



Sierra Wireless FX30

Hardware User Guide



SIERRA
WIRELESS®

41110030
Rev 1

Important Notice

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.

Safety and Hazards

Do not operate the Sierra Wireless modem in areas where blasting is in progress, near medical equipment, near life support equipment, or any equipment which may be susceptible to any form of radio interference. In such areas, the Sierra Wireless modem **MUST BE POWERED OFF**. The Sierra Wireless modem can transmit signals that could interfere with this equipment.

The driver or operator of any vehicle should not operate the Sierra Wireless modem while in control of a vehicle. Doing so will detract from the driver or operator's control and operation of that vehicle. In some states and provinces,

Limitation of Liability

The information in this manual is subject to change without notice and does not represent a commitment on the part of Sierra Wireless. SIERRA WIRELESS AND ITS AFFILIATES SPECIFICALLY DISCLAIM LIABILITY FOR ANY AND ALL DIRECT, INDIRECT, SPECIAL, GENERAL, INCIDENTAL, CONSEQUENTIAL, PUNITIVE OR EXEMPLARY DAMAGES INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS OR REVENUE OR ANTICIPATED PROFITS OR REVENUE ARISING OUT OF THE USE OR INABILITY TO USE ANY SIERRA WIRELESS PRODUCT, EVEN IF SIERRA WIRELESS AND/OR ITS AFFILIATES HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR THEY ARE FORESEEABLE OR FOR CLAIMS BY ANY THIRD PARTY.

Notwithstanding the foregoing, in no event shall Sierra Wireless and/or its affiliates aggregate liability arising under or in connection with the Sierra Wireless product, regardless of the number of events, occurrences, or claims giving rise to liability, be in excess of the price paid by the purchaser for the Sierra Wireless product.

Patents

This product may contain technology developed by or for Sierra Wireless Inc. This product includes technology licensed from QUALCOMM®. This product is manufactured or sold by Sierra Wireless Inc. or its affiliates under one or more patents licensed from InterDigital Group and MMP Portfolio Licensing.

Copyright

© 2016 Sierra Wireless. All rights reserved.

Trademarks

Sierra Wireless®, AirPrime®, AirLink®, AirVantage®, Legato®, and the Sierra Wireless logo are registered trademarks of Sierra Wireless.

Windows® and Windows Vista® are registered trademarks of Microsoft Corporation.

Linux® is the registered trademark of Linus Torvalds in the U.S. and other countries.

Macintosh® and Mac OS X® are registered trademarks of Apple Inc., registered in the U.S. and other countries.

QUALCOMM® is a registered trademark of QUALCOMM Incorporated. Used under license.

Other trademarks are the property of their respective owners.

Contact Information

Sales information and technical support, including warranty and returns	Web: sierrawireless.com/company/contact-us/ Global toll-free number: 1-877-687-7795 6:00 am to 6:00 pm PST
Corporate and product information	Web: sierrawireless.com

Contents

Introduction to the FX30	6
Key Features	6
Accessories	7
Warranty	7
Reference Documents	8
Installation and Startup	9
Tools and Materials Required	9
Installation Overview	9
Step 1—Insert the SIM Card and Optional IoT Card	9
Step 2—Mount and Ground the FX30 Chassis	11
Replacing existing Fastrack Supreme or Fastrack Xtend Device	13
Step 3—Connect the Antennas	15
Step 4—Connect the Data Cables	16
Cabling Concerns	17
Cable Strain Relief	17
Step 5—Connect the Power and I/O	17
Fusing	17
Power Connector on the FX30	18
Power Modes	18
Wiring Diagrams	19
I/O Configuration	20
I/O Pins	21
Step 6—Check the FX30 operation	25
LED Behavior	26
Ethernet LEDs	26
Step 7—Using the FX30	26
Using the FX30 as an Embedded Platform for IoT Applications	27
AT Commands	27
Linux Shell Commands	28
Legato Application Framework	28
AirVantage IoT Platform	28

Specifications	30
Radio Frequency Bands	33
Radio Module Conducted Transmit Power	33
Mechanical Specifications	35
WP Radio Module Interface Mapping	37
Internet of Things (IoT) Expansion Card	39
Pin-out Information	39
Regulatory Information	40
Important Information for North American Users	40
RF Exposure	40
EU	41
Accessories	42
DC Power Cable (Black Connector)	42
AC Power Adapter (Black Connector)	43
AC Power Adapter Input	43
AC Power Adapter Output	43
AC Power Adapter Environmental Specifications	43
AC Power Adapter Reliability and Quality Control	44
AC Power Adapter Safety Standards	44
AC Power Adapter EMC Standards	44
AC Power Adapter Hazardous Substances	44
AC Power Adapter Energy Efficiency	45
Index	46



1: Introduction to the FX30

1

The Sierra Wireless® FX30, a small, rugged, programmable Internet of Things (IoT) gateway, runs the secure Legato® Application Framework, and a long-term support Linux® operating system. You can use the FX30 as a simple USB modem, but its full potential is realized when you use it as an embedded cellular platform for IoT applications. With Ethernet, USB, I/O interfaces, and IoT Expansion cards, the FX30 can connect to many machines and infrastructures. The Linux-based Legato framework enables you to use efficient low-level C programming to write IoT applications for any connected machine.

Key Features

- Penta-band HSPA+
- Ethernet 10/100 Mbps
- USB 2.0
- mini-SIM slot
- Three configurable I/Os
- Internet of Things (IoT) slot
- GNSS (GPS/Galileo/GLONASS)
- Legato support
- Ultra low power mode

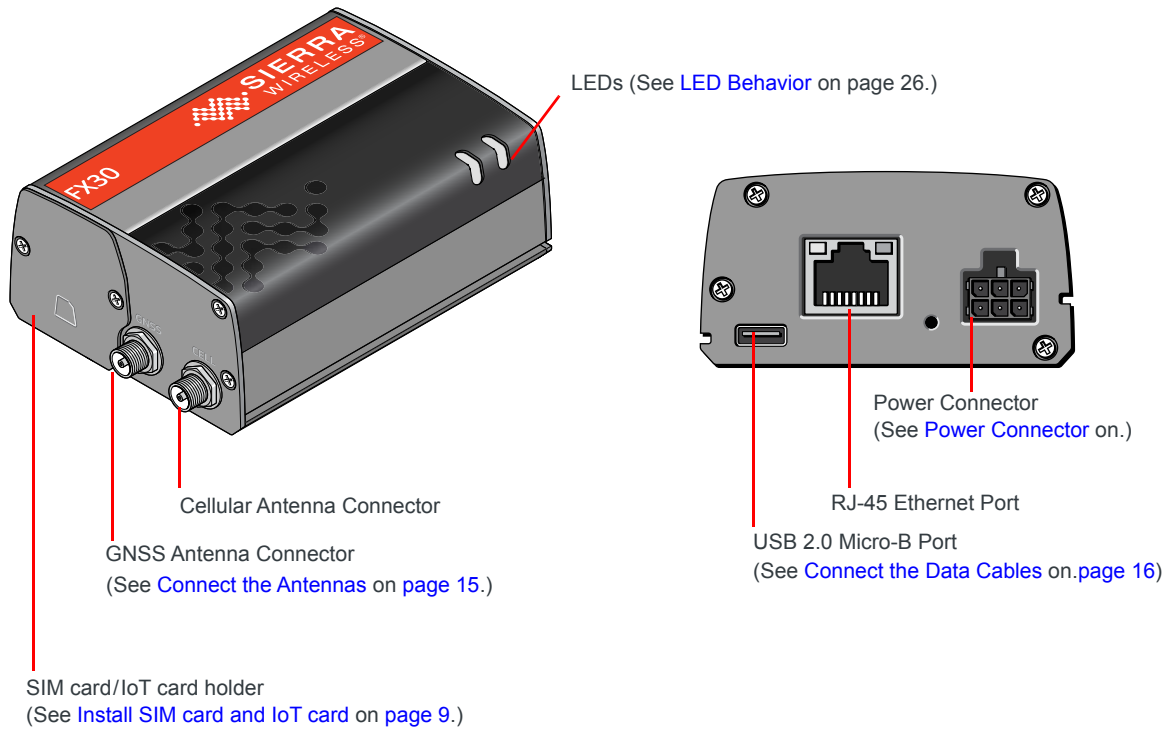


Figure 1-1: FX30 Connectors, LEDs and SIM Card Holder

Accessories

The following items come with the FX30 gateway:

- DC power cable
- Mounting bracket

You can order the following items separately from Sierra Wireless:

- Universal AC power adapter
 - Voltage input: 100–240 VAC
 - Current output: 1.5 A
- Compatibility bar (useful if you are replacing a Fastrack Supreme or a Fastrack Xtend)
- Range of GNSS and cellular antennas

Commonly available standard accessories you may want:

- 35 mm DIN rail clips

Warranty

The FX30 comes with a 3-year warranty.

Reference Documents

Document Number	Title	Location
4116440	WP75xx/WP8548 Product Technical Specification	source.sierrawireless.com
4118047	WPx5xx AT Command Reference	source.sierrawireless.com
4117166	IoT Expansion Card Design Specification	http://mangoh.io/documentation/iot_expansion_card-design_specifications.html
n/a	Legato information	legato.io



2: Installation and Startup

This chapter shows how to connect, install and start the Sierra Wireless FX30. It also describes the front panel LEDs, and I/O functionality.

Note: The FX30 must be installed by a qualified technician.

Tools and Materials Required

- mini-SIM card (provided by your mobile network operator)
- #1 Phillips screwdriver
- Laptop computer
- AC adapter or DC power cable
- micro-B USB cable
- Cellular antenna
- Optional:
 - GNSS antenna

Installation Overview

The steps for a typical installation are:

1. [Insert the SIM card and optional IoT Expansion card.](#)
2. [Mount and ground the FX30.](#)
3. [Connect the antennas.](#)
4. [Connect the data cables.](#)
5. [Connect the power and I/O.](#)
6. [Check the FX30 operation.](#)
7. [Using the FX30.](#)

The following sections describe these steps in detail. Read these sections carefully before performing the installation.

Step 1—Insert the SIM Card and Optional IoT Card

The Sierra Wireless FX30 has one mini-SIM (2FF) card slot.

If the SIM card has not already been installed, insert the SIM card into the gateway before connecting any external equipment or power to the FX30.

To install the SIM card:

1. Use a Phillips screwdriver to remove the cover.
2. Orient the SIM card, as shown in [Figure 2-1](#). The gold contacts on the SIM card face up.
3. Gently slide the SIM card into the slot until it clicks into place.

To remove a SIM card, press the SIM card in, and release it. Gently grip the SIM card and pull it out.

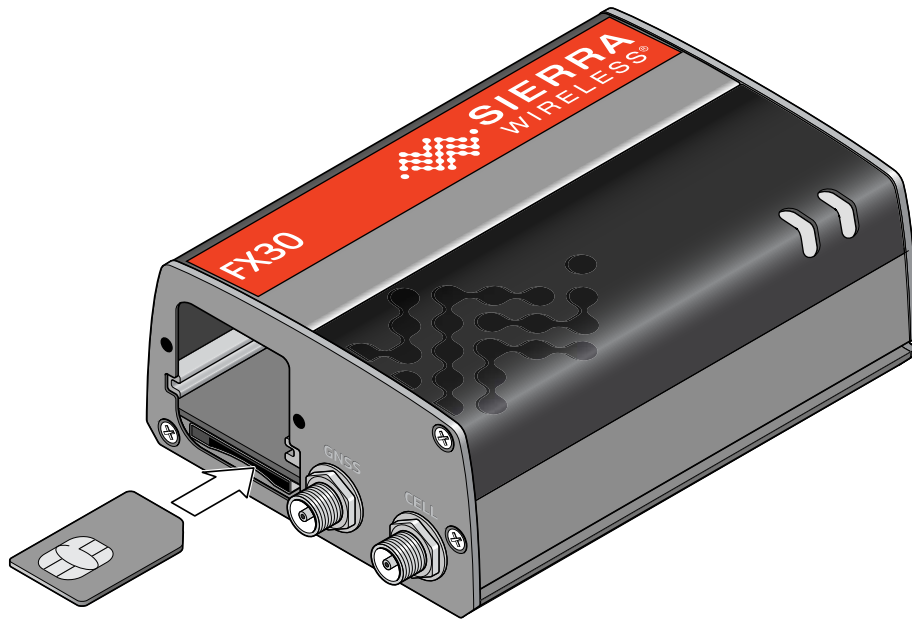


Figure 2-1: Installing the SIM Card

4. Replace the cover.

The FX30 has a slot for an Internet of Things (IoT) Expansion Card that provides a standard hardware interface for sensors, network adapters and other IoT technologies. Using Legato, you can design host applications for the IoT Expansion Card. For more information, see [Internet of Things \(IoT\) Expansion Card](#) on page 39.

To install an IoT Expansion card:

1. Use a Phillips screwdriver to remove the SIM card cover.
2. Orient the IoT Expansion card as shown in [Figure 2-2](#) and slide the card into the IoT slot.
3. Replace the cover.

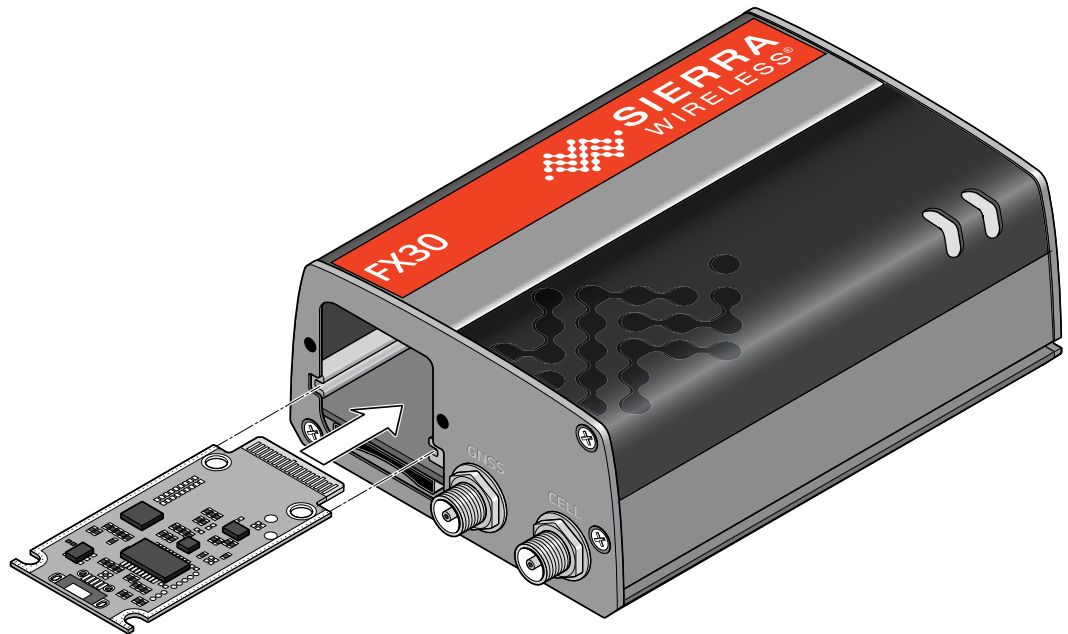


Figure 2-2: Installing the IoT Expansion Card

Step 2—Mount and Ground the FX30 Chassis

The FX30 can be flat mounted, or mounted on a DIN rail. There is also a compatibility bar that allows you to use the same mounting holes if you are replacing a Fastrack Supreme or a Fastrack Xtend programmable gateway. See [Replacing existing Fastrack Supreme or Fastrack Xtend Device](#) on page 13.

Mount the FX30 where:

- There is easy access for attaching the cables.
- 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.

You can mount the FX30:

- On a flat surface ([page 11](#))
- On a DIN Rail ([page 12](#))

To flat mount the FX30:

1. Attach the bracket to the mounting surface, using the attachment points shown in [Figure 2-3](#).

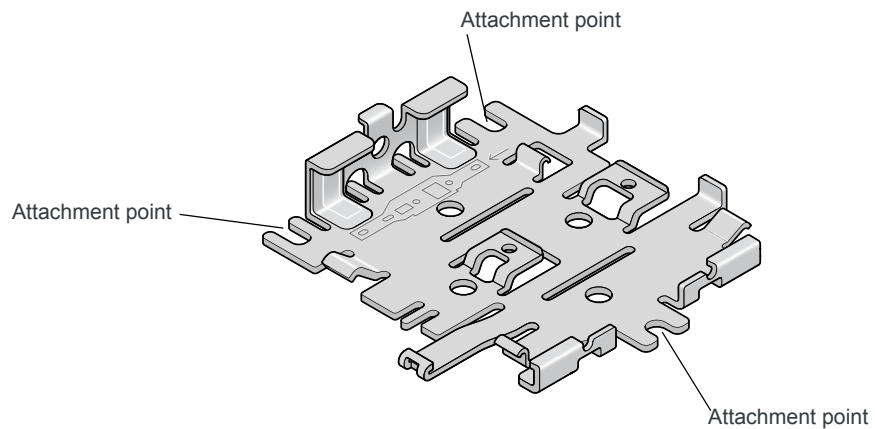


Figure 2-3: Mounting Bracket, showing attachment points

2. Slide or snap the FX30 into the bracket.

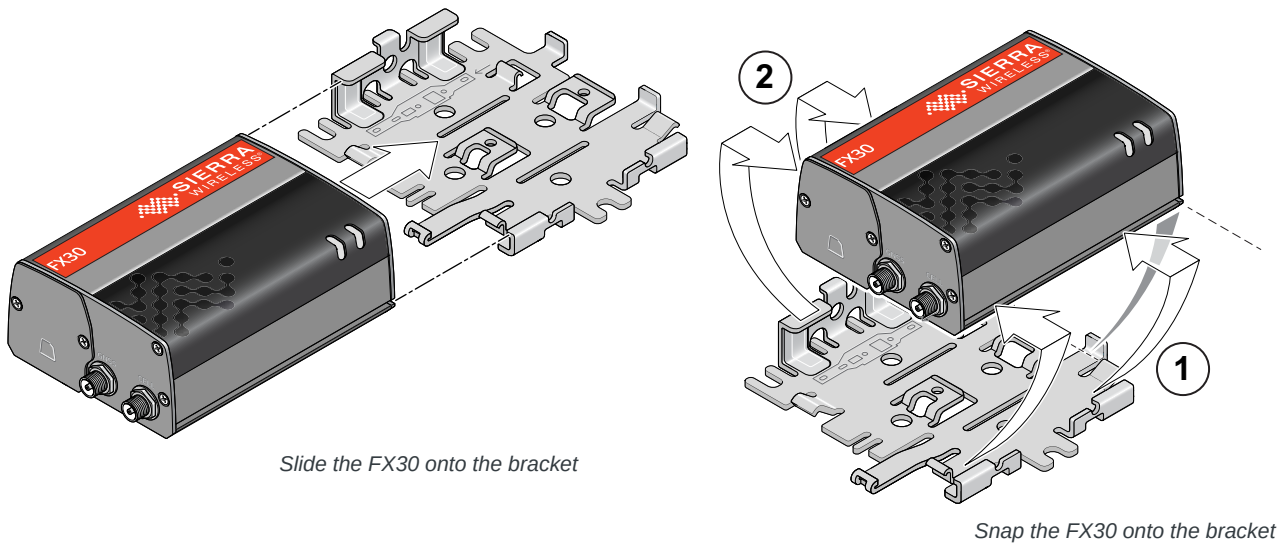


Figure 2-4: Attaching the FX30 to the bracket

To mount the FX30 in a DIN rail:

1. Attach the DIN rail clips to the bracket as shown in [Figure 2-5](#).

If you are mounting the FX30 on its edge, attach one DIN rail clip to the side of the bracket.

If you are mounting the FX30 horizontally or vertically, attach two DIN rail clips to the bottom of the bracket.

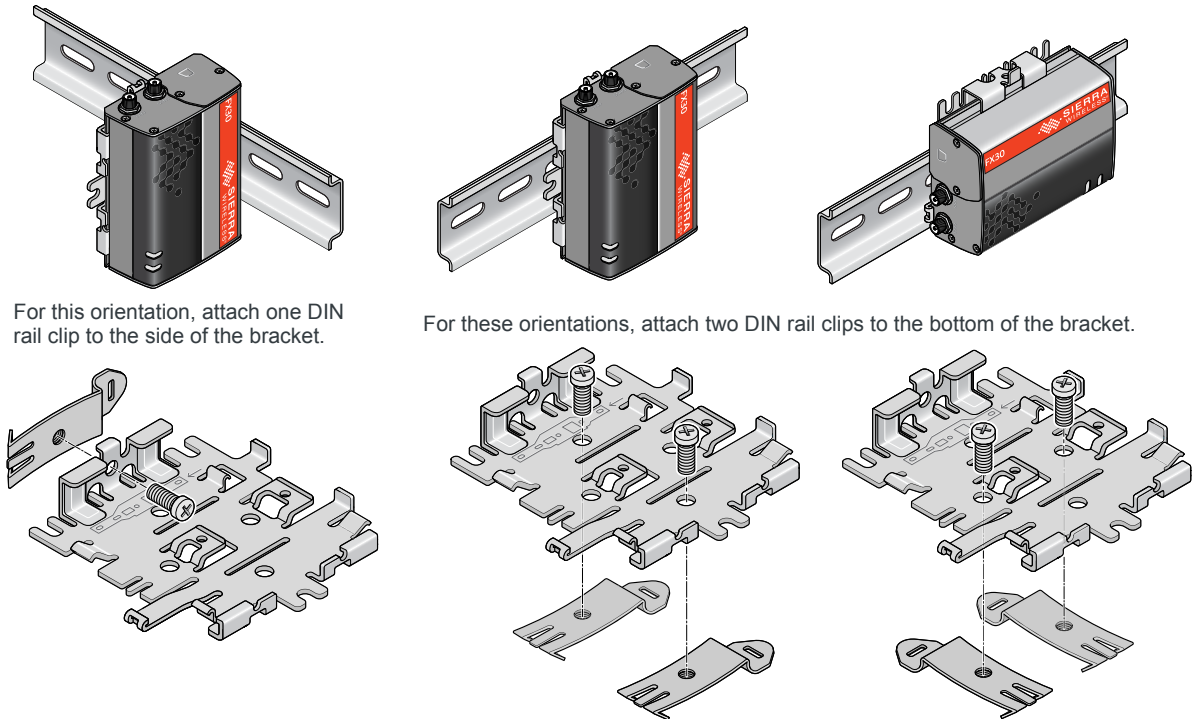


Figure 2-5: Attaching the DIN rail clips

2. Slide or snap the FX30 onto the bracket, as shown in [Figure 2-4](#).
3. Attach the FX30 to the DIN Rail. See [Figure 2-5](#).

Replacing existing Fastrack Supreme or Fastrack Xtend Device

If you are going to be mounting the FX30 in a location where you previously had a Fastrack Supreme or a Fastrack Xtend mounted, attach the compatibility bar to the bracket. The compatibility bar is available from Sierra Wireless.

Note: Adding the compatibility bar does not change the height of the gateway + mounting bracket. See [Figure 3-2](#) on page 36.

To attach the compatibility bar to the bracket:

1. Note the large and small raised tabs on the bracket. Each tab has a small hole in the center of the raised portion. Also note the large and small rectangular openings in the compatibility bar. See [Figure 2-6](#).

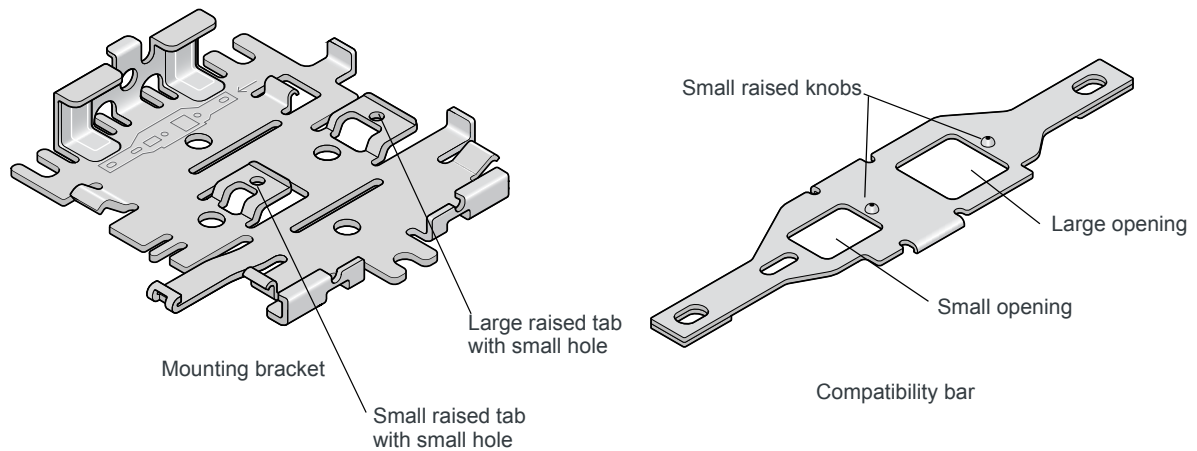


Figure 2-6: Mounting bracket and compatibility bar

2. Orient the mounting bracket and the compatibility bar as shown in [Figure 2-7](#).

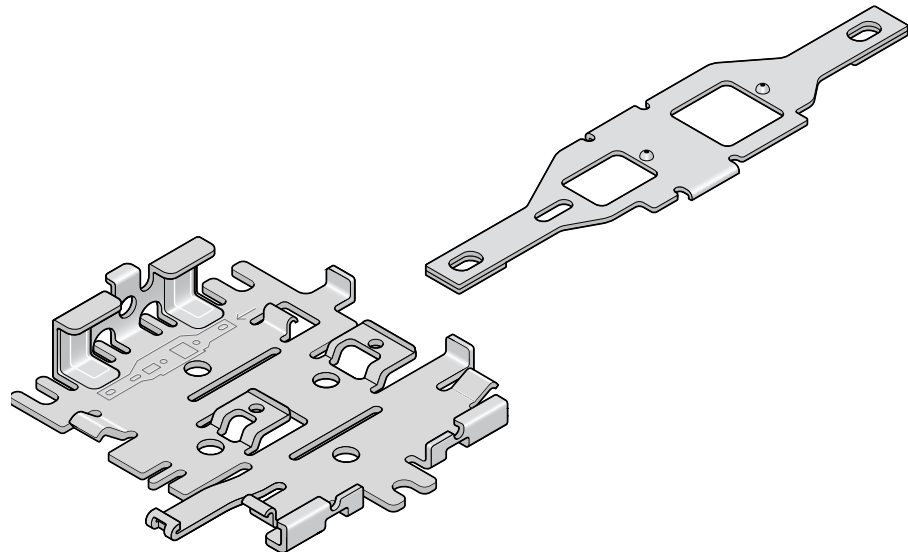


Figure 2-7: Mounting bracket and compatibility bar orientation

3. Place the compatibility bar on top of the bracket, so that the tabs on the bracket are inside the openings in the bar, and slide the bar into place. When fully secure, the knobs on the bar should be inside the small holes on the tabs.

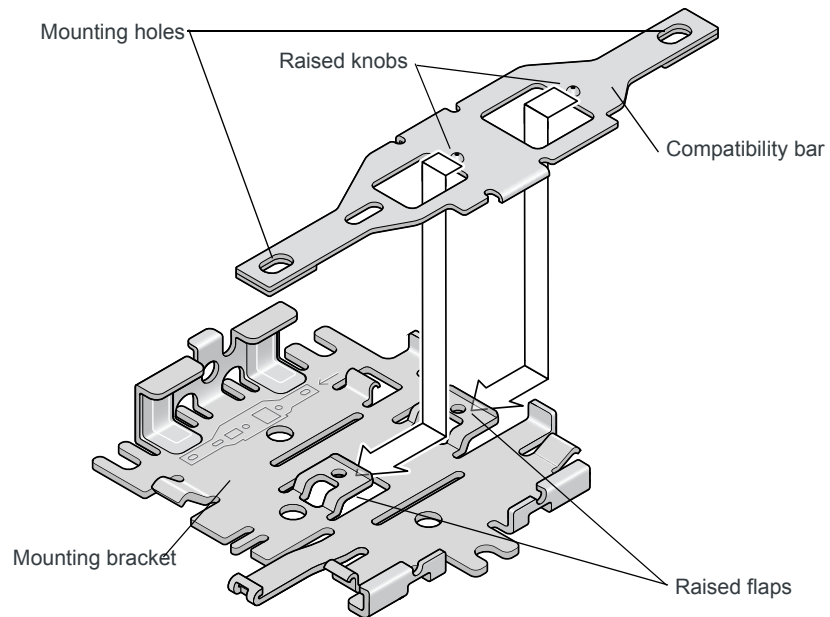


Figure 2-8: Attaching the compatibility bar

4. The mounting holes in the adapter bar match the existing mounting holes for the Fastrack Supreme or Fastrack Xtend.

For DC installations (with a fixed “system” ground reference), Sierra Wireless recommends always grounding the FX30 chassis to this system ground reference.

To ensure a good grounding reference, attach the FX30 to a grounded metallic surface.

Step 3—Connect the Antennas

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

The FX30 has two SMA female antenna connectors:

- Cellular antenna connector
 - GNSS antenna connector
- GNSS bias supports 3.15 V antennas

For regulatory requirements concerning antennas, see [Maximum Antenna Gain](#) on page 40.

Note: The antenna should not exceed the maximum gain specified in [RF Exposure](#) on page 40. In more complex installations (such as those requiring long lengths of cable and/or multiple connections), you must follow the maximum dBi gain guidelines specified by the radio communications regulations of the Federal Communications Commission (FCC), Industry Canada, or your country's regulatory body.

Note: Take extra care when attaching the antennas to the SMA connectors. Finger tight (approximately 0.6–0.8 Nm 5–7 in-lb.) is sufficient and the max torque should not go beyond 1.1 Nm (10 in-lb.).

To install the antennas:

1. Connect the cellular antenna to the SMA cellular antenna connector.
Mount this antenna so there is at least 20 cm between the antenna and the user or bystander.
2. If used, connect a GNSS antenna to the SMA GNSS antenna connector.
Mount the GNSS antenna where it has a good view of the sky (at least 90°).

Note: If the antennas are located away from the gateway, keep the cables as short as possible to prevent the loss of antenna gain. Route the cables so that they are protected from damage and will not be snagged or pulled on. 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 connectors from the gateway over time.

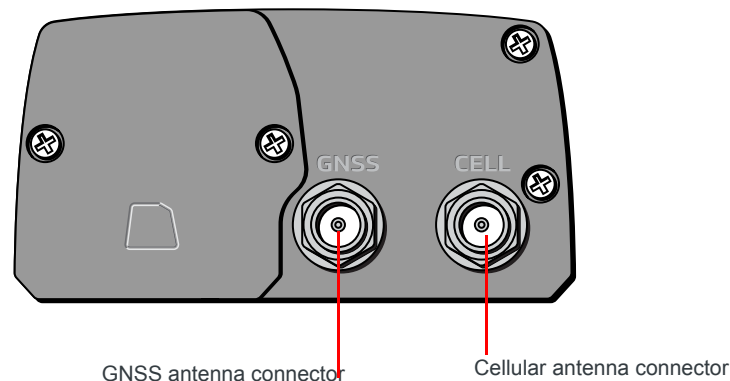


Figure 2-9: Antenna Connectors

Step 4—Connect the Data Cables

The FX30 has two ports for connecting data cables:

- [USB](#) (Micro-B)
- [Ethernet](#) (RJ-45) —Use a Cat5 or greater Ethernet cable

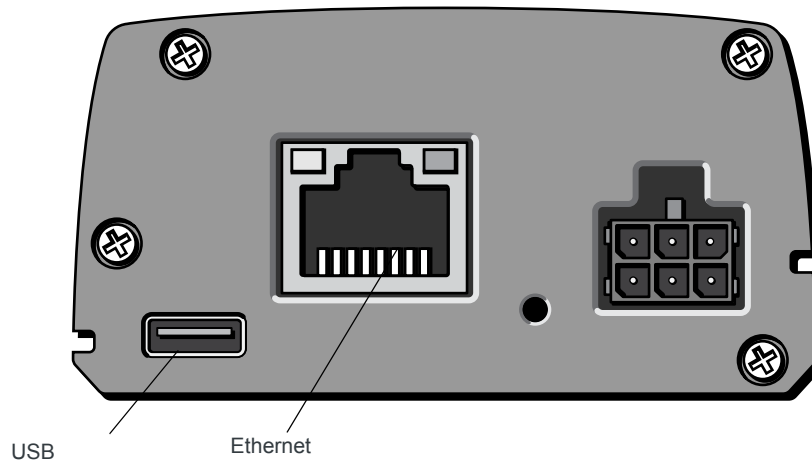


Figure 2-10: Connectors for data cables

Cabling Concerns

Separate the antenna, data, and power cables from other wiring 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 FX30 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 gateway, so both the gateway 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.

Step 5—Connect the Power and I/O

The Sierra Wireless FX30 comes with a 1.5 meter (about 5 ft.) DC power cable. You can also purchase an optional AC adapter.

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

The FX30 supports an operating voltage of 4.75 V–32 V.

Fusing

The Sierra Wireless DC power cable has a 3 A fuse installed in the cable. If that cable is used, no additional fusing is required.

Power Connector on the FX30

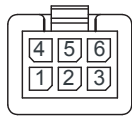


Figure 2-11: DC Power Cable Connections

Table 2-1: Power Connector Pin and DC Cable Wires

Pin	Function	Associated DC Cable Wire Color	Description
1	Power	Red	(20 AWG + Fuse) Main power supply for device Fuse: Slow-blow 3 A 250 V (5 x 20) <i>Note: If you want to turn the FX30 on/off using a control line, Sierra Wireless strongly recommends that you connect the on/off line to Pin 3 and apply continuous power on Pin 1.</i>
2	Ground	Black	(20 AWG) Main device ground
3	On/Off	Yellow	(28 AWG) On/Off: Control line to turn the gateway on and off. Pin 3 must be connected: either to the input power source or to an on/off switch. The FX30 is off when this pin is either open-circuit or grounded, and on when this pin is connected to power.
4	IO 1	Brown	Digital input Wake from active low power mode or ultra low power mode
5	IO 2	Green	Digital input Wake from active low power mode or ultra low power mode Analog input
6	IO 3	Orange	Digital input Digital output

Power Modes

The FX30 has three power modes:

- Off—Gateway is turned off. No power to the gateway.
- Ultra Low Power—The gateway is in its lowest power state. Ports are powered down, but the gateway monitors GPIO1 and GPIO2 and wakes up if the I/O state changes. This is useful if the gateway only needs to be active

very infrequently (for example, in a remote monitoring station that must transmit data once a day)

- **Active Low Power**—The gateway is fully powered and operating in a low energy state. The gateway monitors GPIO1 and GPIO2 and wakes up if the I/O state changes.
- **On**—Gateway is fully powered.

Wiring Diagrams

Always On Installation

For an Always On application, connect the wires as shown in [Figure 2-12](#).

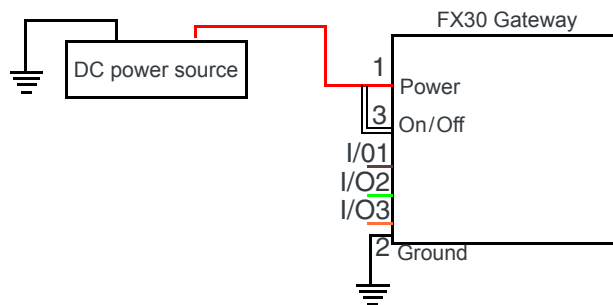


Figure 2-12: Always on installation

- **Pin 1 (Power)**—Use the red wire in the DC cable to connect Pin 1 to the power source.
- **Pin 2 (Ground)**—Use the black wire in the DC cable to connect Pin 2 to ground. See also [Step 2—Mount and Ground the FX30 Chassis](#) on page 11.
- **Pin 3 (On/Off)**—Connected to power
- **Optional**—I/O1, I/O2, and I/O3

On/Off Installation

For an On/Off application, connect the wires as shown in [Figure 2-13](#).

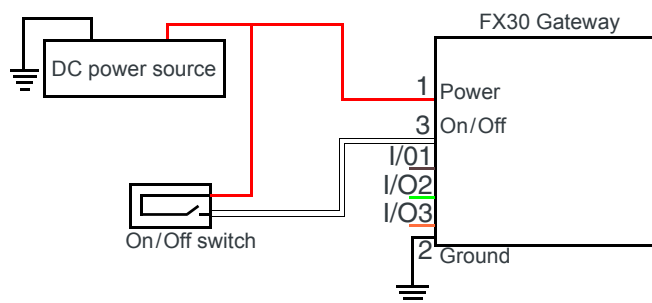


Figure 2-13: On/Off Installation

- **Pin 1 (Power)**—Use the red wire in the DC cable to connect Pin 1 to the power source.

- Pin 2 (Ground)—Use the black wire in the DC cable to connect Pin 2 to ground. See also [Step 2—Mount and Ground the FX30 Chassis](#) on page 11.
- Pin 3 (On/Off)—Connected to an on/off switch
Pin 3 must be connected.
- Optional—I/O1, I/O2, and I/O3

Installation with I/O Input Triggered by Standby Mode

If you have an installation where you want to use the I/O to monitor an external device such as a motion detector or gate sensor, refer to [Figure 2-14](#). If desired, you can use Legato to program the I/O line to wake the gateway from ultra low power mode for a specific length of time.

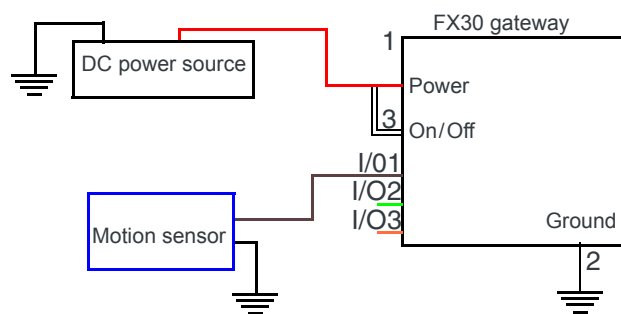


Figure 2-14: Fixed Installation with I/O

- Pin 1 (Power)—Use the red wire in the DC cable to connect Pin 1 to the power source.
- Pin 2 (Ground)—Use the black wire in the DC cable to connect Pin 2 to ground. See also [Step 2—Mount and Ground the FX30 Chassis](#) on page 11.
- Pin 3 (On/Off)—Connected to power
Pin 3 must be connected.
- Optional—I/O1, I/O2, and I/O3
See [I/O Configuration](#) on page 20.

I/O Configuration

The Sierra Wireless FX30 power connector has three pins you can use for I/O configuration:

- I/O1—Digital input only; allows wakeup from ultra low power mode
- I/O2—Digital and analog input; allows wakeup from ultra low power mode
- I/O3—Digital input and digital output

Note: The IoT Expansion Card has four GPIO pins that you can program using Legato. For details, refer to the [IoT Expansion Card Design Specification](#).

I/O Pins

You can use the I/O pins as:

- Digital inputs
(See [Table 2-2](#) on page 22 and [Figure 2-15](#) on page 21.)
- High side pull-ups/dry contact switch inputs
(See [Figure 2-16](#) on page 22.)
- Analog inputs
(See [Table 2-3](#) on page 23 and [Figure 2-17](#) on page 23.)
- Low side current sinks
(See [Figure 2-18](#) on page 24.)
- Digital outputs/open drains
(See [Table 2-4](#) on page 25 and [Figure 2-19](#) on page 24.)

Note: The I/O pin functionality is programmable in Legato applications.

Digital Input

Digital input is available on I/O1, I/O2, and I/O3 on the power connector.

Note: To use I/O3 as a digital input, GPIO56 (that drives I/O3 when used as a digital output) must be low.

You can connect any of these pins to a digital input to detect the state of a digital sensor or pulse counter.

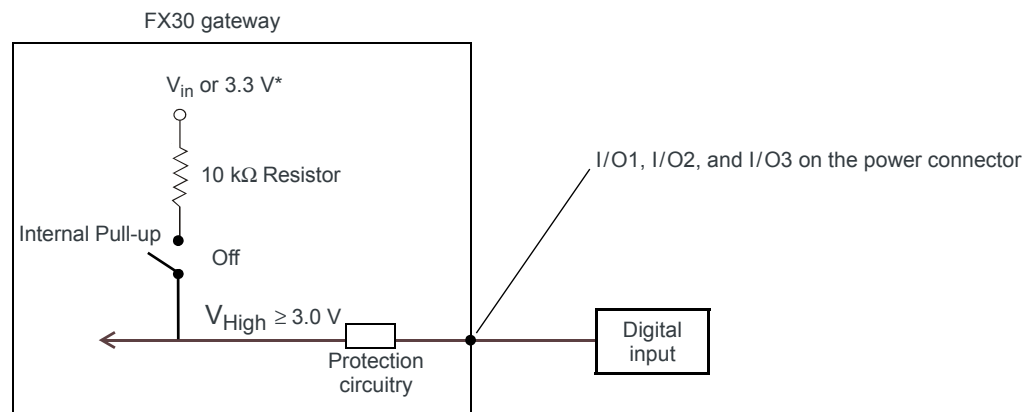


Figure 2-15: Digital Input

Note: When using a digital input, the pull-up should be Off.

Table 2-2: Digital Input

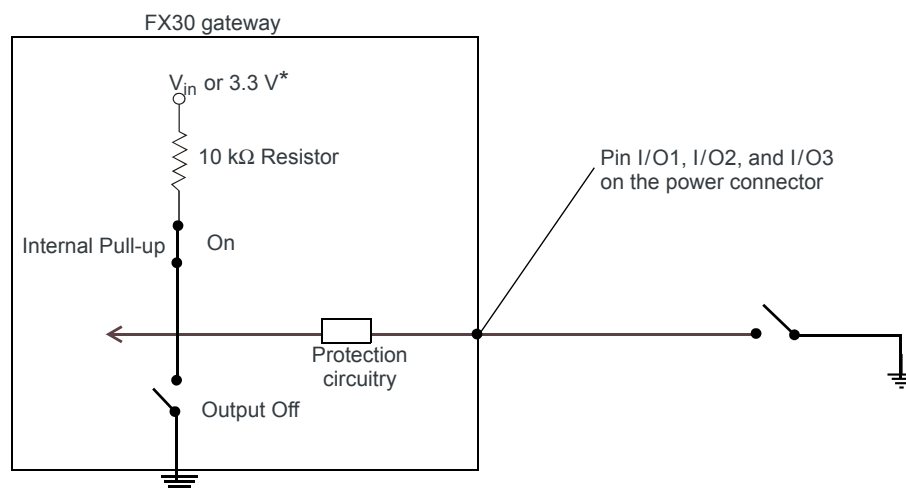
Pull-up	State	Minimum	Typical	Maximum	Units
Off	Low	—	—	1.0	V
	High	3.0	—	V _{in}	V

High Side Pull-up / Dry Contact Switch Input

High side pull-up/dry contact switch input is available on I/O1, I/O2, and I/O3 on the power connector.

Note: To use I/O3 as an high side pull-up/dry contacts switch input, GPIO56 (that drives I/O3 when used as a digital output) must be low.

You can connect any of these pins to a dry contact switch.



*I/O 1 and I/O 2 are pulled to 3.3 V through a 10 kΩ resistor.
I/O 3 can be pulled to V_{in} through a 10 kΩ resistor.

Figure 2-16: High Side Pull-up / Dry Contact Switch Input

Note: For this use case, the pull-up must be enabled.

Analog Input

Analog input is available on I/O2 on the power connector and on the IoT interface.

You can connect any of these pins to an analog gauge. As an analog input (voltage sensing pin), the gateway monitors voltage changes in small increments. This allows you to monitor equipment that reports status as an analog voltage.

The pin detects inputs of 0V–10 V (or 0V–5 V when the lower ADC range is selected). When used with a sensor to transform values into voltages, the pin can monitor measurements like temperatures, pressures or the volume of liquid in a container.

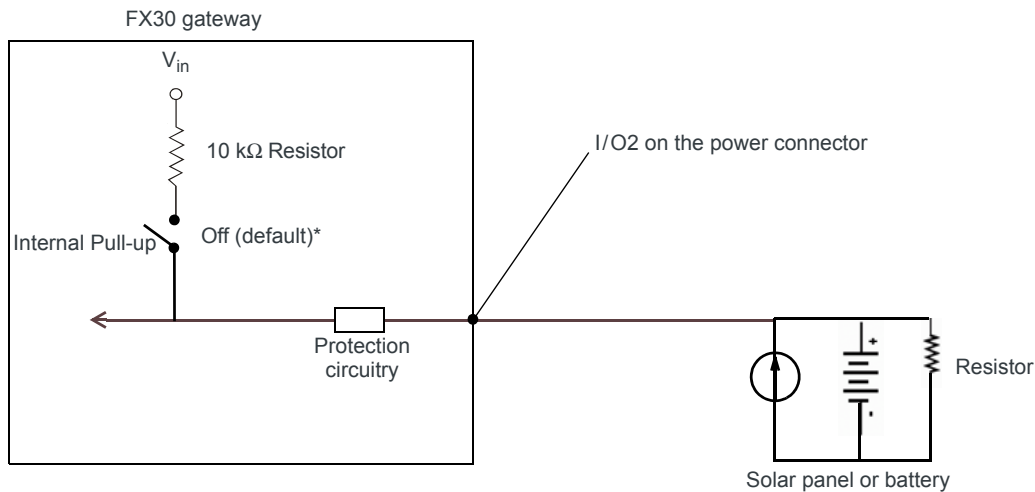


Figure 2-17: Analog Input

Note: When using a analog input, the pull-up should be Off.

Table 2-3: Analog Input

Pull-up		Minimum	Typical	Maximum	Units
Off	Analog Input Range	0	—	5 or 10 ^a	V
	Analog Input Precision	—	< 10 for 0–10 V ADC range 5 for 0–5 V ADC range	25	mV

a. Depending on the ADC range selected.

Low Side Current Sink Output

Low side current sink output, for example to drive a relay, is only available using I/O3 on the power connector.

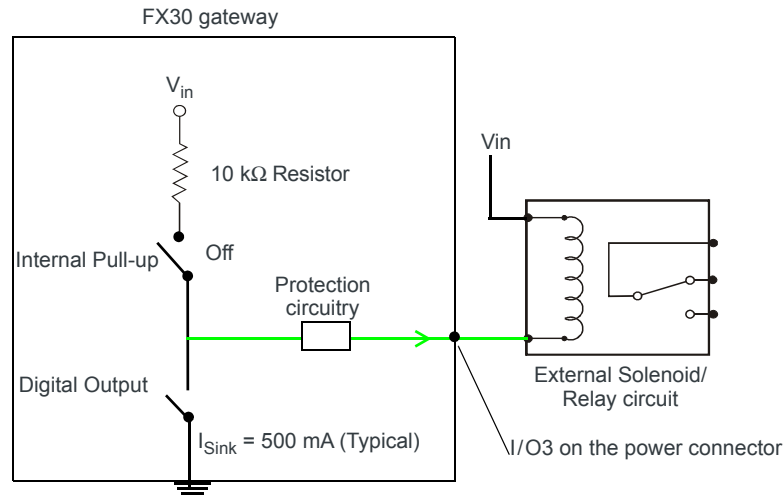


Figure 2-18: Low Side Current Sink

Note: When using low side current sink output, the pull-up should be Off.

The I/O can typically sink 400 mA, but this can vary depending on factors such as temperature.

Digital Output/Open Drain

Digital output/open drain is only available using I/O3 on the power connector.

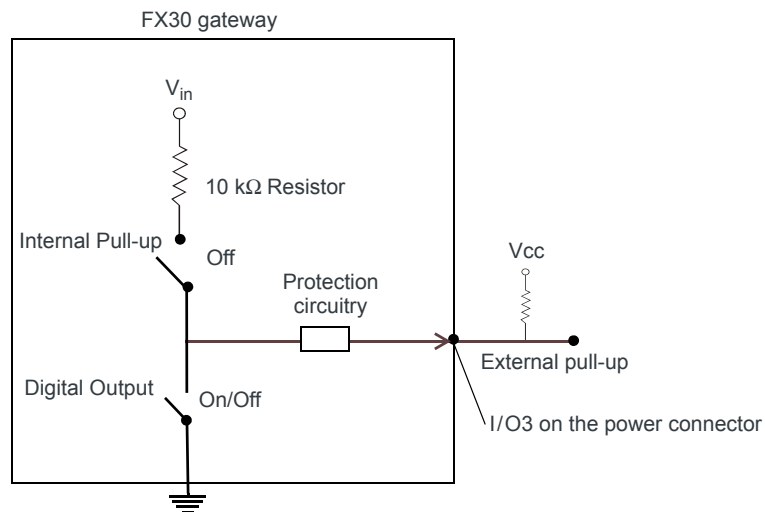


Figure 2-19: Digital Output/Open Drain

Note: To provide voltage on the digital output, either use the internal pull-up or add an external pull-up.

Table 2-4: 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 FX30 operation

1. On initial power up, the Power LED is red. When the processor boots up, the LED turns amber (by default). The Power LED can be controlled by Legato applications.

If the Power LED does not turn on, ensure that the:

- Power connector is plugged in and supplying voltage of 4.75 V or greater.
- On/Off (pin 3) is connected to the battery or power source. (See [Step 5—Connect the Power and I/O](#) on page 17 for details.)

LED Behavior

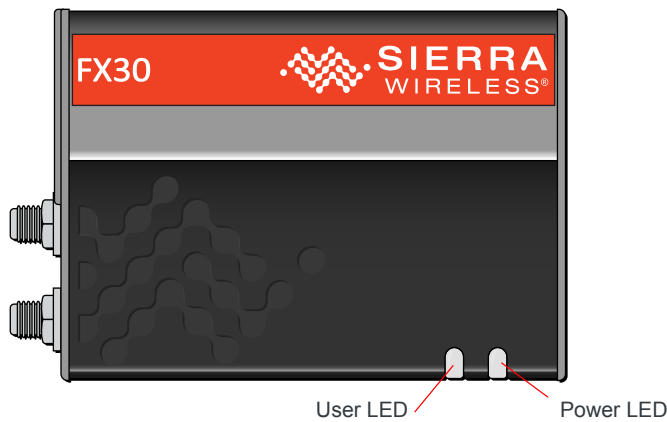


Table 2-5: LED Behavior

LED	Color / Pattern	Description
Power (Default Behavior)	Off	No power or input voltage ≥ 32 VDC or ≤ 4.75 VDC
	Solid Red	The gateway is powered on.
	Solid Amber	The processor is booted up.
<i>Note: You can write Legato applications to define the behavior. Possible colors are: red, green, amber.</i>		
User	Possible colors: • Red • Green • Amber	Based on two GPIOs. The behavior of this LED is defined by the Legato application. See Table 3-6 on page 37.

Ethernet LEDs

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

- Activity – The right (blinking amber) LED
- Connection Speed – The left LED is green to indicate a 100 Mbps link and off when either no cable is connected or a 10 Mbps link is detected.

Step 7—Using the FX30

You can use the FX30 as:

- A USB modem

- An embedded cellular platform for IoT applications. The remainder of this section will provide information to get you started and refer you to additional resources.

Using the FX30 as an Embedded Platform for IoT Applications

To program the FX30, you can use:

- [AT Commands](#)
- [Linux Shell Commands](#) on page 28
- [Legato Application Framework](#) on page 28

AT Commands

The radio module for the FX30 is the Sierra Wireless AirPrime® WP8548. For a complete list of AT Commands for the WP8548 radio module, refer to the [WPx5xx AT Command Reference](#) (document number 4118047).

In addition, the following AT Commands are specific to the FX30:

Function	Type	Format	Output	Example
GPIO AT Commands				
GPIO Read Reads the current value of any input or output GPIO.	Query	AT!FWD?GPIO,<GPIO #> where <GPIO #> is any available GPIO, i.e.: 2,7,8,13,21-25,32-58	<value><CR><LF><CR><LF> OK where <value> is either 0 or 1 0 = low 1 = high ERROR if invalid GPIO #	AT!FWD?GPIO, 2 1 OK AT!FWD?GPIO, 10 ERROR
GPIO Write Sets the value of any configured output GPIO.	Set	AT!FWD=GPIO,<GPIO #>,<value> <GPIO #> is any GPIO set as an output. i.e.: 32,43-58 8,13,25,33,42 only valid if set as output <value> is either 0 or 1 0 = low 1 = high	OK if GPIO is set as requested ERROR if invalid GPIO # or value	AT!FWD=GPIO, 43, 1 OK AT!FWD=GPIO, 2, 1 ERROR

Function	Type	Format	Output	Example
Ethernet AT Commands				
Ethernet Link Speed Queries the Ethernet link speed.	Query	AT!FWD?ETHSPEED	xxx Where xxx is the link speed on the Ethernet port negotiated by the connected devices.	AT!FWD?ETHSPEED 100 OK
Ethernet IP address Sets the Ethernet IP address.	Set	AT!FWD=ETHADDR,<ipv4 address>[,<ipv4 mask>[,<ipv4 gw>]]	OK if Ethernet ip address is set as requested ERROR if invalid ip address	AT!FWD=ETHADDR, 192.168.13.33 OK AT!FWD=ETHADDR, 192.13 ERROR

Linux Shell Commands

You can communicate with the FX30 using Legato Shell Commands. For more information, refer to the Legato Shell documentation on legato.io

Legato Application Framework

Before building custom applications for the FX30, you need to become familiar with Legato. The best place to start is legato.io. Click the Build Apps icon. This section contains:

- Concepts
 - Overview—a high-level summary of Legato's approach to application development
 - Develop Apps—the essentials for creating an app from scratch
 - Definition Files—reusable external interfaces and internal content
 - Sample Apps—sample apps for commonly-needed functions
- Tools—Information on Target, Host, and Build tools

Other references:

- Download the Legato Reference Manual (PDF) from [http://source.sierrawireless.com/resources/legato/reference manual/](http://source.sierrawireless.com/resources/legato/reference%20manual/)
- Clone a Legato project from GitHub, a web-based repository hosting service (<https://github.com/>)

AirVantage IoT Platform

AirVantage IoT platform offers advanced services for device management, connectivity management and for enabling device to cloud applications.

AirVantage Device Management services are available through a web-based operations console providing an intuitive and customizable user interface to configure, monitor, and manage your deployed FX30:

- Monitoring and Management

- Command and Control
- OTA Firmware Update
- Deployment Configuration
- Legato Application Lifecycle Management

Free and unlimited OTA Firmware Updates are offered with FX30.

To get started either call your Sierra Wireless reseller or visit:
<https://airvantage.net/>

>> 3: Specifications

This chapter describes the FX30 gateway specifications.

Table 3-1: Specifications

Certification and Interoperability	Emissions / Immunity	• CE (Including EMC Test case for vehicle installation EN301489) • ACMA RCM • FCC • Industry Canada
	Safety	• CB Report IEC 60950-1 • UL Listed
	Industry Certification for Vehicles	• E-Mark UN ECE Regulation No. 10 Rev. 5
	Environmental Compliance	• RoHS 2011/65/EU (RoHS 2) • WEEE • REACH
	GSM/HSPA+ Certifications	• PTCRB • GCF
Environmental Testing	Vibration (operational)	MIL-STD-810G, test method 514.6C Category 4 CWV (Composite Wheeled Vehicle)
	Shock (operational)	MIL-STD-810G, test method 516.6
	SAE J1455 (Shock and Vibration) for heavy-duty vehicles	• 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 IV
	Temperature (operational)	MIL-STD-810G, test methods 501.5, 502.5 (-30° to +75°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 517.5 95% RH over temperature range of +20°C to + 60°C
	IP rating	IP30
	Drop (non-operational)	ISTA 2A 2001, test categories 1, 4, 5, and 6
Electrostatic discharge (ESD)		8 KV contact discharge, 15 V air discharge

Table 3-1: Specifications (Continued)

Mobile Network Operator Certification (pending)		AT&T (planned)
Network Technology	HSPA+ GSM/GPRS/EDGE	For a list of supported bands, see Table 3-2 on page 33.
Host Interfaces	Antenna connectors	- Cellular - GNSS
	USB	- USB 2.0 micro-B connector complies with USB Version 2.0 for high speed operation - Sierra Wireless recommends you: - Use a USB 2.0 cable - Connect directly to your computer for best throughput.
	Ethernet	10/100 Base-T RJ-45 Ethernet - Auto-crossover support - Auto-negotiation, full- and half-duplex - Not software configurable
	IoT (Internet of Things) Connector	See Internet of Things (IoT) Expansion Card on page 39.
SIM Card Interface		A mini-SIM (2FF) SIM card operated at 1.8 V/3.3 V.
Input/Output For more information, see page 20 .		- Configurable I/O - Wakeup on I/O, serial, or cellular events
Power Adapter Pins		6-Pin connector: - Power - Ground - On/Off - I/O1 - I/O2 - I/O3
LEDs See LED Behavior on page 26.		2 LEDs: - Power - User configurable
Mechanical Specifications For mechanical drawings, dimensions, and weight, see Mechanical Specifications on page 35.		- Housing—The FX30 is made of ruggedized powder-coated aluminum. - RoHS2—The FX30 complies with the Restriction of Hazardous Substances Directive 2011/65/EU (RoHS2). This directive restricts the use of hazardous materials in the manufacture of various types of electronic and electrical equipment.
Screw Torque Settings		- Mount screws 1.1 N-m (10 in-lb) - Antennas Finger tight (5–7in-lb.) is sufficient and the max torque should not go beyond 1.1 N-m (10 in-lb).
Operating Voltage		4.75 to 32 VDC

Table 3-1: Specifications (Continued)

GNSS Technology	Satellite channels available	Acquisition: 118 Simultaneous tracking: 40
	Support for predicted orbits	Yes
	Predicted orbit CEP-50 accuracy	5 meters
	Constellations	• GPS L1 • Galileo E1 • GLONASS L1 FDMA
	GNSS Message Protocol	NMEA
	Standalone Time to First Fix (TTFF)	• Hot start: 1 second • Warm start: 29 seconds • Cold start: 32 seconds
	Sensitivity	Standalone of MS-based tracking sensitivity: -161 dBm Cold start sensitivity: -145 dBm MS-assisted GNSS acquisition sensitivity: -158 dBm

Radio Frequency Bands

Table 3-2: FX30 Supported Radio Frequency Bands

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
HSPA+	Band 1	1920–1980 MHz	2110–2170 MHz
	Band 2	1850–1910 MHz	1930–1990 MHz
	Band 5	824–849 MHz	869–894 MHz
	Band 8	880–915 MHz	925–960 MHz
	Band 19	830–845 MHz	875–890 MHz
GSM / GPRS / EDGE	Band 850	824–849 MHz	869–894 MHz
	Band 900	880–915 MHz	925–960 MHz
	Band 1800	1710–1785 MHz	1805–1880 MHz
	Band 1900	1850–1910 MHz	1930–1990 MHz

Table 3-3: GNSS Bands Supported

Band	Frequency
GPS L1	1575.42 MHz
GLONASS L1 FDMA	1602 MHz
Galileo E1	1575.42 MHz

Radio Module Conducted Transmit Power

The following tables provide radio module conducted transmit power specifications.

Table 3-4: WP8548 Conducted Transmit Power (HSPA+)

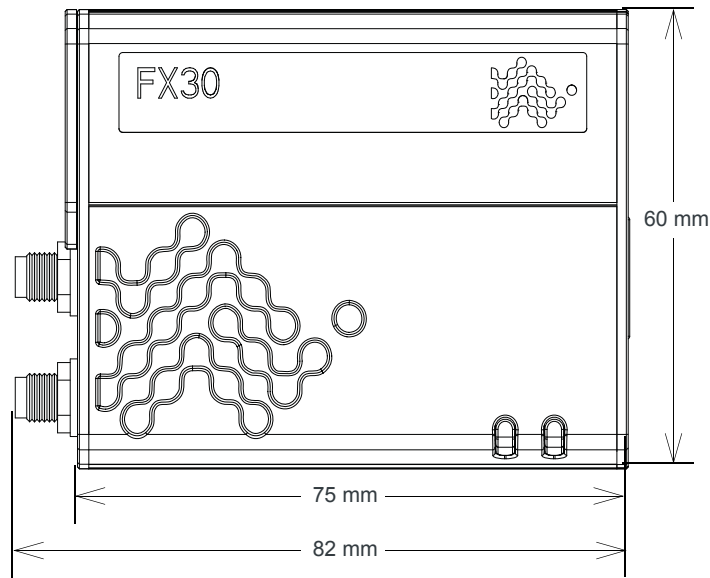
Band	Conducted Tx Power (dBm)	Notes
HSPA+		
Band 1 (IMT 2100 12.2 kbps) Band 5 (UMTS 850 12.2 kbps) Band 6 (UMTS 800 12.2 kbps) Band 8 (UMTS 900 12.2 kbps) Band 9 (UMTS 1700 12.2 kbps) Band 19 (UMTS 850 12.2 kbps)	+23±1	Connectorized (Class 3)

Table 3-5: WP8548 Conducted Transmit Power (GSM)

RF Band	Min	Typ	Max	Notes
GSM 850	31	32	33	GMSK mode, connectorized (Class 4, 2 W; 33 dBm)
E-GSM 900	31	32	33	
DCS 1800	28	29	30	GMSK mode, connectorized (Class 1, 1 W; 30 dBm)
PCS1900	28	29	30	
GSM 850	25.5	26.5	27.5	8PSK mode, connectorized (Class E2; 0.5 W; 27 dBm)
E-GSM 900	25.5	26.5	27.5	
DCS 1800	24.5	25.5	26.5	8PSK mode, connectorized (Class E2; 0.4 W; 26 dBm)
PCS1900	24.5	25.5	26.5	

Mechanical Specifications

Top view



End views

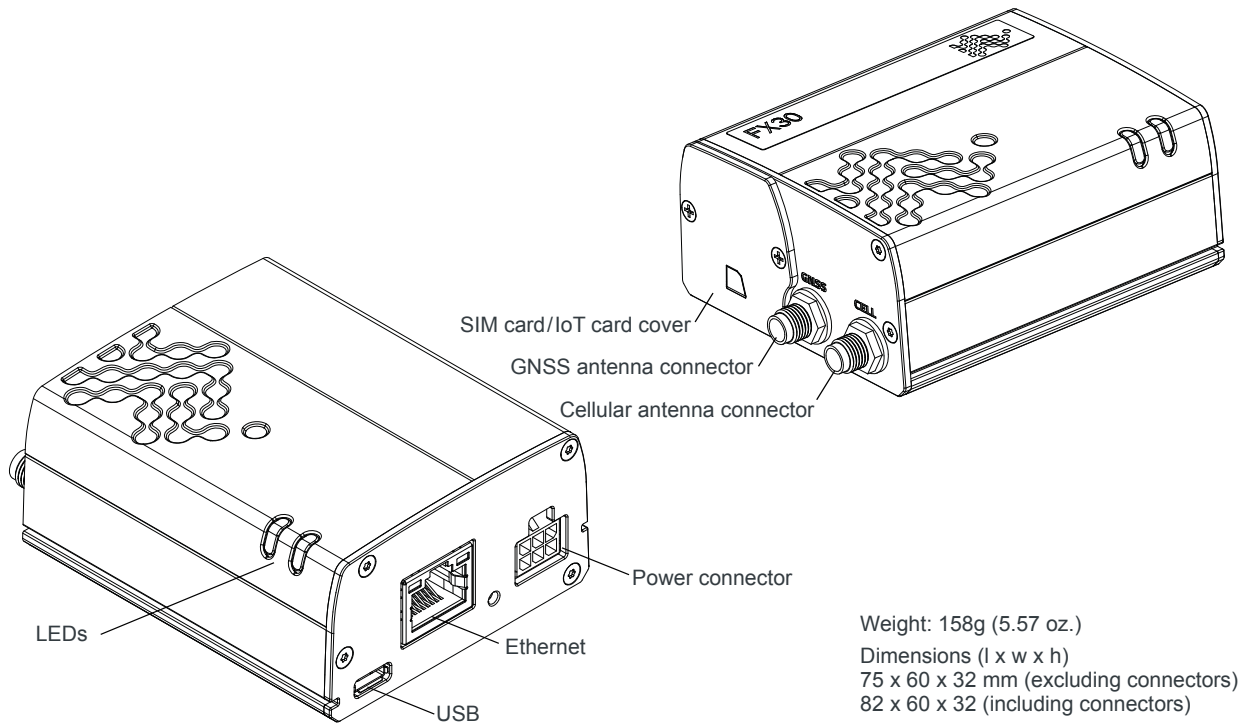


Figure 3-1: FX30 Mechanical Specifications

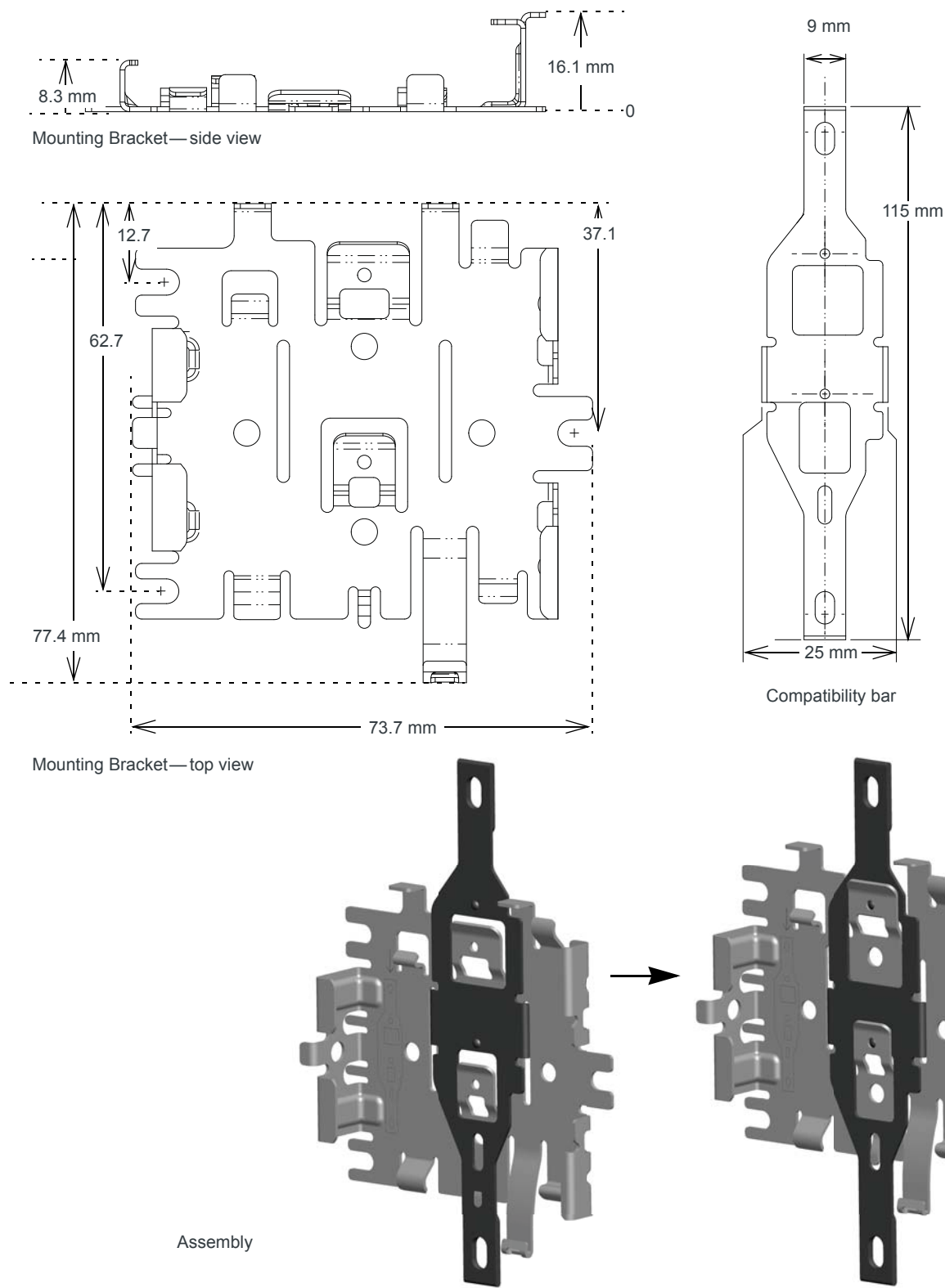
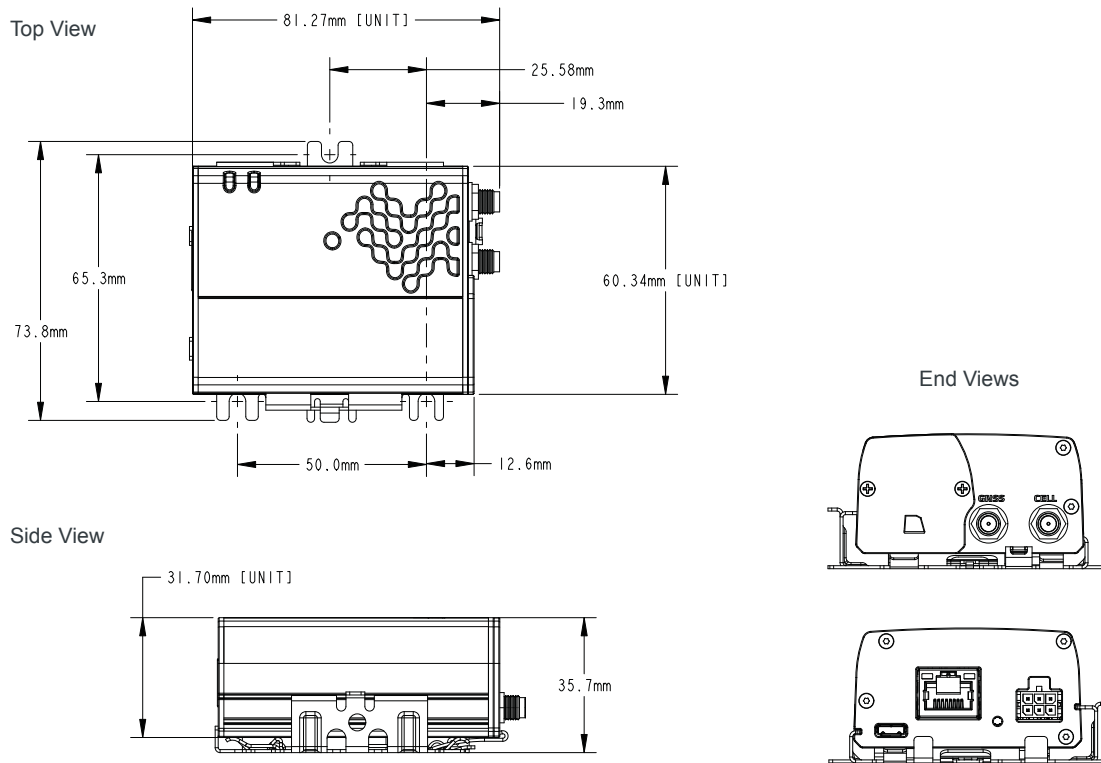


Figure 3-2: Mounting Bracket Mechanical Specifications



Note: "Unit" refers to the gateway itself.

Figure 3-3: FX30 on mounting bracket

WP Radio Module Interface Mapping

Table 3-6 describes the GPIO pins on the WP8548 radio module that are specific to the FX30. For a complete list of pin-outs for the WP8548 radio module, refer to the [WP75xx/WP8548 Product Technical Specification](#).

Table 3-6: WP8548 Radio Module Interface Mapping

Name	Function	WP GPIO	Description
IO1 (Pin 4)	Digital Input	GPIO2	High: External I/O1 is low (ground) Low: External I/O1 is high Default is external low.
	Internal Pull-up	GPIO57	High: Enables internal pull-up to 3.3V (default) Low: Disables internal pull-up

Table 3-6: WP8548 Radio Module Interface Mapping

Name	Function	WP GPIO	Description
IO2 (Pin 5)	Digital Input	GPIO21	High: External I/O2 is low (ground) Low: External I/O2 is high Default is external low.
	Internal Pull-up	GPIO53	High: Enables internal pull-up to 3.3V Low: Disables internal pull-up (default)
	Analog Input	ADC1	ADC with 15 bits of resolution
	Adjust ADC range	GPIO25	Two selectable ranges: Low: 0~5V (default) High: 0~10V AT!FWD=GPIOCFG,25,OUT to set I/O as an output AT!BSGPIO=25,0,0 to set I/O low AT!BSGPIO=25,1,0 to set I/O high
IO3 (Pin 6)	Digital Input	GPIO22	High: External I/O3 is low (ground) Low: External I/O3 is high Default is external low.
	Internal Pull-up	GPIO54	High: Enables internal pull-up to Vin Low: Disables internal pull-up (Default)
	Digital Output	GPIO56	High: Output transmitter ON —clamps external IO3 to ground Low: Output transmitter OFF —IO3 floats (can be used as input) Default is external low.
External Push Button	Digital Input	GPIO7	High: External Push button is released (default) Low: External push-button is being pushed
Power LED	Red Power LED	GPIO49	High: Turns Power LED (Red) ON (default) Low: Turns Power LED (Red) OFF <i>Note: Polarity is inverted compared to other LEDs.</i>
	Green Power LED	GPIO50	High: Turns Power LED (Green) OFF (default) Low: Turns Power LED (Green) ON <i>Note: Requires correct setting of GPIO51 to function</i>
	Green LED Function	GPIO51	High: Connects GPIO50 to green Power LED Low: Connects WAN Activity signal to green Power LED (default)
User LED	Red User LED	GPIO47	High: Turns User LED (Red) OFF (default) Low: Turns user LED (Red) ON
	Green User LED	GPIO48	High: Turns User LED (Green) OFF (default) Low: Turns user LED (Green) ON
GPS Bias	Enable GPS Bias	GPIO52	High: Enables 3.15V GPS antenna bias voltage (default) Low: Disables 3.15V GPS antenna bias voltage
Ethernet Disable	Disable Ethernet Port	GPIO55	High: Enables Ethernet controller (default) Low: Disables Ethernet controller

Table 3-6: WP8548 Radio Module Interface Mapping

Name	Function	WP GPIO	Description
Power Hold	On/Off Override	GPIO58	High: Holds power on even if On/Off is LOW (used to control shut-down) (default) Low: Release power hold; On/Off line controls On/Off state
On/Off (Pin 3)	External On/Off Input	GPIO24	High: external On/Off signal is Low (in OFF state) (default) Low: external On/Off signal is high (in ON state) <i>Note: GPIO58 must be low in order for device to power off.</i>

Internet of Things (IoT) Expansion Card

The FX30 is compatible with single slot, category 1 (14 mm maximum), power category 1 and 2 IoT Expansion cards. The IoT connector has 38 pins and supports the following interfaces:

- 1 x ADC
- 4 x GPIO
- 1 x I2C
- 1 x PCM
- 1 x SPI
- 1 x UART
- 1 x USB
- 1 x SDIO

Pin-out Information

For complete pin-out information, refer to the [IoT Expansion Card Design Specification](#) (document number 4117166) available on source.sierrawireless.com.

>> 4: Regulatory Information

4

Important Information for North American Users

Warning: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense. 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 between 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

The antenna gain must not exceed the limits and configurations shown in the following table:

Device	Frequency Band	FCC ID/IC Number N7NWP8 2417C-WP8 Maximum Antenna Gain (dBi)
Sierra Wireless FX30	2	3
	5	4
	GPRS/EDGE 850	4
	GPRS/EDGE 1900	3

EU

Sierra Wireless hereby declares the Sierra Wireless FX30 device is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

The FX30 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 1999/5/EC is available for viewing at: source.sierrawireless.com/resources/airlink/certification_and_type_approval/FX30_ce_declaration_of_conformity/.

WEEE Notice



If you purchased your Sierra Wireless FX30 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.

>> A: Accessories

A

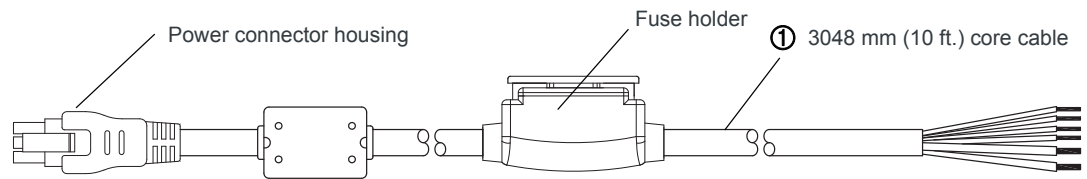
DC Power Cable (Black Connector)

Table A-1: DC Power Cable

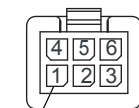
DC Power Cable	
Part Number	2001013
Product Release	2016

Components:

- ① 1 UL2464 20 AWG x 6 core cable
- ② 6 Molex female crimp terminals
- ③ 1 Molex male 2x2P Ph: 3.0 mm housing, 250V, 5 A max, PA65 black UL94V-O (part number 43025-0408)



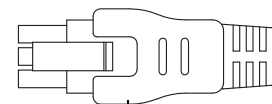
Power connector (end view)



② Female crimp terminals

Pin	Wire color
1	Red
2	Black
3	Yellow
4	Brown
5	Green
6	Orange

Power connector housing (side view)



③ Male housing

Figure A-1: DC Cable Specifications

AC Power Adapter (Black Connector)

Table A-2: AC Power Adapter

AC Power Adapter	
Part Number	TBC
Product Release	2016

AC Power Adapter Input

Table A-3: 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. Maximum input current is 500 mA at 100–240 VAC. Inrush current will not exceed 75 A at 100–240 VAC input and maximum load from a cold start at 25°C.</i>			

AC Power Adapter Output

Table A-4: AC Power Adapter Output Specifications

		Minimum	Typical	Maximum	Test conditions
Output Voltage	—	11.4 VDC	12.0 VDC	12.6 VDC	0 ~ 1.5 A loading

AC Power Adapter Environmental Specifications

Table A-5: AC Power Adapter Environmental Specifications

Operating	
Operating Temperature	0°C ~ 40°C (operates normally)
Relative Humidity	10% ~ 90%
Altitude	Sea level to 2,000 meters
Vibration	1.0 mm, 10–55 Hz, 15 minutes per cycle for each axis (X, Y, Z)

Table A-5: AC Power Adapter Environmental Specifications (Continued)

Non-operating	
Storage Temperature	-30°C ~ 70°C
Relative Humidity	10% ~ 90%
Vibration and Shock	MIL-STD-810D, method 514

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 at least 200,000 hours at 25°C (MIL-HDBK-217F).

AC Power Adapter Safety Standards

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

Table A-6: AC Power Adapter Safety standards

Regulatory Agency	Country or Region	Certified	Standard
UL	USA	Approved	UL60950-1
GS	Europe	Approved	EN60950-1
CE	Europe	Approved	EN60950-1
SAA	Australia	Approved	AS/NZS 60950
CCC	China	Approved	GB4943
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 EN55022, FCC Part 15, Class B, GB9254.

AC Power Adapter Hazardous Substances

- EU Directive 2011/65/EU “RoHS”
- EU Directive 2012/19/EU “WEEE”
- REACH

AC Power Adapter Energy Efficiency

The AC adapter complies with International Efficiency Levels, as shown in [Table A-7](#).

Table A-7: 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 85%	VI
230 VAC, 50 Hz.	Less than 0.3 W	Greater than 80.4%	V

A

Accessories, [7](#)
Analog input, [22](#)
Antenna
 connecting, [15](#)
 maximum gain, [40](#)

C

Cable strain relief, [17](#)
Cables, connecting, [16](#)
Certification
 Industry Standards, [30](#)
 Mobile Network Operator, [31](#)
Communication
 command line prompt, using, [25](#)
Current sink, [24](#)

D

DC cable wires, [18](#)
Digital output, [24](#)

E

Environmental Testing, [30](#)
Ethernet
 LEDs, [26](#)

F

Features, [6](#)

G

GNSS, [32](#)
Grounding the chassis, [15](#)

H

Host Interfaces, [31](#)

I

I / O Configuration, [20](#)
Input
 analog, [22](#)
 dry contact switch, [22](#)
 on/off switch, [21](#)
Installation
 connect data cables, [16](#)
 connect power cable, [17](#)
 connecting antennas, [15](#)
 fixed (with I/O), [20](#)
 insert SIM cards, [9](#)
 overview, [9](#)
 tools and materials required, [9](#)
IoT expansion card, [10](#)

IP address, obtaining with command line prompt, [25](#)

L

LED
 description of LED, [25](#)
LTE, bands supported, [31](#)

M

MTBF
 AC adapter, [44](#)

O

Open drain, [24](#)
Operating voltage, [31](#)
Output, digital, [24](#)

P

Pinging the router with command line prompt, [25](#)
Power
 connecting, [17](#)
 connector, [17](#)
Pull-up resistor, [22](#)

R

Regulatory information, [40](#)
Regulatory specifications, [44](#)
RF specifications, [15](#)

S

Screw Torque, [31](#)
SIM cards, insert, [9](#)
Specifications, [30](#)
 environmental, [30](#)
 environmental testing, [30](#)
 GNSS, [32](#)
 Input / Output, [31](#)
 regulatory, [44](#)
 RF, [15](#)
Standards, regulatory, [44](#)

T

Tools required for install, [9](#)

W

Warranty, [7](#)
Wiring diagrams, [19](#)