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# INTRODUCTION

Thank you for purchasing the REI Dynamic Spring Rate Checker. This manual explains the operation of the SPRING6 software package that is part of your spring checker system.

The SPRING6 software runs under the Microsoft WINDOWS XP/2000 operating systems. If you are new to these operating systems, refer to the Microsoft manuals that were included with your computer. Go through the tutorial and become familiar with window and mouse operations.

## GETTING STARTED

This manual is written as a supplement to enhance your factory training, not replace it. It is recommended that you read the entire manual before attempting to operate the spring checker. Some things that may not be clear when first encountered in the manual will be more fully explained later. As an aid, all computer commands and options will appear as a different font: **Computer Command**.

## ATTACHING THE SPRING CHECKER TO YOUR DYNO

Before attaching the spring checker, make sure the dyno actuator shaft is set to its lowest position (Bottom Dead Center). You will also need to remove the upper and lower clevis' that are used to hold dampers in place.

If your rater is equipped with a hand pump the pump can be quickly clamped to one of the vertical columns on the dyno using the two clamps that are secured to the pump body. The hose end of the pump should face the ground. The "T" shaped device that holds the hydraulic cylinder and displacement sensor fits between the two columns with the bottom of the device resting over the exposed threaded stud where the lower clevis was. The catch bar should be secured with the pin in place to keep the "T" device from moving. Screw the upper cup to the threaded stud on the load cell (where upper clevis was) so that the proper side faces down. One side of the upper cup is flat (for closed-ended springs) and the other side has a helical cutout (for open-ended springs). When installing the upper cup thread the cup on to the stud then loosen the cup one turn. This allows the cup to rotate preventing spring windup from deflecting the lower cup and displacement sensor. (figure 1)

The displacement transducer cable, attached to the "T" shaped device, should be plugged into the temperature channel located on the electronics board

Stand-alone spring raters should follow setup instructions that are delivered with the spring rater.



Figure:1 REI dynamic spring rater mounted on a 5-VS dynamometer

# COLLECTING DATA

To start the program click on the Roehrig Spring icon on the desktop,

1. When you are ready to collect data click on **test** in the pull down menu. If you are using an existing test, click on **Test**. To create a new test use the **Create Test** wizard. Test parameters are explained in the next paragraph and on page 12.
2. Select your test profile from the pull down list and use the **edit button** if you wish to make any changes to the selected test. Preload is the range in displacement or force that the spring will be compressed before the test range starts. Test range is the range the program collects and saves data for the test. The program will save and allow you to view data in the test and preload range. NOTE: the program collects and averages all the samples over the complete test range to calculate the spring rate number. Test with different test ranges might produce different saved spring rates on the same spring if the spring is progressive. All coil springs will show increases in rate as the spring is compressed at some point in the compression. Preload, test range, sample rate and release speed must all be the same to have repeatable data to compare graphs.
3. If you wish to view the graph with displacement graphed as compression from extended height enter the spring length in the spring size window and click the switch in spring size box. You may save the edited test as the original test name or re-name the test using the **Save As** button. (figure:2)

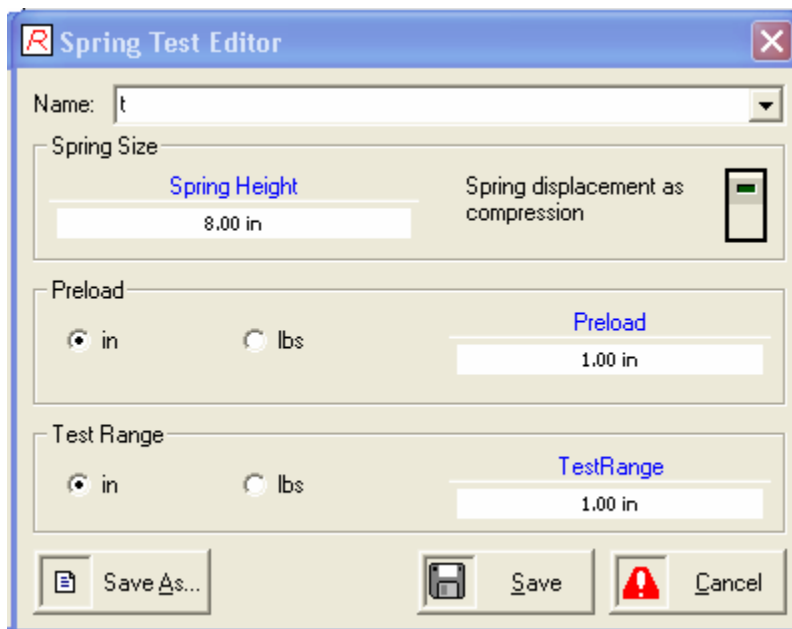


figure:2

- Place the spring in on the lower spring cup and lower the cross bar onto the spring. **TIGHTEN THE HANDLES AND NUTS ON THE CROSSBAR.** After cross bar is tight click **Start Test**.
- In the next window you may use the zero button to zero the force and displacement sensors. This only affects the live reading and has no effect on the test (figure:3)

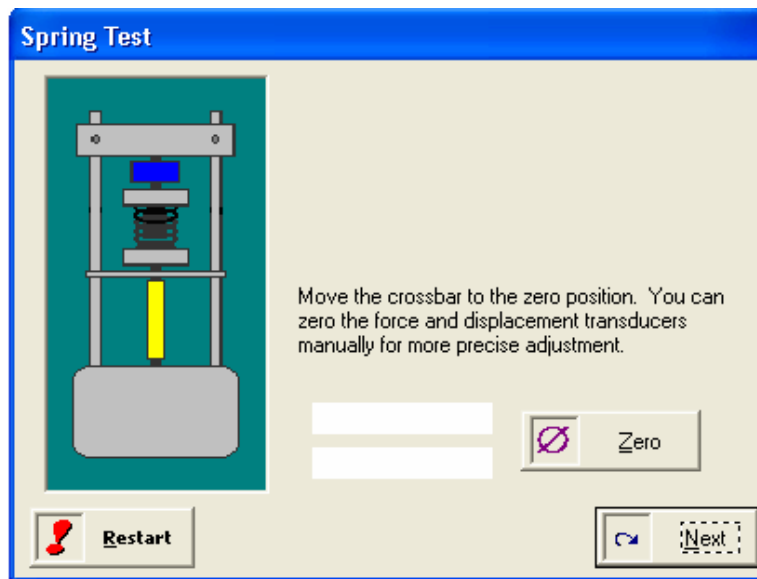


Figure:3

- The next screen will instruct the operator to compress the spring. (figure:4) As the spring is compressed the bar graphs marked **preload** and **test range** will fill out as the test is run through the preload and test range. When the spring has been compressed to the end of the test range a new screen will appear notifying the user to stop compressing the spring, be sure to continue to compress the spring until the screen changes and prompts you to stop. Ending the compression early can disrupt the data collection at the start on the collection. At the end of the compression you will be instructed to wait for the program to stabilize, if you over compress the spring the program will warn you. Over compressing the spring will not affect the collected data but loading the load cell past its rating could damage the load cell. **THE TOTAL OF PRELOAD AND TEST RANGE FORCE SHOULD NEVER EXCEED THE LOAD CELL RATING.** If you are unsure of your load cell rating contact REI support.

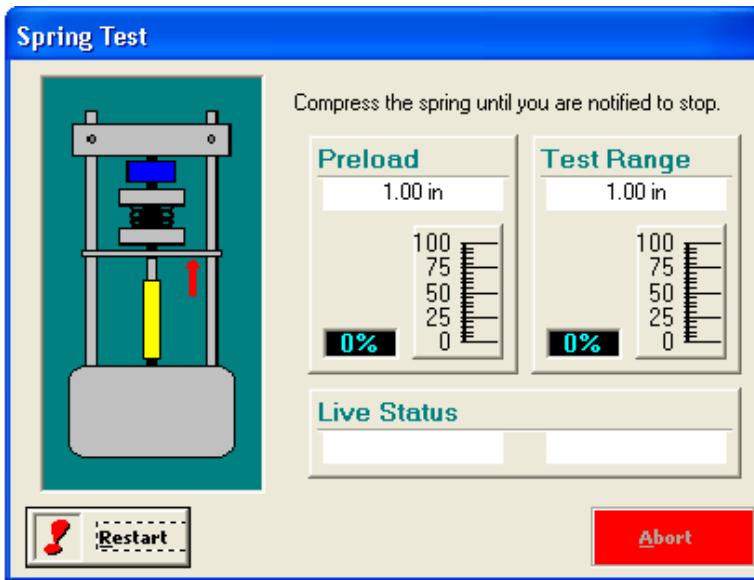


figure:4

7. After the program stabilizes the user will be prompted to collect data by releasing the compressed spring using the release knob located on the hand pump. A consistent release speed is important to the repeatability of the spring rater because the software is sampling samples per second. Different release speeds can vary the numbers of data points collected, which can affect the data. At the end of the release the software will calculate the spring rate using two different methods and display these rates both methods are explained on page eight under **data**.
  
8. Click on the **next** button to bring up the screen to name and save this collection. After you save the file the graph will automatically be displayed on the graph screen. For a more involved explanation of the methods used to calculate spring rate see the section of the manual titled "Where the numbers come from." The program will display the spring rate for each open data file. Use the data page in the properties menu to define which method the program should use as a default. From the factory the program defaults to the average spring rate.

## ANALYZING YOUR DATA

When the test is complete and you have named the file the program will display the trace of the last collected data file automatically. File names and calculated spring rate are displayed on the left side of the main screen. The program will overlay all open data files. By checking or un-checking the boxes next to the file name the operator is able to hide or show any open files, **S** is the test range data **P** will show the preload data. The color of the file trace

can be changed using the **C** hot key. Different graph options are available in the **Graph** pull down menu or on the toolbar. Graph properties can be modified in the Scale tab at the top of the graph. To close a displayed data file highlight the data file and use the **delete** button, this only closes the file in the program, the file is still saved in the original file location.

To aid the operator in analyzing the graph a movable cursor and zoom window are available. To use the cursor select the desired data file from the list of open files on the left of the screen and use the right and left arrow keys to move the cursor along the trace. The data from each data point will read out on the status bar at the bottom of the screen. To zoom in on a section of the trace place your cursor at a point on the graph hold down the left mouse button and drag a box around the area you wish to zoom, or use the zoom tool bar items To return to full view use the **reset zoom** button on the tool bar. You can copy the graph to a document by clicking on the camera icon (figure:5) on the toolbar, then click paste in the document you have open.

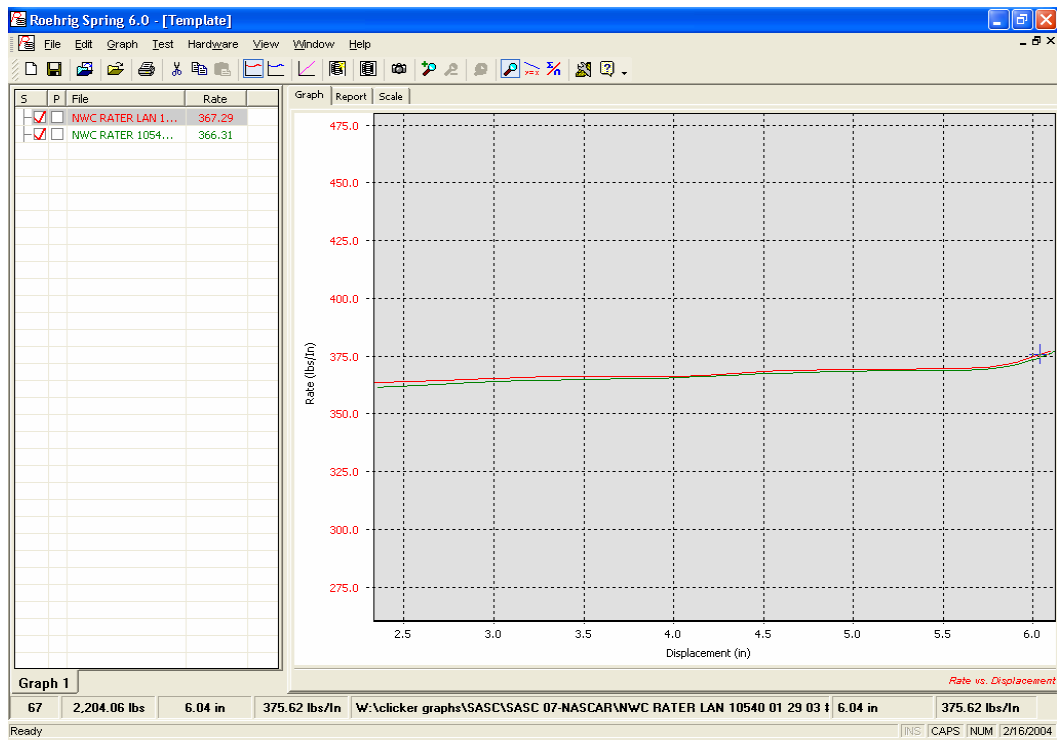


figure:5

Your data can also be viewed in numeric form by selecting the **data** tab at the top of the graph (figure:5). The program will display the data for the data file name that is highlighted in the list of open data files on the left of the main screen. The up and down arrows can be used to move between file with the data window open. By using the

**Report** box on the right of the screen you can define how the data is displayed (figure:6). The numeric report can be exported to a file or the clipboard in three different formats using the **Export** box located under the Report box. If you are unfamiliar with these formats experiment with each to determine what report will fit your needs The **Test Data** box describes the test that the data is being displayed for. The Avg. Rate is the average of all data points in the test range the **Test Range** rate is a rate average of the first and last data points in the test range. To move between data files on the graph or data screen use the up and down arrows.

The scaling tab is used to define the scaling and orientation of the data on the graph page. Auto scale will size the graph to fit the data trace. The span box can be used to define the minimum scaling of the graph when you are on auto scale. To use span enter a scaling number in the span box (you must have auto scale checked) the program will now keep you scaling at that span and place the trace on the middle of the graph, if the trace is larger than the span the program will auto scale. Using span on the rate axis will keep the trace in the middle of the graph no matter what the rate. To set the scaling remove the check from auto scale and fill in your scaling numbers. From this page you can also define the number of lines per axis, and invert the sign or axis for both the x and y axis.

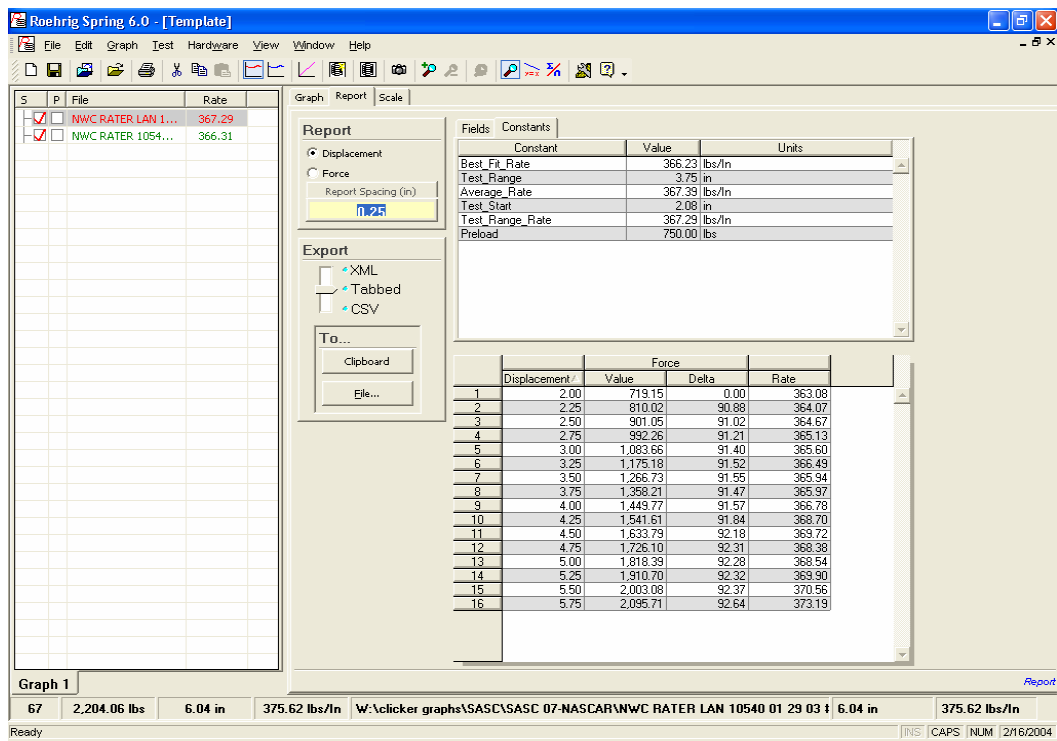


figure:6

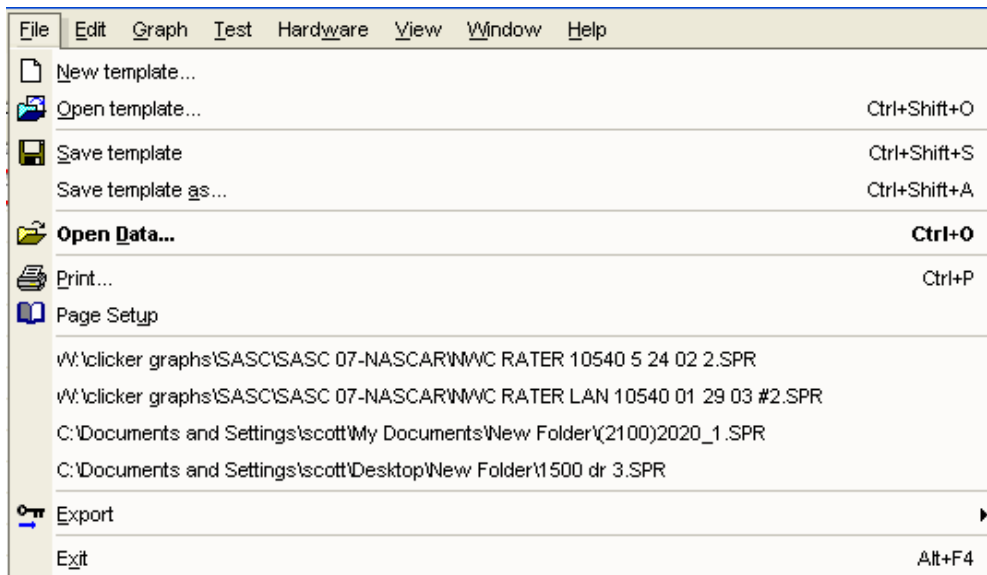
## ICONS

Certain commands can be accomplished by clicking the icon on the tool bar below the menu Bar. Most commands can also be executed using hot key listed on the hot key list or from the pull down menus.

# MENUS

Each menu displays options and various tasks that can be done in the program. The following is a description of each menu, and what can be found under each menu heading. Please be aware that some sections are for advanced users only and should not be used unless you are familiar with function of the option and how it might affect the data. Main menus are displayed in blue in the following section.

## FILE



**New Template...** Templates will save all open data files in one file. To make a new template, click on New Template.

**Save Template...** allows the user to name the template when the save window appears. Templates are saved to a separate directory and named by the user. This option can also be used to save multiple traces on one graph.

**Open Template...**This menu opens to the directory that stores all templates allowing the user to select a preferred template.

**Save Template...**Selecting this option will open the save template window. To save a new template, give a name to your new template and click Save.

**Open Spring Data** Use this selection to open and graph saved data files.

**Printer Setup** Displays the windows print setup screen

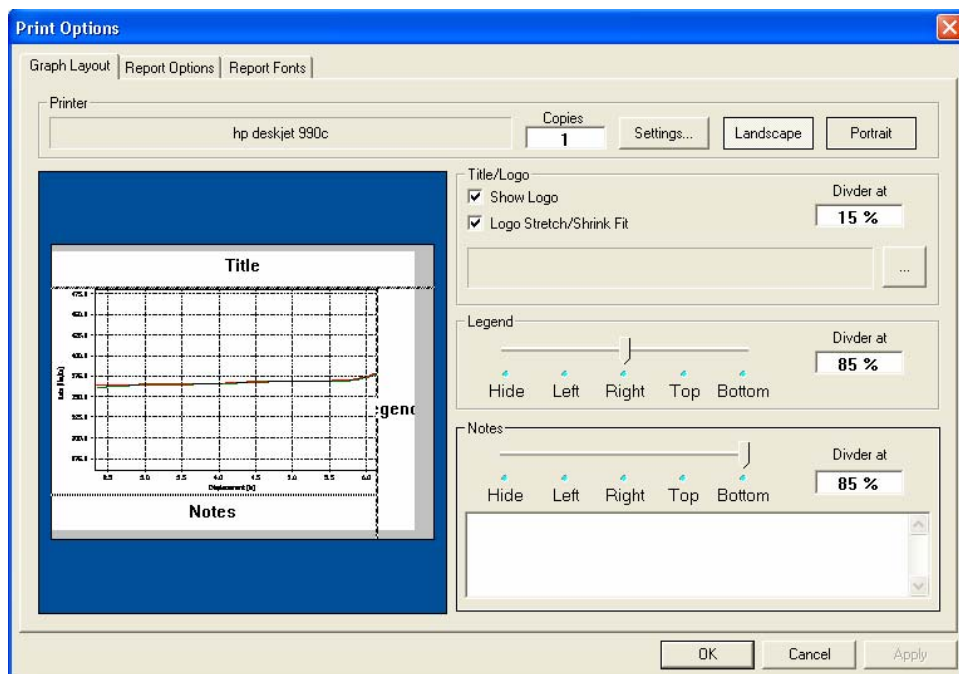
**Print** All user defined print options are on this screen.

The graph layout function allows the user to size his graph, legend, and notes on the paper to fit his needs. The numbers that are entered in the divider box are the percent of the page from top or left that each item will start at. If the notes were positioned at the bottom of the page and set on 90% the note box would start at 90% of the page, measuring from the top of the page. The legend and notes can be located on the left, right, top, and bottom of the page or hidden. Moving an item will require a change in the page percent number to keep the graph area the same. In most cases selecting the same print settings on different machines will produce the same size graph on the paper, if you attempt to match graph sizing on different printers it may be necessary to set the size number different to create the same size graphs.

**Show Logo-** Check this box to include a logo on your printed graph. To select a new logo click the small button to the right of the status bar under the show logo box. Select the bit map file you wish to use. The loaded logo file name will appear in the status box. If you select the stretch to fit box, the program will fit the logo to the page without changing the graph size. If this box is not checked the program will display the logo as the saved bitmap size.

**Report options** This page defines all parameters for the numeric reports that are printed. To print only the graphs with no report remove all check marks on the Data Report section of this page. To print only the reports without the graphs uncheck the print graph box at the top of the page.

The graph and data can be printed on the same page by checking the **Graph Size** box and adjusting the graph size to fit the data on the graph page, when printing data and graph on the same page the lay out works best on portrait mode.



**Export** This button allows you to export your data card configuration (all data card calibrations) or your system settings (all user defined settings including created test and preference settings). It is a good idea to export your system settings to a floppy disk and save it in a safe place in case of a computer failure.

## EDIT

**Cut, Copy, Paste** Use these commands to move or copy data files between open graphs. These commands operate in standard windows format.

## Preferences

In this window the user can define default settings that control how a test will be run and graphed. Many of these settings can be changed in other parts of the program without affecting the default settings selected on this page. After changing a setting you must hit the enter key before **OK** or **Apply** to hold your change on all preferences pages.

### Display

To display the preload on all test click include the preload button. Default graph will define the graph type that the program will open. The default rate switch will determine the method the program will use to calculate the spring rate displayed in the legend and saved. Test range rate is the most popular method. (figure:7)

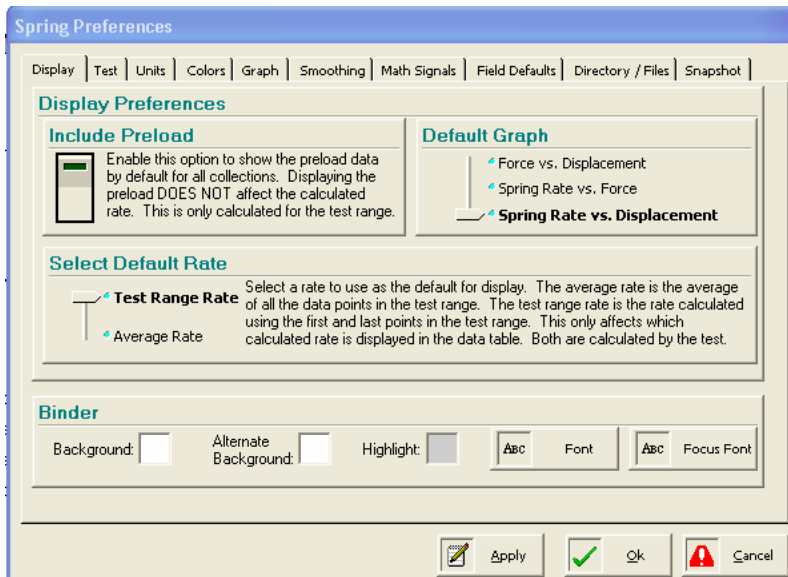


figure:7

## Test

The enter Test Description box is used to control when the test description page will be displayed for user to fill in test information. Settle time is the time that the program will dwell at the end of a test, this is preset and should not be changed.

## Units

Use this page to set English or metric measurements in displayed data, Custom option allows user to mix systems. To change to a different metric unit click on the unit, use the pull down menu that opens to select a new unit. The CTL-F12 hot key or the unit hotkey can also be used to switch between units.

## Color

This window lets the operator select the colors and order of colors that the program will use for displaying data files graph traces. Click on each box to select the color.

## Graph

Grid, Cursor Styles, fonts and Trace Width can be modified from the graph page. Trace Width will define the thickness of the data traces as shown on the monitor and printed graph. (figure:8)

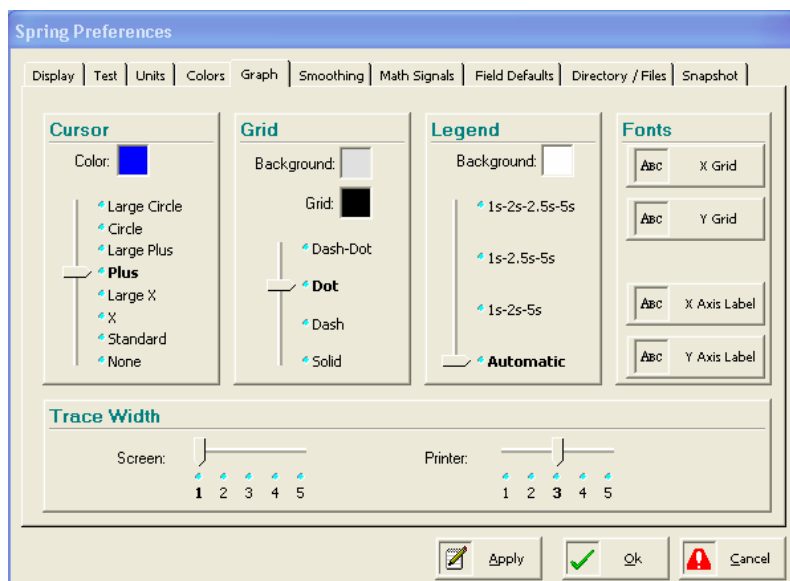


figure:8

## Smoothing

Smoothing on this page only affects the look of the graph to aid in comparing graphs, it does not affect the recorded spring rate number. REI recommends a 30 smoothing on the rate channel. In most cases all other channels should have the smoothing set to zero (figure:9)

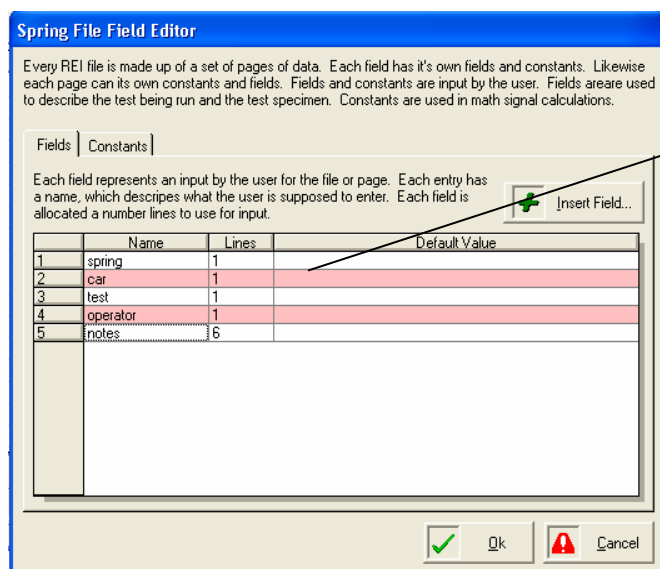
## Math Signals

Math signals are channels that are not collected but are created with a mathematical operation using constants, math functions and channels. Math channels are treated the same as collected channels and may be graphed and used in other math channels. The math syntax for creating math signals is listed at the end of this manual.

## Field Defaults

Fields are the pages that have areas for the operator to fill in test and spring information. The fields are held with the test and displayed on the report tab. The default page allows you to customize the fields to contain the information you need.

Clicking on the edit test Defaults will open the window displayed below. By clicking on a cell you can change the name of a field or the number of lines that will be reserved for that field. By using the INSERT key new lines may be added to expand the field page. To delete a line highlight the name by clicking on it and use the delete key. The default boxes can be used for descriptions that you want to appear with each saved data file as a default. Constants are numbers that would be used with math channels. This window allows the use to completely customize the data displayed on the report page.



Click on cell to Highlight that cell, when a cell is highlighted you can modify the contents of that cell

## Directory/Files

From this page the user can define the default file name and default location the data files. By default the program will always return to the last used directory when saving a data file. A user may select there own default location by clicking *Use a predefined directory*. The button to the right of the file name allows the operator to select another file for the default directory. This page can also be used to define the default file name (Spring Data by default) or have the program us the last entered file name followed by a number that is automatically inserted as a default.

## Graph

This window allows you to select what graph format the program uses to display the open data files. Select the graph type you wish to use by clicking on the appropriate graph type or use the hot keys. The following is a short description of each graph type. Options to aid the user in viewing the data are explained in detail in the analyzing your data section starting on page six. Use the properties page in the Edit menu to find options to change the layout of the graph.

**Spring rate vs displacement** (figure:10) depicts the spring rate by calculating the change in force divided by the change in displacement between each recorded data point and plotting these points against spring displacement.

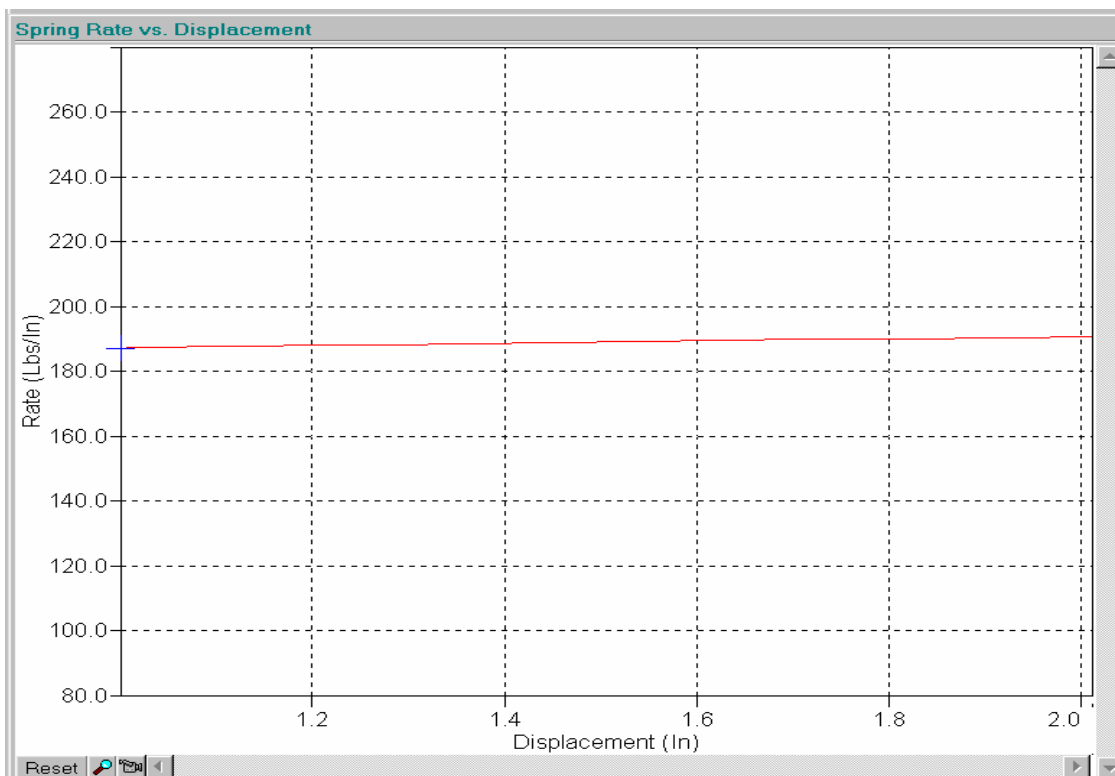


figure:10

**Spring rate vs force** This is the same graph as spring rate vs displacement except the X-axis is force.

**Force vs Displacement** (figure:11) Force is the y-axis and displacement the x-axis in this graph.

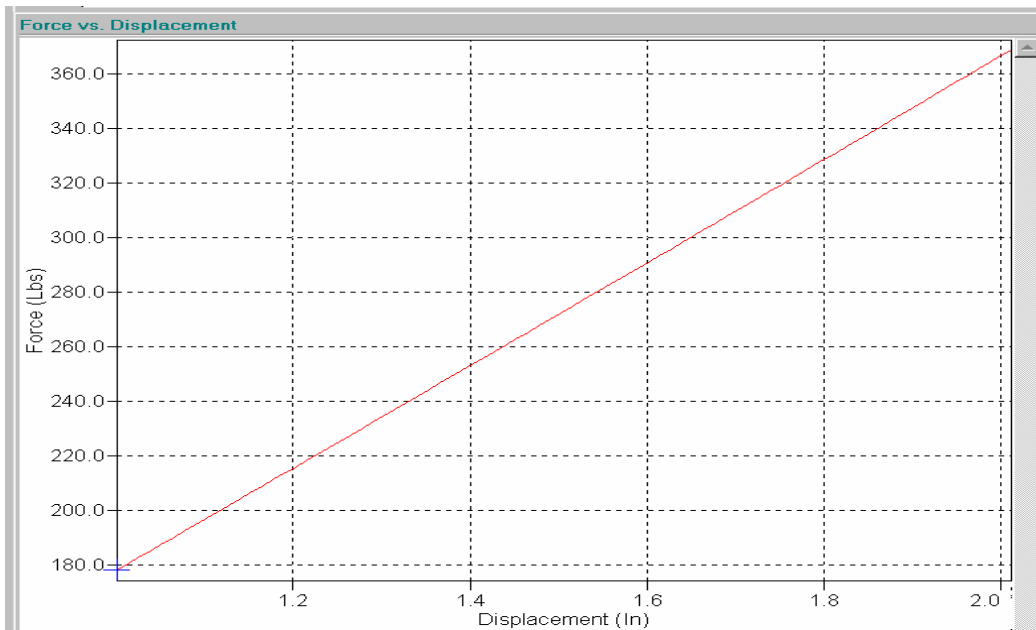


figure:11

**Raw Force vs Displacement** (figure:12) This graph shows the collected force values compared to displacement without the internal filtering that is built into the program. All other graphs are filtered to eliminate electronic noise that hurts the repeatability of the data. You may view the raw numeric values by clicking the **copy** button in the **Edit** pull down menu with this graph open, then open an MS Excel spreadsheet and click on **paste**. No numeric data is available on the data page for raw data, To view raw numeric data it must be viewed in Excel.

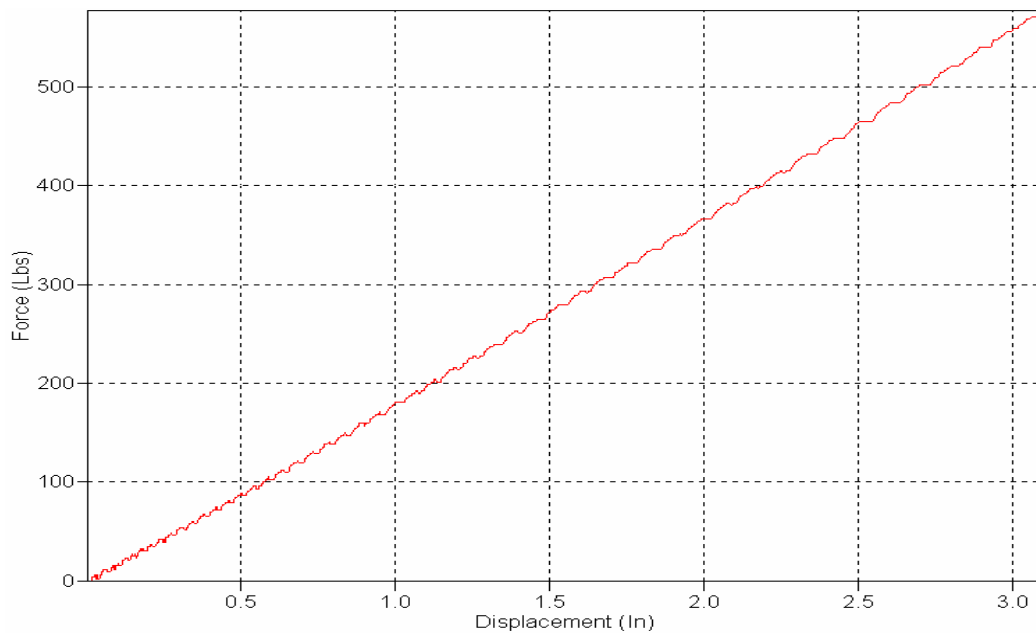


figure:12

**Validation** With the validation option selected, the program will check the collected data against the validation parameters the operator has entered and return a pass or fail if any data points fall outside the defined area. On a test run after validation is enabled a window will be displayed after the collection is complete informing the operator if the collection passed or failed the validation and what data points were out of range if it failed (figure 13). Data files that are opened with validation selected will show a green or red box before the file name on the main screen. Validation parameter settings will hold as a default until changed by the operator. The “V” hotkey can be used at any time to display the validation window that will show what data points failed the validation test.

**Validation parameters** This window allows the user to design a validation test that can quickly show if a spring is outside a group of set parameters. (figure:13)

**Color-** This color will be used to create a block for the test range and rate on the graph.

**Validation rate-** Data files with any data points that fall out side the rates entered here will fail the validation test. The user may select a minimum and maximum by clicking the switch on and typing in a rate number.

**Validation range** – Use this box to define the range that the validation rates will apply. A spring must fall within the defined rates over the validation range to pass the validation test. When using rate vs displacement enter your range in displacement (inch,mm,m). Spring rate vs force graphs need to be validated in a force range (pounds,kilograms,Newton).



figure:13

If a collection fails the validation based on the parameters entered you can view the failed data points by double clicking on the red validation box in the legend. This box will appear green if the collection passes the validation.

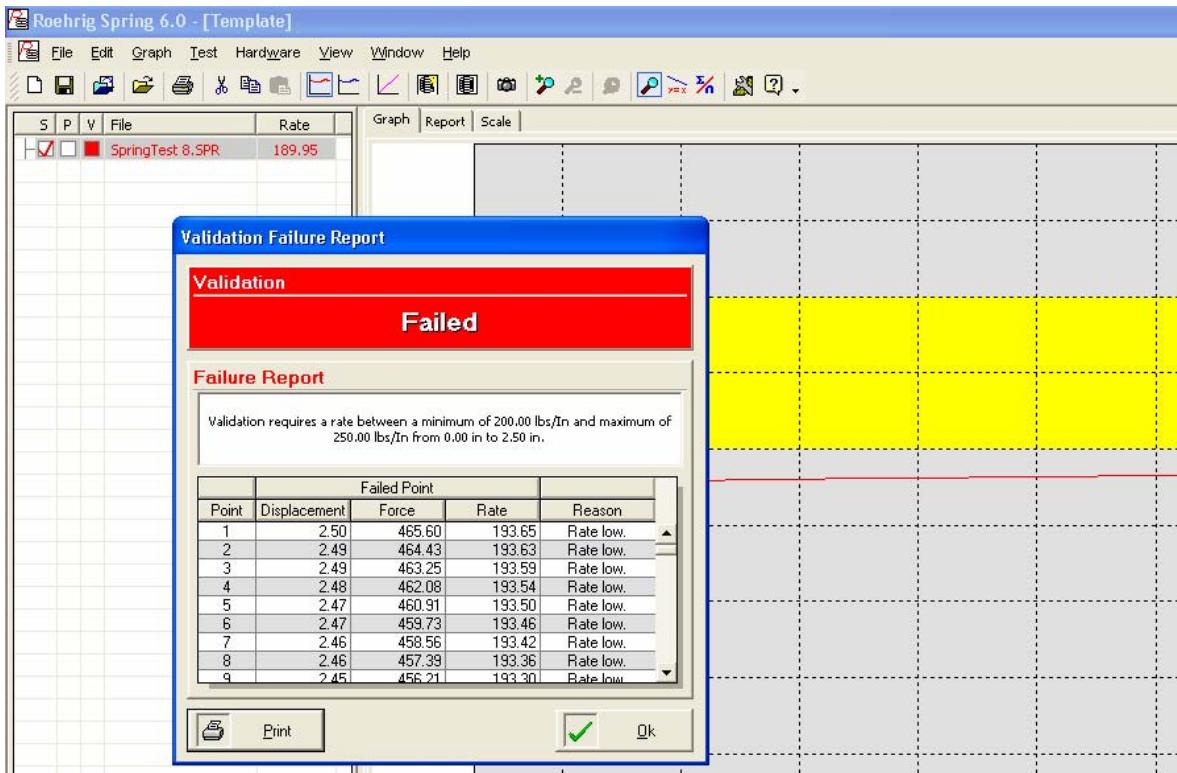


Figure:14 Graph with validation displayed

## Test

### Perform test

This screen is used to perform a spring test as outlined on page two in collecting data

### Create test

Standard test profiles are preset from the factory and can be selected in the **test** box, and modified with the **edit** button. To create a new test use the **create test** button. The create test wizard will walk you through the options to create a new test. After you name the new test the program will save that test in the pull down menu on the **test** page.

## Delete test

Using the delete test button will permanently remove the selected test profile from the from the test profile list.

## Hardware

### Data card

This menu contains specific calibration for each sensor and the data card type. **WARNING! ALTERING THESE NUMBERS WILL CHANGE THE CALIBRATION OF YOUR SPRING RATER AND MAKE YOUR DATA INCORRECT.**

### Monitor

This screen shows the live reading for each sensor. Each channel is displayed in graph and numerical form. This window can be used to diagnosis problems with your dyno.

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DON'T PANIC