Titan
Quick Start

User Manual

MARS *LABS*
Partners in Precision Performance
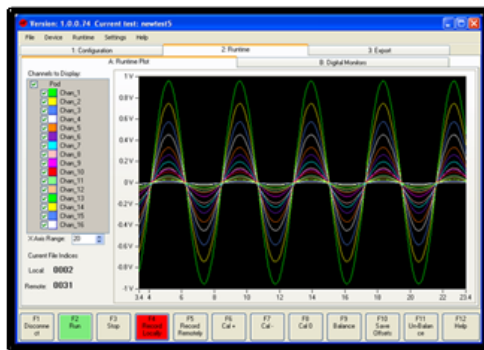
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Warning

Only a qualified technician or representative of Mars Labs should attempt to service the components of this system. There are no user-serviceable parts inside.

For the safety and protection of the equipment, power must be turned off prior to connecting or disconnecting cables and sensors.

Titan Quick Start Manual
MNL-1008_RevG
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Introduction

This Quick Start document is intended to provide a brief overview of the Titan hardware and software, and describes the basic installation and configuration information needed to quickly get you 'up and running'. The document contains excerpts from various Titan User Manuals and is not intended to be a complete information source. For detailed information about a specific Titan product, please consult the appropriate Titan User Manual.

About Titan

The Mars Labs Titan family is a flexible, scalable line of data acquisition products that provide custom solutions for high or low speed applications. Products can be mixed and matched to provide up to 128 channels of data acquisition and storage.

A minimum Titan data acquisition system consists of an Input Module (a Titan Pod or Mini-Recorder) and the Titan Control Software application. Together, this package provides a fully integrated 16-channel system suitable for a variety of data acquisition applications. By combining up to eight Input Modules with a Titan CPU Channel Multiplexer, large channel-count systems can be easily realized.

Titan Input Modules feature a 16-channel interface with on-board signal conditioning, programmable gain and filtering, and A/D conversion. Mini-Recorder versions also provide built-in data storage via an SD memory card. Titan Modules are powered by a special dual-USB cable when connected to a PC, or from an external power source through the Auxiliary Power connector. When multiple devices are combined in a Titan CPU-based system, modules are powered by the CPU through a single cable that provides power, synchronization and communications.

Adding to the Titan hardware family, the Titan DAC seemlessly integrates with Titan Mini-Recorders or Pods to provide an analog output that is useful for monitoring and control applications.

The Titan Control Software (TCS) application provides for the configuration, acquisition, display and storage of sensor data from Titan Input Modules. TCS allows you to easily configure and control up to 16 channels of sensor data from a single Titan device, and up to 128 channels from a Titan CPU and multiple Titan modules.

Support

Product support is available by contacting the factory during regular business hours (9am – 6pm EST) at 301-470-6277. Additional information can be found on our web site: http://www.marslabs.com

General Guidelines and Precautions

Electrostatic Discharge

Although the input connectors of Titan devices incorporate ESD protection, it is good practice to always ground yourself and the Titan hardware while using the equipment. Users should always observe approved ESD handling procedures to prevent ESD damage.

Power Adapters

When using a power adapter with Titan hardware, always connect the adapter to the Titan *before* applying power. Never 'hot plug' a Titan device under any circumstances - hot plugging may damage the device!

Preparations

Begin by installing the Titan Control Software (TCS) application and supporting software framework.

> **NOTE:** *If you received a demo netbook system, TCS and the required drivers have already been installed.*

System Requirements

You will need a PC running Windows XP w/SP3 or Windows 7/8, 100MB hard drive space, 512MB RAM (minimum), and a free USB port. The display should have 1024 x 768 minimum resolution. A 2.4G Pentium 4 or faster PC is recommended for best performance. A basic working knowledge of Microsoft Windows is an important prerequisite for installing and using TCS.

Installing the Software

TCS runs only on Windows PCs, and requires Microsoft's .NET Framework. Installers for both TCS and Microsoft.NET are found on the supplied CD-ROM.

1. Begin by installing the .NET Framework by running the executable file "dotnet35.exe". The installer is located on the CD-ROM:

   TCS3\Contents\dotnet installer\dotnet35.exe

> **NOTE:** *Installation of the .NET framework is only required for Windows XP systems. It is not needed for Windows 7 & 8 systems.*

2. Next, install the TCS application by running the setup file "TCS_setup_vX.X.X.exe". When the Installation Options window appears, accept the default settings by clicking 'Next'. When the Installation Folder window appears, accept the default folder location by clicking 'Install'. The setup executable will install the TCS application and all related files; it will also place a shortcut on the desktop for convenience. The TCS application will be installed in:

   \Program Files\MarsLabs\TSC3

Making Connections

Assemble the Titan hardware where you plan to set up the equipment. Make the following connections:

1. Plug the Titan Power Adapter into the Titan device, and then plug the adapter into an outlet. The device will initialize. For a Mini-Recorder, the STOP led will blink with power applied. If an SD memory card is installed, the STOP LED will be illuminated solid.

2. With a USB cable, connect the Mini-Recorder USB port to one of the USB ports on the host PC.

Installing the Drivers

The first time a Titan Input Module is connected, the PC may issue a prompt that a new hardware device has been found and ask you to load the Titan device driver. This driver ('stmcdc.inf') is included as a part of the TCS installation, but is not automatically installed. The driver is located here:

\Program Files\MarsLabs\TCS3\Drivers\VCOM_Driver

To install the driver:

1. Keep the Titan device plugged in and open the Device Manager on the PC.
2. Double-click on 'Ports' to display the missing Titan driver (a yellow question mark will be superimposed on the missing driver icon).
3. Right-click on the missing driver and select "Update Driver".
4. Follow the Hardware Update Wizard prompts to perform the update:
   a. Select the option to install the driver from a specific location
   b. Select the option to choose the driver to install
   c. Navigate to the driver location and install the driver.

For more information on Titan Driver installation, refer to the Troubleshooting section in the TCS User Manual.

> **NOTE:** *This procedure addresses the driver installation on Windows XP machines. Windows 7 & 8 users will observe slight deviations from the installation description, but the overall procedure is basically the same.*

Signal Input

Your Titan demo system may include a signal input cable. This cable provides a convenient means to apply test tones using the supplied WAV file (generated by the PC using an audio playback application such as the Windows Media Player) to the Titan device. Connect the signal input cable to the headphone jack of the PC. If no cable was furnished, you will need to fabricate an input cable and provide a signal input from a Function Generator or similar device. See the 'Cabling' section for details.

On the PC, navigate to the DEMO directory on the CD-ROM and load the file "1-2-4-8-16.wav" into your audio playback software (see **NOTE below**). Adjust the software for maximum output. If the software supports it, enable the playback to loop continuously. If the software does not support looping, you will need to play the file each time you wish to acquire and view signals.

With the signal input cable in place, you are now ready to explore TCS. Skip to the 'Configuring TCS' section.

> ***NOTES:***
> *1. The "1-2-4-8-16.wav" file is a small audio file that outputs a series of sine wave test tones of increasing frequency, each with a duration of approximately 10 seconds. The series is 1 Hz, 2 Hz, 4 Hz, 8 Hz and 16Hz.*
>
> *2. In demo systems, this file is located on the desktop.*

Cabling

A simple signal input cable can be fabricated using a DB9 male connector, a wire pair, and the mating connector to the signal source output (an Oscillator, Function Generator, etc.).

Wire the signal source output connection to pins 7 and 8 of the DB9 connector as shown below.

Notes:
1. If the desired signal source is the PC audio output as described in the previous section, use a 3.5mm (1/8") TRS plug with the sleeve connected to pin 7 and the tip connected to pin 8 of the DB9 connector.

2. The pinout of the DB9 connector can be found in the Titan Hardware manual.
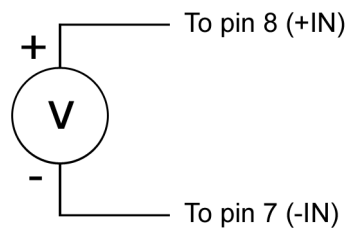
Figure 1. Signal source connections

Connect the completed cable to a Function Generator or other signal source, and configure the source for a 1 Hz, 5Vpp sine wave output. Apply the test signal to channel 1, and follow the 'Configuring TCS' section.

Configuring TCS

Configuring a test in TCS involves four steps:

1. Select the basic test configuration in the 'Device Configuration' screen. Select the device speed, scan rate and filter frequency that is appropriate for your test.

2. Configure your sensors in the 'Sensors' screen.

3. Assign sensors to channels in the 'Tags and Channels' screen

4. If your test is to be run on a recurring basis (every 5 minutes, at the beginning of the day, etc.), or if the test is only run when a threshold is reached, make the appropriate selections in the 'Recording & Triggers' screen.

This section will walk you through the four steps for a stand-alone configuration using a Titan Mini-Recorder (or Pod), and then briefly address data acquisition operations in the 'Runtime' screen and data export operations in the 'Export' screen. It will then address configurations for the Titan CPU and the Titan DAC.

Complete details about all of the configurations described herein can be found in the following documents:

>   MNL-1001 - TCS User Manual
>   MNL-1009 - Titan B-Series Mini-Recorder User Manual

NOTE: *The TCS User Manual can also be evoked at anytime from within TCS by selecting 'HELP' in the 'Help' menu, or by typing CTRL-H.*

Launch TCS

> ***NOTE:*** *If you are using the PC to generate the test signal, start the audio playback of the WAV file before launching TCS.*

Begin by double-clicking on the TCS icon on the desktop. The first time TCS is run, a message window will appear informing you of how TCS organizes test files (for more on TCS File Organization, consult the TCS User Manual). Click 'OK' to dismiss the message and continue. The 'Welcome to Titan' window will propmt you to to Create a new Test or Load an existing Test. For this Quick Start example, you will Create a new test.

Click on the 'USB/Serial (Mini-Recorder)' radio button. This selection is used for both Mini-Recorder and Pod devices in a stand-alone configuration. The 'Ethernet (Titan CPU/CPX)' and 'USB/Serial (Mini-Recorder+DAC)' configurations will be covered later.

TCS assigns a default name that is based on the selected Connection Type and the current date. Change the name by click inside the 'Test Name' field and enter "Titan_Demo". All data taken during the session will be exported using this name.

> ***NOTE:*** *TCS test names cannot contain spaces. Any combination of upper & lower case letters and numbers are acceptable, as are most punctuation characters.*
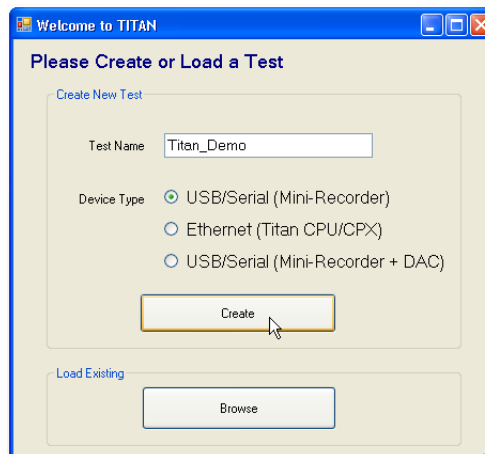

After selecting the connection type and test name, click 'Create' to begin configuring the test.

TCS will configure itself for Mini-Recorder operation and display the Configuration tab screen (below), where basic acquisition parameters are selected (the 'Device Configurations' tab), sensors are configured (the 'Sensors' tab), channels are assigned (the 'Tags and Channels' tab), and recording options are chosen (the 'Recording Options' tab).

The connected Titan device should appear in the 'Select Port' display on the left side of the screen:
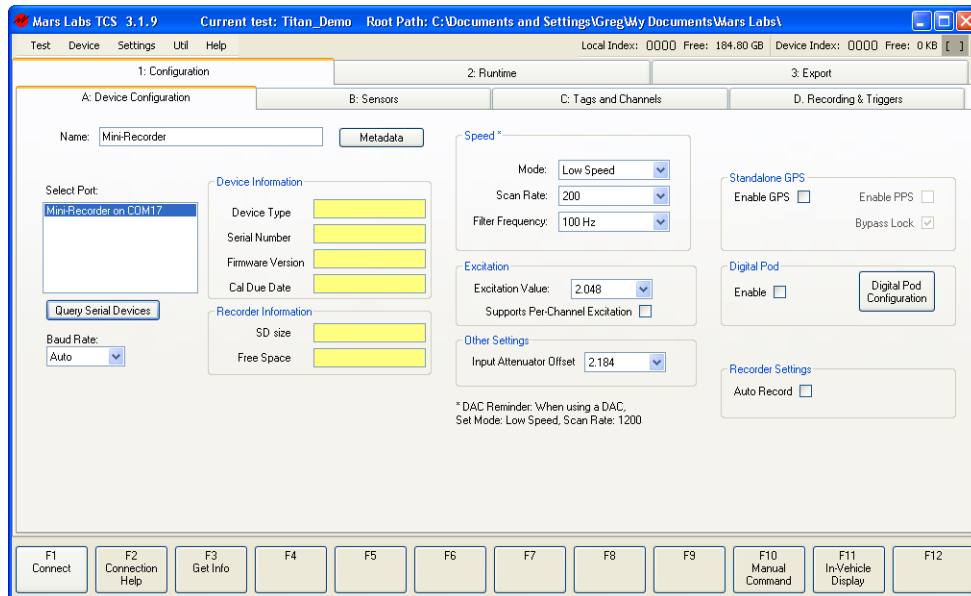
NOTE: *If the Titan device does not appear in the 'Select Port' display, click on the 'Query Serial Devices' button, and then select the device.*
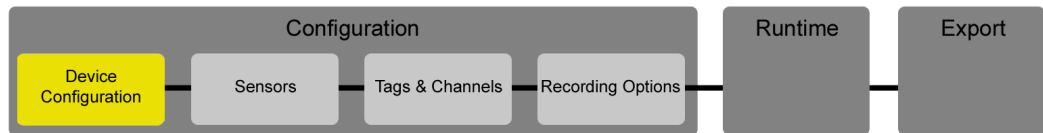
Device Configuration

At the bottom of the TCS window is a row of function keys that select various functions in TCS screens. Click on function key F1 (CONNECT). TCS will connect to the Titan device, and the Device Information fields will be populated with information about the connected device:
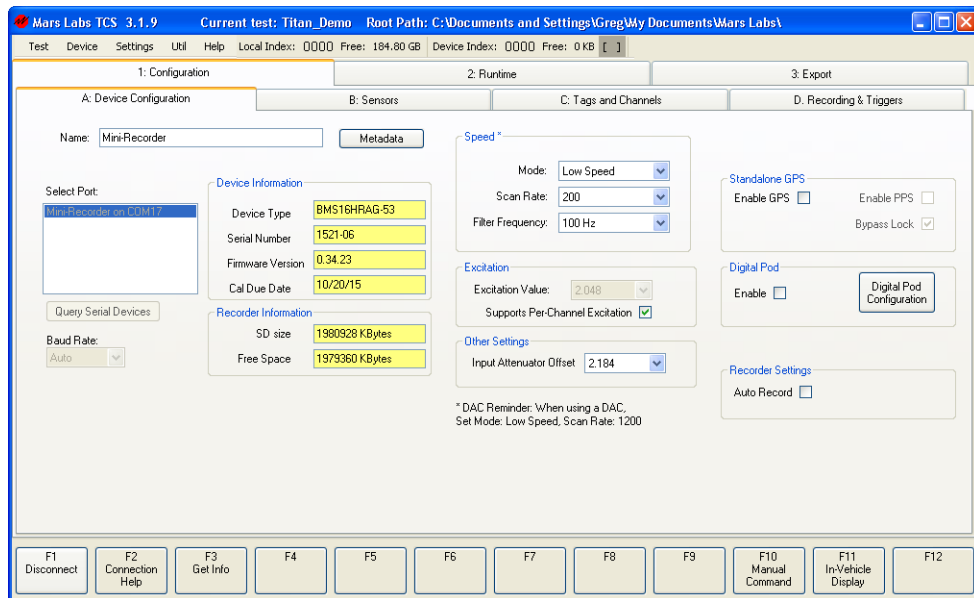
TCS defaults to the device configuration shown above:

Low Speed mode	Input Attenuator Offset: 2.184V
Scan Rate: 200 Hz	GPS disabled
Filter Frequency: 100 Hz	Digital Pod disabled
Excitation value: 2.048V	Auto Record disabled
Per Channel Excitation: Enabled	

Accept the default values. We will take a closer look at them later.

NOTES:

1. Depending on the connection status, the function key F1 will display either 'Connect' (if not connected), or 'Disconnect' (if connected).

2. If the Recorder Information 'SD size' field displays "ERROR - NO FILESYSTEM", it indicates that no SD card is installed in the Mini-Recorder. If you install an SD card after connecting to TCS, click 'GET INFO' [F3] to refresh the display. The Recorder Information fields will then be updated to display the size and the amount of free space on the SD card.

3. Memory cards are formatted in the Mini-Recorder using the 'Format' command. Consult the 'Formatting Memory Cards' section in the Mini-Recorder User Manual.
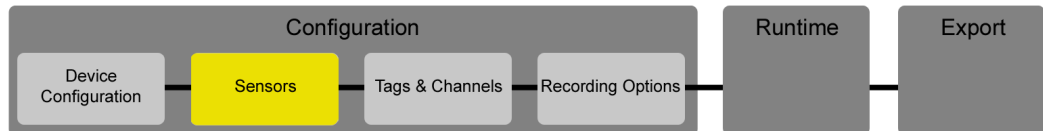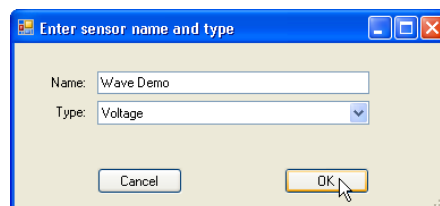
Sensors

Switch to the Sensors tab screen. The Sensors screen is where you configure the sensors to be used in a test. Available sensor types include Voltage, Acceleration, Strain, Digital, Thermocouple, Displacement, Load, Pressure and Other (Sensitivity or Polynomial).

For this example, you will configure a simple voltage sensor. Click F5 (NEW SENSOR). A window will appear that allows you to select the sensor type and name the sensor:
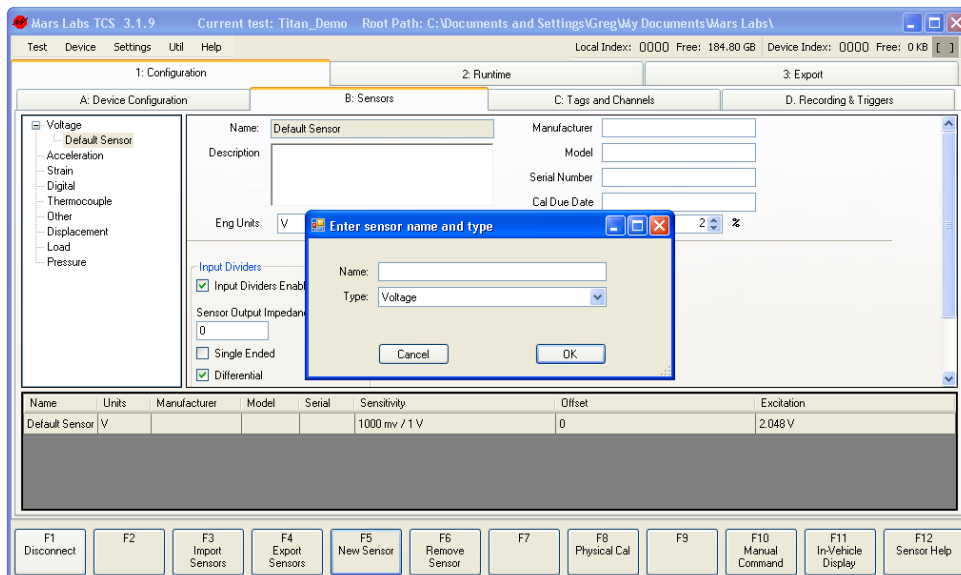

A drop down menu selects the sensor type. The menu defaults to 'Voltage', which is the correct sensor type for this example. In the Name field, simply enter "Wave Demo" as shown, and then click 'OK':

NOTE: You can also create a new sensor simply by double-clicking on the desired sensor type in the Sensor Tree on the left side of the window. Note, however, that sensors created in this manner will be named automatically; you will not be able to assign the name.
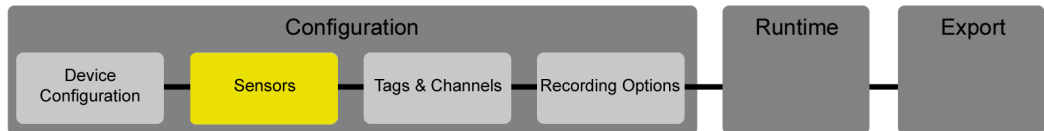
The table at the bottom of the Sensors window provides an overview of all of the sensors that are defined for the selected sensor type. The sensor that was just created appears here:
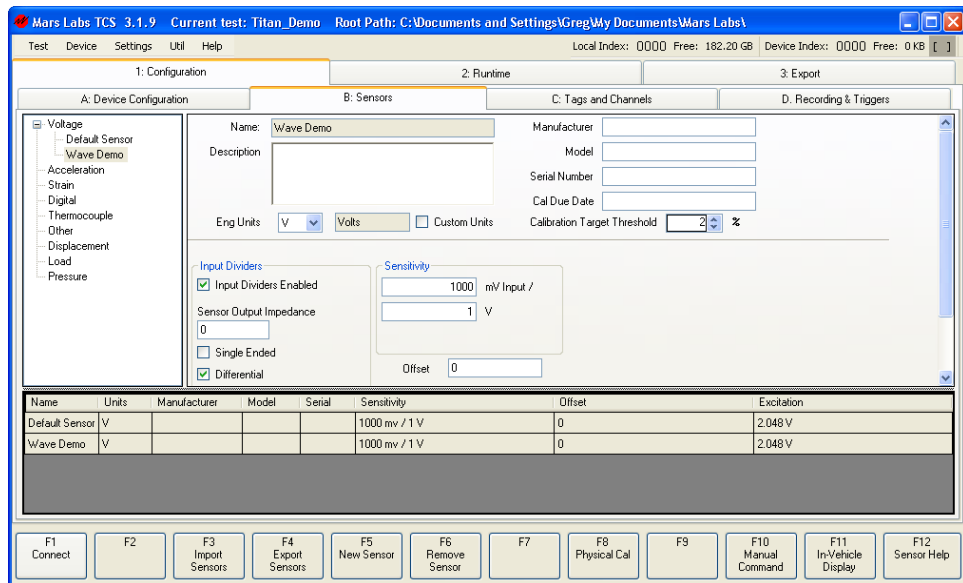
The Sensor window allows you to add general information about the sensor (description, model number, manufacturer, etc.) and input additional configuration information (sensitivity, excitation , etc.).

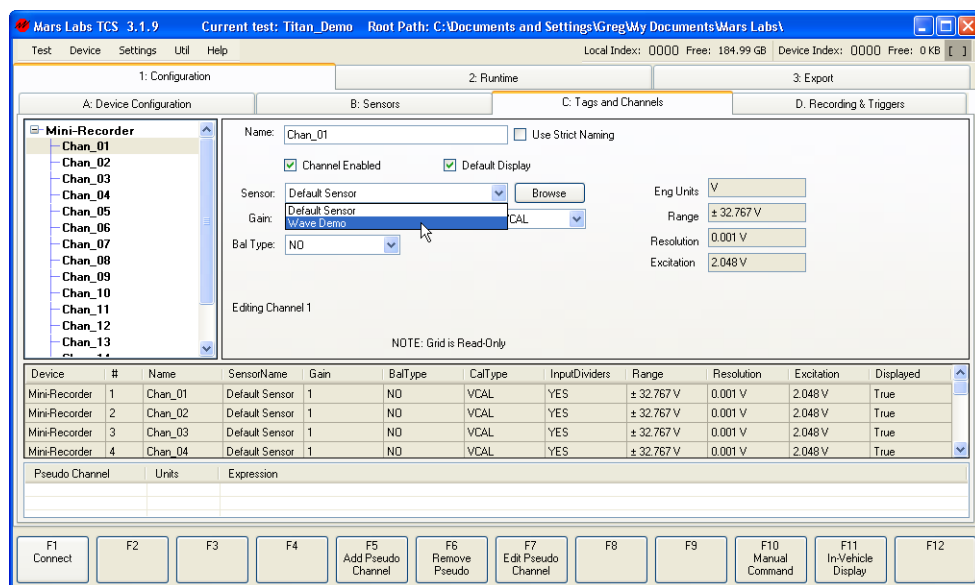Leave all selections at the their default values.
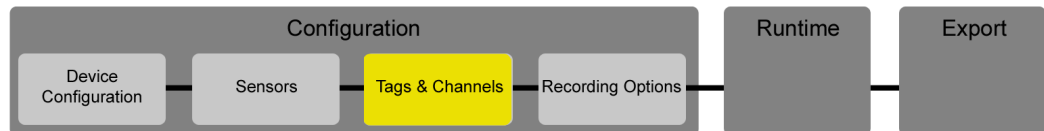
Tags and Channels

Switch to the Tags and Channels tab screen. The Tags and Channels screen is where you assign sensors to channels and select individual channel options, such as enabling Balance and choosing the Calibration type.

Initially, all channels are assigned to a default voltage sensor type. For this example, make sure channel 1 is selected in the Channel Tree list, and then select the 'Wave Demo' sensor from the Sensor drop down box as shown.


Leave all other channel options set to their default values.

A summary of sensor configurations for all channels appears in the table at the bottom of the screen. The summary is comprised of the settings made in the 'Sensors' and 'Tag and Channels' tab screens.
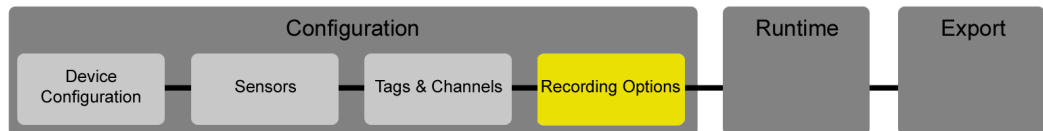
Recording & Triggers

Switch to the Recording & Triggers tab screen. This screen is the last window in the Configuration setup. It allows you to enable and configure triggers to capture data when specific conditions are met, or to capture data on a scheduled basis. There is also an option to enable both Local and Remote recording ('Redundant Recording') for scheduled and triggered events.
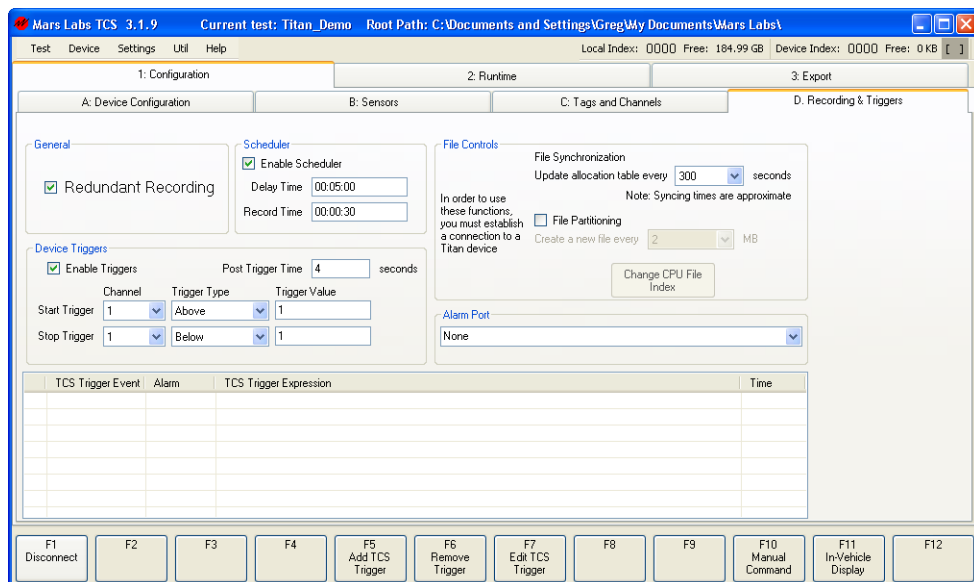

Recording & Triggers will not be enabled for this example - it is mentioned here for the sake of completeness as a part of the Configuration process. For more information on Recording & Triggers , consult the TCS User Manual.

Save the Test

With all configurations complete, save the test by selecting 'SAVE' from the TEST menu before continuing:
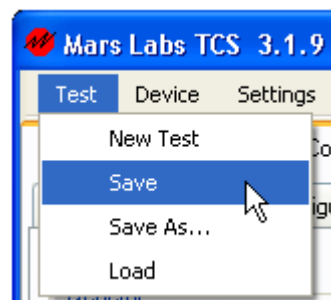

The test will be saved under the current test name "Titan_Demo".
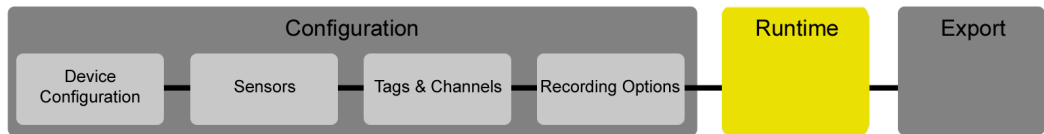
Runtime

Switch to the Runtime tab and click function key F3 (SCAN). The button will briefly turn yellow while TCS transmits the configuration setup to the Titan device. After a few seconds, the SCAN button will turn green, indicating that the device is running. TCS will begin monitoring the incoming signals:
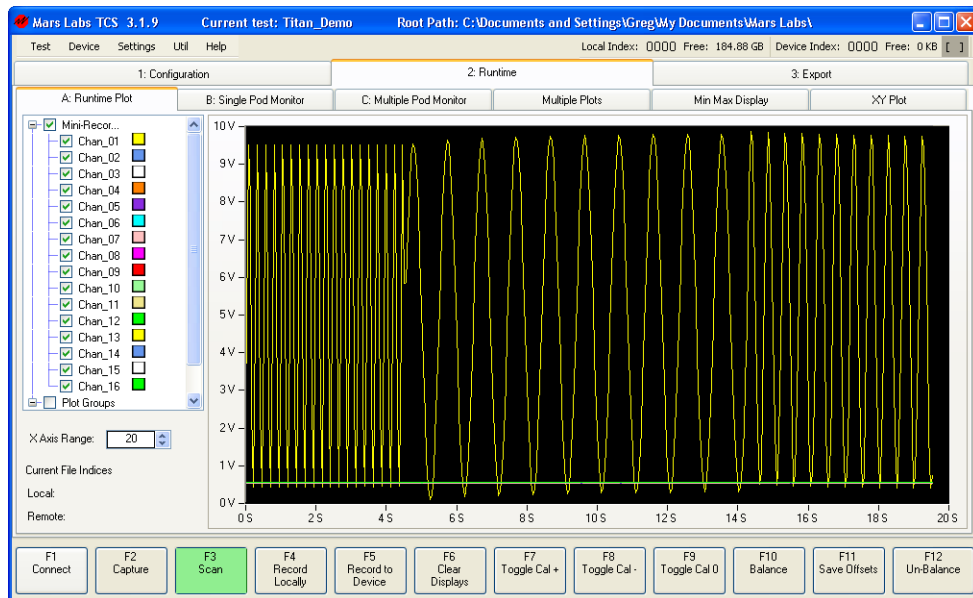
Test signals appear on a scrolling display window. Signals are color-coded according to the Channel Tree on the left side of the screen (channel color-codes are assigned by right-clicking on a channel and selecting from a color palette). Since the test signal was applied to channel 1, it appears as a yellow trace on the display as shown above. The green line in the figure represents all of the other channels (2 thru 16), with no signal applied.

You can display any channel or any group of channels by enabling the related checkboxes in the Channel Tree on the left.

Although TCS initially defaults to a scrolling plot display, the Runtime window offers a number of graphical and numerical viewing options, including displays of GPS data (when connected to a GPS sensor) and digital data (when connected to a Titan Digital Pod). Some screens feature a 'detach' option that allows you to open a second window to view selected data, providing simultaneous graphical and numerical real-time views. For information on all of the Runtime screens, consult the TCS User Manual.

In the Runtime screen, twelve function keys allow you to initiate scanning and recording functions, enable calibration and balance functions, and acquire, display and manipulate sensor data.

The Function keys are loosely organized into groups as follows:

Connectivity
F1   (Connect/Disconnect) - Connects or disconnects the selected Titan device (the function key toggles between conditions)

Recording & Displaying Data
F2   (Capture) - Selects the Capture function (described below)
F3   (Scan) - Initiates data scanning on the connected device and displays the data in the currently selected window (toggle ON/OFF)
F4   (Record Locally) - Initiates local recording on the PC (toggle ON/OFF)
F5   (Record to Device) Initiates remote recording on the Titan device (toggle ON/OFF). If the connected device is a Pod that does not support remote recording this button has no function.
F6   (Clear Graph) - Clears the plot in the Runtime Plot window

Calibration Functions
F7   (Toggle Cal +) - Toggles the 'Cal+' function On/Off
F8   (Toggle Cal -) - Toggles the 'Cal-' function On/Off
F9   (Toggle Cal 0) - Toggles the 'Cal 0' function On/Off

Balance Functions
F10 (Balance) - Selects the Balance function (offset removal). Balance will be applied to all channels that have Balance enabled in the Tags and Channels screen (BAL Type = YES).
F11 (Save Offsets) - Saves the channel offsets for all channels to the connected Titan device. Channels that have Balance disabled will get an offset value of '0' (no offset).
F12 (Un-Balance) - Restores channel offsets

To record the test signal, click F4 (Record Locally). The function key will turn red, indicating that TCS is now recording the data:
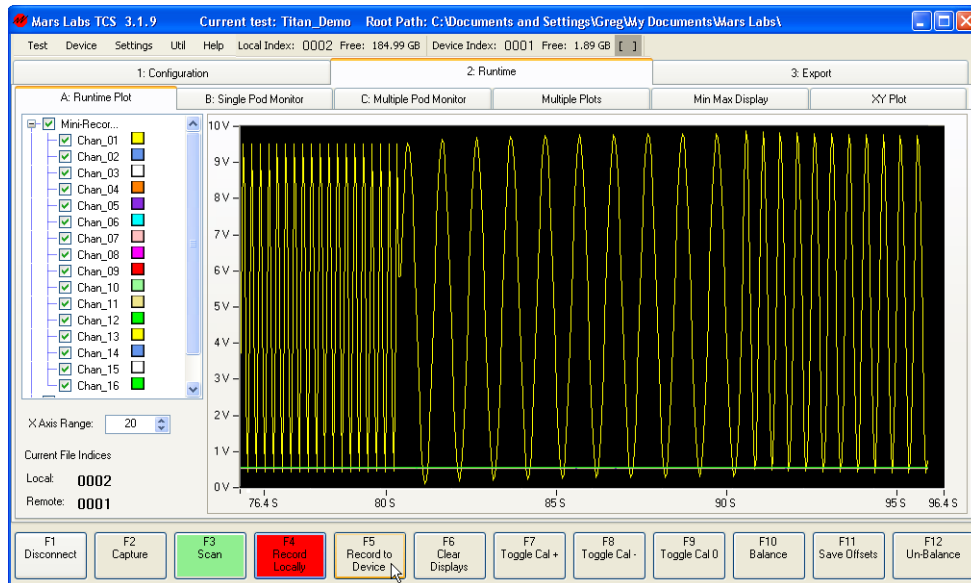

NOTE: If the Titan device is Mini-Recorder with an SD card installed, clicking F5 (RECORD TO DEVICE) will initiate remote recording on the device. You can record locally to TCS and remotely on the Mini-Recorder at the same time.

The CAPTURE function

While recording, click F2 (CAPTURE). A Capture window will appear that allows you to acquire a snapshot of the input and display a detailed image of the data. It also allows you to perform an FFT or Power Spectrum analysis on the acquired signal.

Each time you click on the 'Re-acquire Data' button, the program will capture and display a timed snapshot of the current input. The figure below shows a 5-second capture of channel 1 with sample points displayed.
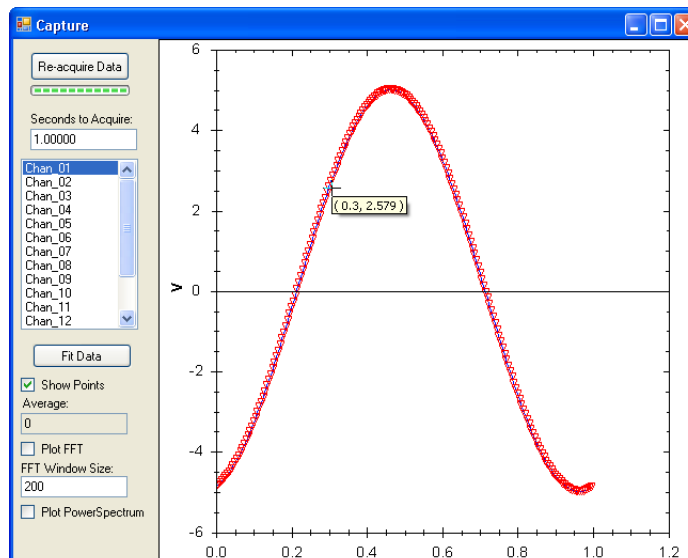
FFT and Power Spectrum views of the data can be displayed by clicking the 'Plot FFT' or 'Plot Power Spectrum' checkboxes. The figure below shows an FFT view obtained by acquiring the data with a 16 Hz signal present. Note that moving the mouse pointer over the plot will display information about the signal at the selected point:
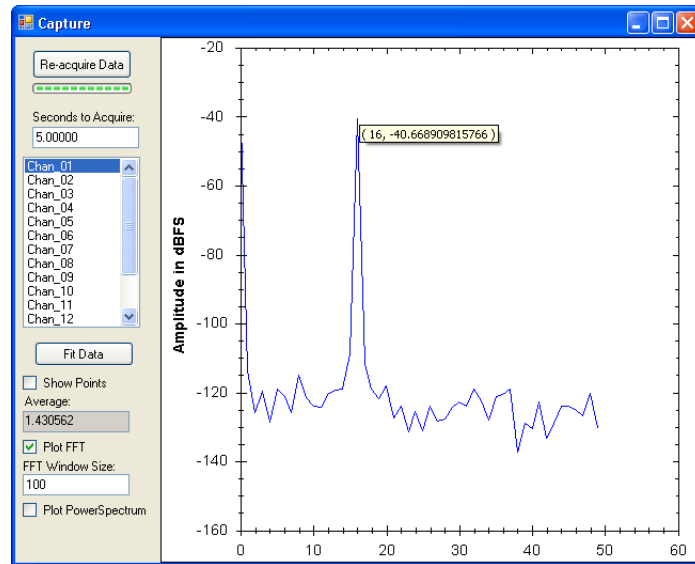

In any view, you can also zoom in or out of the plot using the scroll wheel, and right-clicking inside the window will display a menu of additional manipulation options.

NOTE: *The maximum amount of data that can be acquired using CAPTURE is 1.2M samples; this means that the maximum acquisition time is defined by the selected scan rate.*

Close the CAPTURE window by clicking on the close box.

Continue to record a few more seconds of data, and then click F4 to stop recording. Click F3 to stop scanning. You have just recorded a data file.
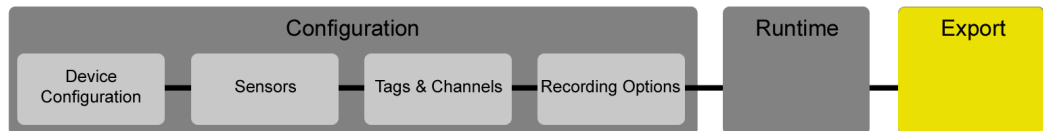
Export

Switch to the Export screen. The Export screen allows you to select and review recorded data files and export the files in a number of formats. A list of all of the files that have been recorded under the current test configuration will be displayed. Double-click on the file that was just recorded:
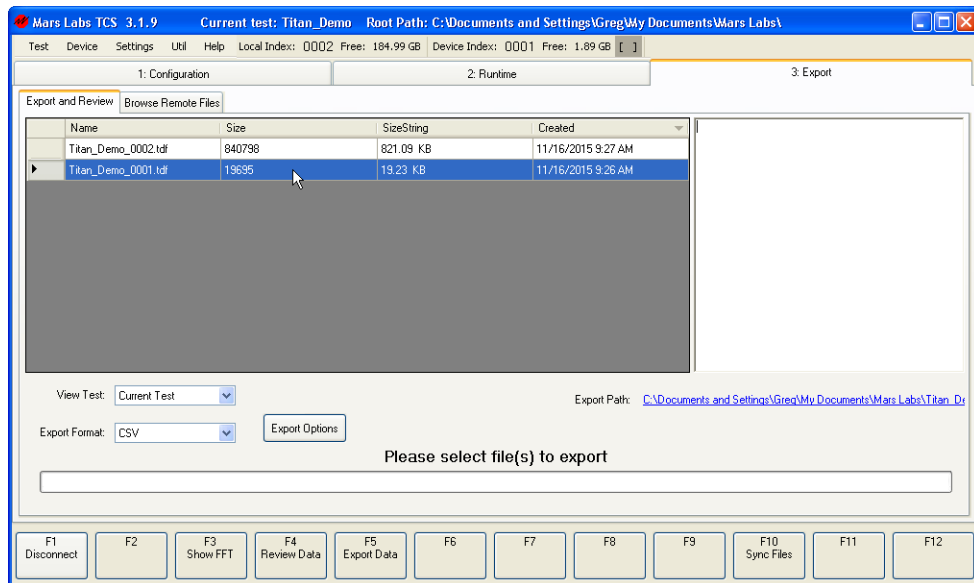

A Review window will appear, providing an overview of the recorded file. To zoom in and display a specific portion of the data, highlight the area to be viewed by clicking and dragging the cursor over the desired region as shown:
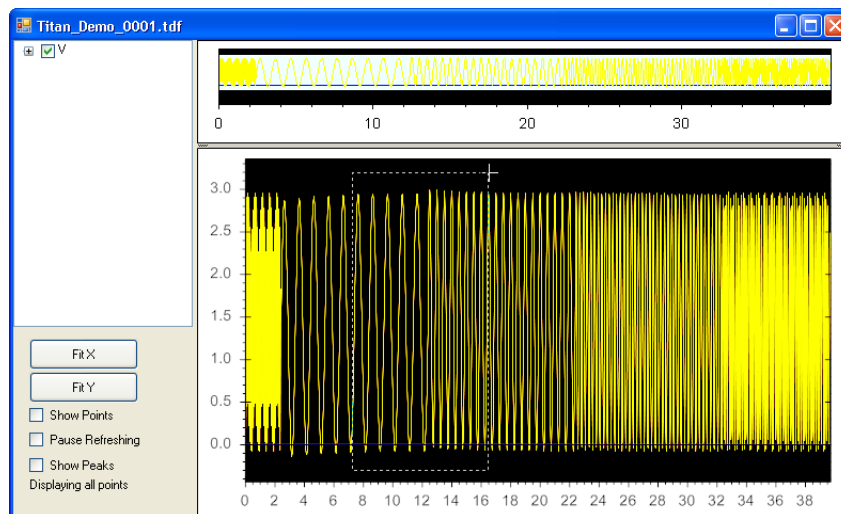

NOTE: *The Review window is also evoked using the F4 (REVIEW DATA) function key*

A magnified view of the selected region will appear. By holding down the CTRL key, you can now use the cursor to freely move the magnified region left/right, or up/down. Selection options on the left of the display allow you to view individual channels or groups of channels, fit the data to the X-axis and/or Y-axis, and toggle sample points ON and OFF. Data is automatically decimated to optimize the view of the displayed region:
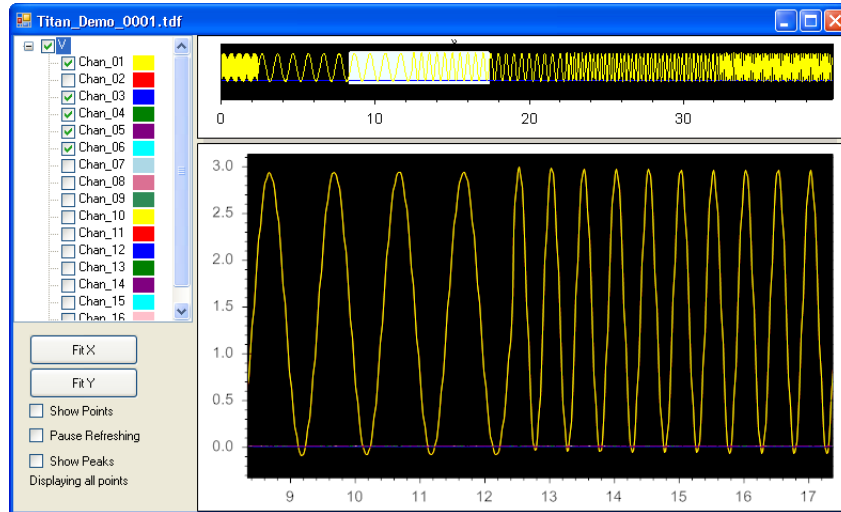
NOTE: *Right-clicking inside the Review window displays a menu of additional manipulation options (identical to the CAPTURE window).*

Returning to the Export screen, you can perform an FFT on the data file by clicking F3 (SHOW FFT). The figure below shows an example of the FFT Reviewer window displaying a one minute recording of the supplied WAV file:
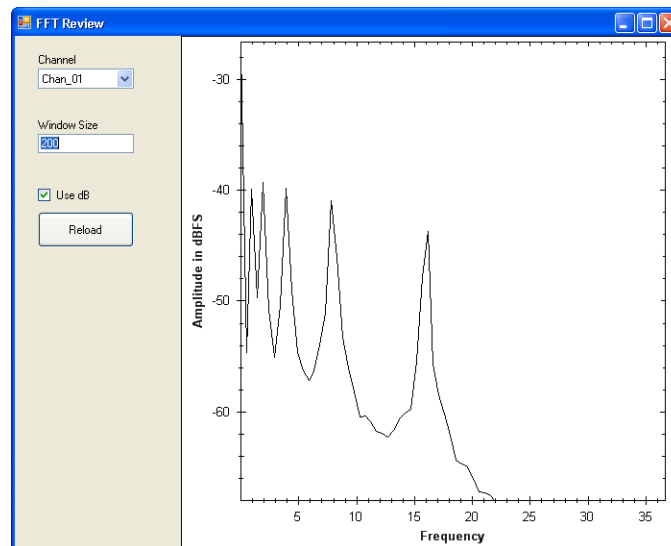
Close the Review and FFT Reviewer windows and return to the Export screen.

After reviewing the data, the test file can now be saved. A number of different file format options are available by selecting from the Export Format drop-down:
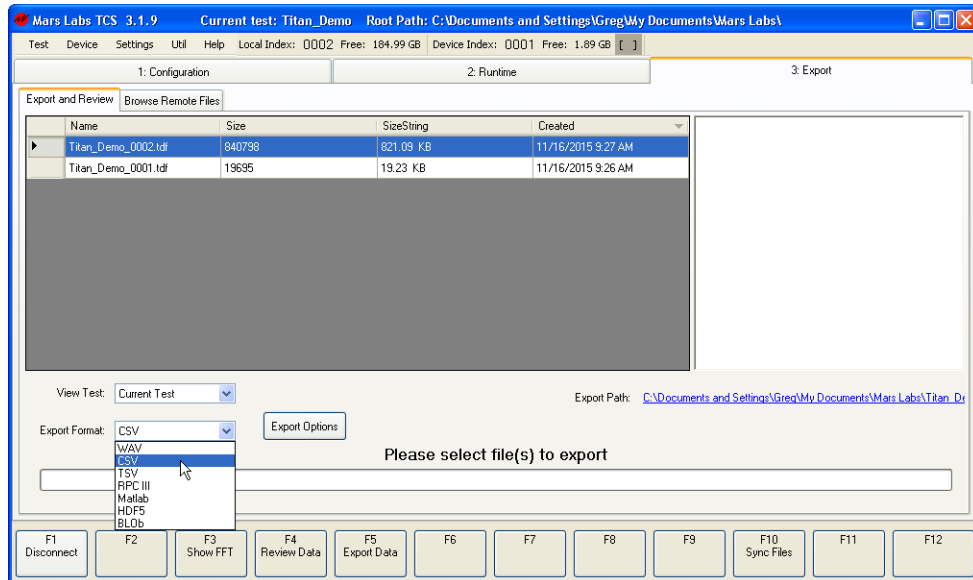
After selecting an export format, clicking on F5 (EXPORT DATA) will export the data set to the location specified in the Export Path. To view the exported file, click on the Export Path name.

NOTE: *This example only addresses locally recorded data files. To view and transfer a remotely recorded file, switch to the 'Browse Remote Files' tab. Data files recorded under the current test name will be displayed. Simply select a file and click TRANSFER FILES (F6). The file will be transferred into TCS, and the file name will appear on the 'Export and Review' screen with an '-r' (for "remote") appended to the file name. All viewing and saving options in the Export screen also apply to remotely recorded files.*

When finished exploring the Export screen, click DISCONNECT (F1). Remove power from the Titan Device and disconnect USB.

TCS offers much more capability and functionality than can be conveyed in this brief document. For complete descriptions of all TCS screens, configuration options and functionality, please consult the TCS User Manual. Detailed information about the hardware is found in the Titan Pod/Mini-Recorder User Manual. Both manuals are available as PDF's in the 'docs' directory of the CD-ROM.

NOTE: *The TCS User Manual can also be evoked at anytime from within TCS by selecting 'HELP' in the 'Help' menu, or by typing CTRL-H.*