DYNAMIC SHEAR TESTER

MODEL DS-2000

OPERATING INSTRUCTIONS

CHEMINSTRUMENTS

510 COMMERCIAL DRIVE

FAIRFIELD, OHIO 45014

(513) 860-1598

www.cheminstruments.com

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CONTENTS

PRODUCT DESCRIPTION

Congratulations on the purchase of your new ChemInstruments DS-2000 Dynamic Shear Tester. This versatile, user-friendly, carefully designed instrument allows you to determine shear resistance by force rather than time.

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:

- Selectable testing speeds.
- Selectable testing lengths.
- Tension relief mode.
- Selectable units of measure: Kilograms, Grams, Newtons, Pounds, & Ounces.
- Compatible with EZ Data System software. See www.cheminstruments.com for details.

SPECIFICATIONS

Electrical	120/240 VAC, 50/60 Hz, 2 amps
Operating Temperature	32 – 150 degrees Fahrenheit (0 – 70 degrees Celsius)
Humidity	0 – 55% relative humidity
Speed	0.05 – 2 inches/minute (0.05 inch increments) 0.15 – 5 centimeters/minute (0.05 centimeter increments)
Data Test	0.25 – 3.5 inches (0.25 inch increments) 0.5 – 8.5 centimeters (0.5 centimeter increments)
Physical Dimensions	Width: 14 inches (36 centimeters) Depth: 18 inches (46 centimeters) Height: 9 inches (23 centimeters) Weight: 29 pounds (13 kilograms)

UNPACKING

ChemInstruments has made every effort to ensure that the DS-2000 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 DS-2000 consists of the following parts:

- The test frame, which includes the motor/drive mechanism and the data acquisition system.
- An envelope with this manual.
- Power cord.

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

ASSEMBLY

Carefully remove the test frame/drive/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 DS-2000 in an area where temperature and humidity are controlled to standard conditions of 72 ± 2 degrees Fahrenheit and 50 ± 5% relative humidity.

CONNECTING THE POWER CORD

WARNING: Make sure the power source matches the requirements of the DS-2000. Damage will occur if this unit is plugged into the incorrect power supply.

Connect the power cord to its receptacle on the backside of the control cabinet at the far left side when viewed from the rear. Complete the connection by inserting the male end of the power cord into a convenient AC outlet. Notice that the on/off power switch is located directly beside the power cord receptacle on the backside of the test frame.

WARNING: Before proceeding with using the DS-2000, it is advisable to become familiar with the Key Components. These Key Components and a brief description of their function follow in the next section.

KEY COMPONENTS

- **POWER SWITCH** is located on the back panel of the control cabinet directly beside the power cord connection**.**
- **LOAD CELL** measures the forces involved with a test.
- **LOAD CELL ASSEMBLY** consists of the mounting bracket for the load cell with grip.
- **GRIP** secures the free end of the test strip to the load cell.
- **E-STOP** emergency stop disrupts all electrical power. Turn to release.

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

OPERATION

The dynamic shear tester will quickly measure shear resistance by force rather than time to get a clear understanding of the adhesive's chemistry. Dynamic shear testing offers a faster, more accurate representation of an adhesive's ability to resist polymer disentanglement. Using the DS-2000, you can graph the actual holding power with one simple test instead of running multiple hang tests and plotting their statistical time-to-fail.

The test speed, sampling distance, and tension relief mode are parameters that can be specified through the setup menu. Jog and return speed are set at 15 inches/minute.

Test sampling begins after 50 grams of force are measured with an electronic load cell. The measured data is collected by the data acquisition unit where it is stored in memory for use in calculating the maximum, minimum, and average values.

The load cell samples at 50 times per second for speeds of 0.05 – 0.3 inches/minute. Eight samples are collected, averaged, and stored as a data point. Therefore, a test will generate data points every 160 milliseconds.

The load cell samples at 400 times per second for speeds of 0.35 – 2 inches/minute. 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 150 degrees Fahrenheit (0 to 70 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. The internal control board will go through a self-test.

TOUCH SCREEN FORMAT

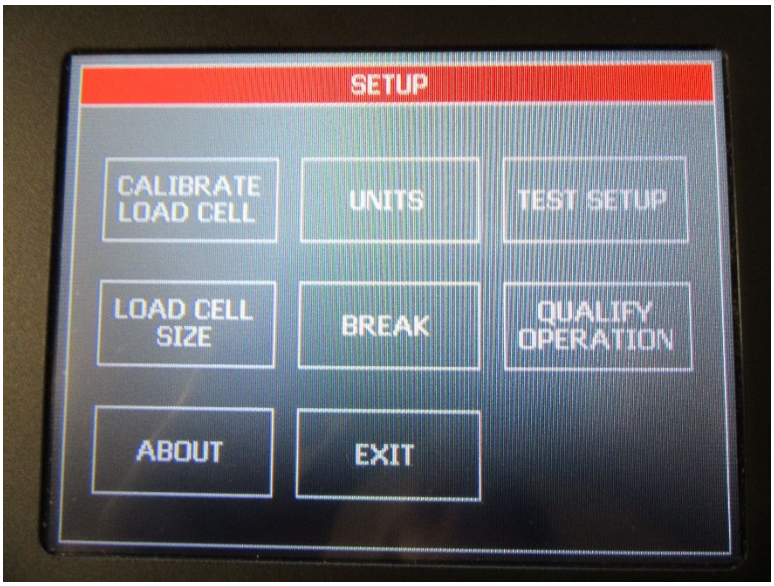
MAIN SCREEN

- **Current Load** – displays the force currently measured by the load cell.
- **Current Speed** – displays the test set speed.
- **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, work and elongation of the last test.

SETUP SCREEN

- **Calibrate Load Cell** – is used to calibrate the load cell.
- **Units** – is used to change the force units and/or the speed units.
- **Test Setup** – will open another menu to set the test speed, tension relief 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.
- **Qualify Operation** – is used to troubleshoot hardware problems with the DS-2000.
- **About** – is used to retrieve the machine's software version and control board's hardware revision.

If there are 30 seconds of no screen or test activity when in any of the setup screens except the hardware tools screen, then the machine will exit the setup screen and return to the main screen.

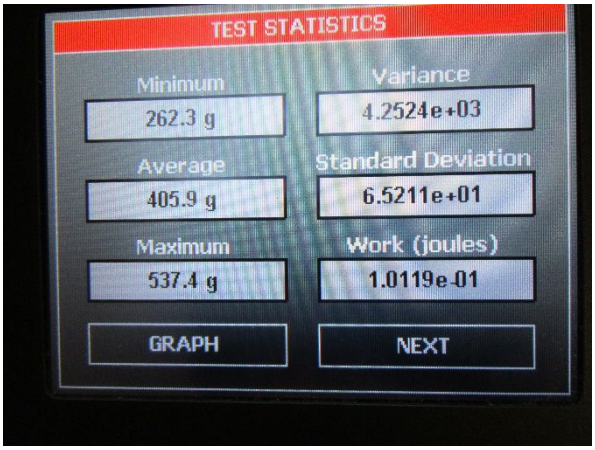


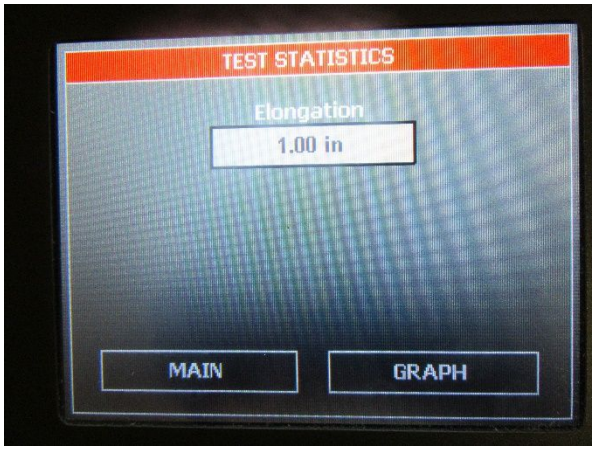
GRAPH SCREEN

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

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.





MOTOR MOVEMENT SCREEN

The motor movement screen will allow the user to jog, return, or start a test. Jog and return speed is 15 inches/minute. Test speed is selected from the setup screen. Return will return the cart to the start point of the most recent test.

MACHINE SETUP

LOAD CELL CALIBRATION

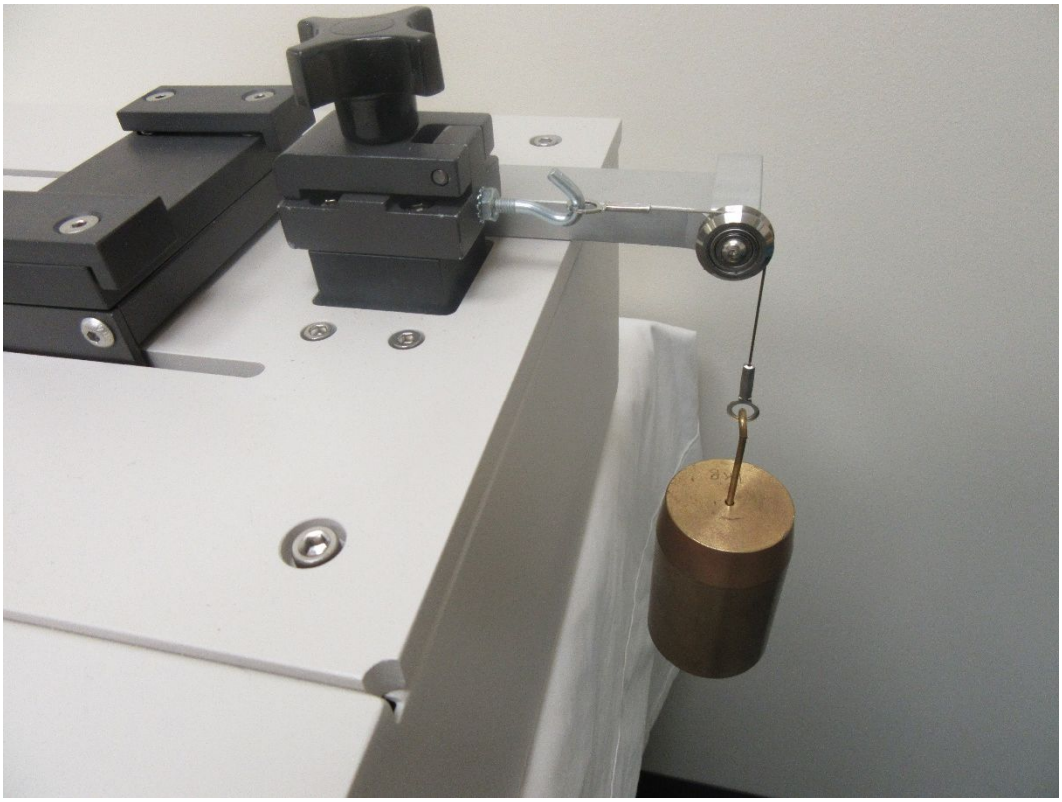
It is important to calibrate the load cell to ensure that reliable data will be gathered. A calibration procedure is built into the software of the DS-2000. This procedure should be followed upon first use of the DS-2000 and whenever necessary thereafter. The following is the step-by-step procedure for calibrating the load cell.

MAKE SURE THE DS-2000 HAS BEEN ON FOR 30 MINUTES BEFORE PROCEEDING WITH CALIBRATION.

LOAD CELL CALIBRATION PROCEDURE

1. Locate the wire attached to the load cell assembly.
2. Select SETUP from the main screen.
3. Select CALIBRATE LOAD CELL from the setup screen.
4. The first screen in the calibration process describes the 2 point calibration process. Select OK to continue.
5. The next screen measures the low calibration value desired (typically 0). Make sure that you do not have a weight hanging from the calibration string and select OK.
6. The next screen measures the high calibration value desired. This weight should be close to the maximum expected test value. Hang the weight on the loop end of the calibration wire making sure that the wire is able to move freely. See photo below.
7. Set the high calibration value by selecting CHANGE and entering the value of the weight in grams and select ENTER.
8. Make sure that the calibration weight is completely at rest and then select OK.

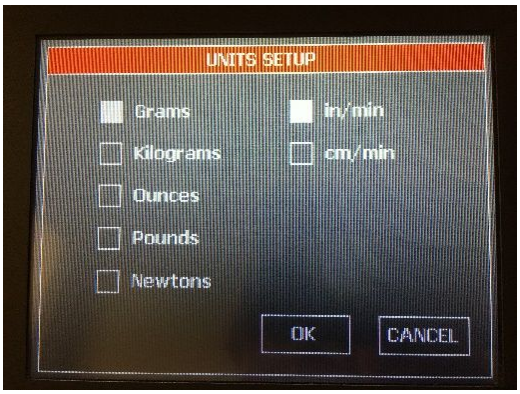
9. The display will show the main screen and the current reading of force will be displayed under CURRENT LOAD.
10. Verify the calibration by hanging a different calibration weight on the calibration wire.
11. Repeat the calibration procedure if necessary.



SETTING FORCE AND SPEED UNITS

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

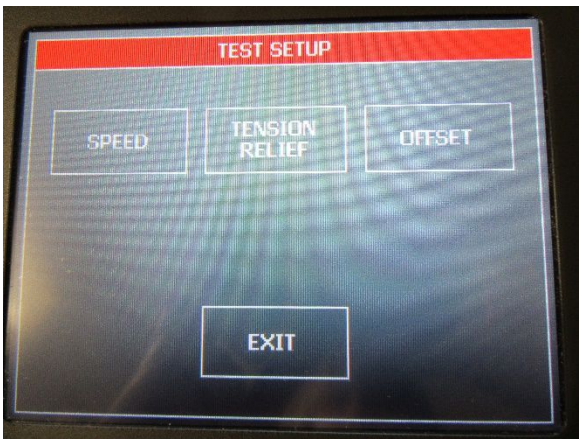
1. Select SETUP from the main screen.
2. Select UNITS from the setup screen.
3. Select the desired units and select OK to confirm the entered units.



TEST SETUP

Test setup allows the speed, tension relief, and data 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

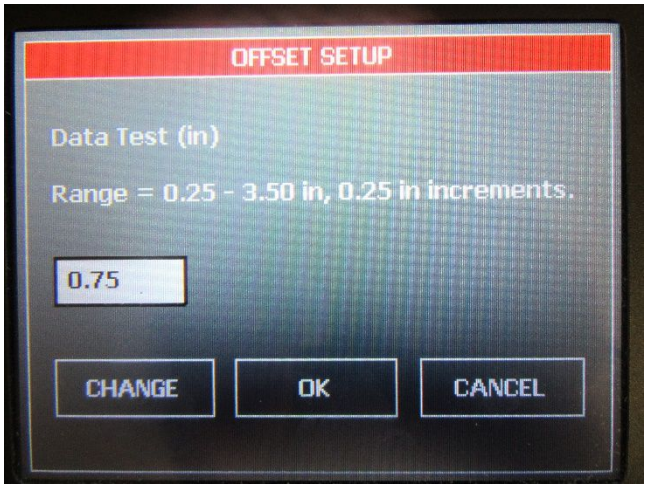
To perform a test correctly, it is necessary to set the test speed in accordance with the selected test method. The following is a step-by-step procedure for setting the speed.

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

DATA TEST

To collect test data correctly, it is necessary to set the data test length. The following is a step-by-step procedure for setting the data test distance.

1. Select SETUP from the main screen.
2. Select OFFSET from the setup screen.
3. Select CHANGE and enter the desired data test value in the selected units and press ENTER. Select OK to confirm the entered data test.



TENSION RELIEF

If Tension Relief mode is ON and there is more than 50 grams of force on the load cell when a test is started, the cart will move 0.25 inches to the right to attempt to relieve the tension. At this point, if there is less than 50 grams of force then the cart will move to the left at 5 inches/minute until 50 grams are measured. Once the 50 grams are registered, the test will begin. If there are still more than 50 grams measured after the tension relief distance, then the test will be aborted and an error message will be displayed.

If Tension Relief mode is OFF and there is less than 50 grams of force on the load cell when a test is started, the cart will move to the left at 5 inches/minute until 50 grams are measured. Once the 50 grams are registered, the test will begin. If 50 grams are never measured, then the cart will continue to move until it triggers the left distance limit which will cause the test to be aborted.

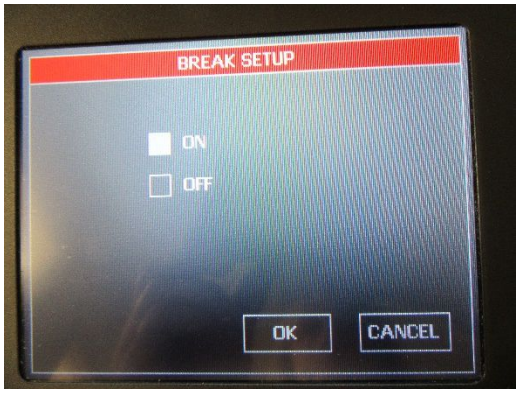
Tension Relief can be set with the following procedure.

1. Select SETUP from the main screen.
2. Select TENSION RELIEF from the setup screen.
3. Select either ON or OFF. Select OK to confirm.

BREAK

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

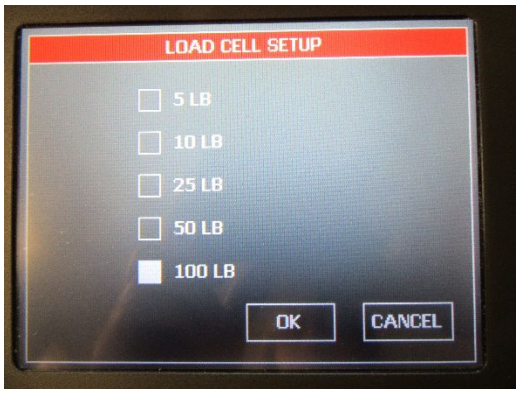
1. Select SETUP from the main screen.
2. Select BREAK from the setup screen.
3. Select the desired break setting. Select OK to confirm.



LOAD CELL SIZE

Set the installed load cell size for proper break function.

1. Select SETUP from the main screen.
2. Select LOAD CELL SIZE from the setup screen.
3. Select the installed load cell size. Select OK to confirm.



QUALIFY OPERATION

Some of the hardware functions of the DS-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.
- **AD Reading** – displays the hardware counts measured on the control board from the load cell interface. Pulling on the load cell will display values greater than 32000. Pushing on the load cell 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

Make sure the load cell has been calibrated and is reading correctly before running a test.

Set test speed, sampling distance, and tension relief mode before running a test.

Test data will not be collected until 50 grams of force are measured by the load cell.

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.

The load cell samples at 50 times per second for speeds of 0.05 – 0.3 inches/minute. Eight samples are collected, averaged, and stored as a data point. Therefore, a test will generate data points every 160 milliseconds.

The load cell samples at 400 times per second for speeds of 0.35 – 2 inches/minute. 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.

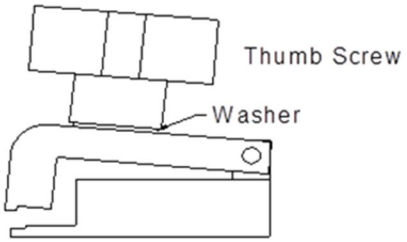
TENSION RELIEF

If Tension Relief mode is ON and there is more than 50 grams of force on the load cell when a test is started, the cart will move 0.25 inches to the right to attempt to relieve the tension. At this point, if there is less than 50 grams of force then the cart will move to the left at 5 inches/minute until 50 grams are measured. Once the 50 grams are registered, the test will begin. If there are still more than 50 grams measured after the tension relief distance, then the test will be aborted and an error message will be displayed.

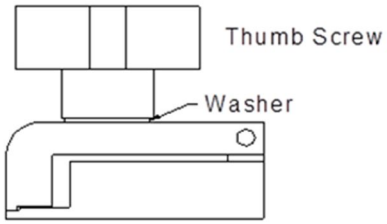
If Tension Relief mode is OFF and there is less than 50 grams of force on the load cell when a test is started, the cart will move to the left at 5 inches/minute until 50 grams are measured. Once the 50 grams are registered, the test will begin. If 50 grams are never measured, then the cart will continue to move until it triggers the left distance limit which will cause the test to be aborted.

GRIP OPERATION

The grip opens by turning the thumb screw counter-clockwise. Insert the free end of the sample into the open grip and close the grip by turning the thumb screw clockwise.



Grip Open



Grip Closed

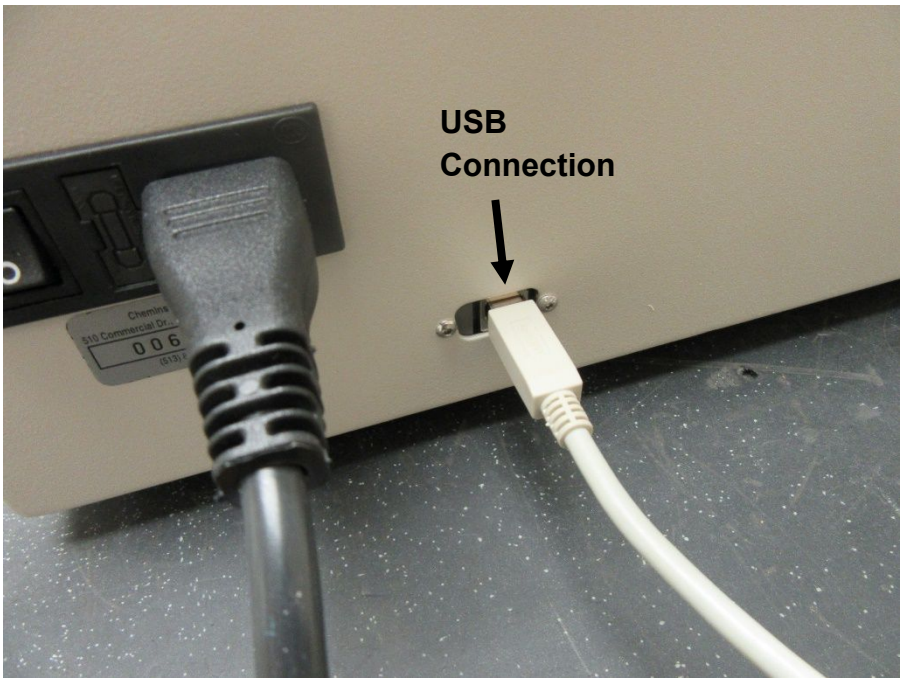
NOTE: The grip is attached directly to the load cell. Do not move the grip sideways or up and down. When opening and closing the grip, support it with one hand and operate the thumb screw with the other hand to avoid damaging the load cell. For proper operation of the load cell it is necessary for the grip to be mounted with a space between the load cell housing and the grip. DO NOT TIGHTEN THE GRIP AGAINST THE LOAD CELL HOUSING.

WARNING: Rotating the Grip on the threaded mounting rod, causing the Grip to come in contact with the wall of the load cell housing will damage the load cell. There must be a physical gap maintained between the Grip and the load cell housing for the load cell to function correctly.

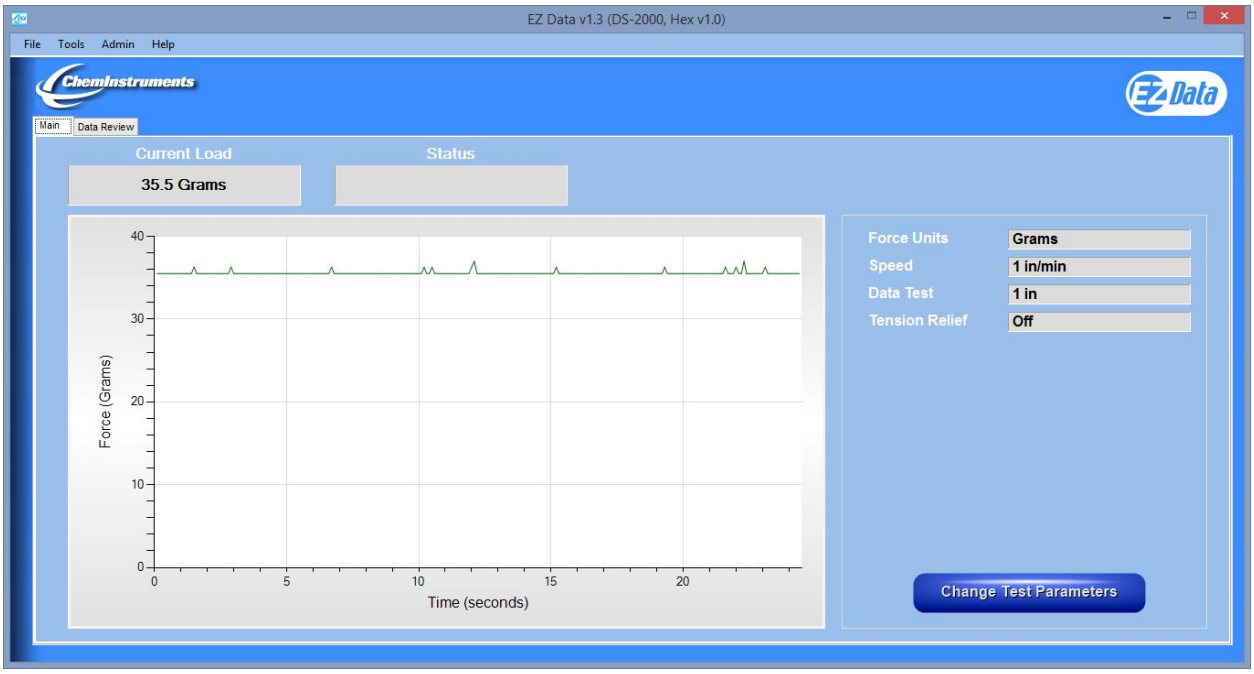
EZ DATA

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 EZ Data.

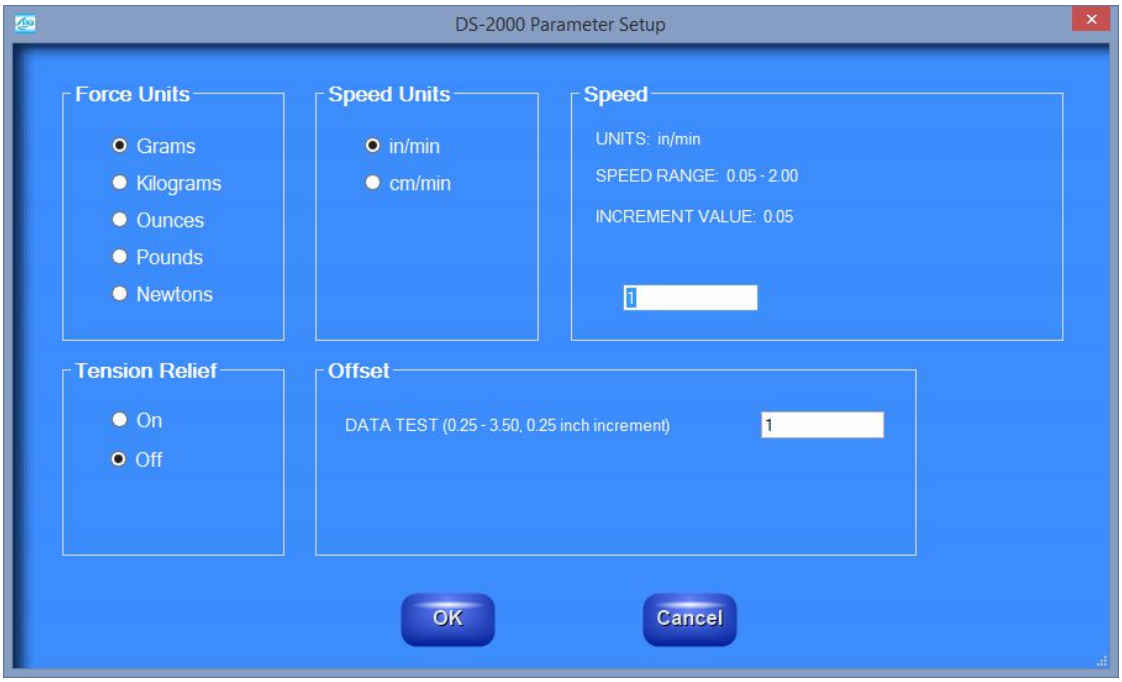
The DS-2000 can be connected to your computer with a Type A-B, Revision 2.0 Compliant, USB cable.



The following picture is the main screen of EZ Data with a DS-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.



DS-2000 parameter setup.



MAINTENANCE

TROUBLESHOOTING

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

Troubleshooting Chart

Problem	Possible Cause	Procedure
No Data collected	Display is in SETUP screen	Go to MAIN screen to run a test
Data measurement consistently low/high	Improper calibration	Check calibration and/or calibration angle
	Bad calibration	Refer to load cell calibration
Calibration drifts	Bad or damaged load cell	Replace load cell
Display is black.	Display is bad.	Replace display.
	Power switch is not ON.	Turn ON power.
	Power supply is bad.	Replace power supply.
	E-Stop is enabled.	Rotate E-Stop clockwise to disable.
Display is stuck at ChemInstruments logo.	Control board is bad.	Replace control board.

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, tolulene, 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.