ADHESION/RELEASE TESTER

MODEL AR-2000

OPERATING INSTRUCTIONS

CHEMINSTRUMENTS

510 COMMERCIAL DRIVE

FAIRFIELD, OHIO 45014

(513) 860-1598

www.cheminstruments.com

Revision 1.3

August 23, 2018

CONTENTS

PRODUCT DESCRIPTION 3
SPECIFICATIONS 3
UNPACKING 4
ASSEMBLY 5
ATTACHING MAST AND LOAD CELL ASSEMBLY 6
ATTACHING SWITCHES 8
CONNECTING THE POWER CORD 8
KEY COMPONENTS 10
OPERATION 13
POWER UP 13
TOUCH SCREEN FORMAT 14
MACHINE SETUP 17
PEEL RATE GEOMETRY/DISCUSSION 23
RUNNING A TEST 25
EZ DATA 32
MAINTENANCE 36
TROUBLESHOOTING 36
MAINTENANCE PROCEDURES 38
CLEANING THE TOUCH SCREEN 40

PRODUCT DESCRIPTION

Congratulations on the purchase of your new ChemInstruments AR-2000 Adhesion/Release Tester. This versatile, user-friendly, carefully designed instrument allows you to determine adhesion and release values of adhesive laminates at various speeds and at various angles of separation.

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:

- 2 modes of operation: constant speed and ramped speed testing.
- Selectable testing speeds.
- Selectable separation angles from 90 degrees to 180 degrees.
- User-selectable data acquisition area on the test sample.
- Selectable units of measure: Kilograms, Grams, Newtons, Pounds, & Ounces.
- Compatible with EZ Data System software. See www.cheminstruments.com for details.

SPECIFICATIONS

Electrical	120 VAC, 50/60 Hz, 5 amps or 240 VAC, 50/60 Hz, 5 amps
Operating Temperature	32 – 150 degrees Fahrenheit (0 – 70 degrees Celsius)
Humidity	0 – 55% relative humidity
Speed	1 – 1200 inches/minute (1 inch increments) 3 – 3048 centimeters/minute (1 centimeter increments)
Physical Dimensions	Width: 36 inches (91 centimeters) Depth: 13 inches (33 centimeters) Height: 24 inches (61 centimeters) Weight: 92 pounds (42 kilograms)

UNPACKING

ChemInstruments has made every effort to ensure that the AR-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 AR-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.
- The mast for mounting the load cell assembly.(Strapped to the wood 2x2 bracing)

Within the crate is a small box containing the following parts:

- The pivoting bracket and attached load cell assembly with calibration bracket and wire.
- 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 AR-2000.

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 AR-2000 in an area where temperature and humidity are controlled to standard conditions of 72 ± 2 degrees Fahrenheit and 50 ± 5% relative humidity.

ATTACHING MAST AND LOAD CELL ASSEMBLY

Attach the mast to the test frame using the small clamping knobs that are included. Make sure the mast is mounted with the flat side on the backside as shown in Figure 2. The attachment holes for the mast are located on the back panel of the test frame toward the left end of the frame when viewed from the back.

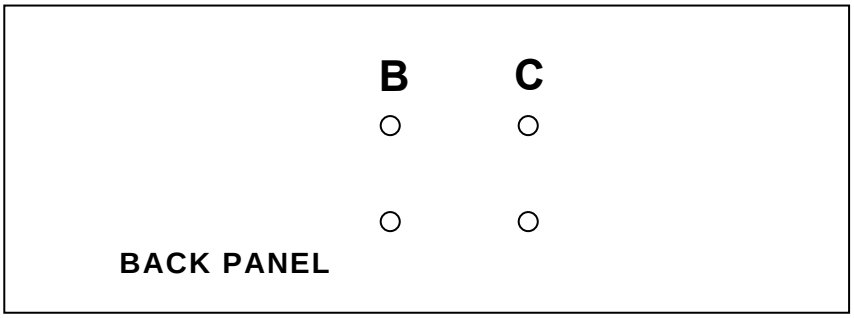


Figure 1 - Mast Mounting Locations

NOTE: If the tests to be run use relatively short sample strips at 90° or 180°, mount the mast using the holes marked “C” in Figure 1. If testing longer strips, mount the mast using holes marked “B” in Figure 1.

Slide the pivoting bracket with load cell assembly onto the mast and tighten the large clamping bolt that is part of the assembly. On the side panel of the AR-2000, one end of the load cell cable is permanently attached. Plug the free end of this cable into the socket on the load cell assembly. (See Figure 2)

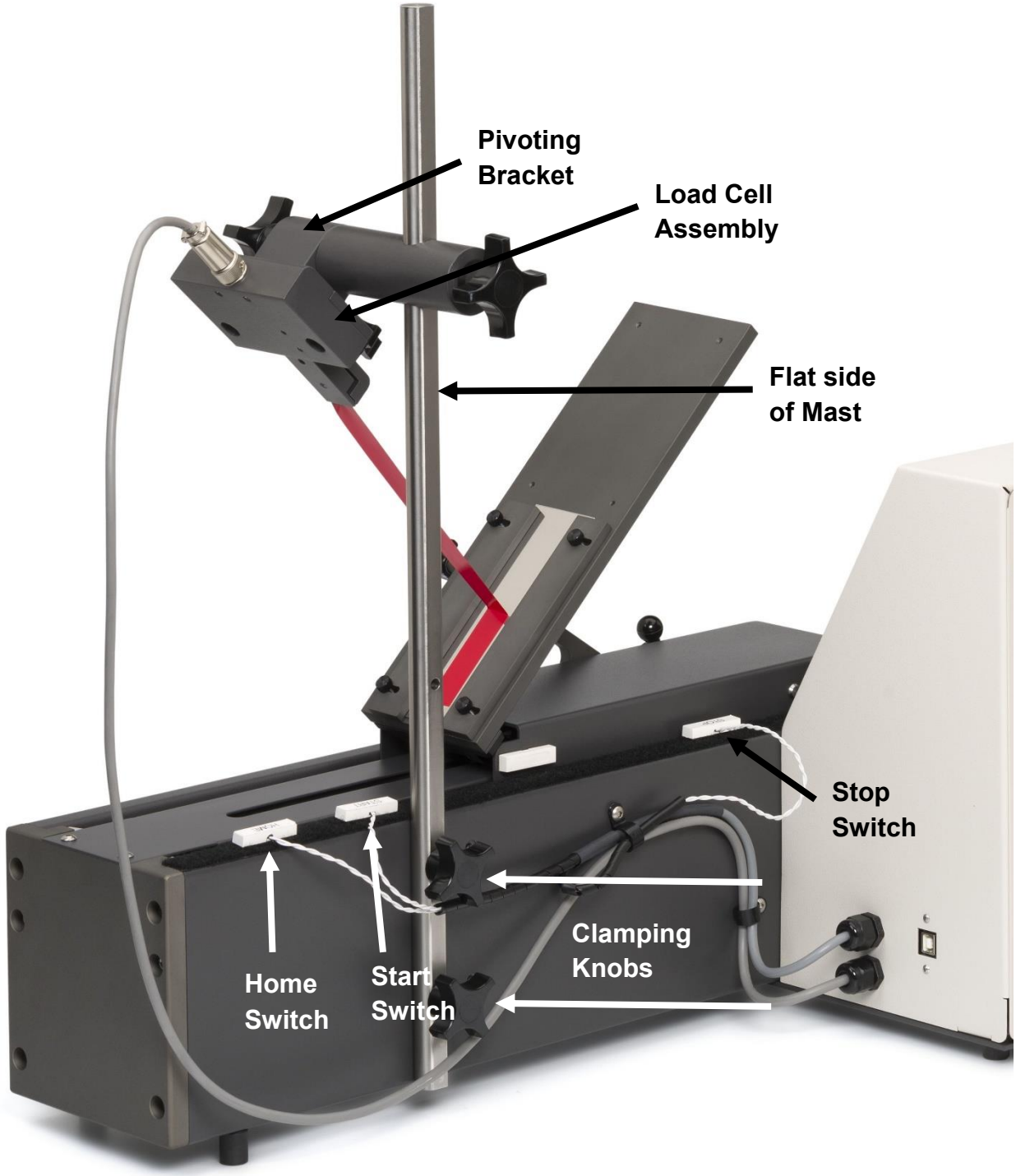

Pivoting
Bracket
Load Cell
Assembly
Flat side
of Mast
Stop
Switch
Clamping
Knobs
Home
Switch
Start
Switch

Figure 2

ATTACHING SWITCHES

One end of the control cable is also permanently attached to the side panel of the control cabinet. The free end of this cable terminates in three white reed switches, marked “Home”, “Start” and “Stop”. Each of these reed switches carries a piece of Velcro® fastener that is designed to attach to the fastener tape located on the back rail of the test frame. Attach the reed switch marked “Home” to this tape at the right end of the test frame. Attach the reed switch marked “Start” to this tape at a location approximately 2 inches to the left of the “Home” switch. Attach the reed switch marked “Stop” to this tape at a location approximately even with the side of the control cabinet. See Figure 2 for switch locations.

CONNECTING THE POWER CORD

WARNING: Make sure the power source matches the requirements of the Adhesion Release Tester. Damage will occur if this unit is plugged into the incorrect power supply. The AR-2000 is NOT a dual voltage machine.

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.

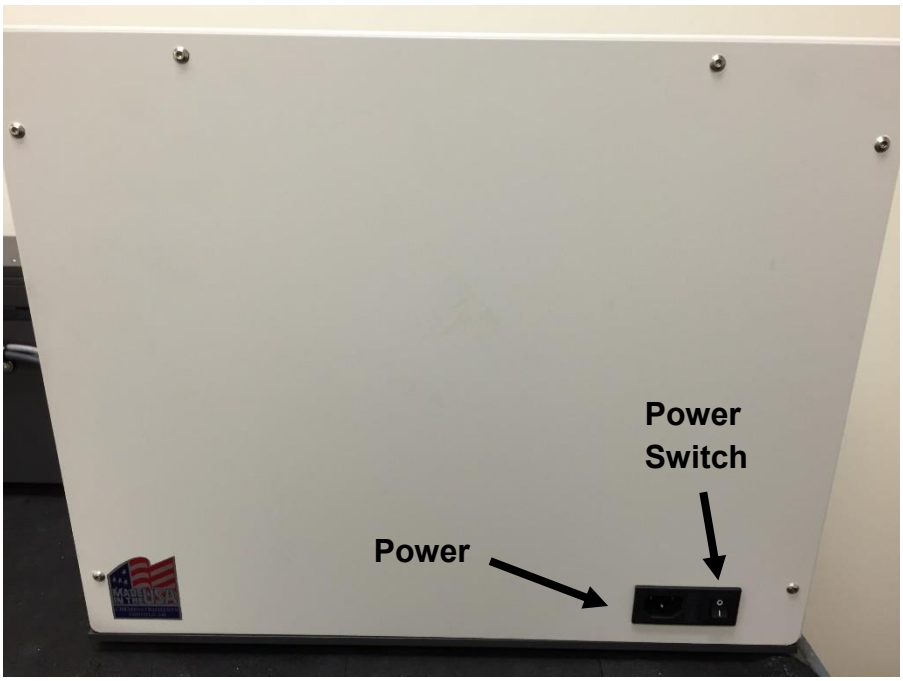


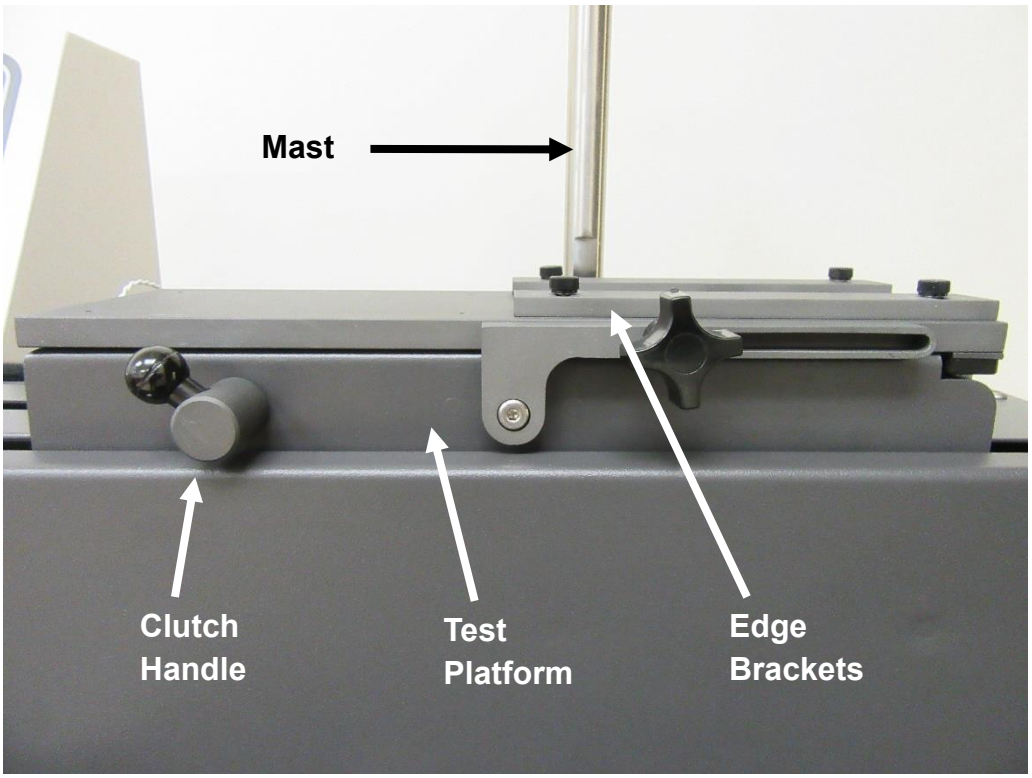
Figure 3

WARNING: Before proceeding with using the AR-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.

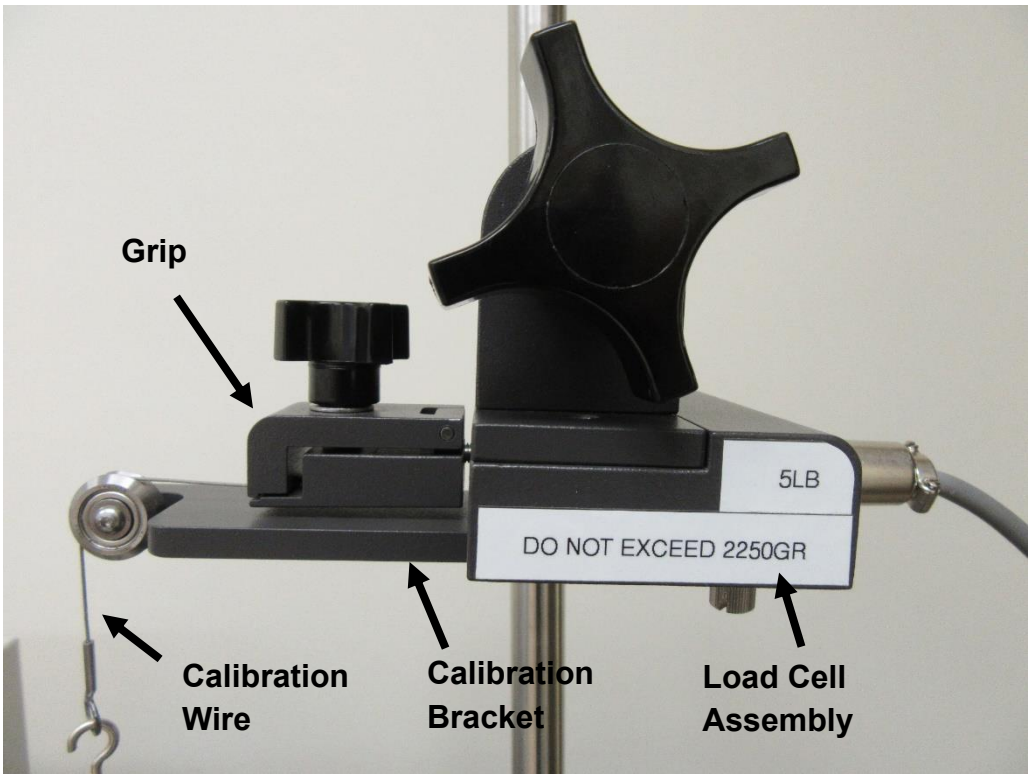
KEY COMPONENTS

- **POWER SWITCH** is located on the back panel of the control cabinet directly beside the power cord connection**.** (See Figure 3)
- **FUNCTION SWITCHES** control the start and stop of data acquisition. The "Home" switch cycles the data acquisition unit into its "ready" mode. The "Start" switch starts the data acquisition and the "Stop" switch stops the data acquisition. (See Figure 2)

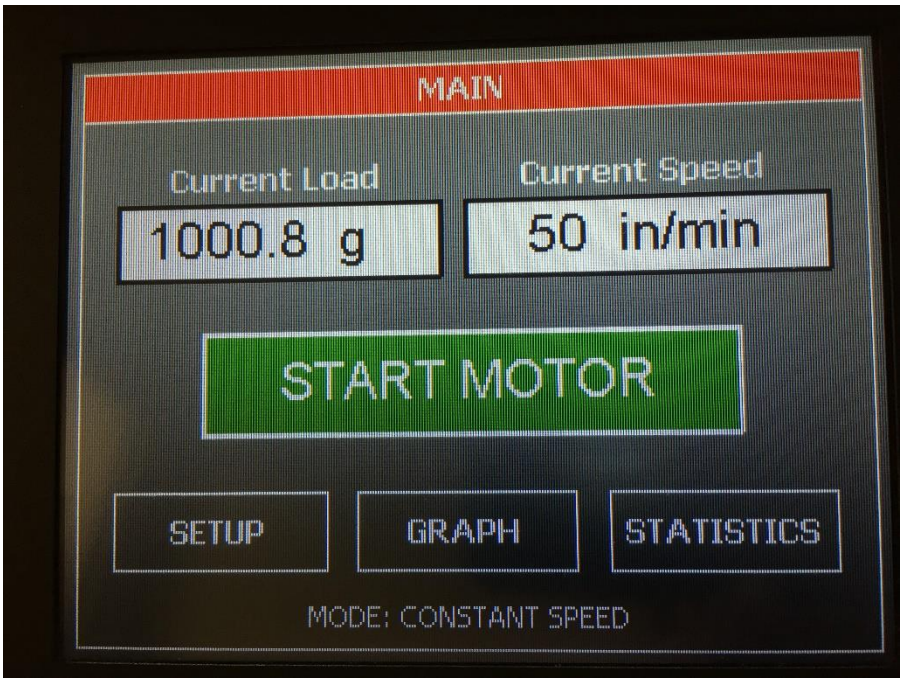
- **TEST PLATFORM** provides a surface to hold the test material.
- **EDGE BRACKETS** hold test panels in place on the test platform.
- **CLUTCH HANDLE** engages and disengages the test platform with the drive chain. The clutch handle is disengaged when the handle is to the left. The clutch handle is engaged when the handle is to the right. The clutch handle is disengaged in the photo below.
- **MAST** holds the pivoting bracket with load cell assembly and permits running tests at angles between 90° and 180°. A small peg on the backside of the mast allows for convenient positioning of the load cell for testing at a 180° angle.



- **LOAD CELL** measures the forces involved with an Adhesion/Release 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.
- **CALIBRATION BRACKET and CALIBRATION WIRE** are used in the load cell calibration process.



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



OPERATION

A pressure-sensitive adhesive laminate sample is peeled at a selected angle (typically 90° or 180°) and at a selected speed (from 1 - 1200 inches per minute). An electronic load cell measures the peel/release force, then feeds the information to a data acquisition unit. Movable reed switches are positioned along the test bed and determine the portion of the test sample data to be recorded by the data acquisition unit. The data acquisition unit collects the selected portion of test data from the load cell and stores these data points in memory for use in calculating the maximum, minimum and average values.

A load cell measures the force as the test material is peeled. 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

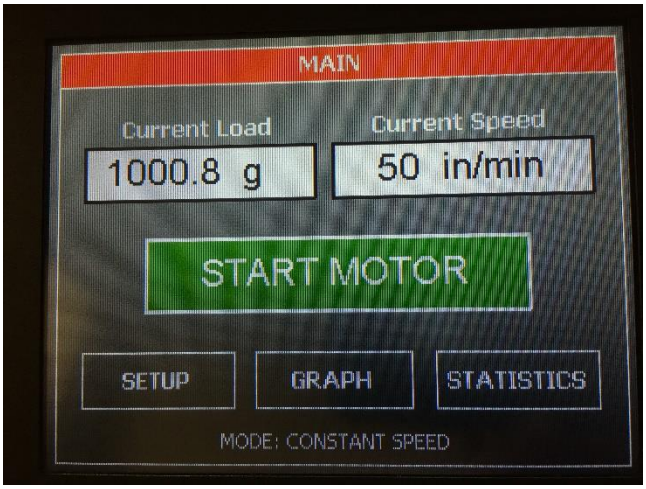
WARNING: Operating temperature for this equipment is 32 to 150 degrees Fahrenheit (0 to 70 degrees Celsius). The equipment needs to be completely free of condensation, inside and out, before applying power.

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 and then as a safety measure will not start the chain drive until the user selects the START MOTOR button on the touch screen.

TOUCH SCREEN FORMAT

MAIN SCREEN

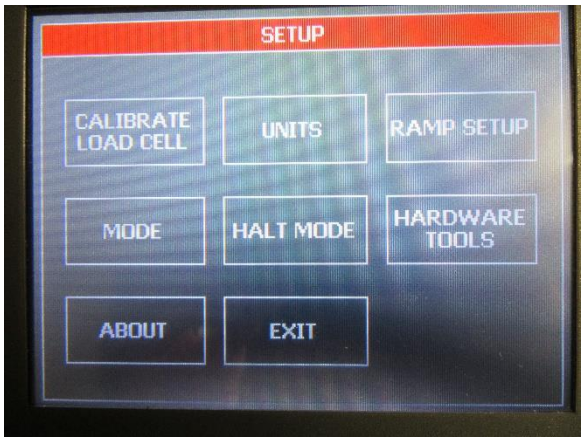
- **Current Load** – displays the force currently measured by the load cell.
- **Current Speed** – displays the set speed of the chain.
- **Setup** – will display all setup options.
- **Graph** – will display the graph, minimum, maximum, and average values of the last test.
- **Statistics** – will display the minimum, maximum, average, variance, standard deviation, and work of the last test.



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.
- **Speed/Ramp Setup** – is used to set the sled speed or ramp parameters.
- **Mode** – is used to select the constant speed mode or ramp mode.
- **Halt Mode** – is used to turn on/off automatically stopping the motor after 2 minutes of inactivity. This is only applicable in Constant Speed Mode.
- **Hardware Tools** – is used to troubleshoot hardware problems with the AR-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.

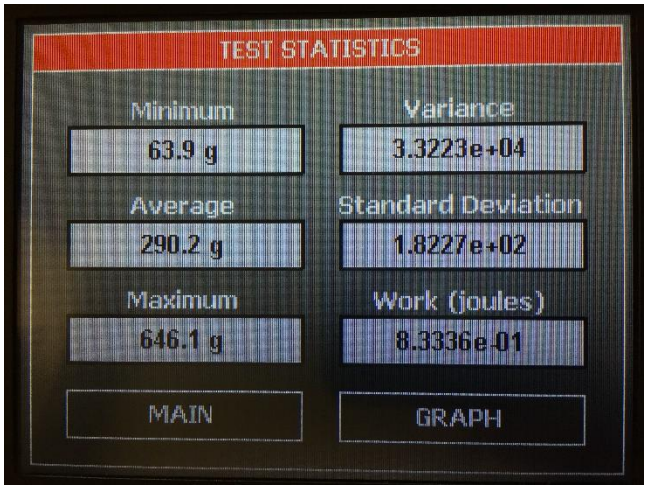


GRAPH SCREEN

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.

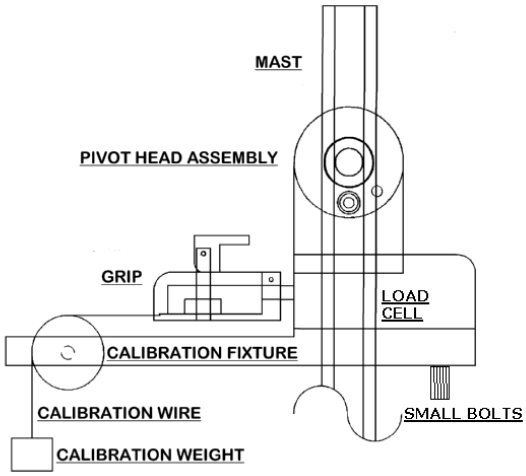


MACHINE SETUP

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

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



LOAD CELL CALIBRATION PROCEDURE

1. Move the pivot head assembly containing the load cell assembly to a position approximately 8 inches above the surface of the test frame.
2. Confirm that the load cell is mounted at the same angle as the test angle.
3. Attach the calibration fixture onto the bottom of the load cell mount using the two small bolts.

4. Place the knotted end of the calibration wire in the jaw of the grip taking care to keep the wire in a straight line from the grip to the pulley. Run the wire over the pulley so that a calibration weight can be attached to the end of the wire.
5. Select SETUP from the main screen.
6. Select CALIBRATE LOAD CELL from the setup screen.
7. The first screen in the calibration process describes the 2 point calibration process. Select OK to continue.
8. 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.
9. 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.
10. Set the high calibration value by selecting CHANGE and entering the value of the weight in grams and select ENTER.
11. Make sure that the calibration weight is completely at rest and then select OK.
12. The display will show the main screen and the current reading of force will be displayed under CURRENT LOAD.
13. Verify the calibration by hanging a different calibration weight on the calibration wire.
14. Turn motor on. Engage the test platform to simulate running a test. After the test platform has traveled to the left of the stop switch, confirm that the average measured force is the same as the selected weight hanging from the calibration string.
15. Repeat the calibration procedure if necessary.
16. Remove calibration bracket and calibration wire when finished with the calibration procedure.

MODE

The AR-2000 can be operated in a constant speed mode, ramp mode, or COF mode. The following is a step-by-step procedure for setting the mode.

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

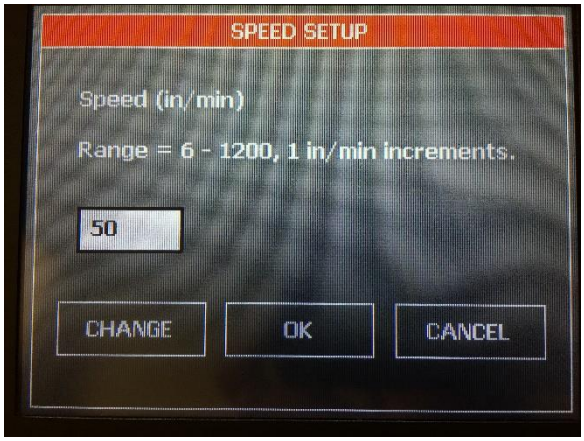
SETTING SPEED/MODE PARAMETERS

NOTE: The unit of measure for speed can be changed by selecting UNITS from the setup screen.

Constant Speed Mode

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

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.



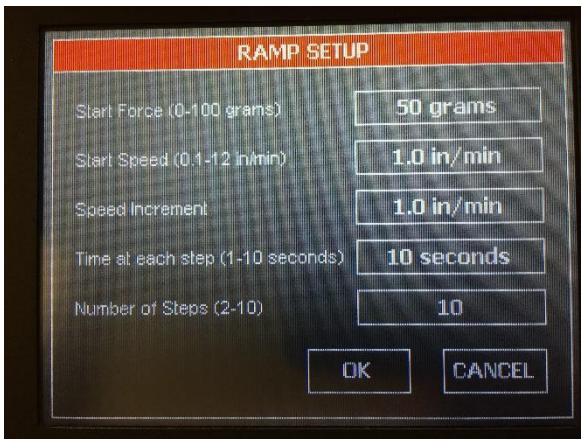
Ramp Speed Mode

The following is a step-by-step procedure for setting the ramp speed mode parameters.

1. Select SETUP from the main screen.
2. Select RAMP SETUP from the setup screen.
3. Select the box next to each parameter to enter a screen which allows you to change the value of the parameter. Select ENTER or OK to confirm the parameter.

<u>Definition of Ramp Parameters:</u>

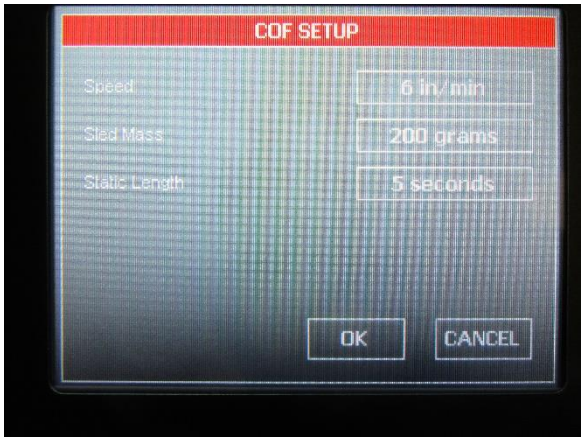
- Start Force is the force that must be measured by the load cell before the ramp will begin. The machine speed will be 5 inches/minute while trying to find the start force. If Start Force is set to zero then the ramp will begin as soon as the START TEST button is pressed.
- Start Speed is the speed for the first step of the ramp test.
- Speed Increment is the amount that the speed is incremented for each step of the ramp.
- Time at each step is the amount of time that the system will stay at the given speed.
- Number of steps is the number of different speed levels for the ramp test.



COF Setup

The following is a step-by-step procedure for setting the COF mode parameters.

1. Select SETUP from the main screen.
2. Select COF SETUP from the setup screen.
3. Select the box next to each parameter to enter a screen which allows you to change the value of the parameter. Select ENTER or OK to confirm the parameter.



Definition of COF Parameters:

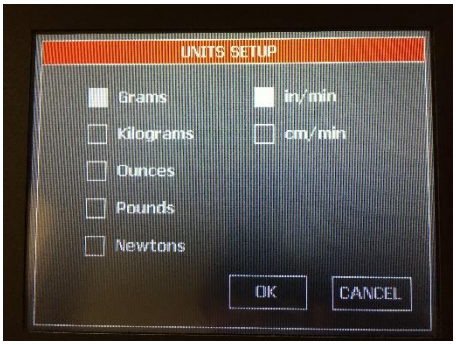
- Speed range for COF mode is 1-24 inches/minute and 3-60 centimeters/minute.
- Sled mass weight range is 1-2000 grams.
- Static Length range is 1-10 seconds.

The COF mode requires the use of a test sled which an optional fixture that can be purchased for use with the AR-2000.

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.



LOCATING FUNCTION SWITCHES FOR CONSTANT SPEED MODE

To record test data properly, it is necessary to position the function switches so that the data collected is from the center of the test material. The following is the step-by-step procedure for locating the function switches.

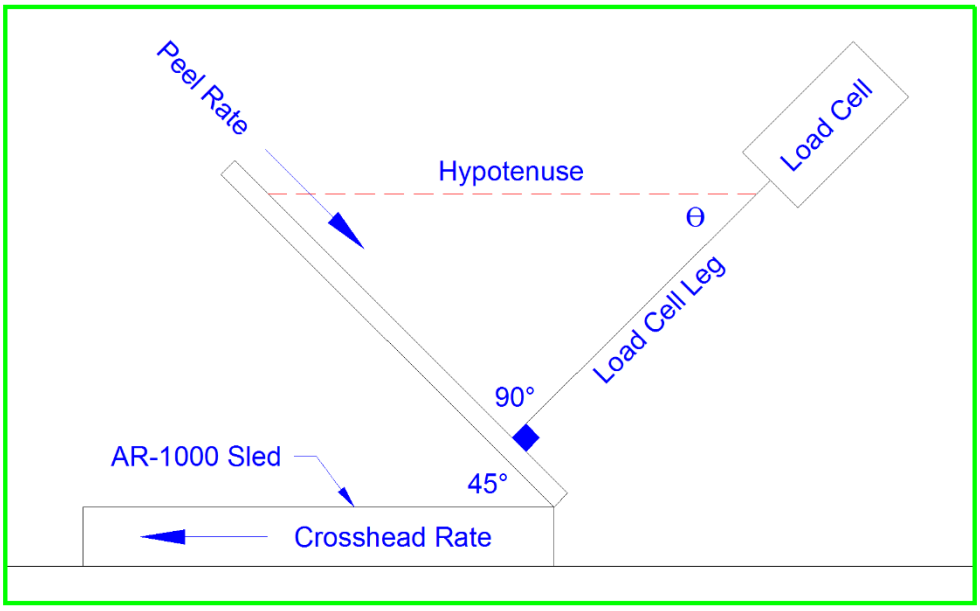
1. Determine the test method to be followed and the position of the sled for the start of the test.
2. Place the HOME switch so that it is aligned with the magnet on the back of the sled when the Sled is at the starting position.
3. Place the START switch at least **1.5 inches** to the left of the HOME switch.
4. Place the STOP switch far enough to the left of the START switch, to gather all the test data.
5. Adjust the function switches' location so that the "heart" of the test material is the data collected. A few practice tests with similar size samples are advised.

NOTE: As the test platform moves past the START switch, the display status will show "Collecting test data". The display will continue to update the current load as the test data is collected.

PEEL RATE GEOMETRY/DISCUSSION

AR-2000 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 = ɵ = 45˚ (based on 90˚ peel test)
- Formula to solve for load cell leg of triangle:
    - Peel Rate = Cos (ɵ) * Crosshead Rate
- Using a Crosshead Rate of 12 inches/minute
- Peel Rate = Cos (ɵ) * 12, where cos(45˚) is 0.707
- The Peel Rate equals 8.5 inches/minute for a Crosshead Rate of 12 inches/minute



AR-2000 PEEL RATE DISCUSSION

There is a difference in the peel rate with regards to using a 90˚ fixture on a Tensile machine versus a sled type machine such as the ChemInstruments model AR-2000. If both devices are set to operate at the same speed, the Tensile machine will peel a tape at that same rate, but the AR-2000 will peel a tape slower.

The term ***Peel Rate*** describes the separation rate at the peel junction, the point where tape separation from a test panel occurs.

The term ***Crosshead Rate*** describes the rate of the mechanism that move the test panel.

Consider a triangle that makes up the pulling and peeling functions on a Tensile machine. The peel and crosshead rates are equal since the peeling action is performed in the horizontal leg of the triangle and motion occurs in the vertical leg. Since the triangle is a right triangle when performing a 90˚ peel, the legs are equal and thus so is the Peel Rate with respect to the Crosshead Rate.

Consider a triangle that makes up the pulling and peeling functions on an AR-2000 machine. The peel and crosshead rate are ***not*** equal since the peeling action is performed in the load cell leg of the triangle and motion occurs in the hypotenuse. The Peel Rate is therefore a factor of the angle between the load cell leg and the hypotenuse, simple trigonometry applies here. Since the triangle is a right triangle when performing a 90˚ peel, the load cell leg is shorter than the hypotenuse and thus the Peel Rate is less with respect to the Crosshead Rate. Knowing the 90˚ angle of peel and using a Crosshead Rate of 12 inches/minute, the math in the above noted example works out to a Peel Rate of 8.5 inches/minute.

Therefore, general formulas for a sled type machine such as the ChemInstruments AR-2000 is thus:

Peel Rate = 0.707 * Crosshead Rate

Crosshead Rate = Peel Rate / 0.707

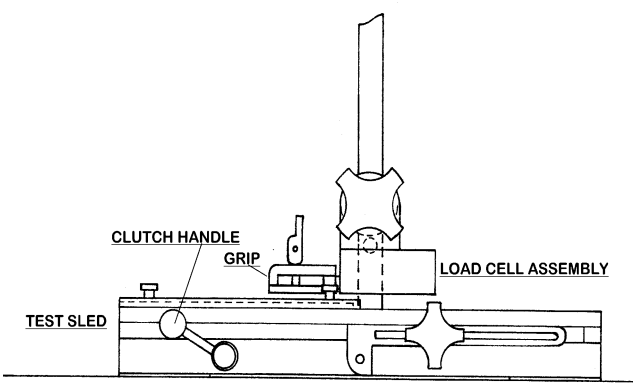
RUNNING A TEST

Peel adhesion tests run according to written test methods, such as ASTM, PSTC, TLMI and others. These tests are conducted to determine the peel adhesion values of the selected PSA material as it is removed from a stainless steel test panel. The AR-2000 will accommodate test panel dimensions of 2” wide by 5” or 6” in length. For both a 90 degree and 180 degree test method you will need to attach the panel edge brackets to the test platform, using the four small bolts and the holes closest to the left end of the test platform. Be sure that the recessed area of the edge brackets face to the inside and that the closed ends are to the right. This will allow the test panel to slide easily into the edge brackets from the left side.

180 DEGREE TESTS

For a 180° peel test, the test platform and the load cell must be in the horizontal position, with the load cell assembly at the lowest position on the mast.

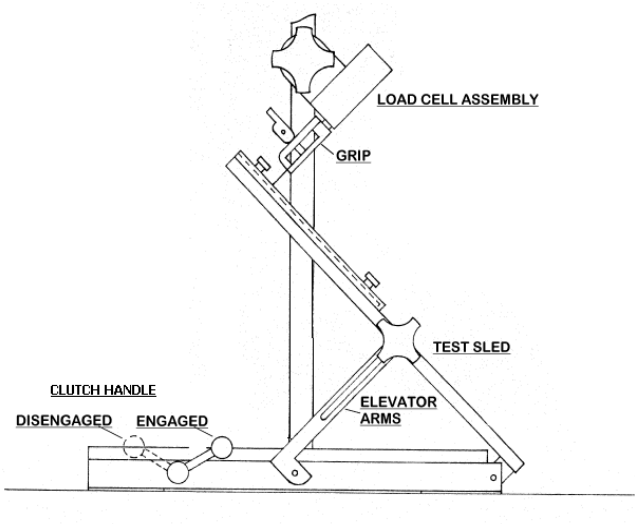
NOTE: Make sure that the load cell has been calibrated at this 180 degree angle.



90 DEGREE TESTS

For a 90° peel test, loosen the clamping bolt on the rear of the pivot head assembly and slide the bracket up the mast. Retighten the clamping bolt then loosen the opposite clamping bolt on the front of the load cell assembly. Tilt the load cell assembly counterclockwise until it snaps into a detent. Tighten the front clamping bolt. The load cell will now be at a 90° angle to the raised test platform.

NOTE: Make sure that the load cell has been calibrated at this 90 degree angle.

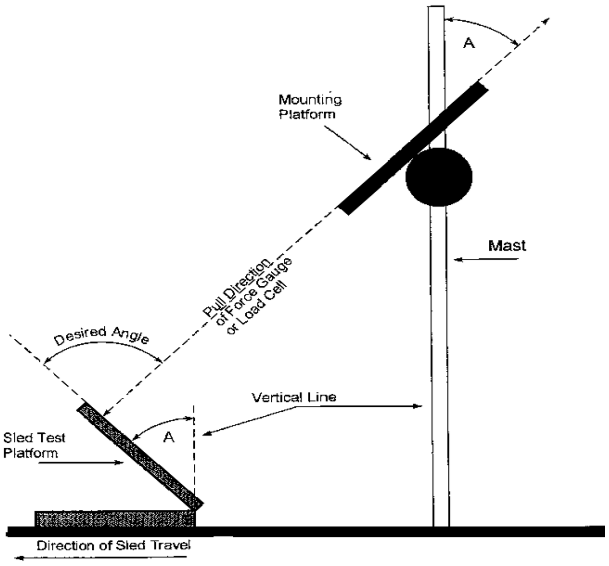


TEST ANGLES BETWEEN 90 AND 180 DEGREE TESTS

Test angles between 90 and 180 degrees can be established using the following setup formula.

1. Determine the angle desired for the test method to be performed.
2. The angle for the test platform and the load cell (A) will be equal. This angle is determined by dividing the desired test angle by 2. This result is the angle (A) that is used in setting the test platform and the load cell.
3. Run your test as described in the following test procedure.

NOTE: Make sure that the load cell has been calibrated at the proper angle (A) before proceeding with the test procedure.



TEST PROCEDURE – CONSTANT SPEED MODE

1. Slide the test panel with the test material into the edge brackets so that the free end of the test strip is to the left. Bend the free end of the test strip back over the end of the test strip and insert it into the grip. (See Grip Operation)
2. Set the test platform speed if necessary. (See Setting Speed)
3. Make sure the AR-2000 is NOT in the SETUP screen.

4. Turn the clutch handle on the test platform to the left to disengage it from the drive chain and move the sled to the start position at the right end of the test bed.

NOTE: In order for the test data to be collected properly it is important that the Test Platform be positioned to trigger the HOME Switch prior to engaging the Test Platform.

5. Make sure that the chain is moving. If it is not moving, press the START MOTOR button on the main screen of the AR-2000.
6. Engage the test platform by rotating the clutch handle clockwise. As the test platform moves past the START switch the status will display “Collecting test data”.
7. When the test platform has moved past the STOP switch, the graph screen will be displayed to show the graph, minimum, maximum, and average of the test data collected.
8. To run additional tests, replace the test material and repeat the procedure starting at step 4. It is not necessary to enter any Control key commands if the same test method is to be repeated.

NOTE: The units of measure for force can be changed by selecting SETUP and then selecting UNITS. Select the unit of measure desired and then select OK.

TEST PROCEDURE – RAMP MODE

1. Slide the test panel with the test material into the edge brackets so that the free end of the test strip is to the left. Bend the free end of the test strip back over the end of the test strip and insert it into the grip. (See Grip Operation)
2. Set the test ramp parameters if necessary. (See Setting Speed)
3. Make sure the AR-2000 is NOT in the SETUP screen.
4. Turn the clutch handle on the test platform to the left to disengage it from the drive chain and move the sled to the start position at the right end of the test bed.
5. Press the START TEST button.
6. Engage the test platform by rotating the clutch handle clockwise.
7. If the START FORCE setting is greater than 0 grams then the machine will move at 5 inches per minute until the START FORCE is measured by the load cell.
8. The test will continue for all defined steps at the required speed for the given test length.

9. When the ramp test is complete, the graph screen will be displayed to show the graph, minimum, maximum, and average of the test data collected.
10. To run additional tests, replace the test material and repeat the procedure starting at step 4. It is not necessary to enter any Control key commands if the same test method is to be repeated.

NOTE: The units of measure for force can be changed by selecting SETUP and then selecting UNITS. Select the unit of measure desired and then select OK.

TEST PROCEDURE – COF MODE

1. Attach the sample material to both the Test Sled and Test Platform according to the appropriate test method.
2. Place the Test Sled on the center of the Test Platform and as far left as the connecting cable will allow.
3. Position the Test Sled so that the edges of the Test Sled are parallel to the edge of the Test Platform.
4. Adjust the position so that the cable has enough slack for it to rest on the Test Platform. The Current Load reading should be below 5 grams at this point.
5. Press the START TEST button.
6. Engage the Test Platform by rotating the clutch handle clockwise.
7. Press the STOP TEST button when the Test Sled has traveled the required distance.
8. The computed Static and Kinetic COF results will be available in the STATISTICS screen.

NOTE: The units of measure for force can be changed by selecting SETUP and then selecting UNITS. Select the unit of measure desired and then select OK.

COF TEST DESCRIPTION AND RESULTS

The Test Platform moves at a constant speed causing friction between itself and the stationary test sled. The forces generated during the test are measured and used in calculating the Static COF and Kinetic COF of the test material.

STATIC

The first part of the test is the static part. The static length is defined in setup and can range from 1 second to 10 seconds. The peak value during this part of the test is saved and defined as “First Peak”. The Static COF value is defined as follows:

$$Static\ COF = \frac{First\ Peak\ (in\ grams)}{Sled\ Mass\ (in\ grams)}$$

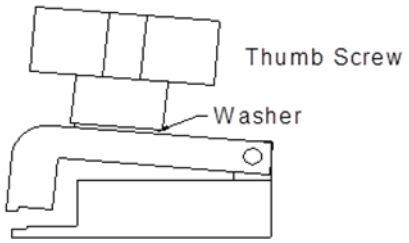
KINETIC

The second part of the test will contain the remaining data points. The average, high, and low are calculated from the test data and saved. The Kinetic COF value is defined as follows:

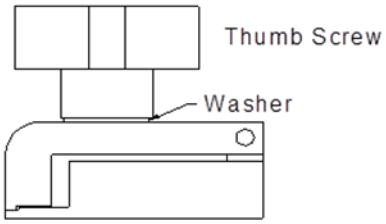
$$Kinetic\ COF = \frac{Average\ (in\ grams)}{Sled\ Mass\ (in\ grams)}$$

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.

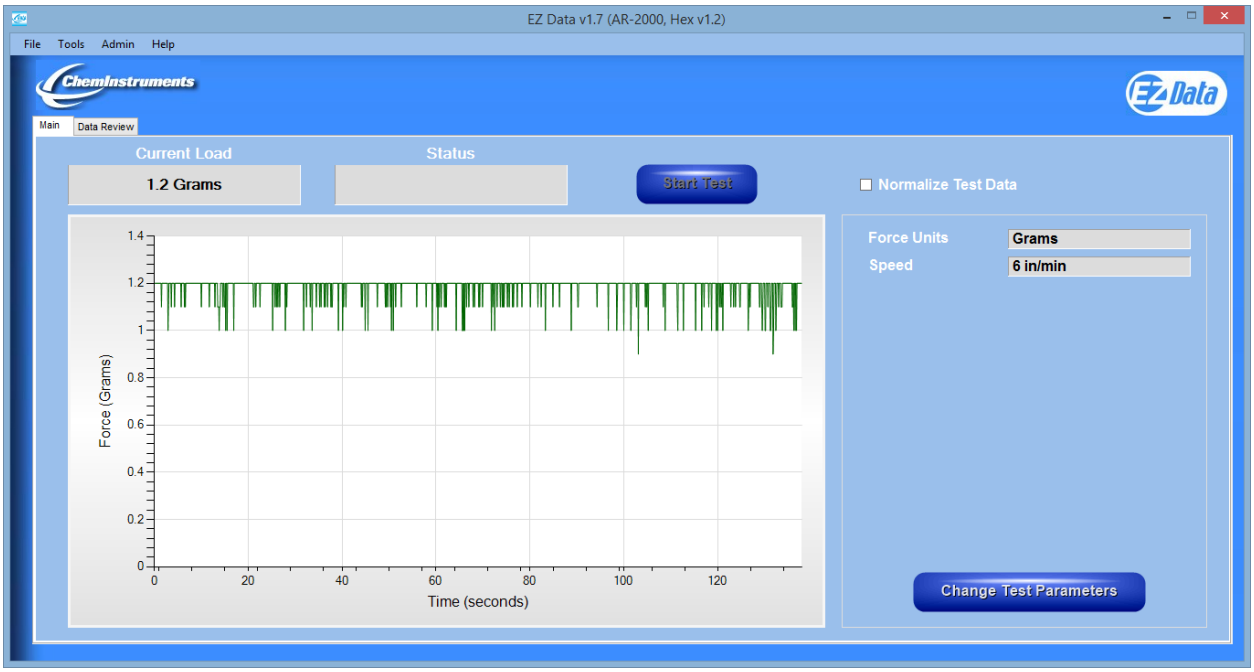
EZ DATA

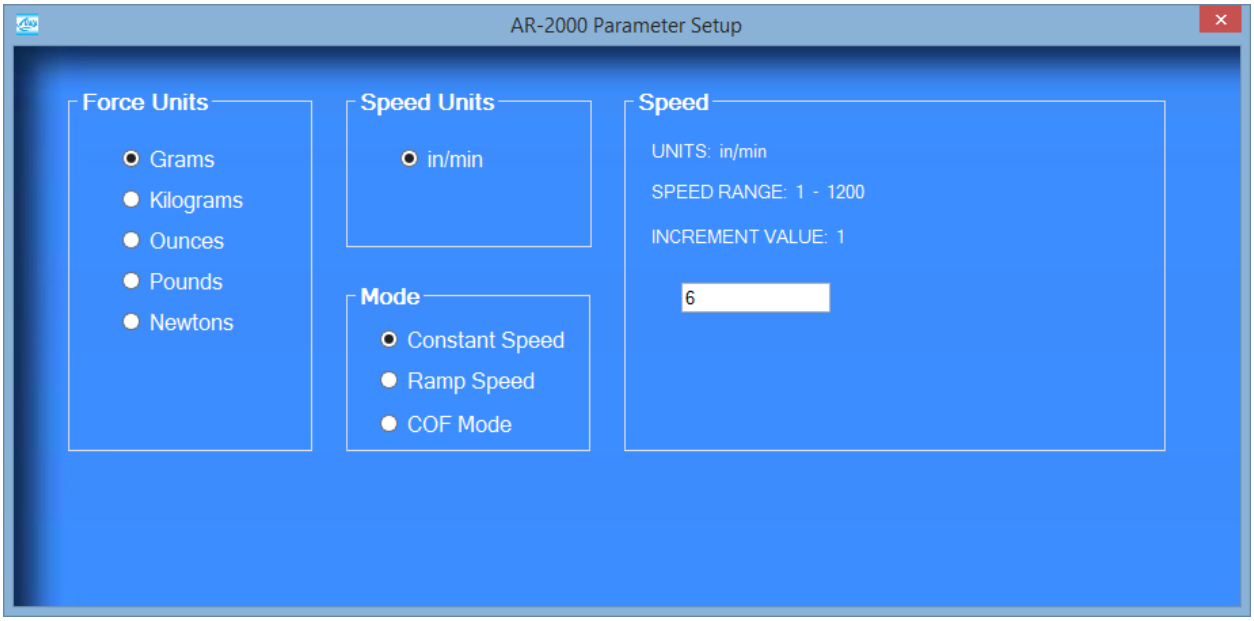
EZ Data is a ChemInstruments program that runs on your computer and will allow you to interface to your ChemInstruments machine in order to save test data files, save raw test data to excel, graph and crop test data, tabulate test data files, and overlay test data files. Please refer to the EZ Data manual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

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

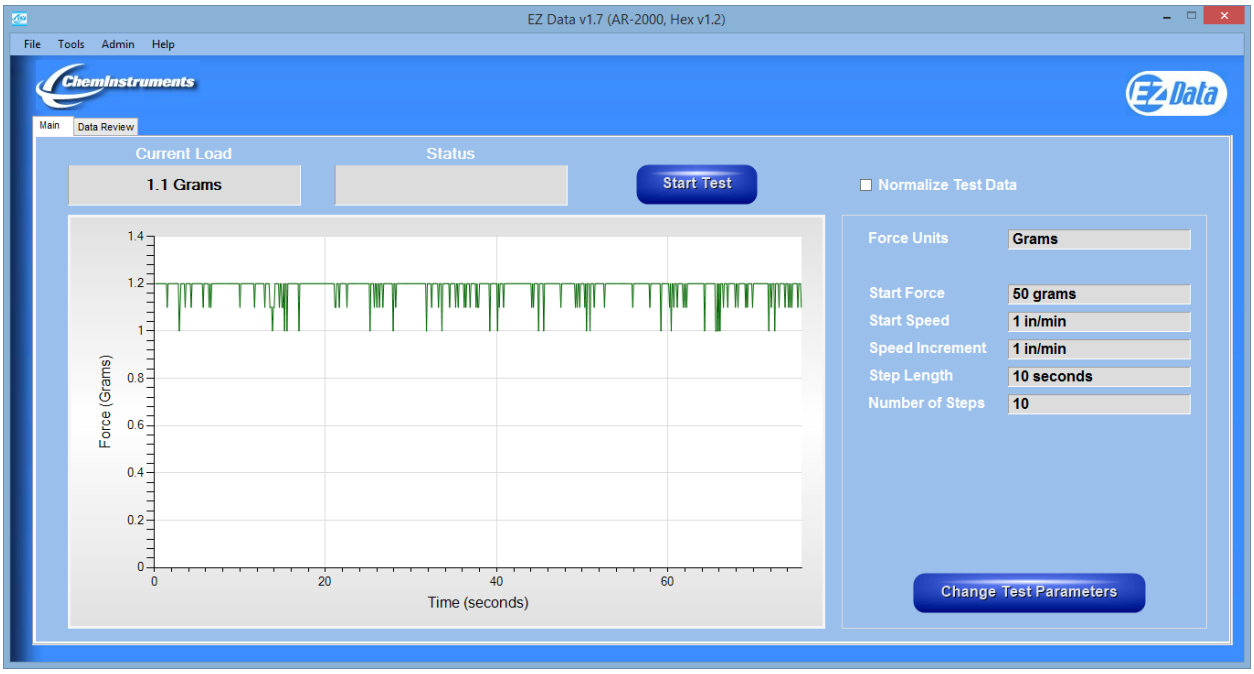
The following pictures are the main screen of EZ Data with an AR-2000 connected. This screen will show the current load as a value and a real time graph as data is collected from the load cell. It shows the test setup parameters for constant speed mode, ramp speed mode, and COF mode. It will also allow you to change the test parameters.

Constant Speed Mode

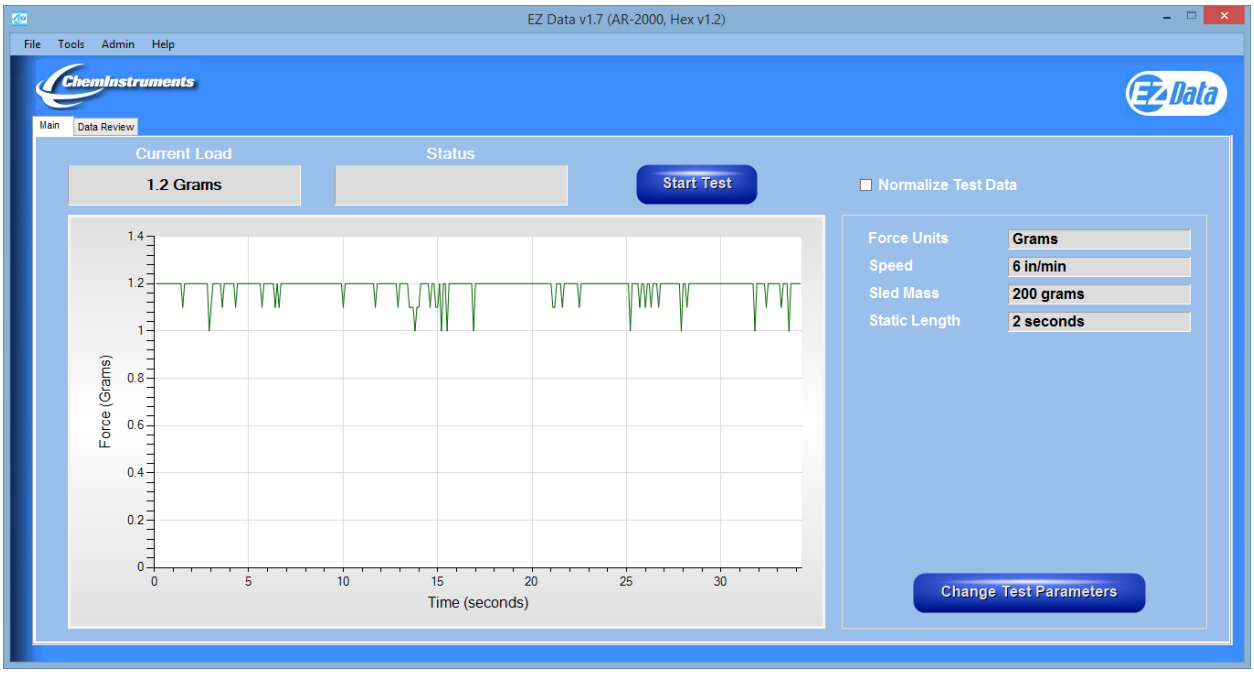


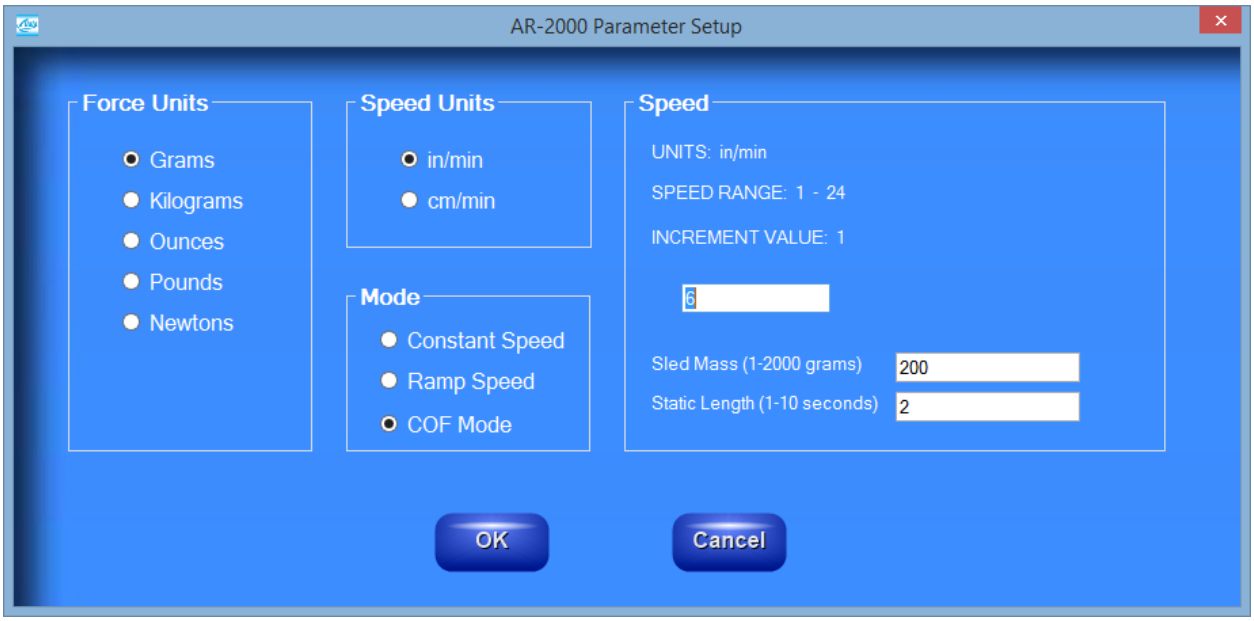


Ramp Speed Mode



COF Mode


EZ Data v1.7 (AR-2000, Hex v1.2)
File
Tools
Admin
Help
ChemInstruments
EZ Data
Main
Data Review
Current Load
1.2 Grams
Status
Start Test
Normalize Test Data
Force (Grams)
Time (seconds)
Force Units
Grams
Speed
6 in/min
Sled Mass
200 grams
Static Length
2 seconds
Change Test Parameters


AR-2000 Parameter Setup
Force Units
Grams
Kilograms
Ounces
Pounds
Newtons
Speed Units
in/min
cm/min
Mode
Constant Speed
Ramp Speed
COF Mode
Speed
UNITS: in/min
SPEED RANGE: 1 - 24
INCREMENT VALUE: 1
6
Sled Mass (1-2000 grams)
200
Static Length (1-10 seconds)
2
OK
Cancel

MAINTENANCE

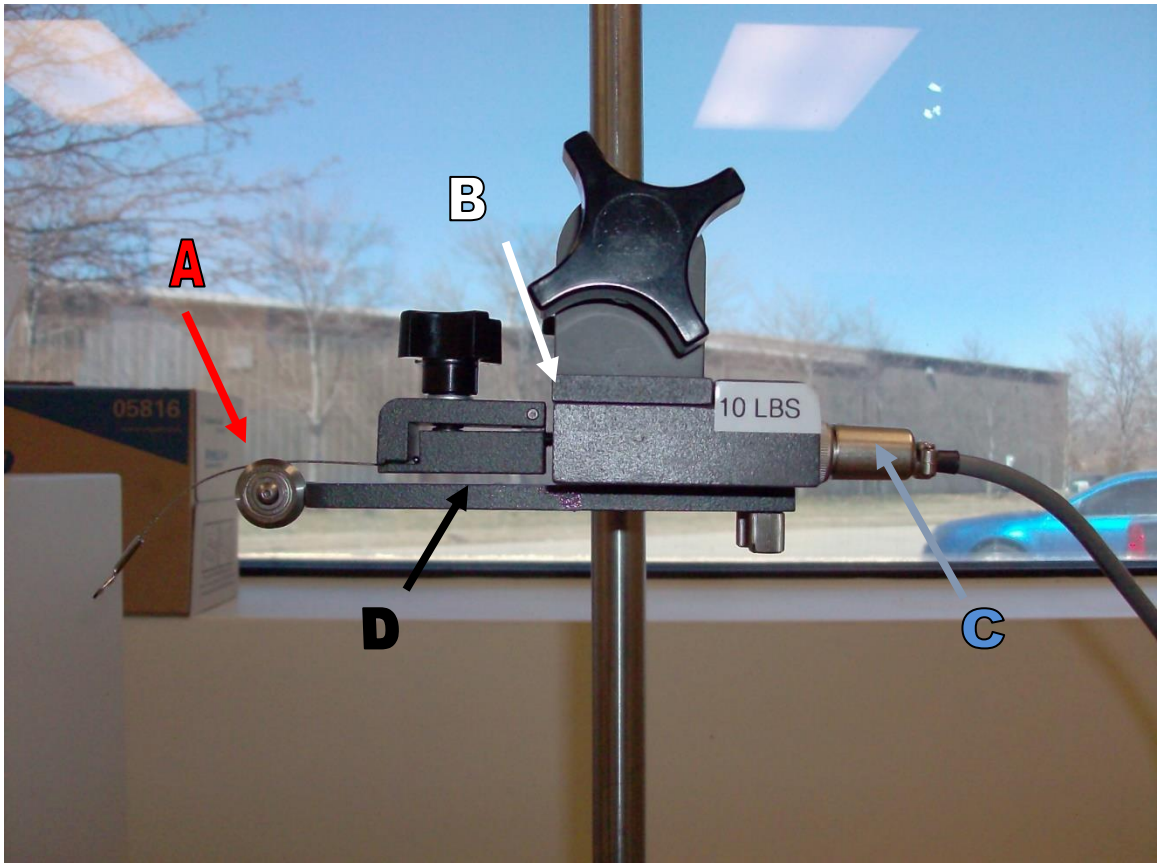
MACHINE TROUBLESHOOTING

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	HOME switch not tripped	Reposition HOME switch
	START switch too close to HOME or STOP switch	Move START switch at least 1.5 inches away from HOME and STOP switches
	Display is in SETUP screen	Go to MAIN screen to run a test
	Magnet missing on test platform	Reattach magnet to test platform
Test platform skips	Loose chain	Refer to Chain Tightening
	Test platform engaging finger out of adjustment	Refer to Adjusting Test Platform Engaging Finger
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.

CALIBRATION TROUBLESHOOTING



A: Be sure that the calibration wire is in the groove running through the center of the bearing.

B: Be sure there is a gap between the load cell sample grip and the load cell housing.

C: Be sure that the load cell cable is attached to the load cell.

D: Be sure that the calibration bracket is attached to the load cell housing.

MAINTENANCE PROCEDURES

As with any precision equipment it is important to provide care and maintenance to ensure proper performance and long life. The following section will address certain procedures for making changes in the AR-2000 and providing care for proper operation.

MECHANICAL MAINTENANCE SCHEDULE

The AR-2000 Adhesion/Release tester is a durable and well-designed piece of testing equipment requiring only minimal maintenance. In addition to normal and weekly general cleaning, ChemInstruments recommends that the following additional steps be performed on a monthly basis or as required.

- Check and adjust, as needed the drive chain.
- Lubricate the drive chain with a chain oil.
- Clean linear rods.
- Check and adjust the engaging finger on the test platform.
- Clean and lubricate the drive & idler shafts and their bronze bearings.

These simple steps, if performed regularly, can ensure the continued reliable performance of your AR-2000 Adhesion/Release tester.

CHAIN ADJUSTMENT

After an extended period of use the chain on the AR-2000's drive will stretch. This can cause undo vibration and improper drive for the test platform. This chain can be easily adjusted by performing the following procedure.

1. Make sure the AR-2000 has been turned off and unplugged from the electrical outlet.
2. Remove the top guard in order to gain access to the four locking bolts on the bearing slide.
3. With a 7/32 Allen wrench loosen the four locking bolts on the bearing slide.
4. Locate the adjusting screws on the end plate at the right end of the test bed.
5. With a 3/16 Allen wrench, turn each of the adjusting screws ¼ turn.

6. Check the tension of the chain before turning the adjusting bolt again. Proper adjustment will allow the chain to flex between sprockets, and engage the test platform without skipping.
7. Once adjusted, retighten the four locking bolts described in step 3.

TEST PLATFORM ENGAGING FINGER

The engaging finger on the bottom of the test platform must be positioned 90° to the bottom of the test platform in order for it to catch the chain. To adjust the engaging finger, perform the following procedure.

1. Make sure the power to the AR-2000 has been disconnected.
2. Check the position of the engaging finger by moving the clutch handle to the "engage" position. The engaging finger should be positioned at 90° to the bottom of the test platform.
3. To adjust the engaging finger, turn the clutch handle to the 12 o'clock position.
4. Using a 3/32" Allen key loosen the setscrew on the engaging finger and rotate it so that it is fully extended downward. Retighten the setscrew.

TEST PLATFORM & LINEAR RODS

The components of the test platform require maintenance to ensure proper performance. Every 3 months, or as needed, the following procedure should be performed.

1. Disconnect the power to the AR-2000.
2. Remove the top guard to the test bed.
3. With a soft clean cloth, wipe the linear rods. These rods provide the surface for the test platform's linear bearings to travel on as tests are conducted.
4. Wipe the rods with a light lubricant.
5. Lubricate the drive and idler shafts and their bronze bearings with a light lubricant.

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.