



EXTREME ENVIRONMENTS. EXTREMELY RELIABLE.



LT1 (CELL/GOES) Logging Transceiver

Operator's Manual

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

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Chapter 1 GENERAL

1.1 DESCRIPTION

The LT1 is a battery powered compact data collection platform with a built-in telemetry module, either cellular or satellite (GOES/EUMETSAT or Iridium).

IMPORTANT:

- The LT1 **MUST** be mounted in an IP66 weather-proof enclosure that is fitted with a 35mm x 7.5mm DIN rail.¹
- The LT1 must be used in conjunction with FTS360, a secure web-based software platform and the associated FTS360 Config App², accessible from a computer browser or smart device. Details are in Chapter 2.

Most aspects of the installation and operation of all models are the same. This manual will use the term LT1 when describing all common aspects. Specific models will be identified for information unique to their operation. Refer to Appendix C for specifications of each model.

The LT1 has a data terminal block which accommodates SDI-12 and NMEA sensors and a counter specific to a tipping bucket rain gauge. It has a spring clip for mounting the unit on a 35mm x 7.5mm DIN rail. The serial number for the LT1 is found on a sticker under the flexible port access cover (see Figure 1-2).

1.2 LT1 VERSIONS (LT1-CELL/LT1-GOES)

Each model of LT1-Cell and LT1-GOES have two versions: the original and an updated version (V2). V2 units have hardware upgrades which offer additional features over the original version. These upgrades are:

- It can support four SDI-12 sensors (original version supports two)
- It has a larger memory capacity to support more sensor parameters and redundant message configuration

The indicator V2 will follow the model number on the product label (eg: LT1-GOES V2). Additionally, the firmware will begin with the number 2 (eg: 2.0.6). The firmware version the LT1 is running is displayed on the “Edit Station” screen in FTS360 and in the FTS360 Config App at the bottom of the dashboard, when connected to the LT1.

¹ The LT1 is designed to operate in a dry, protected environment. Exposure to rain greater than 1mm per minute, spraying or splashing water may cause the unit to fail.

² Details of FTS360 and the FTS360 config App can be found in 700-FTS360-Man(FTS360 and FTS360 Config App User Manual)

1.3 LT1 PARTS

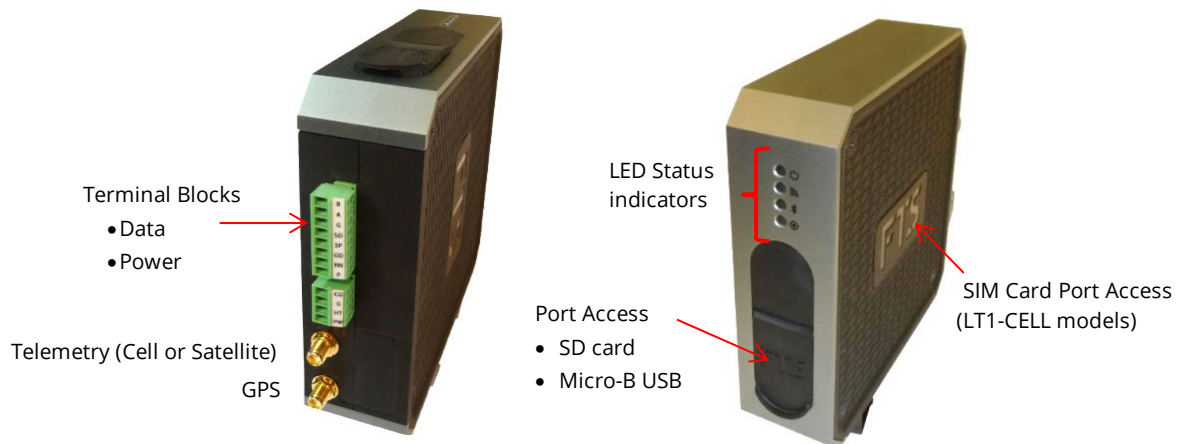





Figure 1-1: Parts of the LT1

1.4 COMPLIANCE INFORMATION

<p>LT1-CELL LT1-CELL-VZ LT1-GOES LT1-IRID</p>		<p>This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.</p> <p><i>Le présent appareil est conforme à la partie 15 des règlements de la FCC. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) il doit accepter toute interférence reçue, notamment celles pouvant entraîner un dysfonctionnement.</i></p> <p>This equipment may be operated in the USA and Canada.</p>																																
<p>LT1-CELL</p>		<p>This equipment may be operated in all EEA countries and Switzerland.</p> <table border="1"> <tr> <td>AT</td><td>CY</td><td>EL</td><td>HR</td><td>IT</td><td>LU</td><td>PL</td><td>SI</td> </tr> <tr> <td>BE</td><td>DK</td><td>ES</td><td>HU</td><td>LI</td><td>MT</td><td>PT</td><td>SK</td> </tr> <tr> <td>BG</td><td>DE</td><td>FI</td><td>IE</td><td>LV</td><td>NL</td><td>RO</td><td>UK</td> </tr> <tr> <td>CZ</td><td>EE</td><td>FR</td><td>IS</td><td>LT</td><td>NO</td><td>SE</td><td></td> </tr> </table>	AT	CY	EL	HR	IT	LU	PL	SI	BE	DK	ES	HU	LI	MT	PT	SK	BG	DE	FI	IE	LV	NL	RO	UK	CZ	EE	FR	IS	LT	NO	SE	
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CZ	EE	FR	IS	LT	NO	SE																												
<p>LT1-CELL</p>		<p>This device complies with ACMA regulatory arrangements and may be operated in Australia</p>																																

1.4.1 SDI-12 VERSION 1.3

The LT1 follows SDI-12 version 1.3 protocols with the exception of cyclic redundancy check (CRC) commands and continuous measurement commands which it does not support.

1.4.2 SD CARD AND MICRO-B USB PORTS

The SD card and Micro-B USB ports are accessed by opening the rubberized access cover. The SD card stores data locally (details in section 2.3.2). The USB port is used for connecting to an LT1 station with a computer using the FTS360 Config App for Windows. To close, ensure the cover is firmly seated by running your thumbs along the side of the LT1 and overlapping the edge of the access cover.

NOTE: Do not apply direct, localized pressure³ to the edge of the cover immediately over the SD card as this may disengage the SD card.



Figure 1-2: SD card and Micro-B USB port access

The LT1 is shipped with an FTS tested and approved industrial grade SD card inserted in the SD card port. Detailed information on SD cards and their use can be found in section 1.6.

IMPORTANT!

- Only FTS supplied SD cards should be used with the LT1 for logging.
- SD cards should only be removed as per instructions in Section 1.6.1

1.4.3 SIM CARD PORT – LT1-CELL

Only LT1-CELL models require a SIM card to operate. The SIM card port is accessed through the FTS panel located on the side of the device (see Figure 1-3). To open the access panel, insert a small screwdriver into the slot and gently pry the panel open.

NOTE: Only open the access panel in a protected, dry environment. Any moisture entering the electronics compartment can cause the microprocessor to fail.

³ Force that is applied directly over the SD port such that the cover depresses.

The SIM card holder will be firmly seated in the locked position. To unlock it, gently slide the black holder towards the SIM card holder's hinge. Once it is unlocked, the SIM card holder will spring up slightly and then it can be swung to its fully open position, from which the SIM card can be removed/inserted.

When returning the SIM card holder to its seated position, apply slight pressure and slide the back of the SIM card holder to the locked position.

IMPORTANT! When inserting or removing the SIM card, care must be given to ensure the SIM card is not bent or damaged in any way as this may result in transmission failure.



Figure 1-3: Accessing the SIM card (cellular models)

1.5 TELEMETRY AND NETWORK COMMUNICATION

The LT1 can be ordered with either cellular, GOES/Meteosat, or Iridium telemetry. Local communication with an LT1 is performed using the built-in Bluetooth module and FTS360 Config App available on iOS and Android devices.

1.5.1 LT1-CELL

The LT1-CELL uses Message Queue Telemetry Transport (MQTT) messaging protocol, a standard commonly used for Internet of Things (IoT) applications, for remote transmissions. It transmits sensor and station data and receives commands such as firmware updates over the internet. Station and data management is handled by FTS360, a secure web-based software platform.

Data from the LT1-CELL is stored locally, and then securely sent to FTS360 which provides real-time, high-speed access to the LT1-CELL's data. FTS360 can be accessed from the browser on a computer or on a smart device.

1.5.2 LT1-GOES

The built-in G6 transmitter of the LT1-GOES is certified by NOAA to operate on the GOES satellite network, and by EUMETSAT for the Meteosat network. It transmits station and sensor data in GOES/Meteosat industry standardized formats.

1.5.2.1 **GOES GPS ANTENNA REQUIREMENTS**

The G6 component of the LT1-GOES has a GPS module used for accurate timing of the satellite transmissions. It will work with either passive antenna or a 3 Volt active GPS antenna. The antenna type needs to be right hand circular polarization. Both the antenna and the cable need to be capable of handling the maximum 14 watts power output of the module.

1.5.3 **LT1-IRID**

The LT1-IRID connects to the Iridium satellite system, a network that provides pole-to-pole coverage. With seamless connectivity between The LT1-IRID at site and FTS360, a secure web-based software platform, bi-directional communication of data and station configuration is easy and fast.

Data from the LT1-IRID is stored locally on the SD card, and then securely sent through an iridium based IoT network providing real-time, high-speed access to data to FTS360 which provides real-time, high-speed access to the LT1-IRID's data. FTS360 can be accessed from the browser on a computer or on a smart device."

1.6 **SD CARDS**

The LT1 is shipped with an FTS approved industrial grade 4GB SD card inserted in the SD card port and contains the station's logs. On average, two years data can be stored on this card. This SD card has been tested to work with the LT1's embedded system and in the environmental conditions in which the LT1 is designed to operate. Removing it or replacing it with a non-certified (standard) SD card can cause reduced functionality of the LT1 and compromise the station's logs.

Updating an LT1-GOES/LT1-IRID station's firmware requires a FAT32 formatted SD card.

1.6.1 **SAFELY REMOVING/INSERTING THE SD CARD**

In order to prevent corruption of the SD card and loss of integrity of stored information and logs, the SD card must be safely removed. If conducting a FW update, removal of the SD card is imbedded in the FW update steps. Follow the directions in Section 1.7.

If removing the SD card for other reasons (troubleshooting, copying logs etc.) connect to the LT1 using the FTS360 Config App. From the Station Dashboard page select the SD Card line and then the "Safely remove SD card" button. Follow the prompts to remove and re-insert.

NOTE: The station's SD card is an industrial card certified to operate within the LT1's environmental specifications and contains the station's logs. If it is not replaced, or is replaced with a non-certified SD card, station logs may be compromised.

1.7 **FIRMWARE UPDATES**

Firmware updates should be installed when they are released as they include new or enhanced features, or modifications to improve performance, including bug fixes. It is important to wait until the firmware update has completed before taking any other action with the station.

1.7.1 LT1-CELL

Firmware updates for LT1-CELL units are conducted through FTS360 due to the bi-directional telemetry. In FTS360, select the station and the “Edit Station” button. Select the Update Firmware button and follow the prompts.

1.7.2 LT1-GOES

IMPORTANT: Prior to conducting a firmware update on an LT1-GOES ensure you do the following:

- Update to the most current version of the FTS360 App to ensure all features of the update will function.
- Download the FW upgrade to a FAT32 formatted SD card before travelling to the field.

NOTE: For LT1-GOES, 360.ftsinc.com will automatically download both FW upgrade variants (for version 1 and version 2 models). Bring both to the field: the LT1-GOES will only accept the FW version specific to its model. Both versions will automatically download; however, a prompt requesting the multiple file download may appear the first time this is done.

1.7.2.1 *Updating using a smart device:*

Updating an LT1-GOES/LT1-IRID station’s firmware requires a FAT32 formatted SD card, a device capable of downloading to an SD card, and a site visit to the LT1 station.

- 1) Ensure you have the most recent version of the FTS360 Config App downloaded to your device.
- 2) From FTS360, go the Station’s page and select the “Edit Station” button.
- 3) Select the Download Firmware button.

Note: The firmware file will be saved with the following naming nomenclature:

LT1_GOES_APP_[FW ver].bin

Example: For FW update ver 1.11.25 the file appears as LT1_GOES_APP_1_11_25.bin

- 4) Follow the prompts to download both the firmware update files to the SD card.
- 5) Prepare for a site visit (sync the FTS360 Config App and bring the SD card)
- 6) At the site, connect to the station.
- 7) From the Station dashboard. Select the Station arrow, then the “Update Firmware From SD Card” button. Follow the prompts.

IMPORTANT! DO NOT use the FTS360 Config App until the FW update has completed.

- 8) Upon completion of the update you will automatically be disconnected from the station. Re-connect to the station.
- 9) Safely eject the SD card used for the firmware update (from the Station Dashboard page select the SD Card line and then the “Safely remove SD card” button. Follow the prompts.)
- 10) Replace the station’s original SD card.

NOTE the station’s SD card is an industrial card certified to operate within the LT1’s environmental specifications and contains the station’s logs. If it is not replaced, or it is replaced with a non-certified SD card, station logs may be compromised.

1.7.2.2 **Updating using a Windows 10 PC**

You will need the Windows 10 PC and a Micro-B data-USB cable

- 1) Ensure you have the most recent version of the FTS360 Config App downloaded to your PC.
- 2) From FTS360, go the Station’s page and select the “Edit Station” button.
- 3) Select the Download Firmware button.
- 4) Follow the prompts to download the firmware update to your PC. Copy both firmware files to an accessible folder on the PC. Download both FW upgrades.

Note: The firmware file will be saved with the following naming nomenclature:

LT1_GOES_APP_[FW ver].bin

Example: For FW update ver 1.11.25 the file appears as LT1_GOES_APP_1_11_25.bin

- 5) Prepare for a site visit (sync the FTS360 Config App and bring the data-USB cable)
- 6) At the site, connect the PC to the station using the data-USB cable.
- 7) Select the Station arrow, then the Update Firmware button. Follow the prompts.

IMPORTANT! DO NOT use the FTS360 Config App until the FW update has completed.

1.7.3 **LT1-IRID**

The LT1-IRID firmware can be updated remotely through FTS360 or on-site. Note that data charges will apply for remote updates.

If updating remotely through FTS 360, follow the firmware update instructions for LT1-CELL (section 1.7.1)

If updating on-site, follow the firmware update instructions for an LT1-GOES (Section 1.7.2)

Chapter 2 STATION AND DATA MANAGEMENT

2.1 STATION MANAGEMENT

Two software tools are required to manage LT1 stations: FTS360, a secure web-based software program, and the FTS Config App which must be used for the initial setup and configuration of a station. The FTS Config App can be used with iOS, Android, and Windows 10 devices⁴. The FTS Config App is also required to make changes to stations at remote sites which do not have two-way communication or internet access. Table 2-1 provides a comparison of FTS360 and FTS360 Config App features/ capabilities,

FTS360 must be used in conjunction with the FTS360 Config App to provide complete station set up, configuration, and management capabilities. Stations and Station Groups can be created, sensors configured, and data viewed. See the FTS360 User Manual (700-FTS360-Man) for a full description of the software's capabilities and operating details.

FTS360 can be accessed from the browser on a computer or on a smart device and provides remote capabilities when connected to the internet. The FTS360 Config App is an extension of FTS360 which runs on mainstream iOS, Android, and Windows 10 devices. It is intended for use in the field and provides direct Bluetooth access to the station when within 50 feet. The FTS360 Config App is used for the initial set up and configuration/ editing of a station's sensors in the field. Note that changes made using the FTS360 Config App must be synchronized with FTS360 for changes to be recognized by the software platform (see section 2.3.3)

Table 2-1: FTS360 vs FTS360 Config App

	FTS360		FTS360 Config App
	LT1-CELL/ LT1-IRID	LT1-GOES/ METEOSAT	
Use with web browser	●	●	
Use with Smart Device	●	●	●
Create configurations for sensor library	●	●	
Real time display of station health	●	●	●
Create alerts/notifications	●	●	
Export data via csv	●	●	
Configure/edit stations and sensors	●		●
Local Bluetooth access			●
Add stations			●
Add sensors			●
Test sensors			●
Transparent Mode for SDI-12 sensors			●

⁴ The FTS360 Config App can be downloaded from  [Download on the App Store](#)  [Get it on Google play](#)  [Download on the Windows Store](#) for iOS, Android and Windows respectively.

2.2 USING FTS360 AND THE FTS360 CONFIG APP

This section provides basic information on using the FTS360 Config App for the initial setup of an LT1. For a detailed description of the operation of FTS360 refer to the “FTS360 User Manual” (700-FTS360-Man). Details of configuring an LT1 with the FTS360 Config App are found in Chapters 5 and 6.

2.2.1 FTS 360 ACCOUNT INITIALIZATION

In order for Agency users to have access to FTS360, the Administrator must first initialize the account and assign an Agency name. Note that in some cases, FTS will have completed this step on behalf of the client. If that is the case, the Administrator will not have to Sign Up as outlined in the following paragraph. Instead, an e-mail will be sent to the Administrator with directions on how to log in to FTS360. The Administrator must then create user accounts for the Agency.

To create the Agency, the Administrator must go to the Sign Up URL <https://360.ftsinc.com/signup> and complete the fields. The first user to sign up is automatically assigned Administrator status. The Administrator must then create user accounts for the Agency.

2.2.2 DOWNLOADING THE FTS360 CONFIG APP

The FTS360 Config App for use on an Apple or Android smart device uses Bluetooth technology to provide direct, local access to a station, permitting configuration changes to it when in the field and internet connection is not possible. The FTS360 Config App is designed to have the same look and feel as FTS360 and will permit you to configure stations when within close proximity to the station.

The FTS360 Config App can be downloaded from the Apple App Store or Google Play. Search for FTS360.

2.2.3 SYNCHRONIZATION

Prior to going to the field and immediately upon return (or when internet connection is possible), you should log on to the FTS360 Config App to synchronize with FTS360. After synchronization **DO NOT** log off prior to going to the field. Any changes made in the field will not be reflected in FTS360 and FTS 360 will not be able to display data from that station until synchronization occurs upon return from the field.

2.2.4 USING THE FTS360 CONFIG APP IN THE FIELD

In order to use the FTS360 Config App to communicate directly with a station you must:

- have access to FTS360 and be assigned either an Administrator or Technician role
- have downloaded/updated the FTS360 Config App onto the smart device which will be used in the field

- log onto the FTS360 Config App as a member of the Agency to which the station is assigned,
- synchronize with FTS360, and remain logged on (Note: Synchronization occurs automatically when logging onto the FTS360 Config App with an internet connection)

Prior to going to the field and immediately upon return (or when internet connection is possible), you should log on to the FTS360 Config App to synchronize with FTS360. Until synchronization occurs, FTS360 will not be able to display data from that station.

IMPORTANT! For FTS360 to recognize LT1 data it receives, the FTS360 Config App **MUST** be synchronized with FTS360 after a field visit.

2.2.5 ADDING STATIONS

LT1 stations can only be added using the FTS360 Config App. LT1-GOES stations can be added using FTS360 or the FTS360 Config App. The station will be added to the Agency which the user is logged into.

IMPORTANT! Ensure you are logged into the Agency into which you want to add the new station.

The first time a station is connected to the FTS360 Config App, it's identified by its serial number unless the station was created in FTS360 and given a different name. 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 created name using the station edit function in FTS360 or the FTS360 Config App.

2.2.6 RESETTING A STATION

Resetting a station is done through the Edit Station screen on the FTS360 Configuration App . There are three options for resetting a station:

- 1) Reset PW:** This will reset the station to the default password. All settings and configurations remain, however, no other user will be able to access the station until you sync your device with FTS360.
- 2) Reset Station Config:** This returns the station to its factory default settings. All sensor and telemetry configurations will be lost. The Station remains in FTS360 as part of the Agency and is accessible. Sensor and telemetry configurations will have to be entered for data transmission. The station retains its last saved name. All data logged prior to resetting the station configuration is retained under the station's name in FTS360. If the LT1 is reconfigured with new telemetry and sensors, new data will be logged under the station's name continuous with previously logged data.

3) Remove Station from FTS360: Resets the station to factory defaults and removes the station from FTS360. All data will be removed from FTS360 so users should save any data to other files before deleting the station. Once deleted, the station can be set up as new station in the same agency or a different agency. Refer to section 2.2.5.

2.3 DATA MANAGEMENT

Remote data management is dependent on the telemetry of the LT1 device.

LT1-CELL: securely transmits data through the cellular network to FTS360 where it can be viewed and exported. Also stores data locally to SD card (see SD Card information in this section).

LT1-GOES: transmits data through the GOES/Meteosat network where it is available to users through the standard distribution pathways of the relevant satellite authority. Additionally, the data collected from any GOES/Meteosat capable data collection platform can be ingested by FTS360 for managing data. Also stores data locally to SD card (see SD Card information in this section).

LT1-IRID: securely transmits data through the Iridium network and to FTS360 where it can be viewed and exported. Also stores data locally to SD card (see SD Card information in this section).

SD CARD: All models can also store data locally to the supplied SD card for redundancy. This SD card has been tested to work in the environmental conditions in which the LT1 is designed to operate. Replacing it with a non-FTS approved, standard SD card can cause reduced or lost data in the logs.

2.3.1 SD CARD – STORED INFORMATION AND TIMESTAMPS

The LT1 uses active data management which ensures no data is missed. Data collection and storage will begin as soon as the cellular network provides a time stamp (LT1-CELL only) or a GPS time is obtained, whichever comes first. After this initial time synchronization, in the event of a network failure or no GPS fix, the LT1 continues to store data locally to the SD card. However, the time can drift up to 2 seconds per day until a GPS connection is restored. Default GPS synchronization occurs once per day.

For LT1-CELL and LT-IRID, once connectivity is restored, the LT1 will synchronize with FTS360 and any missing data will be added to the FTS360 database.

For a GOES unit, data missing from transmissions must be collected on-site from the SD card.

2.3.2 SD CARD DATA LOG DIRECTORY AND FILE NAMING STRUCTURE

There are two data log types stored on the SD card: the .csv data log and the raw telemetry data log. Refer to Table 1-1 for the directories and naming structures of the data log types.

For the raw telemetry data, each line is a direct copy of the data point and format sent over the telemetry connection. For example, the LT1-CELL and LT1-IRID will contain JSON strings, while the LT1-GOES will contain GOES formatted strings depending on the configuration of the GOES format.

Table 2-2: Data Log Directory and Naming Structure⁵:

DATA LOG TYPE	DIRECTORY AND NAMING STRUCTURE
.csv	<p>Directory: /LT1-CELL<serial number>/DATA/<filename> /LT1-GOES<serial number>/DATA/<filename> /LT1-IRID<serial number>/DATA/<filename></p> <p>Naming structure: (8_dig_serial_number)_(8_dig_sequence_number)_(compact_timestamp)_DATA.csv</p>
Raw telemetry	<p>Directory: /LT1-CELL<serial number>/TELEM/<filename> /LT1-GOES<serial number>/TELEM/<filename>/ LT1-IRID<serial number>/TELEM/<filename></p> <p>Naming structure: (8_dig_serial_number)_(8_dig_sequence_number)_(compact_timestamp)_TELEM.txt</p>

Naming structure example Telemetry log:

00000019_00000160_20180218T062746Z_Telem.txt

LT1 Serial
Sequence
Date
Time
Data log

..
#
yyyymmdd
HHmmssUT
type

This is the Telemetry data file for SN 19, sequence number 160, starting on Feb 2, 2018 at 6:27:46 UTC

2.3.3 COPYING DATA FROM THE SD CARD

- 1) To copy data from the SD card, the card must be safely removed from the LT1 in one of two ways:
 - a) Connect to the LT1 with the FTS360 Config App using Bluetooth. From the Station Dashboard select the SD Card menu and then the “Safely remove SD card” button. Follow the prompts; or
 - b) Power down the LT1 by removing the power terminal block.

IMPORTANT! Failure to safely remove the SD card can result in corrupted data.

- 2) Insert the SD card into a device (such as a laptop) which has an SD card reader;

⁵ Firmware version 1.4 and later

- 3) Select the desired files and drag and drop them into a compatible program such as an Excel spreadsheet or Notepad++;
- 4) Safely eject the SD card from the device and replace it in the LT1;
- 5) Refresh the dashboard to detect the SD card and display SD card information.

Chapter 3 FTS360 CONFIG APP GENERAL INFORMATION

The FTS360 Config App⁶ on a smart device uses Bluetooth technology to provide direct, local access to an LT1 station within 50 feet. It is used for initial station setup and sensor configuration. It is also used for making configuration changes in locations where internet connection, and therefore remote access by FTS360, is not possible. Afterwards, it must be synchronized with FTS360 for the station and its data to be accessible in FTS360. The FTS360 Config App is designed to have the same look and feel as FTS360. Note that screens may not appear the same on all devices but all screens will have the same functionality.

3.1 **STATION FUNCTIONALLITY WHILE CONNECTED TO THE APP**

When connected, the station will continue to process remote and scheduled tasks. Data will continue to be logged but will not be transmitted until disconnection takes place. However, any actions or requests made using the FTS360 Config App take priority; if there is a conflict, remote or scheduled requests will not occur. This may result in some missed data points during the period of connection.



Transparent Mode: When communicating with an SDI-12 sensor using SDI-12 commands in transparent mode, the collection and transmission schedule for ALL sensors is suspended until transparent mode is exited.

3.2 **REQUIREMENTS TO USE THE FTS360 CONFIG APP**

In order to use the FTS360 Config App, you must be assigned as either an Administrator or Technician in FTS360. A Viewer will not be able to use the FTS360 Config App, as Viewers are not able to configure stations.

In order to communicate directly with a station you must:

- Have access to FTS 360 and be assigned either an Administrator or Technician role
- Have downloaded the FTS360 Config App onto the smart device which will be used in the field
- Have logged onto the FTS360 Config App and synchronized it with FTS360. Synchronization occurs automatically by logging onto the FTS360 Config App with an internet connection
- Ensure you have logged into the FTS360 Config App as a member of the Agency to which the station is assigned.

⁶ Available from  for iOS  for Android  for Windows devices. Search for FTS360 Config.

3.2.1 USING THE APP WITH AN ANDROID DEVICE

If using an Android device, in order to connect to the LT1 the “location services” feature must be enabled and the device must have lock screen security. If using an Android device, if the device’s unlock PIN is changed, you must re-log into the FTS360 Config App and synchronize.

3.3 PRIOR TO PROCEEDING TO THE FIELD

Prior to proceeding to the field, the following must be done:

The FTS360 administrator must:

- Initialize FTS360 (<https://360.ftsinc.com/signup> or login if FTS initialized FTS360 on your behalf).
- Create a Technician account for the field technician
- For LT1 stations, ensure any SDI-12 sensors to be added in the field exist in the sensor library (either as a default sensor or create a custom sensor)

The field technician must:

- Log in to <https://360.ftsinc.com> at least once;
- Download/update the FTS360 Config App onto the smart device that will be used in the field and have logged in

Always update the App and confirm the station has the latest Firmware before proceeding to the field. Update the station’s firmware if required. LT1 Cell firmware can be done directly through FTS360. LT1 GOES requires a manual update in the field. See section 1.5 for details.

- Conduct required equipment tests
- For LT1 stations, confirm sensors to be added in the field exist in the sensor library
- Sync the FTS360 Config App with FTS360

IMPORTANT! If you will be working offline (ie: no internet connectivity) in the field, DO NOT log out of the FTS360 app after synchronizing with FTS360.


- Create and use a checklist of all tools and equipment that will be required on-site

3.4 SYNCHRONIZING THE APPLICATION

Synchronizing the FTS Config App with FTS360 ensures that both programs will have the most current station configuration information. This is extremely important if you will be working offline (ie: no internet connectivity) in the field. The Station Discovery page and User Information menu will indicate the time of the last synchronization with FTS360.


Although the FTS360 Config App will periodically synchronize with FTS360 when a network connection is available, a manual synchronization should always be done immediately prior to leaving for the field and immediately upon return.

If using an Android device, if the device's unlock PIN is changed, you must re-log into the FTS360 Config App and synchronize.

To synchronize, select the  icon located in the top right-hand corner of the screen or the blue Sync button on the bottom of the Station Discovery page.

IMPORTANT:

- You must be on-line in order to synchronize.
- Always synchronize data before proceeding to the field and at the first opportunity after changes have been made while operating offline.

If pages have been edited and changes saved using the FTS360 Config App or the FTS360 Config App has not been synchronized recently the  icon will be displayed on the Station Discovery page.

If you have internet connection, when you disconnect from the station, the application will sync and push those changes to FTS360 while simultaneously scanning for other stations. If there is no internet connection, only a scan is conducted and once you have internet, you must synchronize with FTS360 for those changes to be recognized.

3.5 WORKING ONLINE

The FTS360 Config App is working online when the application is open and the device has internet connectivity.

When working online and connected to a station, at the time changes are saved, the information will be saved locally to the station and will also be pushed to FTS360, but no FTS360 information will be pulled down to your device. Any changes made to a station by a different user after you last synchronized the FTS360 Config App will not be reflected until after your device has been synchronized.

When operating online, full data synchronization will be made:

- 1) When first logging into the FTS360 Config App;
- 2) When switching agencies within the FTS360 Config App;
- 3) After selecting the "Sync Data" button; or

If you belong to more than one Agency, you must log into each Agency separately to conduct a full data synchronization with those Agencies' stations.

3.6 WORKING OFFLINE

If the site does not have internet connectivity, any changes made to that a station while working offline using the FTS360 Config App will not be reflected in FTS360 until the device used at the station is synchronized. Once you enter an area where you can access the Internet, open the FTS360 Config App to synchronize the configuration with FTS360.

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

IMPORTANT! Synchronize the FTS360 Config App with FTS360 after working offline to ensure FTS360 and the FTS Config App have the latest configuration data.

3.7 PASSWORDS

If the station is new to your agency, the first time the FTS360 Config App connects with the station, a password is generated. The password will be stored in FTS360 so other technicians in your agency can access this station. See section 1.3 for details on password generation.

It is absolutely necessary that upon return from the field after setting up a new station or resetting a station, that you synchronize the FTS360 Config App of the smart device used in the field with FTS360 to transfer and store the password information to FTS360.

IMPORTANT! Failure to synchronize the FTS360 Config App to the FTS360 after setting up a new station will prevent any other person in your agency from connecting to the station.

If the smart device used to set up a new station is lost or broken before synchronization with FTS360 took place, the station will need to be returned to FTS to be factory reset. Contact FTS Support for direction.

3.8 STATION DISCOVERY AND CONNECTING TO A STATION


Once opened, the FTS360 Config App will automatically scan for Bluetooth (LT1). A scan can also be triggered by selecting the Scan button. All detected stations within a 50-foot range will be listed.

Select the Connect button to the desired station. If you are in a different agency to that to which the station belongs, you will be prompted to switch agencies in order to connect. If the station is part of an agency to which you do not belong, access will be denied.

The first time a station is connected to the FTS360 Config App, it's identified by its serial number.

Additional Menu items →

The BLE icon indicates the strength of the signal:

 Strong signal.


 Weak signal.
Reduce distance to the station.



Figure 4-1: Station Discovery Screen

To display the station's dashboard, select **Connect**. The BLE Status light on the LT1 will become solid "On" when connectivity is 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. The LEDs on the LT1 to which you are connected will flash.

3.9 STATION DASHBOARD ELEMENTS

The dashboard has four sections parts: user information, station identification and health indicators, sensor information, and action buttons. Elements which display a right arrow are used to access additional screens from which to review or edit information.

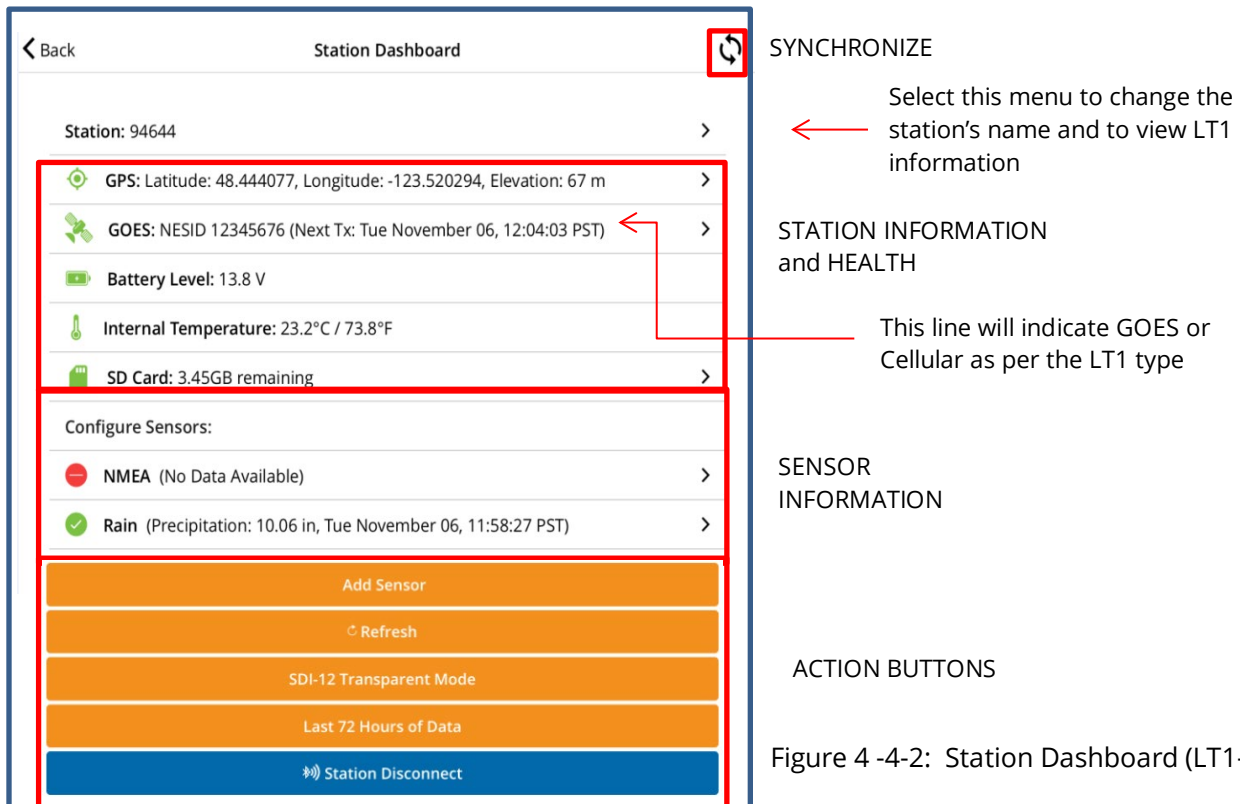
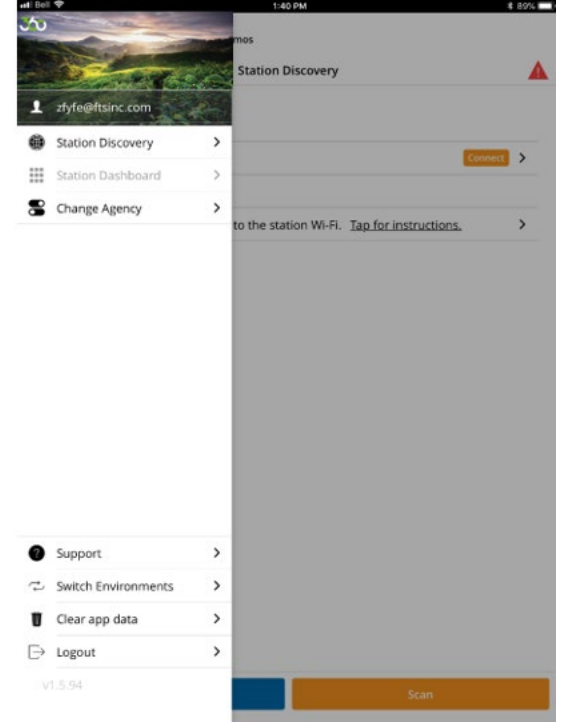


Figure 4 -4-2: Station Dashboard (LT1-GOES)

3.9.1 ADDITIONAL MENU ITEMS

The following additional menu items can be viewed by selecting the menu button in the upper left corner (see Figure 4-1):

<ul style="list-style-type: none">• Profile: your contact information• Station Discovery: brings you to that page• Station Dashboard: brings you to that page (once connected to a station)• Change Agency: If you belong to more than one agency• Support: contact information for FTS support• Switch Environments: detailed explanation follows• Clear App Data: detailed explanation follows• Logout• FCA version	 The image shows two overlapping mobile app screens. The background screen is the 'Station Discovery' page, featuring a landscape image at the top, a user profile 'zlyfe@ftsinc.com', and a 'Connect' button. The foreground screen is a menu with items: 'Station Discovery', 'Station Dashboard', 'Change Agency', 'Support', 'Switch Environments', 'Clear app data', and 'Logout'. At the bottom of the menu is the version 'v1.5.94' and a 'Scan' button.
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3.9.2 SWITCH ENVIRONMENTS

This is for the exclusive use of FTS Technicians and Service personnel. Customers cannot access this feature.






















3.9.3 CLEAR APP DATA

Clearing app data should not normally be required. It is a troubleshooting tool used if you believe the app data on your device has been corrupted. Clearing the app data resets the app to factory defaults and clears all stored passwords and settings for all stations from the device's app.

IMPORTANT! After clearing app data, you must perform a synchronization with FTS360 in order to access any station.




Synchronizing with FTS360 will reload all station passwords and settings, restoring the device's ability to access stations.

3.9.4 STATION INFORMATION AND HEALTH ICONS

INDICATOR	ICON	MEANING/COMMENTS
GPS:		GPS Fix not established.
		GPS fix established. Followed by latitude, longitude and elevation.
Cellular: (LT1-CELL units only)		No signal detected. Check antenna.
		Online. Strong signal (RSSI > -69)
		Online. Poor signal (RSSI ≥ -69)
		Extremely weak signal (RSSI ≤ -109)
GOES (LT1-GOES units only)		GOES message configured. Ready to transmit as scheduled.
		GOES message configured but no GPS signal. Unable to transmit as scheduled (time signal comes from GPS).
		GOES message not configured or failsafe tripped
		G6 information not available (Indicates the G6 information on the Station GOES Settings page has not been input)
IRIDIUM (LT1-IRID units only)		Good RSSI signal strength.
		Low RSSI signal strength.
		No signal strength, unable to transmit or other condition as indicated.
Battery Level:		Battery charging
		Battery fully charged
		Battery discharging with Battery Level: indicated
		Battery critical
Internal Temperature:		Internal temperature within operating range. Followed by the internal temperature
		Internal temperature outside of operating range.
SD Card		SD card installed. Followed by remaining space on card.
		SD card not installed

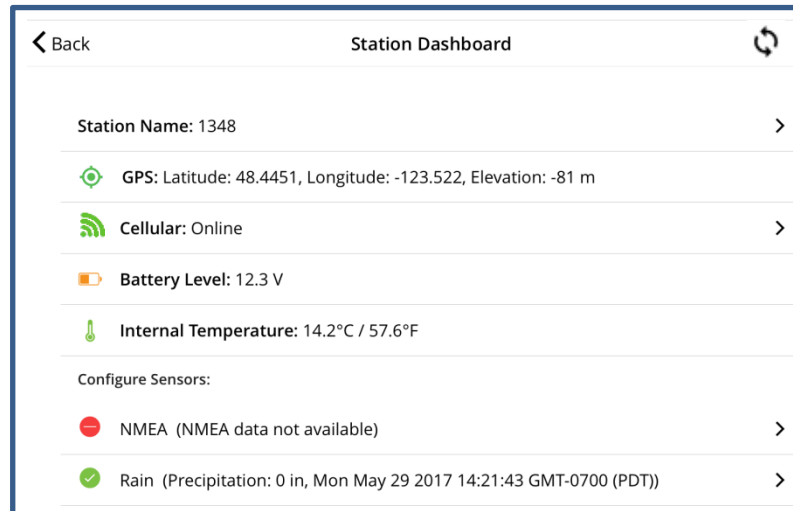
The GPS coordinates can be entered manually by selecting the “Manually override GPS coordinates” and entering in the desired latitude, longitude, and elevation. Note that manually overriding the coordinates does not affect the GPS signal so time synchronizing and GOES telemetry transmissions will still occur as long as the GPS signal is received.

3.9.5 SENSOR INFORMATION ICONS

ICON	MEANING/COMMENTS
	For NMEA or Rain sensor: The named sensor is inactive. The named sensor has not been added or configured. For SDI-12 sensors: Once the named sensor has been added, this icon with the message "Waiting for sensor data" will briefly show while settings are being saved
	Named sensor has been added and configured but no readings have been taken yet. Followed by message, "data not available".
	Named sensor has been added, configured and has data. Message indicates the last reading with its timestamp

This LT1-Cell station has two sensors configured:

- an NMEA sensor which has not taken any readings yet
- and a Rain gauge



This LT1-GOES station has a Rain gauge and an SDI-12 sensor configured
The NMEA sensor is inactive

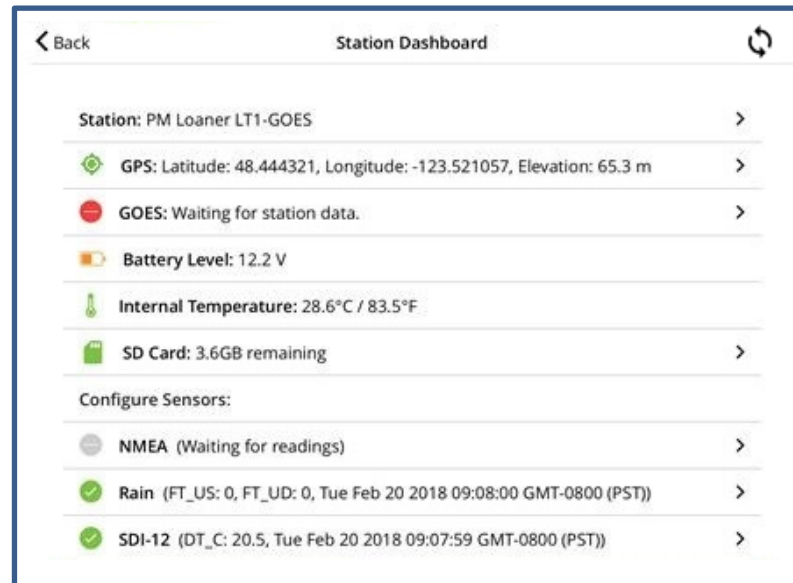


Figure 4-3: Station Dashboards showing Sensor Information

3.9.6 ACTION BUTTONS

Add Sensor: Select this to add an SDI-12 sensor (see Chapter 6 for details). Follow prompts on successive screens and complete fields with desired sensor type/details.

Refresh: This will refresh the Station identification and health portion of the dashboard.

SDI-12 Transparent Mode: Provides capability to send SDI-12 commands to SDI-12 sensors (see section 8.3 for details).

Last 72 Hours of data: Will download selected data points within a defined timeline from the last 72 hours

Flash LEDs – When selected will flash the LEDs. Used to quickly identify the LT1 if more than one is in the area.

Station Disconnect: Disconnects from station.

3.10 EDIT STATION SCREEN

Select the Station line to view the Edit Station Screen:

From this screen you can:

- 1) Change the Station's name
- 2) View/change the Schedules for the LT1's system (battery voltage, case temperature, signal strength) and location (latitude, longitude and elevation) information
- 3) View product information
- 4) Update the firmware (see Section 1.6)
- 5) Reset the station (see section 2.2.6)

The screenshot shows the 'Edit Station' screen with the following details:

- Station Name: 104575
- Information Sampled Every: 1 Hour(s)
- Next Sample At: 17:00 PDT
- Location Sampled Every: 24 Hour(s)
- Next Sample At: 17:00 PDT
- Serial Number: 104575
- Manufacture Date: 10/01/2019
- Firmware Version: 2.1.18
- Hardware Version: I
- Station Type: LT1-GOES-V2

Buttons visible: CHANGE SCHEDULES, UPDATE FIRMWARE FROM SD CARD, RESET STATION.

3.11 STATION DISCONNECTION

Should the Bluetooth signal be interrupted and connection lost (ie: you move out of range), the FTS360 Config App will indicate "Lost Connection Reconnect?". You must return within range and re-connect with the station. Any changes made that were not saved before losing the connection will have to be repeated.

Chapter 4 INSTALLING AN LT1 STATION

This chapter provides direction for setting up an LT1 that was not purchased as part of an LT1 SYSTEM. If you purchased any LT1 SYSTEM KIT⁷ refer to the LT1 System Installation and Quick Start Guide (700-LT1-SYS-IG) included in your System Kit.

4.1 COMPONENTS

The LT1 consists of the following components, specific to your order (depending if it is an LT1- CELL variant, an LT1-GOES, or an LT1-IRID):

LT1-CELL /LT1-CELL-VZ-	
ITEM	PART #
LT1- CELL or LT1-CELL-VZ complete with:	
<ul style="list-style-type: none"> • 4 pin power terminal block • 8 pin data terminal block • 4 GB SD Card (inserted) • Slot Screwdriver • Integrated Cellular and GPS antenna 	LT1-4PIN LT1-8PIN 19100 19367 18682
OPTIONAL: SIM card (inserted) with purchase of FTS cellular plan	

LT1-GOES/LT1-GOES-GPS	
ITEM	PART #
LT1-GOES complete with:	
<ul style="list-style-type: none"> • 4 pin power terminal block • 8 pin data terminal block • 4 GB SD Card (inserted) • Slot screwdriver • SMA male to N female adaptor • GPS antenna* 	LT1-4PIN LT1-8PIN 19100 19367 20180 GPS-ANTENNA-WP
*LT1-GOES-GPS-BNDL only	

LT1-IRID	
ITEM	PART #
LT1-IRID complete with:	
<ul style="list-style-type: none"> • 4 pin power terminal block • 8 pin data terminal block • 4 GB SD Card (inserted) • Slot screwdriver • Iridium and GPS antenna assembly 	LT1-4PIN LT1-8PIN 19100 19367 20846

4.2 REQUIRED TOOLS

The following tools and equipment will be required for setting up an LT1 station:

- Weatherproof (minimum IP66) enclosure with 35mm x 7.5mm DIN rail and grounding lug
- 12VDC sealed lead acid battery
- GPS antenna mount

⁷ Either an LT1-CELL-SYSTEM-KIT, LT1-CELL-VZ-KIT or LT1-GOES-SYSTEM-KIT

- Earth-ground system (typically a copper or copper sheathed grounding rod driven into the ground) with 16 AWG - 28 AWG copper wire
- 2 spools 16-28 AWG wire (for positive and negative power connections)
- Wire cutters
- Wire strippers
- Additional tools as required to install the enclosure and mount the antenna

4.3 **GENERAL**

- The LT1 MUST be mounted in an IP66 weather-proof enclosure that is fitted with a 35mm x 7.5mm DIN rail.

IMPORTANT! The LT1 is designed to operate in a dry, protected environment. Exposure to rain greater than 1mm per minute, spraying or splashing water may cause the unit to fail.

- For ease of use, it is recommended to remove the SDI-12 and power terminal blocks from their ports when making the wire connections.
- Ensure there is enough slack in all wire connections for the LT1 to be manipulated as required to mount on the DIN rail without applying strain to any of them.

4.4 **POWER REQUIREMENTS**

The LT1 requires a 12 volt power source, typically a 12 VDC sealed lead acid battery which may be used in conjunction with a solar charger.



IMPORTANT! Power connections must be made in the order indicated and in accordance with manufacturer's directions for solar panel use to prevent damage to the station and equipment.

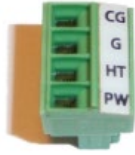
4.4.1 **POWER IF USING FT7X2 RS-485 WIND SENSOR HEATER OPTION**

The LT1 is designed to work with an FT7 RS-485 wind sensor. 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.

If using a heated sensor, the associated draw on the supplied power must be taken into account to calculate battery longevity and solar panel requirements.

4.5 POWER TERMINAL BLOCK WIRING DIAGRAM

Power connections to the LT1 are made using the 4 pin power terminal block. Once all connections are made, the terminal block will be inserted into the terminal port to complete the cycle.



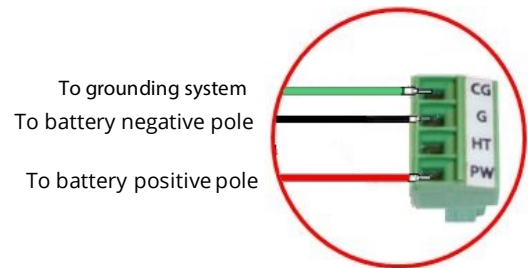
CG	Chassis Ground
G	Power Ground
HT	High Current Power In (for use with FT742 heated anemometer)
PW	Positive

Figure 4-1: Power Terminal Block

4.5.1 WIRING DIRECT TO BATTERY


If the LT1 is not being used in conjunction with a solar panel and regulator, follow these steps.

- 1) Connect the positive wire to the PW pin and the negative wire to the G pin.
- 2) Connect the Power Ground (G) wire to the negative pole of the battery (always connect this one first).
- 3) Connect the Positive (PW) wire to the positive pole of the battery.
- 4) Connect the Chassis Ground wire (CG) to the grounding system
- 5) Do not insert power terminal block at this time.



4.5.2 WIRING WITH A SOLAR PANEL AND SOLAR REGULATOR

Make power connections in accordance with the manufacturer's instructions.



Follow the manufacturer's directions for connecting the solar panel and regulator to prevent any damage to the system.

4.5.3 GROUNDING THE LT1

An external earth ground wire **MUST** be attached between the earth grounding system and the CG (Chassis Ground) pin 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 to ensure all local regulations and requirements are met.

- Set up the earth-ground system (typically a copper or copper sheathed grounding rod driven into the ground) and run the grounding wire from the system to the enclosure’s grounding lug.

4.6 CONNECTING CELLULAR TELEMETRY

The LT1-Cell has a dual GPS and cellular antenna each with individual SMA connectors. Mount the dual antenna in the desired position. If mounted inside an enclosure, ensure the materials will not interfere with the GPS’ signal. The FTS enclosure has a built-in antenna mount. Attach the antenna leads to their respective connectors.

4.7 CONNECTING SATELLITE TELEMETRY

Note that the LT1 only accepts SMA connectors for telemetry and GPS connections; therefore, an SMA to N adapter has been provided for connecting GOES antennas. Mount the satellite and GPS antennas in their desired locations and connect to their respective connectors on the LT1.

4.8 CONNECTING SENSORS

Sensors are connected via the 8-pin data terminal block. The LT1 can accommodate one FT7 RS485 or one NMEA device, two SDI-12 sensors (four if a V2), and a rain gauge. If two or more 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. Use the following pin layout as a reference.

NOTES:

- Only FT Tech FT7 RS-485 sensors are compatible with the LT1
- The Signal Ground (G) or Power Ground (GD) pins are not specific to any type of sensor: either can be used for any sensor’s ground wire.



B	FT Tech RS485/NMEA negative
A	FT TechRS485/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

Figure 3-2: Data Terminal Block

4.8.1 CONNECTING A TIPPING BUCKET (RAIN GUAGE)

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

4.8.2 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 on the FTS Support Site (App Note 162).

4.9 MOUNTING THE LT1

- Insert the SD card (see section 1.3.1) if not already inserted
- Insert the SIM card (Cell models only - see section 1.3.2) if not already inserted
- Ensure the GPS and telemetry antenna cables are attached to their respective connectors.
- Attach the LT1 to the DIN rail by inserting the spring clip into the bottom rail, applying upward pressure until the top lip slides over the top rail. Release the pressure so that the LT1 will snap down into position on the DIN rail. The spring pressure will hold the LT1 in place.
- Once the power connections have been made to the 4-pin terminal block, insert it into the LT1 and wait for the LT1 to boot up and obtain GPS and cellular connections, indicated by the LED status lights.

4.10 LED STATUS INDICATORS

Once power is supplied the LT1 will boot up, connect to the telemetry network, and establish a GPS fix. There are four green LED lights which indicate the status of the system in either of its two modes (operating and low power). Refer to Appendix A for details of LED status indicators.

Chapter 5 CONFIGURING A STATION USING THE FTS360 CONFIG APP

5.1 PRIOR TO GOING TO THE FIELD

<p>The FTS360 administrator must:</p> <ul style="list-style-type: none"><input type="checkbox"/> Initialize or login to FTS360. Refer to section 1.5.3 for details<input type="checkbox"/> Create a Technician account for the field technician<input type="checkbox"/> Ensure any SDI-12 sensors to be added in the field exist in the sensor library (either as a default sensor or create a custom sensor)⁸	<p>The field technician must:</p> <ul style="list-style-type: none"><input type="checkbox"/> Log in to https://360.ftsinc.com at least once;<input type="checkbox"/> Download/update the FTS360 Config App⁹ onto the smart device that will be used in the field and log in<input type="checkbox"/> Confirm/update the Station to the most current firmware (see section 1.6)<input type="checkbox"/> LT1-Cell: Activate the SIM card and test the LT1 (see section 5.2.1). Ensure the provisioned SIM card remains inserted.<input type="checkbox"/> LT1-GOES: Have the assigned NESDIS, channel and transmission window information (obtained from NOAA or EUMETSAT). Test the LT1 (send a test transmission – see section 5.2.2)<input type="checkbox"/> LT1-IRID: Test the LT1-IRID (see section 5.2.3)<input type="checkbox"/> Ensure the SD Card is inserted<input type="checkbox"/> Log onto the Sync the FTS360 Config App (need internet), synchronize with FTS360. DO NOT LOG OUT<input type="checkbox"/> Confirm sensors to be added in the field exist in the sensor library
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5.2 TESTING THE LT1

Prior to proceeding to the field, the LT1 should be tested in order to confirm it arrived damage free and fully functional. It also assists in trouble shooting should there be issues arising in the field (ie: narrowing down possible issues to connectivity and the network rather than the LT1 itself).

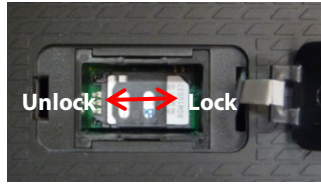
To limit on-site time in remote areas, FTS recommends that you initially configure the LT1 and sensors at a site with internet connectivity and a phone network (line) so that field technicians can easily contact FTS Support should they require assistance.

5.2.1 TESTING THE LT1-CELL

If the LT1-CELL unit was purchased with an FTS data plan, it will be shipped with an activated SIM card. If your company did not purchase an FTS data plan, the SIM card from your agency's cellular plan must be activated and used to test the LT1-CELL. Refer to section 1.4.3 for details of inserting the SIM card and operation of the SIM card holder.

⁸ Refer to the FTS360/FTS360 Config App User Manual for details.

⁹ Available in the Apple App Store or Google Play. Search for FTS360Config)



To test the LT1-CELL, you will only need to connect the telemetry and power. There is no need to connect sensors¹⁰ as the GPS and internal LT1 data points will provide enough data to confirm functionality.

- 1) Connect the power, GPS antenna, and cellular antenna as described in Chapter 3 and wait until the system, telemetry and GPS LED status indicators are solid or blinking.
- 2) Open the FTS360 Config App, log in, and select the station from the Station Discovery screen (identified by its serial number found under the SD card port access). The station's health indicators should display, confirming connectivity and power.
- 3) Select the Cellular menu and ensure the correct APN¹¹ is entered. The APN is provided by either FTS or your cellular provider, dependant on your agency's communication plan. See Section 5.3 for a list of APNs for FTS plans and instructions on how to enter the APN if required.
- 4) Confirm cellular LED goes solid to indicate connectivity. Refer to the trouble shooting guide (Appendix A) if the light does not go solid. Cellular connectivity must be established for data to be published to FTS360.
- 5) If configuring sensors, connect and configure sensors (Chapter 4). Synchronize the device with FTS 360, disconnect from the station, and confirm the sensor data is published in FTS360 as scheduled.

5.2.2 TESTING THE LT1-GOES

Ideally, when testing the LT1 GOES, a message with data should be sent to ensure expected data does not exceed the allotted transmission window. This will require the GPS to have obtained a fix, sensors to be configured, data collected, and a full message transmitted in accordance with your transmission schedule. Therefore, ensure you allot sufficient time before your scheduled transmission window to complete set up.

HINT: Allow sufficient time to complete setup, configuration, and data collection before your allotted transmission window.

¹⁰ Unless configuring the LT1 and sensors prior to travelling to a remote site as outlined in section 2.2

¹¹ Access Point Name: the name of the gateway between a mobile network and another computer network such as the Internet

If you are unable to complete a full test transmission as noted above, or if you are confident your transmission will not exceed the allotted transmission window, there is no need to configure sensors, just send a “Test GOES Transmission”.

NOTE: A “Test GOES Transmission” (Fixed) should also be sent from the actual site once the unit is set up to confirm its operation.

- 1) Connect the power, GPS antenna, and GOES antenna as described in Chapter 3 and wait until the system, telemetry and GPS LED status indicators are solid or blinking.
- 2) Open the FTS360 Config App, log in, and select the station from the Station Discovery screen (identified by its serial number found under the SD card port access). The station’s health indicators should display, confirming connectivity and power.
- 3) Select the arrow on the GOES/EUMETSAT icon line. Fill in the fields with your provided satellite information and Save Changes.
- 4) Configure your sensors: It is recommended to configure your sensors prior to going to the field as outlined in section 3.2 and necessary if you intend on testing your transmission in accordance with your assigned transmission window.

IMPORTANT! If you choose not to configure your sensors at this time, the message can only be configured using the available parameters (eg: Lat and Long, battery voltage) and the message will have to be configured and proven once the sensors are configured in the field.

- 5) Select the “Configure Transmitted Message” bar and select fields to be included in the transmitted message. You can confirm the message information and transmission format by selecting the “Show Configured” button.
- 6) Confirm the GOES icon turns green indicating GOES and message information is configured.
- 7) Enable Transmission.
- 8) Select “Test GOES Transmission”. Select Type: Fixed. If you were assigned a test transmission channel, enter that. If not, select the appropriate channel for your satellite assignment (NOAA channels 195 for East or 196 for West).

NOTE: Test transmission channels 195 and 196 are assigned by NOAA and any number of organizations may be accessing the channel at the same time which may interfere with your transmission.

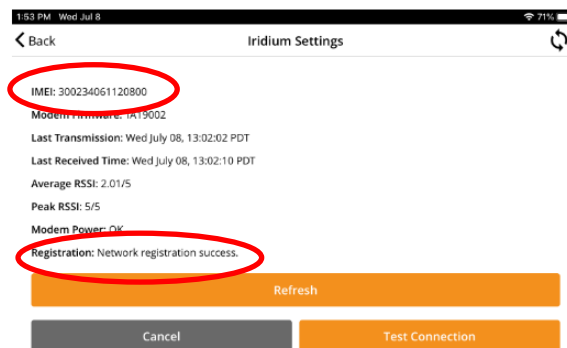
- 9) Confirm test transmission was received (view data through the standard product distribution path of the relevant satellite agency¹²).
- 10) Ideally, wait for a full cycle of data collection prior to a scheduled transmission, and then confirm expected data received in the correct format.

5.2.3 TESTING THE LT1-IRID

The LT1-IRID is shipped with a fully provisioned iridium modem. To test the LT1-IRID, you will only need to connect the telemetry and power. There is no need to connect sensors¹³ as the GPS and internal LT1 data points will provide enough data to confirm functionality. Note that data charges will apply in accordance with your company's Iridium plan.

IMPORTANT: Ensure the Iridium antenna has an unobstructed view of the sky to ensure good signal quality and minimum data transfer delay.

- 1) Connect the power, GPS antenna, and Iridium antenna as described in Chapter 3 and wait until the system, telemetry and GPS LED status indicators are solid or blinking.
- 2) Open the FTS360 Config App, log in, and select the station from the Station Discovery screen (identified by its serial number found under the SD card port access). The station's health indicators should display, confirming connectivity and power.
- 3) Select the Satellite Telemetry Line to bring up the Iridium Settings page. The IMEI information will be filled and the Registration line should indicate "Network registration success".



- 4) If configuring sensors, connect and configure sensors (Chapter 4). Synchronize the device with FTS 360, disconnect from the station, and confirm the sensor data is published in FTS360 as scheduled.

¹² EDDN, for example.

¹³ Unless configuring the LT1 and sensors prior to travelling to a remote site as outlined in section 2.2

5.3 CELLULAR TELEMETRY – ENTERING THE APN

If the station supports cellular telemetry, there are options to configure the cellular mode for customers who have not purchased an FTS cellular plan and need to set up their SIM card. Typically, these settings are automatically sent to the station via the inserted SIM; however, if your provider requires this information to be input manually, do so in this screen. After entering the APN and Carrier, select the Commission button.

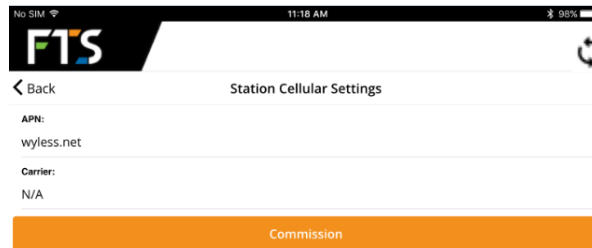


Table 5-1: FTS PLAN PROVIDERS AND APNS

PLAN	APN
Bell APN (Canada)	wrmstatic.bell.ca.ioe
Rogers (Canada/USA)	m2minternet.apn
Verizon APN (USA)	we01.vzwstatic
Bell International (international)	wrstat.bell.ca

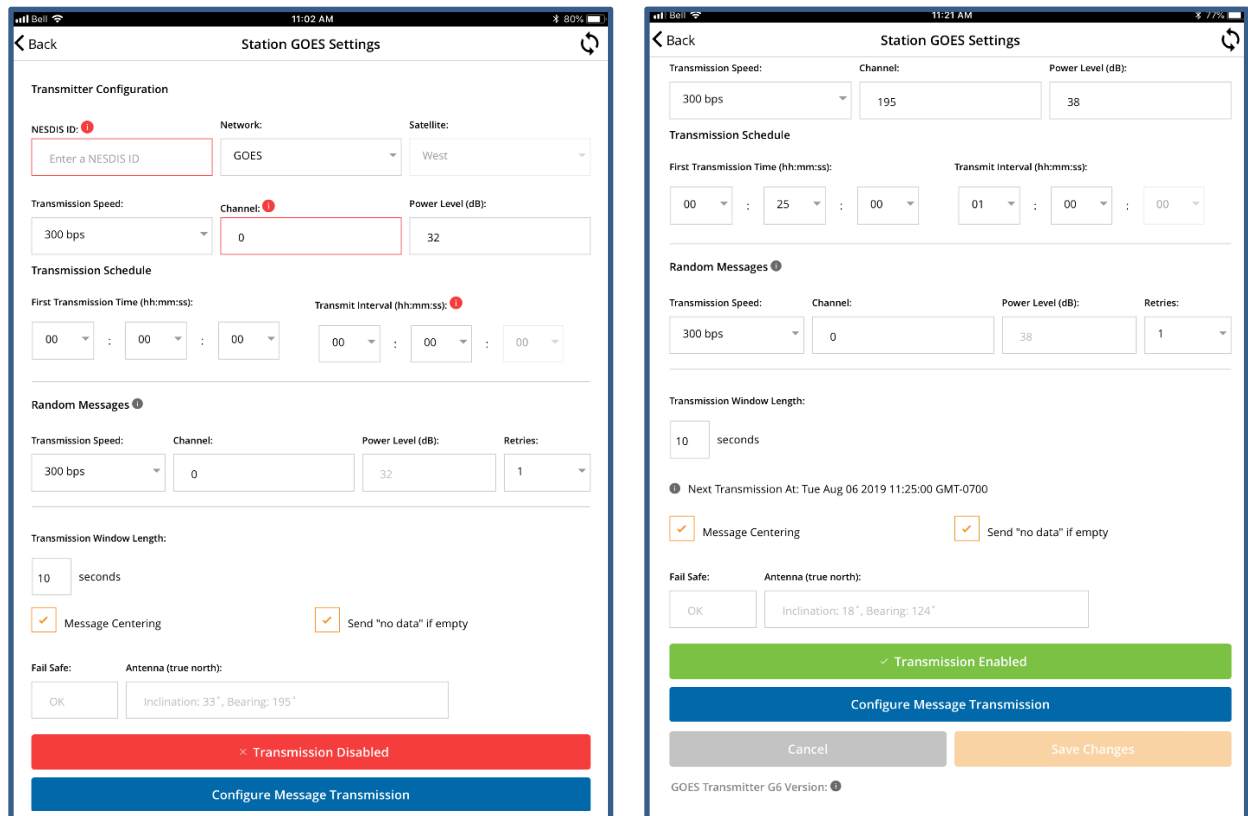
5.4 GOES/EUMETSAT SETTINGS

Settings for the GOES /EUMETSAT satellites are provided by NOAA/ EUMETSAT respectively. To configure the satellite transmissions, select the arrow on the GOES/EUMETSAT icon line to display the Station GOES Settings page.

- 1) Fill in the fields with your provided satellite information and Save Changes (Section 5.4.1).
- 2) Then, select **Configure Message Transmission** to configure the message (Section 5.4.2).

IMPORTANT: After saving the GOES settings, you must configure the message in order to transmit and receive data.

5.4.1 STATION GOES SETTINGS



Unconfigured Settings

Configured Settings – Changes Saved

NOTE: the information shown in the fields is for demonstration purposes only. You must use the settings provided to you by NOAA/EUMETSAT

Figure 5-1

First Transmission Time: This should be minutes and seconds assigned for your transmission time. Hours should be left blank.

Transmit Interval: Standard transmission interval is every hour.

In the Configured Settings screen in Figure 5, transmissions will occur every hour at 25 minutes after the hour (e.g. at 04:25:00, 05:25:00, 06:25:00, etc.).

Message Centering: Message Centering “On” is the default and is recommended to use. Message centering takes into account the full length of the message and then places it in the middle of the window instead of transmitting at the start of its transmission time. This helps avoid message collisions due to a neighboring or rogue message overlapping going over its 10 second window

Send “no data” if empty: When selected, if the buffer is empty, the message “NO DATA AVAILABLE FOR TRANSMISSION” will be sent. This feature ensures that a transmission occurs at every

transmit interval and can provide valuable troubleshooting information (confirms that a transmission would have been successful had there been data provided). It is recommended that this feature be enabled; however, the user should verify that this type of message is compatible with any transmission reception software being used to download data.

Fail Safe: The G6 transmitter has a built-in Fail Safe ability. The failsafe is designed to disable a malfunctioning transmitter in order to protect other users of the satellite system from a transmitter that is transmitting for too long or too frequently. A tripped failsafe indicates that there is a problem with the GOES transmitter and transmissions are not possible until the Fail Safe is cleared. If the Fail Safe has tripped, a “Reset” button will be displayed.

If the failsafe has tripped it can be cleared at the station by selecting the Reset button. Once cleared, all scheduled and random transmissions will resume. Data that was collected while the Fail Safe was tripped can be retrieved from the station’s SD card in the Data folder csv files and also in the GOES format in the Telem folder (see Section 2.3.2).

If the failsafe continues to trip, the unit should be returned to FTS for repair or replacement.

Antenna (true north): The antenna’s inclination and bearing information in degrees True.

Save Changes: Once all the required fields are filled in, the Save Changes bar will be available. Saving changes automatically enables transmissions.

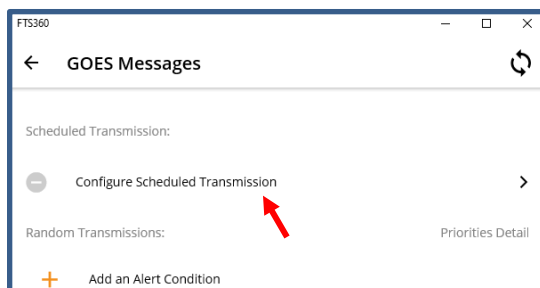
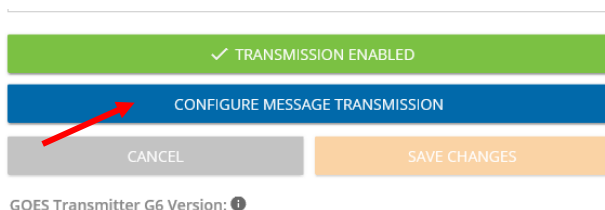
Transmission Enabled/Disabled: Selecting this button switches between the two states. Once all fields are completed, the Transmission Enabled button will be displayed

Configure Message Transmission: Select to configure the message. See following section for details.

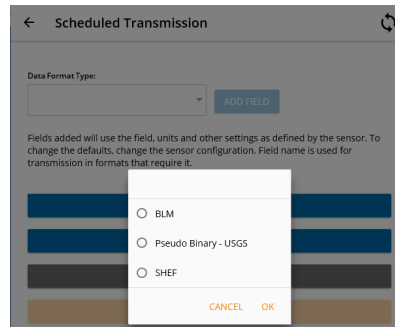
5.4.2 CONFIGURE MESSAGE TRANSMISSION

Use the following steps to configure a message:

- 1) From the Station GOES Settings page, select the Configure Transmitted Message button, and then Configure Scheduled Transmission



- 2) Use the drop-down menus to select the message type (Pseudo Binary-USGS, SHEF, or BLM)

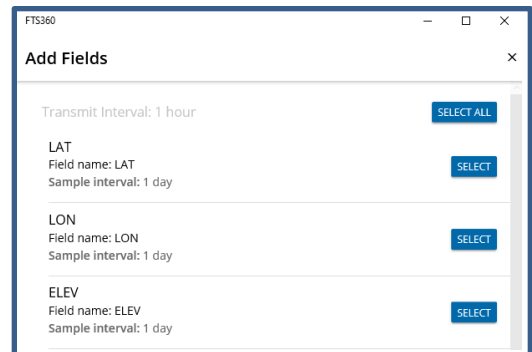


- 3) Input number of redundant messages (optional – not supported by BLM messages).

About Redundant Messages: The content of messages can be configured to be repeated in subsequent transmissions. Transmitting redundant copies is useful if any data is garbled or lost during a transmission so that it is more likely to receive a complete data transfer. A transmission which has one redundant record consists of the most recent data (as defined in the data set) followed by the data from the previously transmitted data set. A transmission which has two redundant messages consists of the most recent data followed by the data from the two previously transmitted data sets, etc.

- 4) Press the **Add Fields** button and select the desired data fields to be included in the message.

About Fields: The list includes built-in data points and configured data points from any attached sensors.



- 5) Select "Done" when finished.
- 6) Message fields can be viewed and amended using the Details cog.

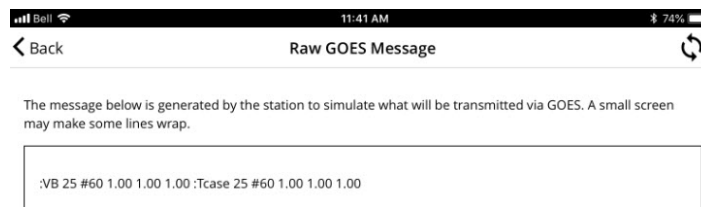
The list order can be changed using the shift up/down arrows

The selected fields will be listed in the order of transmission. The list (transmit) order can be rearranged by using the Shift arrows. Field details can be reviewed and amended by selecting the Details cog.

Field	Friendly Name	Precision	Shift	Delete	Details
VB	VB	2	↑ ↓	✖	⚙️
Tcase	Tcase	2	↑ ↓	✖	⚙️
YF	YF	2	↑ ↓	✖	⚙️
YR	YR	2	↑ ↓	✖	⚙️

- 7) Select Save Message

- 8) **Confirm message format:** Confirm message format and data points by viewing an example of a configured message. Select Show Configured Message. Note that no data is sent and only simulated values of 1.0 are displayed to illustrate the message format.



Reset: If changes have been made but not saved, selecting Reset will discard those changes and remain on the same page.

Cancel: If changes have been made but not saved, selecting Cancel will discard those changes and return to the previous page.

5.4.3 SETTING UP RANDOM TRANSMISSIONS

Random transmissions are SHEF or Pseudo Binary (USGS-PB) transmissions that are made outside of the scheduled transmission and are sent when an alert condition is detected. Random transmissions are not supported by BLM message type. Random transmissions are set up from the Station GOES Settings page and must be set up after the Scheduled Transmissions.

A random transmission will be sent every time an alert condition is detected but not more frequently than five minutes.

IMPORTANT!:

- 1) Variables used to trigger an alert in random transmissions should have a minimum 5-minute sample frequency. More frequent sampling of alert variables during an alert event will result in a data backlog.
- 2) If using a 5-minute sample rate for an alert variable, the number of retries should not exceed one (1) to prevent a data backlog

NOTES:

- The random transmission feature will only operate in conjunction with FTS360 Config App version 1.7.16 and later
- The number of random transmission retries should not be greater than 1 if using a 5-minute sample frequency for alert trigger variables to prevent a data backlog.
- If multiple data points are included in a random transmission, only the trigger data value will be updated. Other data values will be the previous reading (currently logged values)

- A scheduled message will always be transmitted in accordance with the programmed schedule. If there is a conflict, Random transmissions will be sent immediately after the scheduled transmission.
- Random transmissions have a maximum message size of 77 bytes. Data which exceeds this limit will be truncated.

To set up a Random Transmission, first input the transmission channel on the Station GOES page (see Figure 8-3). In order to send random transmissions, random channel parameters must be provided by NOAA/ EUMETSAT.

Retries: Random Transmissions can be re-sent in subsequent transmission windows for up to a maximum of 5 transmissions. Each Repeat Count transmission will be identical to the preceding one. After the last repeat count transmission, the next message will be updated with the latest variable data and then this information will be sent in accordance with the assigned Repeat Count. The default setting is one (1) which means the message will only be sent twice (the original and one repeat).

NOTE: If using a 5 minute sample rate for an alert variable, the number of retries should not exceed one (1) to prevent a data backlog.

5.4.4 CREATING ALERT CONDITIONS

After setting up the random message transmission parameters, select the “Configure Message Transmission” button and then select the “Add an Alert Condition” option.

- 1) Define the condition using the drop-down menus
- 2) Add the fields which include the data you want transmitted.
- 3) Save Message.
- 4) Confirm message format using the Show Configured Message button.

The screenshot shows the 'Random Transmission' configuration window. At the top, there are fields for 'Condition' (Last Sample), 'Expression' (VB (VB)), 'Operator' (<), 'Value' (9), and 'Unit'. Below this is the 'Message' section, which includes a 'Data Format Type' dropdown menu currently set to 'SHEF' and an 'Add Field' button. A table below the 'Add Field' button shows the configuration for the added field:

Field	Friendly Name	Precision	Shift	Delete	Details
VB	VB	2	↑ ↓	✖	⚙️

At the bottom of the window, there are four buttons: 'Reset' (blue), 'Show Configured Message' (blue), 'Cancel' (grey), and 'Save Message' (orange).

5.4.5 TEST GOES TRANSMISSION

The test transmission is sent to the LRGS and is used to confirm correct satellite network and antenna power settings. It will not transmit data. To send a test transmission, select the “Test GOES Transmission” button. If you were assigned a test transmission channel, enter that. If not, select the appropriate channel for your satellite assignment.

Type: there are three types of Test transmissions: Fixed (default - standard use), Random, and Carrier (diagnostic tool - rarely used).

Fixed: The common form of test transmission. It consists of the message header followed by a series of plain text strings:

```
001014E809124191542G47-0NN195EFF00396
Operator Initiated Test Transmission:
Operator Initiated Test Transmission:
Operator Initiated Test Transmission:
Operator Initiated Test Transmission:
Operator Initiated Test Transmission:
Operator Initiated Test Transmission:
```

Random: Enter the test transmission channel you were assigned. Consists of the message header followed by a line of text:

```
001014E809124191542G47-0NN195EFF00396
Field Initiated Random Test Transmission
```

Carrier: Carrier test transmissions are not normally required for standard station operations. Carrier test transmissions are used for diagnostic purposes in conjunction with specialized equipment to see if the antenna is receiving enough power or to confirm the RF Carrier frequency of the transmission. As such, a tone at the frequency of the message is sent out rather than a text message.

5.5 IRIDIUM SETTINGS

The LT1-IRID is shipped with a fully provisioned Iridium modem. The Iridium Settings page will indicate the IMEI number and that the Registration was successful (see section 5.2.3). Data will be sent as determined in accordance with the sensor configuration when the satellite is in range.

Chapter 6 CONFIGURING SENSORS

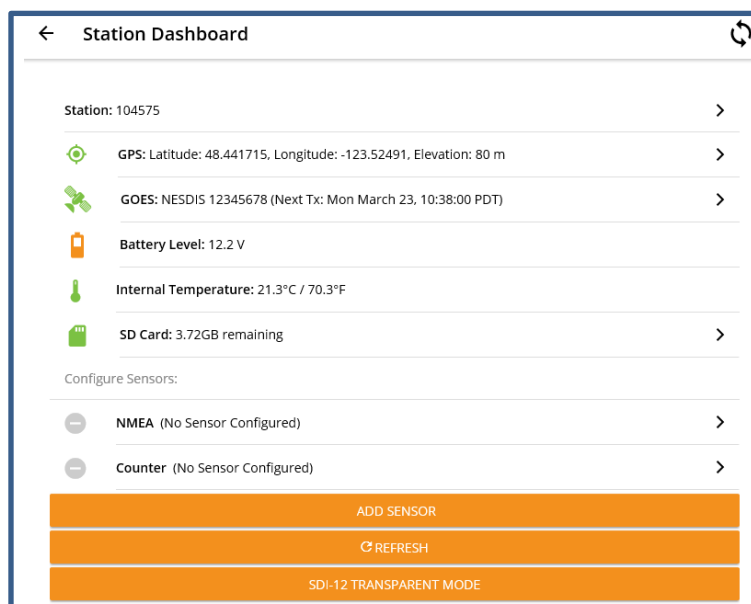
Once connected to the LT1 and powered, use the FTS360 Config App to add and configure the sensor(s) for the station. Ensure you test each sensor and save the settings before exiting the page. Upon completion, ensure you synch your changes with FTS360.

When determining the sample schedule, bear in mind the time it takes for the sensor to take and register a sample and for that information to be buffered prior to the scheduled transmission.

6.1 SENSOR TEMPLATES AND THE LIBRARY

The Sensor Library consists of specific templates for use with SDI-12 and NMEA sensors. The templates have pre-defined default configurations which simplify setting up sensors. The drop-down Sensor-Type menu consists of Custom Sensor templates, displayed first and identified by an asterisk, and Built-In Sensor Templates. Custom Sensor Templates are generated by your Agency in accordance with its specific needs. Built-In Sensor Templates are generic templates with the most common settings for the listed sensor. Refer to the FTS360 Manual for details on adding Custom templates to the library.

When a sensor template is selected, any of the default settings for that template may be changed and saved to the sensor being configured. These changes will only be saved to that sensor and will not affect the library item. In other words, the next time the library item is displayed from the drop-down menu, the original default settings will be in place. If you have several sensors that you would like to configure with the same settings, consider creating a custom template using FTS360.



6.2 **LT1-CELL: CALCULATING START TIME FOR SDI-12 AND COUNTER SENSORS**

This is optional and used for those agencies with a requirement for data readings as close as possible before transmission. If you do not require this level of timing, you can leave the start time at the default setting or set it to the desired minute from which you want the sample readings started.

For a sensor to collect information and have the most recent readings available for the scheduled transmission, the sampling start time must be determined as follows:

Sample start time = a - (b+c+d)

- In which:**
- a) Transmission interval
 - b) Time to take readings (found by entering the measurement command from transparent mode – refer to section 6.3.1 and the sensor’s manual)
 - c) Time to buffer the readings
 - d) Safety buffer (to ensure no truncation of data occurs during buffering)

Example: Sample Interval: 5 minutes

- a) Transmission interval: Hourly at 5 minutes after the hour
- b) Time to take readings: 10 seconds
- c) Time to buffer the readings: 5 seconds
- d) Safety buffer: 2 seconds

Using the example figures: Start time = 00:05:00 – (10 secs+5 secs + 5 secs + 2 secs)

Start time = 00:05:00 – 00:00:27

Start time = 00:04:38

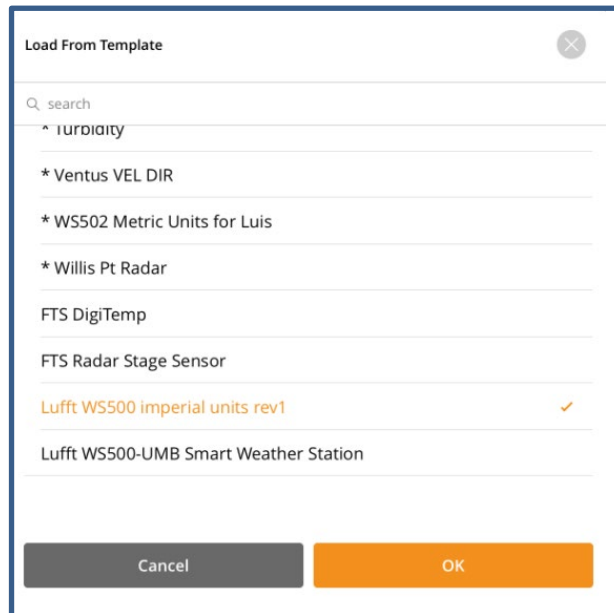
Therefore, with a sample interval of 5 minutes, samples are taken at 00:04:38, 00:09:38, 00:14:38, 0019:38 etc. so the hourly transmission will include the last logged data point which was taken at 27 seconds before the transmission.

6.3 CONFIGURING AN SDI-12 SENSOR

- 1) Select the Add Sensor bar and select the desired sensor from the drop-down list.

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

- 2) Edit fields as necessary.



- 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.

- 4) **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 (ie: phone, tablet, laptop) 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.

- 5) **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.

6.3.1 TRANSPARENT MODE – SDI-12 SENSORS

Select the SDI-12 Transparent Mode button on the Station Dashboard screen to communicate with SDI-12 sensors using SDI-12 commands. You must know the SDI-12 sensor's address (as entered on the Sensor's configuration page or by using the address query command - see section 6.3.3.1) and refer to the sensor's manual for details of SDI-12 commands specific to that sensor.

IMPORTANT! When in transparent mode, the collection and transmission schedule for ALL sensors is suspended until transparent mode is exited.

The FTS360 Config App will automatically add the sensor address and command terminator character (!) to the command. The sensor address used is based on the address selected in the drop-down menu.

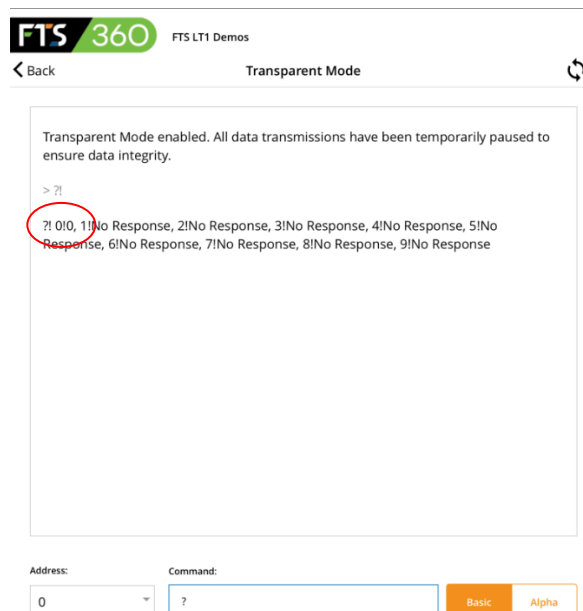
Therefore, when typing SDI-12 commands into the FTS360 Config App, you only need to include that part of the command which falls between the sensor address and the command terminator character (!).

Example: For a sensor at address1:
Standard SDI-12 start measurement command: **1M!**
Command typed into FTS360 Config App: **M**

6.3.1.1 ADDRESS QUERY COMMAND

If the sensor's address is unknown, return to the Station Dashboard and select the SDI-12 Transparent Mode button. Enter the Address Query (?). All addresses (0-9) will be queried and a response received from each one. The address which the sensor is on will respond with the address.

The sensor in this example is at address 0 as shown by the query and response: 0!0. All other addresses indicate no sensor.



If two SDI-12 sensors are connected to the LT1, there will be two responses returned, one for each address. In order to determine the sensor which corresponds to each address, review each sensor's configuration page or remove one sensor and re-send the address query command.

If there is an address conflict (both sensors have the same address), one sensor will have to be removed and the change address command sent to the connected sensor.

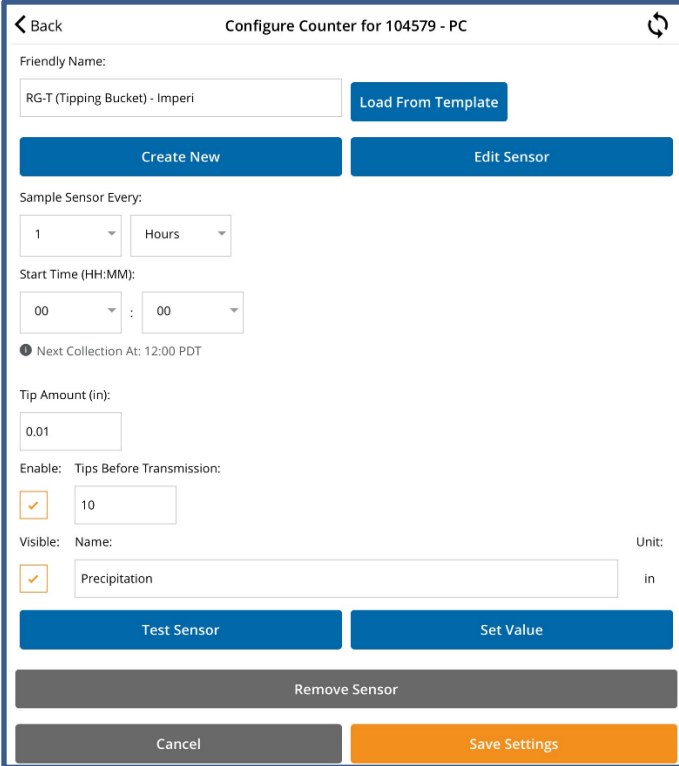
6.4 CONFIGURING A COUNTER SENSOR (TIPPING BUCKET)

Select the Counter line from the Station Dashboard and the Load from Template. Load the appropriate template and fill in the fields.

6.4.1 LT1-CELL: TIPS BEFORE TRANSMISSION

The **Tips before Transmission** option appears on LT1-CELL units. When enabled, the LT1 will transmit in accordance with the scheduled transmission and when the input number of tips has been reached.

Select the enable box and input the desired number of tips



Configure Counter for 104579 - PC

Friendly Name: RG-T (Tipping Bucket) - Imperi Load From Template

Create New Edit Sensor

Sample Sensor Every: 1 Hours

Start Time (HH:MM): 00 : 00

Next Collection At: 12:00 PDT

Tip Amount (in): 0.01

Enable: Tips Before Transmission: 10

Visible: Name: Precipitation Unit: in

Test Sensor Set Value

Remove Sensor

Cancel Save Settings

6.5 CONFIGURING AN NMEA SENSOR

Select the NMEA line from the Station Dashboard

- 1) Select the sensor type from the drop-down menu
- 2) Fill in the Friendly Name. This is the name that will be displayed in FTS360 and the app
- 3) Select the desired sample schedule
- 4) Test the sensor to confirm operation
- 6 Save Settings

The screenshot shows a window titled "Configure NMEA for 104575" with the following fields and controls:

- Friendly Name:** A text input field containing "NMEA Wind Sensor" and a blue "LOAD FROM TEMPLATE" button.
- Sample Sensor Every:** A dropdown menu set to "5" and another dropdown menu set to "Minutes".
- Start Time (HH:MM):** Two dropdown menus set to "00" and "00".
- Next Collection At:** A label indicating "00:00(PDT)".
- Visible:** A table with two rows:





Visible:	Name:	Unit:
<input checked="" type="checkbox"/>	Wind Speed	m/s
<input checked="" type="checkbox"/>	Wind Direction	deg
- Buttons:** "TEST SENSOR" (blue), "REMOVE SENSOR" (grey), "CANCEL" (grey), and "SAVE SETTINGS" (orange).

Appendix A LT1 LED STATUS INDICATORS

Once power is supplied the LT1 will boot up, connect to the telemetry network, and establish a GPS fix. There are four green LED lights which indicate the status of the system in either of its two modes (operating and low power).

A.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 IRID: Iridium connection established. Unit is provisioned. Blinking: Cellular: Obtaining network connection GOES: No GPS fix or invalid configuration therefore no transmission possible. IRID: the modem is on but the device is not able to connect. 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

A.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 10seconds:
	Telemetry Status	Off
	BLE Status	Off
	GPS Status	Off

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

A.3 LED FAULT INDICATIONS

LED Status Indicators: ○ = On ● = Off N/A –not applicable (can be on, off, or blinking)

* = Blinking once every 10 seconds ** = Blinking every second

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.

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
**	**	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) Confirm correct APN input (from FTS360 Config App dashboard, select “Cellular” and view APN information. 3) SIM card not activated. Call cell plan provider to activate SIM card.
**	**	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
**	N/A	N/A	**	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 station)
**	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.

Appendix B TROUBLESHOOTING

FTS360 Config App

Problem	Indicates	Solution
No BLE status light when attempting to connect	Fault	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1) If you belong to more than one agency switch to the correct agency.
	You do not have permissions for the agency. are not a member of the station's agency	<ol style="list-style-type: none"> 2) Contact your Administrator to obtain permissions (ie: be added as a member of the station's agency and/or be assigned as Technician)
Log in Failed	No internet	<ol style="list-style-type: none"> 1) Log into the FTS360 Config App using the internet prior to going to the field. DO NOT LOG OUT. Once in the field and no internet is available, the station will be automatically detected.

Data Issues

Problem	Indicates	Solution
No timestamp on data	No GPS fix	<ol style="list-style-type: none"> 1) Check GPS antenna connection 2) GPS satellite signals may be blocked or weak <ol style="list-style-type: none"> 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)
Missing data	Field visit	<p>If missing data coincides with the time of a field visit:</p> <ol style="list-style-type: none"> 1) If transparent mode was used, scheduled requests for ALL sensors were stopped. <p>Sync the smart device used in the field with FTS360. Configuration changes made while offline will be logged but not displayed in FTS360 until synchronization occurs.</p>
Additional data sets on a Counter Sensor	The Tips Before Transmission option is enabled (LT1-Cell only)	<ol style="list-style-type: none"> 1) Open the Sensor Configuration page and de-select that option.

Appendix C TECHNICAL SPECIFICATIONS

C.1 LT1 CELL¹⁴

PERFORMANCE DATA	
Local Access	BLE enabled iOS or Android platform.
Remote Access	Using FTS360 software
Local Data Storage	Up to 2 years
ENVIRONMENTAL	
Operating Temperature	-40°C to +70°C (-40°F to +158°F)
Storage Temperature	-55°C to +70°C (-67°F to +158°F)
Relative Humidity	0-95% non-condensing
PHYSICAL	
Dimensions	135mm x 135mm x 40 mm (5.3" x 5.3" x 1.6")
Weight	400 g (0.88 lb)
Material	6000 Aluminum (C-spine) ABS/PC (clamshell) TPE plastic (SD card door)
Housing Rating	IP51
Connectors	4 pin terminal strip (mates with Phoenix Contact 1840382) 8 pin terminal strip (mates with Phoenix Contact 1840421) Connectors compatible with wires 16 to 28 AWG GPS and Cellular (SMA female/jack ports) Standard SIM card port Standard USB micro-B port
Communications	One SDI-12 Port One RS-485 Port (receive only) One GPS Port (receive only) One cellular Port One Bluetooth
ELECTRICAL	
Input Power	9.6 to 20V
Power Source	12 VDC nominal
Current Consumption (not including SDI-12 or RS-485 sensor current draw)	16 mA (single parameter collection and 15 min transmission) @ +13.5 VDC
Protection	SDI-12, power, and RS-485 I/O ports are lightning/static protected. Power is reverse polarity protected. SDI-12 and RS-485 ports are short circuit protected. Internal temperature sensor.

¹⁴ Based on FTS Cellular Logger/Transceiver Specifications dated Feb 2020

DATA and TRANSMISSION	
Data Rates	Cellular (LT1-CELL): HSPA (DL: 21 Mbps, UL: 5.76 Mbps), WCDMA (DL: 384 kbps, UL: 384 kbps), EDGE (DL: 296 kbps, UL: 236.8 kbps), GPRS (DL: 107 kbps, UL: 85.6 kbps) Cellular (LT1-CELL-VZ): LTE (DL 100.0 Mbps, UL: 50.0 Mbps) Bluetooth: 2.4 kbps
Transmit Frequency Ranges	Cellular (LT1-CELL): GSM Quad Band (850, 900, 1800, 1900 MHz), UMTS/HSPA Penta-Band (850, 900, 1700, 2100) Cellular (LT1-CELL-VZ): LTE Band (700, 1700 MHz) Bluetooth: 2402 to 2480 MHz
RF Bandwidths	Cellular (LT1-CELL): GSM (200 kHz), UMTS (5 MHz) Cellular (LT1-CELL-VZ): LTE 700 (41 MHz), LTE 1700 (445 MHz) Bluetooth: 1 MHz
Antenna	Cellular: Linearly Polarized (SMA-connector) GPS: RHCP, 3.3V/50 mA active (SMA-connector) Bluetooth LE: Internal
Real Time Clock	Synchronized to GPS. Clock accuracy: ±1 second

C.2 **LT1-GOES**¹⁵

PERFORMANCE DATA	
Local Access	BLE enabled iOS or Android platform.
Remote Access	Using FTS360 software
Local Data Storage	Up to 2 years
ENVIRONMENTAL	
Operating Temperature	-40°C to +70°C (-40°F to +158°F)
Storage Temperature	-55°C to +70°C (-67°F to +158°F)
Relative Humidity	0-95% non-condensing
PHYSICAL	
Dimensions	135mm x 135mm x 40 mm (5.3" x 5.3" x 1.6")
Weight	682g (1.5 lb)
Material	6000 Aluminum (C-spine) ABS/PC (clamshell) TPE plastic (SD card door)
Housing Rating	IP51

¹⁵ Based on FTS Logger/Transceiver Specifications dated May 7, 2018

PHYSICAL (continued)	
Connectors	4 pin terminal strip (mates with Phoenix Contact 1840382) 8 pin terminal strip (mates with Phoenix Contact 1840421) Connectors compatible with wires 16 to 28 AWG. GPS and Satcom (SMA female/jack ports) USB micro-B port
Communication Ports	One SDI-12 Port (accessible via 8 pin terminal strip) One RS-485 Port (receive only, accessible via 8 pin terminal strip) One GPS Port (receive only, accessible via SMA port) One Satcom (GOES) Port (transmit only, accessible via SMA port) One Bluetooth LE modem (internal antenna) One USB micro-B port (service functionality only)
ELECTRICAL	
Input Power	+10.8 to +16.0 VDC
Power Source	12 VDC nominal
Current Consumption (not including SDI-12 or RS-485 sensor current draw)	10 mA (idle) @ +13.5 VDC 2600 mA (max) @ +13.5 VDC
Protection	4/8 pin terminal strips, USB and SD slot are lightning/static protected (CISPR-24) Power is reverse polarity protected SDI-12 and RS-485 power outputs are short circuit protected Internal temperature sensor
DATA and TRANSMISSION	
Data Rates	Satcom (GOES): 300, 1200 bps Satcom (METEOSAT): 100 bps
Transmit Frequency Ranges	Satcom (GOES/METEOSAT): 401.701 to 402.09850 MHz Bluetooth: 2402 to 2480 MHz
RF Bandwidths	Satcom (GOES): 750 Hz (300 bps), 1.5 kHz (1200 bps) Satcom (METEOSAT): 3 kHz (100 bps) Bluetooth: 1 MHz
RF Transmit Power (conducted)	Satcom (GOES): 38.1 dBm max. (300, 1200 bps) Satcom (METEOSAT): 41.5 W max. (100 bps) Bluetooth LE: 4 dBm max.
Antenna	Satcom (GOES/METEOSAT): RHCP (SMA -connector) GPS: RHCP, 3.3V/50 mA active (SMA -connector) Bluetooth LE: Internal
Real Time Clock	Synchronized to GPS Clock accuracy: ±1 second

C.3

LT1-IRID

PERFORMANCE DATA	
Local Access	BLE enabled iOS or Android platform.
Remote Access	Using FTS360 software
Local Data Storage	Up to 2 years
ENVIRONMENTAL	
Operating Temperature	-40°C to +70°C (-40°F to +158°F)
Storage Temperature	-40°C to +70°C (-67°F to +158°F)
Relative Humidity	0-95% non-condensing
PHYSICAL	
Dimensions	135mm x 135mm x 40 mm (5.3" x 5.3" x 1.6")
Weight	400g (0.88 lb)
Material	6000 Aluminum (C-spine) ABS/PC (clamshell) TPE plastic (SD card door)
Housing Rating	IP51
PHYSICAL (continued)	
Connectors	4 pin terminal strip (mates with Phoenix Contact 1840382) 8 pin terminal strip (mates with Phoenix Contact 1840421) Connectors compatible with wires 16 to 28 AWG. GPS and Satcom (SMA female/jack ports) USB micro-B port
Communication Ports	One SDI-12 Port (accessible via 8 pin terminal strip) One RS-485 Port (receive only, accessible via 8 pin terminal strip) One GPS Port (receive only, accessible via SMA port) One Satcom (Iridium) Port (accessible via SMA port) One Bluetooth LE modem (internal antenna) One USB micro-B port (service functionality only)
ELECTRICAL	
Input Power	+10.8 to +16.0 VDC
Power Source	12 VDC nominal
Current Consumption (not including SDI-12 or RS-485 sensor current draw)	TBA mA(idle) @ +13.5 VDC TBA mA (max) @ +13.5 VDC
Protection	4/8 pin terminal strips, USB and SD slot are lightning/static protected Power is reverse polarity protected SDI-12 and RS-485 power outputs are short circuit protected Internal temperature sensor

DATA and TRANSMISSION	
Data Rates	Satcom (Iridium): 340 B (Max Mobile Originated Message Size) 270 B (Max Mobile Terminated Message Size)
Transmit Frequency Ranges	Satcom (Iridium): 1616 to 1626.5 MHz Bluetooth: 2360 to 2500 MHz
RF Bandwidths	Satcom (Iridium): 31.5 kHz Bluetooth: 1 MHz
RF Transmit Power (conducted)	Satcom (Iridium): +32 dBm max. Bluetooth LE: +4 dBm max.
Antenna	Satcom (Iridium): RHCP, 50 ohms, 3 dBi max (SMA -connector) GPS: RHCP, 3.3V/50 mA active (SMA -connector) Bluetooth LE: Internal
Real Time Clock	Synchronized to GPS Clock accuracy: ±1 second

C.4 4 AND 8 PIN CONNECTOR MAXIMUM RATINGS

4-pin connector pin #	Name	Pin Function	Maximum rating
1	CG	Chassis Ground	-
2	G	Power Ground	-
3	HT	High Current Power In	20 VDC max., -20 VDC min.
4	PW	Battery Power In	LT1-CELL/LT1-IRID: 20 VDC max., -20 VDC min LT1-GOES: 16 VDC max., -20 VDC min.
8-pin connector pin #	Name	Pin Function	Maximum rating
1	B	RS-485 Comms B	12 VDC max., -7 VDC min.
2	A	RS-485 Comms A	12 VDC max., -7 VDC min.
3	G	Signal Ground	-
4	SD	SDI-12 Data	6 VDC max., -3.5 VDC min.
5	SP	SDI-12 Power Out	LT1-CELL/LT1-IRID: 20 VDC max., 0 VDC min LT1-GOES: 16 VDC max., 0 VDC min.
6	GD	Power Ground	-
7	RN	Discrete Counter In	12 VDC max., -0.5 VDC min.
8	P	RS-485 Sensor Power Out	LT1-CELL/LT1-IRID: 20 VDC max., -20 VDC min. LT1-GOES: 16 VDC max., -20 VDC min.

C.5 POWER OUTPUT PIN SPECIFICATIONS

8-pin connector pin #	Name	Pin Function	Specification
5	SP	SDI-12 Power Out	Output: Internally connected to 4 pin connector PW pin 750 mA max. current draw
8	P	RS-485 Sensor Power Out	Output: Before using, strap 4 pin connector PW pin to HT pin (see 700-AN-162) Internally connected to 4 pin connector PW pin 2 A max. current draw

EU DECLARATION OF CONFORMITY

Object of the declaration:

Product: Logging Transceiver

Model/type: LT1-CELL

Manufacturer FTS (Forest Technology Systems)

Address 1065 Henry Eng Place, Victoria, BC V9B 6B2, Canada

This declaration is issued under the sole responsibility of the manufacturer.

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

1999/5/EC Radio and Telecommunication Terminal Equipment (R&TTE) Directive
2014/30/EU The Electromagnetic Compatibility Directive
2011/65/EU The Restriction of Hazardous Substances Directive

Conformity is shown by compliance with the applicable requirements of the following documents:

EN 55022:2010/AC:2011 Electromagnetic compatibility of multimedia equipment - Emission requirements

EN 55024:2010 Information technology equipment - Immunity characteristics - Limits and methods of measurement

EN 55032:2012/AC:2013 Electromagnetic compatibility of multimedia equipment - Emission requirements

EN 301 511 V9.0.2 Global System for Mobile communications (GSM); Harmonized EN for mobile stations in the GSM 900 and GSM 1800 bands covering essential requirements under article 3.2 of the R&TTE directive

EN 301 908-1 V6.2.1 IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 1: Introduction and common requirements

EN 301 908-2 V6.2.1 IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 2: CDMA Direct Spread (UTRA FDD) User Equipment (UE)

- EN 300 440-2 V1.4.1 Electromagnetic compatibility and Radio spectrum Matters (ERM); Short range devices; Radio equipment to be used in the 1 GHz to 40 GHz frequency range; Part 2: Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive
- EN 301 489-1 V1.9.2 Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;Part 1: Common technical requirements
- EN 301 489-3 V1.6.1 Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz
- EN 301 489-7 V1.3.1 Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)
- EN 301 489-17 V2.2.1 Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment; Part 17: Specific conditions for Broadband Data Transmissions Systems.
- EN 301 489-24 V1.5.1 Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA and E-UTRA) for Mobile and portable (UE) radio and ancillary equipment

Signed for and on behalf of: FTS

Place of issue: Victoria

Date of issue: 08 March 2018



Name: Paul Brooks

Position: Director of Engineering, Research and Development

Appendix D CERTIFICATIONS AND REGULATORY NOTICES

D.1 CERTIFICATIONS - LT1-CELL AND LT1-CELL-VZ

FCC Certification: CFR Title 47 FCC Part 15 Subpart B – Unintentional radiators
(LT1-CELL/LT1-CELL-VZ) CFR Title 47 FCC Part 15 Subpart C – Intentional radiators

IC Certification: ICES-003
(LT1-CELL/LT1-CELL-VZ)

CE Certifications: Directive 1999/5/EC – Radio and telecommunications terminal
(LT1-CELL only) equipment (RTTE)
Directive 2014/35/EU – Low voltage directive (LVD)
Directive 2011/65/EU – RoHS directive (RoHS)

Normative documents:

EN 55032:2012/AC:2013	EN 55022:2010/AC:2011
ETSI EN 301 511 V9.0.2	ETSI EN 301 908-1 V6.2.1
ETSI EN 301 9.0.8-2 V6.2.1	ETSI EN 300 440-2 V1.4.1
ETSI EN 301 489-1 V1.9.2	ETSI EN 301 489-3 V1.6.1
ETSI EN 301 489-7 V1.3.1	ETSI EN 301 489-17 V2.2.1
ETSI EN 301 489-24 V1.5.1	IEC 60950-1:2005 (Second Edition) + Am 1:2009 + Am 2:2013

Australia ACMA DoC ACMA12982
(LT1-CELL only)

Colombia CRC LONA 2017554622
(LT1-CELL only)

Peru MTC Certificate TRFM39085
(LT1-CELL only)

NESDIS Certification NOAA NESDIS GOES Data Collection Platform Radio Set
(DCPRS) Certification Standards at 300bps and 1200bps,
Version 2.0, June 2009 and CGMS International Standard,
Version 1, 2009

D.2 CERTIFICATIONS - LT1-GOES

FCC Certification: CFR Title 47 FCC Part 15 Subpart B – Unintentional radiators

IC Certification: ICES-003 Issue 6

CE Certifications: Directive 1999/5/EC – Radio and telecommunications terminal equipment (RTTE)
Directive 2011/65/EU – RoHS directive (RoHS)

NESDIS Certification NOAA NESDIS GOES Data Collection Platform Radio Set (DCPRS) Certification Standards at 300bps and 1200bps, Version 2.0, June 2009 and CGMS International Standard, Version 1, 2009

D.3 CERTIFICATIONS - LT1-IR

Iridium Certification	Approved for use with any Iridium Certified Antenna. The antenna must have a clear view of the sky without obstruction. The cable to the antenna is allowed a maximum loss of 2.1 dB
FCC Certification:	CFR Title 47 FCC Part 15 Subpart B – Unintentional radiators
IC Certification:	ICES-003 Issue 6
CE Certifications:	Directive 1999/5/EC – Radio and telecommunications terminal equipment (RTTE) Directive 2011/65/EU – RoHS directive (RoHS)

D.4 FCC GRANT IDENTIFICATIONS

FCC Grant IDs: Cellular (LT1-CELL): RI7HE910
Cellular (LT1-CELL-VZ): RI7LE910SV
Bluetooth: 2AA9B04

D.5 FCC PART 15 REGULATORY NOTICES

Interference Statement:

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.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment on or off, the user will be required to correct the interference at his own expense and is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver

Modification Statement:

FTS has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate this equipment and/or obtain warranty service for this equipment.

FTS n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur et/ou au service de garantie de cet appareil.

D.6 CONFORMITIES

Australia (issued 27 March 2017): Compliant to ACMA Standards made under the Radiocommunications Act 1992 and the Telecommunications Act 1997.

Any Australian importer of this product who wishes to be covered by this ACMA DoC must enter into an ACMA agency agreement with N136 Pty Ltd. There is no charge to the Australian importer for this agreement

Colombia (issued 21 March 2017): Compliant to Commission for Communications Regulation 4507, 2014

Peru (issued 05 March 2017): Compliant to Communication and Transport Ministry Decree 001-2006-MTC, 21/01/2006.

D.7 RF EXPOSURE

This equipment complies with FCC and IC radiation exposure limits for an uncontrolled environment. The antenna should be installed and operated with a minimum of 20 cm between the radiator and your body.

Cet appareil est conforme aux limites d'exposition aux rayonnements de la FCC et la IC pour un environnement non contrôlé. L'antenne doit être installée de façon à garder une distance minimale de 20 centimètres entre la source de rayonnements et votre corps. Gain de l'antenne doit être ci-dessous:

Maximum antenna gain is shown in the following table:

Le gain maximal de l'antenne est indiqué dans le tableau suivant :

MODEL	Frequency Band <i>Bande de fréquence</i>	Maximum Antenna Gain <i>Gain de l'antenne maximal</i>
LT1-CELL	GSM850/WSDMA850	5.22 dBi
	PCS1800/WCDMA2100	6.45 dBi
	WCDMA1700	3.31 dBi
LT1-CELL-VZ	700 MHz (LTE Band 13)	6.94 dBi
	1700 MHz (LTE Band 4)	5.00 dBi

DOCUMENT REVISION HISTORY

Revision	Date	Description
1	12 Apr 2017	Original release
2	05 Jun 2017	Updated to include LT1-CELL-SYSTEM set up, updated LED status, new conformities and certifications (Peru, Columbia)
3	20 Nov 2017	Added time limit for synchronization
4	8 May 2018	Updated for LT1 FW v1.4.7 and FTS360 Config App v1.3.04. Added LT1-GOES, FTS360 Config App info, added more troubleshooting
5	26 Jul 2018	Updated Table is section 5.1 to SDI-12 (from SDI)
6	31 Mar 2020	Emphasized use of RS485 connections in Section 5.1; emphasized relationship between FTS360 and FTS360 Config App; explained time drift; placed signed EU Letter of Conformity; added LT1-GOES V2 info; FW updating procedures; described random transmission behaviour; updated info and screen shots to bring in line with FCA ver 1.7.16; added details for using Android devices
7	28 Sep 2020	Added LT1-IR info (LT-1442). Details on SD card use (LT-1440)
8	09 Feb 2021	Added Rogers APN info and FW update file naming structure.