**TELONICS**

**TELEMETRY-ELECTRONICS CONSULTANTS**
932 E. IMPALA AVENUE • MESA, ARIZONA 85204-6699 U.S.A.
TEL (480) 892-4444 • FAX (480) 892-9139
E-MAIL info@telonics.com
www.telonics.com

# Model SST-901M
# Spread Spectrum Radio Modem
# User's Guide

**PB008896 Rev A** 2011.09.13

## TABLE OF CONTENTS

**Model SST-901M Spread Spectrum Radio Modem User's Guide**

## 1.0 Notice to United States Users

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 undesirable operation. In normal operation the unit and approved antenna is positioned several feet from the user but under no circumstance should the antenna be positioned less than 20 cm from the operator.

The user is cautioned that changes or modifications not expressly approved by Telonics could void the user's authority to operate the equipment. This restriction includes the use of specified antennas which have been certified for use with the SST-901M. See Antenna Configurations section below.

## 2.0 Notice to Canadian Users

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

The SST-901M (IC: 4610A-SST901M) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

| Approved Antenna Type | Telonics P/N | Max Gain | Required Impedance |
|---|---|---|---|
| Collinear Vertical w/ ground plane | CM007724-900 | 7.2dBi | 50Ω |
| Collinear Vertical w/ ground plane | CM008828-900 | 5.4dBi | 50Ω |
| Aircraft Blade Antenna | CM007462-001 | 4.0dBi | 50Ω |

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

## 3.0 Hardware Setup

The SST-901M is a portable radio modem allowing field data transfer from a deployed Spread Spectrum Unit to a portable laptop computer.  Before the system will function properly, the SST-901M must be properly connected to a laptop computer and an antenna.   There are three connectors on the SST-901M.  Their function and proper connection are described below and diagrammed in figures 1 and 2:

1.  RF connector:  Connect this jack to the external antenna with the supplied coaxial cable assembly.  See the Antenna configurations section for more information about approved antennas and cabling.

2.  USB Jack:  Connect the SST-901M to the laptop computer with the supplied USB cable.  The unit derives power from the laptop via the USB cable.

3.  External Power Jack (optional):  The SST-901M is normally powered by the laptop via the USB cable.  When the radio link is in use, the laptop battery will be depleted much faster than normal.  Laptop battery life can be extended by connecting the optional 12V Auto Charge Cord (Telonics P/N PS000338-001) to the external power jack.  Note that the charge cord only supplies power to the SST-901M – it does not supply power to the laptop computer.
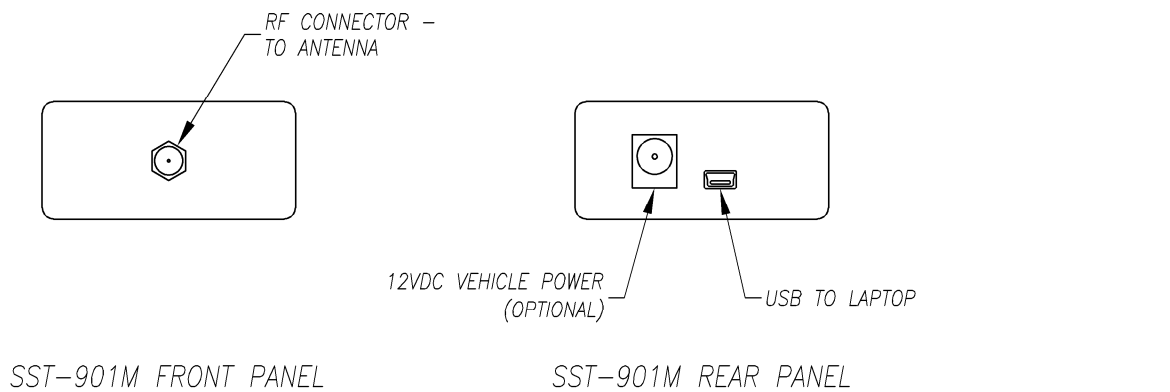


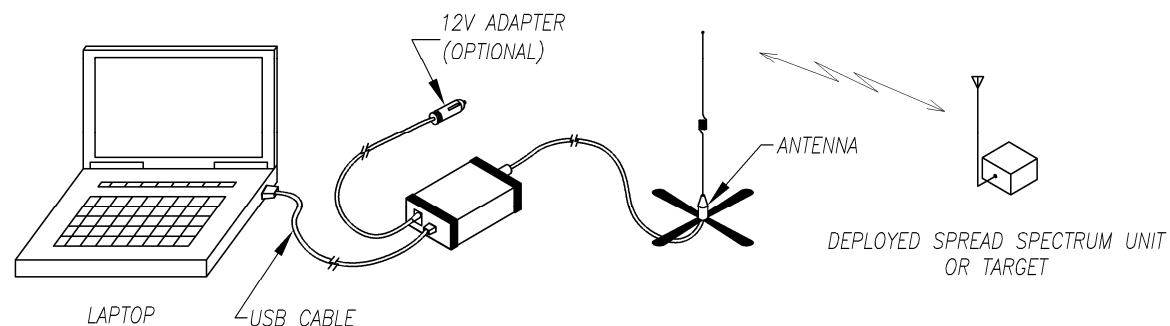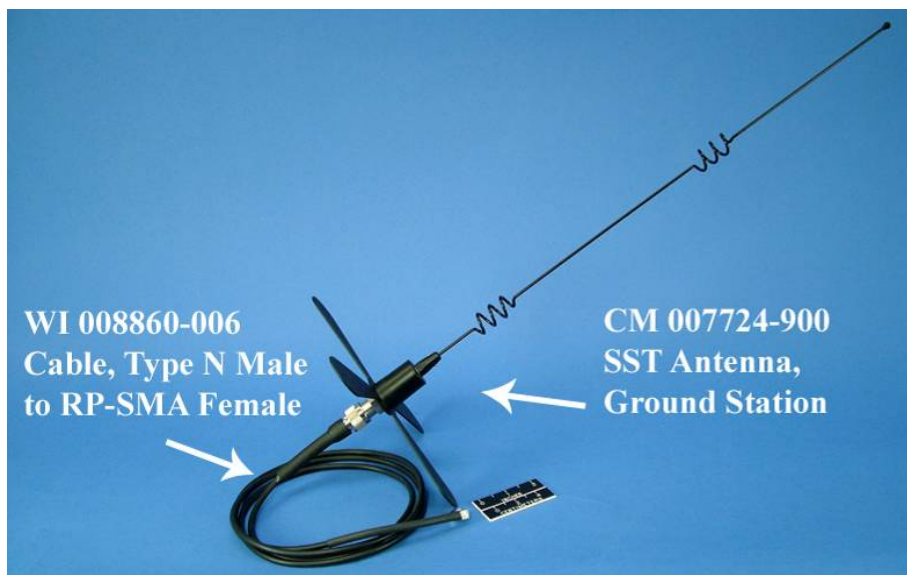**Figure 1** – SST-901M Front and Rear Panel Connections



**Figure 2 –** SST-901M Typical Installation

The following antennas have been specifically designated and certified for use with the SST-901M. Use of other antennas voids the user's authority to operate the equipment.



WI 008860-006
Cable, Type N Male
to RP-SMA Female

CM 008828-900
SST Antenna,
Ground Station



WI 008860-006
Cable, Type N Male
to RP-SMA Female

CM 007724-900
SST Antenna,
Ground Station



CM 007462-001
SST Antenna, Aircraft

CN 007412-001
Adapter, Type N,
right angle
female to male

WI 008860-006
Cable, Type N male
to RP-SMA female

## 4.0 Telonics Data Converter (TDC)

Telonics Data Converter (TDC) is the software user-interface that controls the SST-901M RF Modem to download data over the spread-spectrum link.  TDC can manage the RF connection settings for each deployed SST unit allowing users to download data from units in the field with minimal interaction.  In addition to downloading log memory, TDC also provides the ability to test the RF link, download diagnostic information, initiate a blackout period to save battery life, and convert downloaded data into standard CSV reports.  TDC is compatible with any PC with an available USB port running Windows 2000 or newer, including many ultra-mobile PCs and tablet PCs.

## 4.1 Quick Start Guide

### *Enter your Authorization Code(s)*

The first step to using TDC is to download the utility from the Telonics website. The utility is immediately useable in the evaluation or demonstration mode. In evaluation mode you will not be able to download SST data, download datalogs, or generate reports. This demonstration mode allows you to evaluate TDC and see how you will use TDC during your study. In order for TDC to be fully functional, you must purchase a license. Contact Telonics with your purchase order or credit card information to obtain your Authorization Code. The Authorization Code can be provided to you over the phone, by FAX, email, or postal mail.

Once you have obtained your Authorization Code(s) from Telonics, select the "About Telonics Data Converter" choice under the "Help" menu in TDC. Click the "Add..." button. Enter your Authorization Code and press the "OK" button. If you were given more than one Authorization Code, press the "Add..." button again and repeat for each remaining Authorization Code.

For additional information see the Authorization Codes section of help.

### *Set your Options*

TDC must be configured for use. From the Options Menu, select "File Locations..." to view the Options Window. Set your preferred directory for spread-spectrum files and your report destination folder by typing the full path in the provided field. The spread-spectrum files directory will hold all of the data that you downloaded over the SST link (e.g. TSF files, statistics files, diagnostic information). The report directory will hold your final converted reports. You can also select a directory by pressing the "Browse" button next to the field. From the Options Window, you can view different groups of options by clicking the tabs near the top of the window. Once you have finished adjusting the program options, press the "OK" button to save your changes.

For additional information see the Options section of help

### *Import or Add SST Units*

TDC uses TPF files that describe the unit's identity and operational behavior. These files are typically provided to you as attachments in an email from Telonics.  From the SST tab in the Main Window, press the "Configure unit and session settings" link or alternatively select "Unit & Session Settings..." from the "Spread Spectrum" menu to launch the Spread Spectrum Unit & Session Settings Window. From this window, press the "Import..." button and then browse to the TPF file that was used to program your SST units. TDC will then import the connection settings for each unit in that TPF file.

If you do not have a TPF file for the units, you can also add units by selecting "[Add new unit]" from the list of units and then manually type in the connection settings.

### *Specify Tasks to Perform in Next SST Transfer Session*

From the Spread Spectrum Unit & Session Settings Window, select an SST unit from the list. The "Next Transfer Session" section of the window lists all optional tasks that you can perform during the next SST

session with the selected unit. Be sure to specify the tasks for each unit to which you plan to connect. Consider planning and selecting these tasks ahead of time (in the office) before heading out to download data in the field.

When you are finished importing SST units and selecting tasks for the next transfer session, press the OK button to close the Spread Spectrum Unit & Session Settings Window and save your changes. For additional information see the SST Unit and Session Settings section of help.

### Download SST Data

Connect the SST-901M to the PC using the supplied USB cable. Note that the first time you connect the SST-901M you may be prompted to install a driver. See the USB Driver Installation section of help if you need assistance installing the USB driver. Connect the antenna to SST-901M. Specific antennas have been approved for use in ground monitoring applications and for use in aircraft monitoring. When testing the spread-spectrum link, separate the SST-901M and the units under test by at least 20 meters.

To begin the download test remove the magnet prior to attempting communications. Once you remove the magnet, the unit will enter a predeployment period (typically 4 hours) in which you will be able to conduct SST transfer sessions. During predeployment, the unit will also collect GPS and/or QFP locations (typically once an hour). When the unit is actively trying to collect a GPS or QFP location, you will not be able to conduct an SST session.

From the SST tab in the Main Window, press the "Download file over spread-spectrum link" hyperlink or select "Transfer Session..." from the "Spread Spectrum" menu to launch the Spread Spectrum Transfer Session Window. Select a unit from the list and press the Connect button. TDC will attempt to connect to the unit and complete the tasks that you have previously specified for this unit. If TDC has stored a TPF tile for the selected unit, the SST Active field will tell you the next time the selected unit is scheduled to listen for SST communications.

During an SST transfer session, the window displays progress for each task and the signal strength and transfer rate of the link. After completing an SST session, TDC displays a message indicating whether the session was successful. If the session was successful, TDC updates the Results tabs to show information about the results of the last transfer session. The "Downloaded Data" tab shows the name of the file that contains your downloaded data (including GPS/QFP locations). See the next step for instructions on converting this .tsf file into a report. If the session failed, please try to connect to the unit again.

For additional information see the SST Transfer Session section of help.

### Convert SST Data (.tsf file)

The file that is downloaded from the unit under test is not in a readable form and it is necessary to convert the recovered file. From the Spread Spectrum Unit & Session Settings Window, select the unit for which you would like to convert data (if you have not already done so). The "Downloaded Data" tab will list the SST file (.tsf) that you downloaded during the last SST transfer session with that unit. Click the filename of the downloaded file and TDC will offer to convert the file. The Main Window displays conversion progress in the Results field of the SST tab. After TDC has finished converting the file, the Results field displays the name of the generated report. For detailed conversion instructions, see the Main Window (SST) section of help.

Note that you can also select the SST data to convert from the Main Window in TDC. Select the SST tab and then press the "Select File..." button. Browse to the SST file (.tsf) that you would like to convert. Note that TDC downloads all SST files to the spread-spectrum files directory that you specified in the File Locations tab of the Options Window. TDC automatically names the files to include the CTN of the unit and date/time of the SST session.
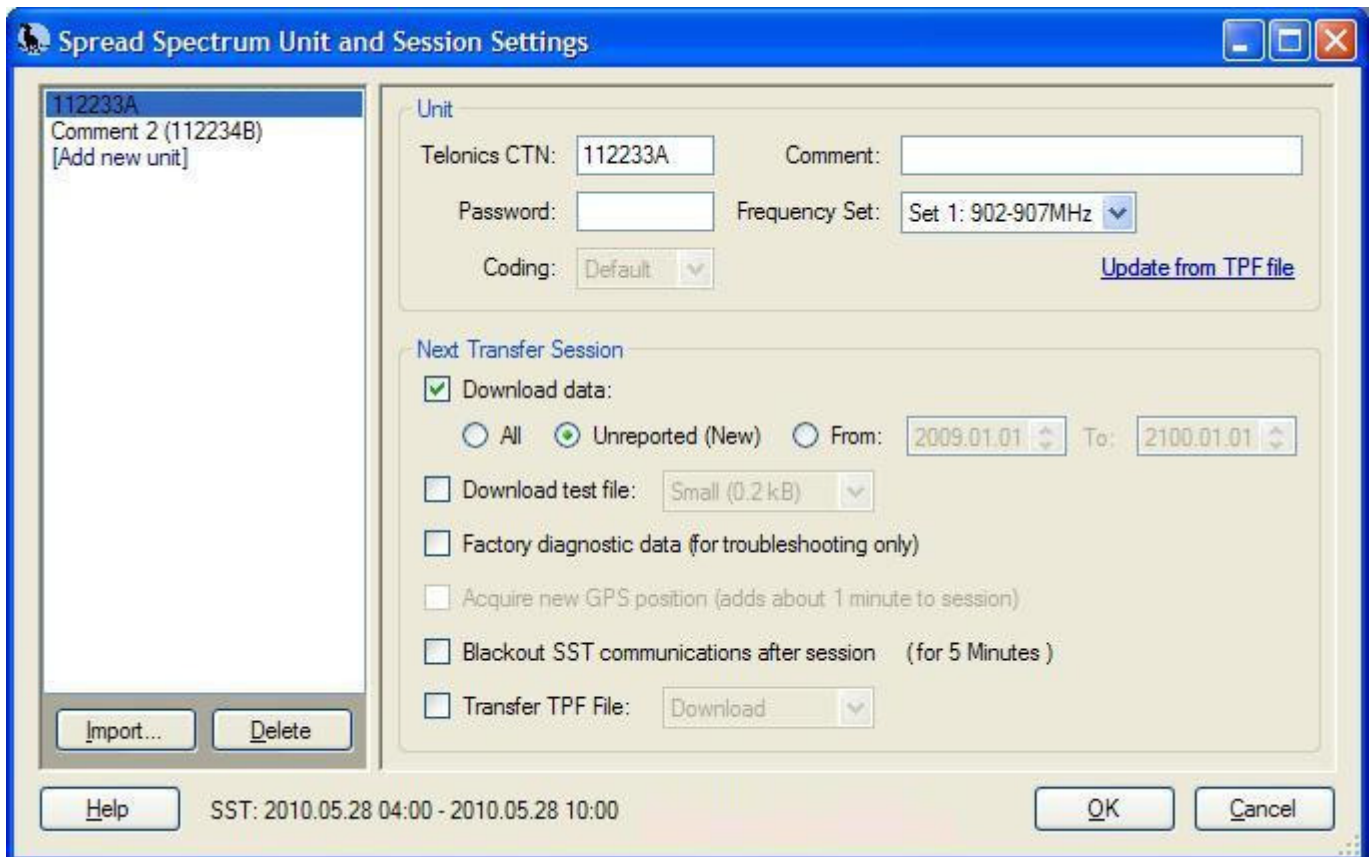
After converting the SST file (.tsf), TDC stores the final report (.csv file) in the reports directory that you specified in the File Locations tab of the Options Window.

If your unit supports QFP locations, be sure that your PC is connected to the Internet when you convert the data (.tsf file). You do not need an Internet connection to download the SST data.

## 4.2 SST Unit and Session Settings Window

The SST Unit and Session Settings Window allows you to perform the following tasks:

- Import new SST units from a TPF file
- Delete an existing SST unit
- Add a new SST unit by manually specifying connection settings
- Update connection settings and assign a comment to a unit
- Specify the tasks to perform during the next SST transfer session



### Unit Selection

The left section of this window lists all SST units known to TDC. To select a unit, click on that unit in the list. To add a new unit manually, select the last entry in the list ("[Add New Unit]") and then type in the connection parameters in the upper-right section of the window.

### Import Button

Press the Import Button to add new SST units from a TPF file. TDC prompts you to select the TPF file. Note that this window manages only SST units, so TDC will not find any units if you select a TPF file for a store-on-board.

### Delete Button

Press the Delete Button to delete the currently selected SST unit from TDC. If you have previously had an SST transfer session with the selected unit, TDC displays a warning message before deleting the unit so that you have an opportunity to cancel the deletion. The Delete Button is disabled when "[Add New Unit]" is selected.

### Unit

The Unit group is located in the upper-right section of this window. It lists the connection settings for the currently selected unit.

### Telonics CTN

The CTN uniquely identifies the unit. TDC uses the CTN during the connection process of an SST session. TDC also uses the CTN to name the files downloaded during an SST transfer session.

### Comment

The Comment field allows you to assign a comment to the selected unit. Using the Comment field allows you to assign a unit name that you can easily identify later. This is particularly useful when you have several SST units listed in TDC.

### Password

The Password field specifies the connection password for the unit. If the unit does not have a password, leave this field blank.

### Frequency Set

The Frequency Set field specifies the frequency set that will be used for communication between the SST-901M and the remote units.  Each set consists of 50 separate frequencies, nominally spaced at 102 kHz intervals.  Frequency Set limits are listed in Section 5.0 of this document.

The choice of which frequency set(s) to use is left to the discretion of the Telonics SST system user.  The decision of which set(s) to use must be made before the study begins so that remote units can be programmed appropriately prior to deployment.  The paragraphs below provide information that may aid in the decision of which frequency set(s) to use for a given study:

- In studies involving multiple deployed (remote) units, all units in close proximity on a given frequency set will be aware that communications are occurring.  Only the SST-901M and the addressed remote unit will be involved in the communication, however all units that can hear the communication will repeatedly spend small amounts of energy receiving and decoding the communication packets only to discover that they are not involved in the communication.  By using multiple frequency sets, this unnecessary energy expense in the remote units can be reduced (extending operational life).

- There is a known source of interference in the area and it is severe enough to prevent successful communications.

- There are multiple studies being run in close proximity and two or more SST-901M units may be in use at the same time.

- Operation of the SST-901M and associated remote units is causing harmful interference in the proper operation of some other system or equipment.

### Coding

The Coding field specifies the coding type for the unit. For now, SST units support only one coding type so this field is disabled.

### Update from TPF File Link

Clicking this hyperlink lets you update the connection settings (password, frequency set, and coding) for the currently selected unit. Clicking this link does not cause TDC to import new units or update the connection settings for other units listed in the TPF file.

### Next Transfer Session

The Next Transfer Session group is located in the lower-right section of this window. It specifies the action to perform during the next SST transfer session.

### Download Data

This setting specifies whether to download all data, new data, by date range, or not to download any data from the unit.

### Download Test File

Use this setting to download a test file. The drop-down list lets you specify the size of the test file. Downloading a test file is useful for testing the performance (range, transfer rate, and signal strength) of the spread-spectrum link.

### Factory Diagnostic Data

Use this setting if you are experiencing problems with the unit and Telonics instructs you to download diagnostic data. You will then need to send your data file (TSF) to Telonics for analysis.

### Acquire New GPS Position

Use this setting to instruct the unit to acquire a new GPS position. TDC will then wait for the unit to acquire the new GPS position, reconnect to the unit, and download the updated position. Depending on how long the unit takes to acquire the GPS fix, this task may add up to 5 minutes to the SST transfer session. Please note that this feature is "grayed out" (not available) in the initial release of the Telonics SST system.

### Blackout Period: SST Communications After Session

This energy-saving feature instructs the unit to black out SST communications after the transfer session is complete. TDC displays the duration of the blackout period if that information is available. Otherwise, see the TPF record for the blackout duration.

### Transfer TPF File

Use this setting to download the TPF File from the unit.

### SST Active Time

The bottom of the window displays the next active time (in UTC) for SST communications if that information is available. The active time for SST communications accounts for the SST schedule and a blackout period that you may have established during your last transfer session.
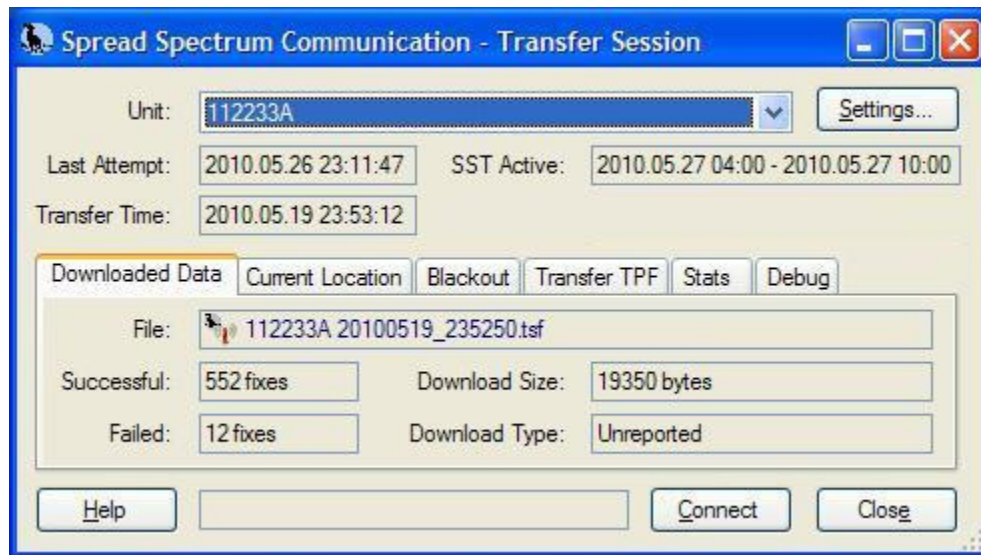
### OK Button

Pressing the OK Button saves any changes that you made within this window.

### Cancel Button

This button closes this window without saving your changes. TDC displays a warning message before dropping the changes that you made, giving you a final chance to save your changes.

## 4.3 SST Transfer Session Window

This program window provides the ability to initiate an SST transfer session, view the status of the current SST transfer session, and view the results from previous transfer sessions.



### Unit

The Unit drop-down list allows you to select the unit for the SST transfer session. The results tabs display the results from the last successful transfer session for the selected unit.

### Settings

The Settings button opens the SST Unit and Session Settings Window.

### Last Attempt

This field displays the time (in UTC) that you last attempted a transfer session with the selected unit. This time is updated as soon as you press the Connect button.

### Transfer Time

This field displays the time (in UTC) of your last successful transfer session with the selected unit. This time is updated after a successful session.

### SST Active

This field displays the next time (in UTC) that the unit is scheduled to listen for SST communications. This time accounts for the SST schedule and a blackout period that you may have established during your last transfer session.

*Results*

These tabs display the results from the last successful transfer session. Files listed in the results section are located in your Spread-Spectrum Files directory (set in the File Locations tab of the Options Window). You can access these files from this window by clicking the filename or icon. The results section includes the following tabs:

- **Downloaded Data**
  The File field lists the downloaded data file (TSF), factory-diagnostic data (optionally included inside TSF), and the test file. The Successful and Failed fields summarize the number of fixes included in the downloaded data file. Download Size describes the number of bytes downloaded for the data file (TSF). Download Type displays the selected options for the data download.

- **Current Location**
  This tab displays information from the most-recent successful GPS fix. TDC downloads this information with every SST transfer session. You can optionally instruct the unit to "Acquire a new GPS fix" as part of the SST session (see SST Unit and Session Settings Window).

- **Blackout period**
  Start Time displays the scheduled start of the SST blackout period , accounting for a short grace period after the last SST transfer session. End Time displays the end of the blackout period. The End Time does not account for on/off periods in the SST schedule. If the End Time is in the middle of an off period the unit will not listen for SST communications until the start of the next scheduled on period. See the SST Active field to see the next time that unit will listen for SST communications.

- **Transfer TPF**
  The Type field specifies whether TDC downloaded or uploaded a TPF file. The Size field describes the number of bytes transferred for the TPF file. The File field lists the name of the transferred TPF file.

- **Stats**
  The Statistics tab summarizes the health of the spread-spectrum link in the most-recent SST transfer session. Avg Signal displays the average signal strength of packets received by the SST-901M. Session Duration displays the total length of the transfer session. Tx Rate shows the average transfer rate for sending and receiving files over the spread-spectrum link. The Bytes Received and Sent fields describe the total number of bytes transferred by the SST-901M during the transfer session. The File field lists the detailed statistics file, which includes additional statistics about the spread-spectrum link.

- **Debug**
  The File field lists the Debug and Packet files. Debug Info displays the contents of the Debug file. If you are experiencing difficulties with SST communications, Telonics may ask you to send these files to the factory for analysis.

*Connect Button*

Press the Connect Button to attempt to connect to the selected unit and conduct an SST transfer session.
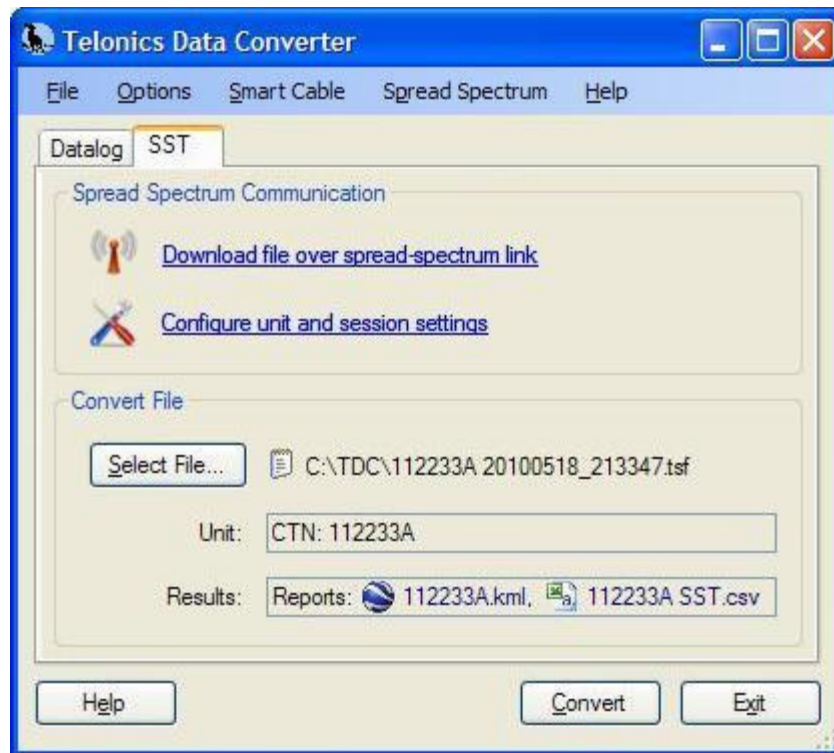
*Stop Button*

Press the Stop button to cancel a transfer session. If Telonics Data Converter has connected to the unit and is in the middle of the transfer session, TDC will warn you before canceling the session. If TDC has not yet connected to the unit, TDC cancels the session without warning.

*Close Button*

Pressing the Close Button closes this SST Transfer Session Window. If TDC is in the middle of an SST session, TDC will give you a warning and cancel the session before closing the window.

## 4.4 Main Window (SST)

The Main Window consists of two separate tabs. To switch to a different tab, click on the name of the tab near the top of the Main Window. This Help page covers the SST Files tab within the Main Window.



### *Main Menu*

Like most applications, the Main Menu in TDC is located at the very top of the Main Window. Choices within the Main Menu allow TDC to perform the following actions:

- Convert Data (File->Convert Data)
- Exit TDC (File->Exit)
- Open the Options Window (Options->File Locations, Options->Report Settings, Options->Data Formats, or Options->Program Operation)
- Open a Download Datalog Window (Smart Cable->Download Datalog...)
- Open a Download TPF File Window (Smart Cable->Download TPF File...)
- Open the Erase Datalog Window (Smart Cable->Erase Datalog...)
- Open the SST Transfer Session Window (Spread Spectrum->Transfer Session...)
- Open the SST Unit and Session Settings Window (Spread Spectrum->Unit & Session Settings...)
- Access the TDC help system (Help->Contents, Help->Index, or Help->Search)
- Open the About TDC Window (Help->About Telonics Data Converter)

### *Spread Spectrum Communication*

The Spread Spectrum Communication box is located near the top of the Main Window. This box provides links to download data and configure communication settings.

### Download file over spread-spectrum link

Click this link to open the SST Transfer Session Window. From that window, you can download data from a unit over the spread-spectrum link. If you have already downloaded the SST file, simply use the Convert File box to select and convert the file.

### Configure unit and session settings

Click this link to open the SST Unit and Session Settings Window. From that window, you can specify the connection parameters for an SST transmitter and choose the options for the next SST transfer session.

### Convert File

The Convert File box allows you to select an SST file. This box displays the selected file, information about that file, and results of the conversion.

### Select File...

Pressing the Select File Button allows you to browse your PC and select an SST file for processing. This button is disabled when TDC is in the process of converting data. TDC displays the currently selected file next to the Select File Button.

### Unit

This field identifies the transmitter that created the selected spread-spectrum file. This information is extracted from inside the spread-spectrum file (.tsf). This field also displays any comments that have been assigned to SST units.

### Results

Telonics Data Converter uses this field to inform you of its progress while it converts the file. After the conversion is finished, this field will contain the name of the generated reports (or state that an error occurred). Click the name or icon of a report listed in the results field to open the CSV or Google Earth file.

### Convert Button

Pressing the Convert Button causes TDC to start converting the spread-spectrum file.

### Stop Button

Pressing the Stop Button causes TDC to stop converting the file. You cannot resume a data conversion once it has been canceled.

### Exit Button

Pressing the Exit Button causes TDC to close all windows and exit. If TDC is converting data when you press the exit button, you will be given a chance to cancel your request to exit.

## 5.0 SST-901M SPECIFICATIONS

### GENERAL
| | |
|---|---|
| FCC ID | JYLSST901M |
| Frequency Range | 902.102 - 927.908 MHz. |
| Spread Spectrum Type | Frequency Hopping FSK |
| Applicable FCC Rules | Part 15 (15.247) |
| Number of RF Frequency Sets | 4 sets, non overlapping |
| | Set 1: 902.102 - 907.100 MHz |
| | Set 2: 908.120 - 913.220 MHz |
| | Set 3: 915.260 - 920.360 MHz |
| | Set 4: 922.808 - 927.908 MHz |
| Nominal Channel Frequency Spacing | 102 kHz |
| Data Interface | USB |

### POWER REQUIREMENTS
| | |
|---|---|
| Primary Supply (USB Power) | 5.0 V |
| Auxiliary Supply (Optional Auto/Aircraft Power) | 10-16 Vdc |
| Transmit Current | 400 mA typ @ 5V |
| | 250 mA typ @ 12V |
| Receive Current | 30 mA typ @ 5V |
| Stand-by Current | < 5 mA |

### TRANSMITTER
| | |
|---|---|
| Power Output | 500 mW (+27dBm) |
| Frequency Stability | ± 0.5 ppm @ 25°C |
| ± 1.0ppm -30<T<+60°C | |
| Modulation Data Rate | 19.2 kbps |
| Modulation Type | FSK |
| Modulation Bandwidth (99%) | 40 kHz typ |
| Load Impedance | 50 Ω |

### RECEIVER
| | |
|---|---|
| Noise Figure | <3.0 dB |
| Sensitivity for $10^{-4}$ BER @ 19.2 kbps | <-110 dBm typ |

### MECHANICAL / ENVIRONMENTAL
| | |
|---|---|
| Dimensions, excluding RF connector | 3.40" l x 2.25" w x 1.0" h |
| | 86 x 57 x 25 mm |
| Operating Temperature Range | -30 to +70 °C |
| Humidity | <95%, non-condensing |