



# **90 DEGREE PEEL TESTER**

**MODEL PA-2000-90**

**OPERATING INSTRUCTIONS**

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

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

**Revision 1.0**

**November 5, 2018**

## CONTENTS

PRODUCT DESCRIPTION .....	3
SPECIFICATIONS.....	3
UNPACKING.....	4
ASSEMBLY.....	5
CONNECTING THE POWER CORD .....	6
KEY COMPONENTS .....	7
OPERATION.....	9
POWER UP.....	9
GRIP OPERATION.....	10
TOUCH SCREEN FORMAT.....	11
MACHINE SETUP .....	15
PEEL RATE/LENGTH GEOMETRY DISCUSSION.....	20
RUNNING A TEST .....	21
EZ DATA SOFTWARE SYSTEM.....	23
MAINTENANCE .....	25
TROUBLESHOOTING .....	25
MAINTENANCE PROCEDURES .....	25
CLEANING THE TOUCH SCREEN .....	26

## PRODUCT DESCRIPTION

Congratulations on the purchase of your new ChemInstruments PA-2000-90, 90 Degree Peel Tester. This user-friendly, carefully designed instrument allows you to determine 90 degree adhesive and release values of many different materials, according to many test methods including ASTM D-3330.



**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:

- Internal load cell accurate to 0.1% of full scale.
- One step test sequence.
- Peel length is programmable.
- 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, 2 amps
<b>Operating Temperature</b>	32 – 122 degrees Fahrenheit (0 – 50 degrees Celsius)
<b>Humidity</b>	0 – 55% relative humidity
<b>Speed</b>	1 - 24 inches/minute, 1 IPM increments 3 - 60 centimeters/minute, 1 CPM increments
<b>Peel Length</b>	0.5 – 4.5 inches, 0.5 inch increments 1.25 – 11.25 centimeters, 1.25 centimeter increments
<b>Physical Dimensions</b>	Width: 18 inches (46 centimeters) Depth: 10 inches (25 centimeters) Height: 25 inches (63 centimeters) Weight: 45 pounds (20 kilograms)

## UNPACKING

ChemInstruments has made every effort to ensure that the PA-2000-90 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 PA-2000-90 consists of the following parts:

- 90 degree peel tester.
- An envelope with this manual.
- Calibration cable (attached).
- 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 them 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 PA-2000-90 in an area where temperature and humidity are controlled to standard conditions of  $72 \pm 2$  degrees Fahrenheit and  $50 \pm 5\%$  relative humidity.

Level the PA-2000-90 tester by adjusting the four leveling feet located at each corner of the unit.



## CONNECTING THE POWER CORD



**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 at the far right 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 PA-2000-90, 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.
- **TEST PLATFORM** consists of the moving platform with test panel brackets.
- **TEST PANEL BRACKETS** hold standard 2 inch wide test panels during testing.
- **LOAD CELL** measures the forces involved with a peel test.
- **LOAD CELL MOUNT** is the adjustable position housing that contains the Load Cell.
- **GRIP** holds the sample and is attached to the load cell.
- **CALIBRATION PAD** is a small circular platform on the top of the Load Cell Mount.
- **TEST TRACK** is the path that the Test Platform travels during a test.



- **TOUCH SCREEN DISPLAY** is the control center for the PA-2000-90.



## OPERATION

An adhesive sample is peeled at a 90 degree angle while attached to the load cell grip.

An electronic load cell measures the peel force, then feeds the information to a data acquisition unit. The data acquisition unit collects the test data from the load cell and stores this information in memory for use in calculating the maximum, minimum and average values.

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 10,000 data points can be saved with any given test.

## POWER UP

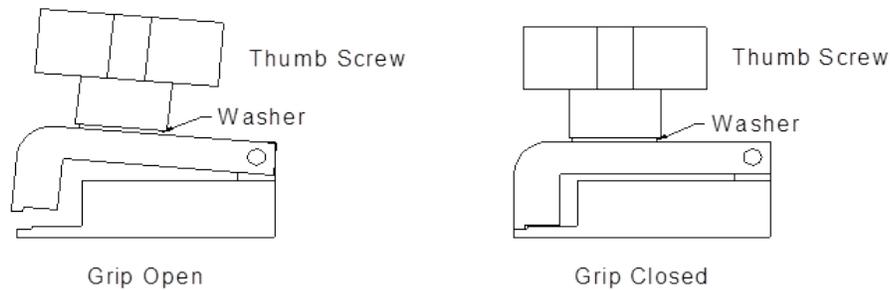


**WARNING: Operating temperature for this equipment is 32 to 122 degrees Fahrenheit (0 to 50 degrees Celsius). The equipment needs to be completely free of condensation, inside and out, before applying power.**

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

## GRIP OPERATION

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



**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.

## TOUCH SCREEN FORMAT

### MAIN SCREEN

---

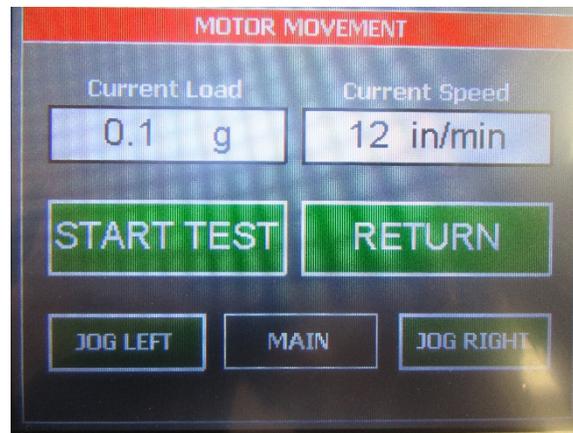
- **Current Load** – displays the force currently measured by the load cell.
- **Current Speed** – displays the set speed of the drive roll.
- **Sled Movement** – will display a new screen which will allow the user to jog or start a test.
- **Setup** – will display all setup options.
- **Graph** – will 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

---

- **Start Test** – starts a test.
- **Return** – moves the test platform to the start position of the last test.
- **Jog Left** – jogs the test platform left until the STOP JOG button is pressed.
- **Main** – will go back to the main screen.
- **Jog Right** – jogs the test platform right until the STOP JOG button is pressed.



## SETUP SCREEN

---

- **Calibrate Load Cell** – allows the user to calibrate the load cell.
- **Units** – change the force units and/or the speed units.
- **Speed** – set the test platform's test speed.
- **Peel Length** – is used to select the peel length.
- **Tension** – is used to turn on/off the function to look for 20 grams of force before starting to measure test data.
- **Qualify Operation** – is used to troubleshoot hardware problems with the PA-2000-90.
- **About** – retrieve the machine's software version and control board's hardware revision.
- **Exit** – go back to the main screen.

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



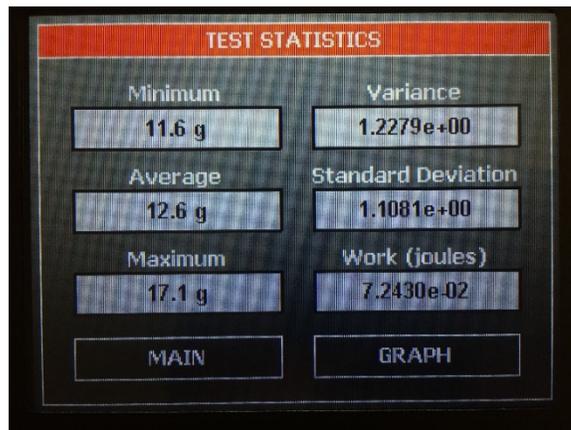
## GRAPH SCREEN

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.



## 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 PA-2000-90. This procedure should be followed upon first use of the PA-2000-90 and whenever necessary thereafter. The following is the step-by-step procedure for calibrating the load cell.



**MAKE SURE THE PA-2000-90 HAS BEEN 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

---

1. Select SETUP from the main screen.
2. Select CALIBRATE LOAD CELL from the setup screen.
3. The first screen in the calibration process describes the 2 point calibration process. Select OK to continue.
4. The next screen measures the low calibration value (typically 0). Make sure that you do not have a weight on the Calibration Pad and select OK.
5. The next screen measures the high calibration value. This weight should be close to the maximum rated load cell value. Place the weight on the Calibration Pad.
6. Set the high calibration value by selecting CHANGE and entering the value of the weight in grams and select ENTER.
7. Make sure that the calibration is on the Calibration Pad and then select OK.

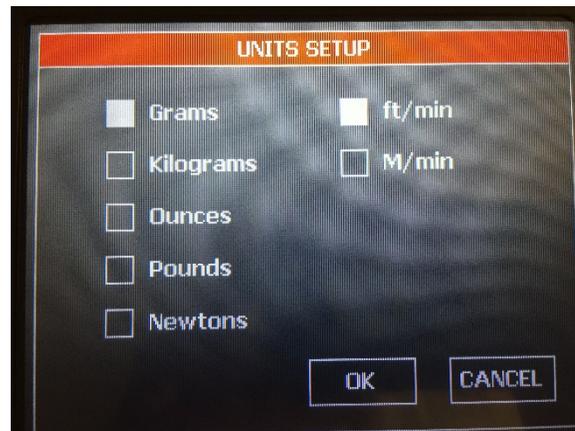
8. The display will show the main screen and the current reading of force will be displayed under CURRENT LOAD.
9. Verify the calibration by placing a different calibration weight on the Calibration Pad.
10. Repeat the calibration procedure if necessary.

## 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. Select OK to confirm the entered units.

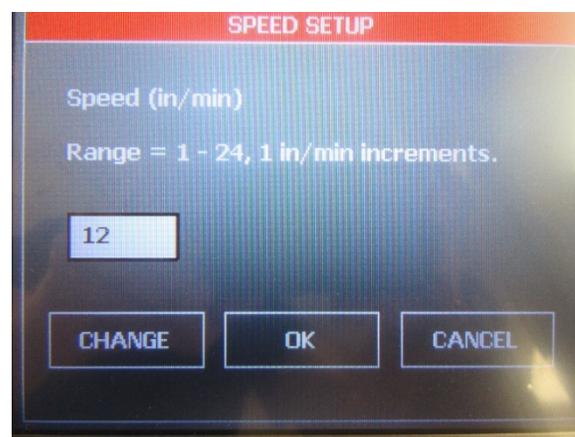


## SPEED

---

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.

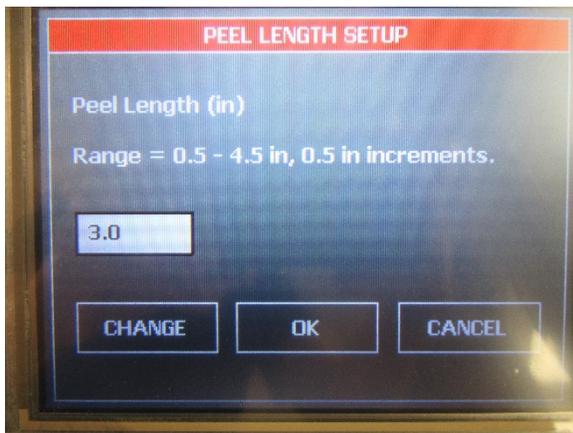
1. Select SETUP from the main screen.
2. Select SPEED from the setup screen.
3. Select CHANGE and enter the desired sled speed in the selected units and press ENTER. Select OK to confirm the entered speed.



## PEEL LENGTH

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

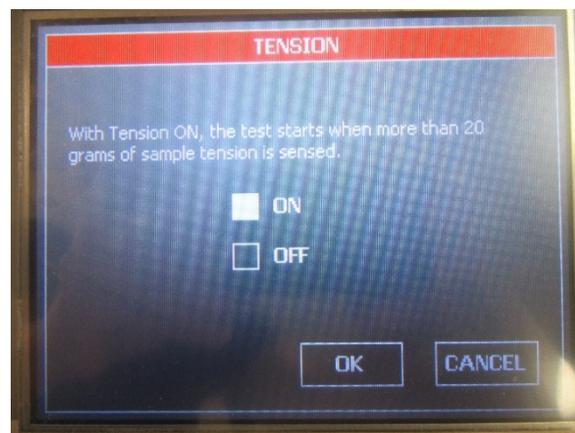
1. Select SETUP from the main screen.
2. Select PEEL LENGTH from the setup screen.
3. Select CHANGE and using the arrow buttons, select the desired peel length and select OK. Select OK again to confirm the entered peel length.



## TENSION

If tension mode is ON then the load cell must measure more than 20 grams of force before the distance measurement will begin.

1. Select SETUP from the main screen.
2. Select TENSION from the setup screen.
3. Select ON or OFF and select OK to confirm tension.



## QUALIFY OPERATION

---

Some of the hardware functions of the PA-2000-90 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 sled.
- **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.
- **Start Test** – will run a test at the set speed. A test can be simulated with a weight hanging to verify the load cell calibration if necessary.



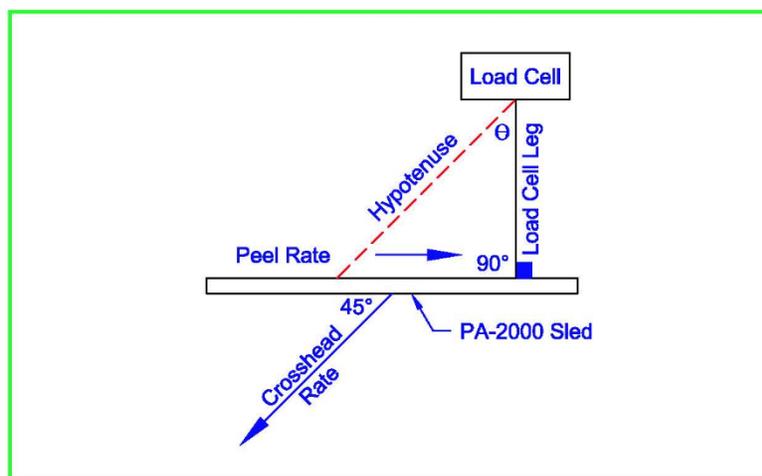
## PEEL RATE/LENGTH GEOMETRY DISCUSSION

### PA-2000-90 PEEL RATE GEOMETRY

- Refer to the diagram below
- Crosshead Rate = Hypotenuse (This is the speed set on machine control)
- Peel Rate = Load Cell Leg
- Load cell angle of triangle =  $\theta = 45^\circ$  (based on  $90^\circ$  peel test)
- Formula to solve for load cell leg of triangle:
  - Peel Rate =  $\text{Cos}(\theta) * \text{Crosshead Rate}$
- Using a Crosshead Rate of 12 inches/minute
- Peel Rate =  $\text{Cos}(\theta) * 12$ , where  $\text{cos}(45^\circ)$  is 0.707
- The Peel Rate equals 8.5 inches/minute for a Crosshead Rate of 12 inches/minute

### PA-2000-90 PEEL LENGTH GEOMETRY

- Refer to the diagram below
- Peel Length = The Test Length set on machine control
- Crosshead Length of Travel = The actual length that the crosshead travels to peel the entered Peel Length
- Formula to solve for crosshead length of travel:
  - Crosshead length of travel =  $\text{Peel Length} / \text{Cos}(\theta)$
- Using a Peel Length of 2 inches
- Crosshead Length of Travel =  $2 / \text{Cos}(\theta)$ , where  $\text{cos}(45^\circ)$  is 0.707
- The Peel Length equals 2 inches and the Crosshead Length of Travel is 2.8 inches.



## RUNNING A TEST

Make sure the load cell has been calibrated and is reading correctly.

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 10,000 data points can be saved with any given test.

## TEST PROCEDURE

---

1. Prepare your sample according to the chosen test method, and slide the test panel into the Test Panel Bracket.
2. Place the leading loose end of your sample in the Load Cell Grip.
3. Set speed and peel length as described in setup.



**WARNING: Before proceeding, make sure there is nothing in the path of the test platform.**

4. Push START TEST on the display.
5. Wait for the test platform to come to a complete stop.
6. The internal computer will calculate the average, high, and low values measure during the preset peel length.
7. 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.



**WARNING: Make sure there are no objects in the test platform's path before pushing the Return button**

8. Pushing RETURN on the display will return the test platform to the start position for the next test.

**NOTE: The sled moves 1.4 times the actual distance peeled when peeling at 90 degrees. See Peel Rate/Length Geometry discussion above.**

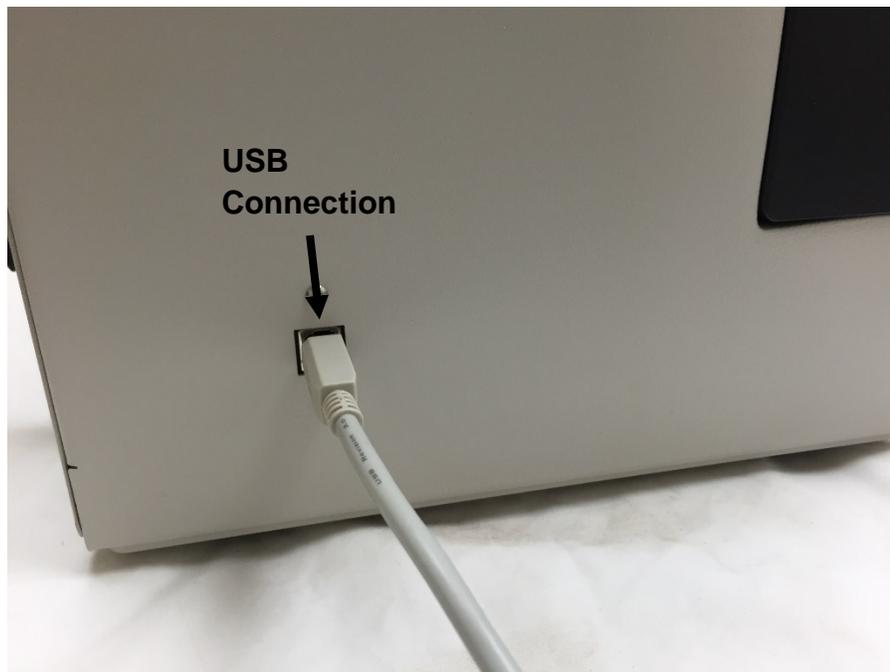
**NOTE:**

1. When tension mode is ON, the PA-2000-90 does not begin measuring distance until 20 grams of force is measured by the load cell. If tension mode is OFF, then the PA-2000-90 starts measuring distance immediately.
2. After the 20 gram threshold has been passed (with tension mode ON), the test platform will travel enough distance to peel  $\frac{1}{2}$  inch of the sample. During this time, measured forces are NOT recorded.
3. After this point, the test platform continues to travel the distance necessary to peel the programmed length of the sample. During this distance traveled, the measured forces are recorded and used to calculate test results.
4. The test platform will travel another  $\frac{1}{2}$  inch, during which measured forces are NOT recorded, before stopping to complete the test sequence.

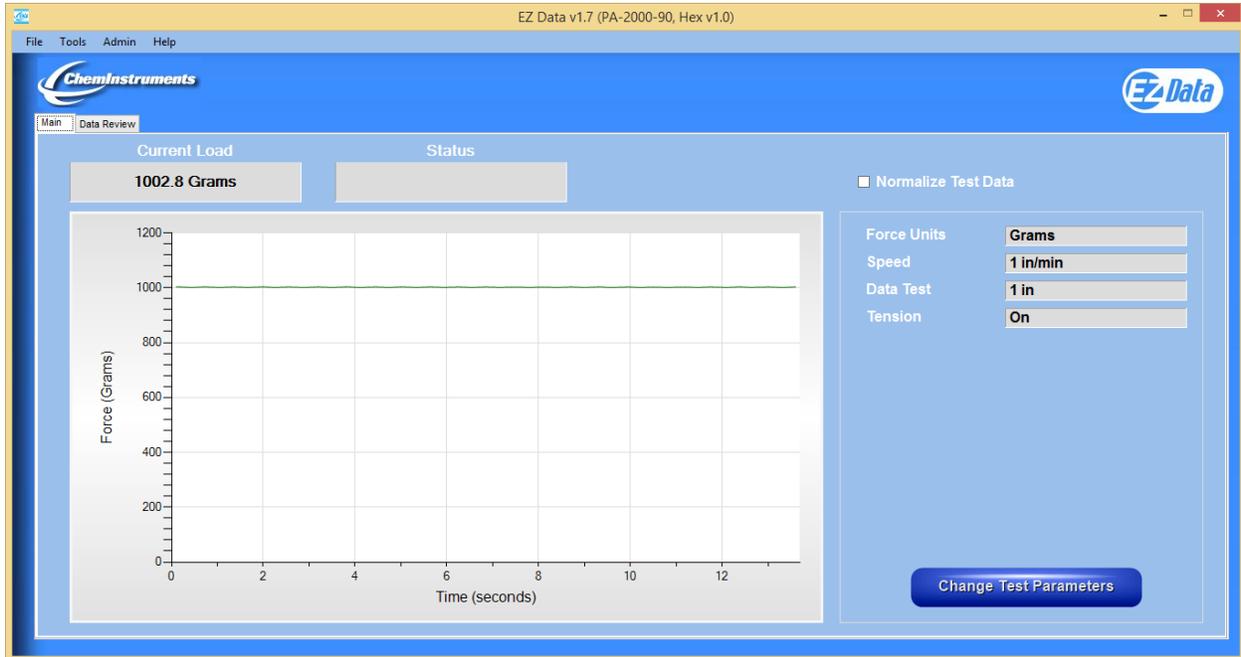
## EZ DATA SOFTWARE SYSTEM

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.

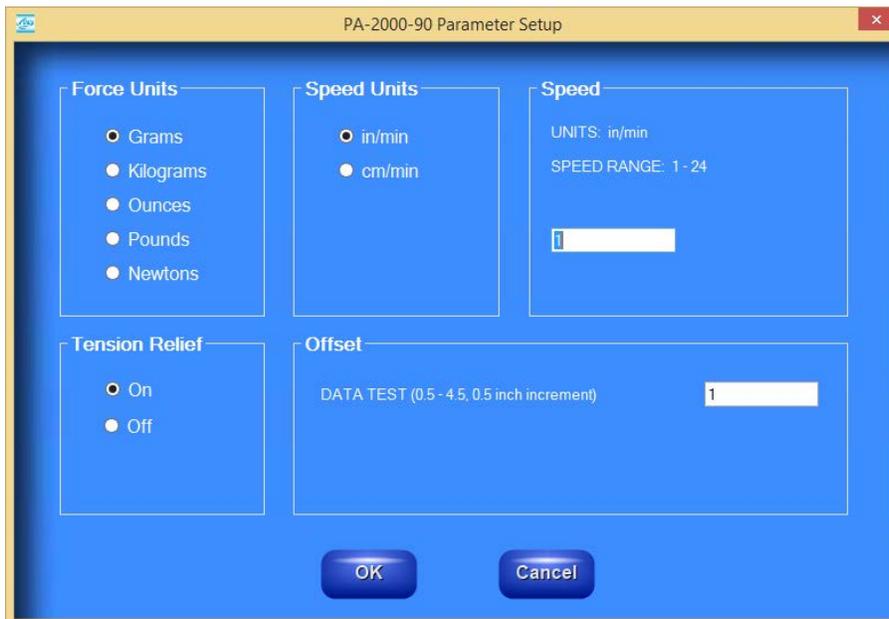
The PA-2000-90 can be connected to your computer with a Type A-B, Revision 2.0 Compliant, USB cable.



The following picture is the main screen of EZ Data with a PA-2000-90 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 PA-2000-90 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
	Sample is not attached to the load cell	Attach sample to load cell per drawing
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.
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, 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.