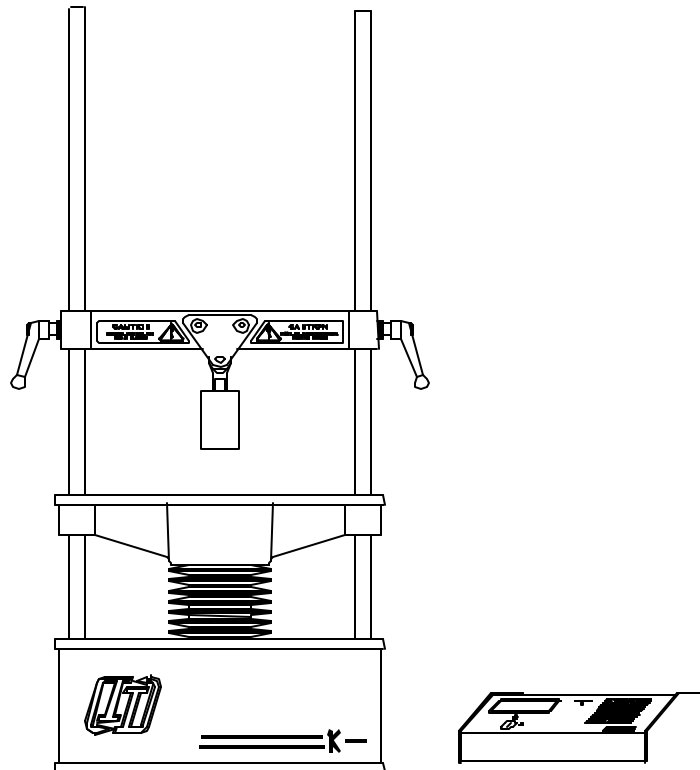


INTERACTIVE INSTRUMENTS



Model 1K Universal Materials Tester Instruction Manual

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Overview

The Model 1K is a general purpose universal materials tester designed as an affordable alternative to servo hydraulic systems. It is an invaluable tool for business, colleges and universities interested in simple materials analysis and/or product inspection.

The 1K is capable of compression and tension testing within its capacity of 1000 lbs. over the 2.5-inch stroke range. The controller is manually or remotely programmed to maintain the load or stroke setpoint. The built-in function generator can be programmed to hold, ramp or cycle a setpoint for hours, days or even months for unattended testing. Other desktop systems typically support open loop displacement ramps, recording the load with respect to time. The Model 1K contains a closed loop load and stroke controller for real-time control of the setpoint making it a true materials tester.

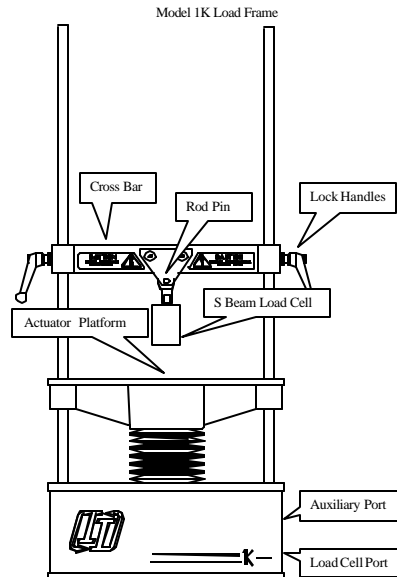
Best of all the 1K does not require costly maintenance programs, special power requirements, a dedicated location or expensive training like other testers.

The control panel has a built in RS-232 serial port enabling a computer to have full control of the Model 1K's functionality. Languages such as LabVIEW, Visual Basic etc. can control the units operation while collecting data for long or short term data logging or real-time graphing. Using external programs to access and control the Model 1K makes it a truly flexible unit.

The easy to access 24"h x 13"w x 6"d test area allows various specimens to be quickly mounted for testing. The upper cross bar height is infinitely adjustable without tools for accommodating various specimens. The S-beam load cell is attached to the cross bar with a pin and various specimen grips or compression plates attach directly to the load cell. An optional low profile load cell is also available as an option if a rigid interface is required. A lower tensile mount can be bolted onto the lower actuator platform to accept tensile grips.

Since the 1K is designed as a general purpose instrument, the uses are limitless. From materials analysis, product testing to fatigue analysis, its functionality goes a long way.

Installation and Setup



- 1) Place the load frame on a stable surface. Two 3/8 16 threaded holes are available on the bottom of the load frame so it can be bolted securely to the surface. Be sure the bolts do not extend more than 1/2" into the load frame or damage to the electronics may result.
- 2) Plug the 15 pin control cable into the rear of the load frame and also into the rear of the control panel and secure both ends with thumb screws.
- 3) Check to see that the load cell is securely attached to the upper cross bar.
- 4) Connect the load cell cable to the lower 9 pin port connector on the right side of the load frame. Be sure to secure the load cell cable to the load frame using the two screws on the connector shell.
- 5) Plug the power cord into the rear of the load frame and into a 110 volt 60 Hz grounded wall outlet.
- 6) Inspect the load frame and control panel for shipping damage. If any damage was caused in shipping, please contact Interactive Instruments immediately. Operating a damaged unit may result in additional damage or personal injury.
- 7) Enable the 1K load frame by turning the Security key on the control panel counterclockwise.
- 8) Verify the actuator platform and the upper cross bar are free of obstruction before applying power.
- 9) Power up the unit using the power switch on the rear of the load frame. As the control panel is powered up, the microprocessor performs internal diagnostics to verify the internal components are performing properly. If the display prompts an error for example:


A/D's	FAIL
-------	------

This is due to the microcontroller detecting an error in the system. Please refer to the **Error Condition** section of this manual for more information.

If the internal diagnostics pass, the LCD will then prompt:

Power Up OK Push to Continue

Be sure the actuator platform is clear to move up or down before continuing. If a specimen is in the test area it may be loaded depending on the direction the platform moves to locate home. If a load greater than 200 lbs. is detected the platform will stop and display a message to remove the load before continuing.

When ready press the  (Enter) key on the front of the control panel and the actuator platform will quickly locate the home position which is 0.5" from the lowest platform position.


Note: The actuator, under normal operation, will make a noise while in motion and may also make noise while stopped. If there are any loud or abnormal noises coming from the unit, turn off the control panel and call Interactive Instruments for further instructions.

While the controller is active, the status LED on the control panel will blink to indicate activity. The same LED will also indicate error conditions by flashing at a faster rate and will remain steady if the actuator is temporarily paused.



Please review the remainder of this manual for useful information.

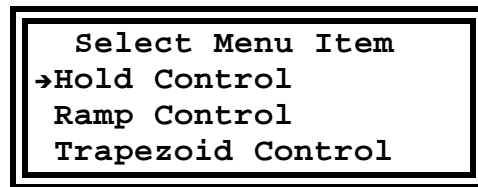
Guide to the Model 1K Controller

Before starting a test

- Verify that the 1K load frame is properly setup (*see Installation and Setup*)
- Insert the Security key and turn to the unlocked position (counterclockwise)
- Power up the load frame by switching the power switch on the rear of the load frame
- Press the  key and the actuator platform will locate the home position

LCD Menu options

The LCD will prompt with the main menu as shown below. If the main menu is not displayed, press the  (menu) key until it appears. Pressing the UP or DOWN arrows scrolls the list of menu options. With the arrow pointing to the menu item, press the  (enter) key to select.




Note: Pressing a number on the keypad that represents the menu line number also selects the menu item. This is a handy short-cut to select frequent menu items once the operator is familiar with the option list. For example if the main menu is displayed press the 2 key to access the ramp control menu item.

Some menu selections display a second list of menu options. The menu tree structure is shown below.



Hold Control	(Go to the programmed setpoint and hold)
Ramp Control	(Ramp the setpoint and hold)
Trapezoid Control	(Toggle between to setpoints with delays)
Set Position	(Set actuator platform position)
Set Actuator Rate	(Set the maximum actuator rate)
Configuration	(System configuration settings)
View Configuration	(View current system configuration)
Configure Channels	(Configure Load, Stroke, Auxiliary Channels)
Zero Current Load	(Update load offset so current load is zero)
Zero Current Stroke	(Update stroke offset so current stroke is zero)
Zero Current Aux	(Update aux. offset so current Auxiliary is zero)
Select Baud Rate	(Select RS 232 baud rate)
PID Parameters	(Adjust Load and Stroke PID parameters)
Data Collect Menu	(Configure internal data collection)
Clear and Start	(Clear acquisition memory and start collecting)
Stop Collecting	(Stop data acquisition)
View Data	(View acquisition data on the LCD)
Print Data	(Print acquisition data using printer port)

Data Channel and System Configuration

Before operating the unit with a specimen the system and data channel configuration should be programmed.

- To configure the data channels (load, stroke and auxiliary) select the **Configuration** menu item and enter the **Configure Channels** menu. Once the range, offset, display units etc. are set for each channel the settings can be previewed using the **View Configuration** menu. *See Data Channel Configuration below for more information.*
- To program the system parameters press the  (menu key) to return to the main menu. *See System Configuration below for more information.*
- Position the actuator to take full advantage of the stroke range by using the **Set Position** menu option. Be sure the actuator has plenty of room to move so it does not run out of room before the test completes.
- Select the **Set Actuator Rate** menu item to speed up or slow down the response of the actuator control. The rate depends on how fast the actuator is allowed to move to maintain control.
- If data is to be collected using the internal acquisition feature, be sure to program it at this time using the **Data Collect Menu**.

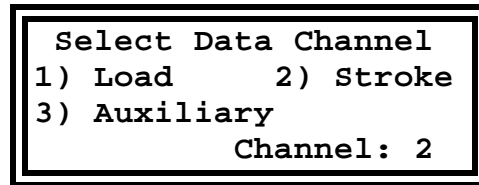
View Configuration

Displays the current data channel and system configuration settings. Press  to advance to each parameter page. When the last page of parameters is displayed the display will return back to the configuration menu. Press  at any time to cancel viewing the parameters and return to the configuration menu. To modify the configuration parameters see Configure Channels below.


Data Channel Configuration

Configure Channels

Each channel (Load, Stroke or Auxiliary) can be configured independently. Selecting the Configure Channel menu option will first prompt which channel is to be configured. The default channel is the current control channel.



Load Data Channel

Selecting the load data channel by pressing 1 will allow the user to modify the display units, load range, offset, maximum limit, minimum limit, and load filter. Since the current settings are shown as the default, the current settings can be kept by pressing the  key as a response.

Load Units

The load units (lb, kp, N, kN, kg) should represent the current load range and calibration of the load cell. Selecting different display units will **NOT** automatically scale and calibration of the load cell. See Load Range below to scale the load cell range to match the load units.

Load Range

The load cell range comes factory calibrated for 1000 lbs. but other load cell ranges can be configured as well. If the load cell calibration of 1000 is maintained then the load cell range can be set to 453.6 (kg/1000 lbs.) and the kg units can be used. Another way to calibrate the load cell in metric units. For example the load cell can be calibrated for 500 kg (or 1,102.2 lbs.) and use 500 as the new load range. **Be careful calibrating the load cell in excess of 1300 lbs. (the limit of the load frame).**

Load Offset

Load Offset can be added to the load cell output to compensate for the weight of a grip or test fixture. Since the offset is added to the load cell output, the offset can be negative to removed or positive to add to the load cell output.

Load Maximum and Minimum

The maximum and minimum software load limits can be set to limit the load range. Once the unit extends beyond either limit, the unit will suspend, display a "Load Limit" prompt over the bar graph, and wait for a setpoint to control the unit in the opposite direction. The unit will also suspend operation if the load reaches the limits of the load cell independent of the software limits.

Load Low Pass Filter

The low pass load filter can also be programmed to filter out any load cell noise. Setting a higher filter value (16 Hz) allows the controller to respond more quickly to variations but becomes more susceptible to load cell noise. Lowering the filter value (1 Hz or lower) reduces the load noise but the system becomes sluggish to changes. Over filtering the load with a rigid specimen and fast actuator settings can generate an uncontrollable oscillation. If this happens, pause the actuator and increase the filter frequency or reduce the maximum actuator speed.

Stroke Data Channel

Selecting the Stroke data channel will allow the user to modify the display units, offset, maximum limit, and minimum limit. Since the stroke is measured digitally, the stroke port and range can not be changed as in the load data channel.

Stroke Units

The stroke units (in, cm) represent the current display units of the actuator position. Because the stroke range is fixed and can not be changed, selecting between inches and centimeters will automatically scale the stroke units from 0 to 2.5 inches to 0 to 6.35 centimeters.

Stroke Offset

Stroke offset can be used to position the stroke zero (home position) to a different location other than the default zero (2 inches from the upper position). Since the offset is added to the stroke output, an offset of 0 places zero at the upper most position with +2.5 at the lowest position. An offset of -2.5" places zero at the lowest position with -2.5" representing the upper position of the platform.

Stroke Maximum and Minimum

Maximum and Minimum software stroke limits can be set to limit the stroke range. Once the unit extends beyond either limit, the unit will suspend, display a "Stroke Limit" prompt over the bar graph, and wait for a setpoint to control the unit in the opposite direction. The unit will also suspend operation if the stroke reaches the physical capabilities of the machine independent of the software limits.

Stroke Low Pass Filter

Since the stroke is derived digitally without analog sensors the controller has no need to filter the stroke value.

Auxiliary Data Channel

The Auxiliary channel is a general purpose analog port that can be used to monitor an analog sensor (eg. load, displacement, strain, temperature etc.) so data can be collected along with the load and stroke data. The Auxiliary connector is the 9 pin connector above the load cell connector on the side of the load frame. *See* Auxiliary Connector for more information

Auxiliary Units

The auxiliary units can be represented in many forms. To make the auxiliary channel flexible a wide range of units (V, %, in, cm, lb, kp, N, kn) are available. The units themselves are only used to make the display more readable and to not effect the displayed value. The Auxiliary range should be programmed to properly scale the analog signal to the auxiliary units.

Auxiliary Range

The auxiliary range default is set to 100% which represents the full scale range of the auxiliary channel. The range value is used to translate the analog voltage into meaningful display units such as inches, % strain or volts. The auxiliary's analog gain and offset can be calibrated externally using external resistors or potentiometers. Without the offset adjustment resistors the aux. port value is always +MAX RANGE.

Auxiliary Offset

Auxiliary Offset can be added digitally to the auxiliary output to compensate for an analog offset. Since the offset is added to the output, the offset can be negative to removed or positive to add to the output.

Auxiliary Maximum and Minimum

Maximum and Minimum limits do not apply to this data channel so they are not applicable.

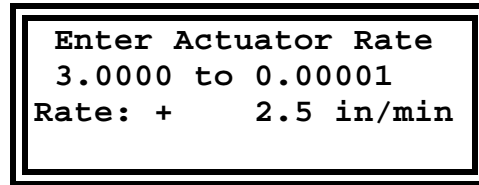
Auxiliary Low Pass Filter

The low pass auxiliary filter can be programmed to filter out noise from the auxiliary sensor. Setting a higher filter value is more suited for fast moving signals but becomes more susceptible to noise. Lowering the filter value reduces noise but the signal becomes sluggish to changes.




System Configuration

Set Actuator Rate


To change maximum allowed actuator rate select **Set Actuator Rate** from the main menu as shown below.



```
Enter Actuator Rate
3.0000 to 0.00001
Rate: +    2.5 in/min
```

The current actuator rate is displayed as the default entry. To accept the default rate, press  without re-entering the rate. . To select a new rate key in the desired actuator rate and press the  (Enter) button. This rate is the maximum rate that the 1K actuator controller will allow at any time (except when using the Set Position menu option). Slower rates are typically used to minimize setpoint overshoot and control oscillation while faster rates can achieve the desired setpoint faster. Pressing the  (Menu) key will cancel the current operation and return to the main menu.

Set Position



The actuator can be repositioned independent of the maximum actuator rate and mode of control. Selecting this menu item prompts for a position value. The default value is the current platform position relative the stroke offset. The stroke range on the second line represents the current max and min stroke limits programmed in the unit. Key the desired position on the keypad and press  (Enter) and the platform will quickly position to the desired location.

```
Enter Position
+0.5000 to -2.0000
Position: +0.0000 in
```

The desired position will be displayed on the LCD along with the current load, and platform position as shown below. Once the desired position is reached, the new position will be maintained using stroke control. Pressing the UP/DOWN arrows at this time will jog the position up or down in 0.0001" increments. Holding the key down will rapidly repeat the increments. Positive position values causes the platform to lower while negative values causes the platform to rise.

```
Set: -1.0000 in
-1.0000 in+    0.0 lb
+ 0.00 %      0:00:00
```

This feature is convenient for positioning the platform for mounting a specimen or returning the actuator to home (0) without having to select stroke control and program a faster actuator rate.

Pressing  or  at any time will cancel the operation and stop the actuator.

Note: The zero position is in reference to the programmed stroke offset which by default is up 0.5000 in. from the lowest stroke position or -2.0" from the upper position. Since the offset is added to the actual actuator position the default offset is -2.0". The maximum stroke range is 2.5000 inches.

Zero Current Load

Programs the offset so the current load value is zero. This is useful to zero out any load offset that may be caused due to the weight of a grip or a test fixture. This offset is removed digitally and will not effect the current load cell calibration. To remove the load offset set the load offset to zero (see Configure Channels) and the original calibration value will be restored. Note, if you continuously have a load offset, it may be better to remove the offset with the analog load cell calibration instead of modifying the a digital offset.

Zero Current Stroke

Programs the offset so the current stroke value is zero. This is useful to set the starting position of the actuator platform. Since the stroke values are calculated using the commanded actuator motor position, no analog offset is necessary.

Zero Current Aux

Programs the offset so the current auxiliary value is zero. This is useful to zero out any external sensor offset. This offset is removed digitally and will not effect the current auxiliary calibration. To remove the auxiliary offset set the aux. offset to zero (see Configure Channels) and the original calibration value will be restored. Note, if you continuously have an auxiliary offset, it may be better to remove the offset with the analog auxiliary calibration instead of modifying the a digital offset.

Select Baud Rate

Select a BAUD rate that matches the rate for the attached computer. The factory default is 38400 which is fast enough for most applications and computers. If your computer is not capable of operating at the faster rates, slow the rate down using a lower BAUD rate. Slower rates will significantly slow the rate of transferring data into and out of the unit while faster rates may be more susceptible to electrical noise.

Select Baud Rate	
1) 1200	2) 2400
3) 4800	4) 9600
5) 19200	6) 38400 →5

PID Parameters

The PID parameters are used to control the motion of the actuator. The three parameters can be modified for the load and stroke channels to change the response time and control error for each control mode. The default parameters were selected to work over a wide range of tests. Sometimes it becomes necessary to modify these parameters to improve the controllers response characteristics for a specific test.

Each of the PID parameters are used to scale the results of control calculations and effect the control behavior. Selecting this menu option prompts the operator for the appropriate control channel that is to be modified. Each channel has a separate array of scale factors so the control channel can be changed without having to re-enter the PID parameters. Once the channel is selected then the display prompts for the Proportional, Integral and Differential scaling factors. Be careful in modifying these terms because they can quickly cause the actuator control to become unstable. Once all variables are entered they all become programmed at the same time. Pressing the Menu key cancels the variable update.

The PID parameters are as follows.

Proportional

The Proportional value scales the proportional error. This error is calculated by taking the difference between the current and desired setpoint. The proportional value is responsible for most of the error correction. Many controls require only the proportional term

Integral

The integral value scales the accumulated or integral error. This error is calculated by accumulating the proportional errors over time. The purpose of this term is to be more aggressive in the control output the longer the error persists.

Differential

The differential value scales the rate of change of or the differential error. This error is calculated by measuring how fast the error is changing and to slow the control down if the change in error is too rapid. This term is useful in minimizing setpoint overshoot and allowing a larger proportional value.

Data Collect Menu

The Data Collect Menu configures the background data collection. Data is collected with respect to the actuator position. As the actuator advances every 0.001" the load, stroke and auxiliary data is stored in memory. Up to 7500 data values can be stored in memory at one time (2500 samples of load, stroke and aux. data points). Once the data is collected the results can be viewed on the LCD or printed using a printer.

Clear and Start

Clears out any accumulated data and begins collecting data. Data is collected when the actuator moves 0.001". Note the stroke data may not be the same as the actuator data because the stroke data accounts for system deflection and the actuator does not.

Stop Collecting

Stops collecting data but leaves the data in memory intact. After a test is complete it is best to disable the data collection or view the results immediately. Reposition the actuator after the test may overwrite existing results.


View Data


View the data one sample at a time of the load, stroke and auxiliary results. All samples are made in parallel.




Print Data



Prints the results on a parallel printer in tabular format. The printed output also records the +MAX and -MAX of the load and auxiliary results.


Selecting a Test mode

Press the  key to display the main menu if it is not currently displayed



The three test modes are **Hold Control**, **Ramp Control** and **Trapezoid Control**. Select one of the modes from the menu to enter one of the tests. This is done by pressing the UP or DOWN arrows to point to the appropriate menu item and press the  (Enter) Key (or press 1 for Hold, 2 for Ramp or 3 for Trapezoid control).

The display will prompt for the desired test parameters before starting the test. Pressing the  key before entering all parameters will cancel the selected test mode. Previous parameters are displayed as the default values. Press  to accept the default value or key in a new value and press .

In Hold mode once the setpoint is keyed the controller immediately begins adjusting the actuator. In Ramp and Trapezoid mode the LCD prompts with a list of the entered parameters for verification before operating. If the parameters are entered properly press the  key to confirm else press  to cancel and re-enter the parameters. The status LED will blink while the actuator is in control.

When a test is underway the  key can be pressed to modify system parameters such as offsets, filters, maximum actuator rates while the test continues.

Pausing a test

The actuator control can be temporarily paused by pressing the  key when the active test data is being displayed on the LCD. Press  a second time to release the pause. To pause the actuator control while in a menu, press the period key on the keypad. Pressing the period a second time will restart the actuator control.


Hold Control

Selecting hold control will prompt for the type of control. Select between Load or Stroke control by pressing 1 or 2 on the keypad.

```
Select Control
1) Load      2) Stroke
```

After selecting the type of control the display prompts for the desired setpoint as shown below (for load control).

```
Enter Load
+1000.0 to -1000.0
Load:    + 0.0 lb
```

The current maximum and minimum values for the selected control are displayed on line 2 as a reference. The current load or stroke value is displayed as the default value for the desired setpoint. Key in a new setpoint and press  to select the new hold setpoint. Positive setpoints represents loading in the tension direction and negative setpoints represents loading in the compression direction.

Once the actuator is in control the Up and Down keys can also be used to jog the current setpoint. Holding the key down will repeat the function.

The Controller will then control the load or stroke by positioning the actuator to maintain the desired setpoint. See **Run Time Display** for more information.


Ramp Control

Selecting ramp control will prompt for the control type. Select between Load and Stroke control by pressing 1 or 2 on the keypad. The display then prompts as shown below assuming load control is selected.

```

Enter Final Setpoint
+2000.0 to -2000.0
Load:+          0.0 lb
  
```

Positive setpoints represents tension loading or an upward stroke while a negative setpoints represents compression loading or downward stroke.



Pressing the  button again will prompt for the ramp rate as shown below assuming load control. If stroke control is selected, the rate will be in in/min.


```





Enter Ramp Rate
0.0001 to 32000
Rate: +1.2345 lb/min
  
```


Pressing the  button again will display the ramp parameters for confirmation as shown below.

```

Push  or 
Final:+ 510.0 lb
Rate: +1.2345 lb/min
  
```





Press  again to begin ramping the setpoint. The Model 1K Controller will ramp the setpoint from the current value to the final setpoint at the programmed rate. Be sure the maximum actuator rate is sufficient to obtain the desired ramp rate. If the maximum actuator rate is too slow, the actuator may not be able to maintain the desired setpoint causing a lag in the ramp. As the internal ramp generator is operating, the setpoint will be updated on the top line of the LCD. See **Run Time Display** for more information.


Pressing the  key while ramping will temporarily pause and actuator controller until the  key is pressed a second time. Pressing the  button while ramping will continue the ramp and display the main menu. This is to allow parameter changes such as actuator rate or limit modifications to be changed during a test. While in the menu, pressing  a second time will return back to display the current load and stroke test results.

With the display showing the ramp run time data, another ramp can easily be programmed before finishing the current ramp by pressing a number, decimal point or change sign key on the keypad. The display will then prompt for the new final setpoint and ramp rate. Pressing  will cancel the previous ramp and the controller will then begin the new ramp.

Once the final setpoint is reached the control will stop the timer and the controller will then hold the final value.

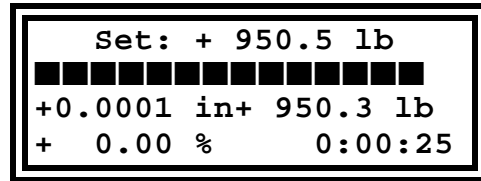
The unit will count the number of completed cycles up to 16777215 and display the count on the fourth line next to the # sign.

Pressing the  key while cycling will temporarily pause and actuator controller until the  key is pressed a second time. Pressing the  button while cycling will continue the trapezoid and display the main menu. This is to allow parameter changes such as actuator rate or limit modifications to be changed during a test. While in the menu, pressing  a second time will return back to display the current load and stroke test results.

With the display showing the trapezoid run time data, another trapezoid can easily be programmed by pressing a number, decimal point or change sign key on the keypad. The display will then prompt for the new setpoints and delays. Pressing  will cancel the previous trapezoid and the controller will then begin the function.

Run Time Display

While the controller is operating it attempts to maintain the desired setpoint by positioning the actuator depending on the feedback signal. The desired setpoint is displayed on the top line along with the units to indicate the type of control (load or stroke). The second line displays a bar graph representing the absolute value of the current load from 0 to full range. The measured stroke and load is displayed on the third display line. Line four displays the auxiliary channel value and the test timer (or cycle count).



Load Data

The Load Data represents the current load measured by the load cell. See **Load Data Configuration** for more information on configuring the load range, offset filter and units.

Stroke Data

The Stroke data reflects the current actuator position relative to the stroke offset. Since the stroke is calculated digitally based on the applied actuator position the resolution and accuracy is much better than using an analog displacement transducer. The system deflection is also taken into account and is subtracted from the calculated actuator position. This allows the Model 1K to measure 0" to 2.5" with 0.0001" resolution or 0.004% resolution. See **Stroke Data Configuration** for more information on configuring the stroke units and offset.

Auxiliary Data

The Auxiliary channel is used to optionally display and record the results of an analog sensor. A second load cell, LVDT or temperature sensor can be attached to the Auxiliary port so the results can be read along with the load and stroke data. If a signal is not attached to this port the results typically display +max range otherwise it represents the signal at the auxiliary channel.





Timer

The timer is a test timer that displays how long the current test has been operating. When the test parameters or mode is changed the timer is reset to zero. The maximum displayed time is 9999 hours 59 minutes 59 sec which is equivalent to about 416 days in one second resolution. This time is based on the microprocessor crystal so the accuracy may vary.


Cycle Counter

The cycle counter is displayed over the test timer when the test mode is configured for trapezoid mode. The maximum displayed cycle count is 16,777,216 cycles.




Actuator Control

Pressing the  key under test will temporarily pause the actuator and hold the clock until the  key is pressed a second time. Pressing the  key while the run time display is shown will continue the test and bring up the main menu. This is to allow parameter changes such as actuator rate or limit modifications during a test. While in the menu, pressing  a second time will return back to display the run time display.

Modifying Test Parameters

With the Run Time Display shown, the test parameters can be reprogrammed without having to halt the current operation. For example if the current operation is ramping the load to 500 lbs. at 10 lbs. per minute, enter a new final ramp value on the keypad and the ramp parameter menu will appear. The new ramp parameters will take effect when the final  (enter) is pressed.

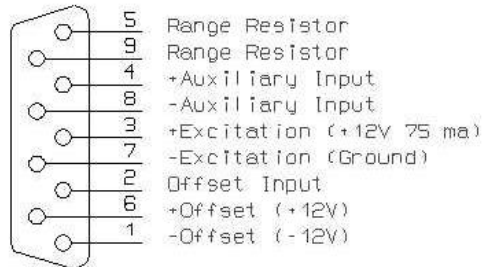
Note: If the security key is locked, the keypad will be disabled to prevent unauthorized modification of the test parameters.

Note: If the incorrect test mode is selected from the menu, pressing the  key will cancel the test configuration. If an incorrect test parameter is entered, press  to clear the number to zero and re-enter the parameter. Pressing the  key a second time will cancel the operation.

Auxiliary Port

The Auxiliary port connection is located above the load cell port on the right side of the load frame. The pins are arranged so common 3/8" trim pots can be easily attached to the DB9 port using solder or crimp connectors minimizing discrete wiring.

Note: The auxiliary port pins are identical to the load cell port.



The input to the auxiliary port is made between pin 8 (+) and pin 4 (-). The default amplifier gain of the auxiliary amplifier is +/- 5.0 volts full scale. The gain of the amplifier depends on the value of the resistor between pin 5 and 9. To increase the amplifier gain add resistance between pin 5 and 9. See the table below to select the appropriate gain.

Voltage Range	Range Resistor	Voltage Range	Range Resistor
+/- 5.0 V	Open	+/- 0.050 V	404 Ω
+/- 2.5 V	40.0K	+/- 0.025 V	201 Ω
+/- 1.0 V	10.0K	+/- 0.010 V	80.1 Ω
+/- 0.50 V	4.44K	+/- 0.005 V	40.0 Ω
+/- 0.25 V	2.11K		
+/- 0.10 V	816 Ω		

Other ranges can be selected using the equation below.

$$\text{Range Resistor} = \frac{40000}{(5.0 / \text{Range Voltage}) - 1}$$

The auxiliary offset can be adjusting by setting the voltage on the offset input (pin 2). Two pins are available that can be used to help set the offset voltage. Pin 1 and 6 output +12V and -12V and can be used to trim the offset voltage using a trim pot. With each end of the trim pot attached between +12V and -12V and the wiper attached to the offset pin, the offset can be trimmed to suit most needs.

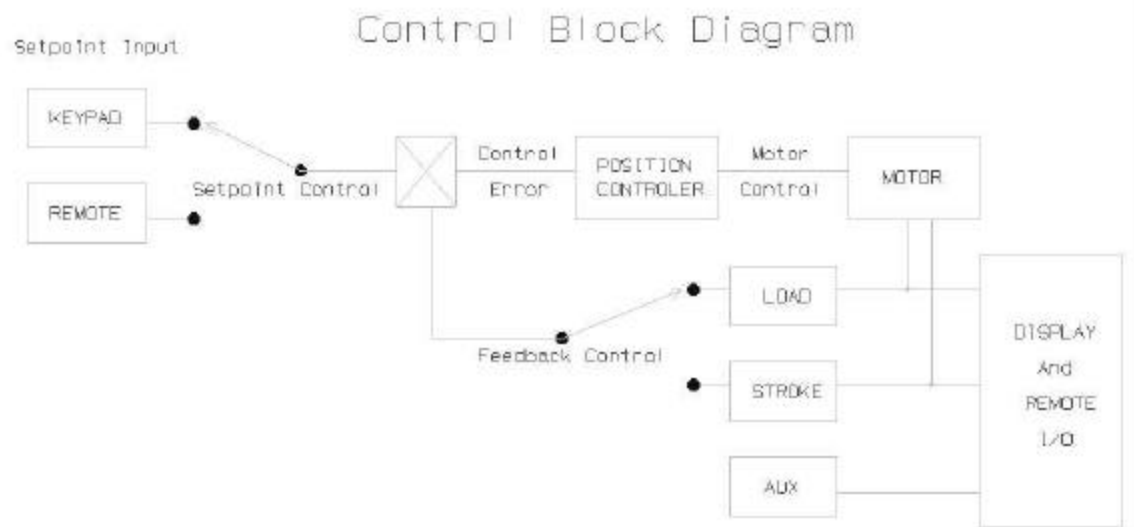
The excitation voltage is available to power a full bridge sensor such as a load cell. The excitation voltage is fixed at +12 volts and is able to deliver up to 75 ma. If the excitation is not needed then this pin can be ignored.

System Block Diagram

The following is a block diagram of the basic internal structure of the model 1K controller. The Setpoint controller selects the desired input to the system. If the keypad (default) is selected as the desired control then a the keypad can be used to program the Hold, Ramp or Trapezoid parameters. Placing the unit in Remote Mode allows a computer to control the test conditions.

The Feedback control switch selects which parameter is controlled. Selecting Load as the feedback places the controller in Load Control and adjusts the actuator to reduce the load error to zero. Selecting stroke feedback will place the unit in stroke control and adjust the actuator to minimize the stroke error.

Note: The Auxiliary port is not in the feedback loop so the auxiliary channel is not a valid control channel.



Calibration

Load cell calibration

Load calibration is accomplished by adjusting the load range and offset trim pots on the load cell connector plugged into the side of the load frame. Before calibrating the Model 1Ks load cell a second load cell and external amplifier is needed as a reference. One of two methods can be used to perform the calibration.

- 1) Remove the load cell from the Model 1K and install it in another load controlling system that is considered a calibration standard. The Model 1K load cell must be attached to the 1Ks internal load cell amplifier.
- 2) Add a calibration standard load cell and load cell in series with the Model 1Ks load cell and use the 1Ks load frame to apply the load.

Once a calibration system is set up to control the load with a calibration load cell in series perform the following steps.

- 1) Adjust the load filter as low as possible and slow the maximum actuator rate to maintain an accurate load control. Be careful about setting the filter to low causing an uncontrollable system oscillation.
- 2) Be sure the load cell is plugged securely into the lower connector and is screwed in place to make a good connection.
- 3) Check that the Model 1Ks load range is configured properly and the offset is set to zero.
- 4) Allow time for the electronics to warm up and stabilize for approx. 15 minutes.
- 5) Set the load to zero (using the calibration standard) and adjust the 1Ks Zero trim pot (lower pot) for zero reading on the LCD.
- 6) Apply the maximum calibration load (in tension or compression) using the calibration standard as the reference.
- 7) Adjust the 1Ks Range trim pot (upper pot) so the LCD matches the calibration standard load.
- 8) Continue with step 3 until the two load cells are close as possible.

Auxiliary Calibration

The auxiliary data port can be calibrated the same as shown in the load cell calibration with the exception the auxiliary port is the top connector and the reference depends on the type of sensor used.

If the auxiliary port is not being used the output is pegged on the positive side to show that a sensor is not connected to the port.

Note: Using the excitation voltage in the auxiliary port may effect the load cell offset. Re-zero the load cell if the auxiliary excitation is used.

Serial Commands

A cable can be attached between a computer and the RS-232 connector in the rear of the control panel. The cable is a DB9 Male to Female straight through extension cable. Once connected to the computer, serial commands can be sent to the Model 1K to control the basic operation of the unit and collect the actual data in real time. Using a basic set of commands, the Model 1K Controller can be programmed with the use of a computer to perform many various tests. The default serial configuration for the Model 1K Controller is 38400 baud, 8 data bits, 1 stop bit, no parity. The commands are case sensitive so the commands are different depending on if the command is upper or lower case .

Below is a list of the serial commands along with a brief description of the command.

Non Remote Commands

C	Activate Computer remote control (see remote commands below)
V	Software version [name major.minor]

Remote Commands

Hold control mode

Hc	Read configuration [setpoint]
HC	Set configuration and start (setpoint)
HS	Stop hold operation
Ht	Read test time [hr, min, sec]
HT	Reset test time

Ramp control mode

Rc	Read configuration [endpoint, rate]
RC	Set configuration and start (endpoint, rate)
RS	Stop ramp test
Rt	Read test time [hr, min, sec]
RT	Reset ramp time

Trapezoid control mode

Tc	Read configuration [lo-setpt,lo-time,hi-setpt,hi-time]
TC	Set configuration and start (lo-setpt,lo-time,hi-setpt,hi-time)
TS	Stop trapezoid test
Tt	Read test time [hr, min, sec]
TT	Reset test time
Tn	Read cycle count [count]
TN	Reset cycle count

Channel Control Commands

o	Read control channel [chan]
O	Set control channel (chan)
k	Read Max limit (chan) [max]
K	Set Max limit (chan) [max]
l	Read Min limit (chan) [min]
L	Set Min limit (chan) [min]
m	Read hi/low channel monitors (chan) [Tst-Hi,Tst-Low,Cyc-Hi,Cyc-Low]
M	Reset channel monitors (chan)
g	Read channel Range (chan) [max value]
G	Set channel Range (chan, max value)
z	Read channel Offset (chan) [offset]
Z	Set channel Offset (chan, offset)
n	Read channel control filter (chan) [factor]
N	Set channel control filter (chan, factor): 0 - 9
e	Read channel units (chan) [units]
E	Set channel units (chan, unit#)

Note: Channel 0 = Load, 1 = Stroke, 2 = Auxiliary


Actuator Commands

x	Abort any test and disable controller
s	Read actuator rate [rate (unit/min)]
S	Set actuator rate (rate (unit/min))
U	Go to stroke position at max speed (position)
w	Read pause status [status]: 0=release, 1=hold
W	Set pause status (status): 0=release, 1=hold

Miscellaneous Commands

?	Help
X	Exit remote control
a	Read all data channels [load, stroke, auxiliary]
B	Set computer baud rate (baud)(CR@ new rate): 1200 to 38400
u	Read 32 bit system status [status]
q	Read switch status bit [switch]
Q	Set/Clear status bit (switch, status)
t	Read test time [hr, min, sec]
y	Read cycle count [count]

Remote Control Mode

The Model 1K defaults to manual control when powered up. To place the unit in remote control mode, the upper case 'C' command must be sent serially to the control panel so the unit knows to take commands from the serial port instead of the keypad. To return back to manual control either press the  (menu) key on the keypad, send a serial 'X' command, or cycle the power switch on the back of the control panel.

Once in the remote control mode, commands can be sent to program the unit in various modes without having to select them from the control panel menu. For example to apply a load of 500 lbs, send the command O0 (letter O - zero) followed by a carriage return (CR) to select load control if load control is not already selected. The response from the controller should be a CR to acknowledge the command. Then send HC500(CR) to set the hold setpoint to 500 lbs. To move the actuator to a desired position of -0.250", send the command O1(CR) to select stroke control followed by HC-.250(CR) and the actuator will move to this position within the limits of the unit.

Sending Commands

All commands begin immediately unless a number or a list of numbers are needed for the command. For example to place the unit in remote mode, the ASCII 'C' command (no CR) is all that is needed. All commands are case sensitive and can perform completely different operations depending on the case. If a command requires a parameter, the number is terminated with a carriage return (0Dh) to terminate numbers. If a return is not sent, the unit will wait until a non-number is received. It is also important to send the commands and numbers as quickly as possible because the function setpoint generator is suspended until the data is completely received. To send a list of numbers, each number can be separated by a comma or a CR. For example to enter the trapezoid control mode the following command can be sent 'TC1000,120,-500,2.5' followed by a return to terminate the last number. This will cycle a force from 1000 and wait 120 minutes then cycle to -500 lbs and wait 2.5 minutes before repeating the cycle.

Note: Sending a Backspace ASCII code while a number is being entered will clear out the current number and allow another number to be entered. This is helpful when manually entering numbers.

Command Reference

General Commands

Enter Remote Control (C)

Once the Model 1K controller has been powered up and the actuator locates the home switch, it is left in stroke control a position 0. The unit can then be placed in remote control by sending it the 'C' command. The LCD will display the prompt "**Remote:**" in place of "**Set:**" on the top line to show the unit is being controlled remotely. Once in the remote command mode, the commands come directly from the serial port and not from the control panel. To exit the remote command mode, press the Menu button on the control panel, the X command or powering down the control panel will also return the unit to manual control mode.

Firmware Version (V)

Access the units firmware name and number. For example version 1.0 is returned as "1K 1.0".

The following commands can be sent to the unit at any time and the unit does not have to be in remote command mode for them to operate. Note, commands with a '#' symbol require one or more numbers following the command.

Hold Control Commands

Hold Control will attempt to maintain the programmed setpoint. Once in hold mode, the setpoint can be programmed remotely to follow a complex waveform or so it can be updated depending on the outcome of a calculation. For example the load can be remotely programmed to vary depending on the strain to maintain true stress on a specimen.

Set Hold control configuration (HC#)

Read Hold control configuration (Hc)

Set and read the hold configuration. The number after the set command will be the setpoint value (force or stroke). For example if the unit is in load control, setting the force to 520.5 lbs requires the command "**HC520.5**" followed by a return and the unit will attempt to maintain 525.5 lbs.

To read the current setpoint, send the command "Hc" (no return) and the unit will return the hold setpoint terminated with a carriage return.

To change between load and stroke control be sure to select the active control channel with the "O" command.

Stop Hold control (HS)

Stop the current test by stopping the controller. The unit will not begin moving until another test start command is received.

Reset Hold timer (HT)

Read Hold timer (Ht)

Read or Reset the test timer to see how long the Hold command(s) have been set. Once command changes to ramp or trapezoid control, the timer is reset back to 0. The read timer format is "XXXXXX,YY,ZZ". where XXXXX = number of hours (range: 0 to 1,193,046), YY = number of minutes (range: 0 to 59) and ZZ = number of seconds (range: 0 to 59).

Ramp Control Commands

Ramp control will ramp the current setpoint up or down at the programmed rate from the current value to a final setpoint. The ramp control is then halted and the controller is placed in the hold mode. The ramp rate is programmable from 0.00001 units/minute to 32000 units per minute.

Unlike the actuator rate which does not modify the setpoint, the ramp mode will perform a linear ramping of the setpoint.

Set Ramp control configuration (RC#,#)

Read Ramp control configuration (Rc)

Set and read the ramp configuration. The number after the set command will be the final setpoint (load or stroke) followed by the ramp rate (units/min). For example if the unit is in load (lbs) control, ramping the force to 525 lbs at 1.2345 lb/min requires the command “**RC525,1.2345**” followed by a return and the unit will increase or decrease the load from the current load at 1.2345 lb/min until 525 lbs is reached. Once the 525 lbs is reached the ramping stops and switches over to hold the final setpoint.

To read the current ramp parameters, send the command “Rc” (no return) and the unit will return the final ramp setpoint and ramp rate separated with a comma and terminated with a carriage return.

Selecting another hold, ramp or trapezoid test cancels the current ramp and continues with the new parameters and/or test mode.

Stop Ramp control (RS)

Stop the current ramp by stopping the actuator controller. The unit will not begin moving until another test command is received.

Reset Ramp timer (RT)

Read Ramp timer (Rt)

Read or reset the ramp timer measuring the current ramp time. If any ramp parameters are changed then the time is reset back to zero. This is because the ramp setpoint is based on the timer value, ramp rate and starting setpoint. The read

timer format is “XXXXXX,YY,ZZ” followed by a return. XXXXX = number of hours (range: 0 to 1,193,046), YY = number of minutes (range: 0 to 59) and ZZ = number of seconds (range: 0 to 59).

Resetting the ramp time will also bring the ramp back to the original starting position because the setpoint is based upon the ramp rate and test timer.

Trapezoid Control Commands

Trapezoid control will cycle between two setpoints with programmed delays at each setpoint. If the unit is in stroke control the two setpoints will be in stroke units. The time is in decimal minutes. Valid delay times from 1 second (0.0166 minutes) to 32768 minutes are possible at each setpoint. The delay time begins before the actual setpoint is reached.

Set Trapezoid control configuration (TC#, #, #, #)

Read Trapezoid control configuration (Tc)

Set and read the trapezoid configuration. The number after the set command will be the first setpoint and delay time followed by the second setpoint and delay time. The setpoint units depend on the current control. If load control is selected then both setpoints are in lbs. The time delay is in decimal minutes. The delay time can be between 0.0 and 32749 minutes or about 22.7 days. The delay timer resolution is in seconds so values under 0.0166 minutes are rounded to 0. Since the loading rate is not programmable, the actuator rate can be used to slow down or speed up the actuators maximum speed to suit the test requirements.

For example if the unit is in load control, cycling between 950 lbs for 1.25 minutes and -500 lbs for 2 hours requires the command "TC950,1.25,-500,120" followed by a return and the unit will start setpoint #1 timer and attempt 950 lbs of tension. After the 1.25 minutes the second setpoint will be attempted for 120 minutes. After the completion of one cycle, the cycle counter is incremented and the cycle is repeated. If a load or stroke limit is reached, the unit will ignore attempts beyond and wait for a setpoint command in the opposite direction.

To read the current trapezoid parameters, send the command "Tc" (no return) and the unit will return the same four parameters given above separated with a comma and terminated with a return. Selecting another hold, ramp or trapezoid test cancels the trapezoid mode and continues with the new parameters and/or mode.

Stop Trapezoid control (TS)

Stop the current trapezoid test by stopping the actuator controller. The unit will not begin moving until another test start command is received.

Reset Test timer (TT)

Read Test timer (Tt)

Read or reset the trapezoid timer to see how long the trapezoid command has been running. Once command changes parameters, the timer is reset back to 0. The read timer format is "XXXXXX, YY, ZZ" followed by a return. XXXXX = number of hours (range: 0 to 1,193,046), YY = number of minutes (range: 0 to 59) and ZZ = number of seconds (range: 0 to 59).

Reset cycle counter (TN)

Read cycle counter (Tn)

Read or Reset the cycle counter. As long as the trapezoid control is operating, the cycle counter will keep track of how many cycles have been exercised. The maximum number of cycles is 16,777,215 counts. Resetting the cycle counter sets the cycle counter to zero.

Channel Control commands

Read control channel (o)

Set control channel (O#)

Read or set the current control channel. (0 = Load, 1 = Stroke). When control is switched from one type of control to another, the current value of the new control channel is used as the new setpoint. This is a covenant method of switching control without having to reprogram a new setpoint minimizing control disruption.

Read channel max limit (k#)

Set channel max limit (K#,#)

Reads and writes the maximum channel limit. Reading or setting a limit first requires the channel number (0 for load or 1 for stroke). The command to set the limits requires the max parameter following the channel number. Reading the command returns the Max limit for the selected channel. If the channel exceeds the maximum limit for the channel, the controller suppresses actuator motion in that direction. This is useful to prevent exceeding the limits of the test.

Read channel min limit (l#)

Set channel min limit (L#,#)

Reads and writes the minimum channel limit. Reading or setting a limit first requires the channel number (0 for load or 1 for stroke). The command to set the limits requires the min parameter following the channel number. Reading the command returns the Min limit for the selected channel. If the channel exceeds the minimum limit for the channel, the controller suppresses actuator motion in that direction. This is useful to prevent exceeding the limits of the test.

Read channel monitors (m#)

Reset channel monitors (M#)

Read and reset the channel monitors. . Reading or resetting the monitors first requires the channel number (0 for load or 1 for stroke). Reading the monitors will respond with 4 numbers. The first two represent the highest and lowest values measured during a test. The monitors are measured internally every 5 ms. The test max/min numbers are reset after the start of the test. The next two numbers represent the highest and lowest values measured in the current cycle. The cycle max/min numbers are reset before the start of the current cycle. The 'm' command can also be used to reset all monitors.

Read channel ranges (g#)

Set channel ranges (G#,#)

Reads and writes the range of a channel. Reading or setting a range first requires the channel number (0-load, 1-stroke, 2-aux). Reading the channel range returns the maximum value allowed by the channel. Writing the channels range will program the data channels maximum value.

Note: Since the stroke channel is fixed digitally the range is not adjustable.

Read channel offsets (z#)

Set channel offsets (Z#,#)

Reads and writes the offset of a channel. Reading or setting the offset first requires the channel number (0-load, 1-stroke, 2-aux). Reading the channel offset returns the value that is currently added to the scaled channel data. It is sometimes necessary to change the channels offset to better represent the actual measured results. For example the load offset can be modified to remove the weight of a test grip or the stroke offset can be programmed to reposition the zero position.

Read channel filter (n#)**Set channel filter (N#,#)**

Reads and writes the filter value of a channel. Reading or setting a filter value first requires the channel number (0-load, 2-aux). Reading the channel range returns a number representing the current filter value. Writing the channels filter will enable a digital filter for the desired channel. At times it is useful to filter the data from a channel to remove noise. Be careful about over filtering the data because it can also remove useful information from the data as well.

Filter Values with associated filter frequency

0 – None	5 – 1 Hz.
1 – 16 Hz.	6 – 0.5 Hz
2 – 8 Hz	7 – 0.25 Hz
3 – 4 Hz	8 – 0.125 Hz
4 – 2 Hz	9 – 0.0625 Hz

Note: Since the stroke channel is read digitally this channel can not be filtered.

Read channel units (e#)**Set channel units (E#,#)**

Reads and writes the units of a selected channel. Reading or setting the channels units first requires the channel number (0-load, 1-stroke, 2-aux). The units are represented by an index number (0 to 8) as shown below in the units table. Each channel has a unique index list that maps the index to the units. Setting the channels units uses the same indexes (0 - 8) found in the read command.

Index Units Table

<u>Index</u>	<u>Load Units</u>	<u>Stroke Units</u>	<u>Auxiniary units</u>
0	lb	in	V.
1	kp	cm	%
2	N	-	in
3	kN	-	cm
4	kg	-	lb
5	-	-	kp
6	-	-	N
7	-	-	kN
8	-	-	kg

Setting the units on the load and auxiliary channels also requires the range to be modified so it properly represents the units. The stroke channel will automatically scale the results to match the desired units

Actuator commands

Abort control (x)

Stops the actuator controller

Read actuator rate (s)

Set actuator rate (S#)

Read and set the maximum allowed actuator rate in inches per minute or centimeters per minute depending on the selected stroke units. To set the stroke rate to 1.25 in/min. send the command “**S1.25**” followed by a CR. Actuator rates that exceed the limits of the unit will be limited to the valid range. The fastest allowed speed is 3.0 in/minute with a resolution of 0.0001 in/minute.

Note: This speed does not take into account the system deflection rate so this speed should only be used as a relative speed.

Go to stroke position (U#)

Go directly to the desired stroke at the fastest stroke rate. The rate and current control channel are preserved and are restored after positioning is complete. If a system limit is exceeded the operation will be canceled.

Read pause status (w)

Set pause status (W#)

Read or set the pause status. Setting the pause status to 1 will pause the current test along with the timer (if active) without changing the test mode or parameters. Setting the status to 0 will release the pause and continue testing. While paused, the actuator controller will be disabled so any change in the system deflection will not change the position of the actuator.

Miscellaneous commands

Help (?)

Displays a list of available serial commands.

Exit Remote control (X)

Exit the remote command mode and return to the manual control panel input mode. See the C command above.

Read load, stroke, auxiliary data (a)

Read the current load, stroke, and auxiliary data from the controller and return the results. The data is returned with the proper range, offset and filtering that is configured for the channel. The data is collected together as closely as possible so the data is not skewed.

Set serial baud rate (B#)

Adjust the computer baud rate. Baud rates from 1200 to 38400 baud can be selected. To select 19200 baud enter the command B19200 followed by a return at the original rate. A CR at the new baud rate must now be received to verify the selection or the baud rate will return to the original setting. The default baud rate on power up is 38400 baud.

Read system status (u)

Reads all system status bits and returns them as a 32 bit hex value terminated with a return. The bits are in the same order as found in the Read Switch Status command but up to 32 bit status can be read with one command. Bit 0 is the least significant bit while bit 31 is the most significant.

The Limit Error status bit can be found in the least significant bit (bit 0). If this bit is set then a load or stroke error has occurred as shown in bits 1 - 4. Bit 7 is the status bit identifying if the setpoint has been reached (minimal control error). Bit 8 to 12 contains the status of the test modes. If the test timer is enabled then bit 8 is set and if the test is paused then bit 9 is set. Bit 10, 11, 12 identify the type of test selected. Bit 17 shows the status of the security key and 14 identifies if the unit is in remote control mode.

0 - Error (Rd/Wr)	9 - Test Paused (Rd/Wr)
1 - At max force (Rd Only)	10 - Hold Mode (Rd/Wr)
2 - At min force (Rd Only)	11 - Ramp Mode (Rd/Wr)
3 - At max stroke (Rd Only)	12 - Trapezoid Mode (Rd/Wr)
4 - At min stroke (Rd Only)	14 - Remote Mode (Rd Only)
7 - At Setpoint (Rd Only)	17 - Keyboard Locked (Rd/Wr)
8 - Timer On (Rd/Wr)	

Read switch status (q#)

Set switch status (Q#,#)

Read or write status switches in the unit. For example to read the status of the timer, send the command "q8" terminated with a return and the timer status will be returned as a 0 if off or a 1 if on. To enable the timer send the command "Q8,1" followed with a return and the timer will activate. Note that in some modes these bits are also set by the controller so some may be set with a command then changed internally. All status bits can be read but not all can be written.

0 - Error (Rd/Wr)	9 - Test Paused (Rd/Wr)
1 - At max force (Rd Only)	10 - Hold Mode (Rd/Wr)
2 - At min force (Rd Only)	11 - Ramp Mode (Rd/Wr)

3 - At max stroke (Rd Only)
4 - At min stroke (Rd Only)
7 - At Setpoint (Rd Only)
8 - Timer On (Rd/Wr)

12 - Trapezoid Mode (Rd/Wr)
14 - Remote Mode (Rd Only)
17 - Keyboard Locked (Rd/Wr)

Read test time (t)

Read the current test timer in the format "XXXXXX , YY , ZZ" followed by a return. XXXXX = number of hours (range: 0 to 1,193,046), YY = number of minutes (range: 0 to 59) and ZZ = number of seconds (range: 0 to 59).

Read cycle count (y)

Reads the current cycle count generated by the trapezoid function.

Error Conditions

If during a test the Model 1K Controller detects an error condition, the actuator will automatically turn off, the display will prompt with the error and the LED will blink rapidly. The following table explains each error condition:

****** SYSTEM ERROR ******

This message is displayed if the microprocessor detects a problem with the system A/D converter, microprocessor or system RAM. This may be due to the Model 1K load frame not being properly connected to the control panel. Check for this condition before calling Interactive Instruments.

"Cable Disconnected"

This message is displayed if the control panel finds that the 15 pin data cable that connects the load frame to the control panel is not properly attached to both ends.

"Remove Load"

If the controller measures a force over 200 lbs. while homing the actuator. If this error occurs, remove the obstruction by loosening the cross bar and press Enter to return the actuator.

"Can not Initialize"

If the controller can't detect the home switch on power up, the unit stops and displays this message. Try re-powering the unit and see if the condition repeats.

Model 1K Specification

Load Frame:	Solid aluminum construction with particle coat paint for rugged use Total dimensions 43" - h, 21" - w, 8" - d Total weight ~70 lbs. Computer generated and tested design
Test Platform:	Test area measures 24" - h, 13" - w, 6" - d Measures both compression and tension to 1000.0 lbs. (0.1 lbs. resolution) 2.5 inch stroke (0.0001" resolution) Variable actuator rate from 0.0001"/min to 3.0000"/min Accepts a 3 point adapter for tensile tests
Actuator Motor:	200 step high torque stepper motor with a 7.2 to 1 gear box Microprocessor controlled for precise positioning and force control 20,000 step per revolution micro-step driver for quiet positioning.
Instrumentation:	Load measured via external S-Beam or Low Profile load cell Data is collected by a microprocessor with a 12 bit A/D converter Displays test results in Metric or English units Support for an optional printer or computer built in
Controls:	16 key keypad with LCD panel for function selection and numeric entry Easy to use menu control to select various tests and set parameters Hold, Ramp and Trapezoid tests supported Load and stroke control available in all test modes LCD constantly maintains load, stroke, auxiliary and test duration Security key prevents tampering of the keypad during test
Software:	Background data acquisition sampling of Load, Stroke and Aux. data Programmable load/stroke control ramp rate from 0.00001 (in or lb.)/min Programmable high and low load and stroke limits Programmable load and auxiliary ranges Programmable load, stroke auxiliary offset Automatically removes most of the system deflection in stroke calculations Auxiliary analog channel with load and offset calibration Displays data in Metric or English units Serial Interface for remote control and data acquisition
Electronics:	24 MHz, 80C320 Microcontroller with 64k of ROM, 32K RAM 11 channel, 12 bit A/D converter RS-232 serial interface adjustable from 1200 to 38,400 baud 4 line by 20 character LCD panel with a 16 key keypad Optional printer port for printing acquired data
Tensile Adapter:	Quickly bolts onto unit for easy installation and removal

Troubleshooting

LCD does not display information

- Check to see that the load frame fuse is not blown. Replace them with properly rated fuses and fuse size (3A 125V)
- Check to be sure the load frame is properly plugged in and turned on
- Verify the control panel is connected and secured to the load frame with the 15 pin data cable
- Verify that wall socket is getting power

System Error is displayed

- See that the 15 pin data cable is plugged securely into the control panel and load frame.
- Check that the load cell is properly mounted and the load cell cable is plugged into the lower analog port on the side of the load frame

Actuator platform will not move

- Check that the 15 pin data cable is plugged securely into the control panel and load frame
- Be sure the power cord is plugged into the load frame and the unit is powered up
- Check to see that the Security Key is in proper position
- Make sure that the load or displacement is not out of range
- Be sure the controller is not paused. Press Enter to release

Has trouble controlling load

- Slow the actuator rate so it does not move for any little control error
- Adjust the load filter to minimize noise but not low enough to distort the load feedback
- Adjust the PID parameters to stabilize the controller
- Be sure the upper cross bar handles are tight to prevent the bar from slipping under load
- Check that the load is centered on the actuator platform and not significantly off center

Stroke Limit reached before the end of test

- Reset the actuator platform to a higher (for tension) or lower (for compression) position before starting a test

Actuator makes noises at times

- The actuator will make noises at some test rates. The motor has a mechanical resonance frequency that will vibrate the frame at some rates. Once a load is applied, the noise should be reduced

Actuator Platform will not initialize

- Check that the load cell is properly plugged into the side of the load frame and secured
- Be sure a load is not applied to the load cell. Loads over 200 lb. will stop the actuator from locating home on power up
- See that the 15 pin data cable is securely attached to both the load frame and the control panel.
- Be sure the power cord is plugged into the load frame and the unit is powered up
- Check to see that the Security Key is in proper position

Keypad is not accepting keys

- The security key should be in the upright (unlocked) position to allow the keypad to operate

Limited Warranty

Interactive Instruments, Inc. warrants the **Model 1K Controller** against defects in material and workmanship for a period of *one* year from receipt by the end user. If Interactive Instruments, Inc. receives notice of such defects during the warranty period, Interactive Instruments will either, at its option, repair or replace products which prove to be defective.

Should Interactive Instruments be unable to repair or replace the product within a reasonable amount of time, customer's alternative exclusive remedy shall be a refund of the purchased price upon return of the product.

If this product was purchased as part of a system in a coordinated shipment or as a system add-on, it is warranted against defects in material and workmanship during the same period as the system.

Exclusions

The above warranty shall not apply to defects resulting from:

improper or inadequate maintenance by customer; customer-supplied software or interfacing; unauthorized modification or misuse; operation outside of the environmental specifications for the product; or improper site preparation and maintenance.