

RAW DATA. REFINED RESULTS.

# QUICK START GUIDE



## STRUCTURAL TESTING SYSTEM

### Document Revision History

Version	Date	Changes
1.0	10/13/2015	Initial release document
2.0	01/24/2019	Updated Content

The information contained within this quick start guide is believed to be accurate and reliable. However, BDI assumes no responsibility for errors, omissions, or misinterpretations. The information herein is subject to change without notification.

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# 1. INTRODUCTION

Thank you for purchasing our latest and most advanced Structural Testing System (STS4). BDI has been developing and refining rugged STSs since the early 1990's and this 4<sup>th</sup> generation system includes the latest wireless and battery power technology while maintaining ease-of-use in difficult field-testing conditions.

This Quick Start Guide outlines the step-by-step procedure for assembling, as well as outlines the operation of a basic STS4 system consisting of the components listed in [Table 1](#).

Table 1: Compatible STS Hardware

<b>STS4-4-IW3</b>	4-Ch Intelliducer Nodes
<b>STS4-4-TE4</b>	4-Ch Terminal Input Nodes
<b>STS4-16-TE4</b>	16-Ch Terminal Input Nodes
<b>STS4-WBS</b>	Wireless Base Station
<b>STS4-ALPT</b>	Load Position Tracking Hardware

For further assistance in configuring STS-LIVE and running tests with an assembled STS4 system, please refer to the extensive series of instructional videos available on the BDI website at:

<https://bditest.com/product/training-support/video-tutorials/sts-live/>

## 1.1 PC REQUIREMENTS

BDI recommends that a personal computer (PC) equipped with a minimum of a Dual Core Intel i5 processor supported with 8Gb RAM and Windows® 10 Pro be used for operating STS4 systems consisting of 100 data channels or less. For higher channel count STS4 systems, please contact BDI for recommended PC capabilities. It is also highly recommended to dedicate one PC for running the STS4 rather than having to configure the Windows® Firewall and other third-party internet security applications that often block the STS-LIVE application on various computer operating systems.

## 1.2 MANUAL INFORMATION

The following highlighted message blocks will appear throughout the manual which contain important information that the user should review.



**STOP:** This symbol and corresponding message represents information that if not followed could lead to damaging the device. **Pay close attention to this message!**



**WARNING:** This symbol and corresponding message represents information that is critical for the successful device operation and/or settings and configuration.



**INFORMATION:** This symbol and corresponding message represents helpful tips for successfully configuring and operating the device.

## 2. SYSTEM ARCHITECTURE

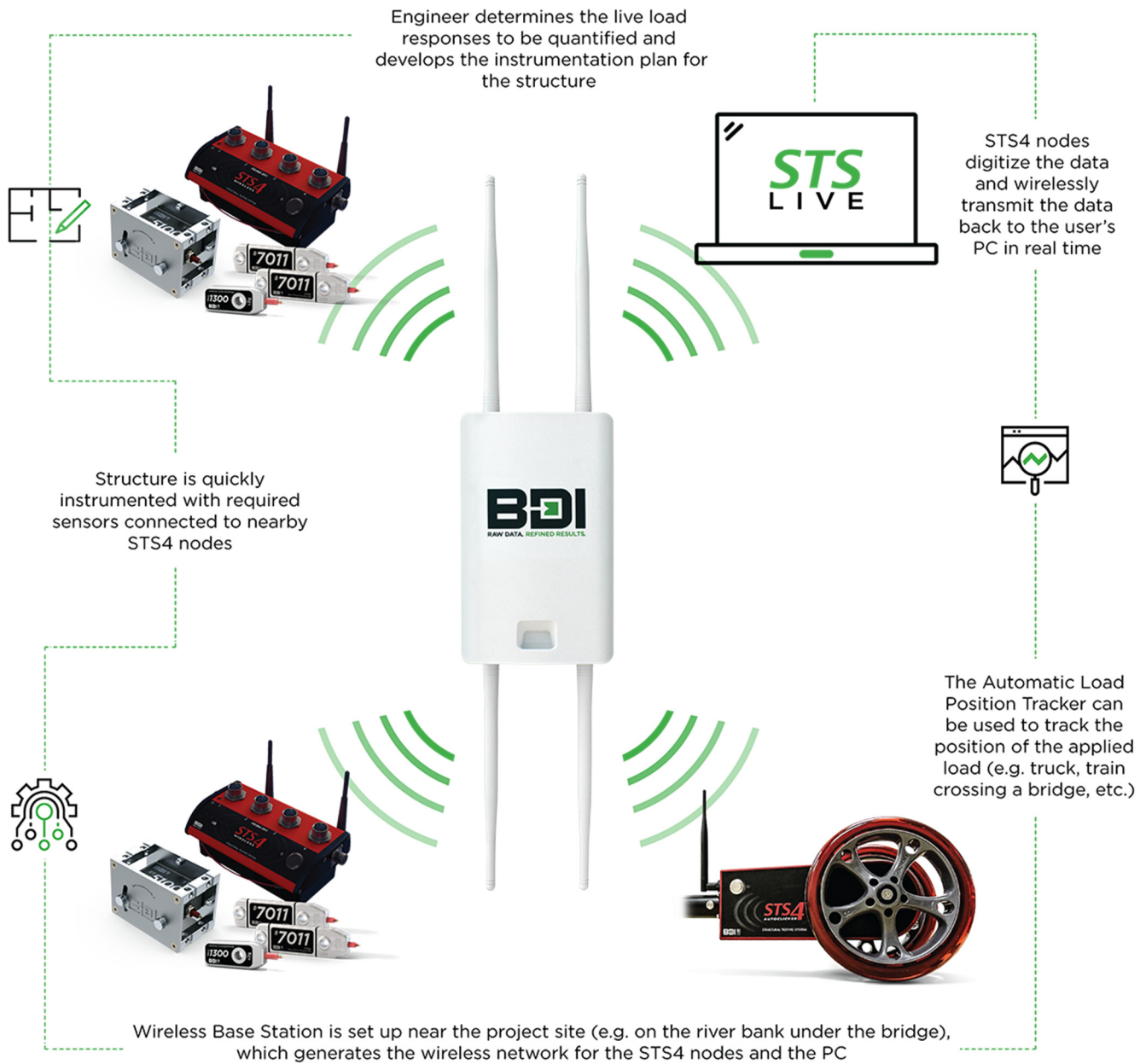


Figure 1: System Architecture

## 3. SETTING UP THE HARDWARE

### 3.1 STS4 WIRELESS BASE STATION

The STS4 Wireless Base Station (STS4-WBS) system is comprised of the Control Unit, dual-band wireless Access Point (AP), and the mounting tripod. The Control Unit provides power to the Access Point, allowing the system to power itself independently off an AC outlet with the supplied Power Supply. The Control Unit and Access Point utilized are connected via an industrial Ethernet cable that is also supplied with the system. If the optional Automatic Load Position Tracker (ALPT) was purchased with the system, and internal receiving radio will be supplied with the STS4-WBS and paired with the transmitting radio within the ALPT.

#### 3.1.1 STS4-WBS Components



Figure 2: STS4-WBS Components

Table 2: STS4-WBS Components

Item	Component
1	2.4 GHz Antennas (x2)
2	5.0 GHz Antennas (x2)
3	Wireless Access Point
4	Wireless Access Point Tripod Mounting Bracket
5	Control Unit Tripod Mounting Bracket
6	Tripod Vertical Pole
7	Tripod Base
8	Control Unit
9	Wireless Access Point to Control Unit Ethernet Cable
10	Computer to Control Unit Ethernet Cable

<b>11</b>	Control Unit Power Supply
<b>12</b>	Optional ALPT Receiver Antenna (900 MHz or 2.4 GHz)

### 3.1.2 STS4-WBS Assembly Procedure

1. Attach the four Antennas (1 & 2) into Antenna Receptacles on Wireless Access Point (3). Be sure to identify the antenna type and attach to the matching receptacle (2.4 GHz vs. 5.0 GHz). Thread clockwise until Antenna is secure. Do not overtighten.
2. Slide dowel on back of Wireless Access Point (3) into Wireless Access Point Tripod Mounting Bracket (4) socket with metal slide handle and secure. Do not overtighten.
3. Slide the adjustable Control Unit Tripod Mounting Bracket (5) to the midpoint of Tripod Vertical Pole (6) and lightly tighten clamp.
4. Attach Tripod Vertical Pole (6) into Tripod Base (7) and extend the three support legs to be 120° apart. Extend the Tripod Vertical Pole (6).
5. Attach the Wireless Access Point Tripod Mounting Bracket (4) to the top of the Tripod Vertical Pole (6) and tighten. The angle of Wireless Access Point can be adjusted as required to assure best signal coverage.
6. Attach the Control Unit (8) to the Control Unit Tripod Mounting Bracket (5).
7. Using the Wireless Access Point to Control Unit Ethernet Cable (9), connect the Wireless Access Point (3) into Control Unit (8) AP receptacle.
8. If using the ALPT, attach the antenna (12) by to the ALPT receptacle on the Control Unit (1).
9. If communicating with the STS network in wired mode, using the Computer to Control Unit Ethernet Cable (10), connect between the PC and the Control Unit (8).
10. If the Control Unit (8) needs to be charged, connect the Power Supply (11) to an AC source and then plug into the Control Unit (8) power input receptacle.

### 3.1.3 WBS Operation

1. Charge Battery: Connect Power Supply (11) to Power Input Receptacle on (1) and plug into 90-220 VAC supply until unit is fully charged. The battery charge level will be indicated by briefly depressing and releasing the power button located on the front of the Core (1). The battery icon LED's will provide a simple display of the remaining charge.
2. Power: Turn power on by holding button down until indicator light turns green (~2 seconds). This initiates the internal network circuitry and the unit will require approximately two minutes to "boot up" and begin broadcasting the "STS" wireless network (SSID). The LED on the side of the Access Point (2) will be illuminated when the unit begins broadcasting the 2.4GHz SSID. When STS-Live has been installed on the PC, the STS4 WBS will automatically attempt to connect to the network, and when successful, will appear in the **Hardware Tab**.
3. Turn off the WBS by holding down the Power button until the LED turns red (~2 seconds).



Figure 3: Assembled STS4-WBS

## 3.2 STS4 NODES

The STS4 node is used to power sensors as well as transmit data from the sensors to the test computer running the STS-LIVE application. The node can accommodate four sensors and communicate over a wired, or wireless TCP/IP network.

### 3.2.1 STS4 Node Components



Figure 4: STS4 Node Components

Table 3: STS4 Node Components

Item	STS4 Node Components
1	2.4 GHz Antennas (x2)
2	STS4 Node
3	Power Supply

### 3.2.2 STS4 Node Assembly Procedure

1. Thread Antennas (1) on to the receptacle in the back of the STS4 node (2).
2. Connect four Intelliducer-based sensors into mating receptacle and rotate sleeve until it snaps into place. Note that any Intelliducer sensor may be plugged into any receptacle since STS-LIVE automatically detects the sensor’s location within the system to properly apply its unique settings.

### 3.2.3 STS4 Node Operation

1. Charge Battery: Connect Power Supply (3) to power input receptacle on the back of the STS4 node (1) and plug into 90-220 VAC supply. The battery charge level will be indicated when initially plugging the Power Supply in and also by briefly depressing and releasing the power button located on the front of the STS4 node (1). The battery status LED’s will display the remaining charge.
2. Power: Depress power button until the LED turns green (~2 seconds). The blue LED will indicate the Node’s connection status as one of the four possible states outlined in Table 4.
3. When STS-LIVE has been installed on the PC and is open, the STS4 node will automatically attempt to connect to the application and will appear in the **Hardware Tab** when successfully connected.
4. If a connection is not established, the STS4 node will enter a low power Snooze cycle (2 minutes) and then attempt to connect again.
5. Turn off node by depressing power button until the power LED turns red (~2 seconds).



Table 4: Blue LED Responses

Blue LED	Description of Node State
<b>Solid On</b>	Powered on and searching for a connection to STS-LIVE. The node will remain in this state for two minutes, or until it establishes a connection to STS-LIVE. If two minutes pass and the node cannot establish a connection, the node will go into a Snooze cycle for two minutes.
<b>Off</b>	Powered down, Snoozing, or Sleeping. If the power LED flashes orange when the power button is depressed, the node is in the Snooze, or Sleep cycle. Wake up node by depressing power button until power LED turns green. If the power LED flashes red, the node is turned off.
<b>Slow Flashing</b>	Connected to STS-LIVE and ready for configuration and test initiation
<b>Rapid Flashing</b>	Testing underway, recording, and storing data

### 3.3 AUTOMATIC LOAD POSITION TRACKER (OPTIONAL)

The Automatic Load Position Tracker (ALPT) uses either a 900MHz or 2.4 GHz (depending on geographic region) wireless connection to connect to the STS4-WBS and consists of two primary components: the ALPT transmitter (main unit with wheels); and the receiving radio, which is integrated into the STS4-WBS. In addition to the main components, the ALPT is provided with mounting hardware to use in connecting the ALPT Main Unit to the load truck. Note that the ALPT and STS4-WBS receiving radio will be configured by BDI prior to use and are not compatible between different STS4-WBS devices.



Figure 5: ALPT Components

Table 5: ALPT Components

Item	ALPT Components
<b>1</b>	ALPT Main Unit
<b>2</b>	C-clamps
<b>3</b>	900 MHz or 2.4 GHz Antenna
<b>4</b>	Extension Rod & Bumper Mounting Bracket
<b>5</b>	Power Supply

### 3.3.1 ALPT Assembly Procedure

1. Attach the Antenna (3) to the ALPT Main Unit (1). Do not overtighten.
2. Insert the hollowed circular slot on (4) into the circular base at top of (1). Align and secure with the supplied screws until they resist torque. Insure mounting hardware and ALPT transmitter are securely connected.



Figure 6: Fully-Assembled ALPT

### 3.3.2 ALPT Operation

1. Charge Battery: Connect Power Supply (5) to Power Input Receptacle on (1) and plug into 90-220 VAC supply until unit is fully charged. The battery charge level will be indicated by briefly depressing and releasing the power button located on the front of the ALPT (1). The series of LEDs will provide a simple display of the remaining charge.
2. Power: Depress and hold power button down until indicator light turns green (~2 seconds). The charge level is displayed during this process. The battery charge level can be checked at any time activating the power button for approximately one second.
3. When STS-LIVE has been installed on the PC and opened, the ALPT will automatically attempt to connect to the application and will appear as "PULSEWHEEL" in the **Hardware Tab** when successfully connected.
4. Turn off ALPT by depressing power button until the power LED turns red (~2 seconds).

### 3.3.3 Installing the ALPT on the Test Vehicle



Figure 7: Typical ALPT Installation

1. Place the bracket opening at the end of item 4 in a secure location on the rear side of the truck.
2. Secure the bracket to the truck using the C-clamps. Tighten the C-clamps until the ALPT assembly is securely attached to the truck.

- The ALPT bracket should be mounted so that the ball joint connecting the bracket and the extension pole is in a neutral position. If the ball joint is maxed out in any one direction, range of motion of the extension pole and ALPT becomes restricted (See Figure 8).



Figure 8: Appropriate Ball Joint Positioning

- The ALPT needs to be mounted such that the angle between the mounting hardware and the ground is between 25° to 45°. Angles outside this range may cause the ALPT to bounce and skip while being pulled, resulting in inaccurate readings.

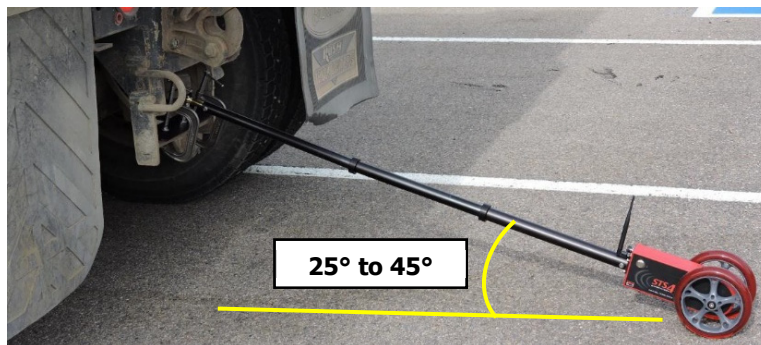


Figure 9: ALPT Installation Angle

**i** **INFORMATION:** The above mounting scenario will vary depending on the test vehicle. The bracket/ball mount should allow the unit to be adapted for most situations. Some user creativity may be required for some applications, meaning it is good practice to determine the configuration of the test vehicle’s rear bumper prior to running the test as delay may occur.

## 4. INSTALLING STS-LIVE

### 4.1 NETWORK SETTINGS

To operate the STS-LIVE application, the Internet Protocol Version 4 (TCP/IPv4) address on the PC must be set according to Figure 10. The IP address used by STS-LIVE is the same for all Windows® operating systems, however, navigating to the settings may vary depending on the operating system version.

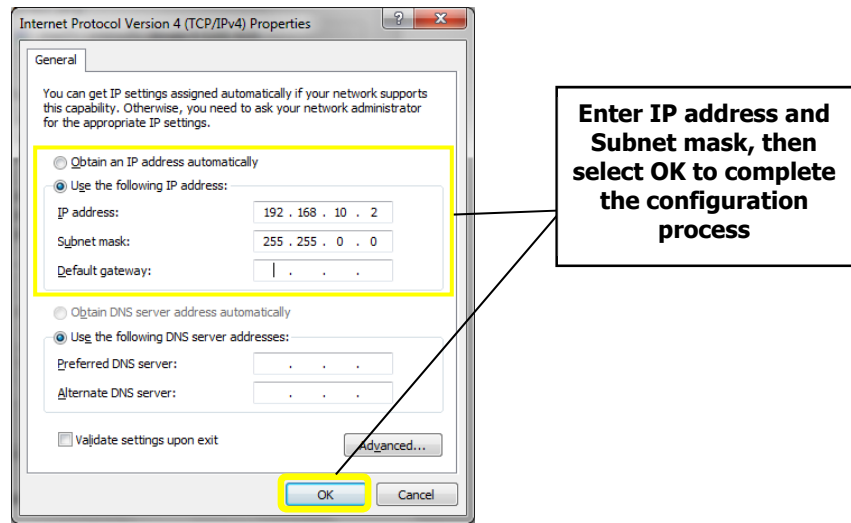


Figure 10: Required PC Network Settings



**WARNING:** It is important that the computer Network Settings are correct before launching the STS-LIVE application and attempting to establish connections with STS4 components. This is often the first suspect in case a connection cannot be established. Please ensure the TCP/IPv4 settings are as follows:

**IP address: 192.168.10.2**

**Subnet mask: 255.255.0.0**

**Default gateway: Blank**

**DNS Settings: Blank**

## 4.2 INSTALL STS-LIVE ON PC

1. Insert USB drive into laptop port or download the latest STS-LIVE Installer from the BDI website.
2. Double click "Setup" to begin installation.
3. Install STS-LIVE to the recommended default hard drive location.
4. Accept License Agreement to continue with installation.
5. National Instruments LabView® application will be automatically installed if it is not already installed on the PC. Two license agreements required by National Instruments must be accepted.
6. The summary of files to be installed are displayed. Note that it may take up to 15 minutes to complete installation.
7. After STS-LIVE successfully installs, the STS-Configuration application will launch so that sensor calibrations can be imported.
  - a. Select folder icon and navigate to the sensor calibration file supplied on USB drive, or otherwise supplied by BDI.
  - b. After the file appears in the Source Sensor File text box, select "Import Sensor File". All of the sensor settings will be imported into the base sensor calibration file.
  - c. Exit the calibration file importer window.
8. Launch the STS-LIVE application.

i

**INFORMATION:** A detailed video that outlines the STS-LIVE installation is available on our website:

<https://bditest.com/product/training-support/video-tutorials/sts-live/>

If USB drive is unavailable, the latest STS-LIVE version is available online. Files are downloaded into a "Zip" file that should be extracted to the hard drive prior to installation.

[https://bditest.com/?smd\\_process\\_download=1&download\\_id=4549](https://bditest.com/?smd_process_download=1&download_id=4549)

### 4.3 COMPUTER SECURITY SETTINGS

Ensure that **ALL** Internet security and firewalls are turned off or enter STS-LIVE as a trusted program within any third-party Internet security software (i.e., Norton Internet Security) and Windows® firewall. In most cases when the STS4 system has communication problems, the issue is a result of the computer's firewall blocking communication. For more details regarding the disabling of security programs, please refer to the operation guide for the specific security program that is installed on the computer.

## 5. ASSEMBLE SYSTEM & COLLECT DATA

### 5.1 STEP 1: ESTABLISH CONNECTION BETWEEN PC AND STS4-WBS

1. Turn on the STS4-WBS and wait for the boot-up sequence to complete. The wireless network "STS" should be visible by the computer's network adapter.
2. If you are using the wireless communication, establish a connection to the "STS" network as shown in Figure 11.

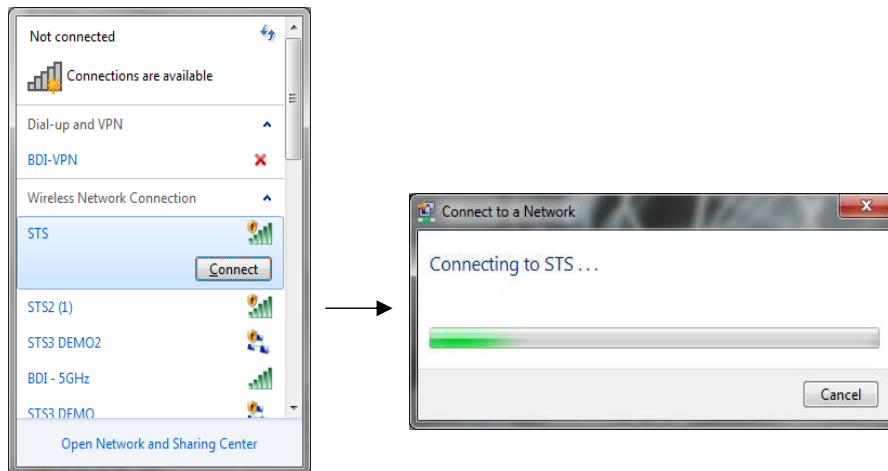


Figure 11: Establishing a Wireless Connection

3. If using the wired connection, simply plug a cable into the STS4-WBS Ethernet port, and the other end into the computer's Ethernet port.
4. Once a connection is established, Windows® will display the connection status in the task bar. The status will include a warning symbol, indicating that the network is not identifiable and that an Internet connection is unavailable, which is ok since this is a closed network.

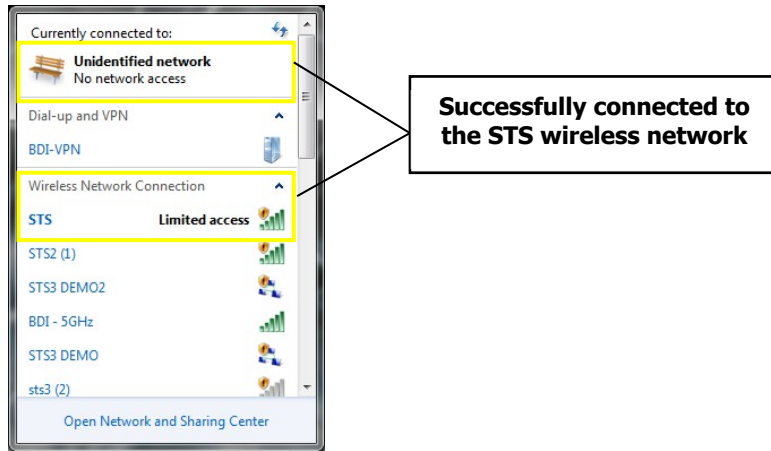


Figure 12: Successful Connection

## 5.2 STEP2: LAUNCH ST5-LIVE

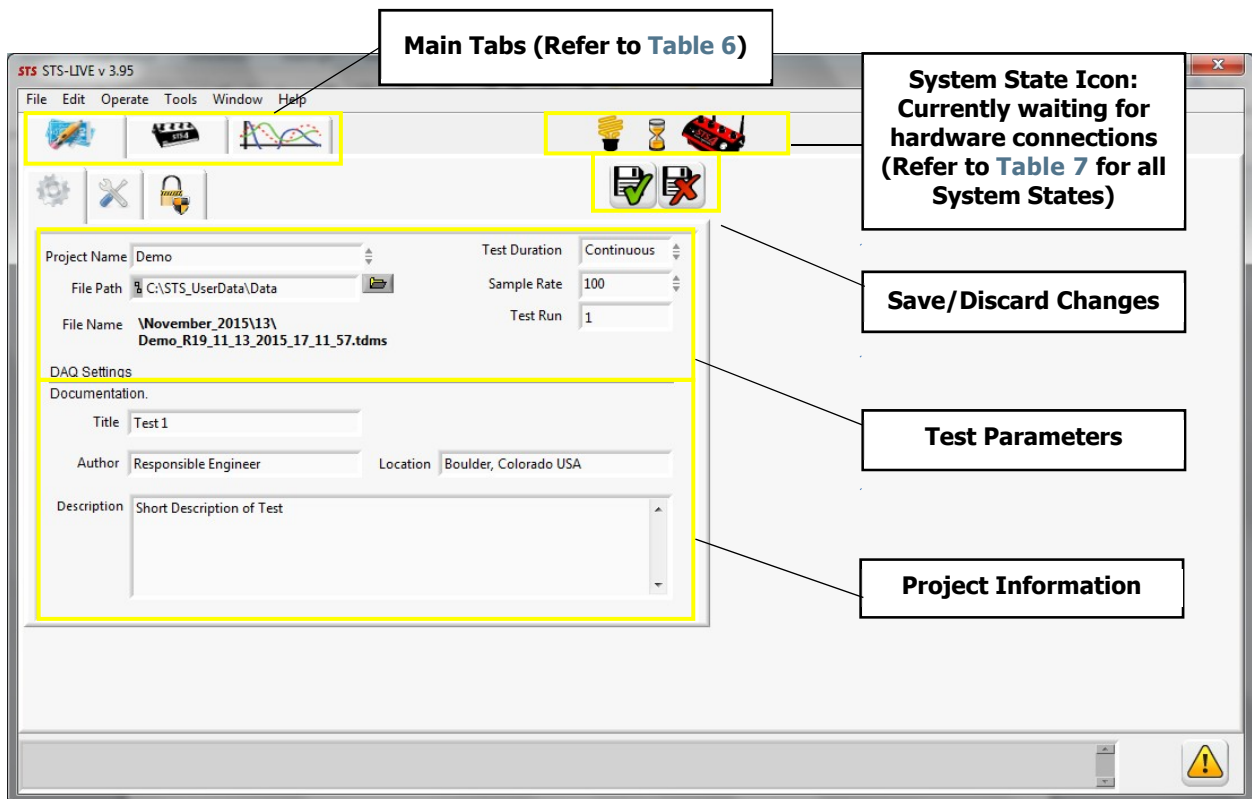


Figure 13: Initial ST5-LIVE Screen after Launch (Settings Tab)

Table 6: Main Tab Descriptions







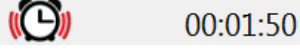
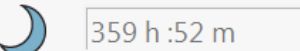


Main Tabs	Description
 <b>Settings Tab</b>	Location where all system settings are located. The user password is entered in this tab. There are three subtabs where additional test attributes can be adjusted and password protection for hardware editing can be set.
 <b>Hardware Tab</b>	Location where all of the connected hardware is displayed. Settings can be viewed and adjusted for the hardware and sensors in this tab.
 <b>Display Tab</b>	Location where sensors can be displayed in a graph. Multiple sensors can be viewed, and display settings can be adjusted, including the application of data filters.

Table 7: System States and Descriptions

System State	Description
 <b>Waiting</b>	STS-LIVE is in a listening mode, waiting for hardware to establish a connection.
 <b>Active</b>	Hardware is actively connected to the system and ready to be used.
 <b>Standby</b>	Hardware is actively connected to the system, but the power to all sensors is turned off.
 <b>Snooze</b>	Hardware is in a low power state and not actively connected to the software. Hardware will attempt to reestablish a connection after the specified snooze cycle has elapsed. This time cycle will be repeated until a connection is established.
 <b>Sleep</b>	Hardware is in a low power state and not actively connected to the software. Hardware will attempt to reestablish a connection after the specified calendar time period has elapsed. The hardware will enter a user defined Snooze mode if a connection is not established after the calendar time has elapsed.
 <b>Transition</b>	This is the state when the hardware is supposed to reestablish a connection to STS-LIVE after a designated Snooze or Sleep mode. There are a few different icons that may show up depending on the state that the system is transitioning from and to.
 <b>Hardware Scan</b>	STS-LIVE is scanning for any change to the hardware configuration. If a change has occurred, the configuration file will be updated.

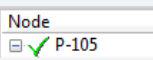
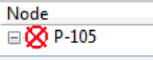
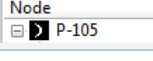
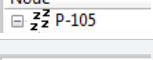
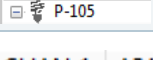
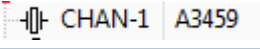
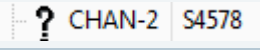
### 5.3 STEP3: ESTABLISH CONNECTION TO THE STS4 NODES & ALPT

1. Connect sensors to STS4 nodes.

**i** **INFORMATION:** Although the STS4 hardware contain electronic protection, it is recommended to always connect sensors when the hardware is powered OFF.

2. Power on all STS4 nodes.
3. A few minutes may be required for all nodes to establish connection to STS-LIVE.
4. If using the optional ALPT, power unit on.
5. All STS4 components should appear in the Hardware Tab. Verify that STS4 components and sensors are accounted for.

Table 8: Node Connection Icons and Sensor Type Icons

ICON	Description
	Hardware has a successful connection with the STS-LIVE
	Hardware does not have a successful connection with STS-LIVE
	Hardware is in Sleep mode
	Hardware is in Snooze mode
	Hardware is in Standby mode
	Sensor is recognized by STS-LIVE (symbol linked to sensor type)
	Sensor is NOT recognized by STS-LIVE

**i** **INFORMATION:** The most common reason for nodes to lose connection is due to disruptions with the wireless network or faulty connection in a wired network. If a node loses connection, check all network devices to ensure that the network infrastructure is intact. When using wireless networks, ensure that STS4 nodes have a clear line of sight to the STS4-WBS for a more stable connection. It is also good practice to have the test computer located close to the STS4-WBS when operating wirelessly. Often, the weak link is the PC to STS4-WBS link due to an improperly-configured PC network adapter, or a low-cost wireless network adapter within the PC.

### 5.4 STEP 4: RUN TEST

Now that all of the hardware has established a successful connection to STS-LIVE, you are ready to collect data. Data collection can be started from either the Hardware Tab or the Display Tab. However, if you would like to view graphical data, that can only be done from the Display Tab.



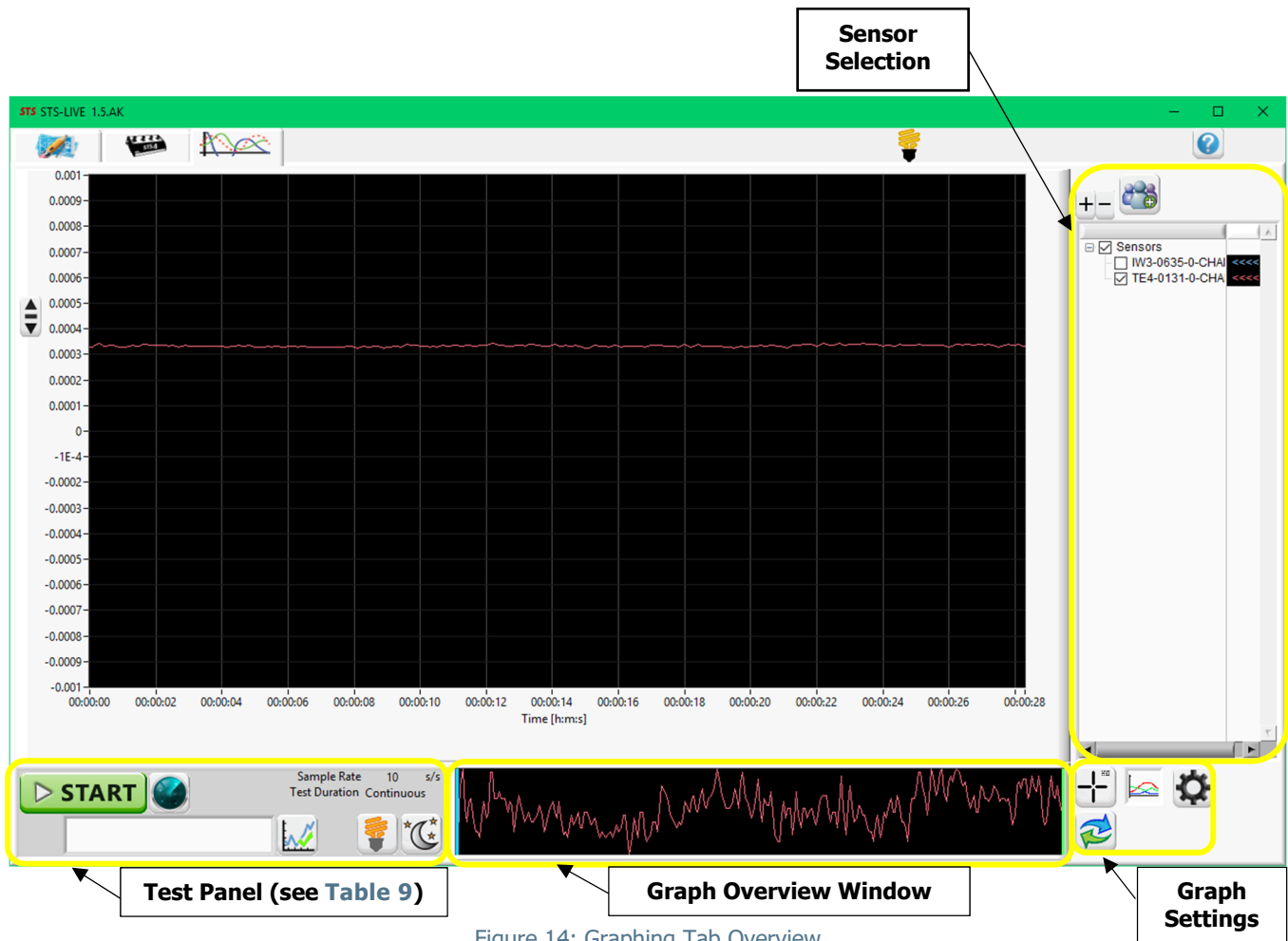









Figure 14: Graphing Tab Overview

Table 9: Test Panel Buttons and Descriptions

Button	Description
 <p><b>View Data</b></p>	<p>This button will start the system in data viewing mode. Data will stream to the graph in real-time allowing the user to view the output from all the sensors that are connected to the system. <u>Data will NOT be stored</u>. This data collection mode is intended for use during system setup to verify that all sensors are recording data correctly.</p>
 <p><b>Record Data</b></p>	<p>This button will start the system in the data acquisition mode. Data will be streamed to the graph window in real time. In addition, all <u>raw data will be stored</u> on the COMPUTER's hard drive.</p>
 <p><b>Stop View/Record</b></p>	<p>This button is only visible when the system is either in the data viewing mode, or the data acquisition mode. Clicking this button will either stop the data viewing mode, or the data acquisition mode.</p>

 <p><b>Data Marker</b></p>	<p>This button is only active in the data acquisition mode. Clicking this button will add a data marker to the data file at the precise time that it is clicked. In addition, there is a text field next to the Data Marker button for you to enter text, which will be stored with the Data Marker.</p>
 <p><b>Low Power On/Off</b></p>	<p>This button will toggle the system between Standby Mode and Active Mode. In Standby Mode, the power to the sensors is turned off.</p>
 <p><b>Snooze/Sleep Settings</b></p>	<p>This button will open a window for you to set either the Snooze or Sleep functions.</p>
 <p><b>Hardware Scan</b></p>	<p>This button will scan the system for new hardware, or any hardware configuration changes and updates from the configuration file.</p>

## 5.5 STEP 5: REVIEW DATA

To view recorded data, follow the file path saved under the **Settings Tab**. By default, this location will be C:\STS\_UserData\Data. STS-LIVE automatically creates a month folder at this location, and a date folder within the month folder that corresponds to the current date and time information of the test computer. STS-LIVE data is saved in a TDMS file format that can be viewed using BDI’s STS-VIEW software, or opened directly in Microsoft Excel. STS-LIVE has an option to save the raw data in an ASCII text file as well (**Settings Tab**).

**i** **INFORMATION:** For a more complete explanation of the TDMS file structure, please visit the National Instruments website: <http://www.ni.com/white-paper/3727/en/>

To view TDMS files with older versions of Microsoft Excel you may need to install the TDMS file reader extension for Excel: <http://www.ni.com/example/27944/en/>

## 6. STS-LIVE SUPPORT

### 6.1 STS-LIVE HELP GUIDE

Additional user support is available through the online STS-LIVE Help Guide by selecting the question mark icon as seen in [Figure 15](#). Note that when the Help Guide is open, all other STS-LIVE functions are disabled. Depress the Help icon a second time to exit Help Guide.

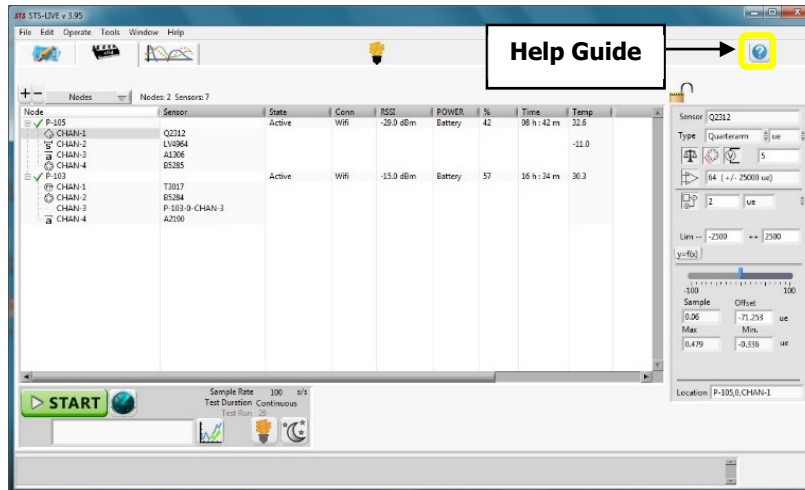


Figure 15: Integrated Help Guide

**i** **INFORMATION:** When the help guide is active, the help icon remains depressed and the mouse pointer changes to indicate that the help system is active. There are many active hyperlinks throughout the STS-LIVE application, clicking on various items will automatically take you to that portion of the help guide. If an active hyperlink does not exist, try using the search function.

## 6.2 TRAINING VIDEOS

This Quick Start Guide has been developed to assist users to assemble, initiate, and test out any size STS4 system with the least amount of effort and training. Due to the nature of structural testing, many more options and test configurations are available which are described in further detail through training videos available in our online video library accessed through the Resources tab at our website and on Youtube.com.

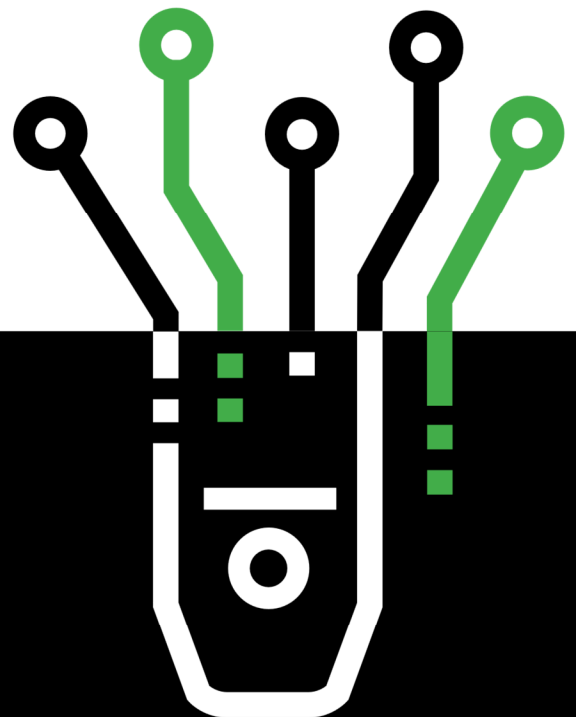
<https://bdiest.com/product/training-support/video-tutorials/sts-live/>

[https://www.youtube.com/channel/UCUX3keE\\_3I3Y0tqOHw6gQkQ](https://www.youtube.com/channel/UCUX3keE_3I3Y0tqOHw6gQkQ)



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