Sierra Wireless FX30

User Guide

SIERRA WIRELESS®

41110030
Rev. 6

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Contents

1: Introduction to the FX30

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.

The FX30 is also available as an Octave edge device. Octave is Sierra Wireless' all-in-one edge-to-cloud solution for connecting industrial assets. See sierrawireless.com/octave/devices for more information.

FX30 Octave

Key Features

- Broad range of LTE & 3G Radio Technologies available (radio module dependent)
  The following FX30 variants are currently available:
  - Penta-band HSPA+ (WP8548)
  - LTE Cat-1 (WP7607-1)
  - LTE Cat-M1/NB1 (WP7702)
- Ethernet 10/100 Mbps
- USB 2.0
- mini-SIM slot
- Three configurable I/Os
- IoT expansion card slot
- GNSS (GPS/Galileo/GLONASS/BeiDou[1])
- Linux-based Legato Embedded Application Framework
- Octave™ All-in-One Edge-to-Cloud solution
- Ultra low power mode

1. Support varies depending on radio module

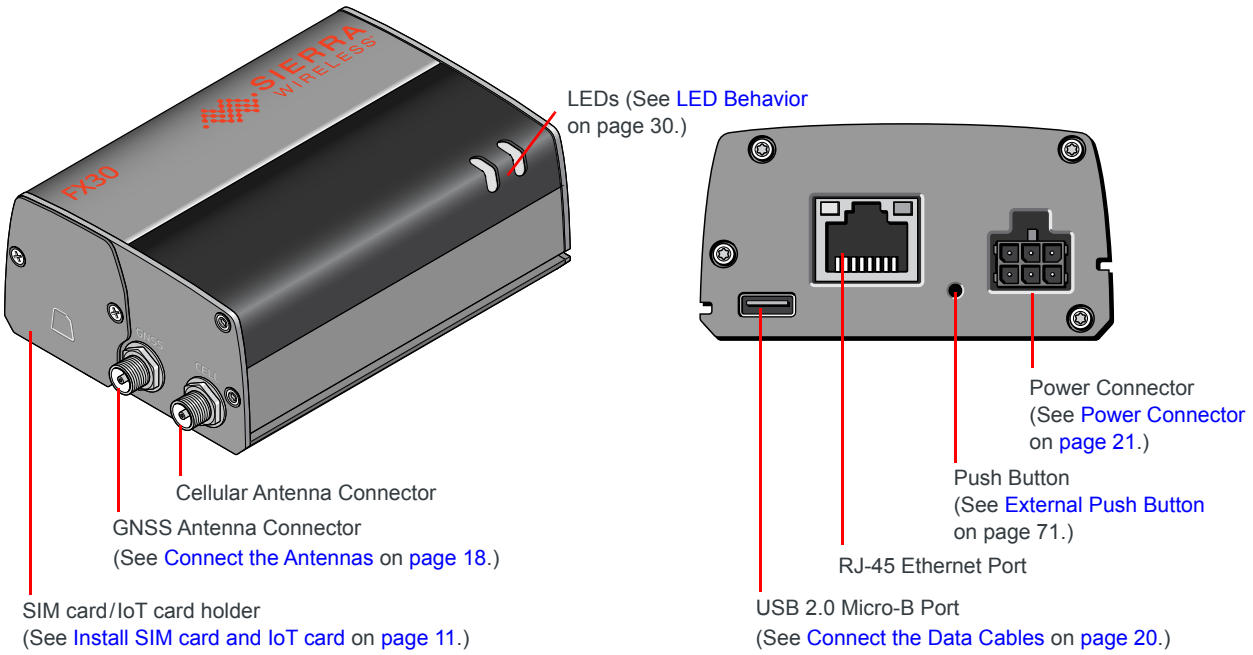


Figure 1-1: FX30 Connectors, LEDs and SIM Card Holder

Power Modes

FX30 has three power modes:

- Off
- Ultra Low Power
- Active

For more information on power modes and power consumption, see Power Modes on page 44 and Power Consumption on page 46.

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
  - Puck antenna (Cell & GNSS; part number 6001128) is recommended

If you are mounting the FX30 on a DIN rail, you will also need 35 mm DIN rail clips.

For more information, see Accessories on page 55.

Warranty

The FX30 comes with a 3-year warranty.

Reference Documents

Document Number	Title
4116440	WP75xx/WP8548 Product Technical Specification
4119652	WP76xx Product Technical Specification
41111420	WP77xx Product Technical Specification
4118047	WP8548/WP75xx/WP76xx/WP77xx AT Command Reference
4117166	IoT Expansion Card Design Specification
n/a	Legato information
n/a	Octave Documentation

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
- GNSS antenna (optional)

Optional Software

Depending on your operating environment, you may want to download and install the following software:

- Windows USB driver—Install the USB drivers for WP Series modules, available from http://source.sierrawireless.com/devices/fx-series/FX30/ (in the Software section under Windows drivers).
- A Windows terminal emulator program such as Tera Term.

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. Use 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 Expansion 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 the SIM card, press it in, and release it. Gently grip the SIM card and pull it out.

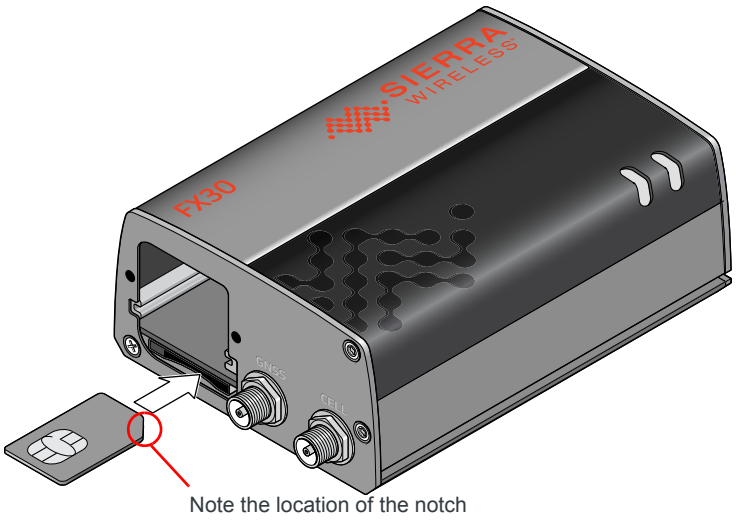


Figure 2-1: Installing the SIM card

4. Reattach the cover.

The FX30 has a slot for an 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 IoT Expansion Card on page 48.

To install an IoT Expansion card:

1. Use a Phillips screwdriver to remove the SIM card/IoT Expansion card cover.
2. Orient the IoT Expansion card as shown in Figure 2-2 and slide the card into the IoT slot.
3. Reattach the cover.

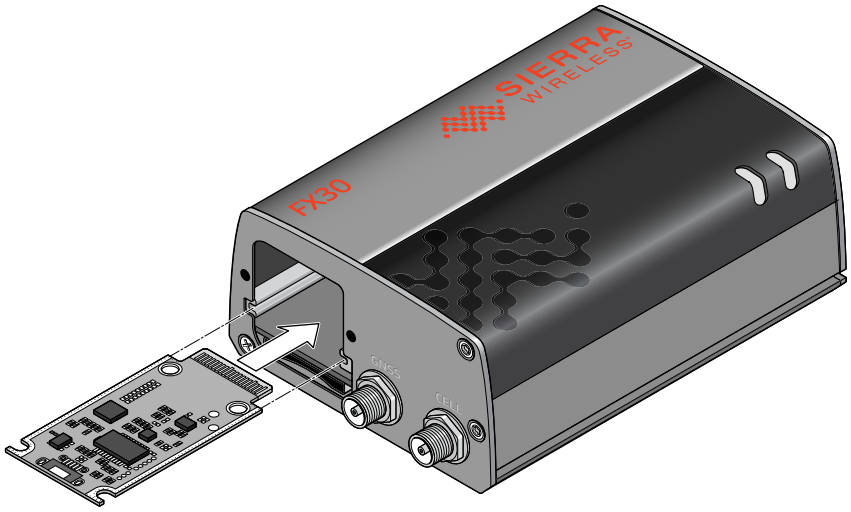


Figure 2-2: Installing the IoT Expansion card

Step 2—Mount and Ground the FX30 Chassis

You can flat mount the FX30 or mount it on a DIN rail. An optional compatibility bar allows you to use existing 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 16.

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 13)
- On a DIN Rail (page 16)

Flat Mount

To mount the FX30 on a flat surface:

1. Attach the bracket to the mounting surface, using the attachment points shown in Figure 2-3.

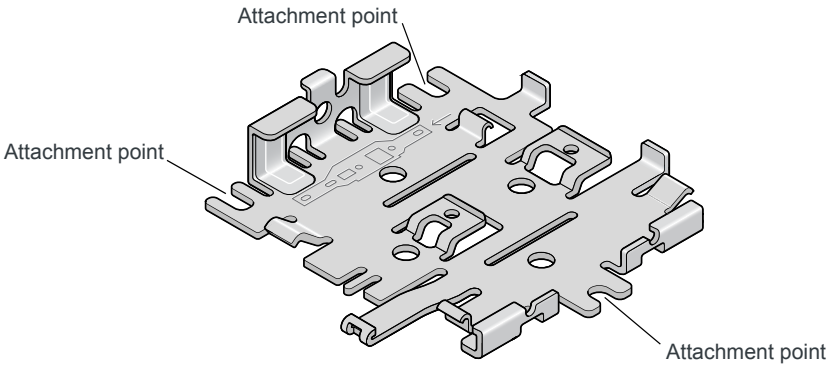
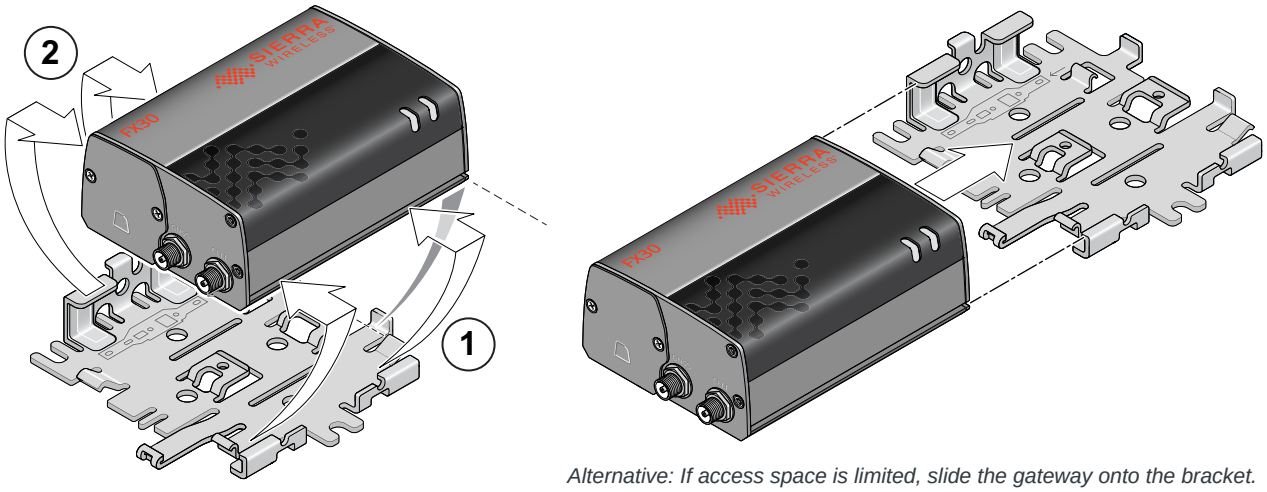


Figure 2-3: Mounting Bracket, showing attachment points

2. Snap or slide the FX30 onto the bracket.



Recommended: Snap the gateway onto the bracket.

Alternative: If access space is limited, slide the gateway onto the bracket.

Figure 2-4: Attaching the FX30 to the bracket

Optional—Mounting in a High Vibration Environment

If you are mounting the FX30 in a high vibration area, Sierra Wireless strongly recommends using two nylon cable ties to secure the FX30 on the bracket.

To secure the FX30 on the bracket:

1. Thread the ties into the holes on one side of the bracket and out the holes on the other side of the bracket, as shown in Figure 2-5 on page 14.

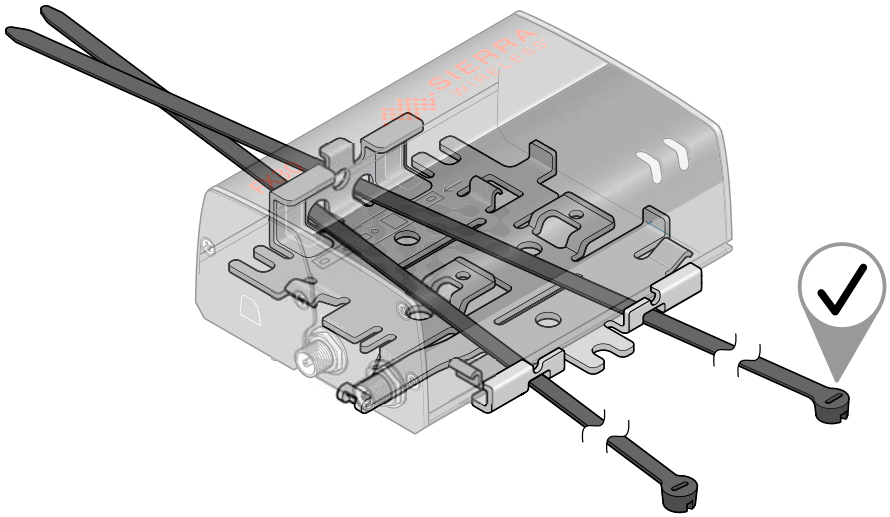


Figure 2-5: Inserting the cable ties

2. Wrap the ties around the FX30 and insert the pointed ends of the ties into the blunt ends.

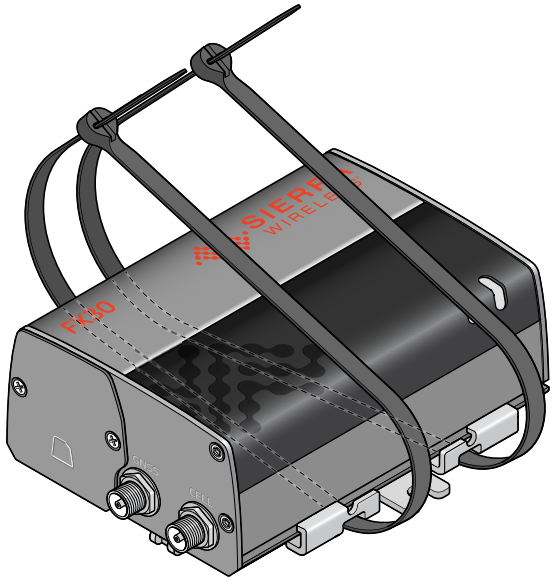


Figure 2-6: Inserting the ends of the ties

3. Tighten and secure the ties around the FX30 and trim off the excess length of the ties.

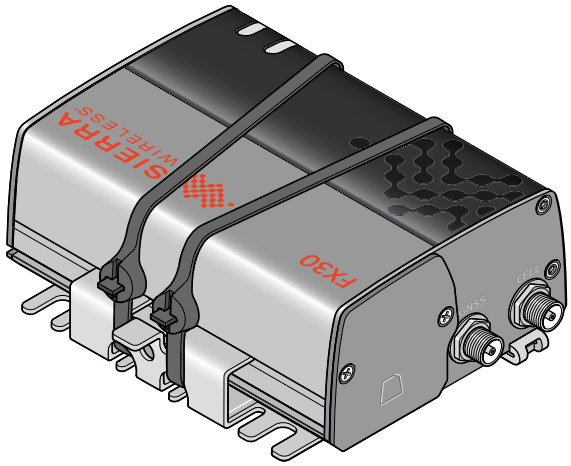


Figure 2-7: Cable ties tightened and trimmed

4. You are now ready to flat mount the FX30 in a high vibration environment. If you are mounting it on a DIN rail, see Mounting on a DIN Rail on page 16.

Mounting on a DIN Rail

To mount the FX30 in a DIN rail:

1. Attach the DIN rail clips to the bracket as shown in Figure 2-8.

   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.

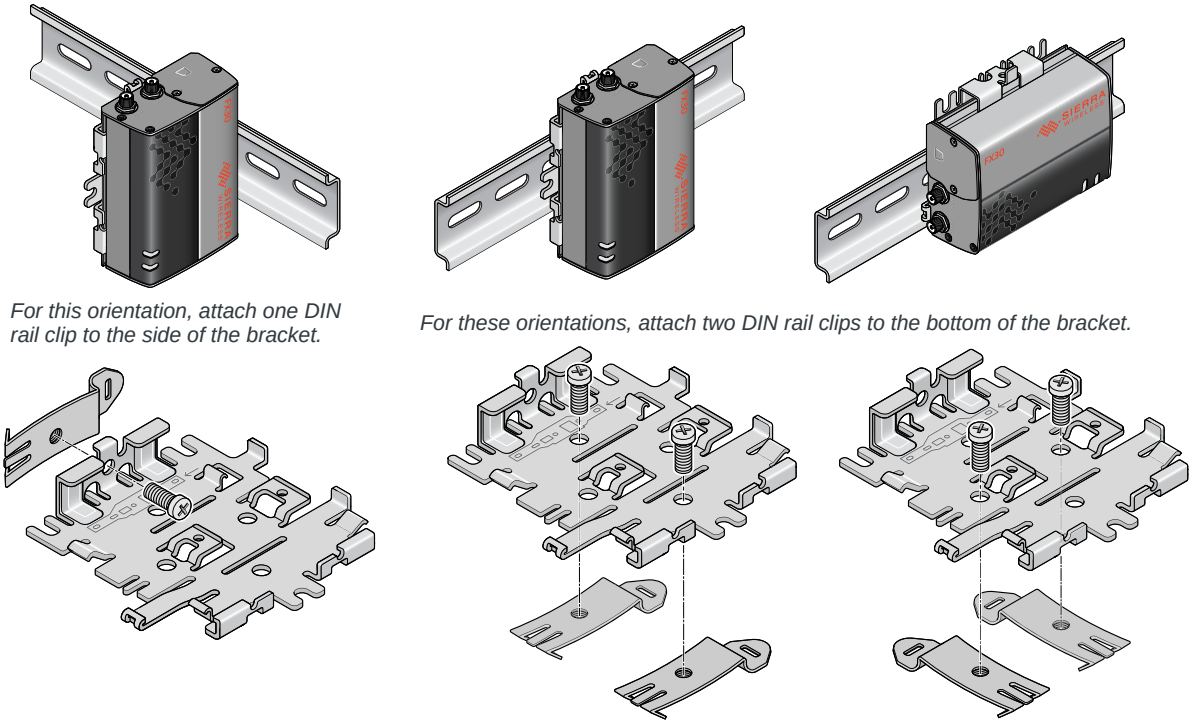


Figure 2-8: Attaching the DIN rail clips

2. Slide or snap the FX30 onto the bracket, as shown in Figure 2-4.
3. If the DIN rails are in a high vibration environment, see Optional—Mounting in a High Vibration Environment on page 14.
4. Attach the FX30 to the DIN Rail. See Figure 2-8.

Replacing Existing Fastrack Supreme or Fastrack Xtend Device

If you are 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 and mounting bracket. See Figure 3-2 on page 43.

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 2-9.

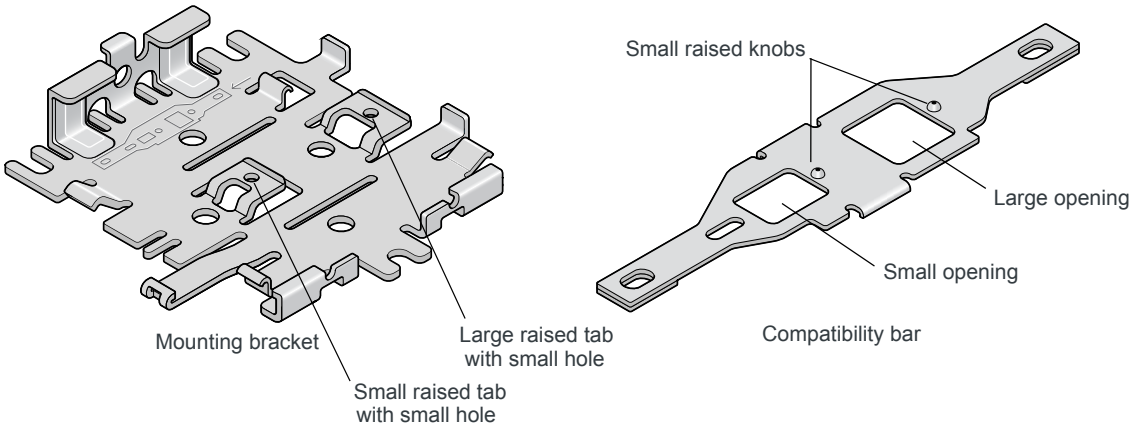


Figure 2-9: Mounting bracket and compatibility bar

2. Orient the mounting bracket and the compatibility bar as shown in Figure 2-10.

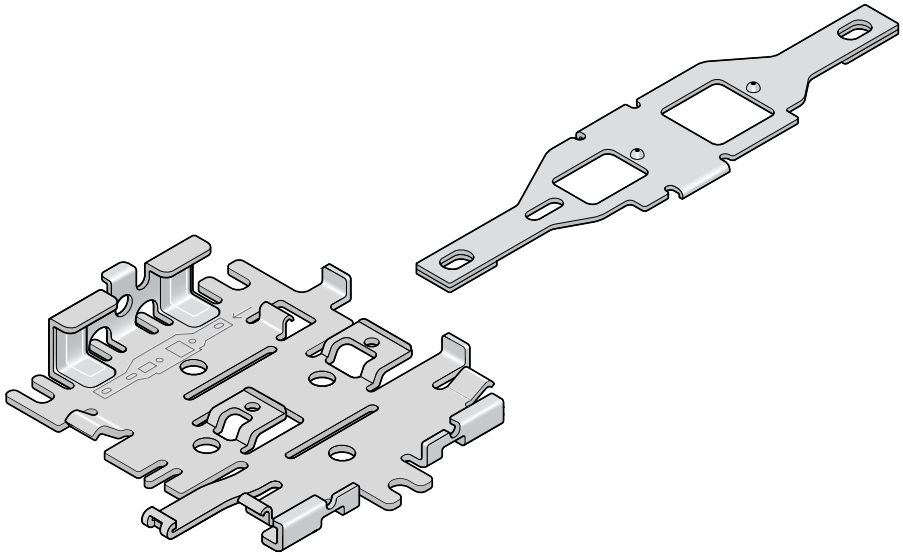


Figure 2-10: Mounting bracket and compatibility bar orientation

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.

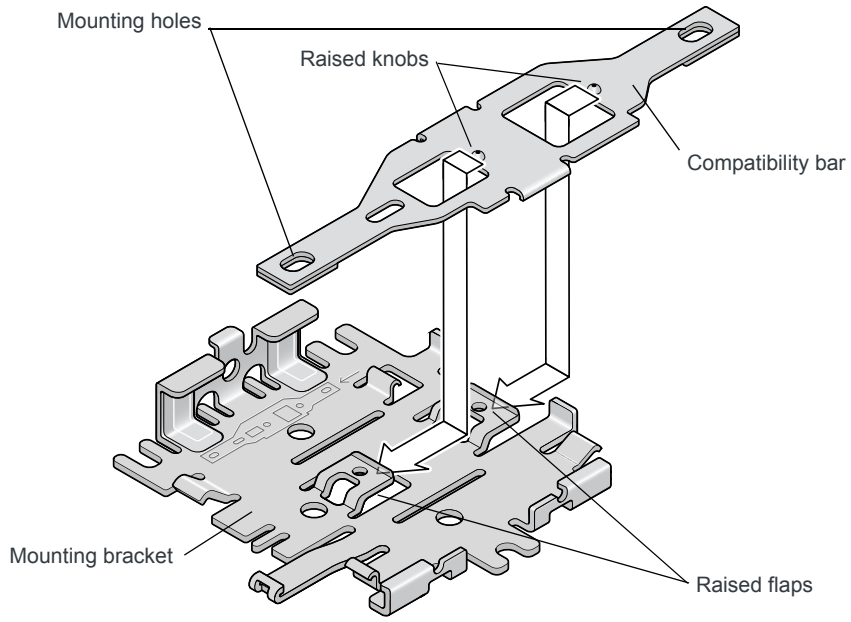


Figure 2-11: Attaching the compatibility bar

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 52.

Note: The antenna should not exceed the maximum gain specified in RF Exposure on page 52. 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.

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: 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.).

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.

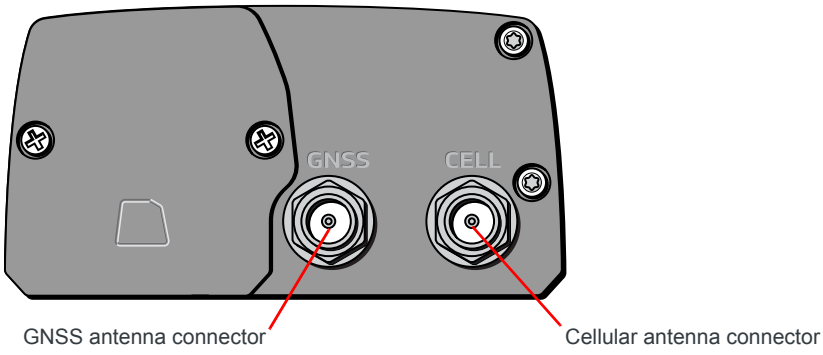


Figure 2-12: Antenna Connectors

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

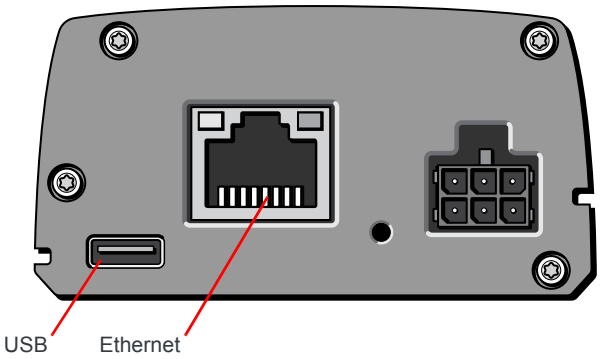


Figure 2-13: Connectors for data cables

Cabling Concerns

Separate the antenna, data, and power cables from other wiring. Route the cables 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 inches) 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. 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. For more information on the DC power cable, see page 55. You can also purchase an optional AC adapter.

Warning: *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 4.75–32 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 and I/O Connections

Table 2-1 describes the functions for the pins on the FX30 power connector. See also I/O Configuration on page 25.

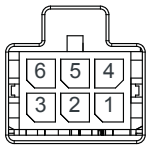


Figure 2-14: FX30 Power Connector

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 × 20 mm) *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.*
2	Ground	Black	(20 AWG) Main device ground

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

Pin	Function	Associated DC Cable Wire Color	Description
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 between power and pin 3. The FX30 is off when this pin is low, but you also have the option to monitor this pin using GPIO 24, and holding the power on while a Legato-designed application executes. For more information, see On/Off Installation on page 23 and OFF Mode on page 44.
4	IO 1	Brown	Digital input Wake from low power modes[a]
			Internal pull-up control
5	IO 2	Green	Digital input Wake from low power modes
			Internal pull-up control
			Analog input
6	IO 3	Orange	Digital input
			Internal pull-up control
			Digital output

Note: See Table D-1, FX30 Hardware Feature to Linux Interface Mapping, on page 71 for the radio module GPIO and Linux interface mapping of pins 3 to 6.

a. For more information on power modes, see Power Modes on page 44.

Wiring Diagrams

In the following diagrams, *FX30* refers to either FX30 and FX30S.

Always On Installation

For an Always On application, connect the wires as shown in Figure 2-15.

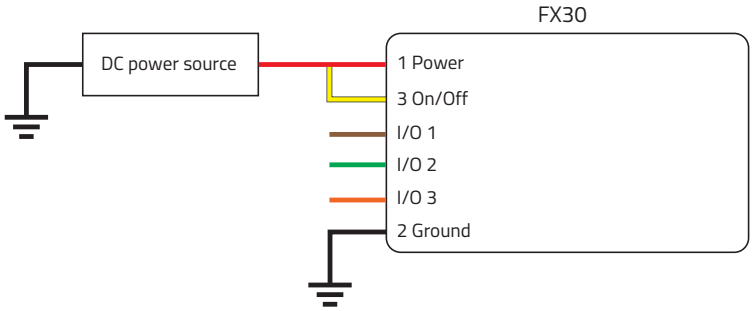


Figure 2-15: Always on installation

- 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 12.
- Pin 3 (On/Off)—Connected to power
- Optional—I/O 1, I/O 2, and I/O 3

Note: See Table D-1, FX30 Hardware Feature to Linux Interface Mapping, on page 71 for the radio module GPIO and Linux interface mapping of pin 3, I/O 1, I/O 2, and I/O 3.

On/Off Installation

For an On/Off application, connect the wires as shown in Figure 2-16 or Figure 2-17.

Note: When using GPIO24 to monitor the ignition state, connect a SPDT switch as shown in Figure 2-16 or an open-collector NPN or PNP transistor with pulldown as shown in Figure 2-17. Otherwise, a switch or transistor is not required.

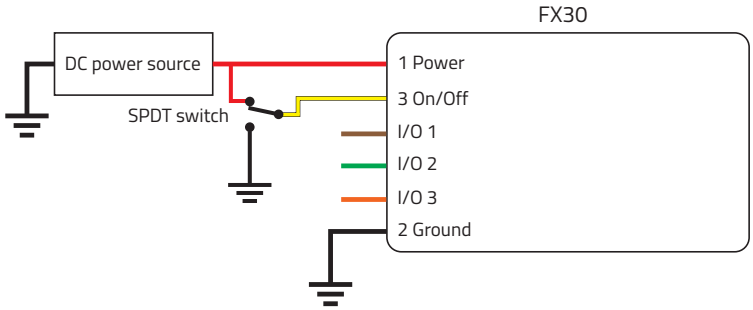


Figure 2-16: On/Off Installation with switch

- 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 12.
- Pin 3 (On/Off)—Connect Pin 3 to the pole of a SPDT switch. Connect the NC throw to power, and the NO throw to ground.

  Pin 3 must be connected.
- Optional—I/O 1, I/O 2, and I/O 3

An On/Off installation may also use a sensor with an open-collector NPN or PNP transistor. The transistor is the switch to turn the FX30 on or off, as shown in Figure 2-17.

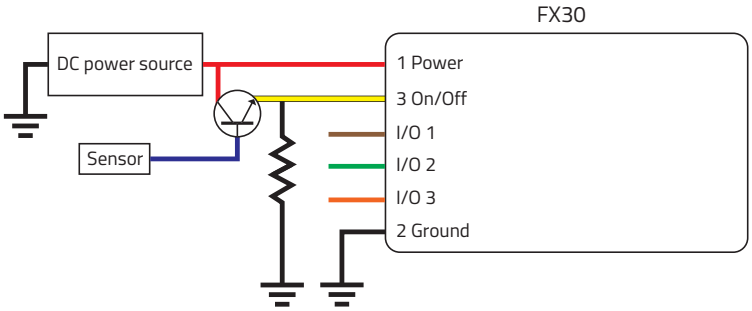


Figure 2-17: On/Off Installation (with sensor and NPN transistor switch)

- Pin 1 (Power)—Use the red wire in the DC cable to connect Pin 1 to the power source and the collector pin of the transistor.
- 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 12.
- Pin 3 (On/Off)—Connect to the emitter pin of the transistor

  Pin 3 must be connected.

Note: When using GPIO24 to monitor the ignition state, if GPIO24 does not read the on/off state correctly and always returns 0, then a 1K external pull-down resistor must be added according to Figure 2-17.

- Optional—I/O 1, I/O 2, and I/O 3

Note: See Table D-1, FX30 Hardware Feature to Linux Interface Mapping, on page 71 for the radio module GPIO and Linux interface mapping of pin 3, I/O 1, I/O 2, and I/O 3.

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 2-18. 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.

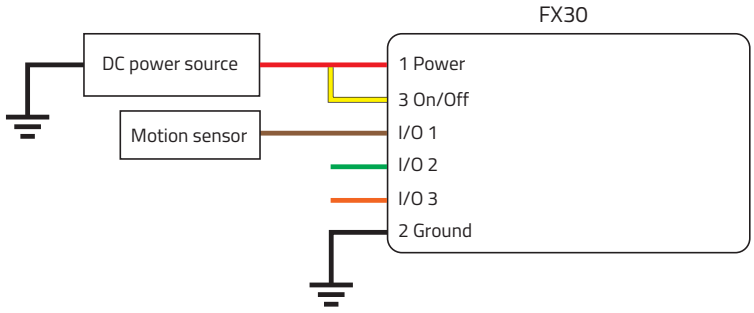


Figure 2-18: Fixed Installation with I/O

- 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 12.
- Pin 3 (On/Off)—Connected to power

  Pin 3 must be connected.
- I/O 1—configured for digital input
- Optional—I/O 2 and I/O 3

Note: See Table D-1, FX30 Hardware Feature to Linux Interface Mapping, on page 71 for the GPIO and Linux interface mapping of pin 3, I/O 1, I/O 2, and I/O 3.

I/O Configuration

The FX30 power connector has three pins you can use for I/O configuration:
- I/O 1—Digital input only; allows wakeup from ultra low power mode
- I/O 2—Digital and analog input; allows wakeup from ultra low power mode
- I/O 3—Digital input and digital output

Note: See Table D-1, FX30 Hardware Feature to Linux Interface Mapping, on page 71 for the GPIO and Linux interface mapping of the I/O pins.

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 26 and Figure 2-19 on page 26.)
- High side pull-ups/dry contact switch inputs
  (See Figure 2-20 on page 27.)
- Analog inputs
  (See Table 2-3 on page 28 and Figure 2-22 on page 28.)
- Low side current sinks
  (See Figure 2-23 on page 28.)
- Digital outputs/open drains
  (See Table 2-4 on page 29 and Figure 2-24 on page 29.)

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

Digital Input

Digital input is available on I/O 1, I/O 2, and I/O 3 on the power connector.

Note: To use I/O 3 as a digital Input, GPIO56 (that drives I/O 3 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.

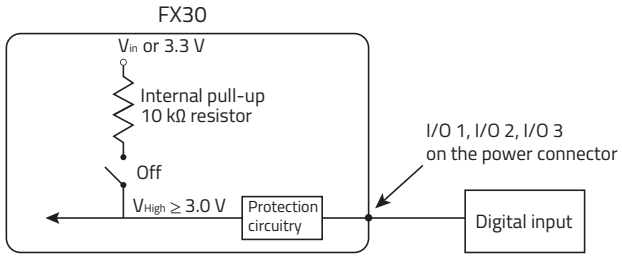


Figure 2-19: Digital Input

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

Table 2-2: Digital Input Voltage Ranges

Pull-up	State	Normal Min.	Normal Max.	Normal Input Impedance	Extended Min.	Extended Max.	Leakage Current in Extended Range
Off	Low	-33.0 V	+1.0 V	>150 kOhm	-36.0 V	—	1 mA max.
	High	+3.0 V	+33.0 V		—	+36.0 V	

High Side Pull-up / Dry Contact Switch Input

The three external I/O pins on the FX30 power connector have a high side pull-up available. This high side pull-up can be driven low using a dry contact switch or NPN/PNP transistor.

To use I/O 3 as a high side pull-up/switch input, GPIO56 (that drives I/O 3 when used as a digital output) must be low.

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

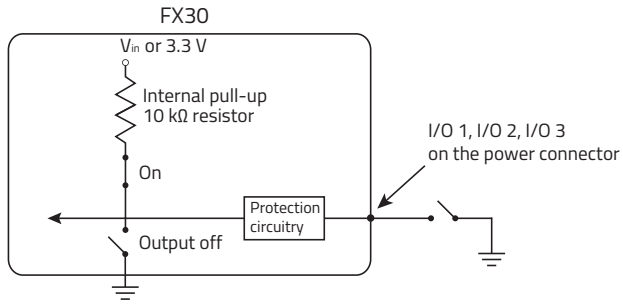


Figure 2-20: High Side Pull-up / Dry Contact Switch Input

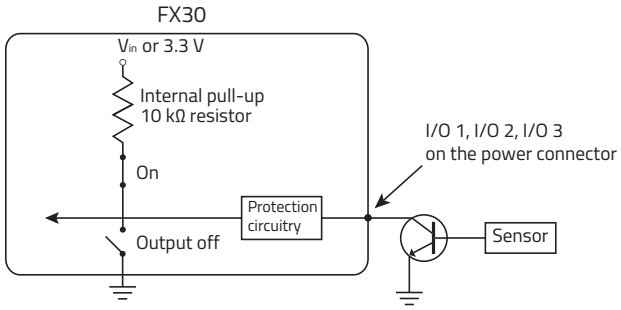


Figure 2-21: High Side Pull-up / Sensor and Transistor Input

Analog Input

Two analog inputs are available on the FX30. External I/O 2 on the power connector maps to ADC1 on the WP module. For more information, see Table D-1, FX30 Hardware Feature to Linux Interface Mapping on page 71.

The IoT interface analog pin maps to ADC0 on the WP module. For more information, see Table 3-13, IoT Connector Interface on page 51.

You can connect either 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 0 V–10 V. 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.

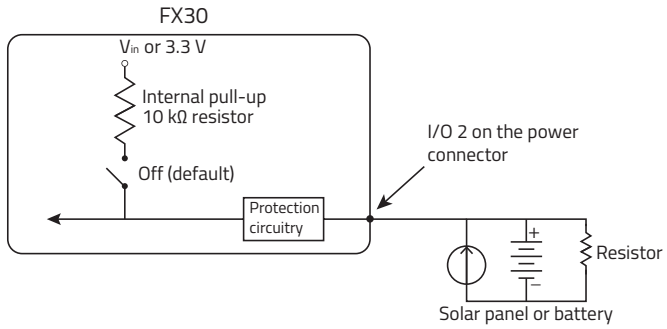


Figure 2-22: Analog Input

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

Table 2-3: Analog Input

Pull-up		Minimum	Typical	Maximum	Units
Off	**Analog Input Range**	0	—	10	V
	Analog Input Precision	—	< 10	25	mV

Low Side Current Sink Output

Low side current sink output, for example to drive a relay, is only available using I/O 3 on the power connector.

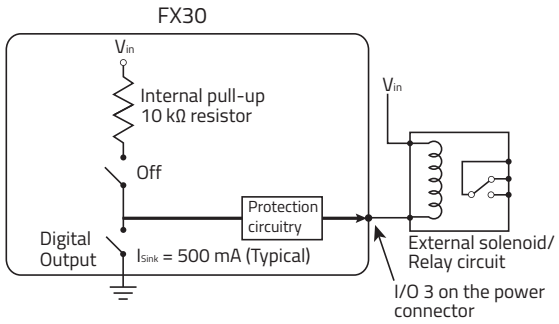


Figure 2-23: Low Side Current Sink

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/O 3 on the power connector.

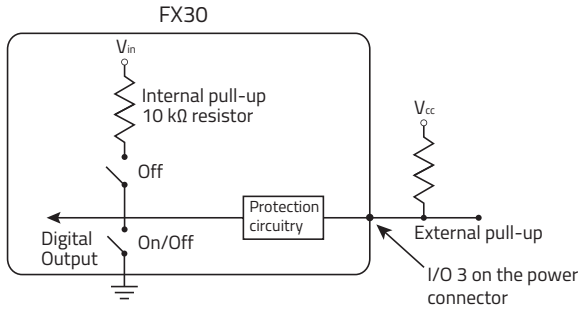


Figure 2-24: Digital Output/Open Drain

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 21 for details.)

LED Behavior

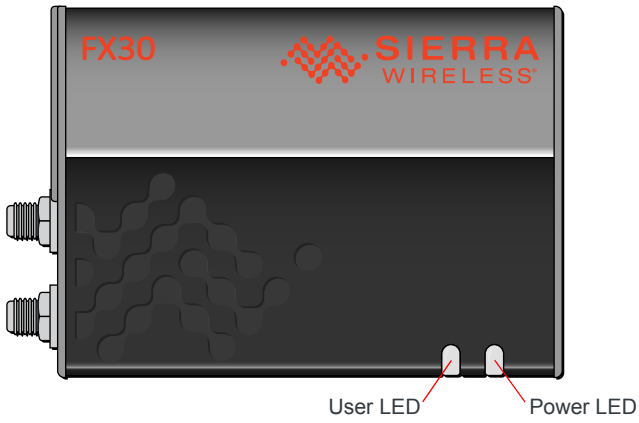


Table 2-5: LED Behavior

LED	Color/Pattern	Description
Power (Default Behavior) *Note: Based on three GPIOs. To define the behavior of this LED, see Power LED on page 72.*	**Off**	No power or input voltage ≥ 32 VDC or ≤ 4.75 VDC
	Solid Red	Gateway is powered on, not attached to cellular network.
	Solid Amber	Attached to cellular network.
User *Note: Based on two GPIOs. To define the behavior of this LED, see User LED on page 72.* *Note: You can write Legato applications to define User LED behavior.*	**Possible colors:** • Red • Green • Amber	User-defined behavior

Ethernet LEDs

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

- Right LED – Activity (blinking amber)
- Left LED – Connection speed (green indicates a 100 Mbps link, and off indicates no cable is connected or a 10 Mbps link is detected).

Step 7—Use the FX30

You can use the FX30 as:

- A USB modem—You can use the FX30 as a USB bitpipe modem based on the Qualcomm proprietary RMNET interface. This can be done through AT commands using AT!SCACT to open and close the data session. For more information and a detailed example, see Using the FX30 as a USB Modem on page 59.
- An embedded cellular platform for IoT applications—Use AT commands, Linux shell commands, or Legato to configure/program. See page 31.

Using the FX30 as an Embedded Platform for IoT Applications

To configure or program the FX30, you can use:

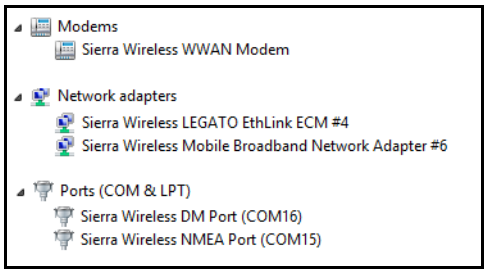
- AT Commands—see AT Commands Reference on page 62
- Linux Shell Commands—see Setup for Linux Shell Commands on page 32
- Legato Application Framework—Legato Application Framework on page 34

Setup for Windows

The following steps assume you have installed the USB drivers for WP Series modules, available from http://source.sierrawireless.com/devices/fx-series/FX30/ (in the Software section under Windows drivers).

To set up the FX30 for use with Windows:

1. Power up the FX30 and connect it to a USB port on the computer.
2. The FX30 appears in Windows Device Manager as shown below.



   - Under **Modems**, **Sierra Wireless WWAN Modem** appears. This is the COM port for communicating with the modem via AT commands.
     - To view the COM port number, right-click the modem name, select Properties, and then select the Modem tab.
   - **Sierra Wireless LEGATO Ethlink ECM** is the Ethernet network adapter over USB, which allows you to SSH to the FX30.
   - The **Sierra Wireless DM Port** is a serial port that allows firmware updates via external tools.
   - The **Sierra Wireless NMEA Port** is a serial port that outputs GPS information.
3. Open a terminal emulator program such as Tera Term.
4. Connect to the AT command port. Set the terminal program com port to match the port number you found for the Sierra Wireless WWAN Modem. You should now be

able to issue AT commands to the modem. If the connection fails, check the serial port settings.

5. Use the terminal program to SSH to root@192.168.2.2 and establish a secure shell connection, The first time you connect, you are prompted to change your Linux root password.

Note: Ensure that you create an effective password that is longer than eight characters, and uses special characters, numbers, and upper and lower case characters.

Useful AT Commands

The radio module for the FX30 is the Sierra Wireless AirPrime® WP8548, WP7607-1, or WP7702. Useful radio module AT commands include:

- Test AT command interface: `AT` should answer OK
- Get device information: `ATI`
- Get SIM status: `AT+CPIN?`
- Enter SIM PIN code: `AT+CPIN=XXXX`
- Configure APN: `AT+CGDCONT=1,"IP","xxxxxx.xxx"`
- Check APN configuration: `AT+CGDCONT?`
- Check signal quality: `AT+CSQ`
- Check network registration: `AT+CREG?`
- Check GPRS network registration: `AT+CGREG?`
- Check operator selected: `AT+COPS?`
- Check for PDP context status: `AT+CGACT?`
- Check for modem status: `AT!GSTATUS?`
- Open a LWM2M session to connect AirVantage: `AT+WDSS=1,1`

Warning: *Do not use the AT+KSIMSEL command with the FX30. This command has the capability of asserting GPIO6 when setting the <sim_slot> parameter to 1, causing the FX30 to malfunction.*

Setup for Linux Shell Commands

You can communicate with the FX30 using Legato shell commands. Before beginning, install a Linux terminal application such as minicom or microcom.

To connect to the USB port on the Linux shell:

1. Connect the USB port on the FX30 to the computer.

   In Linux, the AT command port and NMEA port are USB serial devices located at /dev/ttyUSBx where x is the serial device number in the order it was connected. X depends on the number of USB serial devices you have connected.

2. Connect an SSH client root@192.168.2.2

   The first time you connect, you are prompted to change your Linux root password.

For more information, refer to the Legato shell documentation on legato.io

Useful Linux commands

Useful Linux commands include:

- Get device information: `cm info`
- Get SIM information: `cm sim`
- Get APN status: `cm data`
- Get modem status: `cm radio`
- Switch to AT mode: `microcom -E /dev/ttyAT`
  <CTRL +x> to escape
- Read GPIO Value: `cat /sys/class/gpio/gpioxx/value`
- Set GPIO: `echo 1 > /sys/class/gpio/gpioxx/value`
- Clear GPIO: `echo 0 > /sys/class/gpio/gpioxx/value`
- Establish a data connection: `cm data connect`
- Check Legato application status: `app status`

For a complete list of Linux commands, see:
http://legato.io/legato-docs/latest/toolsTarget_cm.html

Here are some Linux shell command examples for GPIOs:

Table 2-6: Linux shell command examples

To...	Use...
Turn on the green User LED	echo 0 > /sys/class/gpio/gpio48/value
Turn off the green User LED	echo 1 > /sys/class/gpio/gpio48/value
Read the push button state	cat /sys/class/gpio/gpio7/value
Read the analog input value (in µV)	cat /sys/class/hwmon/hwmon0/device/mpp_05

Linux Interface Mapping

Table 2-7: FX30 Interface Mapping to the Linux Interface

FX30 Interface	Linux System
GPIOs	/sys/class/gpio/gpioxx
Ethernet (FX30 only)	eth0[a]
USB	usb0[b]
Serial (FX30S only)	/dev/ttyHSL0

a. eth0 has a default IP address of 192.168.13.31
b. usb0 is a network interface and has a default IP address of 192.168.2.2

Linux Startup

The supported method of making changes to the Linux startup is to create a Legato application. Changes or additions to the Linux scripts in `/etc/rcS.d` are not supported by Sierra Wireless.

Reconfiguring the Firewall

For information about reconfiguring the firewall, see the Application Note *FX30: Network Interfaces and Firewall Rules* (document number 41111930), available on the Source.

Managing the I/O Interface

To manage the I/O interfaces such as digital and analog I/Os, LEDs, push button, and hardware settings driven by GPIO, you can use:

- AT commands (see Managing the I/O Interface with AT Commands on page 62)
- Linux shell commands (see FX30 Linux Interface and GPIO Mapping on page 70)
- Legato Application Framework
  - To use existing Legato tools, see docs.legato.io/latest/tools.html
  - If you are interested in building your own Legato apps, see docs.legato.io/latest/getStarted.html

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
- Security— For security reasons:
  - You are prompted to change the Linux root password the first time you attempt to log in to the Linux console.
  - By default, all routes on the Ethernet and cellular interfaces are disabled. To reconfigure the firewall to allow these connections, see Reconfiguring the Firewall on page 34.

Other references:

- Download the Legato Reference Manual (PDF) from source.sierrawireless.com/resources/legato/referencemanual
- View the Legato online documentation

AirVantage Device Management

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 the FX30.

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

Octave

FX30 Octave is the all-in-one Edge-to-Cloud solution for connecting industrial assets. Using Octave, you can securely extract, orchestrate, and act on data from industrial assets to the cloud. Octave enables you to:

- Extract data from different types of industrial equipment and via popular industrial protocols
- Organize data and control data streams from the edge to the cloud
- Manage assets and update applications from the cloud as business needs change
- Protect your data from the edge to the cloud even as new threats emerge

For more information on Octave, please visit sierrawireless.com/octave.

Reset to Factory Default Settings

Warning: *Resetting the gateway to the factory default settings will remove all customized configuration settings in /etc and /data, including the root password.*

Warning: *Performing a factory reset could result in your FX30 no longer automatically connecting to AVMS. If you perform a factory reset, please issue the AT command AT+WDSC=3,60 to ensure your device checks in to AVMS every 60 minutes.*

To reset the FX30 to the factory default settings:

1. Ensure that the Recovery Activation status is set to Enable. (See Factory Reset AT Commands on page 68.)
2. Upon applying power, press and hold the reset button for about 10 seconds.

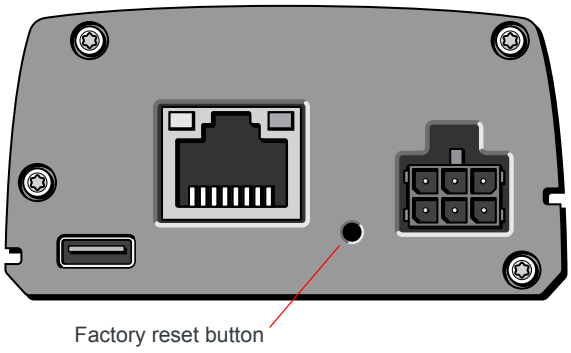


Figure 2-25: Factory reset button

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
Mobile Network Operator Certification (pending)		• AT&T (planned)

Table 3-1: Specifications (Continued)

Network Technology	**LTE, HSPA+ GSM/GPRS/EDGE**	For lists of supported bands, see Radio Frequency Bands on page 38.
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 IoT Expansion Card on page 48.
SIM Card Interface		• Mini-SIM (2FF) SIM card operated at 1.8 V/3.3 V.
Input/Output For more information, see page 25.		• 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 30.		2 LEDs: • Power • User configurable
Mechanical Specifications For mechanical drawings, dimensions, and weight, see Mechanical Specifications on page 42.		• 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 • BeiDou (WP7607/WP7702 only)
	GNSS Message Protocol	NMEA
	Standalone Time to First Fix (TTFF)	• Hot start: 1 second • Warm start: 29 seconds • Cold start: 32 seconds
	Sensitivity	Standalone 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 Radio Module WP8548

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 6	830–840 MHz	875–885 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: FX30 Radio Module WP7607-1

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
LTE	Band 1	1920–1980 MHz	2110–2170 MHz
	Band 3	1710–1785 MHz	1805–1880 MHz
	Band 7	2500–2570 MHz	2620–2690 MHz
	Band 8	880–915 MHz	925–960 MHz
	Band 20	832–862 MHz	791–821 MHz
	Band 28	703–748 MHz	758–803 MHz
HSPA+	Band 1	1920–1980 MHz	2110–2170 MHz
	Band 8	880–915 MHz	925–960 MHz
GMS/GPRS/EDGE	900	880–915 MHz	925–960 MHz
	1800	1710–1785 MHz	1805–1880 MHz

Table 3-4: FX30 Radio Module WP7702

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
LTE	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
	Band 12	699–716 MHz	729–746 MHz
	Band 13	777–787 MHz	746–756 MHz
	Band 17	704–716 MHz	734–746 MHz
	Band 18	815–830 MHz	860–875 MHz
	Band 19	830–845 MHz	875–890 MHz
	Band 20	832–862 MHz	791–821 MHz
	Band 26	814–849 MHz	859–894 MHz
	Band 28	703–748 MHz	758–803 MHz

Table 3-4: FX30 Radio Module WP7702

Radio Technology	Band	Frequency (Tx)	Frequency (Rx)
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 3-5: GNSS Bands Supported

Band	Frequency
GPS L1	1575.42 MHz
GLONASS L1 FDMA	1602 MHz
Galileo E1	1575.42 MHz
BeiDou (WP7607-1/WP7702 only)	1561.098

Radio Module Conducted Transmit Power

The following tables provide radio module conducted transmit power specifications.

Table 3-6: Radio Module WP8548 Conducted Transmit Power

Band	Conducted Tx Power (dBm)	Notes
HSPA+		
Band 1 (IMT 2100 12.2 kbps) Band 2 (HSPA+ 1900 12.2 kbps) Band 5 (HSPA+ 850 12.2 kbps) Band 6 (HSPA+ 800 12.2 kbps) Band 8 (HSPA+ 900 12.2 kbps) Band 19 (HSPA+ 850 12.2 kbps)	+23±1	Connectorized (Class 3)
GSM/GPRS/EDGE		
GSM 850	+32±1	GMSK mode, connectorized (Class 4, 2 W; 33 dBm)
E-GSM 900	+32±1	
DCS 1800	+29±1	GMSK mode, connectorized (Class 1, 1 W; 30 dBm)
PCS1900	+29±1	
GSM 850	+26.5±1	8PSK mode, connectorized (Class E2; 0.5 W; 27 dBm)
E-GSM 900	+26.5±1	
DCS 1800	+25.5±1	8PSK mode, connectorized (Class E2; 0.4 W; 26 dBm)
PCS1900	+25.5±1	

Table 3-7: Radio Module WP7607-1 Conducted Transmit Power

Band	Conducted Tx Power (dBm)	Notes
LTE		
Bands 1, 3, 7, 8, 20, 28	+23±1	Connectorized (Class 3)
HSPA+		
Band 1 Band 8	+23±1	Connectorized (Class 3)
GSM/GPRS/EDGE		
E-GSM 900	33+1/-2	GMSK mode, connectorized (Class E4; 2 W; 33 dBm)
	27±2.5	8PSK mode, connectorized (Class E2; 0.5 W; 27 dBm)
DCS 1800	30+1/-2	GMSK mode, connectorized (Class 1, 1 W; 30 dBm)
	26±2.5	8PSK mode, connectorized (Class E2; 0.4 W, 26 dBm)

Table 3-8: Radio Module WP7702 Conducted Transmit Power

Band	Conducted Tx Power (dBm)	Notes
LTE		
Bands 1, 2, 3, 4, 5, 8, 12, 13, 17, 18, 19, 20, 26, 28	+23±1	
GSM/GPRS/EDGE		
GSM 850	+32±1	GMSK mode (Class 4; 2 W, 33 dBm)
	+27±1	8PSK mode (Class E2; 0.5 W, 27 dBm)
E-GSM 900	+32±1	GMSK mode (Class 4; 2 W, 33 dBm)
	+27±1	8PSK mode (Class E2; 0.5 W, 27 dBm)
DCS 1800	+29±1	GMSK mode (Class 1; 1 W, 30 dBm)
	+26±1	8PSK mode (Class E2; 0.4 W, 26 dBm)
PCS 1900	+29±1	GMSK mode (Class 1; 1 W, 30 dBm)
	+26±1	8PSK mode (Class E2; 0.4 W, 26 dBm)

Mechanical Specifications

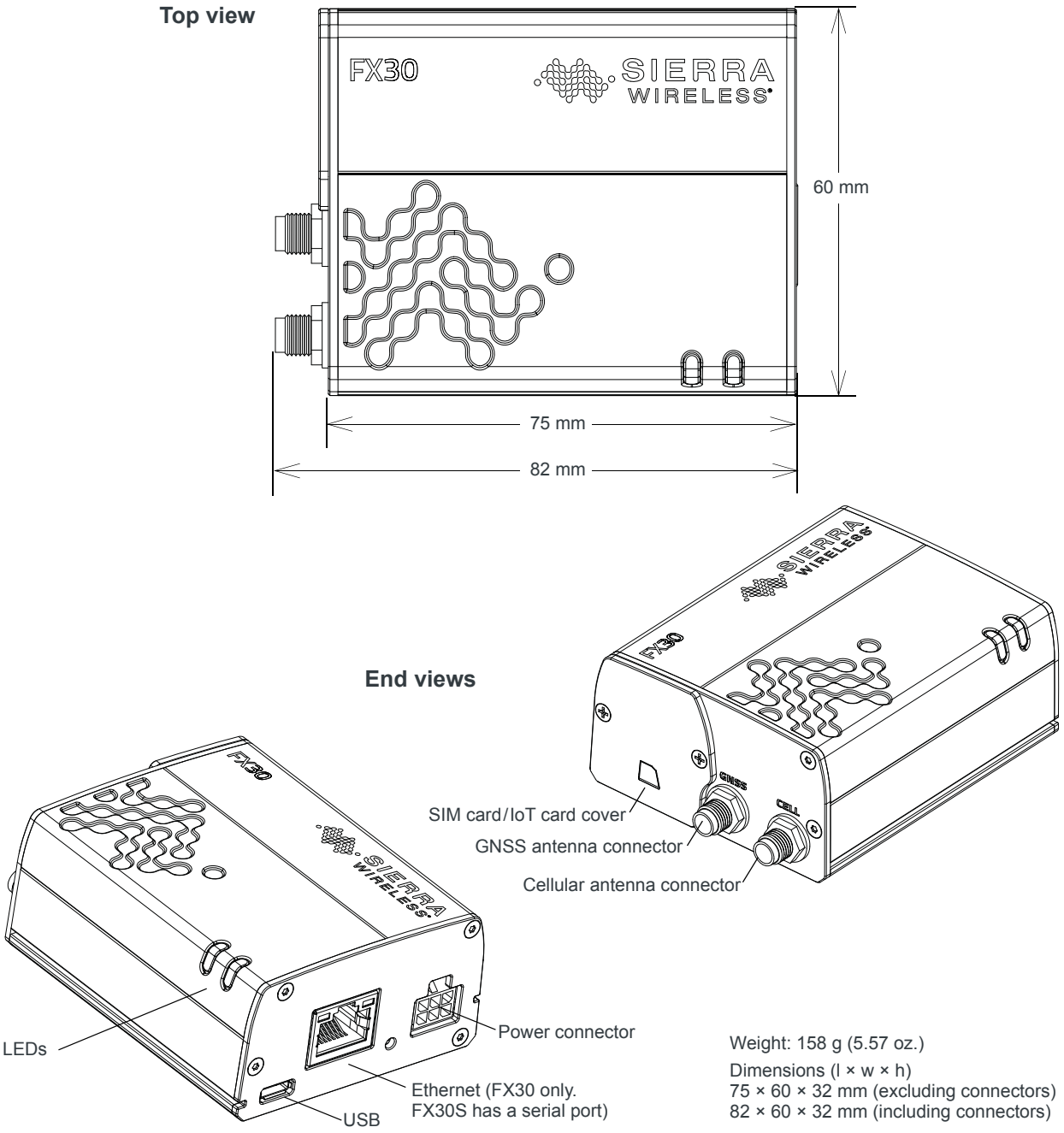


Figure 3-1: FX30 Mechanical Specifications

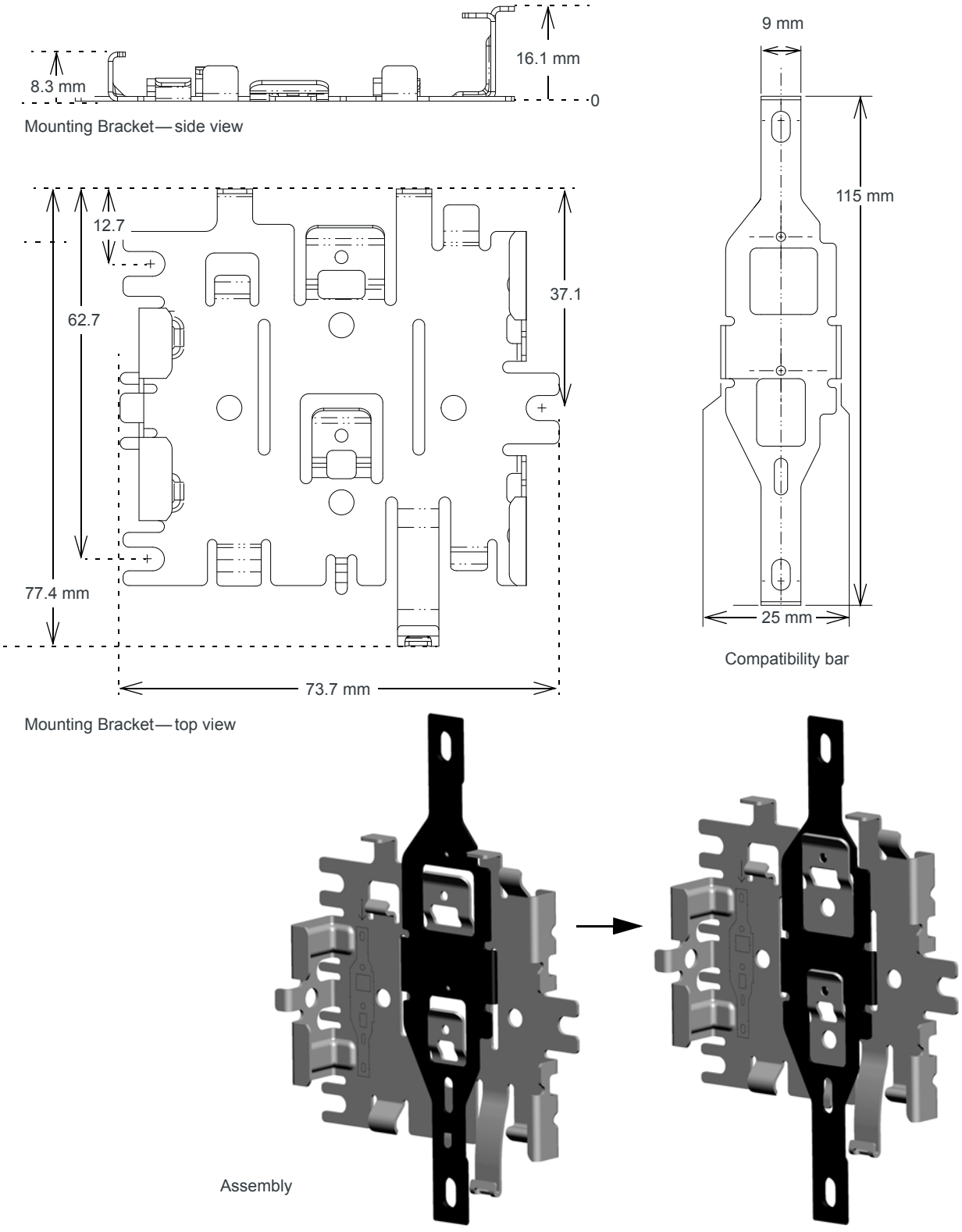


Figure 3-2: Mounting Bracket Mechanical Specifications

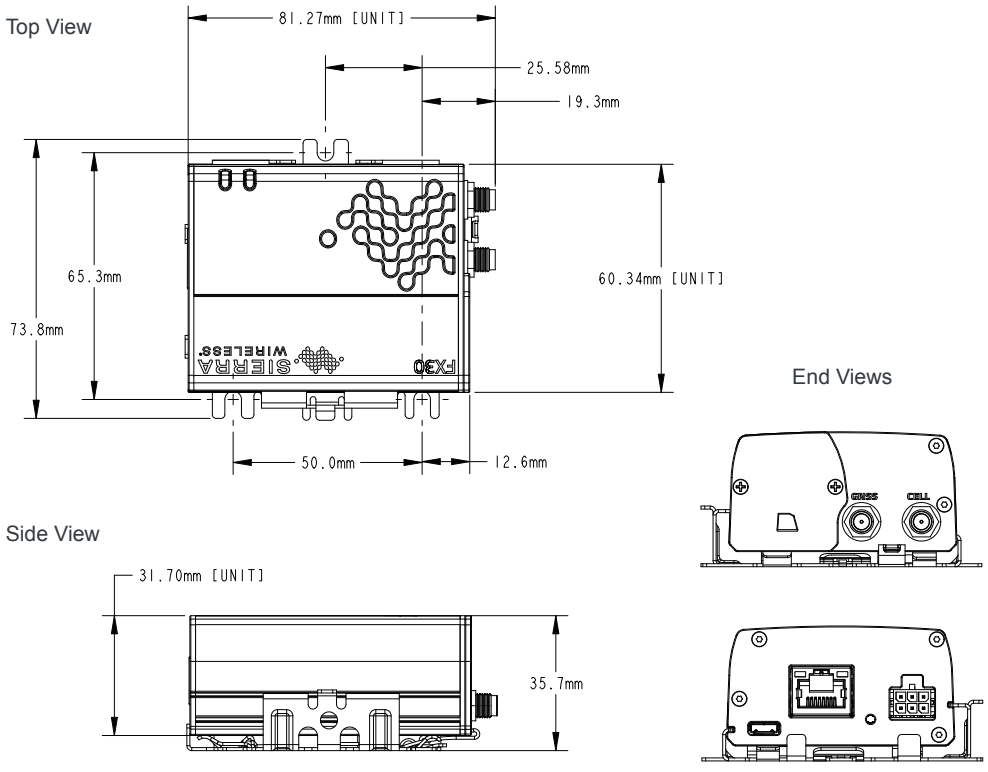


Figure 3-3: FX30 on mounting bracket

Power Modes

The FX30 is designed to handle extremely low power. It has three power modes:

- OFF Mode
- Ultra Low Power Mode on page 45
- Active Mode on page 46

OFF Mode

In Off mode, the FX30 application processor, WWAN radio, and low power micro-controller are off. On/Off is controlled by Pin 3/GPIO24 (On/Off) and GPIO58 (Power Hold).

If no Legato applications are in place for GPIO58 (power hold), the gateway is off when Pin 3 is low and on when Pin 3 is high. Note that the GPIO24 input signal is inverted (Pin 3 low = GPIO24 high, Pin 3 high = GPIO24 low).

However, the power line from Pin 3 is also connected to GPIO58 (power hold). GPIO58 is low by default. If either Pin 3 or GPIO58 is high, the gateway is on. GPIO24 monitors Pin 3. (See Figure 3-4 on page 45.) This gives you the option to design an application that detects when Pin 3 goes low, and holds the power on temporarily to complete the desired actions prior to the gateway turning off, for example, a graceful shutdown process or a “last-gasp”-type feature.

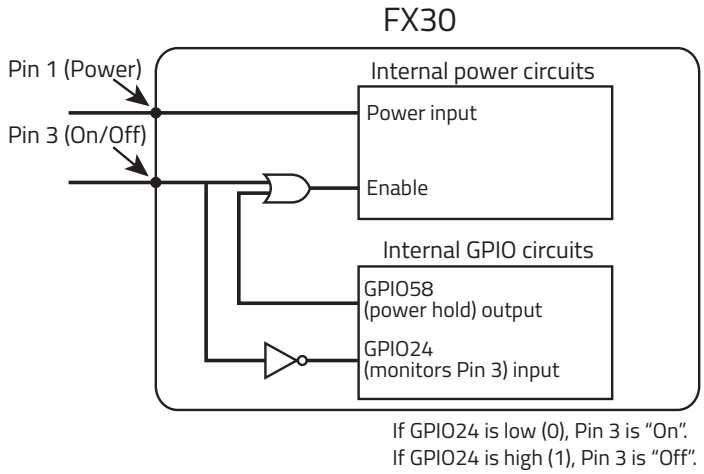


Figure 3-4: FX30 On/Off functionality

Typical wake-up time before network attach is 15 seconds.

Ultra Low Power Mode

In Ultra Low Power Mode (ULPM), the FX30 application processor and WWAN radio are off.

FX30 can be put into ULPM using the "pmtool shutdown" Legato command or the Ultra Low Power Mode Legato API. Typical wake-up time (including boot and network attach) is 60 to 90 seconds.

The low power micro-controller monitors the following wakeup triggers:

- Timer—The timer wakeup must be configured prior to the gateway entering ULPM. You can use the Legato Timer API or the Legato Power Management tool (pmtool) command to configure wakeup from ULPM.

  Note: The ULPM timer starts when the shutdown command is executed. The FX30 shutdown process can take up to 30 seconds to complete. For example, if the ULPM timer is set for 60 seconds, Ultra Low Power Mode begins after 30 seconds, and the FX30 wakes up after an additional ~30 seconds. If the ULPM timer is set to less than 30 seconds, the FX30 may wake up immediately.

- Digital Inputs I/O 1 and I/O 2—I/O wakeup must be configured prior to the gateway entering ULPM. I/O 2 must also be connected to ground. You can use the Legato Power API or pmtool command to configure wakeup from ULPM.

  Note: The external digital I/O 1 and I/O 2 are routed to two sets of pins on the WP module. Each I/O is routed to a standard digital input as well as ULPM wakeup. See Table D-2 on page 73.

Active Mode

In Active mode the FX30 application processor is running and the modem is operating in one of the following modes:

- Full function—The application processor is fully functional and the WWAN radio is on; the GNSS radio can be turned on/off.
- Idle—The application processor is fully functional and the WWAN radio is on. The module is registered on the network, but there is no active connection; the GNSS radio can be turned on/off.
- Airplane mode—The application processor is fully functional and the WWAN radio is off; the GNSS radio can be turned on/off. By default the GNSS radio is on.

Depending on the application, you can lower power consumption by disabling the Ethernet interface using GPIO55 (see Table D-1 on page 71).

Note: GPS bias cannot be disabled to lower power consumption. The Legato command "gnss disable" only disables the GPS within the WP module.

Power Consumption

Table 3-9: Power Consumption—Active Mode FX30 3G (WP8548)

Mode	Conditions	Voltage	Max continuous		Burst	
		V	mA	mW	mA	mW
Active Idle	USB and Ethernet cables are plugged in	24	40	960		
		12	74	888		
		4.5	180	810	208	936
Active Full Function HSPA+	Max Tx power (+23 dBm) USB 70 Mbps Ethernet 55 Mbps	24	138	3312	145	3480
		12	265	3180	270	3240
		5	604	3020	645	3225
Active Full Function GSM	Max Tx power (+31 dBm) USB 70 Mbps Ethernet 55 Mbps	24	110	2640	308	7392
		12	212	2544	600	7200
		5	550	2750	1670	8350

Table 3-10: Power Consumption—Active Mode FX30 Cat-1 (WP7607-1)

Mode	Conditions	Voltage	Max continuous		Burst	
		V	mA	mW	mA	mW
Active Idle	USB and Ethernet cables are plugged in	24	94	2254	TBD	
		12	183	2195	TBD	
		4.5	439	1977	TBD	
Active Full Function LTE	Max Tx power (-18 dBm) USB 103 Mbps Ethernet 85 Mbps	24	112	2680	TBD	
		12	209	2511	TBD	
		4.5	542	2441	TBD	

Table 3-11: Power Consumption—Active Mode FX30 Cat-M (WP7702)

Mode	Conditions	Voltage	Max continuous		Burst	
		V	mA	mW	mA	mW
Active Idle	USB and Ethernet cables are plugged in	24	56	1364	236	5672
		12	114	1371	532	6382
		4.5	254	1141	1339	6027
Active Full Function GSM	Max Tx power (+33 dBm) USB 110 Mbps Ethernet 94 Mbps	24	195	4686	274	6584
		12	357	4282	622	7461
		4.5	918	4133	1560	7022
Active Full Function LTE	Max Tx power (+23 dBm) USB 110 Mbps Ethernet 94 Mbps	24	174	4184	290	6971
		12	319	3824	658	7900
		4.5	820	3690	1652	7435

Table 3-12: Power Consumption — Off and Ultra Low Power Modes (all FX30 variants)

Mode	Conditions	Voltage	Maximum continuous	
		V	µA[a]	µW
Off	On/Off is set to Off	24	71	1697
		12	36	436
		5	16	78
Ultra Low Power	Triggering timer	24	351	8414
		12	172	2059
		5	168	842

a. The FX30 protection circuitry results in the increase in current as voltage increases.

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

For IoT Expansion Card Developers

When developing an IoT Expansion card to use with the FX30, be aware that the distance between the front SMA end plate and PCA front edge is 1.89 mm.

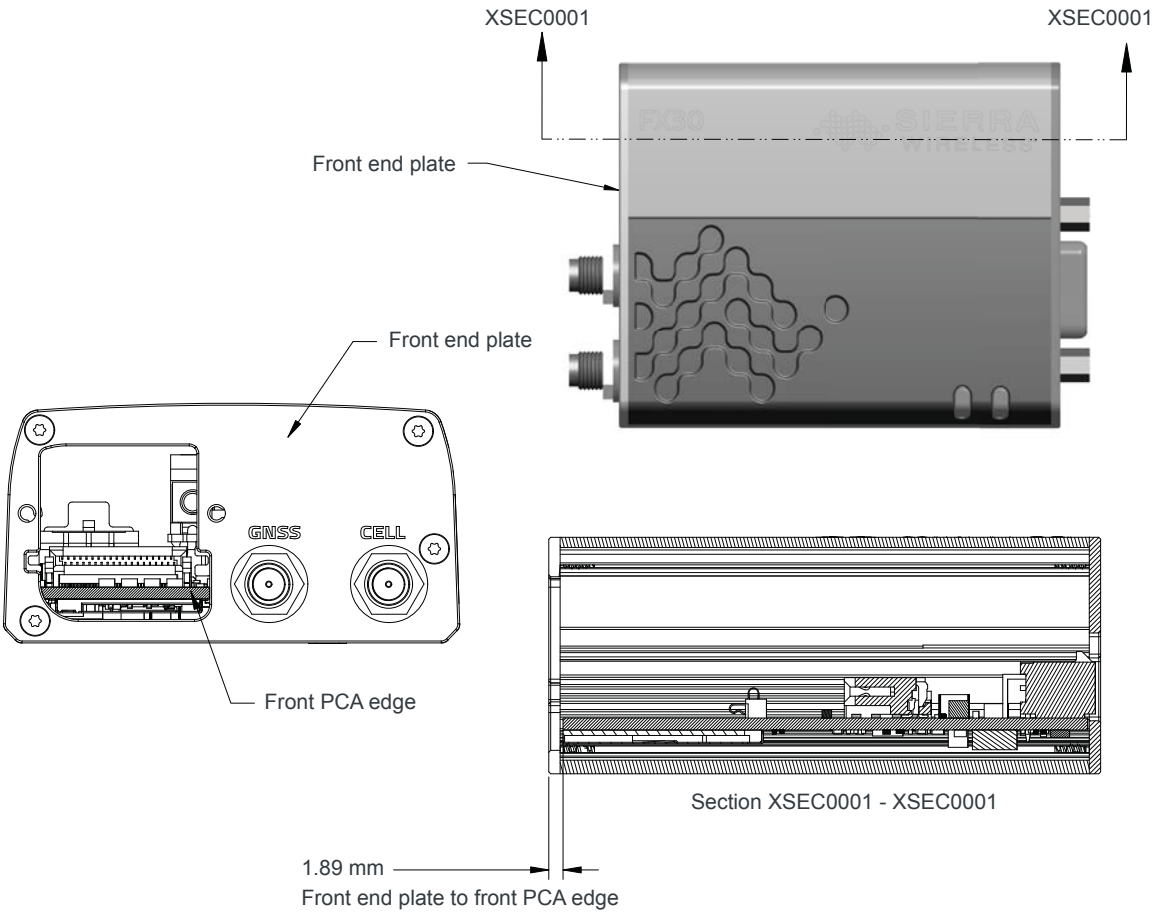


Figure 3-5: IoT Expansion Card Alignment

Pin-out Information

For complete pin-out information, refer to the IoT Expansion Card Design Specification.

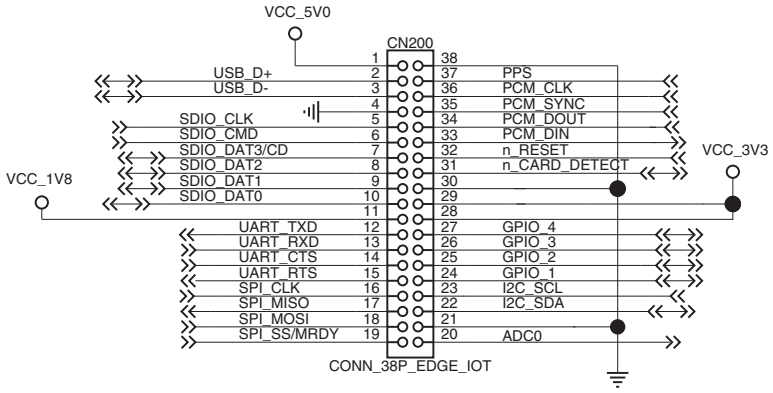


Figure 3-6: IoT Expansion Card Pin Configuration—IoT Expansion Card View

IoT Connector Interface

Table 3-13: IoT Connector Interface

IoT Connector Signal	FX30 Hardware Peripheral	Linux Interface
GPIO1	GPIO42	/sys/class/gpio/gpio42
GPIO2	GPIO33	/sys/class/gpio/gpio33
GPIO3	GPIO13	/sys/class/gpio/gpio13
GPIO4	GPIO8	/sys/class/gpio/gpio8
Iot_DETECT	GPIO25	/sys/class/gpio/gpio25
USB	Hub on HSIC WP interface, mounted on ttyUSB0	/dev/ttyUSB0
SDIO	SDIO	/dev/mmcblk0
UART	UART2	/dev/ttyHSL1
SPI	SPI1	/dev/spidev1.0[a]
ADC	ADC0	/sys/class/hwmon0/device/mmp_01 (in uV units) (WP85)
		/sys/devices/qpnp-vadc-8/mpp2_div1 (WP76/77)
PCM	PCM	/proc/asound and /dev/snd
I2C	I2C1	/dev/i2c-0 (WP85)
		/dev/i2c-4 (WP76/77)

a. For SPI, 3G version R12.x supports the /dev/sierra_spi device.
3G versions R13.1 and R14 support the /dev/spidev device; however, there is a known issue. Please follow the Legato guide: https://docs.legato.io/17_08/howToSPI.html
Cat1 version R10.1 supports the /dev/spidev device; however, the spisvc kernel module must be manually loaded: `insmod /mnt/legato/system/modules/spisvc.ko`
See the Customer Release Notes for more details.
CatM version R9.1 supports the /dev/spidev device; however, the spisvc kernel module is not present and needs to be manually copied to the device.

Note: If you develop an IOT card and use the UART in a hardware loop-back mode by connecting the transmit and receive signals, do not configure UART2 in Linux Console mode (AT!MAPUART=16,2).

4: Regulatory Information

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 tables:

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

Device	Frequency Band	FCC ID/IC Number N7NWP76A/2417C-WP76A Maximum Antenna Gain (dBi)
Sierra Wireless FX30	4	6
	13	6

Device	Frequency Band	FCC ID/IC Number N7NWP76C/2417C-WP76C Maximum Antenna Gain (dBi)
Sierra Wireless FX30	2	6
	4	6
	5	6
	12	6
	HSPA+ 2	6
	HSPA+ 4	6
	HSPA+ 5	6

Device	Frequency Band	FCC ID/IC Number N7NWP77B 2417C-WP77B Maximum antenna gain (dBi)[a]	
		Standalone	Collocated[b]
AirLink FX30	2	9	8
	4[c]	6	6
	5	7	6
	12	6	6
	13	6	6
	17[d]	6	6
	26	7	6
	GSM 850	4	3
	PCS 1900	3	3

a. Maximum antenna gain is 3 dBi in Japan for all channels
b. Antenna gain limit when module collocated with Wi-Fi/Wimax/BT radios
c. B4—CAT-M1 only
d. B17—CAT-NB1 only

EU

Sierra Wireless hereby declares the Sierra Wireless FX30 device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

The FX30 displays the CE mark.

CE

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.

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.

Notice for Brazilian Users

Warning: *This is a class A product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures.*

IMDA

Complies with IMDA Standards DA103548

A: Accessories

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 × 6 core cable

② 6 × Molex Micro-Fit 3.0™ series female crimp connectors (part number 43030-0001)

③ 1 × Molex Micro-Fit 3.0™ receptacle housing, male, 2×3P Ph: 3.0 mm housing, 250 V, 5 A max, PA65 black UL94V-O (part number 43025-0600)

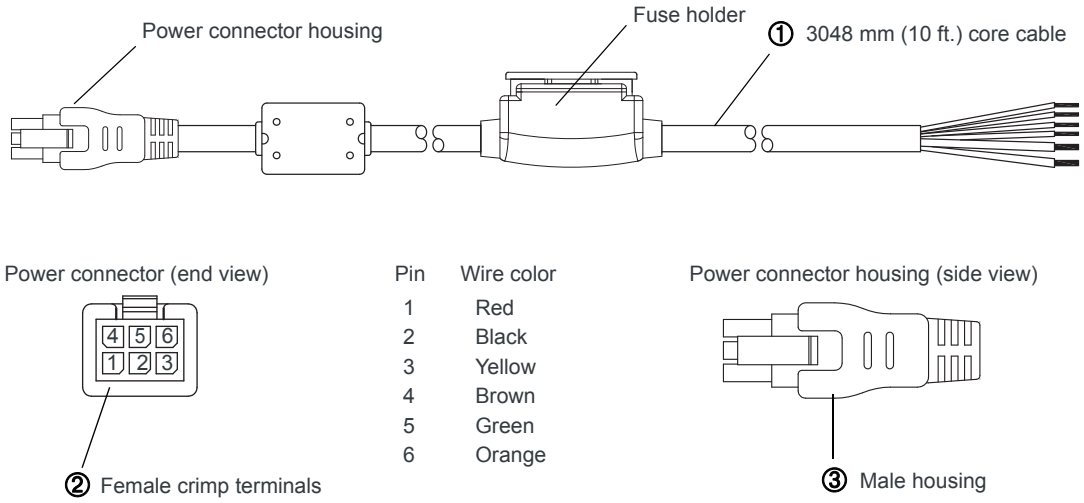


Figure A-1: DC Cable Specifications

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
Note: Input voltage range is 90–264 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.*			

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

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)
Non-operating	
Storage Temperature	-30°C ~ 70°C

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

Relative Humidity	10% ~ 90%
Vibration and Shock	MIL-STD-810D, method 514

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).

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

EMC Standards

The power supply meets the radiated and conducted emission requirements for EN55022, FCC Part 15, Class B, GB9254.

Hazardous Substances

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

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

B: Using the FX30 as a USB Modem

The following instructions provide examples based on Telus service. Substitute the name of your mobile network operator (MNO). Key values and parameters are bolded for emphasis in the examples.

For detailed information about the AT commands used, refer to WP8548/WP75xx/WP76xx/WP77xx AT Command Reference (document number 4118047) available at source.sierrawireless.com.

To use the FX30 as a USB modem:

1. Ensure that your computer is set up to issue AT commands to the FX30. (See Setup for Windows on page 31.)
2. Connect the radio to the network:
   a. If you have not already done so, install the SIM card. (See Step 1—Insert the SIM Card and Optional IoT Expansion Card on page 11.)
   b. Set the MNO's APN using the AT+CGDCONT command. (Most MNOs use Profile number 1. To confirm, check with your MNO.)

      ```
      AT+CGDCONT=1,"IPV4V6","isp.telus.com"
      ```

   c. Check that the profile is correctly set:

      ```
      AT+CGDCONT?
      +CGDCONT: 1,"IPV4V6","isp.telus.com","0.0.0.0",0,0
      ```

   d. Check that the radio is attached and registered on the network.

      ```
      AT!GSTATUS?
      !GSTATUS:
      Current Time:  5699      Temperature: 31|
      Bootup Time:   0         Mode:        ONLINE
      System mode:   WCDMA            PS state:    Attached
      WCDMA band:    WCDMA 1900
      WCDMA channel: 662
      GMM (PS) state:REGISTERED   NORMAL SERVICE
      MM (CS) state: IDLE         NORMAL SERVICE

      WCDMA L1 State:L1M_PCH_SLEEP    LAC:       2B5D (11101)
      RRC State:     DISCONNECTED     UTRAN Cell ID:     0454 761C
      (1108 30236)
      RxM RSSI C0:   -80              RxD RSSI C0: -106
      RxM RSSI C1:   -106             RxD RSSI C1: -106

      IMS Reg State: UNKNOWN          IMS Mode:   Not Support
      IMS Srv State: UNKNOWN SMS,UNKNOWN VoIP
      OK
      ```

3. Activate the PDP context:
   a. Use the Profile number prepared in steps 2b and 2c above.

      ```
      AT!SCACT=1,1
      ```

   b. Check the profile is active:

      ```
      AT!SCACT?
      !SCACT: 1,1
      ```

c. Confirm the PDP context is active.

ACTIVE data session:

```
at!gstatus?
!GSTATUS:
Current Time:  7209            Temperature: 33
Bootup Time:   0               Mode:        ONLINE
System mode:   WCDMA           PS state:    Attached
WCDMA band:    WCDMA 1900
WCDMA channel: 662
GMM (PS) state:REGISTERED      NORMAL SERVICE
MM (CS) state: IDLE            NORMAL SERVICE

WCDMA L1 State:L1M_DCH         LAC:         2B5D (11101)
RRC State:     CELL_DCH        UTRAN Cell ID:     0454 761C
(1108 30236)
RxM RSSI C0:   -91             RxD RSSI C0: -106
RxM RSSI C1:   -84             RxD RSSI C1: -106

IMS Reg State: UNKNOWN         IMS Mode:  Not Support
IMS Srv State: UNKNOWN SMS,UNKNOWN VoIP

OK
```

The RMNET interface on the host computer should now become active, and receive an IP address. Data can now flow from the host computer to the radio network.

4. Deactivate the PDP context:

a. Deactivate the active context

```
AT!SCACT=0,1
```

b. Check the profile is deactivated

```
AT!SCACT?
!SCACT: 1,0
```

c. Confirm the PDP context is de-activated.

DE-ACTIVATED data session:

```
at!gstatus?
!GSTATUS:
Current Time:  7227            Temperature: 33
Bootup Time:   0               Mode:        ONLINE
System mode:   WCDMA           PS state:    Attached
WCDMA band:    WCDMA 1900
WCDMA channel: 662
GMM (PS) state:REGISTERED      NORMAL SERVICE
MM (CS) state: IDLE            NORMAL SERVICE

WCDMA L1 State:L1M_PCH_SLEEP   LAC:         2B5D (11101)
RRC State:     DISCONNECTED    UTRAN Cell ID:     0454 761C
(1108 30236)
RxM RSSI C0:   -91             RxD RSSI C0: -106
RxM RSSI C1:   -106            RxD RSSI C1: -106

IMS Reg State: UNKNOWN         IMS Mode:  Not Support
```

```
IMS Srv State: UNKNOWN SMS,UNKNOWN VoIP

OK
```

The RMNET interface on the host computer should now be de-activated. The IP address should no longer be assigned, and data should no longer be flowing.

C: AT Commands Reference

This appendix documents the AT commands that are specific to the FX30. For a complete list of AT Commands for the radio modules available for the FX30, refer to the WP8548/WP75xx/WP76xx/WP77xx AT Command Reference (document number 4118047) available at source.sierrawireless.com.

In addition, the AT Commands in Table C-2 are specific to the FX30.

Note: Parameters in angled brackets < > are mandatory. Parameters in square brackets [ ] are optional.

Managing the I/O Interface with AT Commands

See AT!FWD?GPIO and AT!FWD=GPIO documentation in Table C-1, and I/O mapping in Table D-1 on page 71.

Because some FX30 GPIOs are driven by an I/O expander, do not use standard AT+WIOR/WIOW AT commands for the FX30.

Warning: *Most FX30 GPIOs are preconfigured. Do not use the AT+WIOCFG command! Using this command could make the FX30 inoperable.*

Here are some AT command examples for GPIOs:

Table C-1: AT command examples

To...	Use...
Turn on the green User LED	AT!FWD=GPIO,48,0
Turn off the green User LED	AT!FWD=GPIO,48,1
Read the push button state	AT!FWD?GPIO,7
Read the analog input value (in mV)	AT!MADC?5

Table C-2: FX30 AT Commands

Command	Description
GPIO AT Commands	
AT!FWD?GPIO Reads the current value of any input or output GPIO.	To Query: AT!FWD?GPIO,<GPIO #> where <GPIO #> is any available GPIO, i.e.: 2,7,8,13,21–25,32–58 Returned values are: • 0 (low) or 1 (high) • ERROR if invalid GPIO# Example: AT!FWD?GPIO,2 1 OK AT!FWD?GPIO,10 ERROR
AT!FWD=GPIO Sets the value of any configured output GPIO.	To set: AT!FWD=GPIO,<GPIO #>,<value> where: • <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 (low) or 1 (high) Returned values are: • OK (if GPIO is set as requested) • ERROR (if invalid GPIO # or value) Example: AT!FWD=GPIO,43,1 OK AT!FWD=GPIO,2,1 ERROR

Table C-2: FX30 AT Commands

Command	Description

AT!FWD?GPIOCFG
Displays the direction and pull settings for exported GPIOs, as read from sysfs.
If the GPIO is not exported, this command reports “NOT SET”. It does not export the GPIO.
	To query:
	AT!FWD?GPIOCFG,<GPIO #>
	where <GPIO #> is any available GPIO, i.e. 2,7,8,13,21–25,32–58
	
	Returned values are:
	• NOT SET (if GPIO has not been exported)
	• DIRECTION: <IN|OUT>
	• PULL: <UP|DOWN> (if GPIO has been exported)
	• ERROR (if invalid GPIO #)
	Example:
	`AT!FWD?GPIOCFG,2`
	`DIRECTION: IN`
	`PULL: UP`
	
	`OK`
	
	`AT!FWD?GPIOCFG,8`
	`NOT SET`
	
	`OK`
	
	`AT!FWD?GPIOCFG,10`
	`ERROR`

AT!FWD=GPIOCFG
Configures the direction and optionally the pull setting for any configurable GPIO.
This command exports a GPIO if it is not currently exported.
Setting is runtime configurable only—this setting is NOT persistent through reboot.
	To set:
	AT!FWD=GPIOCFG,<GPIO #>,<direction>[,<pull>]
	AT!FWD=GPIOCFG,<GPIO #>,<direction>[,<value>]
	where:
	• <GPIO #> is any configurable GPIO 8,13,25,33,42
	• <direction> is either IN or OUT (case insensitive)
	• <pull> (optional) is either UP or DOWN (case insensitive) and only valid if <direction> is IN
	• <value> (optional) is either 0 or 1 to set the initial output value of the pin; it is only valid if <direction> is OUT. If omitted, a default value of 0 is used.
	
	Returned values are:
	• OK (if GPIO is configured as requested)
	• ERROR (if invalid GPIO #, direction or optional pull or value)
	Example:
	`AT!FWD=GPIOCFG,8,OUT`
	`OK`
	
	`AT!FWD=GPIOCFG,8,OUT,1`
	`OK`
	
	`AT!FWD=GPIOCFG,13,IN,UP`
	`OK`
	
	`AT!FWD=GPIOCFG,8,INPUT`
	`ERROR`

Table C-2: FX30 AT Commands

Command	Description
Ethernet AT Commands	

AT!FWD?ETHSPEED
Queries the Ethernet link speed.
	To query:
	AT!FWD?ETHSPEED
	
	The returned value is xxx, where xxx is the link speed on the Ethernet port negotiated by the connected devices.
	Example:
	`AT!FWD?ETHSPEED`
	`100`
	
	`OK`

AT!FWD=ETHMAC
Sets the Ethernet PHY MAC address in use
	To set:
	AT!FWD=ETHMAC,<MAC address>
	
	Note: Do not enter a MAC address with the first octet being a multicast (odd) number. Otherwise, a random MAC address could be assigned to the network adapter.
	
	Returned values are:
	• OK (if the Ethernet MAC address is set as requested)
	• ERROR (if invalid MAC address or if eth0 interface does NOT exist)
	Example:
	`AT!FWD=ETHMAC,aa:3d:21:4b:a3:5a`
	`OK`
	
	`AT!FWD=ETHMAC,49:12:fb:e8`
	`ERROR`

AT!FWD?ETHMAC
Reads the Ethernet PHY MAC address in use
	To query:
	AT!FWD?ETHMAC
	
	Returned values are:
	• <value> (where <value> is the Ethernet MAC address)
	• ERROR (if eth0 interface does NOT exist)
	Example:
	`AT!FWD?ETHMAC`
	`aa:3d:21:4b:a3:5a`
	
	`OK`

Table C-2: FX30 AT Commands

Command	Description

AT!FWD=ETHADDR
Sets the Ethernet IP address.
	To set:
	AT!FWD=ETHADDR,<ipv4 address>[,<ipv4 mask>[,<ipv4 gw>]]
	
	Returned values are:
	• OK (if Ethernet IP address is set as requested)
	• ERROR (if invalid IP address)
	Example:
	`AT!FWD=ETHADDR,192.168.13.33`
	`OK`
	
	`AT!FWD=ETHADDR,192.13`
	`ERROR`

AT!FWD=CLEARETHADDR
Sets the Ethernet PHY IP address back to default value (192.168.13.31)
	To set:
	AT!FWD=CLEARETHADDR
	
	The returned value is OK if Ethernet IP address is set as requested
	Example:
	`AT!FWD=CLEARETHADDR`
	`OK`

USB AT Commands	

AT!FWD=USBMAC
Sets the USB MAC address
	To set:
	AT!FWD=USBMAC,<MAC address>
	
	Note: Do not enter a MAC address with the first octet being a multicast (odd) number. Otherwise, a random MAC address could be assigned to the network adapter.
	
	Returned values are:
	• OK (if USB MAC address is set as requested)
	• ERROR (if invalid MAC address)
	Example:
	`AT!FWD=USBMAC,aa:3d:21:4b:a3:5a`
	`OK`
	
	`AT!FWD=USBMAC,49:12:fb:8e`
	`ERROR`

Table C-2: FX30 AT Commands

Command	Description
AT!FWD?USBMAC Reads the USB MAC address in use for the interface	To query: AT!FWD?USBMAC Returned values are: • <value> (the USB MAC address) • ERROR (if usb0 interface does NOT exist) Example: AT!FWD?USBMAC aa:3d:21:4b:a3:5a OK
Device Query AT Commands	
AT!FWD?DEVTYPE Queries the device type	To query: AT!FWD?DEVTYPE Returned values are: • FX30 (if device type is Ethernet device) • FX30S (if device type is Serial device) • unknown (if device type is unknown) Example: AT!FWD?DEVTYPE FX30 OK
AT!FWD?ALVER Queries AirLink version	To query: AT!FWD?ALVER The returned value is [release -]xxxxxxx “release” will show if it is a proper release, otherwise the version will be xxxxxxx (the git log SHA in short form) Example: AT!FWD?ALVER 1.0.0.5 OK

Table C-2: FX30 AT Commands

Command	Description
Factory Reset AT Commands For instructions on resetting the FX30 to factory default setting, see Reset to Factory Default Settings on page 35.	

AT!FWD=FACTORYRECOVERY
Enables or disables the factory default recovery mechanism.
 	
Note: This command does not perform a factory reset. It enables the reset button to perform a factory reset when it is pressed and held.
	To set:
	AT!FWD=FACTORYRECOVERY,<status>
	where <status> can be either: ENABLE, DISABLE
	
	Returned values are:
	• OK (if a valid <status> is entered)
	• ERROR (if an invalid <status> is entered)
	Example:
	`AT!FWD=FACTORYRECOVERY,DISABLE`
	
	`OK`

Table C-2: FX30 AT Commands

Command	Description
AT!FWD?FACTORYRECOVERY Queries the current status of the factory default recovery mechanism	To query: AT!FWD?FACTORYRECOVERY Returned values are: • ENABLED (if the factory recovery is enabled) • DISABLED (if the factory recovery is disabled) Example: AT!FWD=FACTORYRECOVERY ENABLED OK
AT!FWD?GETAPPINFO Query Legato application info	To query: AT!FWD?GETAPPINFO,<LEGATO APP NAME> Returned values are: • <Legato app name> • status • running processes • app.name • app.md5 • app.version • legato.version *Note: Returned values may be truncated. However, OK will still be returned.* *Note: <Legato app name> is case sensitive. If the name does not match, the command returns [not installed] and ERROR.* Example: AT!FWD?GETAPPINFO,columbiaAtService columbiaAtService status: running running processes: columbiaAtService[565] (565) sh[1060] (1060) /legato/systems/current/bin/app[1061] (1061) app.name: columbiaAtService OK

D: FX30 Linux Interface and GPIO Mapping

This appendix documents FX30 Interface Mapping for the Linux Interface and radio module internal GPIO mapping.

Table D-1 describes the Linux interface mapping to the external FX30 GPIOs and other configurable hardware features.

Table D-1: FX30 Hardware Feature to Linux Interface Mapping

Name	Function	WP GPIO/ ADC	Linux Interface	Description
On/Off (Pin 3)	External On/Off Input	GPIO24	/sys/class/gpio/gpio24	High: external On/Off signal is Low (in OFF state) (default) Low: external On/Off signal is High (in ON state) *Note: GPIO58 must be low in order for device to power off.*
IO1 (Pin 4)	Digital Input	GPIO2	/sys/class/gpio/gpio2	High: External I/O1 is low (ground) Low: External I/O1 is high Default is external low.
	Internal Pull-up	GPIO57	/sys/class/gpio/gpio57	High: Enables internal pull-up to 3.3V (default) Low: Disables internal pull-up
IO2 (Pin 5)	Digital Input	GPIO21	/sys/class/gpio/gpio21	High: External I/O2 is low (ground) Low: External I/O2 is high Default is external low.
	Internal Pull-up	GPIO53	/sys/class/gpio/gpio53	High: Enables internal pull-up to 3.3V Low: Disables internal pull-up (default)
	Analog Input	ADC1	/sys/class/hwmon/ hwmon0/device/mpp_05	ADC with 15 bits of resolution (FX30 3G)
			/sys/devices/qpnp-vadc-8/mpp4_div1	ADC with 15 bits of resolution (FX30 Cat-1/ Cat-M)
IO3 (Pin 6)	Digital Input	GPIO22	/sys/class/gpio/gpio22	High: External I/O3 is low (ground) Low: External 1/O3 is high Default is external low.
	Internal Pull-up	GPIO54	/sys/class/gpio/gpio54	High: Enables internal pull-up to Vin Low: Disables internal pull-up (Default)
	Digital Output	GPIO56	/sys/class/gpio/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	/sys/class/gpio/gpio7	High: External Push button is released (default) Low: External push-button is being pushed

Table D-1: FX30 Hardware Feature to Linux Interface Mapping

Name	Function	WP GPIO/ ADC	Linux Interface	Description
Power LED *Note: Please note the GPIO polarity when turning on Power LEDs.*	Red Power LED	GPIO49	/sys/class/gpio/gpio49	High: Turns Power LED (Red) ON (default) Low: Turns Power LED (Red) OFF
	Green Power LED	GPIO50	/sys/class/gpio/gpio50	High: Turns Power LED (Green) OFF (default) Low: Turns Power LED (Green) ON *Note: Requires correct setting of GPIO51 to function.*
	Green LED Function	GPIO51	/sys/class/gpio/gpio51	High: Connects GPIO50 to green Power LED Low: Connects WAN Activity signal to green Power LED (default)
	Amber LED	GPIO49 GPIO50 GPIO51	/sys/class/gpio/gpio49 /sys/class/gpio/gpio50 /sys/class/gpio/gpio51	Use combination of: • GPIO49 High • GPIO50 Low • GPIO51 High
User LED	Red User LED	GPIO47	/sys/class/gpio/gpio47	High: Turns User LED (Red) OFF (default) Low: Turns User LED (Red) ON
	Green User LED	GPIO48	/sys/class/gpio/gpio48	High: Turns User LED (Green) OFF (default) Low: Turns User LED (Green) ON
	Amber LED	GPIO47 GPIO48	/sys/class/gpio/gpio47 /sys/class/gpio/gpio48	Use combination of: • GPIO47 Low • GPIO48 Low
Ethernet Disable	Disable Ethernet Port	GPIO55	/sys/class/gpio/gpio55	High: Enables Ethernet controller (default) Low: Disables Ethernet controller
Power Hold	On/Off Override	GPIO58	/sys/class/gpio/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
		GPIO32	/sys/class/gpio/gpio32	Reserved; do not use

WP Module Internal GPIO Mapping

Table D-2 shows the mapping of the FX30 function (or signal name) to the WP module GPIO pin number and to the WP module internal processor GPIO number.

For example, the IOT DETECT function is GPIO25 on the WP module, which maps internally to GPIO73 on the MDM processor for the WP85 module and to GPIO51 for WP76/77 modules.

Note: The WP Module GPIO numbers are used for AT commands and Linux GPIO sysfs. The MDM Processor GPIO is typically used for kernel development.

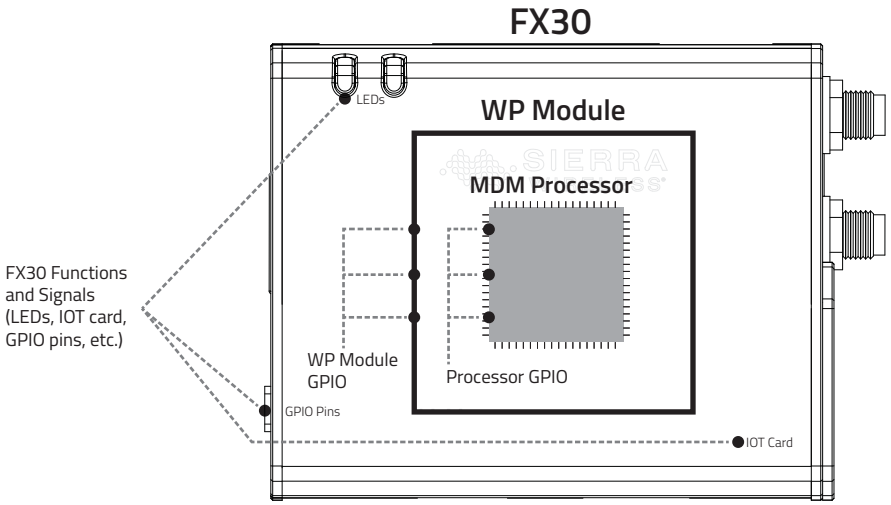


Figure D-1: FX30 GPIO Hierarchy

Table D-2: WP Module Internal GPIO Mapping

FX30 Function	WP Module GPIO	Processor GPIO	
		WP85	WP76/77
IOT DETECT	GPIO25	73	51
IOT GPIO1	GPIO42	80	79
IOT GPIO2	GPIO33	78	78
IOT GPIO3	GPIO13	84	76
IOT GPIO4	GPIO8	29	58
PB	GPIO7	79	16
DIGITAL INPUT1	GPIO2	59	38
DIGITAL INPUT2	GPIO21	50	8
DIGITAL INPUT3	GPIO22	49	9

Table D-2: WP Module Internal GPIO Mapping

FX30 Function	WP Module GPIO	Processor GPIO	
		WP85	WP76/77
ON/OFF MON	GPIO24	61	11
GPS LNA EN	EXT_GPIO_LNA_EN	86	54
IOT PCM OUT	PCM_OUT	23	22
IOT PCM IN	PCM_IN	22	21
IOT PCM CLK	PCM_CLK	20	23
IOT PCM SYNC	PCM_SYNC	21	20
IOT SPI1 MRDY	SPI1_MRDY	9	2
IOT SP1 MOSI	SPI1_MOSI	11	0
IOT SP1 MISO	SPI1_MISO	10	1
IOT SP1 CLK	SPI1_CLK	8	3
IOT UART2 TX	UART2_TX	18	13
IOT UART2 RX	UART2_RX	19	12
IOT UART2 CTS	UART2_CTS	76	15
IOT UART2 RTS	UART2_RTS	64	14
IOT PPS	DR_SYNC	85	53
IOT RESET OUT	GPIO6	66	PMIC GPIO5
QUERY U705A	ANT_CNTL3_EXT	27	48
QUERY U705B	ANT_CNTL2_EXT	26	47
UICC1 DETECT	UIM1_DET	0	34
UICC2 DETECT	UIM2_DET	4	30
ADC RANGE	ANT_CNTL1	25	46
ULPM WAKE1	GPIO36	SWIMCU PTA0	SWIMCU PTA0
ULPM WAKE2	GPIO38 (SPI2_CLK)	SWIMCU PTB0	SWIMCU PTB0

E: FX30 Factory Configuration

eSIM support

Some FX30 variants (such as FX30 Cat-1 WP7607-1) support eSIM. The external 2FF SIM slot is the preferred slot, but the internal eSIM will be used if no external SIM is inserted. You can change the slot using the AT command AT!UIMS or the Legato command `cm sim select`.

Note: If SIM AUTO SWITCH is enabled, the !UIMS setting is updated to reflect the preferred slot. See SIM AUTO SWITCH below.

AUTO-SIM

The AUTO-SIM feature applies to Cat-1 and Cat-M variants, and is enabled by default. This feature reboots the device and loads the carrier configuration (PRI) that corresponds to the SIM. For example, if the external slot is enabled, and a Sierra SIM is inserted, the Sierra carrier PRI will be loaded. By default, if a carrier PRI does not exist (the SIM's carrier does not match a PRI loaded on the radio module), the generic carrier PRI is loaded. Note that the AUTO-SIM feature is not persistent over a firmware update; however, you can re-enable it by using the AT command AT!IMPREF="AUTO-SIM".

SIM AUTO SWITCH

The SIM AUTO SWITCH feature applies to Cat-1 (R10.1.1 and later) and Cat-M (R11 and later) variants. This is a customization that allows a user to select the preferred slot. By default, the external slot is the preferred slot. You can change the preferred slot by executing the AT command AT!CUSTOM="UIMAUTOSWITCH".

Note: This command requires level 2 unlocking. See the WP8548/WP75xx/WP76xx/WP77xx AT Command Reference for more information.

AirVantage Management Services Polling Mode

The default FX30 configuration setting for AVMS Polling Mode is 60 minutes. The AT command to change the setting is AT+WDSC=3,x where x is the number of minutes. See the WP8548/WP75xx/WP76xx/WP77xx AT Command Reference for more information.

Note: If you are experiencing issues with your FX30 not automatically checking in with AVMS, then query the AV Polling rate using AT+WDSC?

If the result is +WDSC: 3,0 then AV Polling is disabled. Please enable polling using AT+WDSC=3,60 to set the polling rate to 60 minutes.

AirVantage Management Services User Agreements

The default FX30 configuration for AVMS User Agreements is “Disabled” for the following modes:

- AVMS connection
- Package download
- Package install
- Device reboot
- Application uninstall

The AT command to change the user agreements is AT+WDSC. See the WP8548/WP75xx/WP76xx/WP77xx AT Command Reference for more information.

UART Settings

The default FX30 configuration setting for UART1 is for AT Command Service, and UART2 is disabled. The AT command to change the setting is AT!MAPUART.

Index

T

U

W