



**TENSILE TESTER**  
**MODEL TT-2000**  
**OPERATING INSTRUCTIONS**

**CHEMINSTRUMENTS**  
**510 COMMERCIAL DRIVE**  
**FAIRFIELD, OHIO 45014**  
**(513) 860-1598**

[www.cheminstruments.com](http://www.cheminstruments.com)

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## PRODUCT DESCRIPTION

Congratulations on the purchase of your new ChemInstruments Tensile Tester. This versatile, user-friendly, carefully designed instrument allows you to perform common tensile, compression, cycle, and loop tack tests.



**WARNING: This equipment can cause injury if not used properly. It is the operator's responsibility to observe all safety rules and warnings.**

The unit has the following features:

- Automated test sequence.
- Collected test data can be exported via USB port.
- Selectable units of measure: Kilograms, Grams, Newtons, Pounds, and Ounces.
- Compatible with EZ-Data System software. See [www.cheminstruments.com](http://www.cheminstruments.com) for details.

## SPECIFICATIONS

<b>Electrical</b>	120/240 VAC, 50/60 Hz, 3 amps
<b>Operating Temperature</b>	32 – 122 degrees Fahrenheit (0 – 50 degrees Celsius)
<b>Humidity</b>	0 – 55% relative humidity
<b>Maximum Separation Distance</b>	32 inches (82 centimeters) minus the length of the grips
<b>Throat Distance from Center of Grip to Mast</b>	3.5 inches (8.9 centimeters)
<b>Speed</b>	0.1 - 25 inches/minute, 0.1 IPM increments 0.25 – 62.5 centimeters/minute, 0.25 CPM increments
<b>Length – Data Start &amp; Test Stop</b>	0 - 2 inches, 0.25 inch increments 0 – 5 centimeters, 0.5 centimeter increments
<b>Length – Data Test</b>	0.25 - 22 inches, 0.25 inch increments 0.5 – 55 centimeters, 0.5 centimeter increments
<b>Length – Loop Distance</b>	0.5 - 4 inches, 0.25 inch increments 1 – 10 centimeters, 0.5 centimeter increments
<b>Dwell Time</b>	1 – 10 seconds, 1 second increments
<b>Length – Cycle Distance</b>	0.25 – 22 inches, 0.25 inch increments 0.5 – 55 centimeters, 0.5 centimeter increments
<b>Number of Cycles</b>	2 – 200 cycles, 1 cycle increments
<b>Physical Dimensions</b>	Width: 13 inches (33 centimeters) Depth: 16 inches (41 centimeters) Height: 47 inches (119 centimeters) Weight: 61.5 pounds (28 kilograms)

## UNPACKING

ChemInstruments has made every effort to ensure that the Tensile Tester arrives at your location without damage. Carefully unpack the instrument and check for any damage that may have occurred during shipment. If any damage did occur during transit, notify the **carrier** immediately.

The ChemInstruments Tensile Tester consists of the following parts:

- The test frame, which includes the motor/drive mechanism and the data acquisition system.
- An envelope with this manual.
- Load cell assembly, including upper and lower grips (unattached).
- Power cord.

Make sure all of these components are present before discarding packaging material.



## ASSEMBLY



**WARNING:** Due to its weight and size, use two people to move the TT-2000.

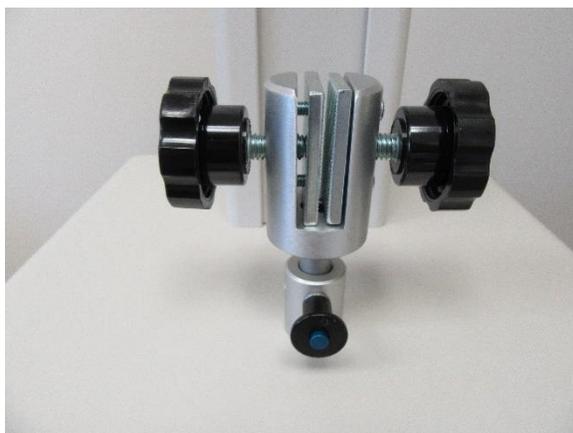
Carefully remove the test frame/data acquisition assembly from the packaging and set it on a sturdy bench top. Check the physical dimensions listed previously for the space required for the instrument. As with any precision piece of laboratory equipment, it is preferable to locate the Tensile Tester in an area where temperature and humidity are controlled to standard conditions of  $72 \pm 2$  degrees Fahrenheit and  $50 \pm 5\%$  relative humidity.



**WARNING:** Damage will occur if this unit is plugged into the incorrect power supply. This is a dual voltage machine. Connect either 120 or 240 VAC.

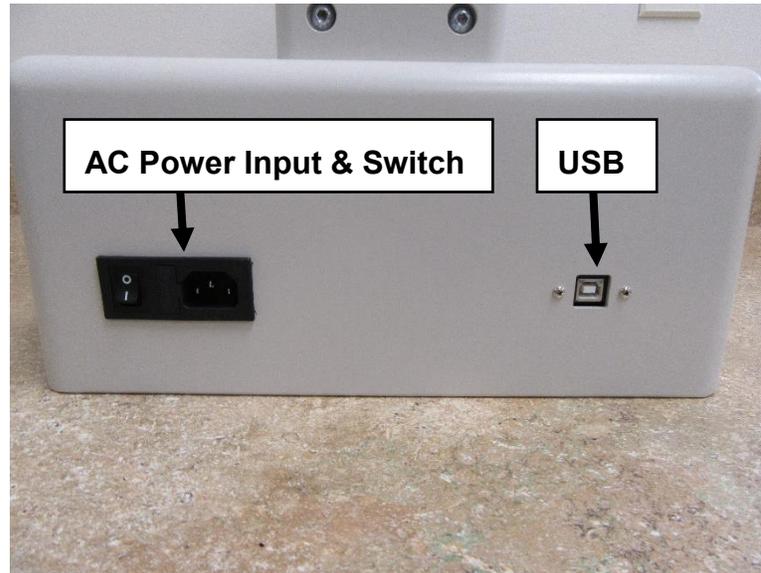
Connect the power cord to its receptacle on the backside of the control cabinet. Complete the connection by inserting the male end of the power cord into an appropriate AC outlet. Notice that the on/off power switch is located directly beside the power cord receptacle on the backside of the test frame.

Attach the upper and lower grips as shown in the pictures below.

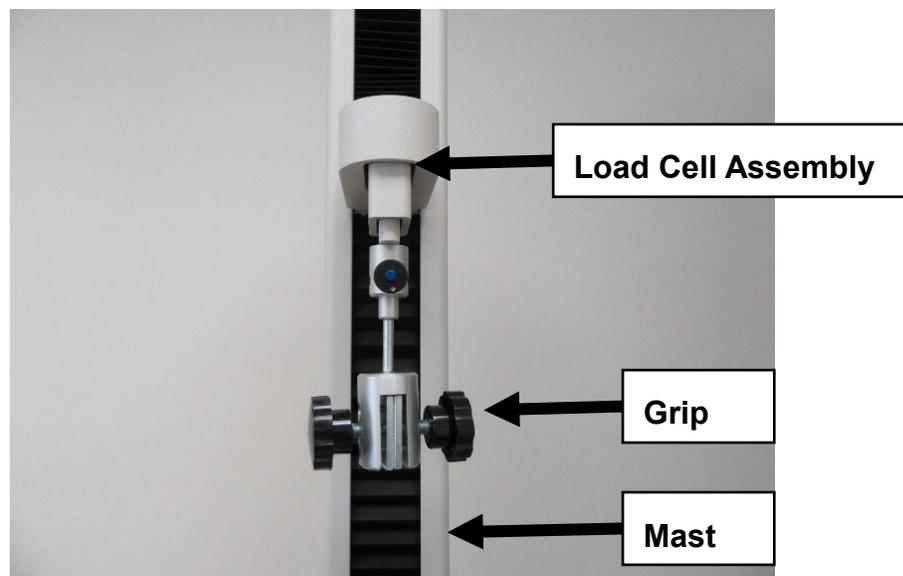


## KEY COMPONENTS

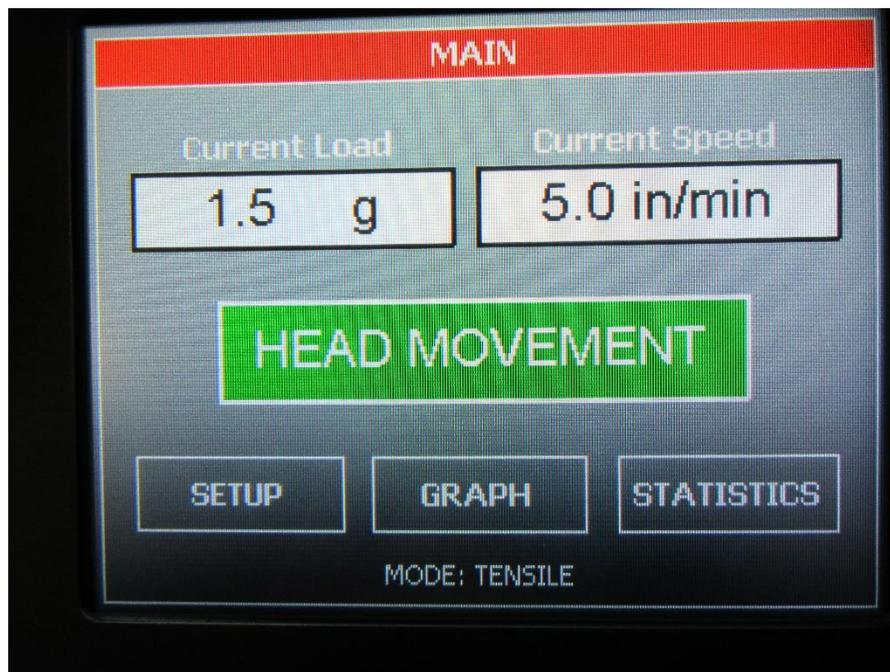
- **POWER SWITCH** is located on the back panel of the control cabinet directly beside the power cord connection.
- **USB CONNECTION** data output port for downloading test/setup data.



- **LOAD CELL ASSEMBLY** consists of the mounting bracket for the load cell.
- **GRIPS** secure the upper and lower ends of the test material.
- **MAST** the track that the load cell assembly travels during the testing cycle.



- **TOUCH SCREEN DISPLAY** is the control center for the TT-2000.



## TOUCH SCREEN FORMAT

### MAIN SCREEN

- **Current Load** – displays the force currently measured by the load cell.
- **Current Speed** – displays the set speed of the test.
- **Head Movement** – will display a new screen which will allow the user to jog or start a test.
- **Setup** – will display all setup options.
- **Graph** – will display the graph, minimum, maximum, and average values of the last test.
- **Statistics** – will display the minimum, maximum, average, variance, standard deviation, and work of the last test.



## SLED MOVEMENT SCREEN

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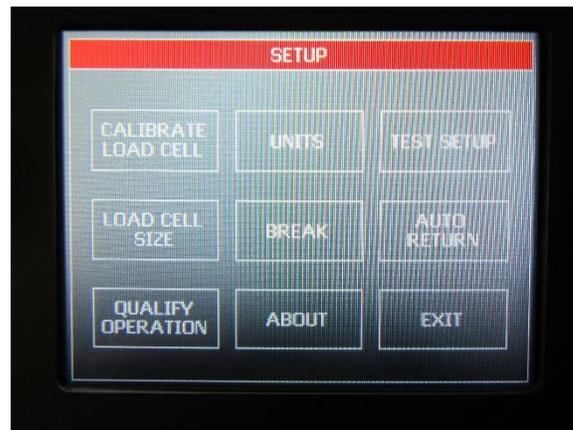
- **Start Test** – starts a test.
- **Return** – moves the test platform to the start position of the last test.
- **Jog Down** – jogs the upper grip up until the STOP JOG button is pressed.
- **Main** – will go back to the main screen.
- **Jog Up** – jogs the upper grip down until the STOP JOG button is pressed.



## SETUP SCREEN

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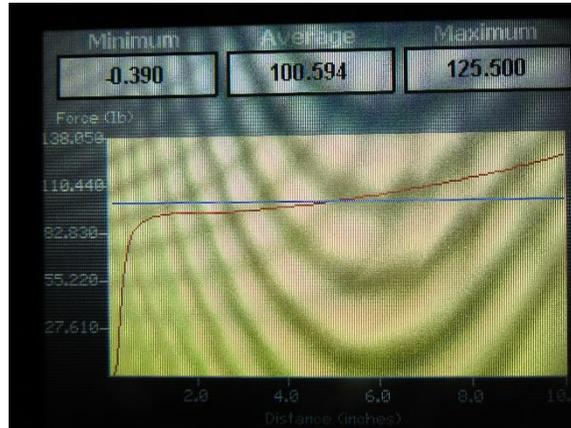
- **Calibrate Load Cell** – allows the user to calibrate the load cell.
- **Units** – change the force units and/or the speed units.
- **Test Setup** – will open another menu to set the mode, test speed, and offset.
- **Load Cell Size** – is used to select the currently installed load cell size.
- **Break**– sets the break mode. If break mode is on, then the system will stop a test when a break has been detected.
- **Auto Return**– sets the auto return mode. If auto return mode is on, then the system will automatically return to the test's start point upon completion of a test. If a break is detected during a test, the system will not auto return.
- **Qualify Operation** – is used to verify some of the hardware functions with the TT-2000.
- **About** – retrieve the machine's software version and control board's hardware revision.
- **Exit** – go back to the main screen.



## GRAPH SCREEN

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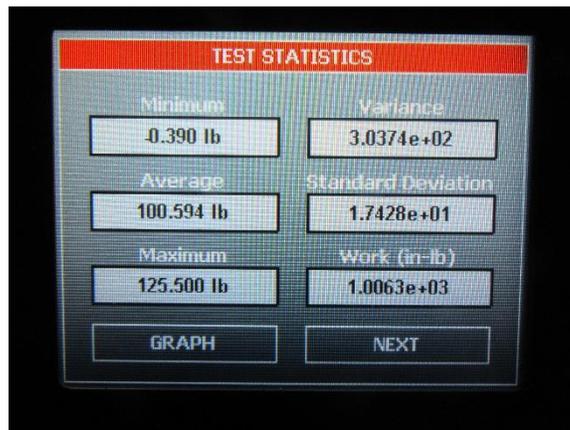
The graph screen will display the graph, minimum, maximum, and average values of the last test. Touch anywhere on the screen to exit the graph screen and return to the main screen.



## STATISTICS SCREEN

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The statistics screen will display the minimum, maximum, average, variance, standard deviation, and work of the last test. Pressing NEXT on the “Test Statistics” screen will display elongation



## THEORY OF OPERATION

Test material is placed in the two opposite grips. The operator programs the test speed, the distance of the test, and the area of data to be recorded. The upper grip, which is fastened to a load cell, travels up and down the mast causing forces on the test sample. An electronic load cell measures the forces, then feeds the information to a data acquisition unit. The data acquisition unit collects the data from the load cell and stores these data points in memory for use in calculating the maximum, minimum and average values. This data can be downloaded through the USB connection port to an appropriate receiving program on your PC.

The load cell samples at 400 times per second. Eight samples are collected, averaged, and stored as a data point. Therefore, a test will generate data points every 20 milliseconds.

A maximum of 26,000 data points can be saved with any given test.

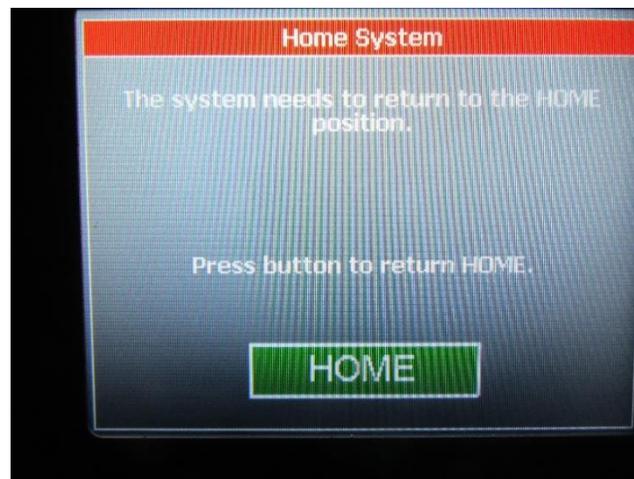
## POWER UP



**WARNING:** Operating temperature for this equipment is 32 to 122 degrees Fahrenheit (0 to 50 degrees Celsius). The equipment needs to be completely free of condensation, inside and out, before applying power.

Turn on the master power switch located on the back panel of the control cabinet next to the power line receptacle.

If the load cell assembly is not at the home switch on power up, the following message will appear. The system must establish the location of the home switch on power up.



## MACHINE SETUP

### LOAD CELL CALIBRATION

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It is important to calibrate the load cell to ensure that reliable data will be gathered. A calibration procedure is built into the software of the Tensile Tester. This procedure should be followed upon first use of the Tensile Tester and whenever necessary thereafter. The following is the step-by-step procedure for calibrating the load cell.



**Make sure that the Tensile Tester has been powered on for 30 minutes before proceeding with calibration.**



**The calibration sequence defaults to grams as the unit of measure. Make sure that your calibration weights and entries are in grams.**

### LOAD CELL CALIBRATION PROCEDURE

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1. Move the load cell assembly with the upper grip to a midpoint of the mast.
2. Confirm that the upper grip is properly attached to the Load Cell Assembly and secured.
3. Select SETUP from the main screen.
4. Select CALIBRATE LOAD CELL from the setup screen.
5. The first screen in the calibration process describes the 2 point calibration process. Select OK to continue.
6. The next screen measures the low calibration value (typically 0). Make sure that you do not have a weight hanging from the upper grip and select OK.
7. The next screen measures the high calibration value. This weight should be close to the maximum rated load cell value. Hang the weight from the upper grip. See photo below.

8. Set the high calibration value by selecting CHANGE and entering the value of the weight in grams and select ENTER. Select OK to continue.
9. The display will show the main screen and the current reading of force will be displayed under CURRENT LOAD.
10. Verify the calibration by hanging a different calibration weight from the upper grip.
11. Repeat the calibration procedure if necessary.

## LOAD CELL REPLACEMENT

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Some users require multiple load cell sizes. Removing and replacing the load cell is simple. The removal procedure is as follows:

1. Remove the upper grip.
2. Disconnect the cable. See photo below.



3. Remove the screw from the top of the load cell assembly. **Make sure that you support the load cell so that it does not fall.**



The installation procedure is as follows:

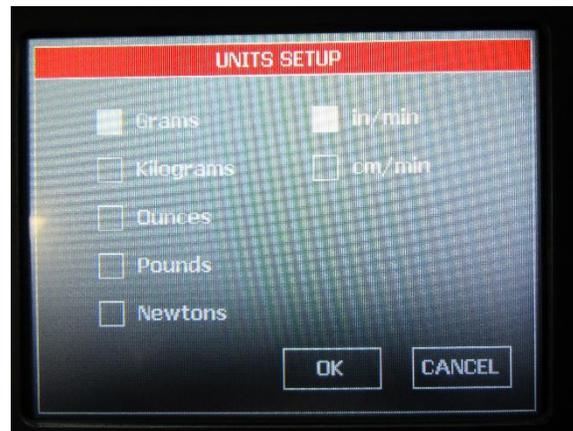
1. Insert the load cell into the upper load cell assembly with the connector pointing towards the back of the TT-2000.
2. Connect the screw through the top of the load assembly to the load cell.
3. Connect the load cell cable.
4. Re-connect upper grip.
5. Re-calibrate the load cell.

## FORCE AND SPEED UNITS

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Force and speed units can be changed with the following procedure.

1. Select SETUP from the main screen.
2. Select UNITS from the setup screen.
3. Select the desired units. Select OK to confirm the entered units.

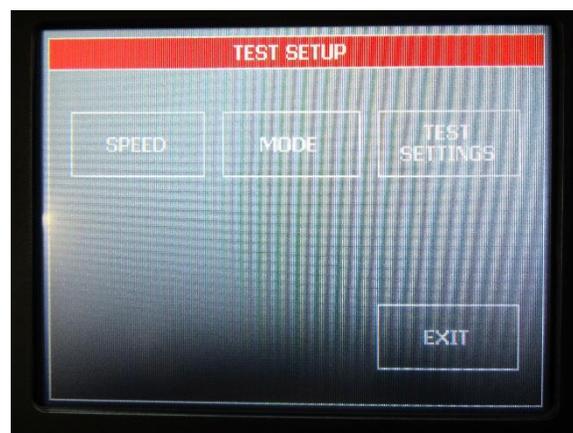


## TEST SETUP

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Test setup allows the speed, mode, and test distance settings to be changed.

1. Select SETUP from the main screen.
2. Select TEST SETUP from the setup screen.
3. Select the setting to change.
4. When complete, select EXIT

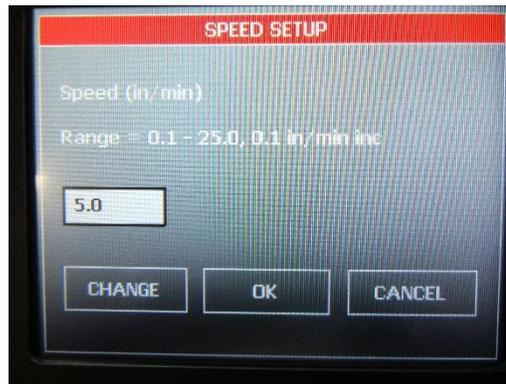


## SPEED

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To perform a test correctly, it is necessary to set the test speed in accordance with the selected test method. The following is a step-by-step procedure for setting the speed.

1. Select SETUP from the main screen.
2. Select TEST SETUP from the setup screen.
3. Select SPEED from the test setup screen.
4. Select CHANGE and enter the desired sled speed in the selected units and press ENTER. Select OK to confirm the entered speed.

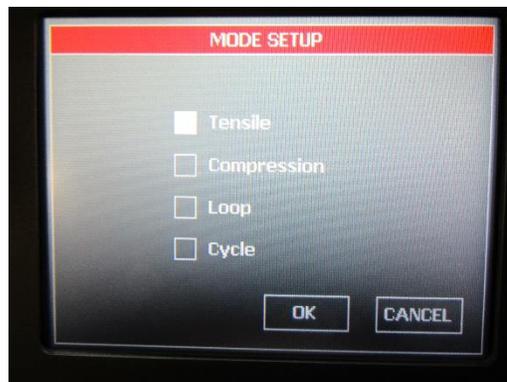


## MODE

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The system allows for testing in tensile, compression, loop tack, and cycle mode.

1. Select SETUP from the main screen.
2. Select TEST SETUP from the setup screen.
3. Select MODE from the test setup screen.
4. Select the desired mode. Select OK to confirm the entered mode.



## TEST SETTINGS

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Offset parameters are data start, data test, and test stop. Test data is only collected during the data test period of the test. No test data will be collected during the data start and test stop periods of the test.

1. Select SETUP from the main screen.
2. Select TEST SETUP from the setup screen.
3. Select TEST SETTINGS from the test setup screen.
4. Select data start, data test, or test stop. Enter the desired value. Select OK. When finished entering all parameters, select OK to confirm.

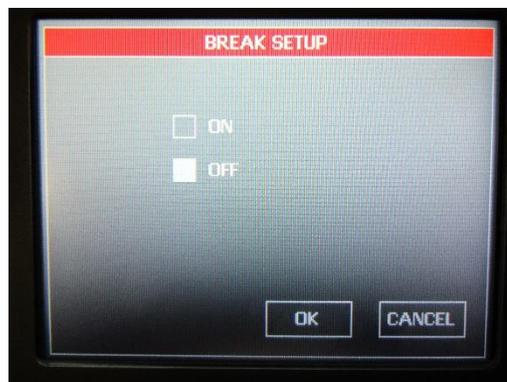


## BREAK

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Setting break on will terminate a test once the load cell reading drops to 0 grams.

1. Select SETUP from the main screen.
2. Select BREAK from the setup screen.
3. Select the desired break setting. Select OK to confirm.

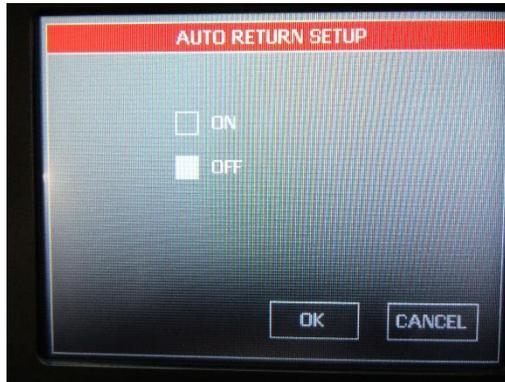


## AUTO RETURN

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Setting auto return on will automatically send the upper grip back to the test's starting position after a test is complete.

1. Select SETUP from the main screen.
2. Select AUTO RETURN from the setup screen.
3. Select the desired auto return setting. Select OK to confirm.



## QUALIFY OPERATION

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Some of the hardware functions of the TT-2000 can be verified with the qualify operation screen.

- **Current Load** – displays the force currently measured by the load cell. It will be displayed in the selected units.
- **Current Speed** – displays the set speed of the test platform.
- **AD Reading** – displays the hardware counts measured on the control board from the load cell interface. Pulling on the load cell grip will display values greater than 32000. Pushing on the load cell grip will display values less than 32000.
- **Test Speed** – is a method of verifying the speed of the test platform. The test platform will move 4 inches at the set speed and measure the amount of time that it takes to travel 4 inches.
- **Verify Load Cell** – will sample the load cell data for 10 seconds. A test can be simulated with a weight hanging from the upper grip to verify the load cell calibration if necessary. The upper grip will not move, the system will simply measure the load cell and display a graph along with the statistics when the 10 seconds is complete.



## RUNNING A TEST

Tensile tests are conducted according to written test methods, such as ASTM, PSTC, TLMI and others.

**NOTE: Make sure the load cell has been calibrated before conducting a test.**

### TEST PROCEDURE

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The ChemInstruments Tensile Tester is very simple to use. The following is the correct procedure for running a Tensile Test. See pictures that follow this procedure for clarification of terms.

1. Make sure that the load cell is calibrated correctly.
2. Set test speed, mode, and travel distances.
3. Attach any fixtures according to the test method.
4. Position the upper grip at the start point.
5. With the upper grip at the start point and fixtures in place, attach the test material.
6. Go to the Motor Movement screen and select START TEST.
7. The test forces will display in the Current Load block. This block will turn green while the test data is being collected. Test data is only collected during the “Data Test” distance part of the travel time.
8. The internal computer will calculate the average, high, and low values measured during the test.
9. The graph screen will be displayed after the completion of a test. The average, high, and low values will be displayed in addition to the graph. The statistics screen will display standard deviation, variance, work, and elongation.

## MODES

Tests can be run in four different modes – tensile, compression, loop, or cycle.

Tensile mode will move the load cell assembly up while testing. The “Data Start” distance will be the first length that the TT-2000 moves. No test data will be collected during this movement. Next the system will move the distance specified in “Data Test”. Test data will be collected and stored during this part of the test. The final part of the test is the “Test Stop” length. Once again, no test data is collected during this part of the test.

Compression mode will move the load cell assembly down while testing. The test parameters for compression mode are the same as those for tensile mode.

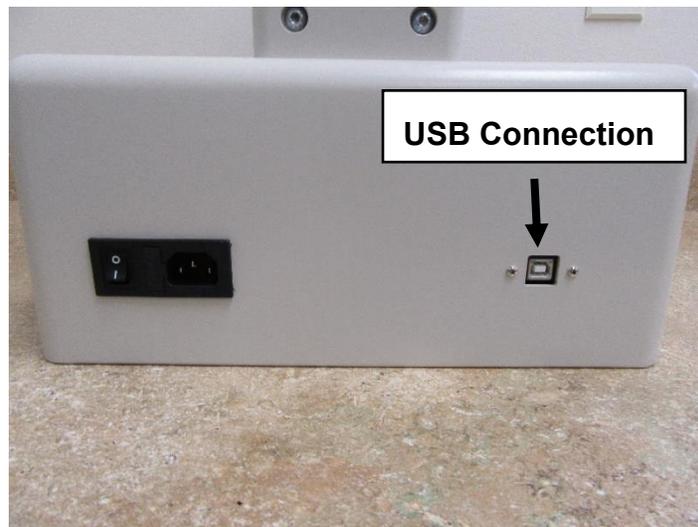
Loop mode is used to perform loop tack testing with the TT-2000 using the TT-LTF-100 fixture. The load cell assembly will move down for the “Loop Distance” length. Once stopped, the TT-2000 will dwell for the amount of time specified in “Dwell Time”. The load cell assembly will then move upward for the “Loop Distance”, measuring force during this movement.

Cycle mode will move the load cell assembly up for the “Cycle Distance” length and then return to the start position. This will continue until all cycles have been completed. Test data is measured during the upward motion. The maximum force value for each cycle is recorded.

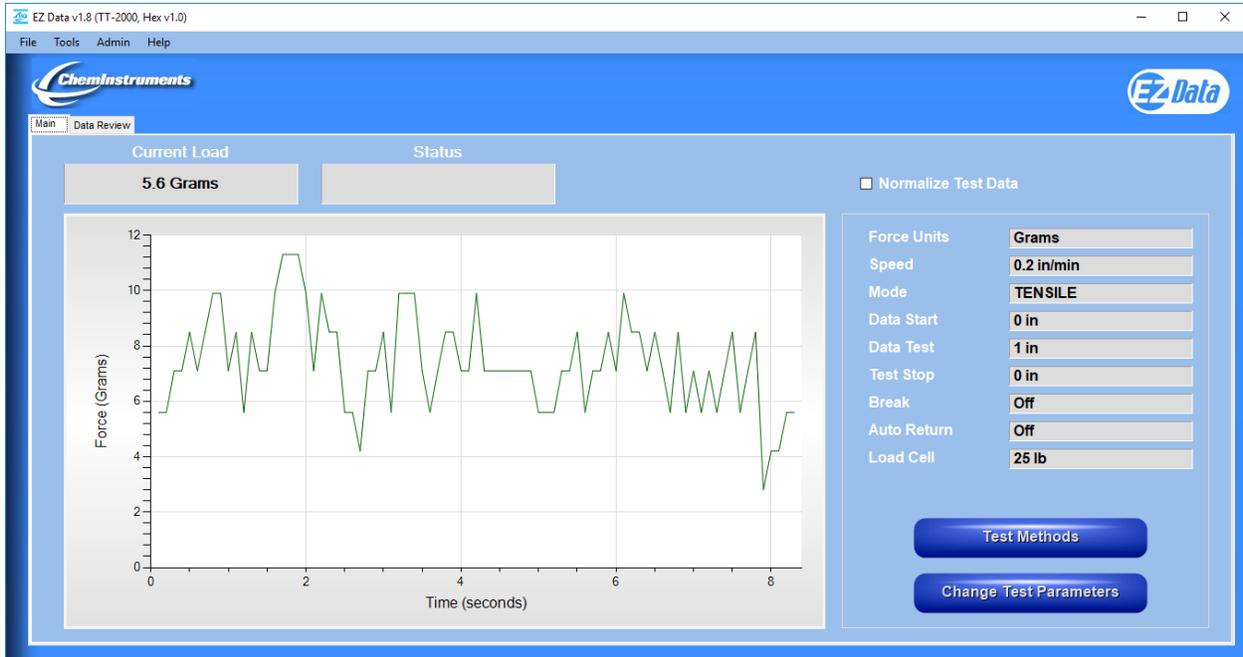
## EZ DATA SOFTWARE SYSTEM

EZ Data is a ChemInstruments program that runs on your computer and will allow you to interface to your ChemInstruments machine in order to save test data files, save raw test data to excel, graph and crop test data, tabulate test data files, and overlay test data files. Please refer to the EZ Data manual for specific information on how to use the EZ Data software system.

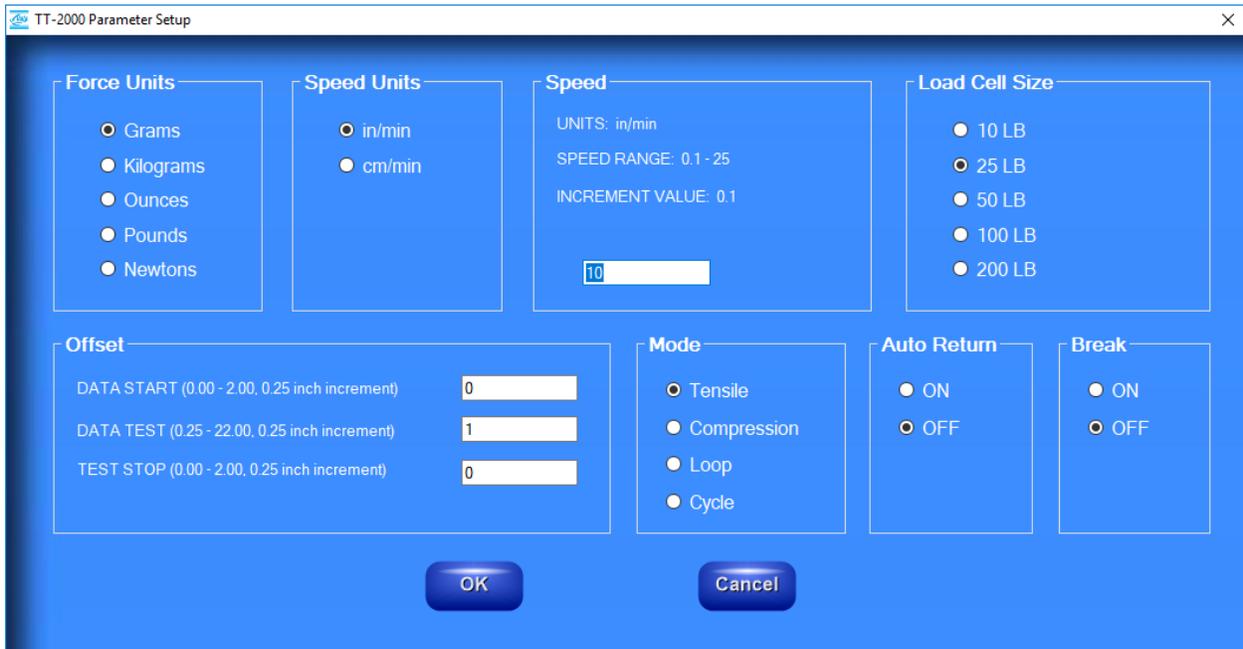
The TT-2000 can be connected to your computer with a Type A-B, Revision 2.0 Compliant, USB cable.



The following picture is the main screen of EZ Data with a TT-2000 connected. This screen will show the current load as a value and a real time graph as data is collected from the load cell. It shows the test setup parameters. It will also allow you to change the test parameters.



The following picture shows the TT-2000 parameter setup.



## TT-2000 ACCESSORIES

### TT-PF-90

- This fixture will allow you to perform 90 degree peel tests with the TT-2000.
- Able to use 2x5 inch or 2x6 inch test panels.



### TT-PF-180

- This fixture will allow you to perform 180 degree peel tests with the TT-2000.
- Able to use 2x5 inch test panels.



### TT-LTF-100

- This fixture will allow you to perform loop tack tests with the TT-2000.
- Able to use 1x3 inch or 1x6 inch test panels.



### TT-UWF-100

- This fixture will allow you to perform unwind tests with the TT-2000.
- Designed for 3 inch diameter cores.
- Can accept up to 3 ¼ inch outside diameter roll.



## MAINTENANCE

### TROUBLESHOOTING

The troubleshooting chart describes some problems that may occur over time. After determining the problem, follow one of the following maintenance procedures.

**Table 1 – Troubleshooting Chart**

<b>Problem</b>	<b>Possible Cause</b>	<b>Procedure</b>
No data collected	Not in Run Menu	Refer to running a test
Load Cell Assembly does not move during a test	Motor is not allowing the assembly to move	Replace motor
Data measurement consistently low/high	Improper calibration	Check calibration
	Bad calibration	Refer to load cell calibration
Calibration drifts	Bad or damaged load cell	Replace load cell

### MAINTENANCE PROCEDURES

As with any precision equipment it is important to provide care and maintenance to ensure proper performance and long life. General cleaning and care will ensure accurate test and trouble free performance.

## CLEANING THE TOUCH SCREEN

It's important to realize the touch panel is sensitive to chemicals.

**Specific Cleaning Information:** Use a soft, lint-free cloth. The 3M Microfiber Lens Cleaning Cloth is especially recommended for cleaning touch panels without requiring liquid cleaner. The cloth may be used dry or lightly dampened with a mild cleaner or Ethanol. Be sure the cloth is only lightly dampened, not wet. Never apply cleaner directly to the touch panel surface; if cleaner is spilled onto touch panel, soak it up immediately with absorbent cloth. Cleaner must be neither acid nor alkali (neutral pH). When using cleaner, avoid contact with the edges of the film or glass, and with the flex tail. Wipe the surface gently; if there is a directional surface texture, wipe in the same direction as the texture. Never use acidic or alkaline cleaners, or organic chemicals such as: paint thinner, acetone, toluene, xylene, propyl or isopropyl alcohol, or kerosene. Suitable cleaning products are commercially available pre-packaged for use; one example of such a product is **Klear Screen™** or commercially available off-the shelf retail brands such as **Glass Plus® Glass and Surface Cleaner** made by Reckitt-Benckiser. Use of incorrect cleaners can result in optical impairment of touch panel and/or damage to functionality.

**Note:** Most products contain 1-3% Isopropyl Alcohol by volume, which is within acceptable limits for Resistive Touch Panel cleaning use.

**Caution:** Many products contain Ammonia, Phosphates, and/or Ethylene Glycol, which are NOT ACCEPTABLE; check product content label carefully.

## LOAD CELL REMOVAL

The load cell assembly can be removed to send back for recertification. The procedure for removal is as follows:

6. Remove the upper grip.
7. Disconnect the cable.
8. Remove the screw from the top of the load cell assembly. **Make sure that you support the load cell so that it does not fall.**

