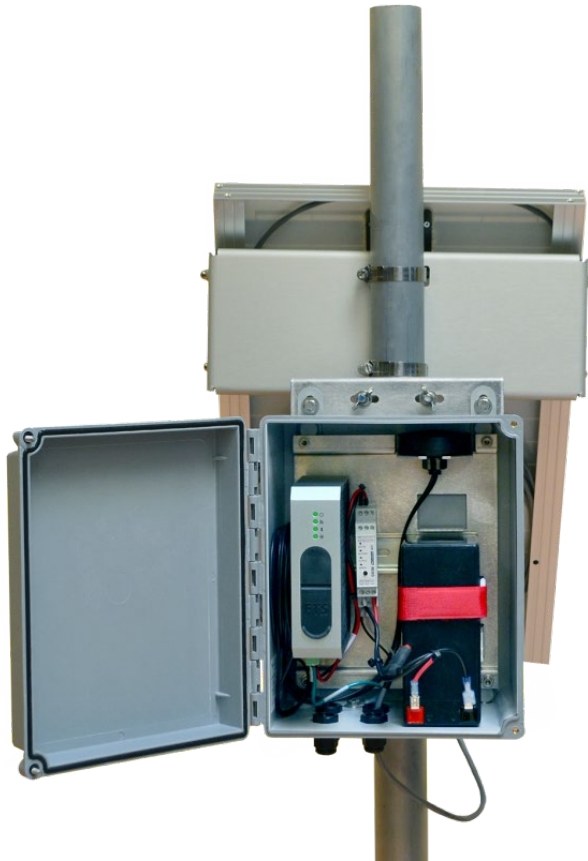# FTS

EXTREME ENVIRONMENTS. EXTREMELY RELIABLE.

LT1 SYSTEM

Installation and Quick Start Guide

For use with LT1-CELL /LT1-CELL-VZ/LT1–GOES

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Contents

Chapter 1   DESCRIPTION

1.1 GENERAL

This guide is meant as a ready reference to set up an LT1 System. Details of all aspects of station operation can be found on the FTS Support website (http://support.ftsinc.com/) in the following manuals:

- LT1 (Cell/GOES) Operator's Manual (700-LT1-Man)
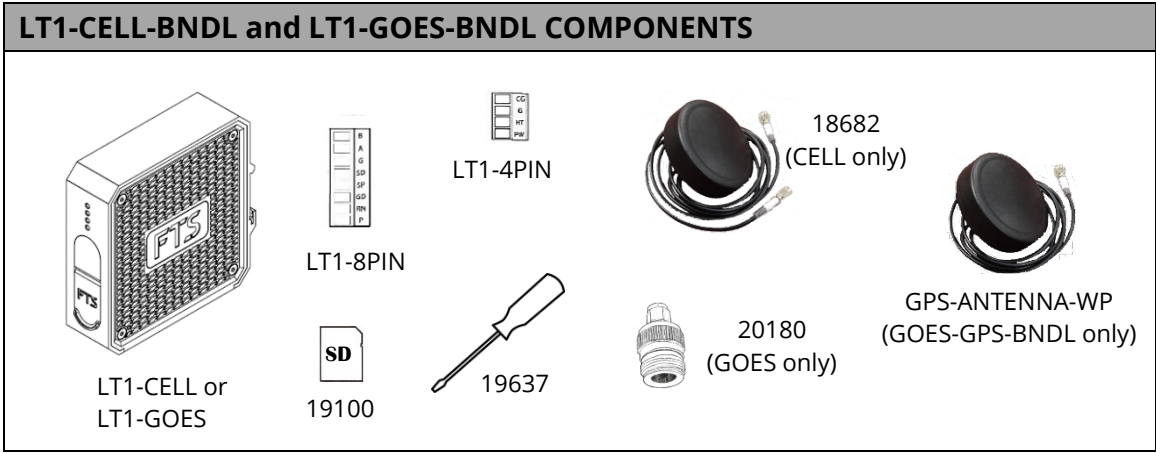- FTS360 and FTS360 Config App (FCA) User Manual (700-FTS360-Man)

LT1-Cell and LT1-GOES systems are set up exactly the same, with the exception of the placement of the telemetry antennas. LT1-Cell systems come equipped with a dual cellular/GPS antenna which is mounted internally; LT1-GOES systems require an externally mounted satellite antenna and the GPS antenna can be mounted either internally or externally.

1.2 SYSTEM COMPONENTS

The LT1 System Kits consist of all the required components to mount an LT1 station on an existing 2" diameter pole assembly. The system will have the specific LT1 Bundle for your order, depending if it is an LT1- Cell or an LT1-GOES. Prior to assembling, examine the shipment and confirm all the parts arrived and are undamaged.
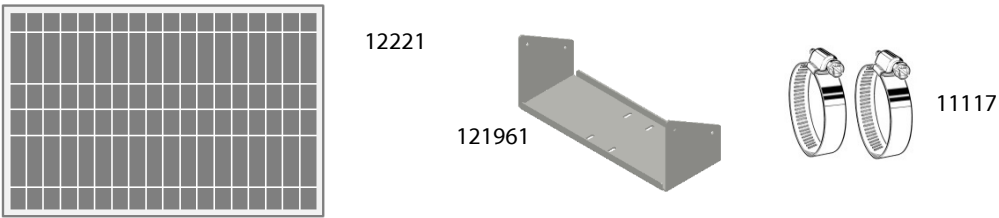
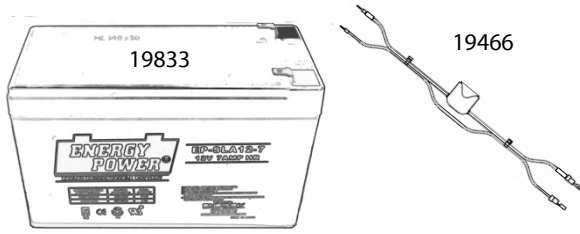| LT1-CELL-BNDL/LT1-CELL-VZ-BND	
ITEM	**PART #**
LT1- CELL or LT1-CELL-VZ complete with: • 4 pin power terminal block • 8 pin data terminal block • 4 GB SD Card (inserted) • Slot Screwdriver • Integrated Cellular/GPS antenna **OPTIONAL**: SIM card (inserted) with purchase of FTS cellular plan	LT1-4PIN LT1-8PIN 19100 19367 18682
LT1-GOES-BNDL/LT1-GOES-GPS-BNDL	
LT1-GOES complete with: • 4 pin power terminal block • 8 pin data terminal block • 4 GB SD Card (inserted) • Slot screwdriver • SMA to N adapter* • SMA plug to SMA jack cable • SMA plug to N plug cable • GPS antenna (LT1-GOES-GPS-BNDL only)	LT1-4PIN LT1-8PIN 19100 19637 20180 19930 19931 GPS-ANTENNA-WP

* Not required if using part# 19931 with integrated SMA to N adaptor

LT1-CELL-BNDL and LT1-GOES-BNDL COMPONENTS

LT1-4PIN

18682
(CELL only)

LT1-8PIN

GPS-ANTENNA-WP
(GOES-GPS-BNDL only)

LT1-CELL or
LT1-GOES

19100

19637

20180
(GOES only)
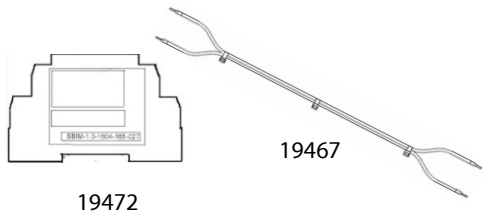
The following components are common to Cellular and GOES systems.

LT1-ENCLOSURE-BNDL

ITEM	PART #
Enclosure complete with:	19478
• mounting brackets kit	
• LT1 Ground Cable 1(attached in enclosure)	19465
• LT1 Ground Cable 2 (attached outside of enclosure)	19484
• 2 x LT1 Pole Mount Brackets with mounting hardware	19480
• 2 x U-Bolts with mounting hardware	11597
• 2ft SMA to SMA cable with built-in gland	19930 (GOES only)
• 15ft SMA to N cable with built-in gland	19931 (GOES only)

Enclosure
(19478)

11597 x 2

x 4

19480 x 2

19930 (GOES only)

19931 (GOES only)

SOLAR-PANEL-BNDL	
ITEM	**PART #**
20W solar panel complete with:	12221
• Mounting bracket	12196
• Hose clamps (x2)	11117

12221   121961   11117

9AH-BATTERY-BNDL	
ITEM	**PART #**
12 Volt 9Ah battery	19833
LT1 Regulator to battery cable assembly	19466

19833   19466

SOLAR-REGULATOR-BNDL	
ITEM	**PART #**
Solar Regulator	19472
LT1 to regulator cable assembly	19467

19472   19467

1.3   POLE MOUNT

The LT1 System comes with fittings so that it can be mounted on a secure vertical pole with a 2" outer diameter. FTS recommends a 1.5"nominal (1.9" outer diameter) schedule 40 or 80 aluminum pipe.

1.4   REQUIRED TOOLS AND EQUIPMENT

The following tools are required to mount the LT1 System on a pole mount:

- ☐ ¼" flathead screwdriver
- ☐ #3 Phillips screwdriver
- ☐ 6/8" wrench (or adjustable)
- ☐ ¼" wrench
- ☐ 5/16" socket wrench
- ☐ Voltmeter
- ☐ Cable ties

Tools and equipment as required to install pole assembly (if not already installed), mount antennas, and install the earth ground system.

Chapter 2   SETTING UP AN LT1 STATION

2.1   PRIOR TO PROCEEDING TO THE FIELD

IMPORTANT! **Prior to proceeding to the field the following <u>MUST</u> be completed**

<u>THE ADMINISTRATOR MUST:</u>

☐ Initialize FTS360 (<u>https://360.ftsinc.com/signup</u> or login if FTS initialized FTS360 on your behalf)
☐ Create a Technician account for the field technician
☐ Ensure any SDI-12 sensors to be added in the field exist in the sensor library (either default or custom sensor)

<u>THE FIELD TECHNICIAN MUST:</u>

☐ Be invited to Join FTS360 by Administrator
☐ Download the FCA onto the smart device that will be used in the field (available in the Apple App Store or Google Play. Search for FTS360Config)
☐ CELL only: Provision the SIM card). Ensure the APN for the SIM card is entered (Go to the FTS Config App's dashboard and select "Cellular")
☐ Test the LT1*
☐ Log onto the FTS360 Config App, synchronize with FTS360. **DO NOT LOGOUT**
☐ Ensure the SD Card and, for cellular units, the provisioned SIM card and are inserted
☐ Ensure any SDI-12 sensors to be added in the field exist in the sensor library
☐ Bring the required tools (see section 1.4)

* Details of testing the LT1 are found in the LT1 User's Manual (700-LT1-Man)

2.2   SITE SELECTION

Select a site which allows for installation of the supporting structure which is oriented so that the solar panel will have maximum sun exposure and antennas will not be blocked by geographical features, excessive tree canopy, or other obstructions.

2.3 MOUNTING THE ENCLOSURE

1) Attach the mounting brackets to the back of the enclosure using the smaller size bolts in the mounting bracket kit (10-32 x .375 bolts).

2) Attach the top and bottom pole mounting brackets to the enclosure mounting brackets using the hex bolts. Place a flat washer on the hex bolt, thread through the enclosure's mounting bracket and finish with another flat washer, split ring washer and hex nut.
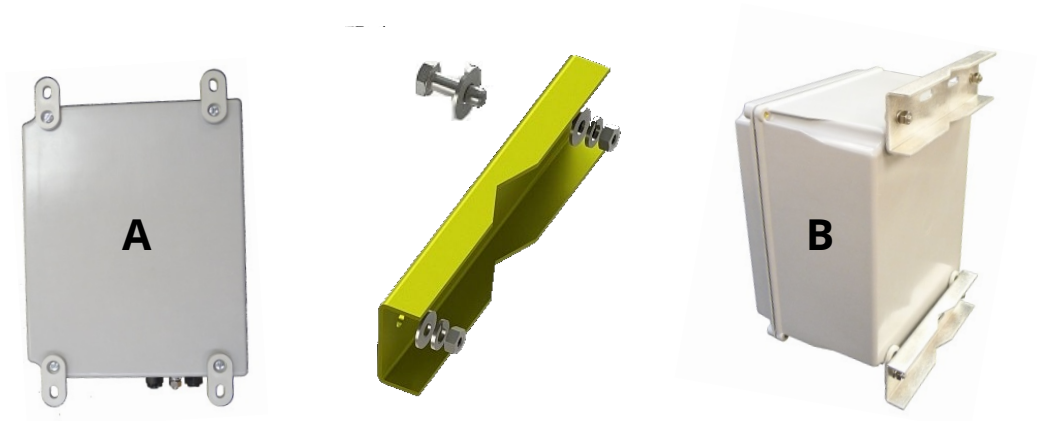

Figure 2-1: Enclosure with (A) mounting brackets and (B) pole mount brackets

3) Position the enclosure on the pole and secure using the U bolts. Place the U bolt around the pole and through the mounting bracket slots.   Place a flat washer, a split ring washer and either a wingnut or a hex nut on the U-bolt posts and then tighten.

4) Place the battery in the enclosure with the posts at the bottom and secure it in place with the strap.

2.4 MOUNTING THE SOLAR PANEL

Select a position in which the solar panel will have maximum sun exposure throughout the day. Try to install your solar panel so that nothing casts a shadow on it during any portion of the day. Consider sun position and length of shadows in all seasons. Even a small shadow cast by a guy line or small branch can affect the efficiency of the solar panel.

Position the solar panel on the pole and secure with the clamps.

> ⚠️ **DO NOT ATTACH THE SOLAR PANEL CABLE TO THE REGULATOR AT THIS TIME!**
> Electrical connections to the regulator should be done in the correct sequence to prevent any damage to the system.

2.5 GROUNDING THE SYSTEM

An external earth ground wire MUST be attached between the earth grounding system and the LT1 SYSTEM to provide protection from lightning and other electrostatic discharge.

Be aware that the composition of the substrate directly affects the efficiency of the earth ground; areas with a low conductive substrate such as rock, sand, ice may require more than one grounding rod.

> **IMPORTANT!** FTS recommends that you consult a qualified professional to ensure adequate earth ground protection is installed for the site and that all local regulations are met.

Set up the earth-ground system and secure the free eye of the LT1 Ground Cable 2 to the grounding system.

2.6 INSERT CABLES

The first step in setting up the internal enclosure components is to feed all cables through the enclosure glands. Unscrew the bottom gland cap and remove the plug. It is recommended to store the plugs in a small bag inside the enclosure so if a cable is removed, the gland can be restored to its sealed state to maintain the IP rating of the enclosure.
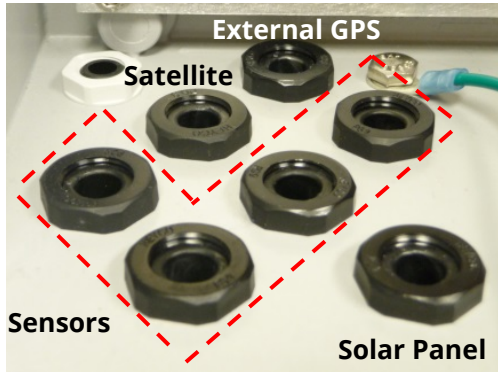
Recommended cable placement
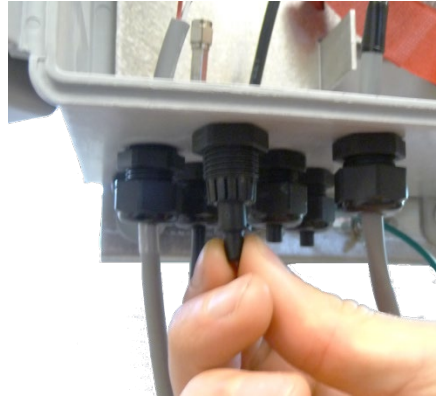
Removing the gland plug

Figure 2-2: Inserting cables

Feed sensor cables and the solar panel cable through a gland cap and then through the gland into the enclosure. Replace the gland cap, ensuring it is tightly screwed on to form a seal.

For LT1-GOES systems, the fitted gland on the SMA to N cable for the satellite antenna and the SMA to SMA jack cable (if using an externally mounted GPS antenna) replaces the enclosure gland. Remove an enclosure gland by unscrewing the internal nut (the 5/8" wrench may be required to initially loosen the nut). Remove the nut on the cable's gland and feed the cable and gland fitting through the bottom of the enclosure. Replace and tighten the nut.

Figure 2-3: Gland replacement and inserted cables – externally mounted GPS

2.7 TELEMETRY

2.7.1 LT1-CELL SYSTEMS

1) Uncoil sufficient cable for the dual GPS/cellular antenna to reach from the platform to the connectors on the LT1. Place the dual antenna on the platform and secure in place with the split nut.

2) Attach the GPS and Cell cables to the appropriate jack on the LT1.

3) Remove the terminal blocks from the LT1 (for ease of making power and sensors connections) and mount the LT1 on the left hand side of the DIN rail.
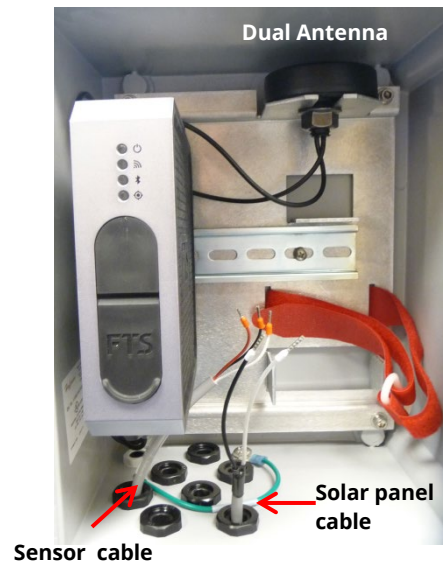

Figure 2-4

2.7.2 LT1-GOES SYSTEMS

1) Mount the satellite and GPS antennas in their desired locations. The GPS antenna can be mounted on the enclosure's antenna platform if its design permits.

2) Attach the satellite antenna and GPS antenna cables to their respective jack on the LT1.

3) Remove the terminal blocks from the LT1 (for ease of making power and sensors connections), and mount the LT1 on the left hand side of the DIN rail.

2.8 CONNECTING SENSORS

Sensors are connected via the 8 pin data terminal block (refer to Figure 2-5 for wiring guidance). The LT1 can accommodate one NMEA device, two SDI-12 sensors, and a rain gauge. If two SDI-12 sensors are being connected, they must have their wires spliced and use the same pins designated for SDI-12 sensors. Additionally, if more than two devices are being connected, a ground terminal will have to be shared.

Once sensors are connected to the 8 pin terminal block it can be inserted into the LT1.
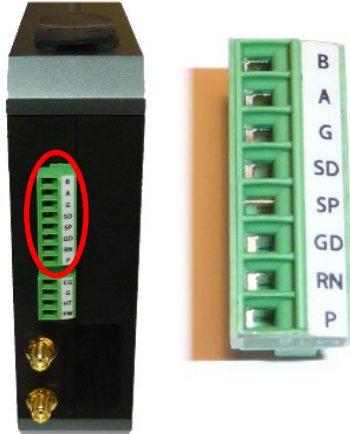
B	RS485/NMEA negative
A	RS485/NMEA positive
G	Signal ground
SD	SDI-12 data
SP	SDI-12 power out
GD	Power ground
RN	Discrete counter in (Rain Gauge)
P	RS485/NMEA power out

CONNECTING SDI-12 SENSORS

Connect the SDI-12 power wire (+) to the **SP** pin, the SDI-12 data wire to the **SD** pin, and the ground wire to either the **GD** or the **G** pin.

CONNECTING A TIPPING BUCKET (RAIN GAUGE)

Connect the signal input wire to the **RN** pin, and the ground wire to either the **GD** or the **G** pin.

FT742 RS-485 WIND SENSOR HEATER OPTION

If using the heater option on an attached FT742 RS-485 wind sensor a power source capable of at least 3 A must be attached to both the PW and HT pins. Details of connecting an FT7X2 RS-485 wind sensor are found in App Note 162 (700-AN-162) and posted to the FTS Support site.

Figure 2-5: 8 Pin Terminal Block Wiring Guide

2.9 POWER CONNECTIONS

The LT1 SYSTEM is powered through a battery which maintains its charge through a solar panel and regulator. Refer to the following diagram for pin locations when connecting devices to the solar regulator.
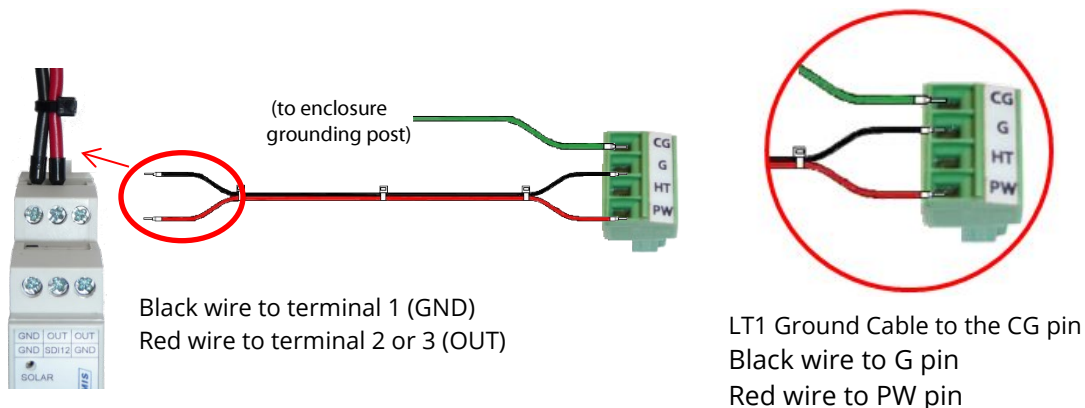
IMPORTANT!
Power connections must be made in the order indicated to prevent damage to the station and equipment.

Figure 2-6: Solar regulator pin diagram

STEP 1: MAKE SOLAR CHARGE REGULATOR CONNECTIONS

1) Remove the cap and plug from one of the enclosure ports. Feed approximately 10 inches of the solar panel cable through an access port. Once all connections are made excess cable can be fed back through the port and the cap secured.

2) Remove the LT1 Power Terminal Block from the LT1. Once all connections are made, the terminal block will be inserted into the terminal port to complete the cycle. Make the following connections with the LT1 to Regulator Cable Assembly:

(to enclosure grounding post)

Black wire to terminal 1 (GND)
Red wire to terminal 2 or 3 (OUT)

LT1 Ground Cable to the CG pin
Black wire to G pin
Red wire to PW pin

3) Connect the leads from the solar panel to the regulator as follows:

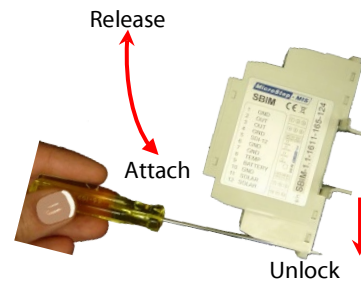Black wire to terminal 10 (GND)
Clear wire to terminal 11 or12

4) Connect the LT1 Regulator to battery cable assembly (part # 19466) to the solar regulator as follows:

To battery

Black wire (-) to terminal 7 (GND)
Red wire (+) to terminal 9 (BAT)
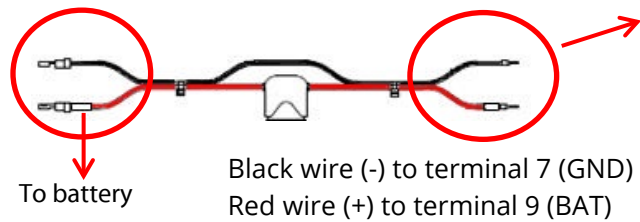
5) Mount the solar regulator onto the DIN rail beside the the LT1 and secure the battery in position using the red Velcro strap.

HINT:
To attach and release the solar regulator, slide a small screwdriver into the bottom latch to unlock and lever up or down accordingly.

Release

Attach

Unlock

STEP 2: CONNECT POWER

1) Connect the LT1 Regulator to battery cable assembly (part # 19466) to the battery as follows:

⚠ WARNING! Damage to the regulator can result if you do not connect these wires in the correct order or with the proper polarity!

a) First, connect the black wire to the battery's negative (-) terminal.

b) Second, connect the red wire to the battery's positive (+) terminal.

The solar regulator LEDs will power up and display green lights. Refer to section 2.7 for details of the solar regulator LED status indicators.

Use the reverse order to disconnect the battery.

2) Use the voltmeter to confirm 12 volts is being supplied to the output terminal on which the LT1 to Regulator Cable Assembly is attached (regulator terminal 2 or 3)

> IMPORTANT! Prior to connecting the LT1, the output from the solar regulator MUST be disabled.

3) Press and hold the button on the regulator for at least 3 seconds. The output LED should turn off and blink on every 2 seconds.

Press for 3 seconds to disable output

Quickly press and release to enable output

Figure 2-7: Solar Regulator status LEDs and final power connections (LT1-CELL shown)

4) Insert the terminal block into the LT1.

5) Turn on the regulator output by quickly pressing the black button on the regulator. Ensure the Output LED on the solar regulator turns solid On and the LT1 LEDs indicate there is power.

2.10 LED STATUS INDICATORS

Once power is supplied, the LT1 will boot up, and establish a GPS fix. The green LEDs indicate the status of the system.

2.10.1 START UP

When power is first supplied or someone connects to the station:

	System Status	**Blinking every second**: System OK **Off:** System powered down/failure
	Telemetry Status	**Solid On**: System OK • Cellular: module powered and communicating to MCU*, cellular link established • GOES: transmitter enabled and valid configuration **Blinking**: Cell: Obtaining network connection GOES: no GPS fix/potential invalid configuration **Off:** System powered down/no link/fault
	BLE Status	**Solid On**: BLE connection established **Blinking:** System OK (module powered and communicating to MCU*, module broadcasting beacon signal) **Off:** system powered down/no beacon signal transmission/fault
	GPS Status	**Solid On:** System OK (module powered and communicating to MCU*, fix established) **Blinking**: Obtaining GPS fix **Off**: System powered down/fault

*MCU= microcontroller unit

2.10.2 LOW POWER MODE:

Three minutes after being disconnected from the FTS360 Config App, the unit will enter low power mode:

	System Status	**Blinks once every 10 seconds**: System OK	**NOTE:** When in low power mode, a fault is not indicated if the Telemetry, BLE and GPS status lights are off. If you suspect a fault, use the FTS360 Config App to connect to the station and observe the LEDs.
	Telemetry Status	**Off**	
	BLE Status	**Off**	
	GPS Status	**Off**	

2.11 SOLAR REGULATOR STATUS LEDS

Once the power loop is complete, the solar regulator LEDs will light to indicate the status.

The Solar, Battery, and Output LEDs are green and are associated with the solar panel input, battery input and output. The Error LED is red.

Once power is supplied to the regulator, the LEDs will display for 15 seconds and then turn off (power saving mode). To review the status LEDs, press the black button.

SOLAR REGULATOR STANDARD LED STATUS INDICATORS				
DESCRIPTION	SOLAR	BATTERY	OUTPUT	ERROR
Solar panel connected	On	-	-	-
Battery ready	-	On	-	-
Output turned on	-	-	On	-
Output disabled (can be turned on)	-	-	Off– blinks on every 2s	-
Battery charging	-	On-blinks off every 2s	-	-
Battery discharging	-	Off-blinks on every 2s	-	-

Chapter 3   CONFIGURING WITH THE FTS360 CONFIG APP

Detailed information on FTS360 and the FTS360 Config App can be found in the FTS360 User Manual (700-FTS360-Man)

3.1   CONFIGURING SENSORS

Once connected to the LT1 and powered, use the FTS360 Config App to add and configure the sensor for the station.

1) Connect to Station

- Open the FTS360 Config App. It should automatically discover the Station. If the station is not discovered, press the "Scan" bar.

  The first time a station is connected to the FTS360 Config App, it's identified by its serial number. Any configuration which happens in the field will be saved to that station. Once synchronization happens, the station's name can be changed from the serial number to a user friendly name using the station edit function in FTS360 or the FTS360 Config App.
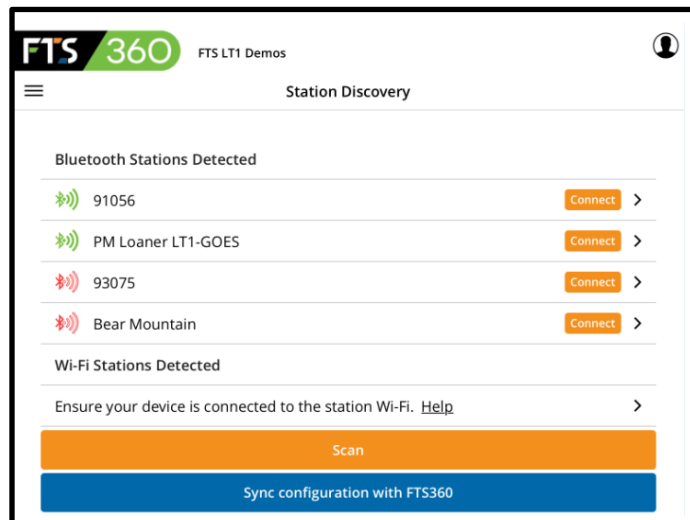
- Select "Connect" to display the Station Dashboard (the BLE Status light on the LT1 will become solid "On" when connectivity established). If there are several stations discovered, ensure you connect to the correct one.
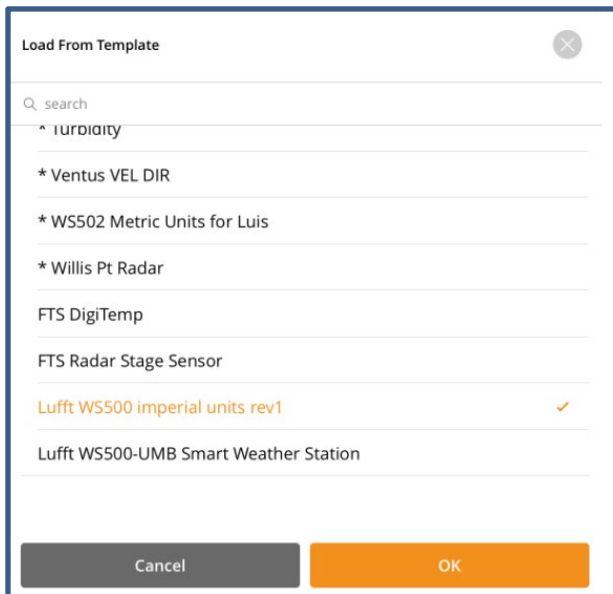
  HINT: If there is more than one LT1 station in the area, once connected, select the Flash LEDs bar to confirm you are connected to the desired station.
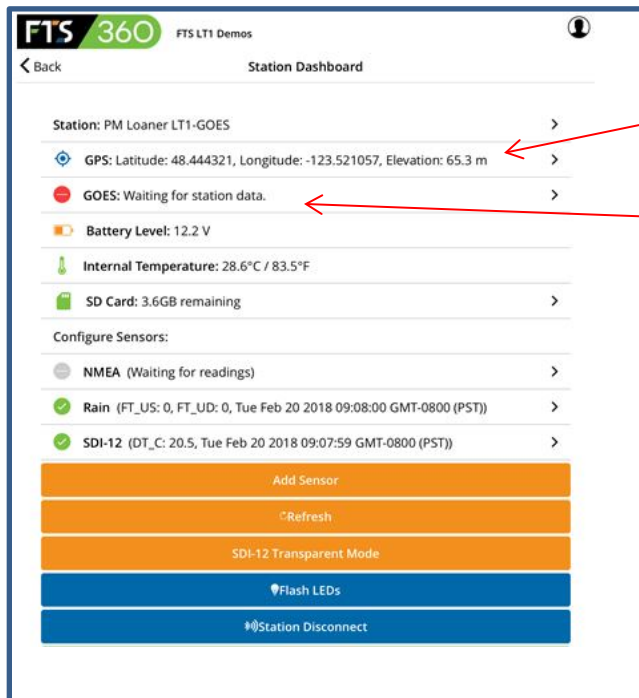
It can take up to 20 minutes to get a GPS fix

This will indicate GOES or Cellular as per the LT1 type

2). Add and configure sensors: Select the sensor type to add (NMEA or Rain). To add an SDI-12 sensor, select the Add Sensor bar.

Select the desired sensor from the Sensor Type drop down list and edit fields as necessary. Save.

HINT: Custom library items created by your agency are listed first, followed by default library items.

Use the Search feature to find a specific entry or to filter the items by sensor type

3). Test the sensor(s): Select the Test Sensor bar. This will trigger a reading by the sensor and the data point(s) will display.

NOTE: New sensors should always be tested prior to leaving the site to ensure they are operating as desired.

3.2 CONFIGURE GOES/EUMETSAT STATION SETTINGS/MESSAGE

GOES/EUMETSAT stations must have the telemetry and message format configured

1) Select the arrow on the GOES line to open the Station GOES Settings screen. Fill in the fields with your provided satellite information.

NOTE: information on this sample screen is for demonstration purposes only:

Once all fields are completed, the Transmission Enabled button will be displayed

2) To configure the message, select the Configure Transmitted Message bar and use the drop down menu to select the data format type.
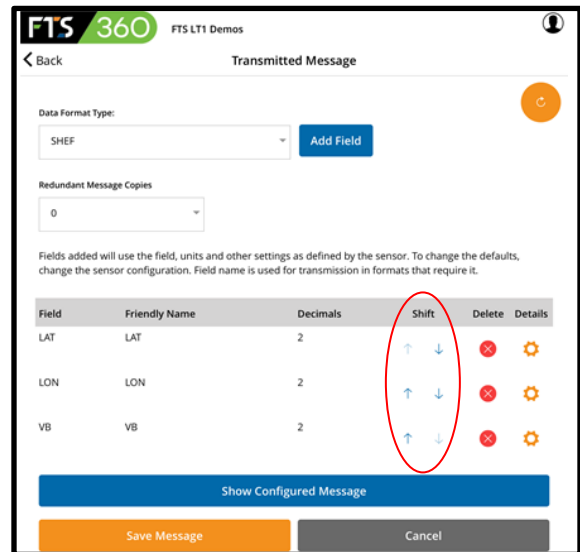
3) Press the Add Fields button and select the desired fields to be included in the message
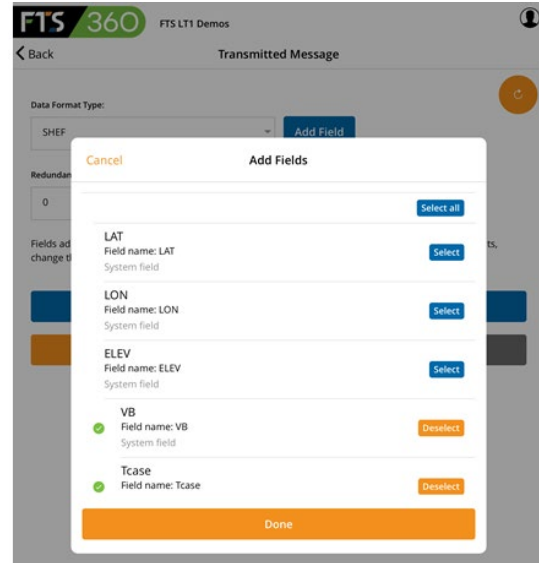
4) Message fields can be viewed and amended using the Details cog. Note that if using the App on a phone, not all columns displayed here (tablet shown) will be visible but can be viewed by selecting the Details cog.

   The list order can be changed using the shift up/down arrows

5) Confirm message configuration by selecting the Show Configured Message. A simulated message using station data will be displayed.

3.3   SYNCHRONIZE AND DISCONNECT

1). Synchronize the FCA with FTS360: Select the Sync Data feature to save changes made in the field with FTS360. If you are not in an area where you can access the Internet to perform a data sync before leaving the site, as soon as you have internet access you should open the FTS360 Config App to sync the configuration back to the FTS360.
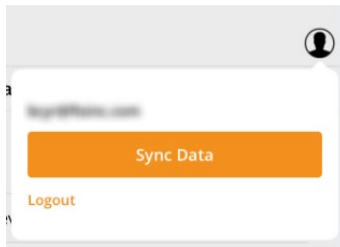
IMPORTANT! Changes made to a station working offline using the FTS360 Config App, will not be reflected in FTS360 until the field device is synchronized with FTS360.

Until synchronization occurs, FTS360 will operate based on the previous configuration. As such, new data transmitted will be stored but not displayed until FTS360 receives the updated configuration.

2). Disconnect: Select the "Disconnect" button on the FTS360
Config App screen

If you move out of range of the LT1, it will automatically disconnect. Any changes made that were not saved before an inadvertent disconnection will have to be repeated and saved.

Appendix A TROUBLESHOOTING

LED Status Indicators: ○ = On ● = Off **N/A** –not applicable (can be on, off, or blinking)
✹ = Blinking once every 10 seconds ✹✹ = Blinking every second

The following LED patterns indicate Normal Operation:

⏻	🔊	✳	⦿	Indicates	Comment
✹✹	○	○	○	System OK	This is the state when power is first applied once all connections are made or when initially connecting to the station using the FTS360 Config App (unit operating normally, no faults).
✹	●	●	●	Low Power Mode	Sending a command (such as the connect, add sensor, or any editing command) will illuminate the lights as indicated above.

The following LED patterns indicate faults:

⏻	🔊	✳	⦿	Indicates	Solution
●	●	●	●	No power to the LT1	1) Check battery connections 2) Confirm wire connections to the terminal block and terminal block firmly seated
				Battery fully discharged	1) Replace battery 2) If being used with a solar panel and regulator, check connections to ensure battery being charged
○ or ●	N/A	N/A	N/A	SD card not inserted	Power off the LT1. Insert SD card or confirm inserted SD card is properly seated and locked.
✹✹	✹✹	N/A	N/A	CELL: No cellular connection	It can take 1-20 minutes (or longer) to get an initial cellular connection based on numerous factors such as geographical location, carrier, if the signal has to roam etc. If after a reasonable time based on the above factors, the cellular LED is still blinking try the following: 1) Check Cellular antenna connection 2) Confirm SIM card is inserted correctly 3) SIM card not activated. Call cell plan provider to activate.
✹✹	✹✹	N/A	N/A	GOES/ Meteosat: No transmission possible	1) No GPS time fix: Wait for GPS time fix 2) Invalid configuration so transmission not possible. Review configuration

---

⏻	🌐	✳	◉	Indicates	Solution
✱✱	N/A	N/A	✱✱ For > 5 minutes	Unable to obtain a GPS fix	1) Check GPS antenna connection 2) GPS satellite signals may be blocked or weak a) Check for physical obstructions such as cliff faces and move GPS antenna to unobstructed area 3) Check Cellular connections (GPS cannot get a fix if cellular module cannot connect to the base stations
✱✱	N/A	○	N/A	Before you connect: Someone else is connected	1) If possible, request the other party to disconnect; or 2) Power cycle the LT1 (remove and replace the power terminal block) to disconnect active BLE connections. This will terminate all other BLE connections.

FTS360 Config App

Problem	Indicates	Solution
No BLE status light when attempting to connect	Fault	1) Power cycle the LT1 (remove and replace the power terminal block) and then attempt to connect 2) If no BLE status light after trying (1), contact FTS Support

Denied access to the station	You are signed into the wrong agency	1) If you belong to more than one agency:
		
		  i) Access the internet and log into FTS360 in the station's agency
		  ii) Open the FTS360 Config App and sync
		  iii) Return to the station and attempt connection

	You are not a member of the station's agency	2) Contact your Administrator to be added as a member of the station's agency

DOCUMENT REVISION HISTORY

Revision	Date	Description
1	7 May 2018	Combined Cellular and GOES installation information. Supersedes 700-LT1-CELL-IG
2	22 Oct 2018	Corrected part # for Slot screwdriver