CHUCK

Bolting Data Processor

Operations Manual

HEX TECHNOLOGY
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Contents

Video Guide to Setup

In addition to the written manual, you can follow these step-by-step guides to unboxing your CHUCK, connecting it to your training skid, and performing the initial software setup. Click on the links to view our video library.

1. [Unboxing CHUCK: What's Inside](#)

2. [Connecting CHUCK to the Grounding Wire](#)

3. [Connecting CHUCK to the Training Skid](#)

4. [Connecting the Server to CHUCK and the Skid](#)

5. [CHUCK's Cable Bays: An Overview](#)

6. [Connecting CHUCK to Cables and Bolts](#)

7. [CHUCK Initial Software Setup](#)

Welcome to CHUCK

CHUCK pairs with instrumented bolts to provide accurate bolt load readings in real time.

These readings are useful for training and testing personnel involved with the assembly of bolted flange joints.

With CHUCK, the complicated physics of bolting become clear as day, with each reading displayed clearly on any wi-fi enabled laptop, smartphone or tablet.

The following guide walks you through the setup and use of CHUCK.

Hardware Check: Procuring Bolts for CHUCK

CHUCK must be paired with instrumented bolts from manufacturer James Walker.

The unit is compatible with studs sized from 5/8" to 1-1/4". (Additional sizes available upon request.)

If you have not already, contact James Walker representative John Carr at john.carr@jameswalker.biz to order your bolts.

Required Equipment for Use

- CHUCK data processor (contents listed below, see "Unboxing Your CHUCK")
- Instrumented bolts (4 to 16 bolts total, size range 5/8" to 1-1/4").
- Matching nuts for bolts
- RG-316 coaxial with SMB connectors
- Flange compatible with bolt configuration
- Torque stand unit (optional) (requires 4x3/4" bolts)

Unboxing Your CHUCK

The package you receive will contain 6 items:

CHUCK Brain (Hexagonal box)	**Server** (Black box)	**Ground Wire**
Micro B USB Cable	**Power Supply** with USB-C connector	**Four (4) #10 machine screws** for mounting CHUCK Brain. (Packaged in red bubble wrap.)

You will find a label on the underside of the CHUCK Brain with the WiFi network name, the WiFi password, and the CHUCK serial number. You will need those items to connect to your CHUCK.

If you discover an item is missing, contact help@hextechnology.com.

Powering Up Your CHUCK

1. Connect the CHUCK Brain to Server using USB cable.
   a. Connect the USB cable to the Chuck Brain using the Micro B USB port centered on one edge of the box.
   b. Connect the other end of the USB cable to any of the four USB ports on the Chuck Server.
2. Power up Server and Brain.
   a. Connect the power supply cable to the USB-C port on the side of the Server.

b. Plug power supply into a wall socket. (CHUCK comes with a universal power supply that will operate on 120 VAC 60 Hz power or 240 VAC 50 Hz power.)
3. Ground the CHUCK Brain.
   a. Connect ground wire to grounding stud on CHUCK Brain (shown, right).
   b. Connect opposite end of ground wire to an appropriate grounding point. The ring terminal is sized for the #10 machine screws that are used to mount the CHUCK Brain. We recommend you ground at one of the mounting screws.

IMPORTANT: CHUCK box MUST be grounded to a point that is electrically connected to the flange containing the instrumented bolts. Failure to establish a ground connection will result in erratic bolt stress readings.

Installing CHUCK to Your Bolting Skid

Both the CHUCK Brain and its companion server can be attached to your skid.

If you've fabricated your skid according to the spec provided by Hex Technology, there will be mounting brackets for both the CHUCK Brain and Server.

Important Note About Paint

Each stud must be electrically connected to the ground stud on the Chuck Brain. Often, when the skid is assembled and painted, the electrical connection between the studs and skid is interrupted by paint. This is particularly common when connecting the torque stand to the skid using a "trailer receiver".

Before connecting studs to the brain, use an Ohm meter to measure continuity between each stud and the ground stud on the brain. (Do this with no load on the studs.) **All studs must have continuity to the ground stud for correct operation.** If you read more than 100 Ohms for any stud, remove paint, and tighten mechanical connections.

Setting Up CHUCK's Software

For the following steps, you will need a Wi-Fi enabled laptop.

You should have received an email (Subject line: "CHUCK License Key") with a license key for your new CHUCK application. Make sure you have that email handy on your laptop before you connect to CHUCK. The license key will look like…

EXAMPLE LICENSE KEY:

key/eyJleHBpcmF0aW9uRGF0ZSI6IjIwMjItMDEtMjEiLCJzZXJpYWxOdW1iZXIiOiIxMDEifQ==.KS1dSXrsDcnKRBmdDReLo1ChZX9Y/2vbkOQvpQ3 7ZM3T5o5soXmLQgcPQCtpHYwxDuR2BzAHDIDSXCaHpxSJXmeUAEqjE5iBYUPVh3SDmVFpqUwe8A9Rfm4Qj2Zp14QAOanpuHqrYYX2fsHdZhV XOK1cAHTNJswxQZJCStEj1iVDhnust9oLnzvVbseRkXZ/C/k52nQVNbsgF/dg+ub2xoe0oWd552guCzABh2BDD/stYk/UwDmt+W98ITF9eY1cJRQY 3ly/3cAKR5/Uu5ujSX2X8b6ZK0lbiUgaY9+6+q5NWk73dpICjiUtyi1UxKvKTeITwsdu4u7LJsMsojV4WA==

Connect to CHUCK

1. Connect your laptop to Chuck:
   a. Find the label attached to the underside of the CHUCK Brain with the WiFi Network ID and password.
   b. From your laptop's wi-fi selector (or the "Network Preferences"), look for the CHUCK wireless network.
   c. To connect, enter the WiFi password.
2. Open your internet browser.
3. Type "http://chuck/" into the navigation bar.
   a. Note: On some computers and browsers, you won't need to type the "http://".
   b. Some computers and browsers will think you are searching for a friend named "Chuck." If you have that problem, key in the Server IP address (http://192.168.4.1) into the navigation bar.
   c. You will arrive at CHUCK's user interface and see a Welcome message:
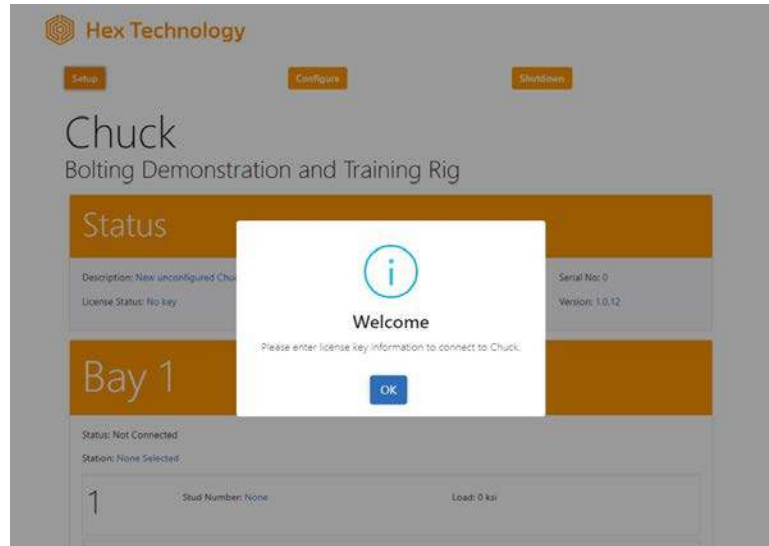
You'll see a welcome message like this when you first connect to CHUCK.

# Getting Started in the Software

Press "OK" in the Welcome Message.

You'll see the user interface consists of 3 main areas:

1) Top navigation buttons
2) A "Status" section presenting license and serial number
3) A section housing four Bays (Bay 1, Bay 2, etc.)

We will discuss each of those items later. During startup, your first step is to provide the necessary information in the Status window.

Status Setup

The "Status" block provides 6 pieces of information on how your CHUCK is operating.
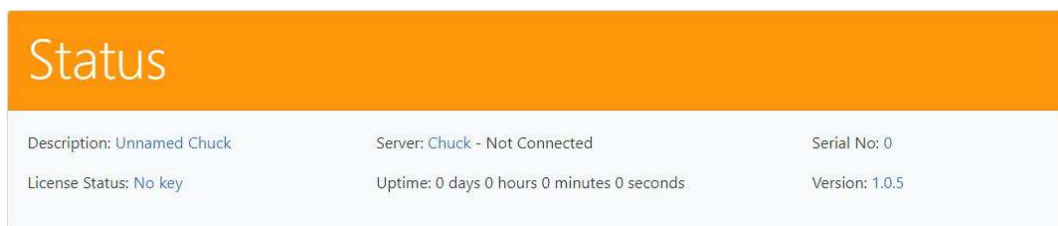
An example of the information you'll see in CHUCK's Status Bar.

During the initial setup, you need to:

1. Click on "Description," then enter a short name for your Chuck. The name can be anything you like, using any characters or capitalization you wish.
2. The "Server" field is pre-set with "Chuck." If you had to enter the IP address in the browser's navigation bar when connecting, you'd use that instead.
3. The Serial No field needs to match the serial number that you will find on a sticker on the CHUCK Brain. Click on the "0" and enter the serial number.
4. In the License Status box, click on "No key" to open that dialog.
   a. You'll have received your license key by email. Find that email on your laptop, copy the license key, and paste it into the window. (You will need to copy everything from "key/" to the two equals signs at the end.)

Status

Description: Unnamed Chuck   Server: Chuck - Not Connected   Serial No: 101

License Status: No key   Uptime: 0 days 0 hours 0 minutes 0 seconds   Version: 1.0.5

Enter License Key:

key/eyJleHBpcmF0aW9uRGF0ZSI6IjIwMjItMDItMDkiLCJzZXJpYWxOdW1iZXIiOiI
xMDEifQ==.H2znE2RnBGNXxYgk7jKdnl9WzQ5cxSDYOg/jY5JkTUucYVK0BOSDo
rTHAIGFD+9ThXE/R1wzsQXHCaHMDdBd3L2qOWsIdF9V9wZiWqAtNPxwkIapRI
Uuh0gajnL2VhYuyHjsOmGn4hhoHvVDamyqBWZynjJQ+1QyVucNS9Gn6w95v+
nZ+inuC3oqavTNUYDcFa5O0FE/ZVg8XguuQ8q+Df8ZDcImoJiC4MkQn/+6aIKv
w/L66dnEpMdNSb/GDKz9B3vXpuLb2OrUknCSA4FioWSlys7yq/ju2DBrQPbVGTe
T9m65HZmidKOQKRvciAgYDTunPYvqCjG7skJ95l+d8Q==

⊘ Submit

⊗ Cancel

Terms and Conditions: By entering a license key, you are acknowledging you have read and understood the Chuck Application End User License Agreement.

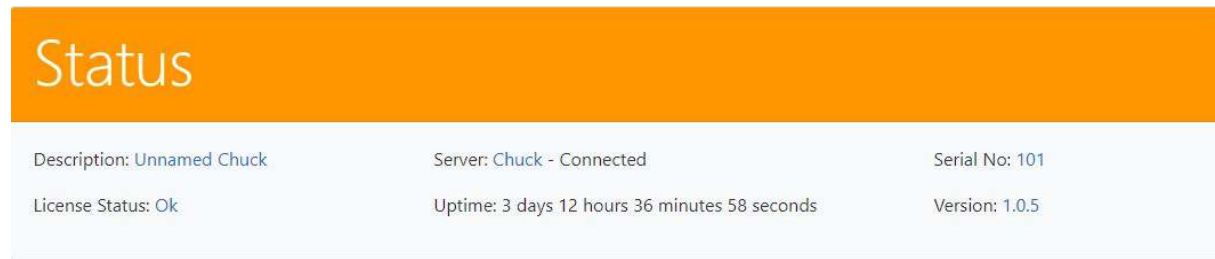b. Click on the link for the End User License Agreement and read the terms.
c. If you are satisfied with the terms, click the "Submit" button.

That completes the initial connection and configuration.

Congratulations! You are now ready to begin training and testing with CHUCK.

Other Uses for the Status Window

The Status window also shows the elapsed time since your CHUCK Brain connected to the CHUCK Server. This field will continue to tick off seconds letting you know your system is operational.


Finally, the status window shows the software version number. If you click on the version number, you will see a window to upload an update file. From time to time, we will make updates to the program available and send you a zip file to upload. We will provide detailed instructions when that happens.

Using CHUCK

Navigation Buttons

The navigation buttons along the top of the screen allow you to navigate through CHUCK's various menus and utilities.

The "Setup" button is highlighted to indicate that is the active page.
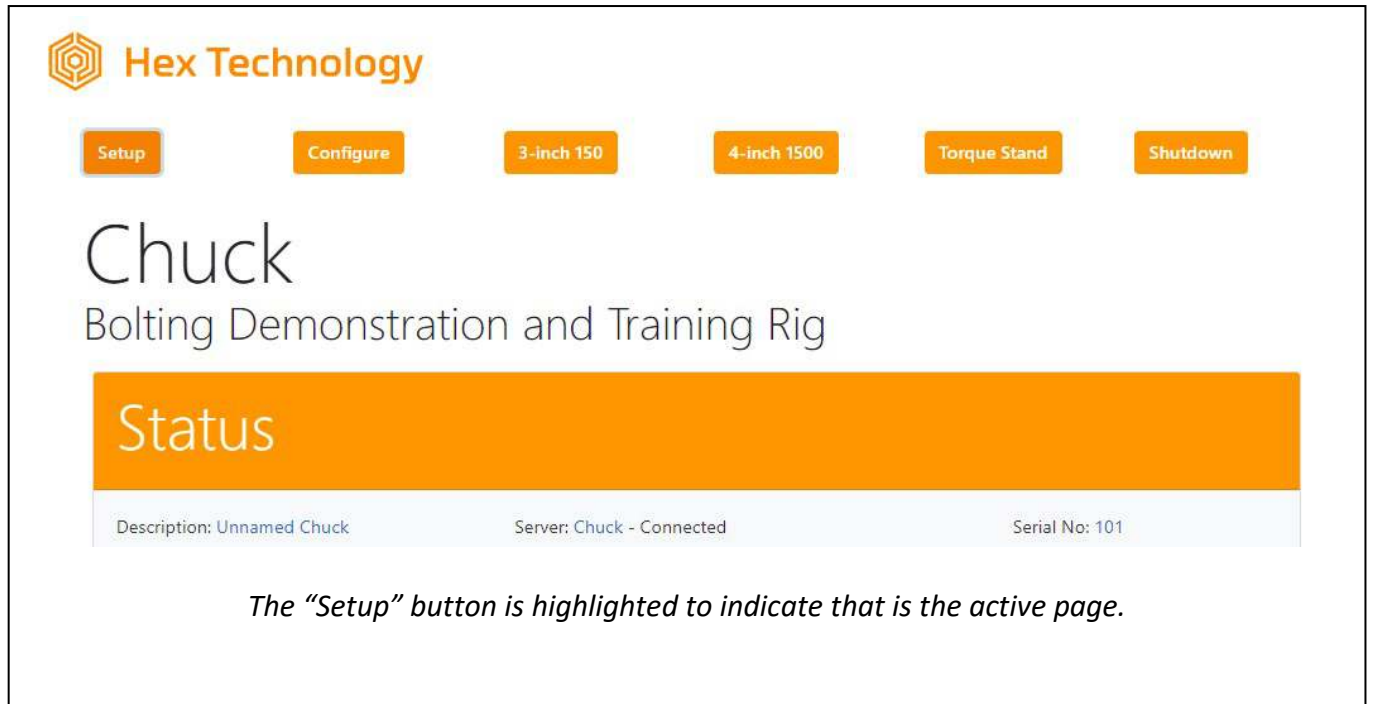
You will see six buttons:

- Setup
- Configure
- 3-inch 150
- 4-inch 1500
- Torque Stand
- Shutdown

Three of the buttons are labeled with the names of three "stations" preset for you and will only show up if you have those stations assigned to bays. Those station names can be changed on the Configure page.

Configure Your CHUCK

Click on "Configure" to access the Configuration Page.

You can configure your system to measure bolt load on multiple flange assemblies. Those assemblies are called "Stations."

In the initial configuration, CHUCK is set up for a 3-inch 150# flange, a 4-inch 1500# flange, and a "Torque Stand." If you want to use a different configuration, you can set that up on the configuration screen.

To change a station's configuration, click the cog icon (⚙) in the upper right corner. You will arrive at a Station Setup window:

In Station Setup, you can adjust…

- **Station Description**, which is the text in the navigation button at the top of the page
- **Number of studs**: Up to 16 studs maximum
- **Size of studs**: Currently supports 5/8", 3/4", or 1-1/4".
- **Data display style**: Flange or Multi-Trial
    - **Flange** means the Station's data display page will show a flange diagram along with columns showing the bolt load on each stud. The columns will change in real time as bolt loads change.

- o **Multi-Trial** is for use with the Torque Stand, or four 3/4" bolts in a fixed arrangement so there is no elastic interaction or flange rotation involved in the assembly. A Multi-Trial station allows up to five successive assemblies to be stored within a single screen (shown below), which is helpful for comparing the effect of good vs. bad assembly practices.
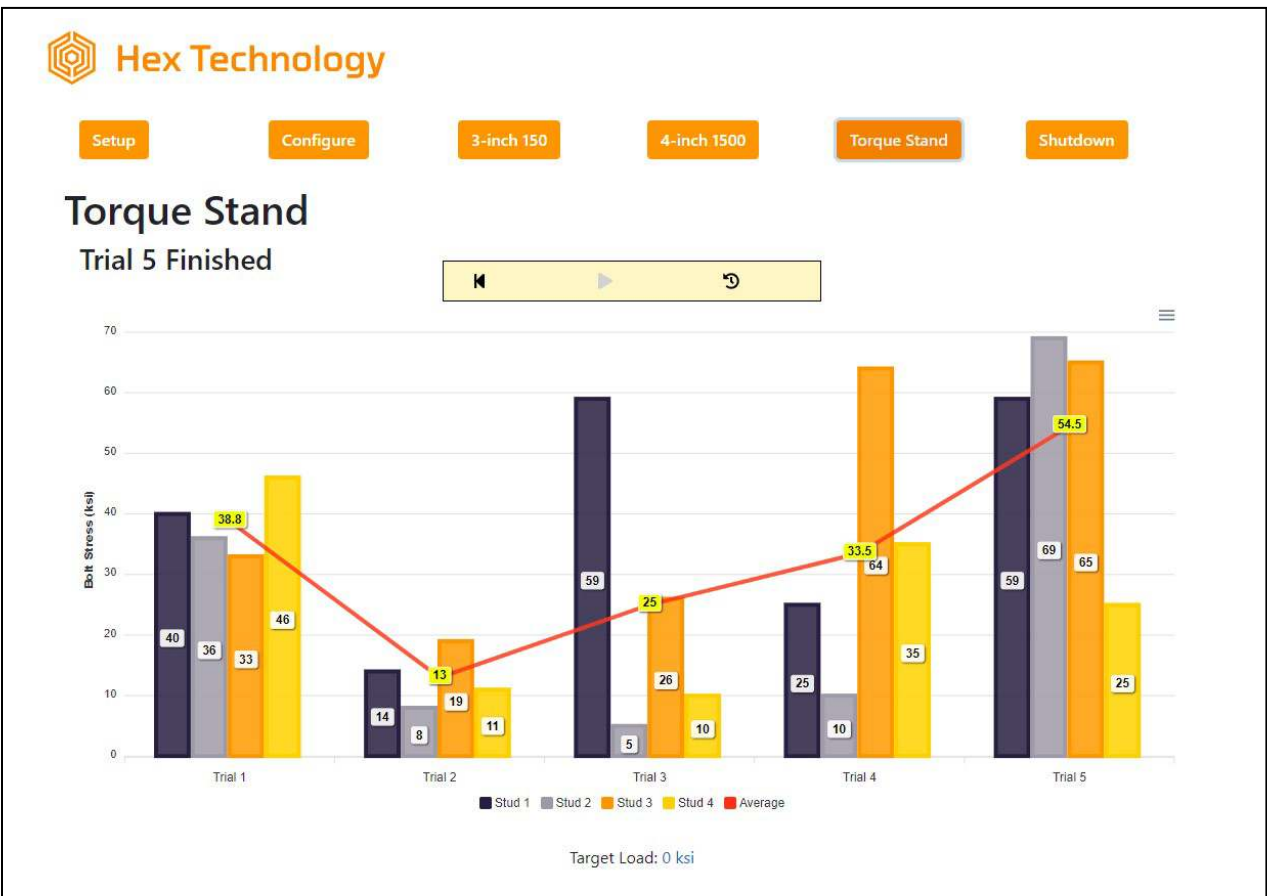
More about how to use the Multi-Trial system is included below (SEE SECTION: "Using CHHUCK with a Torque Stand").

Once you have configured a Station, click "Setup." Setup is where you'll go to assign ports on the CHUCK Brain to studs within the flange or torque stand you've configured.

Bay Setup

The CHUCK Brain has four sets of coaxial connectors within each Bay.

Two Bays are shown above. The four coaxial connectors to the left are one Bay, and the four o the right are the other Bay.

You'll use the "Setup" page within CHUCK's software to tell the unit which ports connect with which studs.

Each Bay contains…

- **A "Status" field**. Reads "Ok" if CHUCK Brain is on, connected to the Server, and working properly. Otherwise, it will read "Not Connected."
- **A Station** assigned to the bay. Click on the Station name to get a dropdown allowing you to select any of the Stations configured on the Configuration page.
- **Four Numbered Sections**, one for each of the ports. Here, you can define the stud number that port relates to.

Click on the number to change it. You will generally number these 1-4.

For an eight-bolt flange, you simply assign two bays to the same station and number the bolts 1-4 on one bay and 5-8 on the second bay. Twelve and 16-bolt flanges can be set up in the same way.

To the right, you will see the current bolt load measured on each port. Until you've completed setup, the number will be invalid. But after everything is configured and connected, it will show the current bolt load.

Calibrating, Connecting and Zeroing Your Bolts

This section describes how you'll go about connecting your CHUCK Brain to the instrumented bolts. The first step is connecting cable bundles to the Brain unit only.

IMPORTANT NOTE: Do not connect cables to bolts until after calibration is complete.

A. Connect Cables to Brain

Each cable bundle contains four coaxial cables marked red, white, blue, and yellow.

We recommend using following sequence when connecting cables to the numbered ports:

1. Red
2. White
3. Blue
4. Yellow
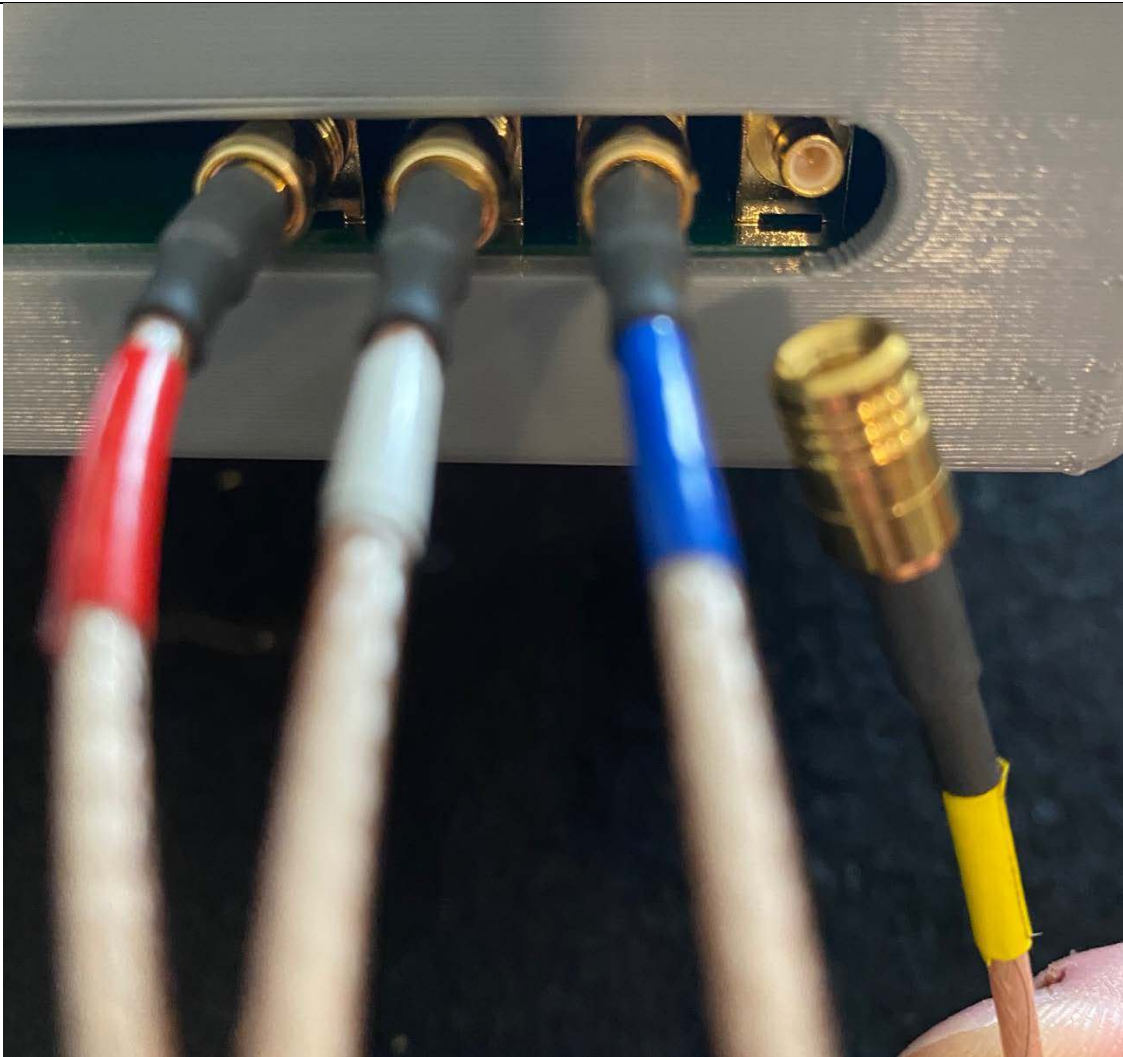
Attach red cable to connector #1, white to connector #2, blue to connector #3, and yellow to connector #4.

Once cables are attached to ports on the CHUCK Brain, but <u>*not yet attached to the bolts,*</u> you must calibrate the Brain.

B. Calibrate Cables and Brain

Return to your laptop and navigate to the Setup page.

You'll see "Calibrate" and "Zero" buttons in the lower left corner for each bay.
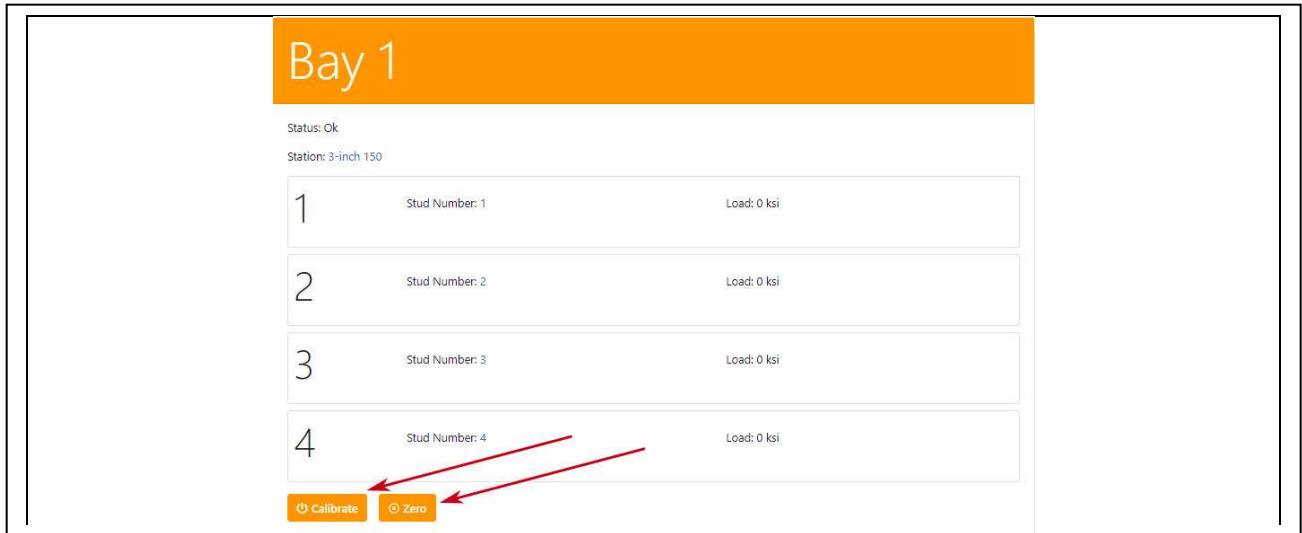
Click "**Calibrate**."

You will see a spinner for a few seconds. Once the spinner is gone, calibration is complete.

C. Connecting Cables to Studs

After calibrating each Bay, connect cables to the studs.

Connect the cable from Port 1 to the stud you consider Stud 1. Generally, this is the first stud clockwise from the top when looking at the front of the flange.
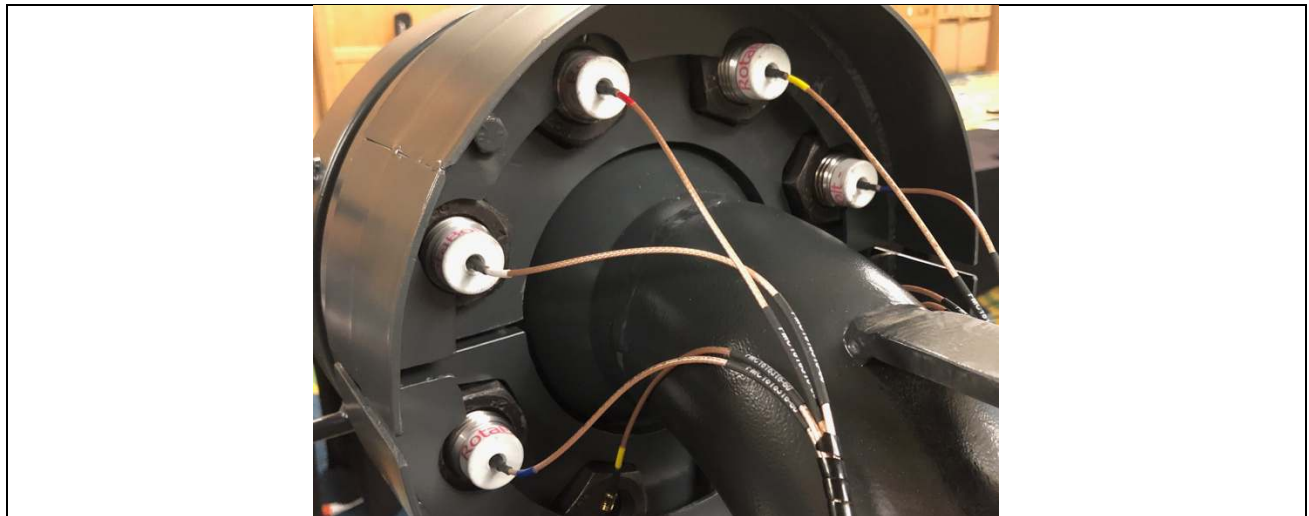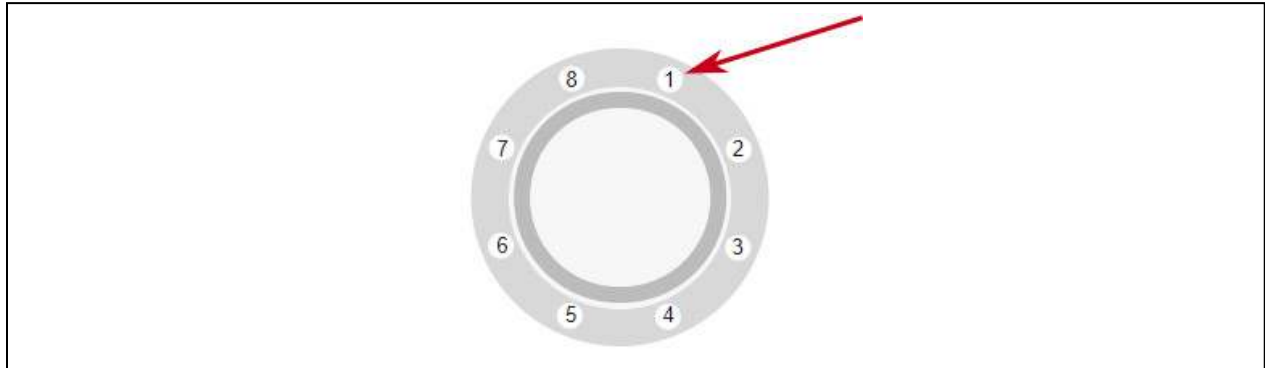

For the Torque Stand, we recommend Stud 1 be the left-most stud.

Once cables are connected to studs, return to the CHUCK interface on your computer and press the "Zero" button.

You need to use the Zero button each time you connect instrumented studs to the CHUCK Brain, or any time you see bolt load drift off zero for an unloaded stud.

When to Calibrate (And Why it Matters)

When you press "Calibrate," the CHUCK Brain measures the effect of its internal circuitry and the connected coaxial cable. So long as you do not disconnect the coaxial cable from the CHUCK Brain, you will not have to press calibrate again.

However, it is important that you recalibrate whenever you change the connection between the port and the cable.

And remember: **Only** calibrate when cables are attached to the Brain but <u>not</u> to a bolt.

D. Dealing with Stud Failures

It is possible for a stud's sensing element to fail causing it to read exceptionally high loads and give an error when you press the zero button. If this happens, you will see an error message that looks like this (for software version 1.014 and above):
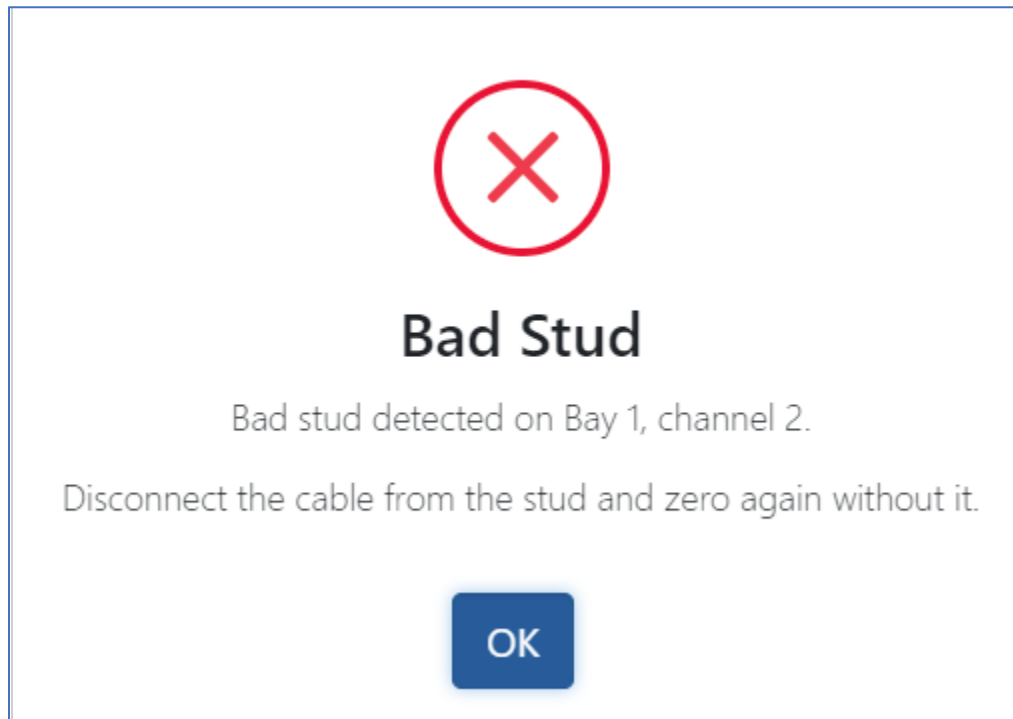

The error message will provide a clue as to which stud has failed. However, a failure of one stud can affect readings on adjacent studs. If you disconnect the stud listed in the message (Bay 1, channel 2 in the above message) and then you get the error on an adjacent stud, disconnect that stud as well and repeat. When you stop getting the error, try reconnecting the first stud you disconnected and zeroing again. Once you have isolated the offending stud, you can replace that stud and continue.

Shutting Down

When your day's work with CHUCK is complete, we recommend you press the Shutdown button on the navigation bar to allow CHUCK to shutdown gracefully before unplugging the server.

When you press the shutdown button, you will see an "Are you sure?" prompt. Press the OK button, and then it's safe to unplug the server.
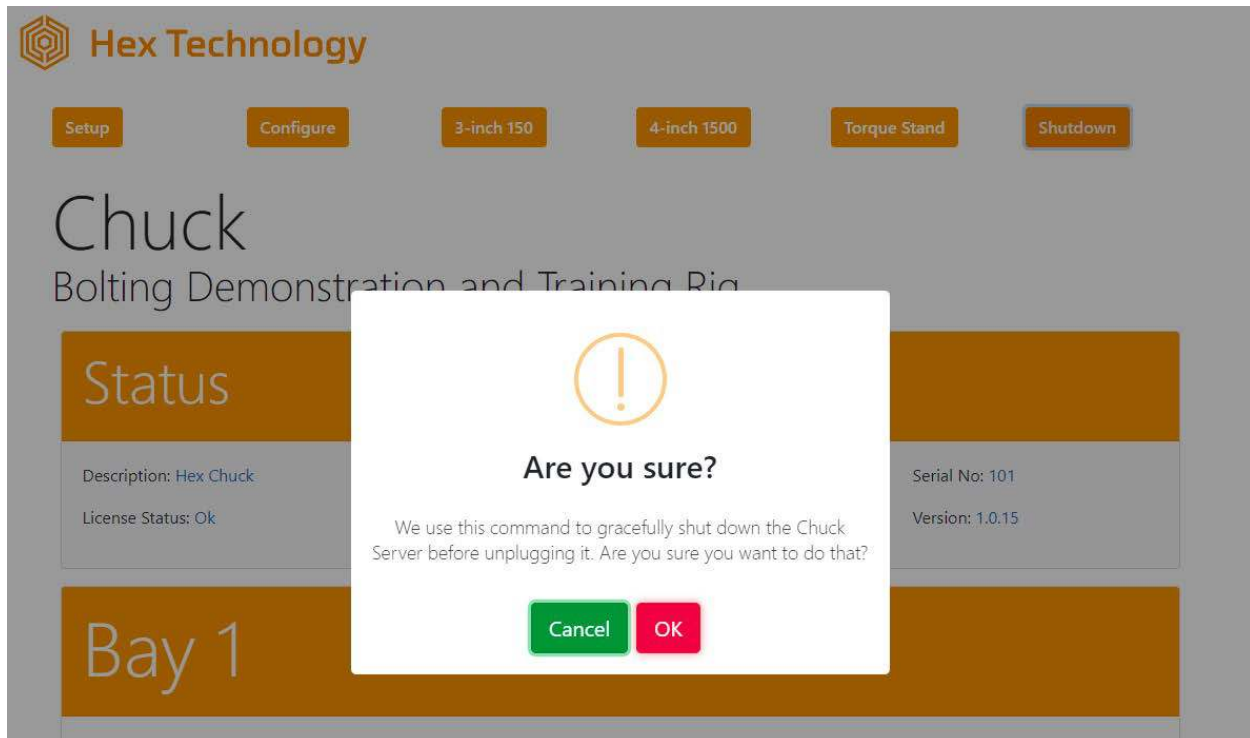
If you have software before Version 1.0.15, pressing OK will make the notification disappear, but you will have no other immediate indication that the server has stopped. After a few seconds, you will see the "Server" indication in the status box change from "Connected" to "Not Connected".
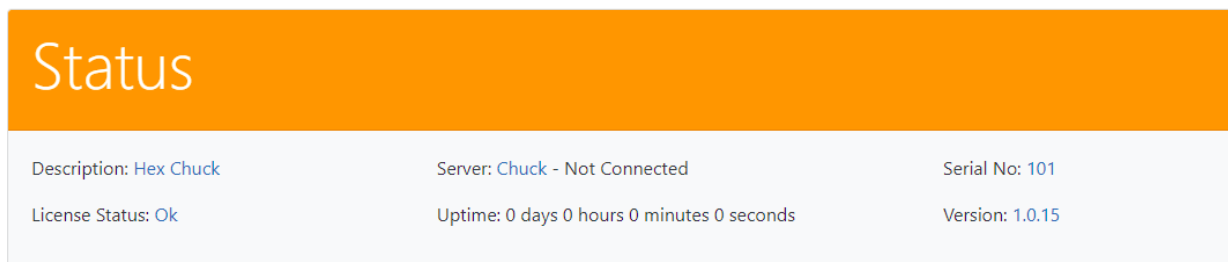
As of Version 1.0.15, pressing the OK button will give you a notice that it's safe to unplug the server:
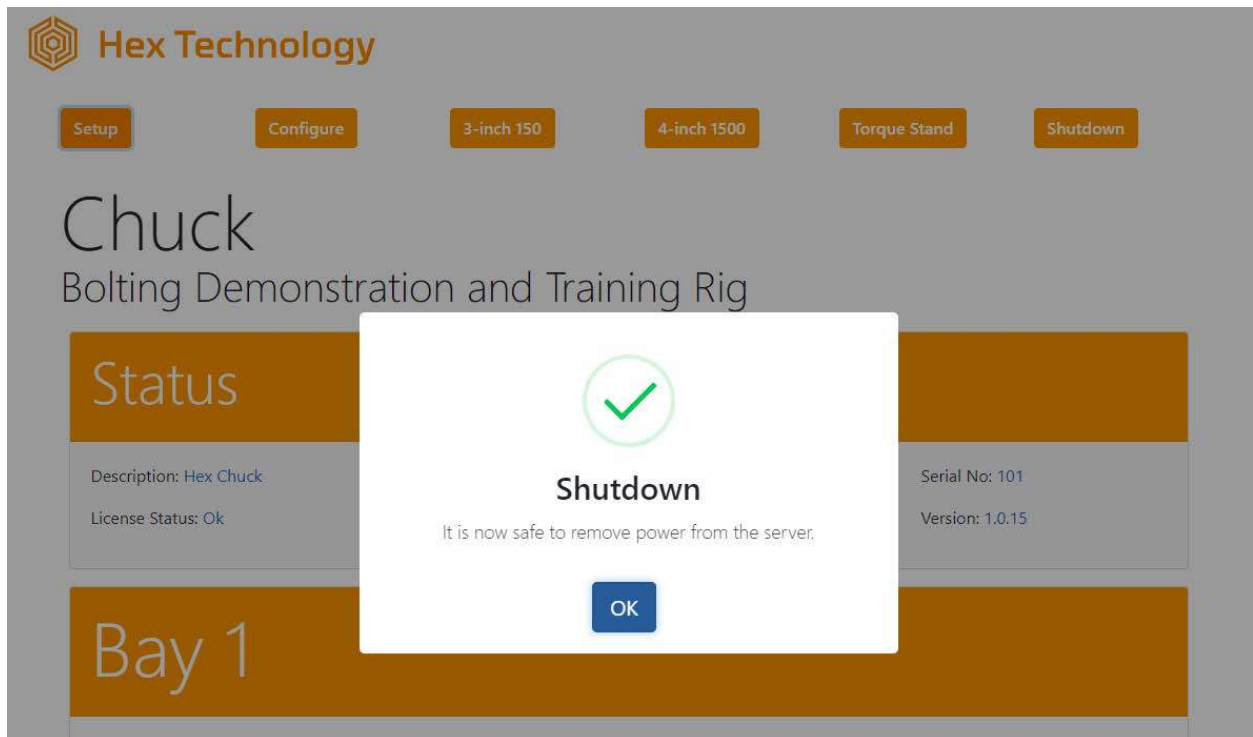
With any version of the software, once you say OK to the "Are you Sure" notification, it is safe to unplug the server right away.

Using CHUCK with Flanges

With flanges, CHUCK provides a real-time graphic display of bolt load.
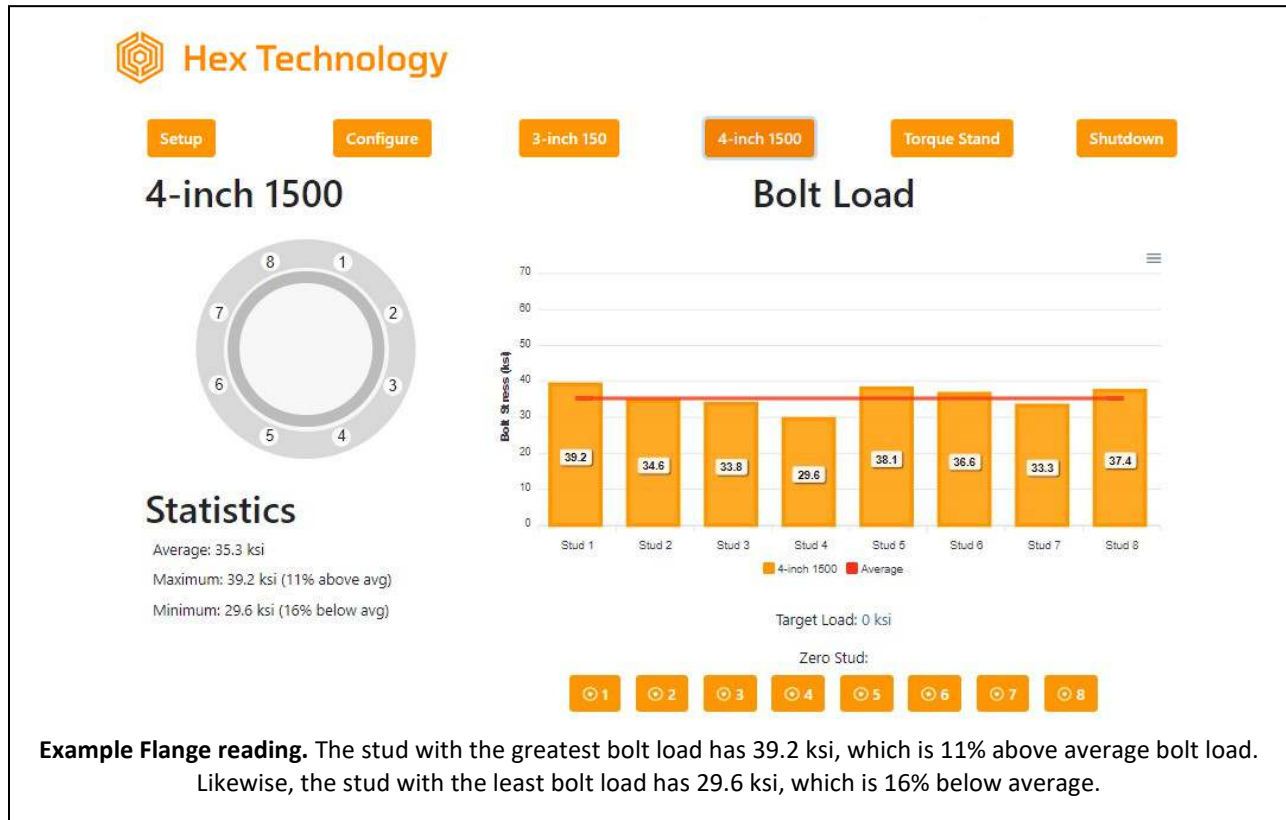
Flanges can range in size from 4-bolt to 16-bolt. Once you have the software configured, using the system is as simple as navigating to the page for the flange, applying torque in the pattern of your choosing, and viewing the results.

Example Flange reading. The stud with the greatest bolt load has 39.2 ksi, which is 11% above average bolt load. Likewise, the stud with the least bolt load has 29.6 ksi, which is 16% below average.

The load on each stud appears as a bar with a number indicating the bolt load value inside.

The average load on all the studs will appear as a red horizontal bar through the columns.

Values for the minimum, maximum, and average load on the flange will be listed at left.

If desired, you can download the graph as a picture (in .png or .svg format) or download the final load values in .csv format. To access these options, use the three-bar menu icon (≡) in the upper right corner of the graph.

Pro Tip: Zeroing and Elastic Interaction

Before applying load to the bolts, if you notice any are not producing a zero ("0") reading, you can zero that bolt within the User Interface. Press the button corresponding to that bolt beneath the "Zero Stud" heading at the bottom of the page.

After you start applying load, you will see load appear on bolts that have not yet been torqued. These loads are due to elastic interaction, and are real. Don't zero them.

Within the Flange screen, you can enter a target bolt load at any time by clicking the Target Load number. This will make the target load appear as a dashed blue line across the graph. The Statistics table will show how much the average load deviates from the target.

Example Flange reading with target. *The target was 40 ksi and the average was 12% below the target.*
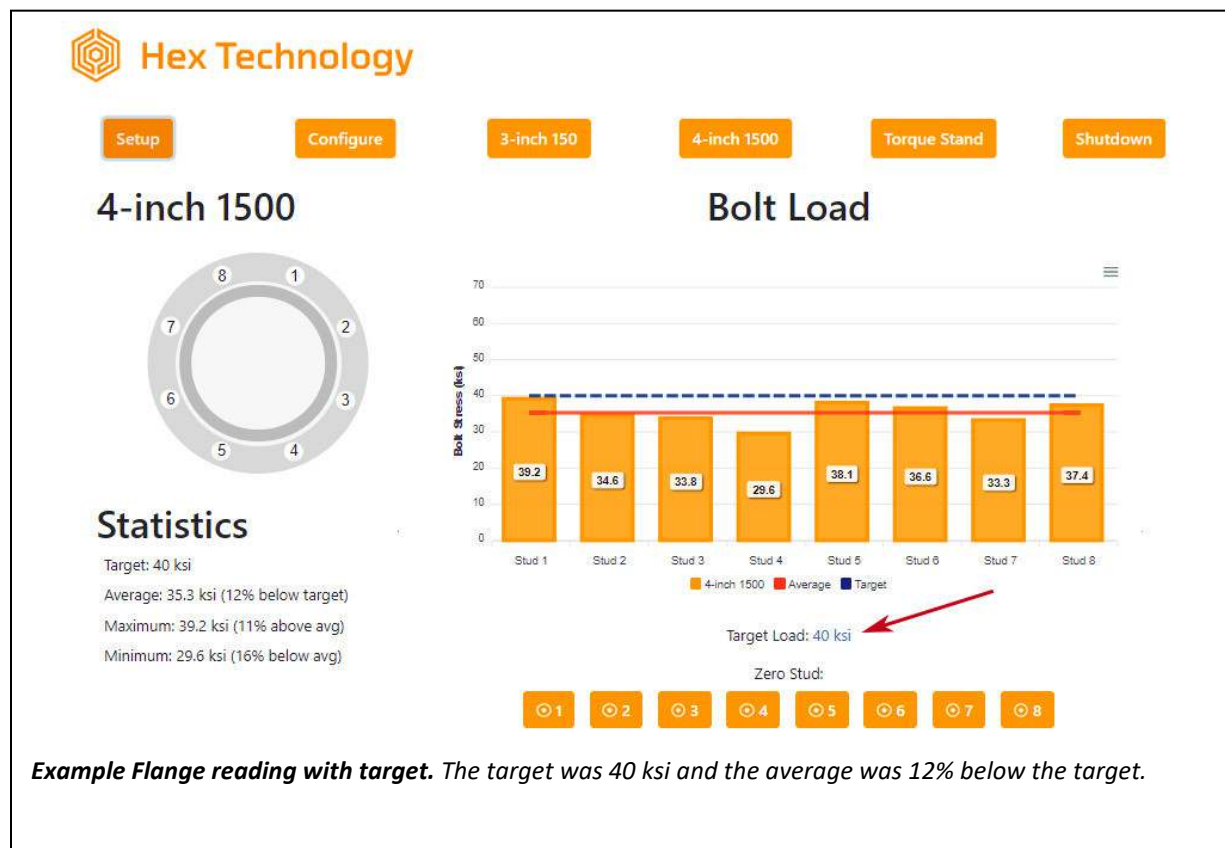
Using CHUCK with a Torque Stand

The torque stand allows you to record up to 5 trials in a single test.

Having multiple trials lets you illustrate differences in bolt load that can result from different assembly processes, such as proper/improper lubrication, tool selection, or tool use/misuse.

At the "Torque Stand" page (shown below), you will see an empty graph along with a notice that Trial 1 is ready. You'll also see a start button.
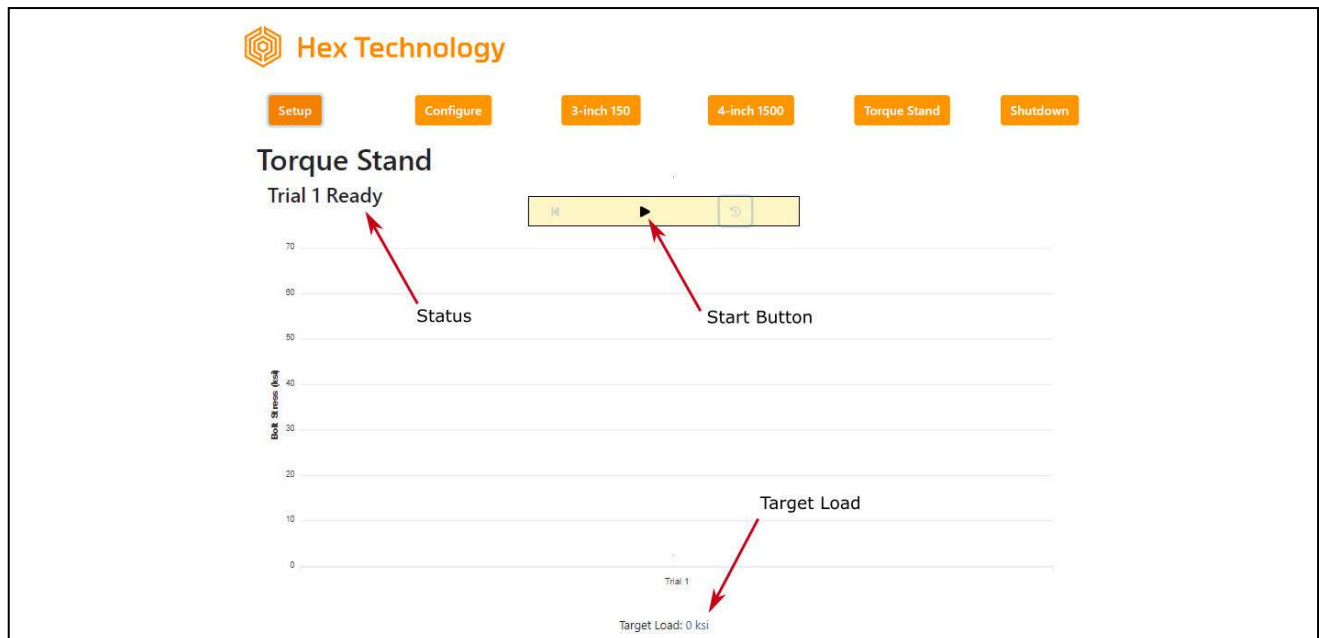

The Torque Stand allows you to enter a target torque, which will show up as a blue line on the graph.

When you are ready to begin a trial, press the start (▶) button. You will see a spinner while the system zeros the studs.

Once zeroing is complete, the status will change to "Trial 1 Running" and the start button will change to a pause button (**II**).

Begin tightening studs. The load on each bolt will display in real time along with an average for all four bolts in that trial.
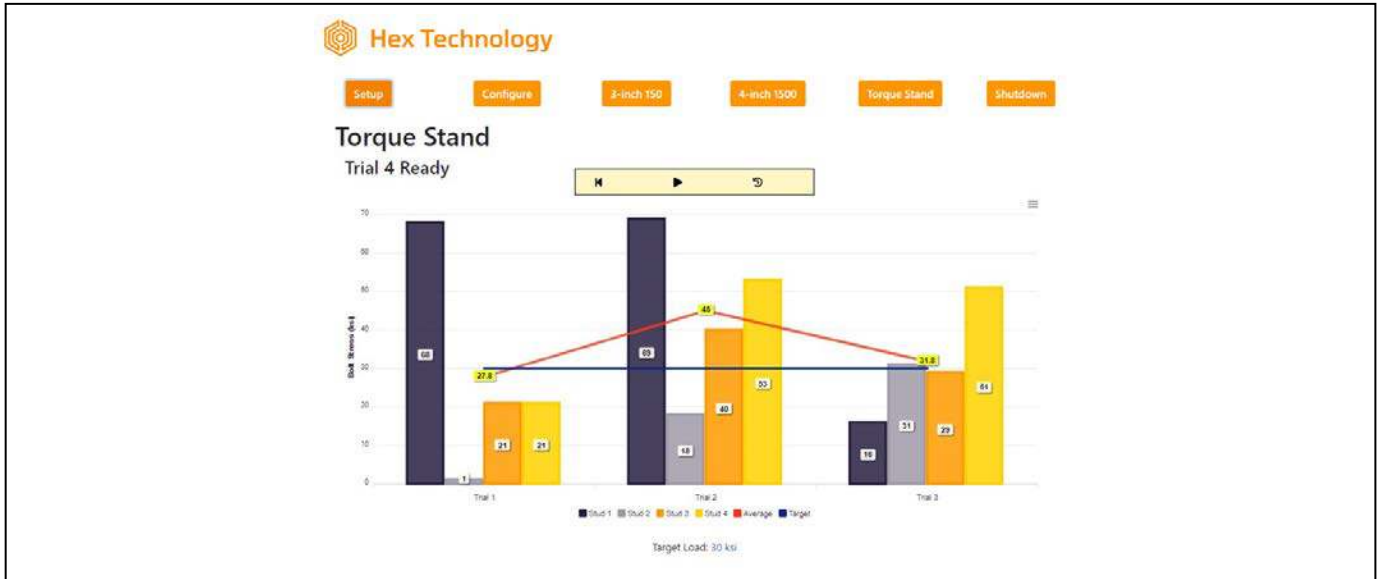
Once you have finished applying torque to all studs, press the pause (**II**) button to save the values measured within that trial.

Press the start button (▶) to begin the next trial. Repeat to record up to five trials.

The controls on the page also include a back button (◀◀), that you can use to repeat a trial, and a reset button (↺) that you can use to clear the screen and start a new operation at Trial 1.

Torque Stand Quick Reference

- Press "Play" (▶) to start a trial.
- Apply torque to bolts.
- Press "Pause" (**II**) to stop the trial and record the bolt readings.
- Press "Play" (▶) to start a new trial.
- Repeat for up to five (5) trials.
- To adjust or redo a trial, Press the "Back" (◀◀) button.