units)—Connects to first cellular radio • Diversity A (all units)—Connects to first cellular radio • Cellular B (units with 2 cellular modules)—Connects to second cellular radio • Diversity B (units with 2 cellular modules)—Connects to second cellular radio <p>RP-SMA connectors:</p> <ul style="list-style-type: none"> • Wi-Fi A (3 connectors) (all units)—Used for Wi-Fi WAN (default configuration) • Wi-Fi B (3 connectors) (all units)—Used for Wi-Fi Access Point (default configuration) • Bluetooth (all units)
	USB	<hr/> <p><i>Note: Do not use the USB ports in a potentially explosive environment.</i></p> <hr/> <ul style="list-style-type: none"> • USB 3.0 Type A port, complies with USB Version 3.0 specification • Port supports use of SeaLATCH Type A USB locking connectors  <p><i>Figure 3-1: USB Type A Locking Connector</i></p> <ul style="list-style-type: none"> • Ports are available for using a flash drive for offline software upgrade if the unit is functional but is unable to be upgraded OTA (Over The Air) • The MG90 Software Configuration User Guide contains the details of USB mode configuration and driver installation.
	Ethernet	<ul style="list-style-type: none"> • (5) Gigabit (10/100/1000 Base-T) RJ45 Ethernet ports • IEEE 802.3 Ethernet specification for 1000 Mbps speed (Gigabit Ethernet) with fallback to 100 or 10 Mbps (Cat 5e or Cat 6 cable is required for Gigabit Ethernet) • Auto-crossover support • Auto-negotiation detects the speed of the connecting device
Auxiliary Input	<ul style="list-style-type: none"> • Reserved for future use • RJ45 port 	

Table 3-1: General Router Specifications (Continued)

	<p>Serial Port</p>	<ul style="list-style-type: none"> 9-pin RS-232 serial port configured as DTE, connects directly to most computers or other devices with a null-modem cable with handshaking <hr/> <p><i>Note: If you have a DTE device, you need to use a null modem (cross-over) cable with handshaking.</i></p> <hr/> <ul style="list-style-type: none"> Used for connecting serial devices and configuration Provides access to MG90's four GPIOs via pins 1, 4, 6, 9 Complies with the EIA RS-232D specification for DTE equipment <div data-bbox="800 604 1075 802" data-label="Diagram"> <p>The diagram shows a DB-9 male serial connector with 9 pins arranged in two rows. The top row contains pins 1, 2, 3, 4, and 5 from left to right. The bottom row contains pins 6, 7, 8, and 9 from left to right. Each pin is represented by a black dot with a vertical line extending upwards and a horizontal line extending downwards.</p> </div> <p><i>Figure 3-2: DB-9 Male Serial Connector</i></p> <hr/> <p><i>Note: An RS-232 GPIO Breakout Cable is available. See GPIO Breakout Cable on page 60 for details.</i></p> <hr/> <p>Table 3-2: Serial Connector Pin-out</p> <table border="1" data-bbox="748 1052 1464 1587"> <thead> <tr> <th>Name</th> <th>Pin</th> <th>Description</th> <th>Type</th> </tr> </thead> <tbody> <tr> <td>DCD</td> <td>1</td> <td>GPIO4</td> <td>IN/OUT</td> </tr> <tr> <td>RXD</td> <td>2</td> <td>Receive Data</td> <td>IN</td> </tr> <tr> <td>TXD</td> <td>3</td> <td>Transmit Data</td> <td>OUT</td> </tr> <tr> <td>DTR</td> <td>4</td> <td>GPIO2</td> <td>IN/OUT</td> </tr> <tr> <td>GND</td> <td>5</td> <td>Main GND. Connected internally to BOARD GND</td> <td>GND</td> </tr> <tr> <td>DSR</td> <td>6</td> <td>GPIO3</td> <td>IN/OUT</td> </tr> <tr> <td>RTS</td> <td>7</td> <td>Ready To Send</td> <td>OUT</td> </tr> <tr> <td>CTS</td> <td>8</td> <td>Clear To Send</td> <td>IN</td> </tr> <tr> <td>RI</td> <td>9</td> <td>GPIO1</td> <td>IN/OUT</td> </tr> </tbody> </table>	Name	Pin	Description	Type	DCD	1	GPIO4	IN/OUT	RXD	2	Receive Data	IN	TXD	3	Transmit Data	OUT	DTR	4	GPIO2	IN/OUT	GND	5	Main GND. Connected internally to BOARD GND	GND	DSR	6	GPIO3	IN/OUT	RTS	7	Ready To Send	OUT	CTS	8	Clear To Send	IN	RI	9	GPIO1	IN/OUT
Name	Pin	Description	Type																																							
DCD	1	GPIO4	IN/OUT																																							
RXD	2	Receive Data	IN																																							
TXD	3	Transmit Data	OUT																																							
DTR	4	GPIO2	IN/OUT																																							
GND	5	Main GND. Connected internally to BOARD GND	GND																																							
DSR	6	GPIO3	IN/OUT																																							
RTS	7	Ready To Send	OUT																																							
CTS	8	Clear To Send	IN																																							
RI	9	GPIO1	IN/OUT																																							
<p>SIM Card Interface</p>		<ul style="list-style-type: none"> Four mini-SIM (2FF) slots—Two for each installed radio module 1.8 V/3.3 V. This interface is compliant with the applicable 3GPP standards for USIM. 																																								

Table 3-1: General Router Specifications (Continued)

Input/Output	<p>GPIOs:</p> <ul style="list-style-type: none"> Configurable I/O pin on power connector GPIOs (4)—Connector type: RS-232 DB9 serial connector (see Serial Port on page 38) <p>Uses:</p> <ul style="list-style-type: none"> Digital input with optional pullup (see Digital Input on page 26) Open drain output with 500 mA sink capability
Power Adapter Pins	<p>4-Pin connector:</p> <ul style="list-style-type: none"> Power Ground Configurable GPIO (digital I/O) Configurable ignition sense
Reset	Manual reset button on front panel
<p>LEDs</p> <p>For more information, see page 30.</p>	<p>6 LEDs:</p> <ul style="list-style-type: none"> GNSS Wi-Fi Network Signal Activity Power
Mechanical Specifications	<ul style="list-style-type: none"> Weight <ul style="list-style-type: none"> 5.3 lb/2.4 kg Dimensions <ul style="list-style-type: none"> Width: 10.6 in / 27.0 cm Depth: 8.7 in / 22.0 cm Height: 2.4 in / 6.0 cm Housing—The MG90 is made of ruggedized powder-coated aluminum. RoHS—The MG90 complies with the Restriction of Hazardous Substances Directive (RoHS). This directive restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.
Screw Torque Settings	<ul style="list-style-type: none"> Mount screws (M6)— 40 kgf/cm (3.92 Nm/35 in-lb). Screws are included with the optional mounting bracket. Antennas—Use the SMA wrench provided to hand-tighten the antennas to the SMA connectors. Do not over-tighten. Recommended torque is 0.6–0.8 Nm (5–7 in-lb), and max torque should not exceed 1.1 Nm (10 in-lb).
Operating Voltage	Input voltage: 7–36V
Power Consumption	<p>Power state:</p> <ul style="list-style-type: none"> ON: <ul style="list-style-type: none"> 1 cellular radio—14 W (typ), 17 W (max) 2 cellular radios—18 W (typ), 21 W (max) Standby—< 135 mW (max)

Table 3-1: General Router Specifications (Continued)

Conducted Electrical Transients	<ul style="list-style-type: none"> • Compliant to ISO 7637-2:2004: <ul style="list-style-type: none"> • Load dump specifications—Test Pulses 1, 5a, 5b • Harness transient specifications—Test Pulses 2a, 2b, 3a, 3b • Cranking specification—Test Pulse 4 • Tolerates +200 V/-600 V spikes • Uninterrupted operation during brownouts down to 5V
GNSS Technology	<ul style="list-style-type: none"> • Embedded 48 channel GNSS receiver and 2 fast acquisition channels; active antenna support • Satellite systems (constellations) supported: <ul style="list-style-type: none"> • GPS, GLONASS, Galileo, BeiDou, QZSS • Protocols: NMEA and TAIP messaging • Local and remote forwarding via TCP or UDP • Local and remote forwarding via serial port • Dead reckoning • Acquisition time (Time to first fix): <ul style="list-style-type: none"> • Hot start: 1 second • Cold start: 30 seconds • Acquisition sensitivity: -148 dBm (GPS, GLONASS) • Indoor sensitivity (tracking mode): -162 dBm
Protocols	<ul style="list-style-type: none"> • Network: TCP/IP, UDP/IP, DNS, IPv4, IPv4/v6 • Routing: NAT, Host Port Routing, DHCP, VLAN • GPS: NMEA, TAIP
Vehicle Area Networking (LAN)	<ul style="list-style-type: none"> • Support for all on-board devices - wired and wireless <ul style="list-style-type: none"> • IEEE 802.11 b/g/n/ac (built-in vehicle AP) • 10/100/1000 Base-T Ethernet - RJ45 x 5 ports • Bluetooth • Serial—RS-232 DB-9 • DHCP Server (RFC 2131) • USB - USB 3.0 x 2, Type A (female) • Compatibility <ul style="list-style-type: none"> • Operates with Wi-Fi certified client devices • Supports all major client operating systems
Wide Area Networking (WAN)	<ul style="list-style-type: none"> • Wireless Networking <ul style="list-style-type: none"> • For product-specific lists of supported bands, see Radio Bands/Conducted Tx Power on page 41. • Support for FirstNet Public Safety Band 14 • Integrated compatibility with current wireless WAN standards including HSPA+, LTE, LTE-A Pro. • IEEE 802.11 b/g/n/ac • Ethernet WAN devices (e.g. satellite modem) • Transmit video and data through the MG90 <ul style="list-style-type: none"> • QOS - Application priority queuing

Table 3-1: General Router Specifications (Continued)

Security	Secure all data transmitted to and from vehicle without need for VPN client software on devices.	<ul style="list-style-type: none"> • WLAN Security and Authentication <ul style="list-style-type: none"> • WEP, WPA, WPA2 • Key management WPA-PSK and WPA-EAP • Firewall <ul style="list-style-type: none"> • Port forwarding • Port blocking • Encryption <ul style="list-style-type: none"> • IPSec including LAN to LAN, Host to LAN, IKEV2, MOBIKE • Authentication and Accounting <ul style="list-style-type: none"> • 802.1x/RADIUS authentication
Management		<p>Manage mobile network, vehicle and network health when operated with AMM.</p> <ul style="list-style-type: none"> • Management <ul style="list-style-type: none"> • Operational support services for fault, configuration, accounting, performance and security • Network coverage reporting • Location-based reporting • Historical logging • Remote software updates • Secure VNC reach-through • Email alerts for configurable thresholds

Radio Bands/Conducted Tx Power

The radio frequency bands supported by the MG90 vary by installed radio module types. The following table identifies supported bands by radio module type.

For detailed RF and Tx output power specifications, refer to the module-specific Product Technical Specification documents available on source.sierrawireless.com.

Table 3-3: Supported Bands

Installed Module(s)	Cellular Radios	
	Bands Supported	Region
EM7511	LTE: 1, 2, 3, 4, 5, 7, 8, 9, 12, 13, 14, 18, 19, 20, 26, 29 ^a , 32 ^a , 41, 42 ^b , 43 ^b , 46 ^a , 48 ^b , 66	North America
	WCDMA: 1, 2, 4, 5, 6, 8, 9, 19	
EM7565	LTE: 1, 2, 3, 4, 5, 7, 8, 9, 12, 13, 18, 19, 20, 26, 28, 29 ^a , 32 ^a , 41, 42 ^b , 43 ^b , 46 ^a , 48 ^b , 66	Global
	WCDMA: 1, 2, 4, 5, 6, 8, 9, 19	
MC7455	LTE: 1, 2, 3, 4, 5, 7, 8, 12, 13, 20, 25, 26, 29, 41	North America/Europe
	WCDMA: 1, 2, 3, 4, 5, 8	

Table 3-3: Supported Bands (Continued)

Installed Module(s)	Cellular Radios	
	Bands Supported	Region
MC7430	LTE: 1, 3, 5, 7, 8, 18, 19, 21, 28, 38, 39, 40, 41	Asia/Pacific
	WCDMA: 1, 5, 6, 8, 9, 19	
	TD-SCDMA: 39	
MC7354	LTE: 2, 4, 5, 13, 17, 25	U.S.
	WCDMA: 1, 2, 4, 5, 8	
	GSM: GSM 850, EGSM 900, DCS 1800, PCS 1900	
	CDMA: BC0, BC1, BC10	

- a. Downlink only
- b. Available in future product variants.

Note: The radio module types in your MG90 are listed in the Local Configuration Interface's WAN Link Status screen (Status > WAN).

MC7455 (North America/Europe)

The following tables indicate supported radio frequency bands and conducted transmit power specifications for MG90s containing MC7455 radio modules.

Table 3-4: Supported Bands (MC7354)

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
LTE	B1	1920–1980 MHz	2110–2170 MHz
	B2	1850–1910 MHz	1930–1990 MHz
	B3	1710–1785 MHz	1805–1880 MHz
	B4	1710–1755 MHz	2110–2155 MHz
	B5	824–849 MHz	869–894 MHz
	B7	2500–2570 MHz	2620–2690 MHz
	B8	880–915 MHz	925–960 MHz
	B12	699–716 MHz	729–746 MHz
	B13	777–787 MHz	746–756 MHz
	B20	832–862 MHz	791–821 MHz
	B25	1850–1915 MHz	1930–1995 MHz
	B26	814–849 MHz	859–894 MHz
	B29	n/a	717–728 MHz
B41	2496–2690 MHz (TDD)		
WCDMA	Band 1	1920–1980 MHz	2110–2170 MHz
	Band 2	1850–1910 MHz	1930–1990 MHz
	Band 3	1710–1785 MHz	1805–1880 MHz
	Band 4	1710–1755 MHz	2110–2155 MHz
	Band 5	824–849 MHz	869–894 MHz
	Band 8	880–915 MHz	925–960 MHz

LTE-A uses carrier aggregation to increase bandwidth. [Table 3-5](#) indicates supported carrier aggregation combinations.

Table 3-5: Carrier Aggregation Combinations (MC7455)

1 + 8	5 + 2/4	13 + 2/4
2 + 2/5/12/13/29	7 + 3/7/20	20 + 3/7
3 + 7/20	8 + 1	30 + 5/12
4 + 4/5/12/13/29	12 + 2/4	

Table 3-6: Conducted Tx Power (MC7455)

Band	Conducted Tx Power (dBm)	Notes
LTE		
Bands 1, 2, 3, 4, 5, 8, 12, 13, 20, 25, 26	+23±1	
Bands 7, 41	+22±1	
UMTS		
Band 1 (IMT 2100 12.2 kbps) Band 2 (UMTS 1900 12.2 kbps) Band 3 (UMTS 1800 12.2 kbps) Band 4 (AWS 1700/2100 12.2 kbps) Band 5 (UMTS 850 12.2 kbps) Band 8 (UMTS 900 12.2 kbps)	+23±1	Connectorized (Class 3)

MC7430 (Asia/Pacific)

The following tables indicate supported radio frequency bands and conducted transmit power specifications for MG90s containing MC7430 radio modules.

Table 3-7: Supported Bands (MC7430)

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
LTE	B1	1920–1980 MHz	2110–2170 MHz
	B3	1710–1785 MHz	1805–1880 MHz
	B5	824–849 MHz	869–894 MHz
	B7	2500–2570 MHz	2620–2690 MHz
	B8	880–915 MHz	925–960 MHz
	B18	815–830 MHz	860–875 MHz
	B19	830–845 MHz	875–890 MHz
	B21	1447.9–1462.9 MHz	1495.9–1510.9 MHz
	B28	703–748 MHz	758–803 MHz
	B38	2570–2620 MHz (TDD)	
	B39	1880–1920 MHz (TDD)	
	B40	2300–2400 MHz (TDD)	
	B41	2496–2690 MHz (TDD)	

Table 3-7: Supported Bands (MC7430) (Continued)

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
WCDMA	Band 1	1920–1980 MHz	2110–2170 MHz
	Band 5	824–849 MHz	869–894 MHz
	Band 6	830–840 MHz	875–885 MHz
	Band 8	880–915 MHz	925–960 MHz
	Band 9	1749.9–1784.9 MHz	1844.9–1879.9 MHz
	Band 19	830–845 MHz	875–890 MHz
TD-SCDMA	Band 39	1880–1920 MHz	

LTE-A uses carrier aggregation to increase bandwidth. [Table 3-8](#) indicates supported carrier aggregation combinations.

Table 3-8: Carrier Aggregation Combinations (MC7430)

1 + 8/18/19/21	18 + 1	39 + 39
3 + 5/7/19/28	19 + 1/3/21	40 + 40
5 + 3/7	21 + 1/19	41 + 41
7 + 3/5/7/28	28 + 3/7	
8 + 1	38 + 38	

Table 3-9: Conducted Tx Power (MC7430)

Band	Conducted Tx Power (dBm)	Notes
LTE		
Bands 1, 3, 5, 8, 18, 19, 21, 28, 39	+23±1	
Bands 7, 38, 40, 41	+22±1	
UMTS		
Band 1 (IMT 2100 12.2 kbps) Band 5 (UMTS 850 12.2 kbps) Band 6 (UMTS 850 12.2 kbps) Band 8 (UMTS 900 12.2 kbps) Band 9 (UMTS 1700 12.2 kbps) Band 19 (AWS 850 12.2 kbps)	+23±1	Connectorized (Class 3)
TD-SCDMA		
Band 39	+23±1	

MC7354 (U.S.)

The following tables indicate supported radio frequency bands and conducted transmit power specifications for MG90s containing an MC7354 radio module.

Table 3-10: Supported Bands (MC7354)

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
LTE	B2	1850–1910 MHz	1930–1990 MHz
	B4	1710–1755 MHz	2110–2155 MHz
	B5	824–849 MHz	869–894 MHz
	B13	777–787 MHz	746–756 MHz
	B17	704–716 MHz	734–746 MHz
	B25	1850–1915 MHz	1930–1995 MHz
WCDMA	Band 1	1920–1980 MHz	2110–2170 MHz
	Band 2	1850–1910 MHz	1930–1990 MHz
	Band 4	1710–1755 MHz	2110–2155 MHz
	Band 5	824–849 MHz	869–894 MHz
	Band 8	880–915 MHz	925–960 MHz
GSM	GSM 850	824–849 MHz	869–894 MHz
	EGSM 900	880–915 MHz	925–960 MHz
	DCS 1800	1710–1785 MHz	1805–1880 MHz
	PCS 1900	1850–1910 MHz	1930–1990 MHz
CDMA	BC0	824–849 MHz	869–894 MHz
	BC1	1850–1910 MHz	1930–1990 MHz
	BC10	817–824 MHz	861–869 MHz

Table 3-11: Conducted Transmit Power (MC7354)

Band	Conducted Tx Power (dBm)	Notes
LTE		
Bands 2, 4, 5, 13, 17, 25	+23±1 dB	
UMTS		
Bands 1, 2, 4, 5, 8 (12.2 kbps)	+23±1 dB	Connectorized (Class 3)

Table 3-11: Conducted Transmit Power (MC7354) (Continued)

Band	Conducted Tx Power (dBm)	Notes
GSM/EDGE		
GSM 850 EGSM 900	+32±1 dB	GMSK mode, connectorized (Class 4; 2 W, 33 dBm)
	+27±1 dB	8PSK mode, connectorized (Class E2; 0.5 W, 27 dBm)
DCS1800 PCS1900	+32±1 dB	GMSK mode, connectorized (Class 1; 1 W, 30 dBm)
	+32±1 dB	8PSK mode, connectorized (Class E2; 0.4 W, 26 dBm)
CDMA		
BC0 (Cellular) BC1 (PCS) BC10 (Cellular)	+24+0.5/-1 dB	

EM7511 (North America)

The following tables indicate supported radio frequency bands and conducted transmit power specifications for MG90s containing EM7511 radio modules.

Table 3-12: Supported Bands (EM7511)

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)	
LTE	B1	1920–1980 MHz	2110–2170 MHz	
	B2	1850–1910 MHz	1930–1990 MHz	
	B3	1710–1785 MHz	1805–1880 MHz	
	B4	1710–1755 MHz	2110–2155 MHz	
	B5	824–849 MHz	869–894 MHz	
	B7	2500–2570 MHz	2620–2690 MHz	
	B8	880–915 MHz	925–960 MHz	
	B9	1749.9–1784.9 MHz	1844.9–1879.9 MHz	
	B12	699–716 MHz	729–746 MHz	
	B13	777–787 MHz	746–756 MHz	
	B14	788–798 MHz	758–768 MHz	
	B18	815–830 MHz	860–875 MHz	
	B19	830–845 MHz	875–890 MHz	
	B20	832–862 MHz	791–821 MHz	
	B26	814–849 MHz	859–894 MHz	
	B29	n/a	717–728 MHz	
	B32	n/a	1452–1496 MHz	
	B41	2496–2690 MHz (TDD)		
	B42 ^a	3400–3600 MHz (TDD)		
	B43 ^a	3600–3800 MHz (TDD)		
B46	n/a	5150–5925 MHz (TDD)		
B48 ^a	3550–3700 MHz (TDD)			
B66	1710–1780 MHz	2110–2200 MHz		

Table 3-12: Supported Bands (EM7511) (Continued)

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
WCDMA	Band 1	1920–1980 MHz	2110–2170 MHz
	Band 2	1850–1910 MHz	1930–1990 MHz
	Band 4	1710–1755 MHz	2110–2155 MHz
	Band 5	824–849 MHz	869–894 MHz
	Band 6	830–840 MHz	875–885 MHz
	Band 8	880–915 MHz	925–960 MHz
	Band 9	1749.9–1784.9 MHz	1844.9–1879.9 MHz
	Band 19	830–845 MHz	875–890 MHz

a. Available in future product variants.

LTE-A uses carrier aggregation to increase bandwidth.

Important: B14 carrier aggregation is not supported.

Table 3-13: Conducted Tx Power (EM7511)

Band	Conducted Tx Power (dBm)	Notes
LTE		
Bands 1, 2, 3, 4, 5, 8, 9, 12, 13, 14, 18, 19, 20, 26, 66	+23±1	
Bands 7, 41, 42 ^a , 43 ^a , 48 ^a	+22±1	
UMTS		
Band 1 (IMT 2100 12.2 kbps) Band 2 (UMTS 1900 12.2 kbps) Band 4 (AWS 1700/2100 12.2 kbps) Band 5 (UMTS 850 12.2 kbps) Band 6 (UMTS 800 12.2 kbps) Band 8 (UMTS 900 12.2 kbps) Band 9 (UMTS 1700 12.2 kbps) Band 19 (UMTS 800 12.2 kbps)	+23±1	Connectorized (Class 3)

a. Available in future product variants.

EM7565 (Global, Not certified in North America)

The following tables indicate supported radio frequency bands and conducted transmit power specifications for MG90s containing EM7565 radio modules.

Table 3-14: Supported Bands (EM7565)

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)	
LTE	B1	1920–1980 MHz	2110–2170 MHz	
	B2	1850–1910 MHz	1930–1990 MHz	
	B3	1710–1785 MHz	1805–1880 MHz	
	B4	1710–1755 MHz	2110–2155 MHz	
	B5	824–849 MHz	869–894 MHz	
	B7	2500–2570 MHz	2620–2690 MHz	
	B8	880–915 MHz	925–960 MHz	
	B9	1749.9–1784.9 MHz	1844.9–1879.9 MHz	
	B12	699–716 MHz	729–746 MHz	
	B13	777–787 MHz	746–756 MHz	
	B18	815–830 MHz	860–875 MHz	
	B19	830–845 MHz	875–890 MHz	
	B20	832–862 MHz	791–821 MHz	
	B26	814–849 MHz	859–894 MHz	
	B28	703–748 MHz	758–803 MHz	
	B29	n/a	717–728 MHz	
	B32	n/a	1452–1496 MHz	
	B41	2496–2690 MHz (TDD)		
	B42 ^a	3400–3600 MHz (TDD)		
	B43 ^a	3600–3800 MHz (TDD)		
B46	n/a	5150–5925 MHz (TDD)		
B48 ^a	3550–3700 MHz (TDD)			
B66	1710–1780 MHz	2110–2200 MHz		

Table 3-14: Supported Bands (EM7565) (Continued)

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
WCDMA	Band 1	1920–1980 MHz	2110–2170 MHz
	Band 2	1850–1910 MHz	1930–1990 MHz
	Band 4	1710–1755 MHz	2110–2155 MHz
	Band 5	824–849 MHz	869–894 MHz
	Band 6	830–840 MHz	875–885 MHz
	Band 8	880–915 MHz	925–960 MHz
	Band 9	1749.9–1784.9 MHz	1844.9–1879.9 MHz
	Band 19	830–845 MHz	875–890 MHz

a. Available in future product variants.

LTE-A uses carrier aggregation to increase bandwidth.

Table 3-15: Conducted Tx Power (EM7565)

Band	Conducted Tx Power (dBm)	Notes
LTE		
Bands 1, 2, 3, 4, 5, 8, 9, 12, 13, 18, 19, 20, 26, 28, 66	+23±1	
Bands 7, 41, 42 ^a , 43 ^a , 48 ^a	+22±1	
UMTS		
Band 1 (IMT 2100 12.2 kbps) Band 2 (UMTS 1900 12.2 kbps) Band 4 (AWS 1700/2100 12.2 kbps) Band 5 (UMTS 850 12.2 kbps) Band 6 (UMTS 800 12.2 kbps) Band 8 (UMTS 900 12.2 kbps) Band 9 (UMTS 1700 12.2 kbps) Band 19 (UMTS 800 12.2 kbps)	+23±1	Connectorized (Class 3)

a. Available in future product variants.

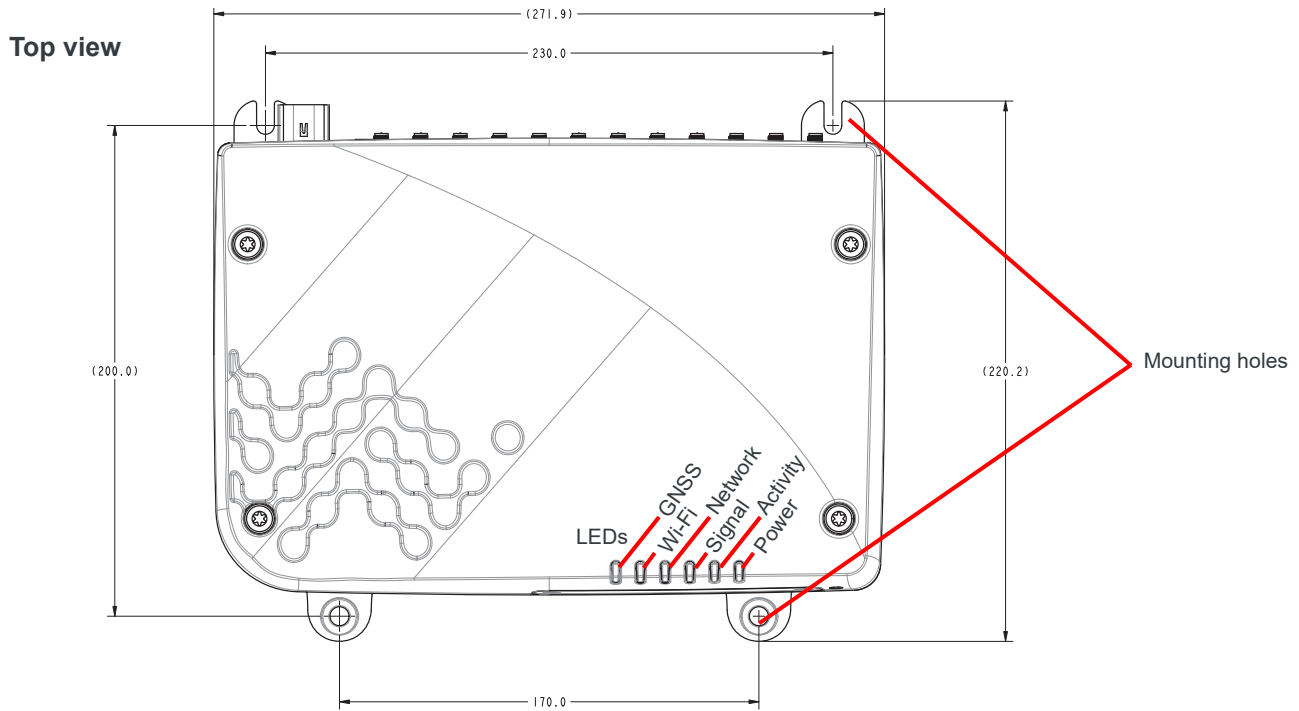
Wi-Fi Support

The MG90 includes two Wi-Fi modules:

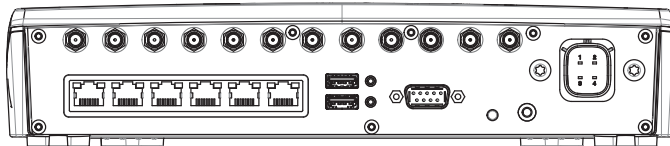
- **Wi-Fi A**
 - **Default configuration—Wi-Fi WAN**
Instead of submitting data over cellular while in the field, the user can choose to wait until the vehicle arrives at its depot, where it can connect to the local access point.
 - Captive portal support
 - 802.11 b/g/n/ac
 - WPA2 Enterprise (RSA) with AES encryption
- **Wi-Fi B**
 - **Default configuration—Wi-Fi Access Point**
The VAN supports connections to the router by wired devices (over Ethernet ports) and wireless devices.
 - Captive portal support
 - 802.11 b/g/n/ac
 - WPA2 Enterprise (RSA) with AES encryption
 - 4 SSIDs with separately configurable security, bandwidth, and QOS
 - Up to 64 clients can connect simultaneously

Both Wi-Fi modules support 2.4 GHz and 5 GHz.

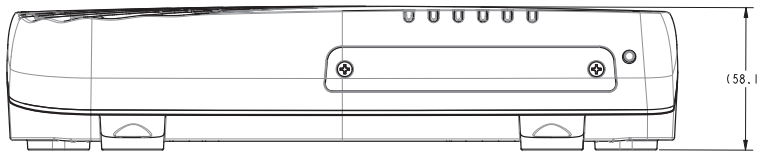
Mechanical Specifications



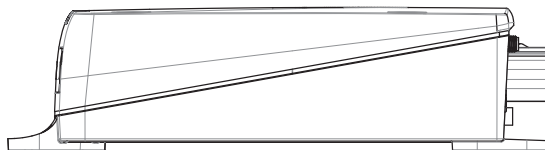
Back view



Front view



Side view



Weight
5.3 lb / 2.4 kg

Figure 3-3: MG90 Mechanical Specifications

>> 4: Regulatory Information

Important Information for North American Users

Note: Equipment listed in [Table 4-1](#), [Table 4-2](#), and [Table 4-4](#) 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.
-

Warning: *Changes or modifications to this device not expressly approved by Sierra Wireless could void the user's authority to operate this equipment.*

RF Exposure

In accordance with FCC/IC requirements of human exposure to radio frequency fields, the radiating element shall be installed such that a minimum separation distance of 20 cm should be maintained from the antenna and the user's body.

Warning: *This product is only to be installed by qualified personnel.*

To comply with FCC/IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain must not exceed the specifications listed below for the device used.

Maximum Antenna Gain and Collocated Transmitter Radiated Power

Note: The antenna gain must not exceed the limits and configurations shown in the following tables. The radiated power of a collocated transmitter must not exceed the EIRP limits shown in the following tables.

Table 4-1: EM7511 Antenna Gain and Collocated Radio Transmitter Specifications

	Operating mode	Tx Freq Range (MHz)		Max Time-Avg Cond Power (dBm)	Antenna Gain Limit (dBi)		EIRP Limits (dBm)
					Standalone	Collocated	
EM7511 FCC ID: N7NEM75S IC: 2417C-EM75S	WCDMA Band 2/ LTE B2	1850	1910	24	6	4	30
	WCDMA Band 4/ LTE B4	1710	1755	24	6	4	30
	WCDMA Band 5/ LTE B5	824	849	24	6	4	30
	LTE B7	2500	2570	23.8	9	4	32.8
	LTE B12	699	716	24	6	4	30
	LTE B13	777	787	24	6	4	30
	LTE B26	814	849	24	6	4	30
	LTE B41	2496	2690	23.8	9	4	32.8
Collocated transmitters	LTE B66	1710	1780	24	6	4	30
	WLAN 2.4 GHz	2400	2500				30
	WLAN 5 GHz	5150	5850				30
	BT	2400	2500				16

Table 4-2: MC7455 Antenna Gain Specifications

Device	Technology	Band	Frequency (MHz)	Maximum antenna gain (dBi)
MC7455 Mini Card FCC ID: N7NMC7455 IC: 12417C-MC7455	LTE	2	1850–1910	6
		4	1710–1755	6
		5	824–849	6
		7	2500–2570	9
		12	699–716	6
		13	777–787	6
		25	1850–1915	6
		26	814–849	6
		41	2496–2690	9
	UMTS	2	1850–1910	6
		4	1710–1755	6
		5	824–849	6

Table 4-3: MC7455 Collocated Radio Transmitter Specifications

Device	Technology	Frequency (MHz)	EIRP Limit (dBm)
Collocated transmitters	WLAN	2400–2500	25
		5150–5850	27
	BT	2400–2500	15

Table 4-4: MC7354 Collocated configuration specifications

Device	Technology	Band	Frequency (MHz)	Collocated configuration Maximum antenna gain (dBi)
MC7354 Mini Card FCC ID: N7NMC7354 IC: 2417C-MC7354	LTE	2	1850–1910	3.0
		4	1710–1755	4.0
		5	824–849	4.0
		13	777–787	4.0
		17	704–716	4.0
		25	1850–1915	3.0
	UMTS	2	1850–1910	3.0
		4	1710–1755	4.0
		5	824–849	4.0
	GSM	Cellular (850)	824–849	4.0
		PCS (1900)	1850–1910	3.0
	CDMA	BC0	824–849	4.0
		BC1	1850–1910	3.0
		BC10	817–824	4.0
	Collocated transmitters ^a	WLAN		2400–2500
			5150–5850	5.0
WiMAX			2300–2400	5.0
			2500–2700	5.0
			3300–3800	5.0
BT			2400–2500	5.0

a. Valid collocated transmitter combinations: WLAN+BT; WiMAX+BT.
(WLAN+WiMAX+BT is not permitted.)

EU

Sierra Wireless hereby declares the Sierra Wireless MG90 devices listed in [Table 4-1](#), [Table 4-2](#), and [Table 4-4](#) are in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

The MG90 displays the CE mark.



Warning: *Changes or modifications to this device not expressly approved by Sierra Wireless could void the user's authority to operate this equipment.*

Warning: *This product is only to be installed by qualified personnel.*

Declaration of Conformity

The Declaration of Conformity made under Directive 2014/53/EU is available for viewing at: source.sierrawireless.com/resources/airlink/certification_and_type_approval/MG90_ce_declaration_of_conformity/.

WEEE Notice



If you purchased your Sierra Wireless MG90 in Europe, please return it to your dealer or supplier at the end of its life. WEEE products may be recognized by their wheeled bin label on the product label.

Battery Replacement/Disposal

The MG90 uses a BR2032 coin type lithium battery to power its RTC (Real Time Clock).

For an installed MG90, the battery should meet or exceed the operational lifetime of the unit. For a device in storage, the battery will last up to 5 years.

Caution: *Risk of explosion if the battery is replaced by an incorrect type. Refer to and follow applicable regulatory requirements (national, provincial, state, local, etc.) for disposal of used batteries.*

>> A: Accessories

Antenna Separation

When installing single-element antenna units, refer to the following table for recommended antenna separation distances.

Table A-1: Recommended Antenna Separation

Service	Frequency (MHz)	Wavelength (λ) (mm)	Antenna Separation	
			Best ($= 1/2 \lambda$) (mm)	Good ($= 1/4 \lambda$) (mm)
LTE	700	428	214	107
	800	375	187	94
	850	353	176	88
	900	333	167	83
	1700	176	88	44
	1800	167	83	42
	1900	158	79	39
	2100	143	71	36
	2300	130	65	32
	2500	120	60	30
	2600	115	58	29
WCDMA	850	353	176	88
	900	333	167	83
	1700	176	88	44
	1800	167	83	42
	1900	158	79	39
	2100	143	71	36

GPIO Breakout Cable

The GPIO breakout cable provides access to four GPIOs via pins 1, 4, 6, 9.

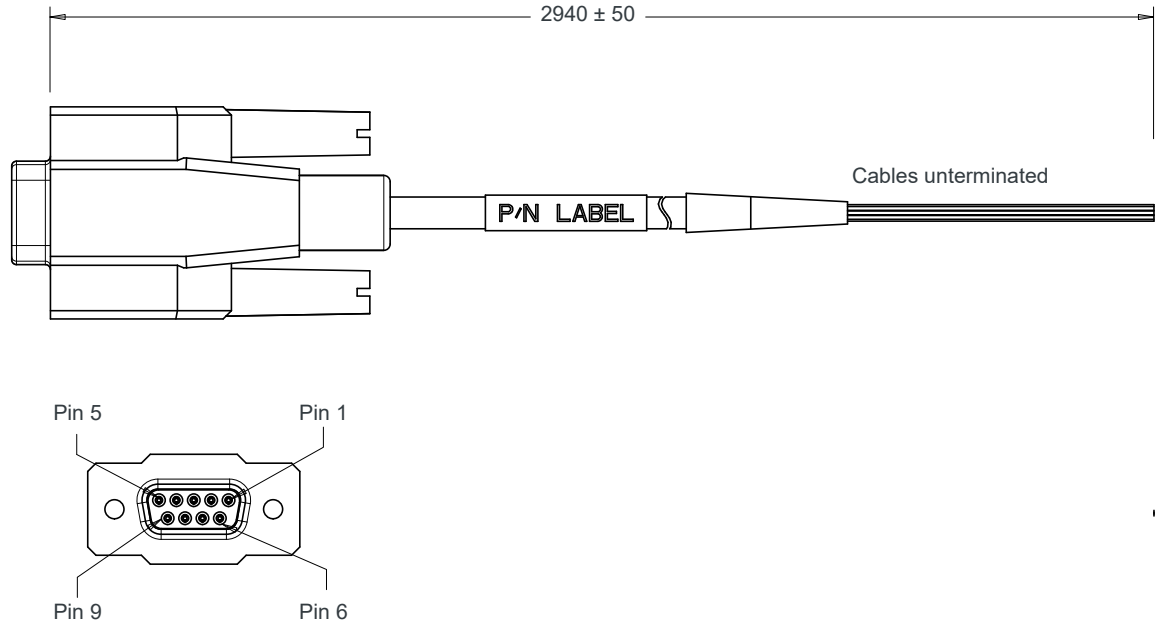


Figure A-1: GPIO Breakout Cable

Table A-2: GPIO Breakout Cable

Part Number	6001095
Product Release Date	2017
Length	113.8–117.7 in (2890–2990 mm)

Table A-3: Pin Assignments

Pin	Color	Interface	Function	Direction
1	Black	GPIO	GPIO4	Input/Output
2	Grey	Serial	Rx	Input
3	Yellow	Serial	Tx	Output
4	Purple	GPIO	GPIO2	Input/Output
5	Orange	Serial	GND	Ground
6	Red	GPIO	GPIO3	Input/Output
7	Brown	Serial	RTS	Output
8	Green	Serial	CTS	Input
9	Blue	GPIO	GPIO1	Input/Output

DC Power Cable (Black Connector)

Table A-4: DC Power Cable

DC Power Cable	
Part Number	6001103
Product Release	2016

Components:

- ① 1 UL2464 cable (2-core × 14 AWG + 2-core × 20 AWG)
- ② 2 Molex female crimp terminals / AWG 14-16, gold-plated (part number 19420-0003)
2 Molex female crimp terminals / AWG 18-22, gold-plated (part number 19420-0004)
- ③ 1 Molex 4 Circuit receptacle for 18-22 AWG wire, 18 A max per contact (part number 19418-0019)

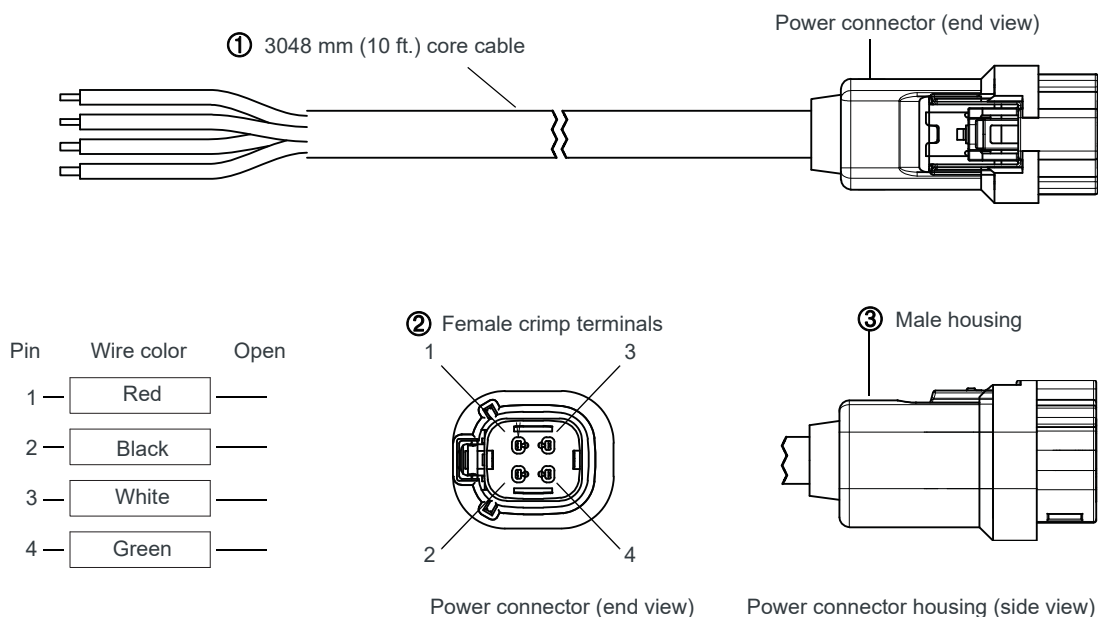


Figure A-2: DC Cable Specifications

AC Power Adapter (Black Connector)

Table A-5: AC Power Adapter

AC Power Adapter	
Part Number	6001023
Product Release	2016

AC Power Adapter Input

Table A-6: Input Specifications

	Minimum	Typical	Maximum
Input			
Input Voltage	90 VAC	100–240 VAC	264 VAC
Input Frequency	47 Hz	50/60 Hz	63 Hz
<i>Note: Input voltage range is 90 VAC to 264 VAC. Inrush current will not exceed 30A/60A cold start at 115–230 VAC input.</i>			

AC Power Adapter Output

Table A-7: AC Power Adapter Output Specifications

	Typical
Output Voltage	12V @ 2.5A

AC Power Adapter Environmental Specifications

Table A-8: AC Power Adapter Environmental Specifications

Operating	
Operating Temperature	-20°C ~ 40°C (operates normally)
Relative Humidity	0% ~ 95%, non-condensing
Altitude	5,000 meters
Non-operating	
Storage Temperature	-30°C ~ 80°C
Relative Humidity	0% ~ 95%

AC Power Adapter Reliability and Quality Control

AC Power Adapter MTBF

When the power supply is operating within the limits of this specification, the MTBF is 1,000,000 hours at 40°C ambient temperature, full load.

Note: For router MTBF, see [Reliability](#) on page 35.

AC Power Adapter Safety Standards

The power supply is certified with the following international regulatory standards:

Table A-9: AC Power Adapter Safety standards

Regulatory Agency	Country or Region	Certified	Standard
UL	USA	Approved	UL60950-1
S-Mark	Europe	Approved	EN60950-1
CE	Europe	Approved	EN 55032:2012+<details>
CCC	China	Approved	GB4943.1-2011; GB/T9254-2008; GB17625.1-2012
CUL	Canada	Approved	CSA C22.2 NO.60950-1

AC Power Adapter EMC Standards

The power supply meets the radiated and conducted emission requirements for EN 55032, EN 61000-6-3, EN 61000-6-4; FCC Part 15, Class B.

AC Power Adapter Hazardous Substances

- RoHS—Specifications of directive 2011/65/EU Annex VI (ROHS-2) with amendment 2015/863-EU (ROHS-3)
- WEEE—EU Directive 2012/19/EU
- REACH

AC Power Adapter Energy Efficiency

The AC adapter complies with International Efficiency Levels, as shown in [Table A-10](#).

Table A-10: AC Adapter Energy Efficiency

Supplied Input	No-load Power Consumption	Average Active Mode Efficiency	International Efficiency Level
115 VAC, 60 Hz	Less than 0.1 W	Greater than 86.9%	VI
230 VAC, 50 Hz	Less than 0.1 W	Greater than 86.9%	VI