CTW Automation Probe Software for the LA Series
Rev E

Index

- Rev E – includes Gain tables for N-Servo and incremental encoder when using CTW Probe for EMA

Introduction

This manual is for the CTW Probe Analysis Software to be used with the LA series of machines designed, built, and manufactured by CTW Automation. It is intended for the purposes of our customers and their LA machines. It is not intended for mass distribution or publication by anyone other than CTW Automation. It is setup to first go through all the Tabs and screens before proceeding to building and executing a Test.

As with all CTW Automation products and services, CTW Automation wants you to be able to use the equipment and obtain results you can use to develop and characterize your shocks, springs and specimens. To that end, we want to help you get the most out of the equipment and for you to be happy to use it.

Technical Help and Support

Your machine was delivered with a full one-year Support contract. This allows the owner e-mail / phone and remote access help via CTW TeamViewer license. Any time after training, if you have questions or concerns, contact CTW for help.

To get the best help, it is important you try to use the following avenues:

E-mail to: Service@ctwautomation.com
Send your name, location and a number to reach you
Please include your serial number, for example RD3-043
Or
Phone: 336-542-5252

We are located on the East Coast in the Eastern Standard Time zone (EST).

- If you have questions about data or a graph, PLEASE attach the data file to the e-mail. We can open it on our computer and understand more than just sending a picture.

- If you have questions about a particular Test you created, it could be helpful to attach that to the e-mail so we can see what you are using for commands

- TeamViewer should be loaded on your computer during calibration or install. If you need a copy it can be found on our website: www.ctwautomation.com go to the Software tab.

Section I - Overview

Overview of the LA Series of Linear Actuators

The LA series is a highly advanced linear actuator designed for performance and dynamic response. It is capable of various wave forms and uses a displacement and time loop for its movement. There are (4) parts to the system and they work together to drive the specimen as the User defines.

1 – The actuator itself along with the specimen window comprised of two columns, a crossbar and load cell. This is the working area for the standard parameters of testing.

2 – The power cabinet houses the motion controller and the servo amplifiers as well as all other items necessary for operating the LA. This is where the input power from the customer connects at one end and while the LA connects at the other.

3 – The motion control hardware is housed inside while the motion control firmware resides on the desktop PC provided with your LA.

4 – CTW Probe analysis software for the LA resides on the PC as well.

It is important to understand that the CTW Probe software provides the User with a specifically designed GUI to allow for quick and easy use of the LA. All four of these components are necessary for standard operation of the LA.

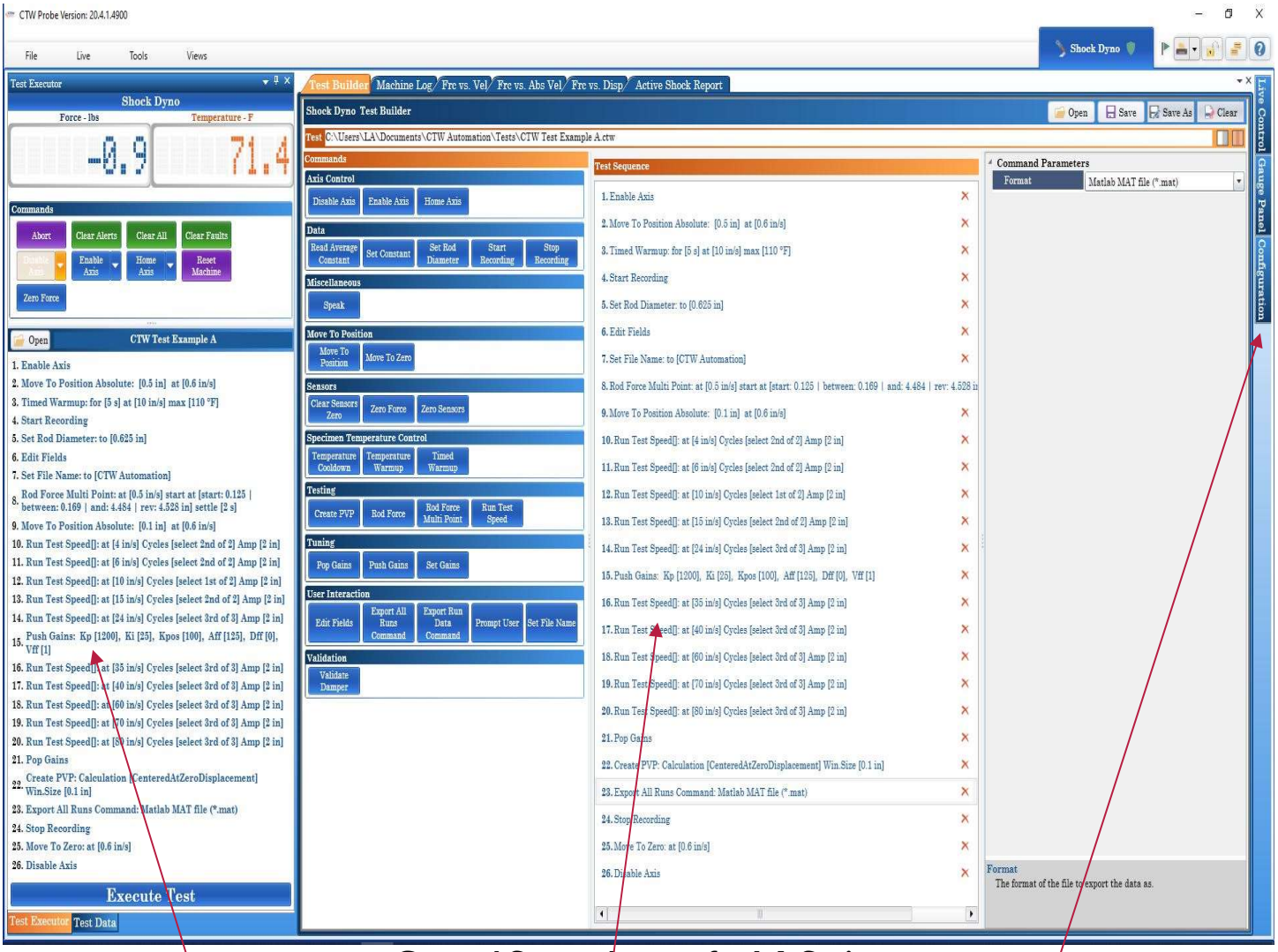
The LA28 & LA48 and Power Cabinet General view

Section II – General Layout of CTW Probe for LA

General Layout of Landing Page

CTW software has different windows or pages depending on what function you are executing. Almost everything the user needs to run a test and display data is on this one window.

This is a typical layout for the Software from a User standpoint. All the Tabs and windows can be changed and moved in almost any manner a person would want. This represents a good start for the first-time user.



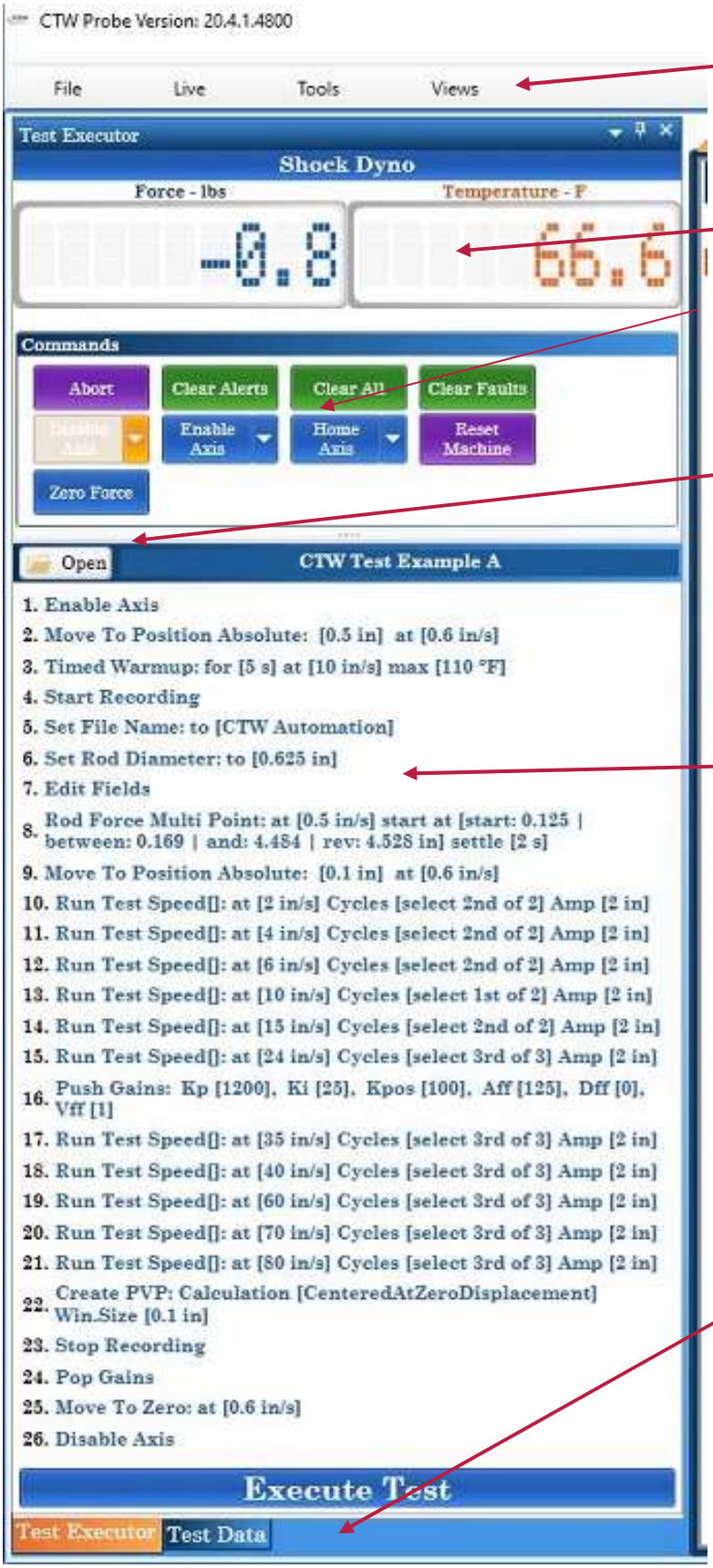
General Screen Layout for LA Series

Left Side for Executing the Test, Loading and working with Data files and Live Control for "homing" the actuator at start up.

Middle section for Graphs and Test Builder

Right side for calibrations and other features beyond standard operations.

Left Side - in detail



Left Side of Screen

The top Toolbar includes: "File", "Live", "Tools" and "Views"

Live readings of "Force" and "Temperature".
"Reset Machine" and "Zero Force"

Open: This is where you load the Test profile you want to run.

"Test" – shows the Test that is loaded.

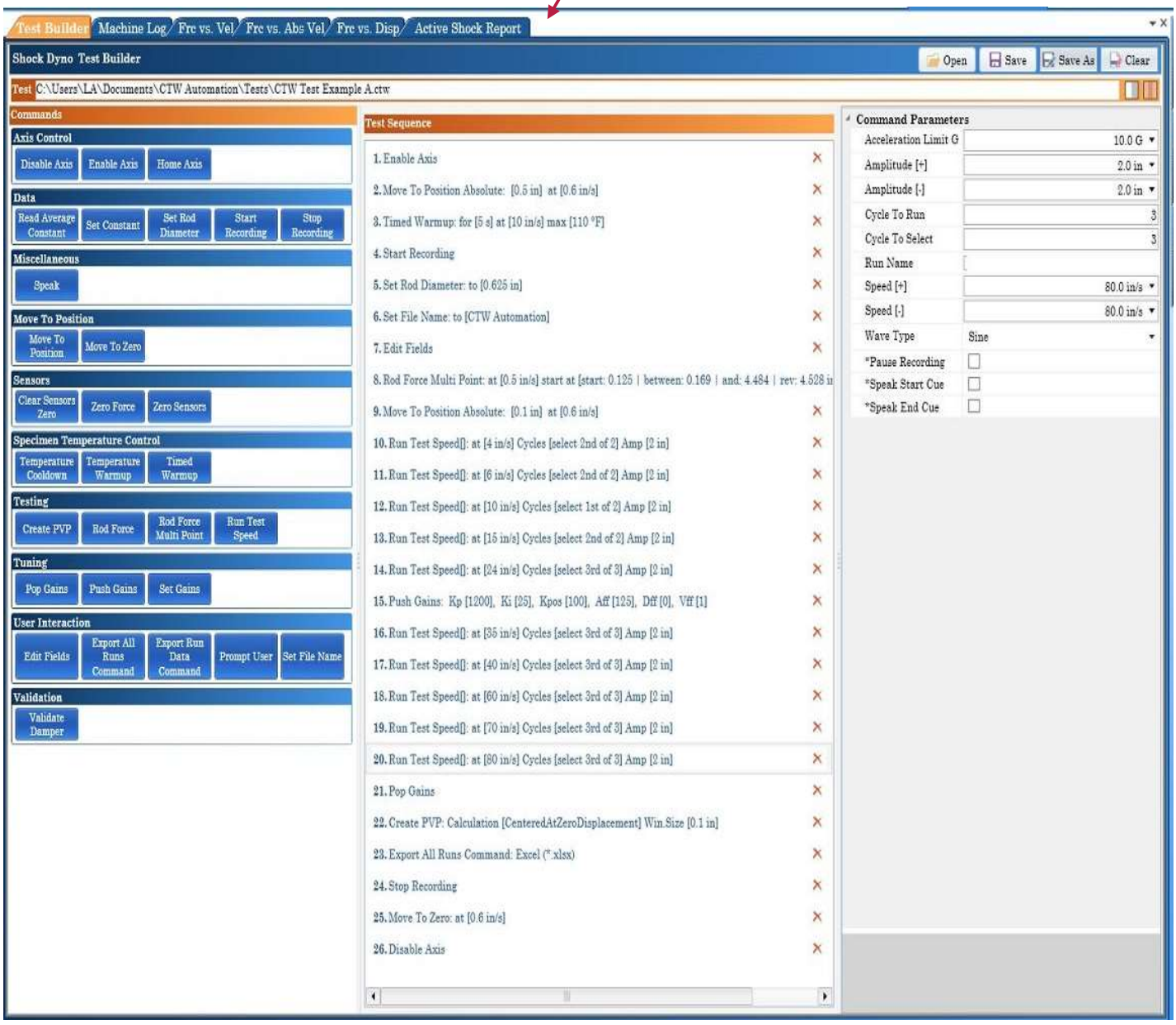
Test Sequence – Lays out the Commands that the Test will execute in the order they were built in Test Editor.
They will be highlighted as they are being run.

Lower Tabs for Typical Layout:
"Live Control", "Test Data", "Test Execution" and "Live Cycles"

Middle section - in detail

Includes the "Test Builder", all Graph types and Reports when generated.

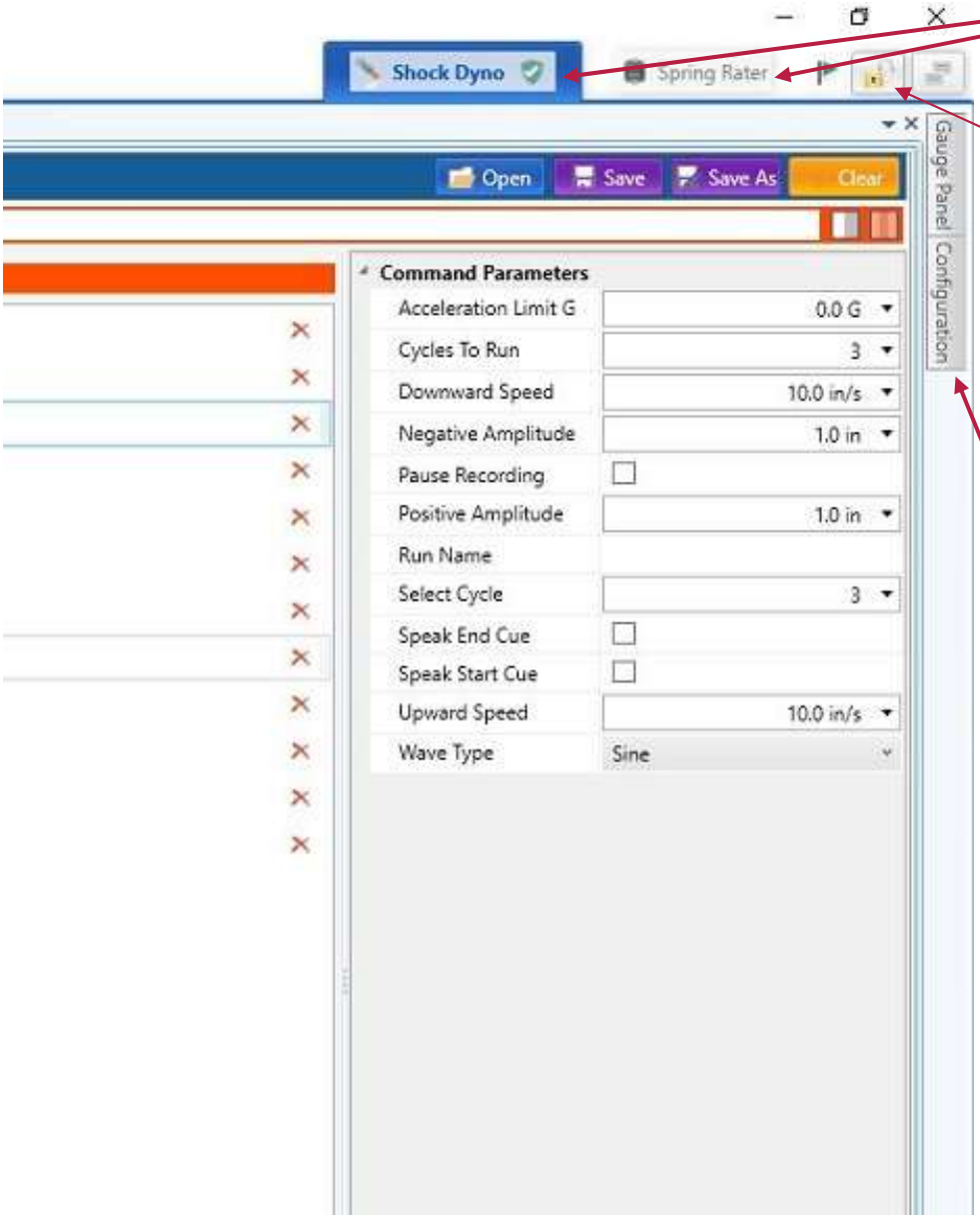
Typical Layout across the top is to place the Graphs and Test Builder as they are used frequently. Graphs can be added and removed. Reports and Live Data will also show along this top Tab area.



Middle Section – Typical

Right side - in detail

Far right of the screen is for windows such as Configuration and Gauge Panel. These contain items for calibration and machine setup as well as a live output voltage and units of channels. These are set to "auto-hide".



Indicates which Software is being used.

Lock Tab can lock the Screen to keep from accidentally changing the windows

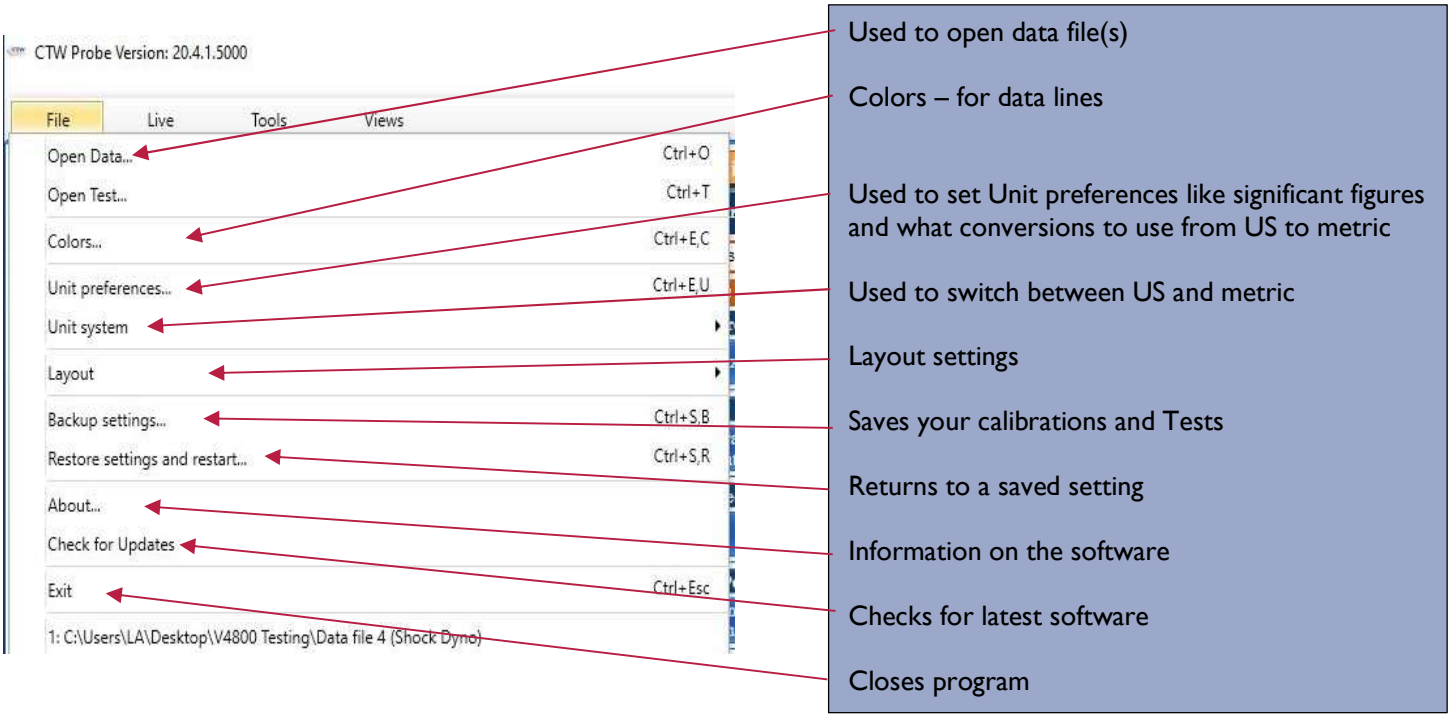
Right Side of the Screen – typical: Seldom used Tabs go here such as the Configuration and Gauge Panel tabs most often during install. They can be made to Auto-hide, Dock or be removed.

Right Side of Screen - Typical

Section III – Toolbar of CTW Probe for LA

File Live Tools Views

File Tab – Listings

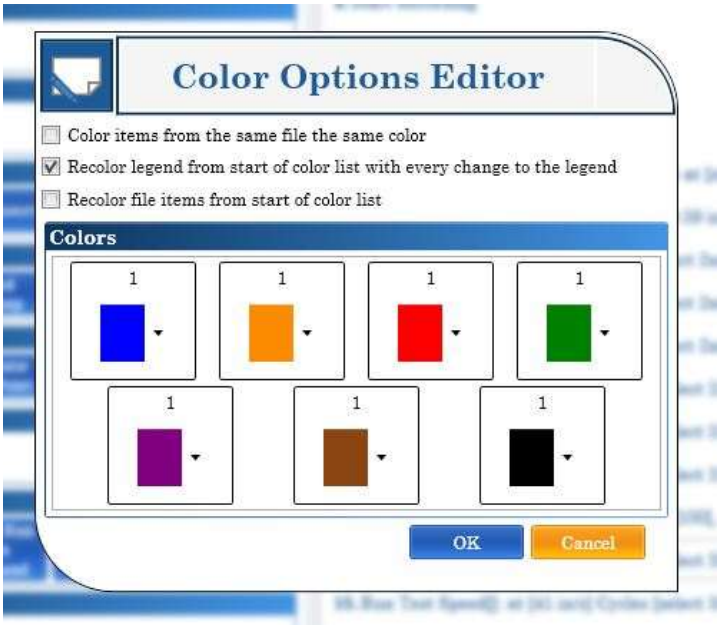


File – Open

This allows the User to open one (1) or multiple data files for viewing. Like Windows, the "Ctrl" and "Shift" keys work for selecting files. This is how you open new d\Data files to be used, graphed, and printed

File – Colors

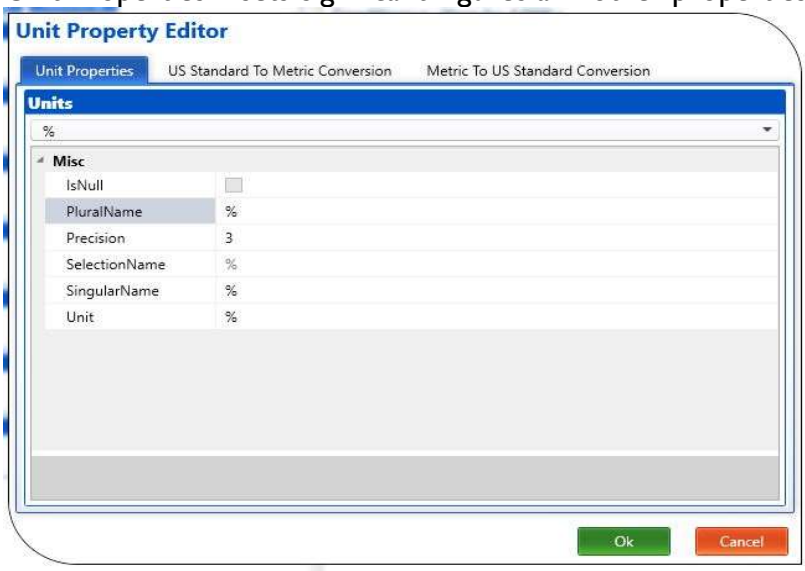
You can use the various features of this area to have the graph lines appear in the color and order you chose.



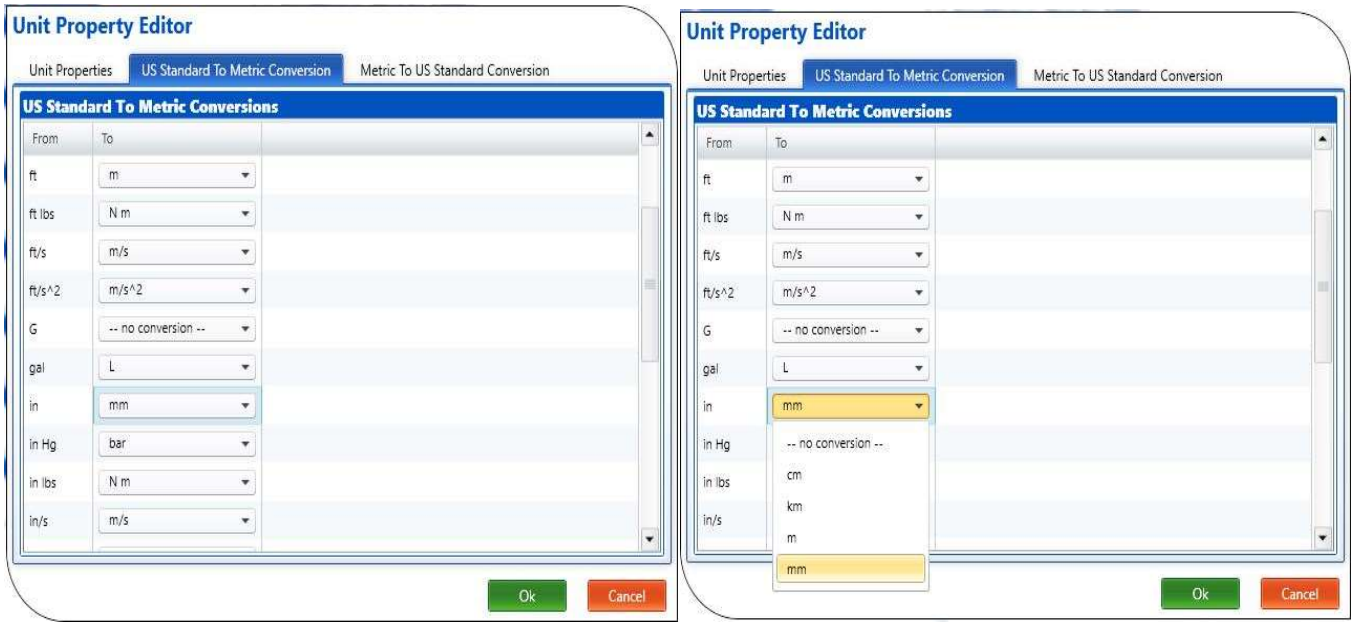
File – Unit preferences…

Opens the Unit Property Editor where all Unit functions, conversions and Unit selection types are picked such as US Standard and Metric

Unit Properties – sets Significant Figures and other properties



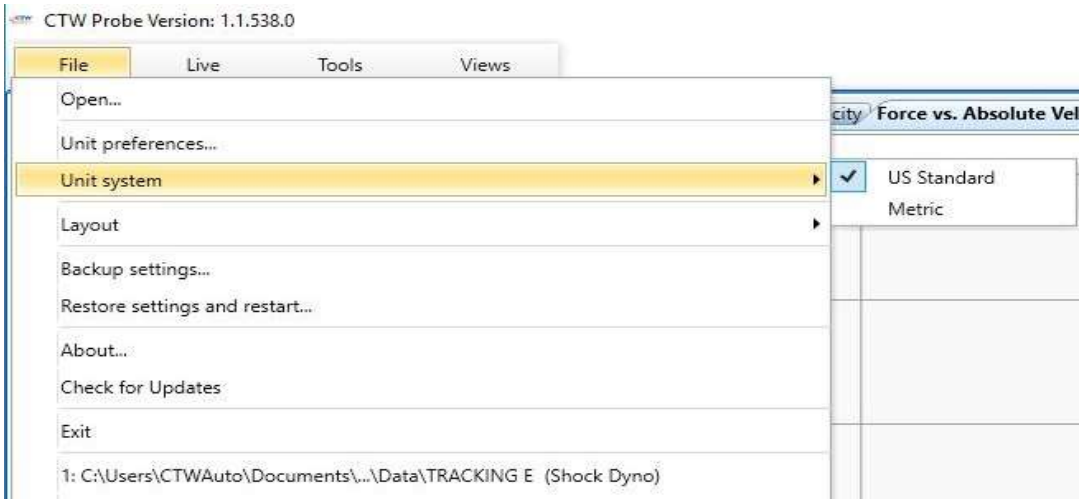
US Standard to Metric Conversion – Select which units to convert from standard to Metric. Note: you can mix standard and metric units.



Example: Showing Inches converting to Metric options

File – Unit System

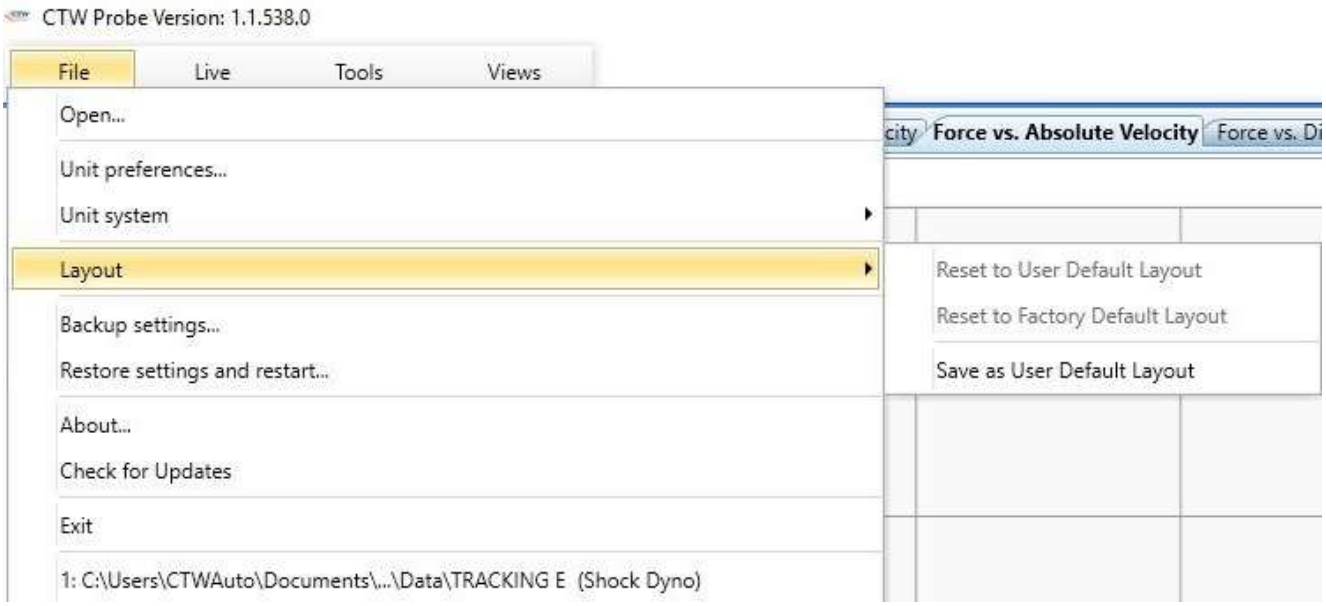
Allows the User to toggle back and forth between their selected US Standard and Metric Units.



File – Layout

This allows the User to select, save and restore the layout of the Landing page.

- Reset to User Default Layout
- Reset to Factory Default Layout
- Save as User Default Layout



File – Backup settings…

This should be used every 4 months to create a backup of your settings and calibrations. A copy should also be kept off the computer.

File – Restore settings and restart…

The User can import their Settings and Calibration to restore to know good values or to import settings to a new computer.

File - About….

Lists the details of the software.

File - Check for Updates

This allows the User to search the CTW archives for a newer version of software. These releases will be posted on the website, Facebook page and newsletter.

File Tab – Live

By checking / unchecking the windows, the User can have access to them on the Toolbar.

Live Data

Live readout of channels in various scope functions.

- Keep unchecked unless using.

Live Control

Real time control of actuator.

- Keep unchecked unless using this feature.

Live Cycles

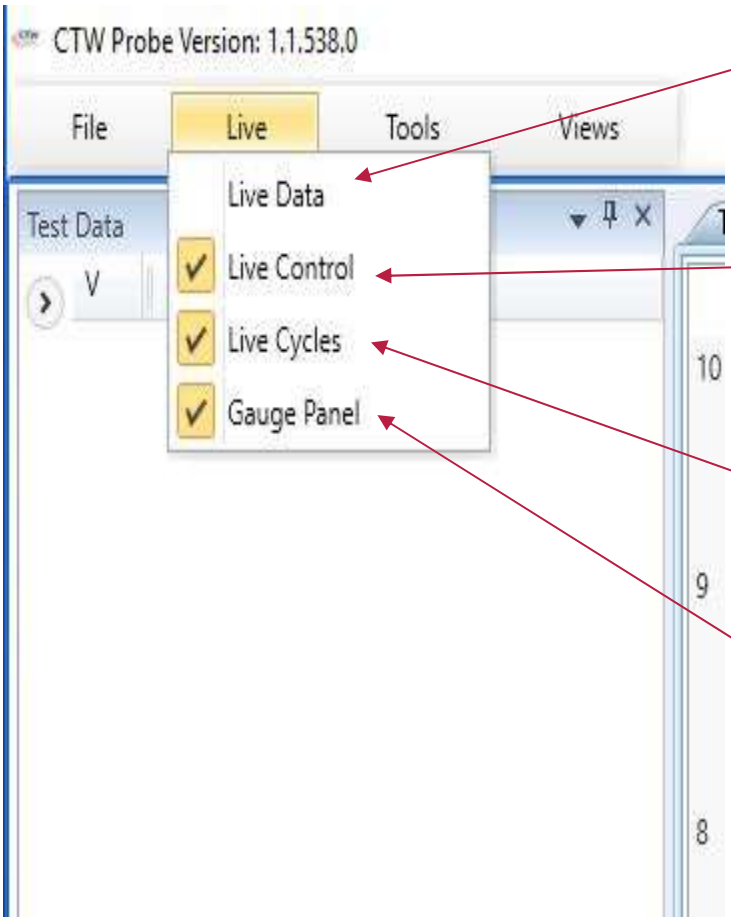
Shows the cycles captured by the User during live capture of data.

- Keep unchecked unless using this feature.

Gauge Panel

Live readout of voltages and units for each channel.

- Keep unchecked unless using this feature.



Live Data - This screen has a Scope function as well as viewing live data.

Live Control - Allows for live operation of the actuator outside of a running a specific Test.

Live Cycles - Shows the data file for the Live Data if collecting cycles

Gauge Panel - Live readout of all sensors and signals being used

File Tab – Tools

By checking / unchecking the windows, the User can have access to them on the Toolbar

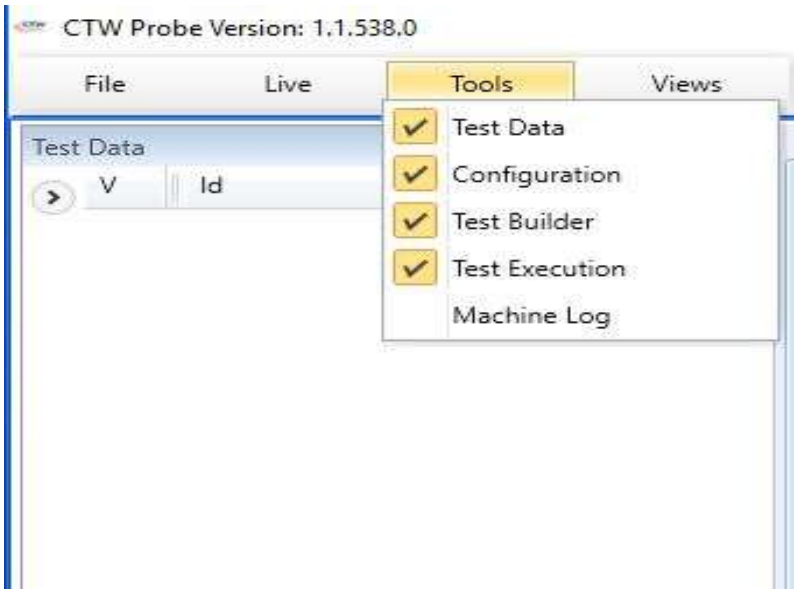
Test Data
Shows all open test files

Configuration
Area where the Machines configurations are kept and edited

Test Builder
The area to build your test Sequence

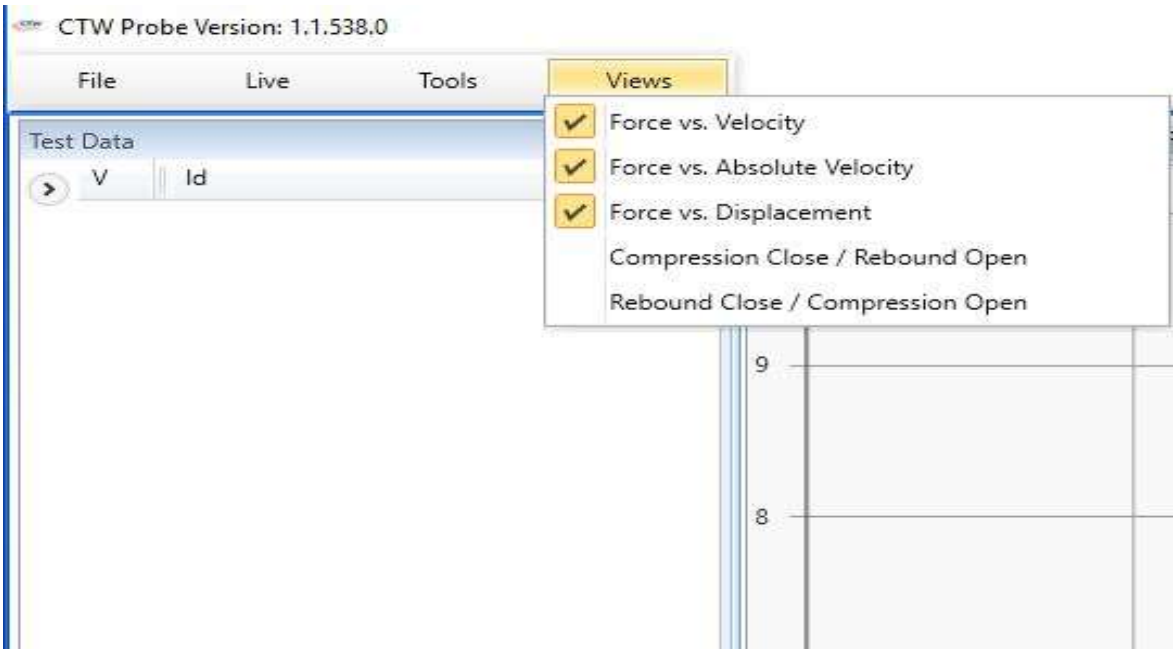
Test Execution
Where you run your Tests

Machine Log
Running collection of all machine operations



File Tab – Views

This tab allows the User to turn the Graphs on and off



Views Tab for Graphs

Force vs. Velocity

This graph plots the force data vs velocity showing both positive and negative values for velocity.

Force vs Absolute Velocity

This graph plots the force data vs. the absolute value of velocity so that everything is positive along the velocity axis.

Force vs. Displacement

This graph plots the force data vs displacement.

Compression Close / Rebound Open

This graph is half of one complete cycle and it represents the lower 180 degrees of a full 360 degree cycle.

Rebound Close / Compression Open –

This graph is half of one complete cycle and it represents the upper 180 degrees of a full 360 degree cycle.

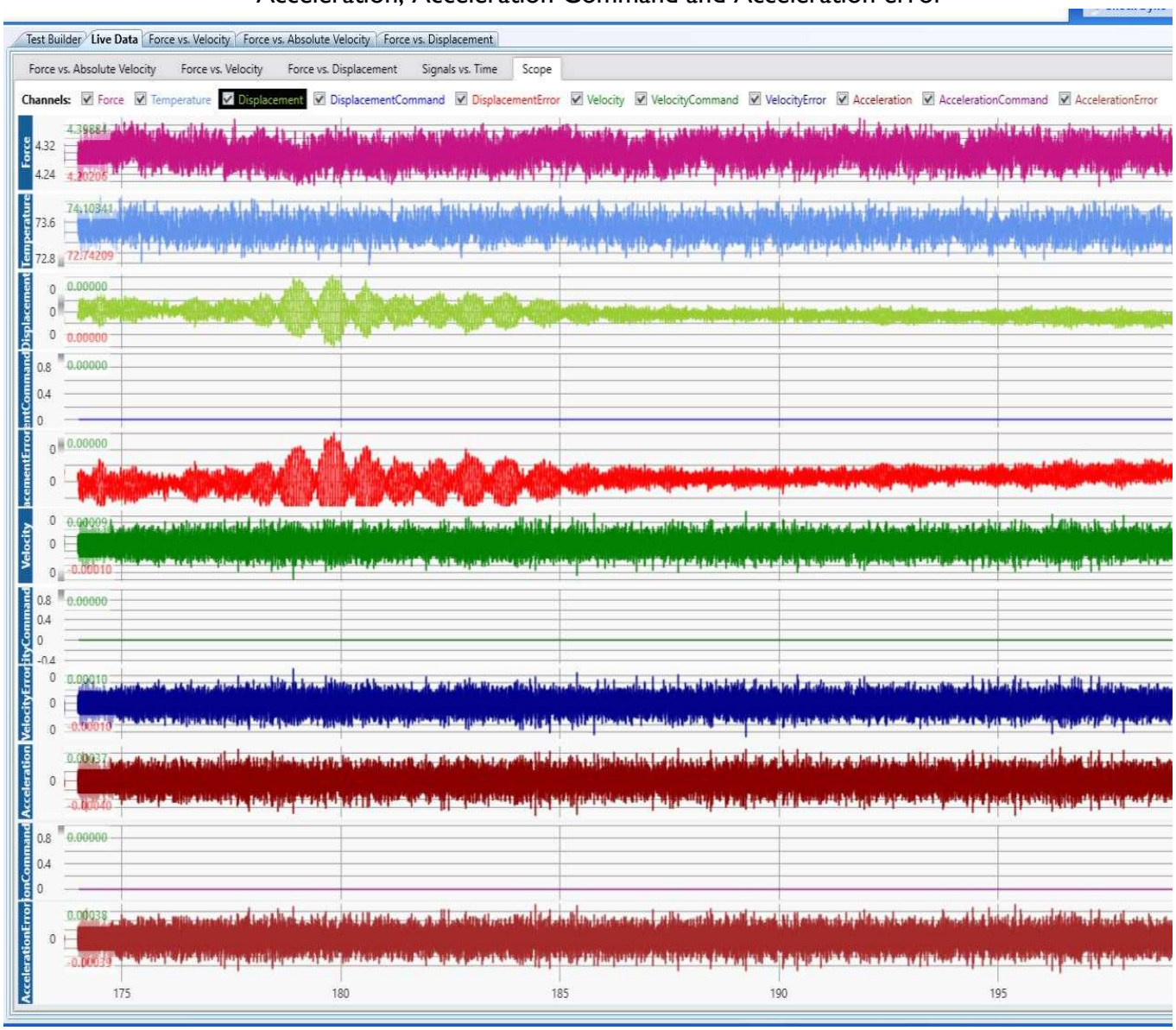
Section IV – Individual Pages explained

Live Data Page

This window shows the Live readings from all signals and collected math functions. They can be viewed in a Scope, Force vs Absolute Velocity, Force vs Velocity, Force vs Displacement and Signal vs. Time.

Signals include:

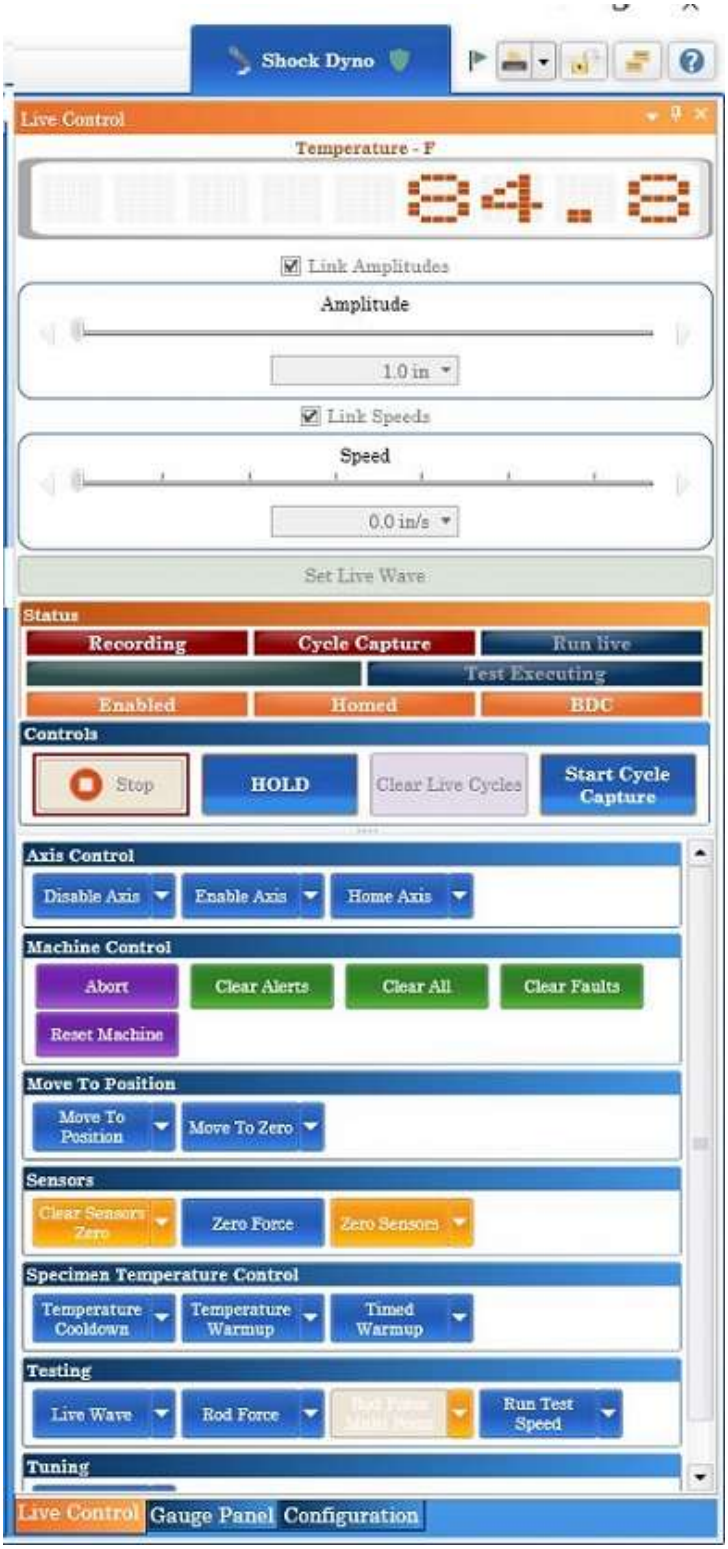
- Force and Temperature
- Displacement, Displacement Command and Displacement Error
- Velocity, Velocity Command and Velocity error
- Acceleration, Acceleration Command and Acceleration error



Live Data: Scope function

Live Control Page

This page allows the User to run the actuator in a live command mode. Details to found in Section IX



Live Control Page

Live Control Instructions

1) Enable Axis

2) Home Axis

3) Move To Position – check to set position using drop down arrow

4) Live Wave – check to set speed and amplitude using drop down arrow

5) Upper Control becomes active the "Set Live Wave" area

"Link Amplitudes" defines + and – to be the same (compression / extension)

"Link Speeds" defines Compression / Extension Speeds to be the same

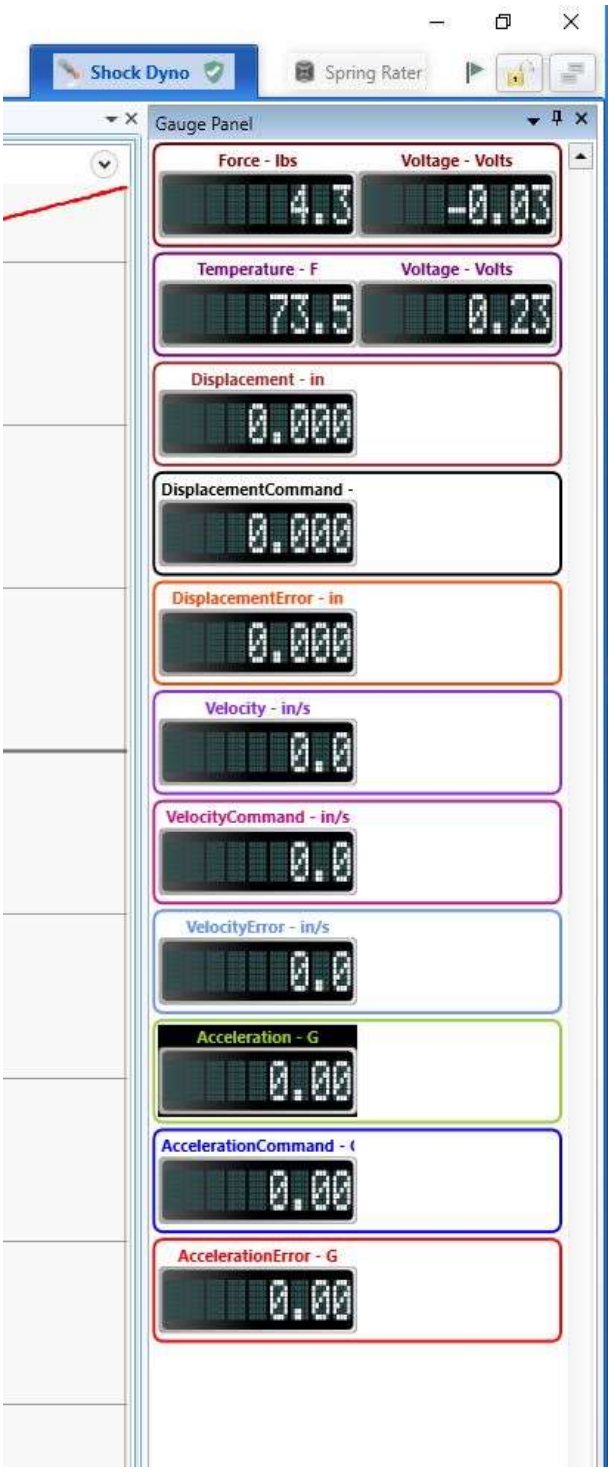
6) Type in a change and click "Set Live Wave" – the new speed will run

7) Start Cycle Capture – starts live cycle collection on Live Data screens

8) "Stop" stops the actuator and places it at the Move To Position

9) Move To Zero

10) Disable Axis

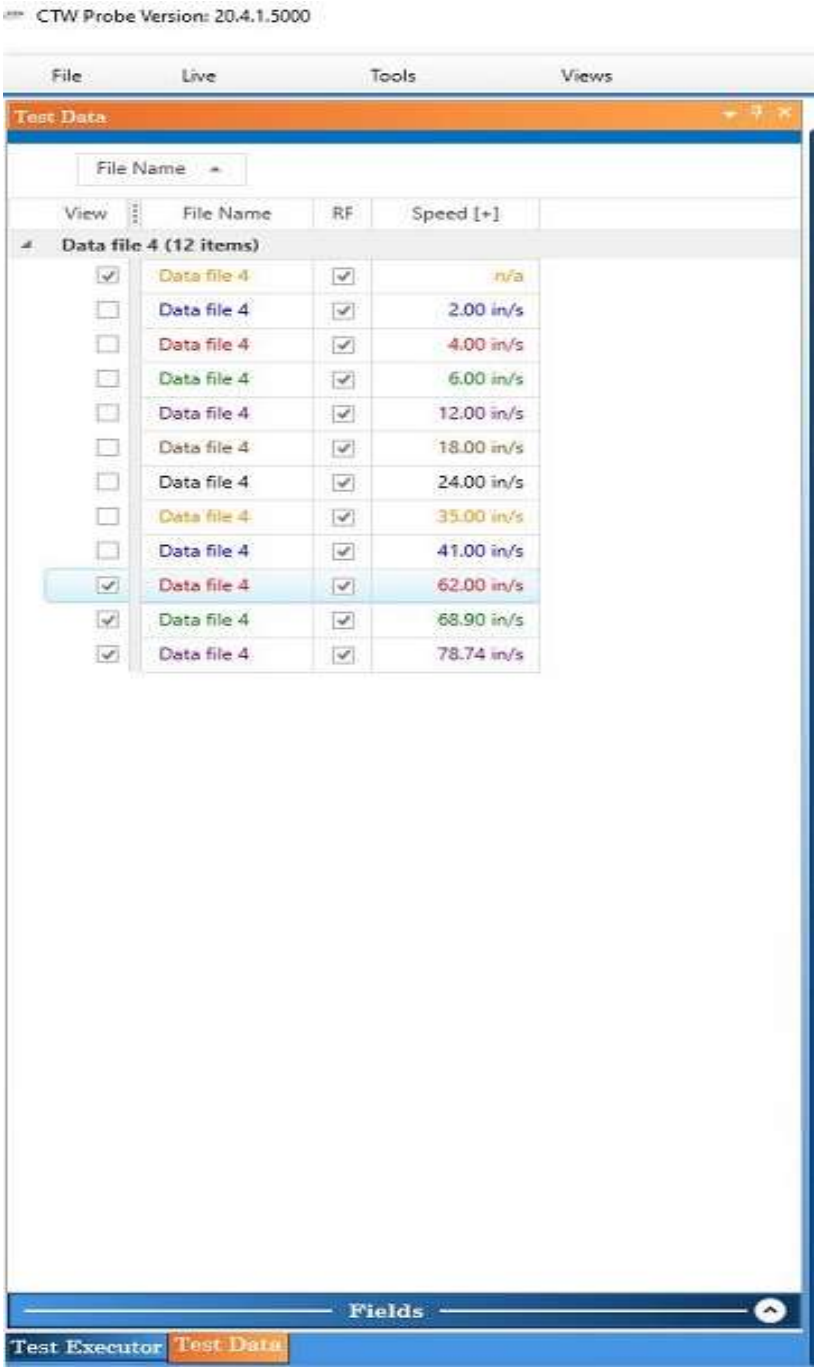


Gauge Panel Screen

Gauge Panel
This is used to get a live reading in numerical output of each signal and collected trace. These can also be viewed in the Scope section of Live Data graph.
These can also be used for calibration as the voltage is displayed direct from the sensor.

Test Data

Area where collected test data is shown – the Data File



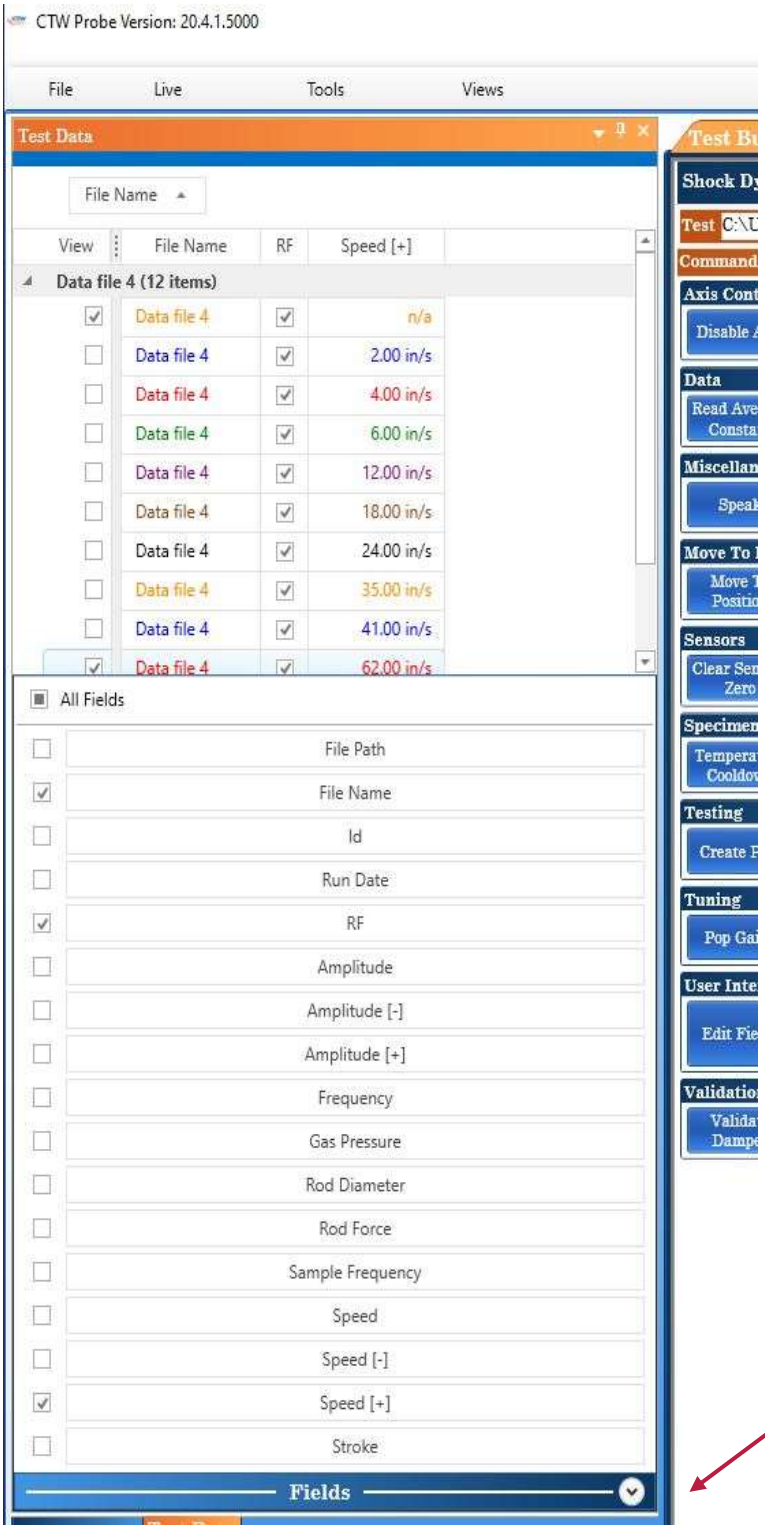
Test Data Window

Test Data Window
The area on the Left side (legend) lists all open Data Files. By checking and unchecking the boxes you can view and hide each individual trace.
To delete from this area, click on the "x" that appears to the left when you hover your mouse.

Note: this does not delete data, it only removes the data from the legend.

Various "Fields" can be added to the screen for viewing more or less information.

You can also sort by any given Field by dragging it to the top of the bar



Fields Available for adding to the Legend

Fields available –
View the list as it expands from the bottom of the screen.
Fields that can be viewed include:

File Path

File Name

Id

Run Date

RF – allows for removing / adding the Rod Force amount

Amplitude

Frequency

Gas Pressure – used with Set Diameter

Rod Diameter

Rod Force – the measured number

Sample Rate

Speed

Stroke

By clicking the arrow, the Fields are revealed that can be added to the legend for viewing for each Data trace. There are many and they can be added and removed.

Test Data - Fields

These are additional information blocks that can be shown for each file

Color – Shows the color of each trace

Path – Shows where it is located on the computer

FileName – Shows the file name as the User saved it

Id – Shows the FileName (again)

RF – Adds a column so that the User can add/remove the Rod Force back into the data

Speed – Reports the requested test speed for the particular trace
Speed (+) Linear actuator only
Speed (-) Linear actuator only

Frequency – Reports the linear frequency of the test for the given trace

Stroke – Reports the stroke of the test (twice the amplitude)

Amplitude – Reports the amplitude of the Test
Amplitude (+) – Linear actuator only
Amplitude (-) – Linear actuator only

Rod Diameter – Reports the rod diameter if the User enter it

Rod Force – Reports the force collected during the rod force phase of the test

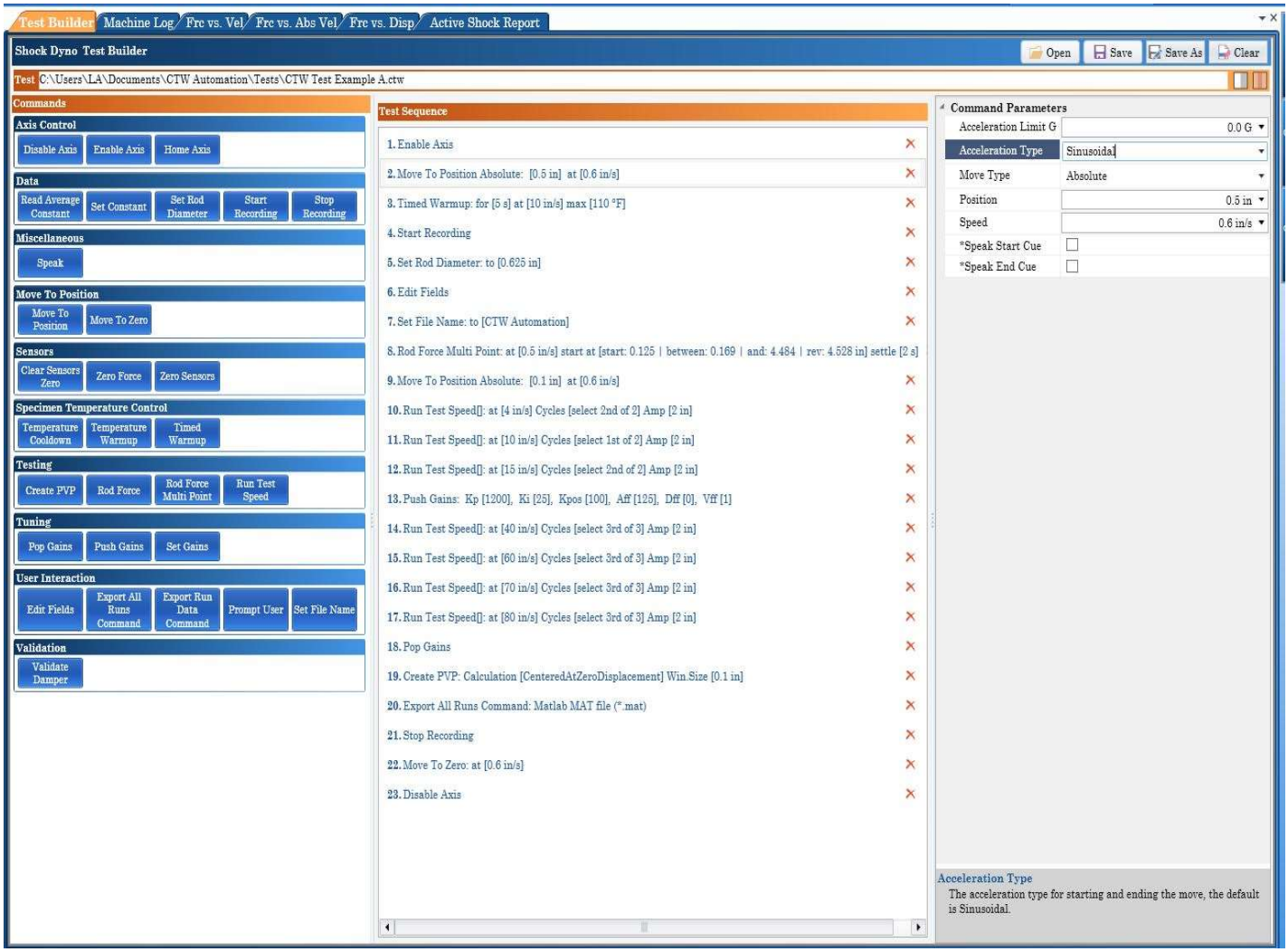
Gas Pressure – Reports the "calculated" Gas Pressure if the Rod Diameter is entered and the Rod Force test done.

Section V – Test Builder

Test Builder

This is where a Test Sequence is built. A Test is a sequence of commands that the User wants to execute. Here you can build simple and complex Tests to exercise the damper or specimen in different ways. You see the current list of Commands in the left column. They are included in the Test by a single click on them. This loads them into the Test Sequence area. These Tests can be saved, changed, and sent to other Users. They are individual files.

Open – Allows the User to pick a saved test.
Save – saves a Test based on the current name (this will over-write a test).
Save As – this allows the User to save the test with a new name
Clear – this clears the Test Sequence area - this does not delete a saved test.



Test Builder Tab

Commands – buttons to add

Axis Control

Disable Axis – turns off actuator; it will accept no further commands
Enable Axis – turns on actuator – does not move but is ready for a command
Home Axis – sets a zero position for the actuator

Data

Read Average Constant – NA
Set Constant – NA
Set Rod Diameter – allows the User to input a specific rod diameter
Start Recording – Begin collecting data to be saved and viewed
Stop Recording – End data that can be viewed

Miscellaneous

Speak – NA

Move To Location

Move To Position – input to move from one position to another
Move to Zero – used at end of Test to return actuator to Home

Sensors

Clear Sensors Zero – clears any "zeroing" of the signals
Zero Force – zeros the load signal
Zero Sensors – zeros all signals

Specimen Temperature Control

Temperature Cooldown – NA
Temperature Warmup – allows for warming the specimen to a set number
Timed Warmup – allows for a cycling of the damper based on time

Testing

Create PVP – Creates a PVP out of any Test Velocities in the sequence
Rod Force – collects force data at a given position
Rod Force Multi-Point – collects multiple force points to approximate force based on position
Test Velocity – runs the specimen at the selected velocity

Tuning

Pop Gains - sends the machines standard gains to the actuator to be used from this point on. These tend to be "softer" and for movement only. Found in the Configuration Tab.
Push Gains –. – sends a User defined set of gains to the actuator to be used from this point on. These are to change or increase the performance of the machine for a particular test.
Set Gains – allows the User to change the gains on the fly

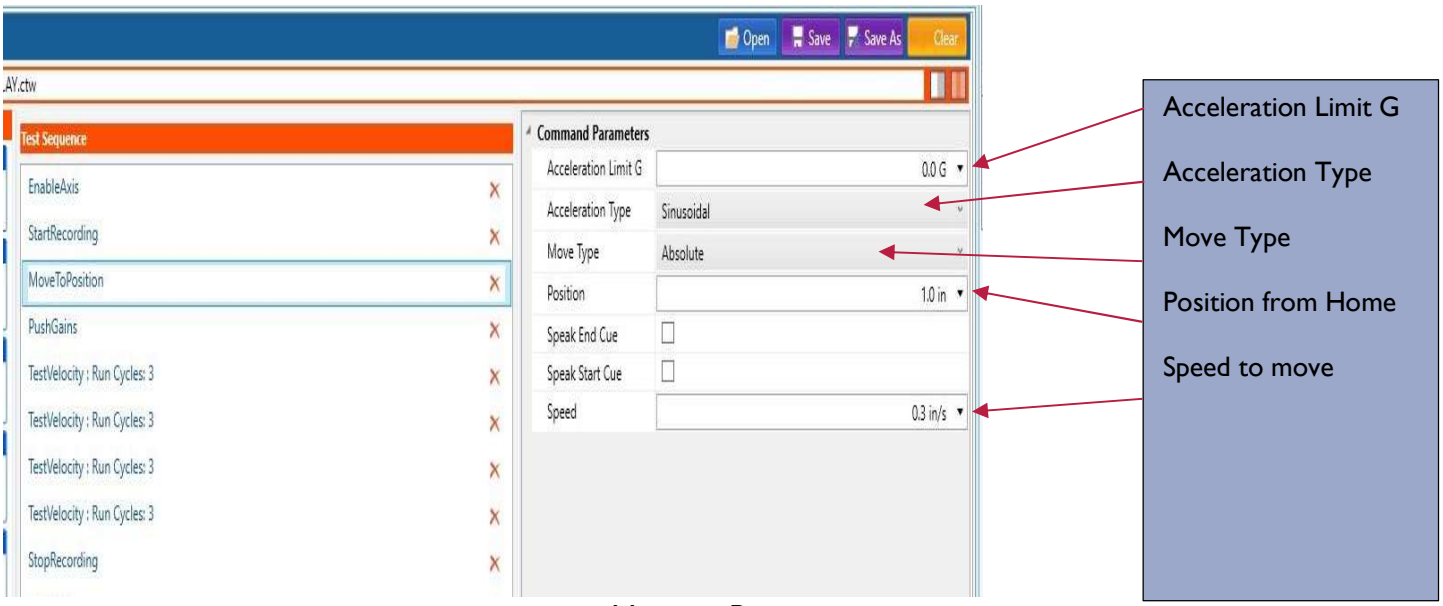
User Interaction

Edit Fields – this window will appear during the Test so the User can enter information
Prompt User – this pause the machine until the User wants to proceed; used to make adjustments
Set File Name – allows for a predetermined file name

Commands –details

MoveToPosition –

The User can input a position and speed to move to move the actuator. The idea being the actuator starts at Home – Zero and in order to begin a Test you would move it off Home some amount to begin the next step/command.



Move to Position

Below is an example of the MoveToPositon displacement trace to visualize

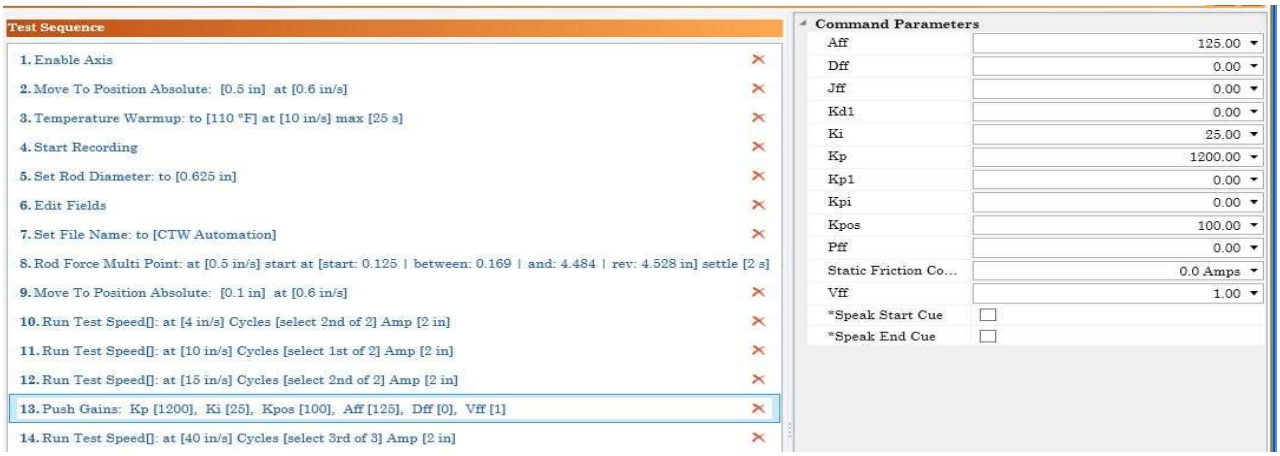
MoveToPosition: example

Gains – Caution

** Please be aware and understand that there is a very large difference in Gains and PID loop settings between the CTW LA Series and the Roehrig EMA. If you are unsure, contact CTW.

Push Gains – LA series of linear actuators

Push Gains are Performance Gains to best control motion when performance is needed. This command allows the User to send tailored "gain" settings for a particular specimen or test velocity. These can be used to get a better performance in a given area. Please consult CTW for what these should be and what possibilities exist for changing.



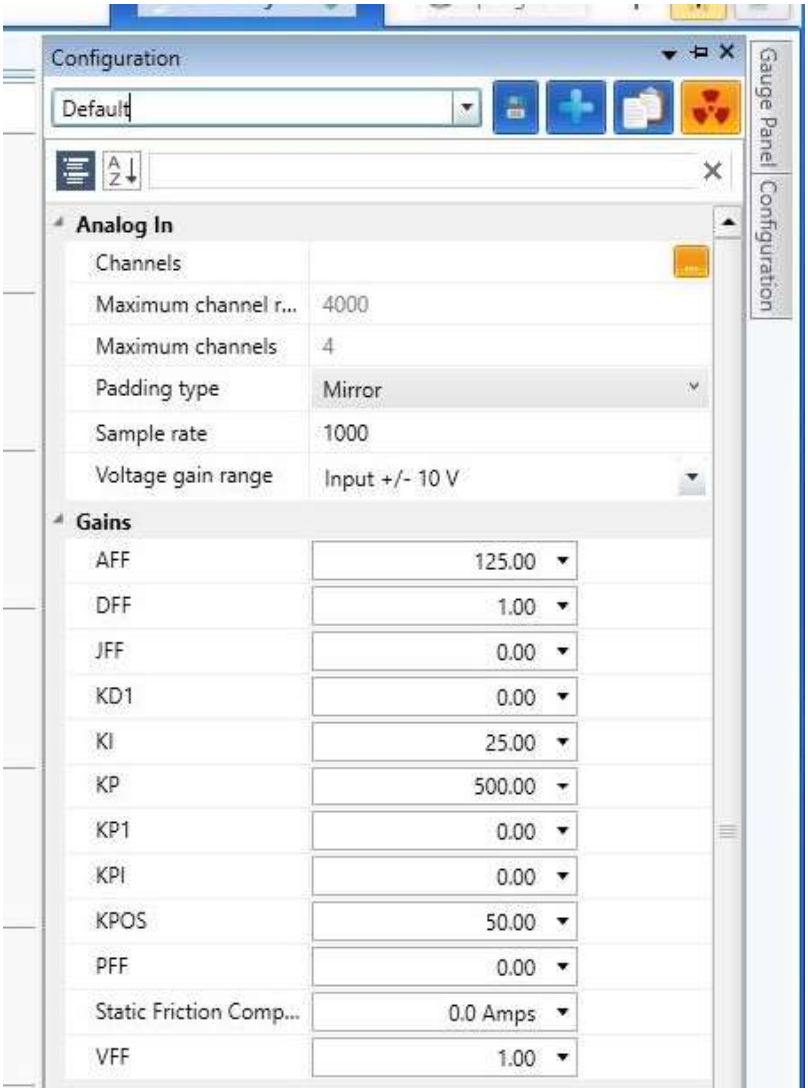
General Table of Pop (soft) and Push (performance) Gains ranges of current use, please work with CTW Automation technicians before trying settings outside of these ranges.

	POP Gains "soft"	PUSH Gains - Performance		General Range
AFF	125	125	125	125
DFF	0	0	0	0
JFF	0	0	0	0
KD1	0	0	0	0
KI	25	25	25	25
KP	500	1000	1200	500 - 1400
KP1	0	0	0	0
KPI	0	0	0	0
KPOS	50	100	150	50 - 150
PFF	0	0	0	0
Static Friction Comp	0	0	0	0
VFF	1	1	1	1

LA-48 PUSH and POP GAINS Table 4-2020

Pop Gains – LA Series of actuators

Pop Gains are non-Performance movement gains. Pop Gains are stored in the Configuration area and are meant to provide a nominal setting for movement only with no regard to performance or frequency response. These are "soft" gains meant to move from one position to another, such as MoveToPosition, Rod Force and Warm-up commands without any additional requirements.



Pop Gains

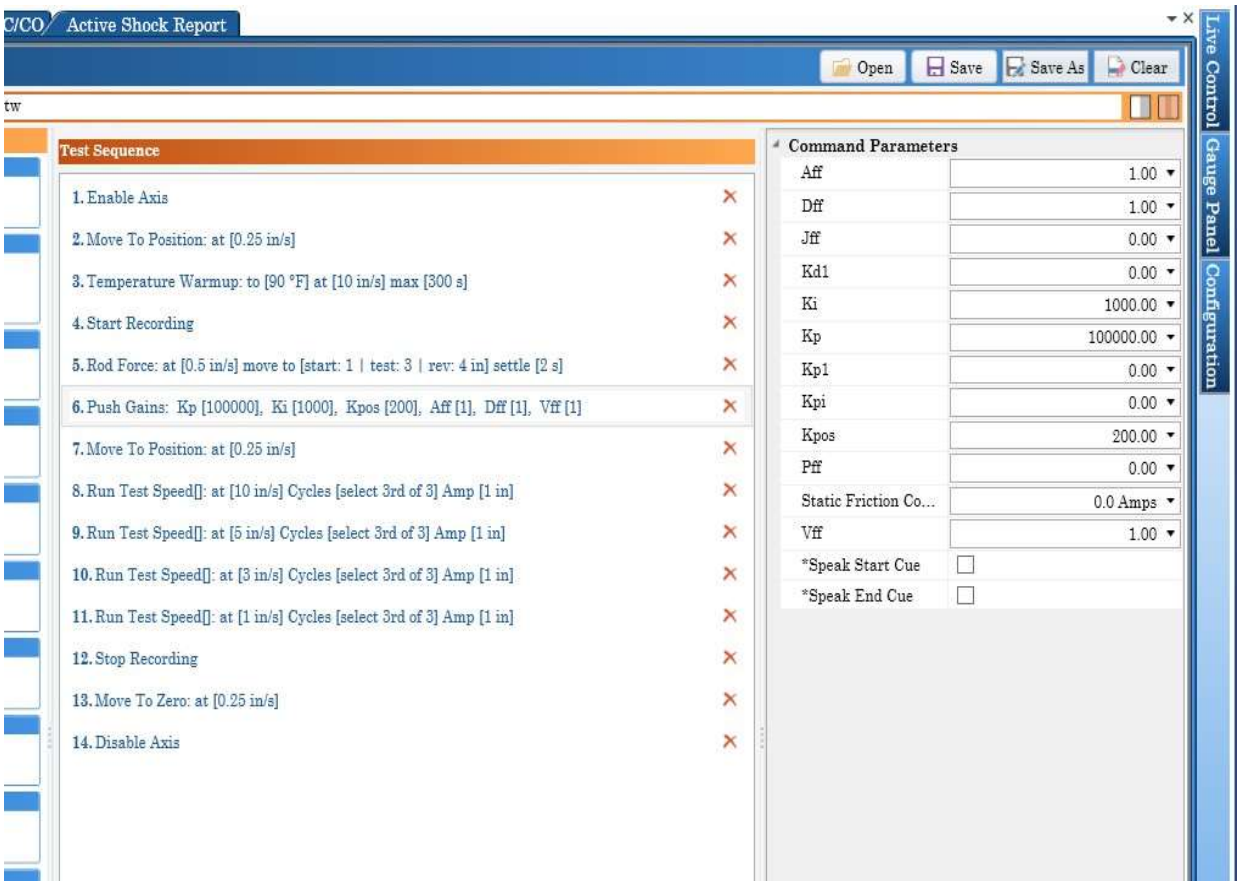
Pop Gains
These Gains are used for general movement of the machine and are intended not for performance but simply to allow for smooth movement from one command to the next. The machine will use these at all times unless a "Push Gain" command is used.

End of LA Series of gains

Push Gains – Roehrig EMA systems - this is based on the encoder

- Depending on how complete of an upgrade CTW performed on your EMA, it is important to understand what type of encoder and gains settings you should use.

Push Gains are Performance Gains to best control movement.
This command allows the User to send tailored "gain" settings for a particular specimen or test velocity. These can be used to get a better performance in a given area. Please consult CTW for what these should be and what possibilities exist for changing.



Push Gains – EMA Series – example in Test Builder

Gain Table for EMA series

General Table of Pop (soft) and Push (performance) Gains and ranges of current use, please work with CTW Automation technicians before trying settings outside of these ranges.

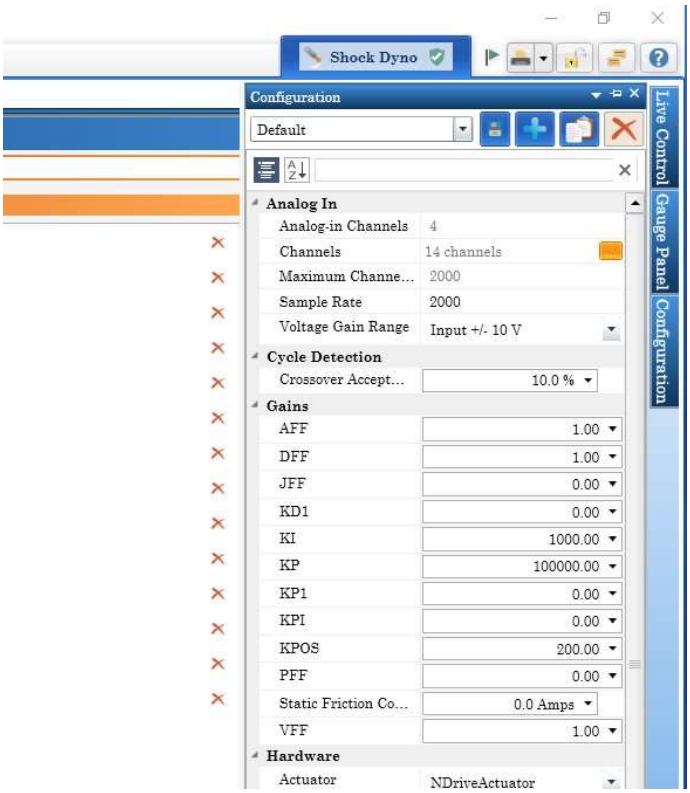
	POP Gains "soft" Non-performance	**PUSH Gains – Performance**		General Range
AFF	1	1	1	1
DFF	1	1	1	1
JFF	0	0	0	0
KD1	0	0	0	0
KI	800	1000	2000	1000 - 2000
KP	80000	100000	110000	100000 - 110000
KP1	0	0	0	0
KPI	0	0	0	0
KPOS	200	200	250	200 - 350
PFF	0	0	0	0
Static Friction Comp	0	0	0	0.0 - 1
VFF	1	1	1	1

LA-48 Push and Pop GAINS Table 1-2020 for EMA series

Gains – Roehig EMA series for pop gains

Pop Gains – Roehrig EMA systems

Pop Gains are non-Performance movement gains.
They are stored in the Configuration area and are meant to provide a nominal setting for movement only with no regard to performance or frequency response. These are “soft” gains meant to move from one position to another, such as MoveToPosition, Rod Force and Warm-up commands without any additional requirements.



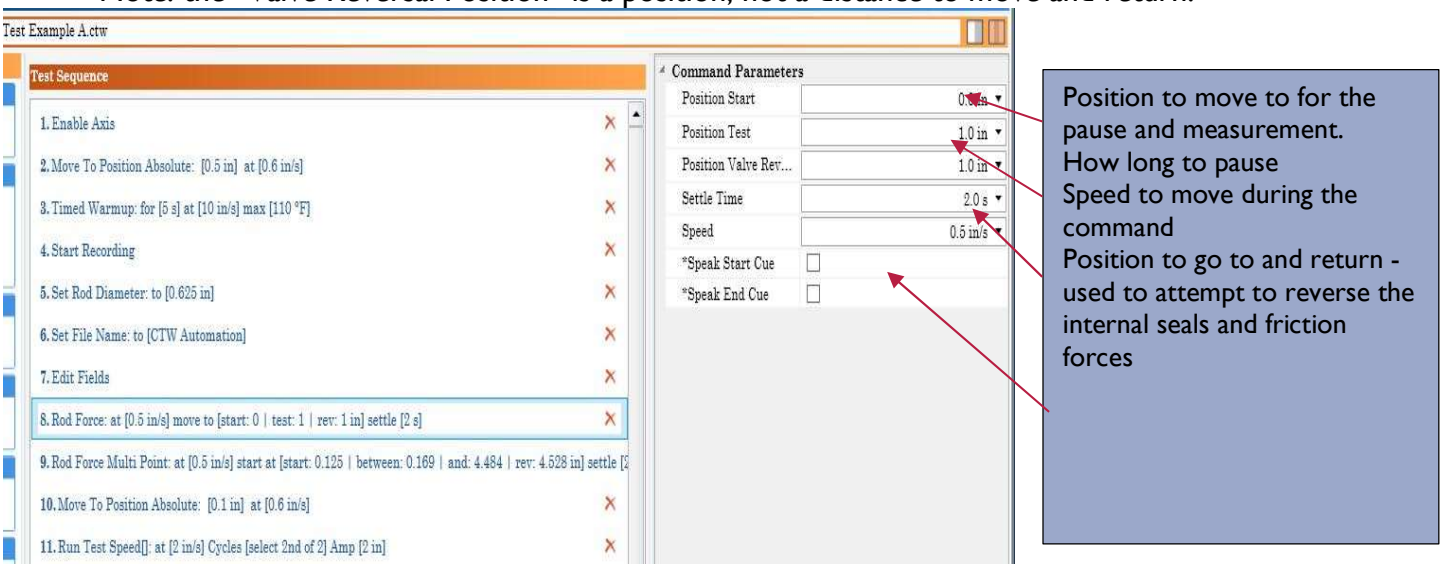
Pop Gains
These Gains are used for general movement of the machine and are intended not for performance but simply to allow for smooth movement from one command to the next. The machine will use these at all times unless a “Push Gain” command is used.

Rod Force Command

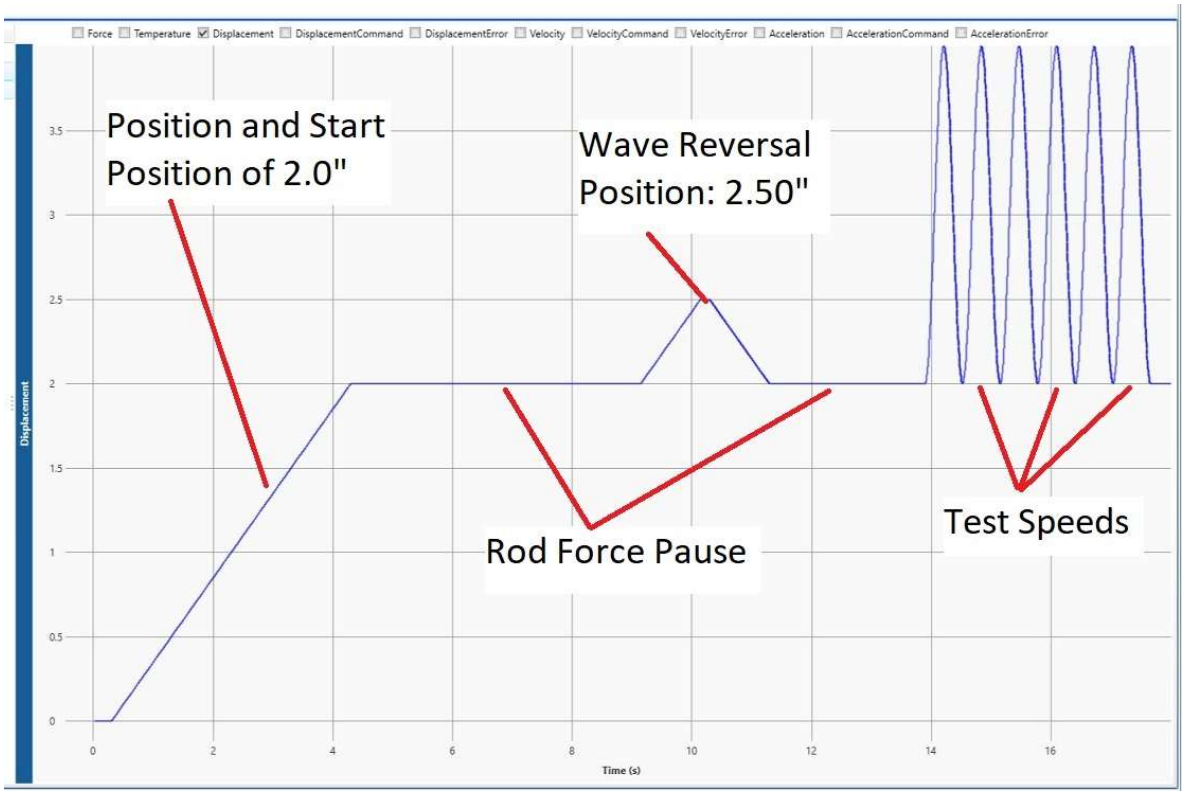
This command allows the User to measure the force exerted on the damper shaft by the internal pressure. The User defines the position and the time to pause before taking a force reading. The actuator then moves to the "Wave Reversal Position" at the requested "speed" before going back to the position to take another reading.

Note: Start position and Position should be the same.

Note: the "Valve Reversal Position" is a position, not a distance to move and return.



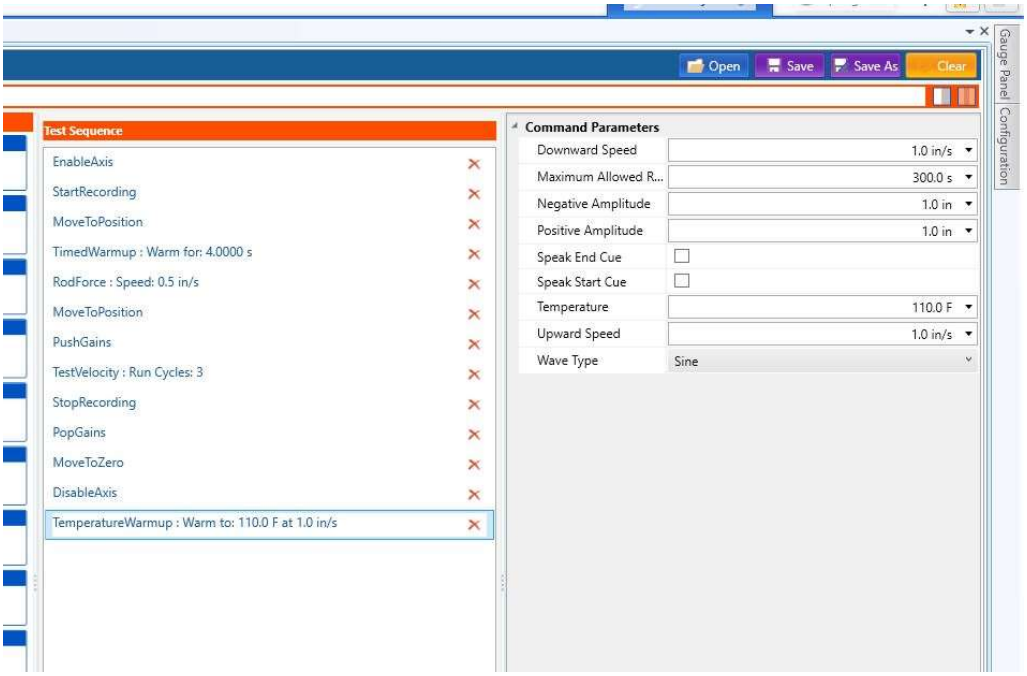
Rod Force



Example of Displacement trace of Rod Force test

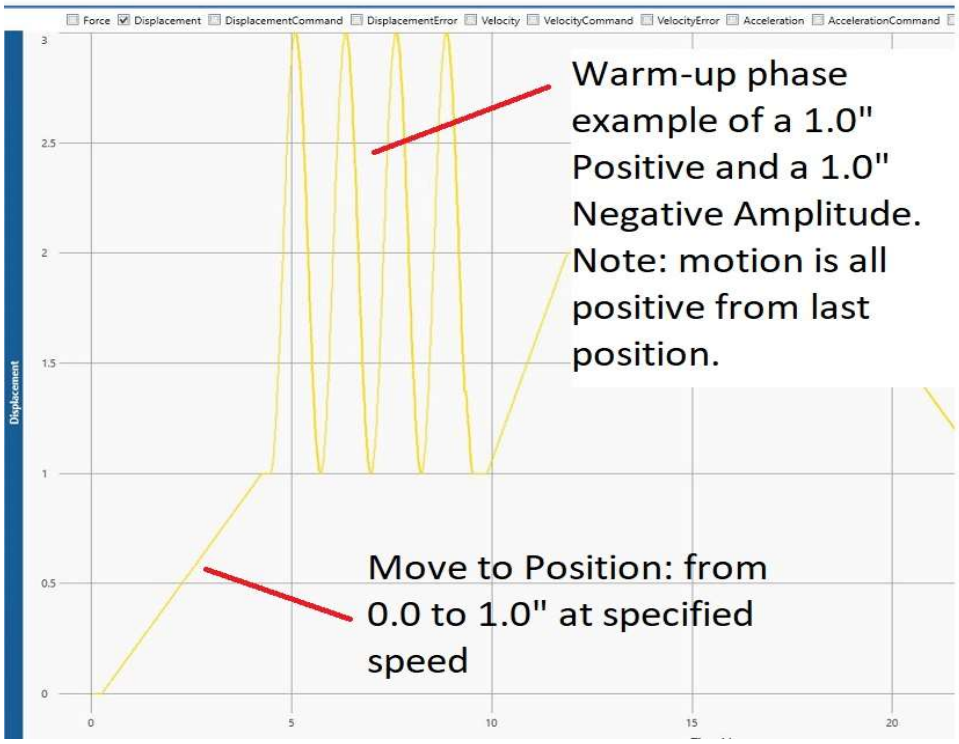
Temperature Warmup

This command allows the User to warm the specimen to a set temperature. Movement is from BDC in the positive direction from the last position.



Temperature Warmup

A 1.0" Negative Amplitude and a 1.0" Positive Amplitude will result in a 2.0" movement in the positive direction from where the actuator's last position was.



Example of "Move To Position" and "Temperature Warm-up"

Test Velocity

The Test Velocity command allows for running the damper at various velocities over various amplitudes and wave types. It can include different positive and negative amplitudes as well as different velocities in the Upward and Downward directions.

Test Velocity Command

Acceleration Limit G – this number limits the actuator to a specific peak level. "0" means no limit while "1" or higher limits movement to the specific acceleration. Very useful on Triangle Wave types where "10" is reasonable to control the turn-around in direction

Amplitude (+) and (-) – the user specifies the amplitude in in each direction (compression and extension)

Cycles To Run – specify how many cycles to run during this Test Speed

Cycle To Select – defines which cycle to use for the data capture to be used for graphing and numerical report

Run Name – a name can be given to this Test Speed

Speed (+) and (-) – speed of compression and extension can be specified and be different

Wave Type – Sine or Triangle

Pause Recording – turns off data recording for this Test Speed

Speak End Cue – audible prompt
Speak Start Cue – audible prompt

Section VI – Building a Test

Test Builder

A Test Sequence is just a series of commands to tell the actuator what to do for the given damper or specimen. With Probe for LA the User can build a Test using Test Builder which allows for "commands" to be selected and placed in a string to be executed. The User can move to any position, perform a warm-up, a rod force, multiple test velocities, various wave forms and more. These saved Tests become a file to be called out later in the Execute window.

For the LA, a Test must include the following:

- Enable Actuator
- Start Recording
- Push Gain
- Test Velocity
- Pop Gain
- Stop Recording
- Disable Actuator

The Test must Enable & Disable the actuator to begin and end the movement.
The Test must Start and Stop recording to collect data. The User can decide just what to collect and what to omit from the data file.
The Test must run at least one Velocity of some wave form; these can include a Sine Wave, Triangle wave and Variable Sine wave.

Most Tests will include a few more items.

- Move To Position: use this to move the actuator to a position that the damper should be tested. Many Users test at what would be mid-stroke of the damper.
  - Keep in mind, the next movement will happen from this position
- Warm up: this can be timed based or temperature
  - Time based allows the User to run for an amount of time at a chosen velocity and amplitude
  - Temperature based uses the IR temperature sensor to run the damper until it reaches the desired temperature.
- Push Gains: these gains are used to control the actuator in a higher degree of motion.
- Pop Gains: these are the simple motion gains, generically called "soft" to be used to move from position to position when tracking the displacement to a high degree is not important.
- Move to Zero: returns the actuator to the Home position. Usually at the end of the Test.

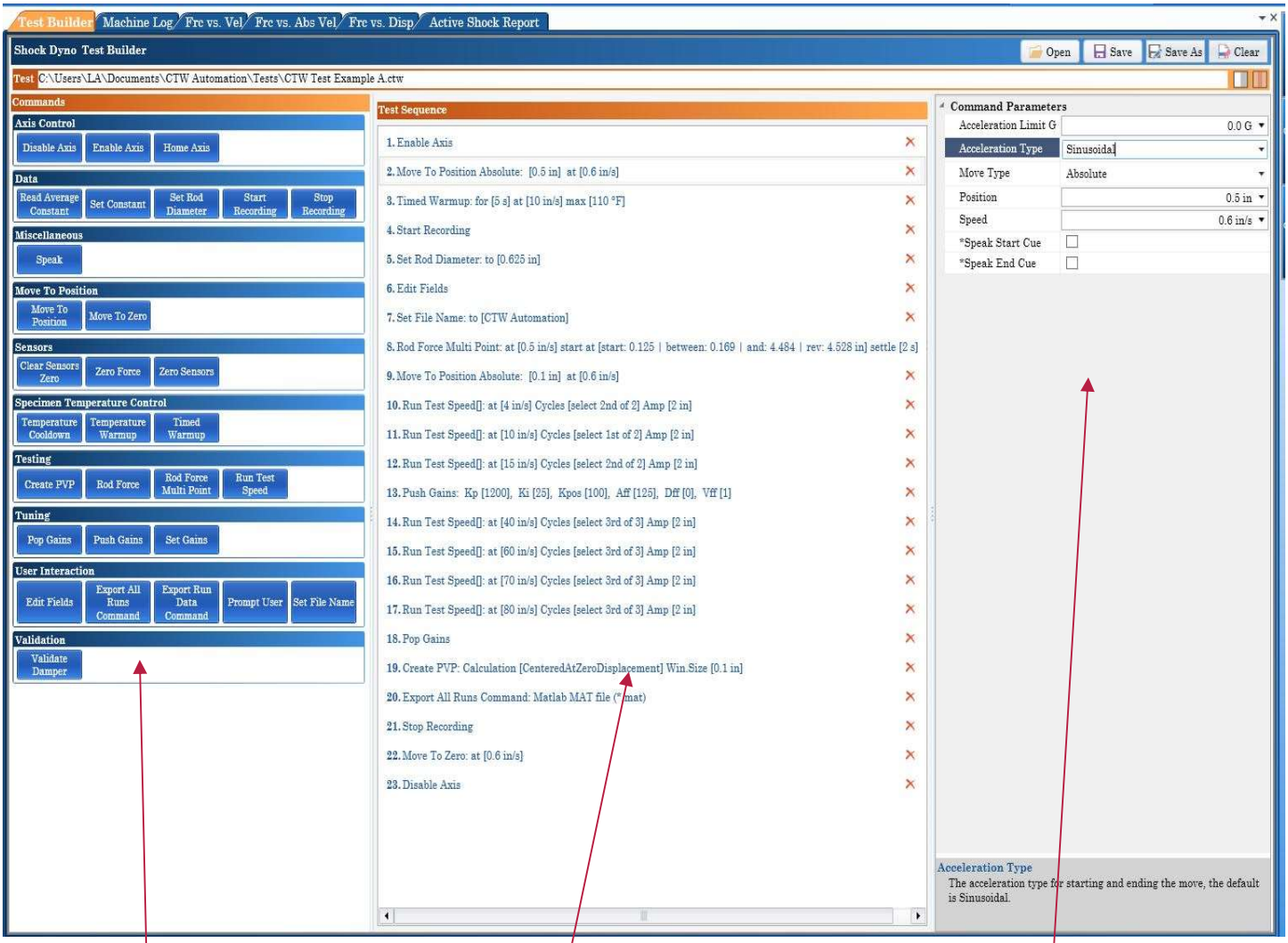
Key Items

- Wave forms move from the last position in the positive direction. If you have a negative amplitude and a positive amplitude as is normal, the motion begins from the bottom of the over all stroke and continues in a positive motion (up).
- The Rod Force should be run at mid-stroke of the test Velocity. This will require a MoveToPosition command after the Rod Force to be correct.

- **CTW Probe does NOT use OFFSETS. It is absolute movement from position zero.**

Standard Test Example

Overall View of the Test Builder with a Test Sequence loaded for example



Command Area –
You can add a Command to the Test Sequence area simply by clicking on it using the mouse, one time.

Test Sequence Area –
This is the exact order that your Test will run. You can layout your Test in the exact order you want to proceed. You build it like you want to run.

Command Parameter –
This area shows the details of each Command as you select it. Changes are made here to the Command.

Example of a Test Sequence for the LA Series of actuators

Test Sequence

1. Enable Axis
2. Move To Position Absolute: [0.5 in] at [0.6 in/s]
3. Timed Warmup: for [5 s] at [10 in/s] max [110 °F]
4. Start Recording
5. Set Rod Diameter: to [0.625 in]
6. Edit Fields
7. Set File Name: to [CTW Automation]
8. Rod Force Multi Point: at [0.5 in/s] start at [start: 0.125 | between: 0.169 |
9. Move To Position Absolute: [0.1 in] at [0.6 in/s]
10. Run Test Speed[]: at [4 in/s] Cycles [select 2nd of 2] Amp [2 in]
11. Run Test Speed[]: at [10 in/s] Cycles [select 1st of 2] Amp [2 in]
12. Run Test Speed[]: at [15 in/s] Cycles [select 2nd of 2] Amp [2 in]
13. Push Gains: Kp [1200], Ki [25], Kpos [100], Aff [125], Dff [0], Vff [1]
14. Run Test Speed[]: at [40 in/s] Cycles [select 3rd of 3] Amp [2 in]
15. Run Test Speed[]: at [60 in/s] Cycles [select 3rd of 3] Amp [2 in]
16. Run Test Speed[]: at [70 in/s] Cycles [select 3rd of 3] Amp [2 in]
17. Run Test Speed[]: at [80 in/s] Cycles [select 3rd of 3] Amp [2 in]
18. Pop Gains
19. Create PVP: Calculation [CenteredAtZeroDisplacement] Win.Size [0.1 in]
20. Export All Runs Command: Matlab MAT file (*.mat)
21. Stop Recording
22. Move To Zero: at [0.6 in/s]
23. Disable Axis

1. Always start by Enabling Axis Command

2. Move to a position to begin

3. Warm or cycle your damper based on Time or Temperature

4. Start Recording

5. Set your damper's shaft diameter to be used to calculate the Gas Pressure (Not required)

6. Edit you Fields / Notes sections to be saved with the Test data (Not required)

7. Save your Data by giving it a name or using a predetermined Name (Not required)

8. Do a Rod Force / Multi-Point Rod Force test

9. Move to a position to begin your Test Speeds

1 thru 17. Run your Test Speeds

13. Add a Push Gains to get more performance from your actuator now that it is moving into a higher force

18. Use the Pop Gain command to return to the softer Gain settings

19. Create a PVP from the Test Speed Data (Not required)

20. Export the data automatically to *.mat or XLXS or CSV (Not required)

21. Stop recording

22. Move back to the Home / Zero position

23. Turn off the actuator

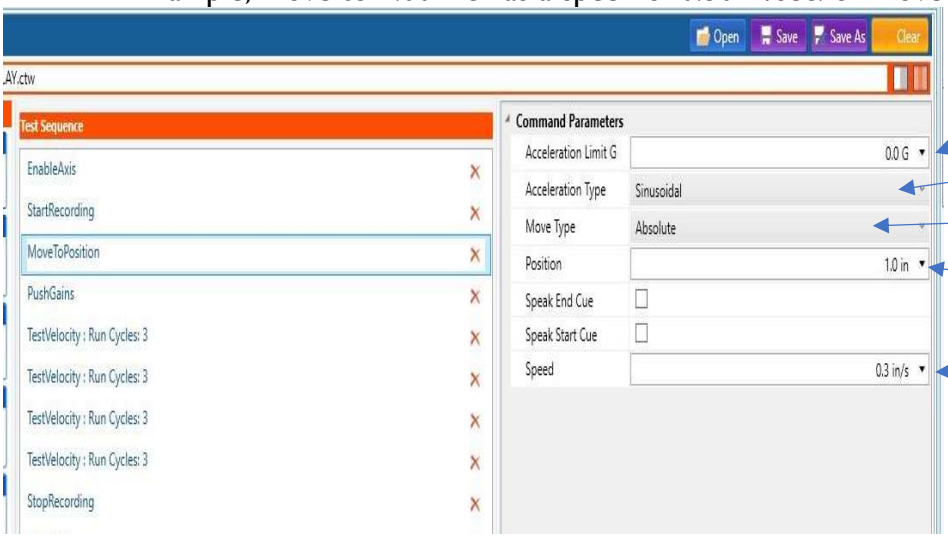
Building a Test Sequence – step by step

1 – **Enable Axis**: enable the actuator so that it can move. This turns the actuator "on" noting that does not mean it will move; it is simply ready to be moved

2 – **Move To Position**: move to a beginning position. Home is Zero – the actuator all the way down – resting position. You need to move it to what might be a BDC position for your Warm-up cycle.

The User can input a position and speed to move the actuator.

- Example, move to 1.00 inch as a speed of 0.50 in/sec. or move to 10 mm at 15 mm/sec



Acceleration Limit G

Acceleration Type

Move Type

Position from Home

Speed to move

Example of the displacement trace of the beginning of a Test Sequence.

Actuator starts at Home / Zero

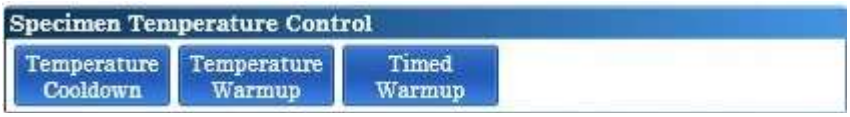
Moves to a Position of 1.00 inch

Then begins a 5 second warm-up cycle (Timed Warm-up)

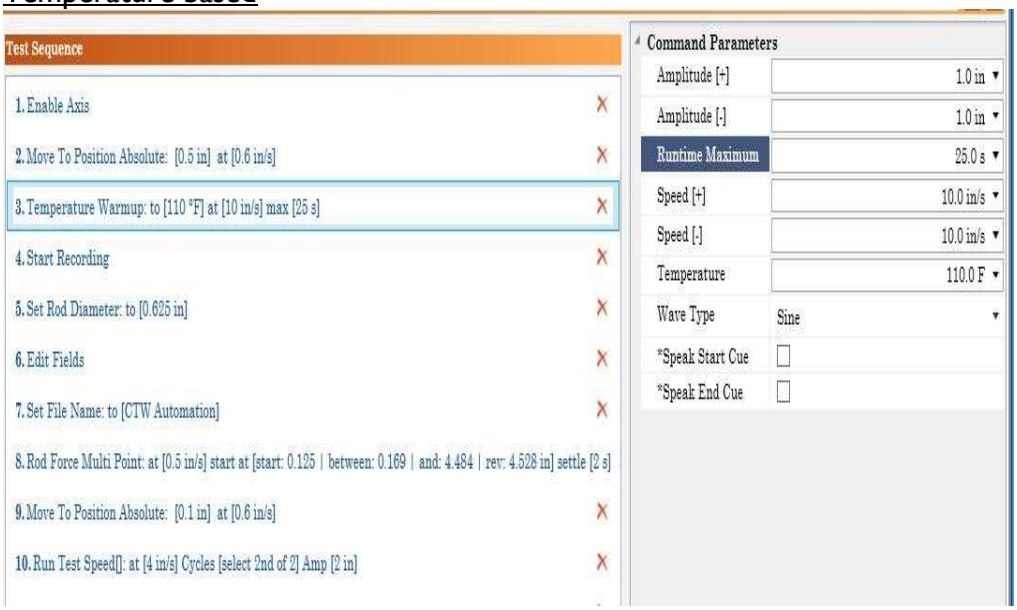
Then it goes into the Rod Force phase

Building a Test Sequence – step by step (cont)

3 – **Temperature Warmup or Timed Warmup**: a pre-testing cycle. You should always move the damper even for a few seconds before beginning the data collection phase just to ensure some level of uniform state. The Timed Warm-up runs for a specified time (in seconds). The Temperature runs until a specified temperature is reached.



Temperature based



Temperature based

Define your +/- Amplitude

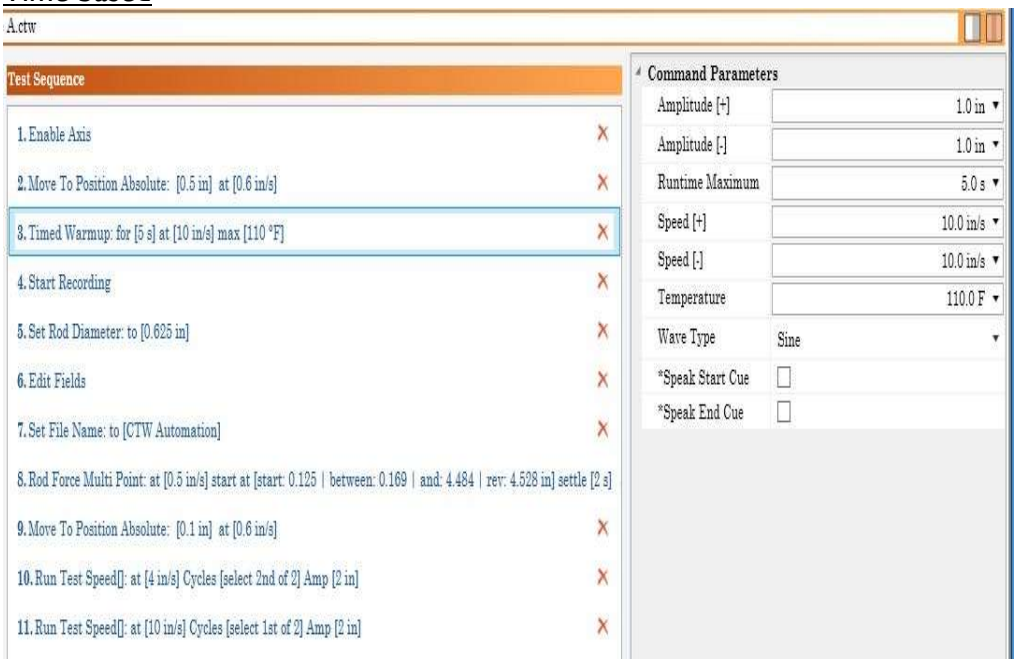
Set a runtime maximum as a safety if it does not get to temperature

Define your +/- speeds also known as Compression / Extension

Select a Temperature to reach

Wave type Sine or Triangle

Time based



Time based

Define your +/- Amplitude

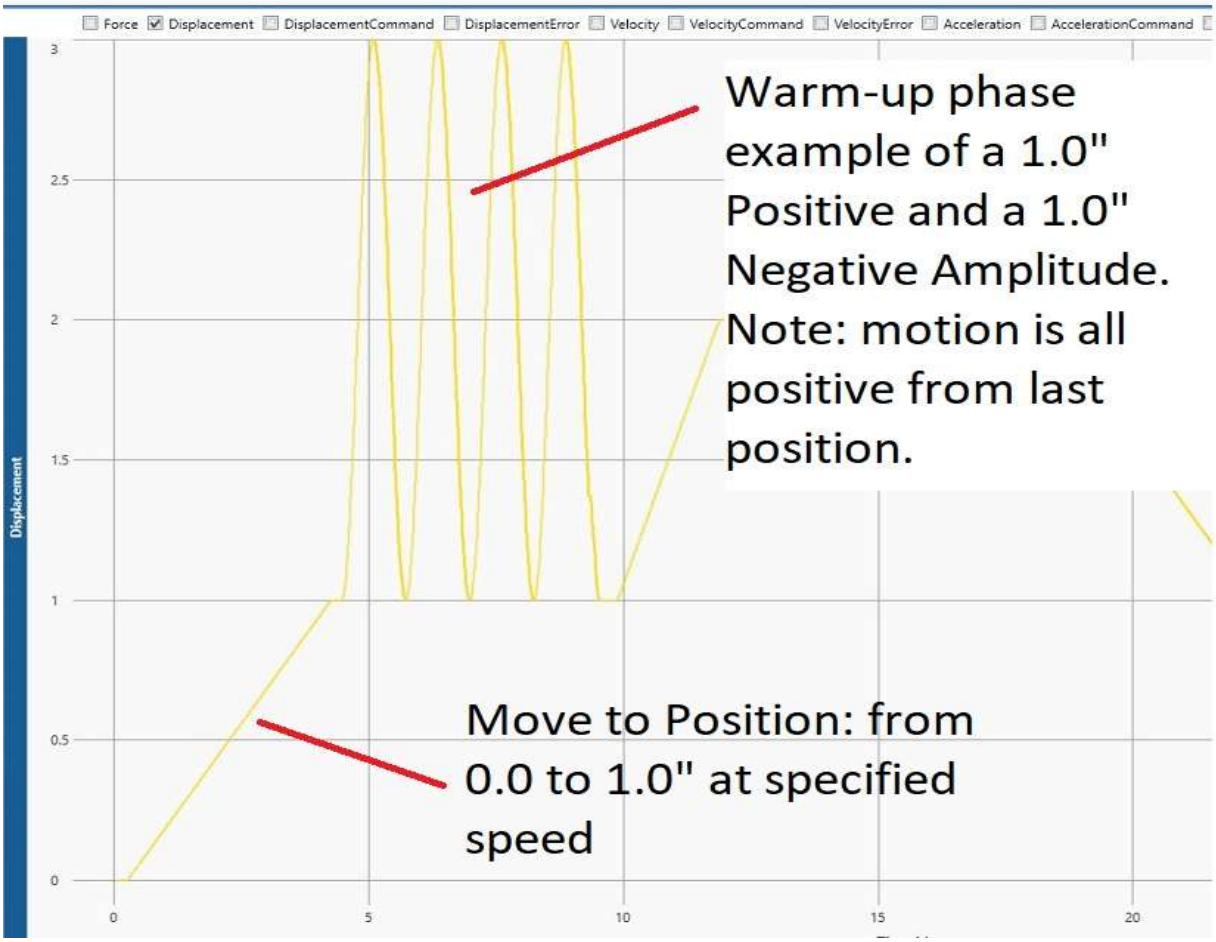
Set a runtime

Define your +/- speeds also known as Compression / Extension

Select a Safety Temperature

Wave type Sine or Triangle

3 – **Temperature Warmup or Timed Warmup (con't)**:



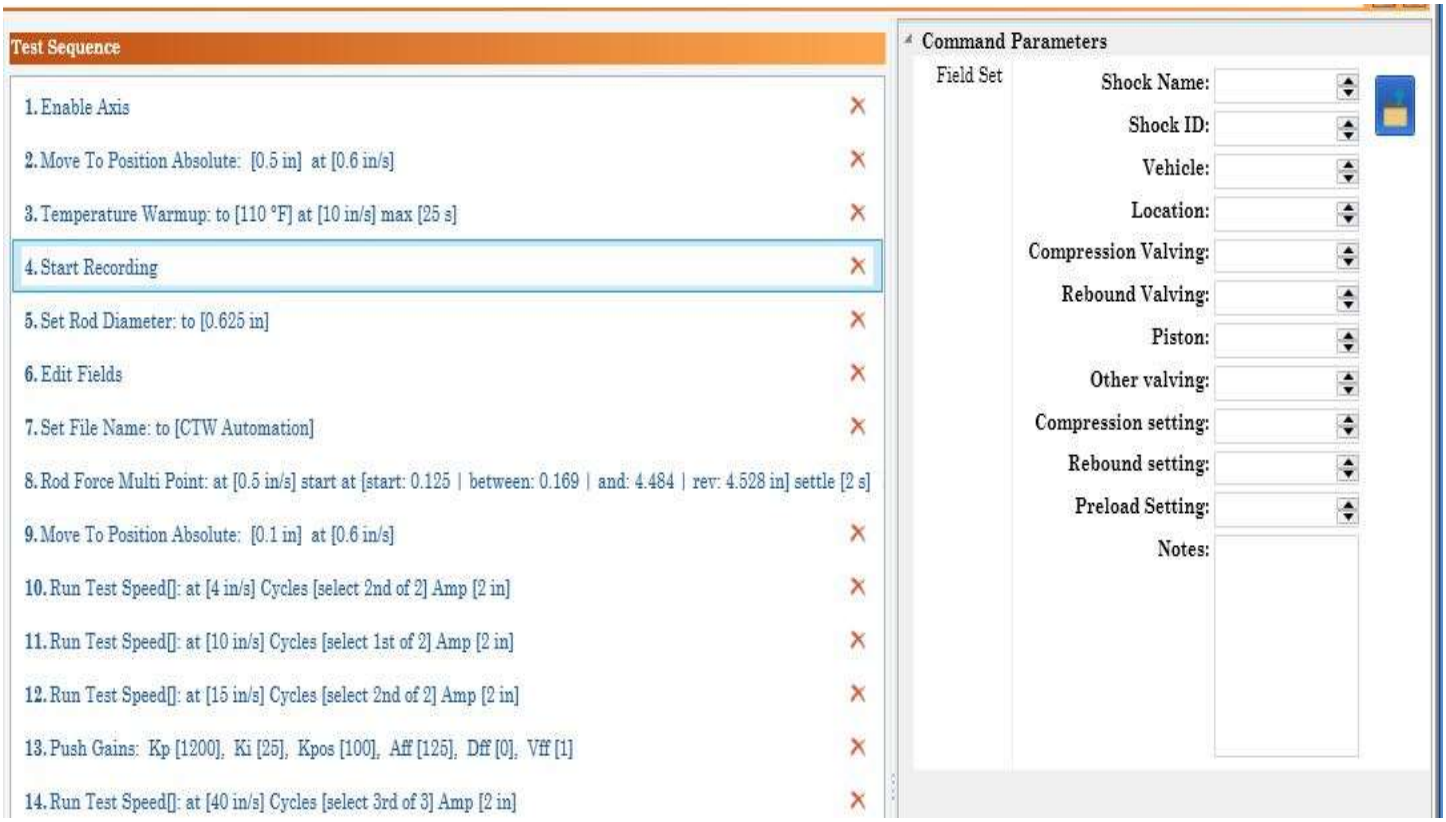
Example of "Move To Position" and "Temperature Warm-up"

Building a Test Sequence – step by step (cont)

4 – **Start Recording**: everything after this will be data you can view. Note normally we do not collect the warm-up phase as it just adds to the file size. You are free to do so if you wish.

Note: Start Recording is also the Command that allows you to load a Fields Set for taking notes for this particular Test Sequence. Using the "File Folder" icon in the Command Parameters you load your previously created Fields.set file to be used in conjunction with the Edit Fields Command.

Note: This Test will always contain this Field after saving.



Building a Test Sequence – step by step (cont)

5 – **Set the Rod diameter:** this command is not required but it allows the User to set the shaft diameter of the damper and keep it specific to this Test. This information is saved with the data file. This diameter is also used later to calculate the Gas Force in the damper.

Note: this diameter cannot be changed while the Test is running. It is designed to be correct when you build and save the Test. It allows you to make Tests specific to a given damper's shaft diameter.

Note: In this case the shaft diameter is 0.625".

Building a Test Sequence – step by step (cont)

6. **Edit Fields**: this command causes a prompt during the Test that allows the User to enter information about the damper that will be saved with the data file. These Fields (or notes) can be custom made to allow you to enter as much data as you want. There is an addendum in this manual with further instructions on creating these Fields.

We have also created the original Roehrig Shock6 layout and it is available for download on our website.

Example of the pop-up that would appear during the Test running.

Edit Fields Example

During the Test, this would appear on the screen to be filled out by the User.

You can "Copy from file" using notes from an existing data file

You can "Copy from most recent test" and then simply change what you need.

"Reset" to clean and start again.

Click "OK" when done with notes.

Cancel to ignore this step

Building a Test Sequence – step by step (cont)

7. **Set File Name:** this command allows the User to enter a name for the data file while the Test is running. You can enter a Name as well so that all you might do is add a number. You can enter a directory to use as well.

Note: You do not have to use this command, it is optional. If you do not use this command you will get the Save as screen at the end of the Test instead.

- Initial Directory – allows the User to set an initial folder for the data file to be saved
- Suggested File Name – allows the User to give an file name. This is useful if collecting in a series or if some information in the File Name is always the same.

When building the Test you can:

Specify where the data file will be stored on the computer

Specify an initial Name that you can add to or alter during the Test

Building a Test Sequence – step by step (cont)

8(A) – **Rod Force & Rod Force Multi Point:** these commands allow the User to measure and save the Rod Force in one of two ways; a single position or a multiple position format.

Rod Force: If your damper does not have a large variation from BDC to TDC of rod force you can use the Rod Force command. It measures the Rod Force at one position. This is typically mid-stroke of your Test velocity.

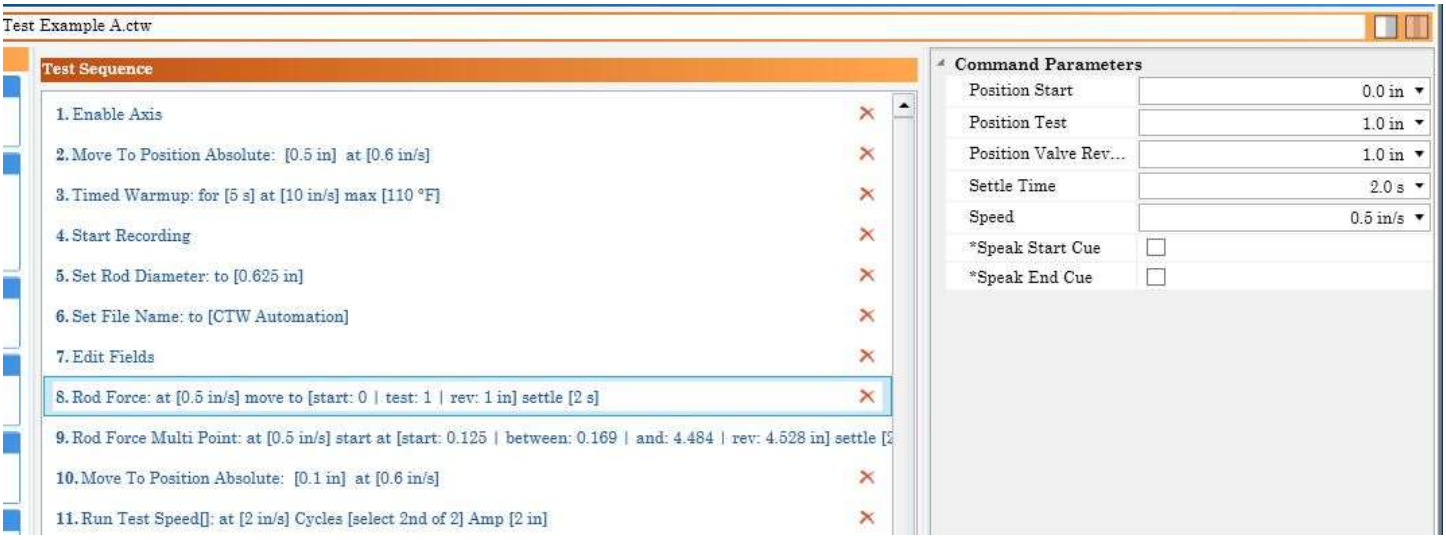
- **Position Start**: consider this to be a position to move from on the way to the Rod Force position. On a crank dyno the Position Start would be BDC and it would move to the Position Test to take the first reading.

- **Position Test**: this is where you want to take the Force reading. It is typically mid-stroke of the Test Velocity. Keep in mind it is absolute position. On a crank dyno it would be mid-stroke.

- **Position Valve Reversal**: the position the actuator will move to/from in between Position Test. The idea is to move up and then back down to reverse any seal directions.

- **Settle Time**: how long the machine will pause and hold before taking a force reading. This will vary based on how much bleed is in the damper system. More bleed might only need 1 second, less bleed perhaps 2 or 3 seconds.

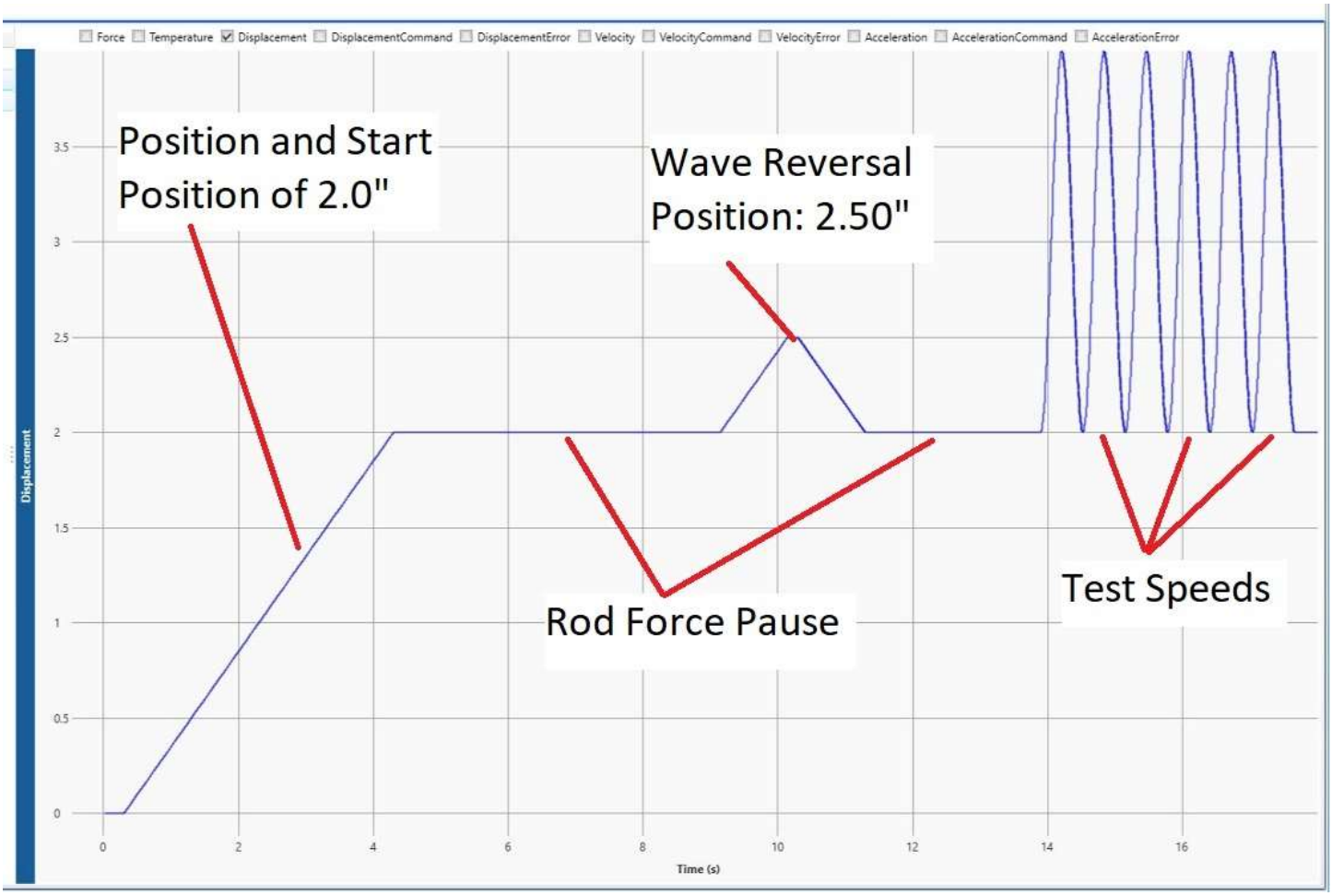
- **Speed**: the speed that the actuator will move between positions. The slower the speed, the less internal pressure will be generated during the move and the more accurate the reading.



The Rod Force Command

Building a Test Sequence – step by step (cont)

In the image the actuator moves to the Position Test from the Position Start. Thses can be different or the same.



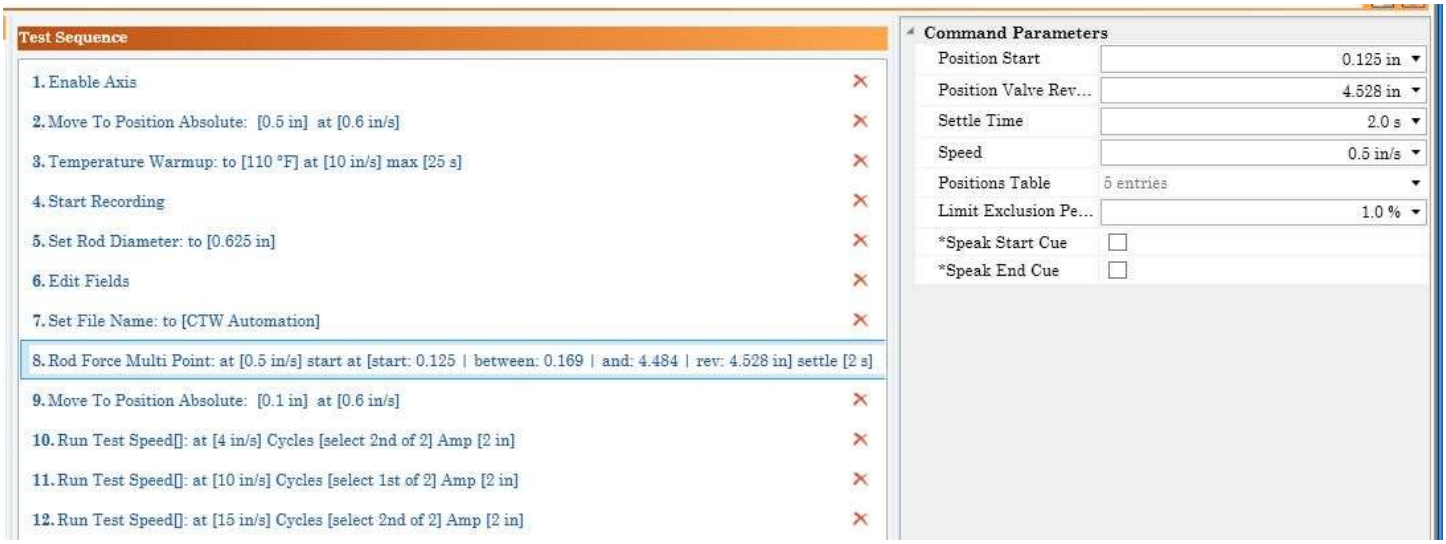
Visualazation of the Rod Force movement based on Displacement

This shows that the actuator went to the Start Position and then the Test Position (2.00”) then settled before taking reading of the load cell. The actuator thenwent to the Wave Reversal position and then back to the Test Position and then paused again. This movement allows for the seals and shaft to move in both directions before taking the force reading.

Building a Test Sequence – step by step (cont)

8(B) – **Rod Force & Rod Force Multi Point:** these commands allow the User to measure and save the Rod Force in one of two ways; a single position or a multiple position format.

Rod Force Multi Point: If your damper has a large variation from BDC to TDC of rod force (motorcycle forks with springs, bicycle dampers or any large diameter shaft/large gas chamber can be examples) you can use the Rod Force Multi Point command to measure the rod force at multiple positions to provide a curve to be applied based on position. Instead of removing just one constant force it removes the force based on the position so that it varies from BDC to TDC. This way you remove the larger spring type addition.

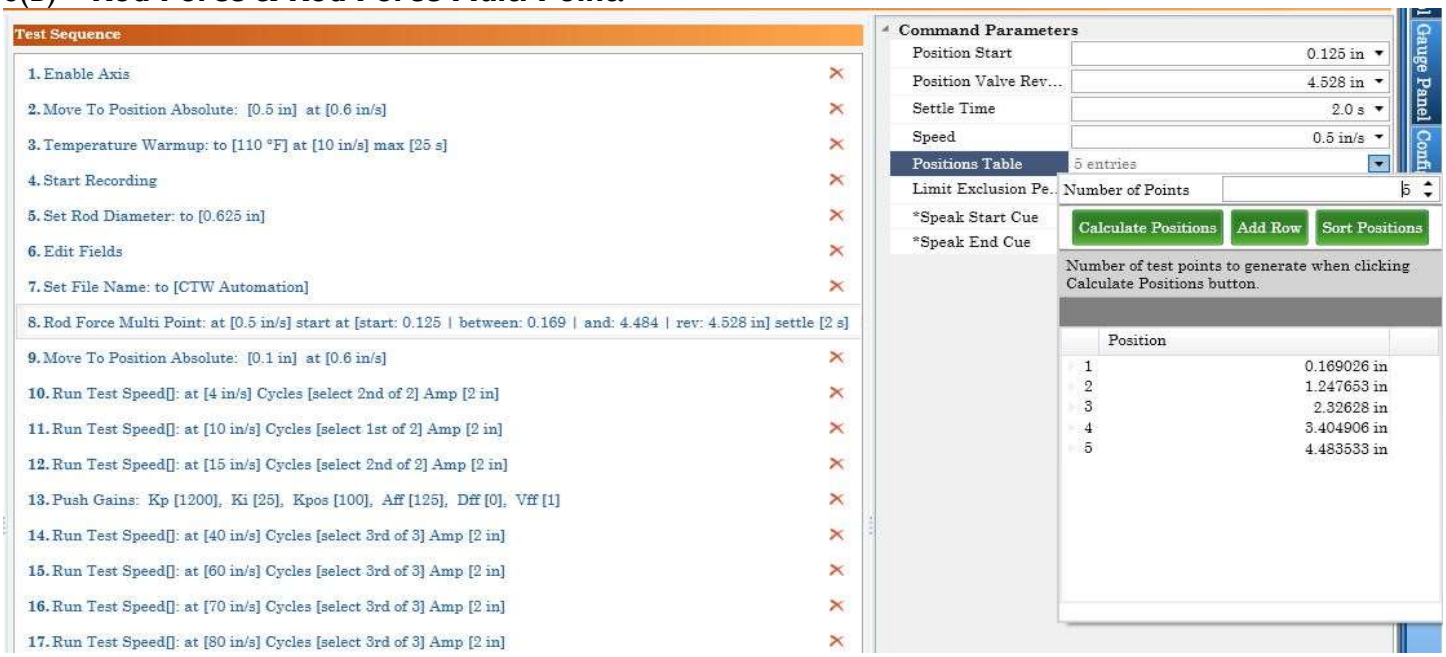


- **Position Start**: this is the lowest position of the Test
- **Position Valve Reversal**: this is the highest position of the Test
- **Settle Time**: how long the machine will pause and hold before taking a force reading. This will vary based on how much bleed is in the damper system. More bleed might only need 1 second, less bleed perhaps 2 or 3 seconds.
- **Speed**: the speed that the actuator will move between positions. The slower the speed, the less internal pressure will be generated during the move and the more accurate the reading.
- **Positions Table**: this is where the software generates a table of positions to be used to take force readings over.

  Enter the number of Points to use in "odd" numbers of 3, 5 or 7. Click "Calculate Positions and a table is generated for the # of points. You can change, by hand, each point if you like. See Table below.

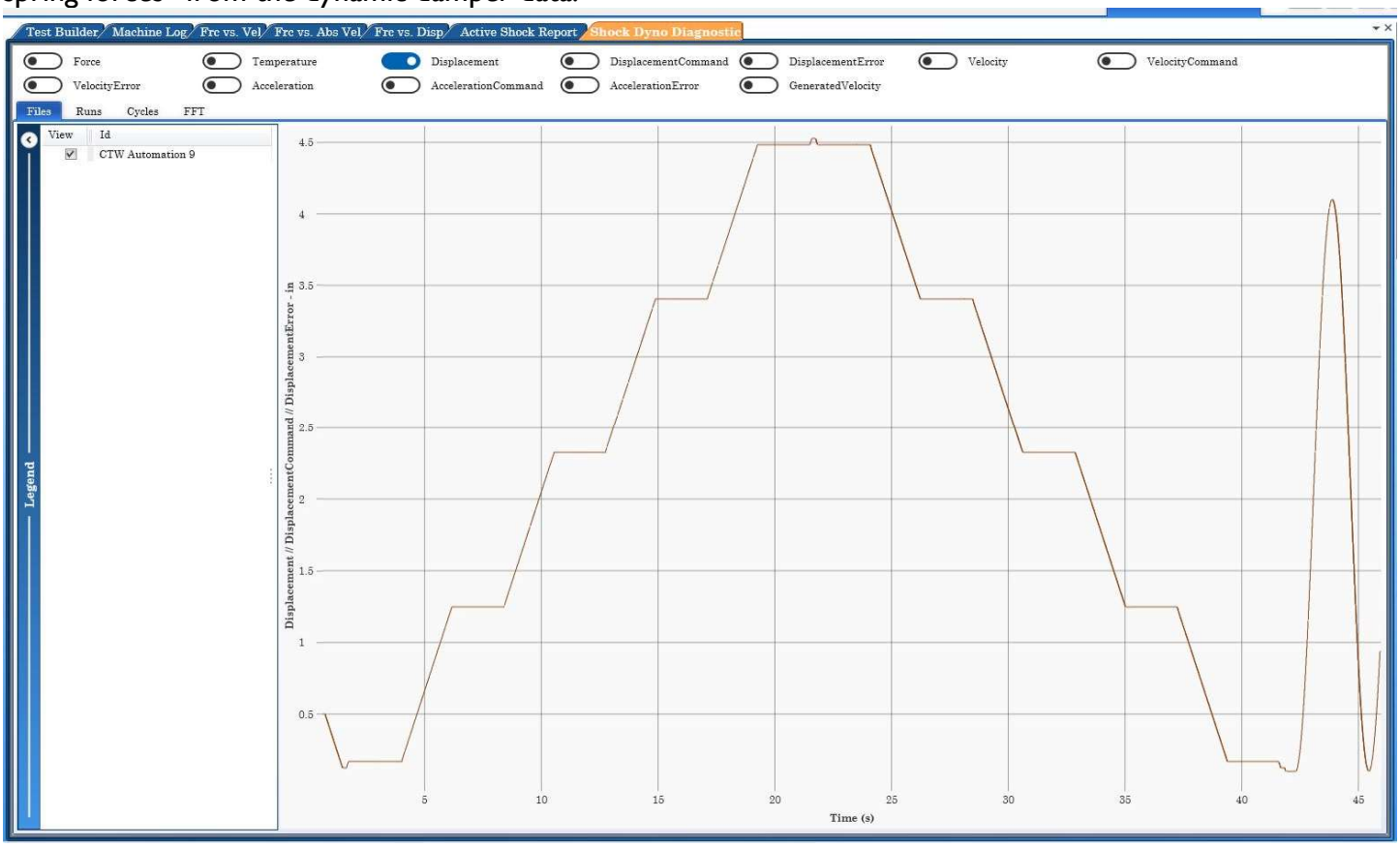
Building a Test Sequence – step by step (cont)

8(B) – **Rod Force & Rod Force Multi Point:**



Rod Force Multi Point – Table shown

Below you can see what the actuator will do based on position to get a range of measurements for the rod force. A force curve is generated from the points to be removed from the data. This helps remove the "static spring forces" from the dynamic damper data.

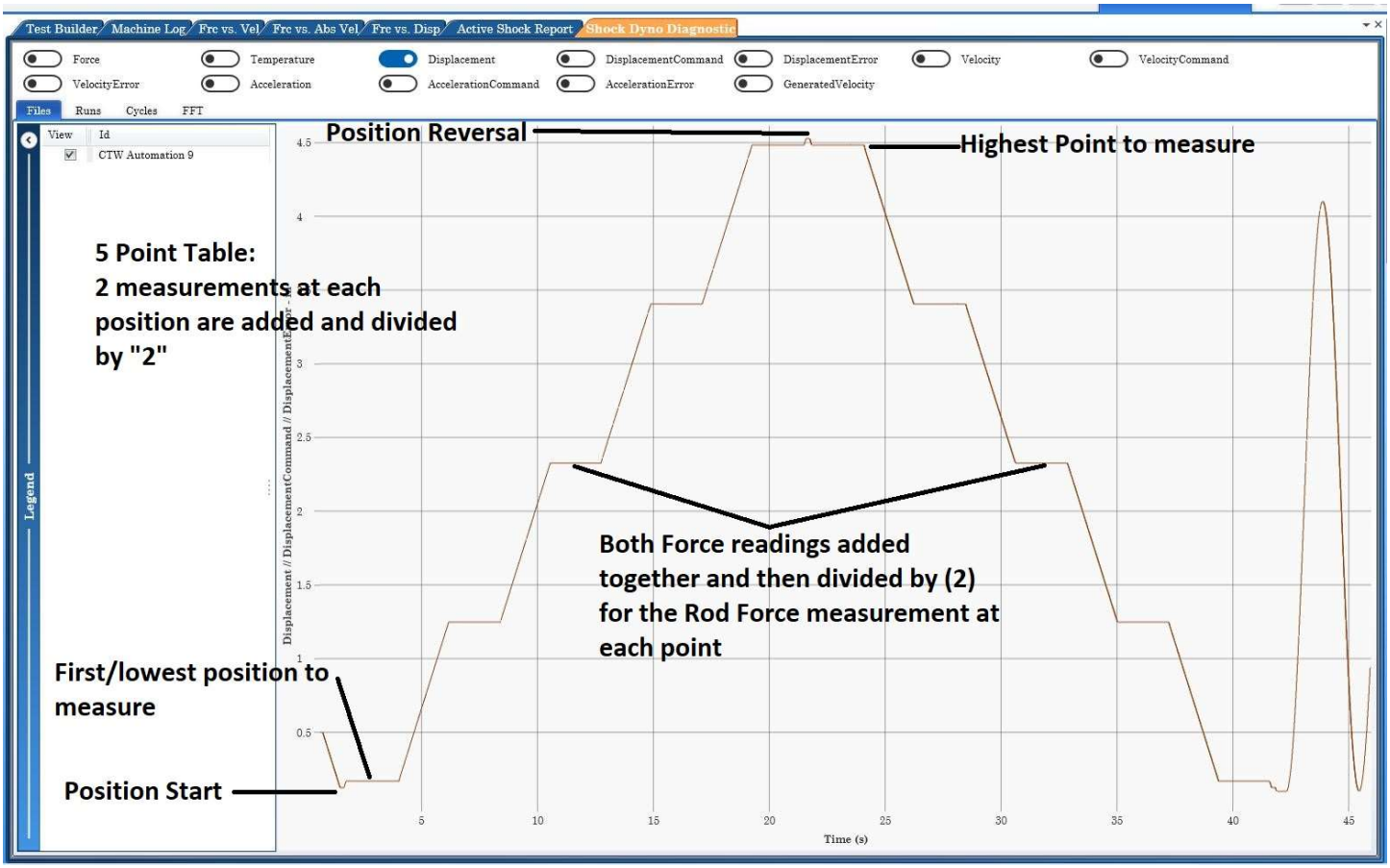


Displacement signal showing the various points for the Rod Force Multi Point Test

Building a Test Sequence – step by step (cont)

8(B) – **Rod Force & Rod Force Multi Point:** these commands allow the User to measure and save the Rod Force in one of two ways; a single position or a multiple position format.

Additional view with notations



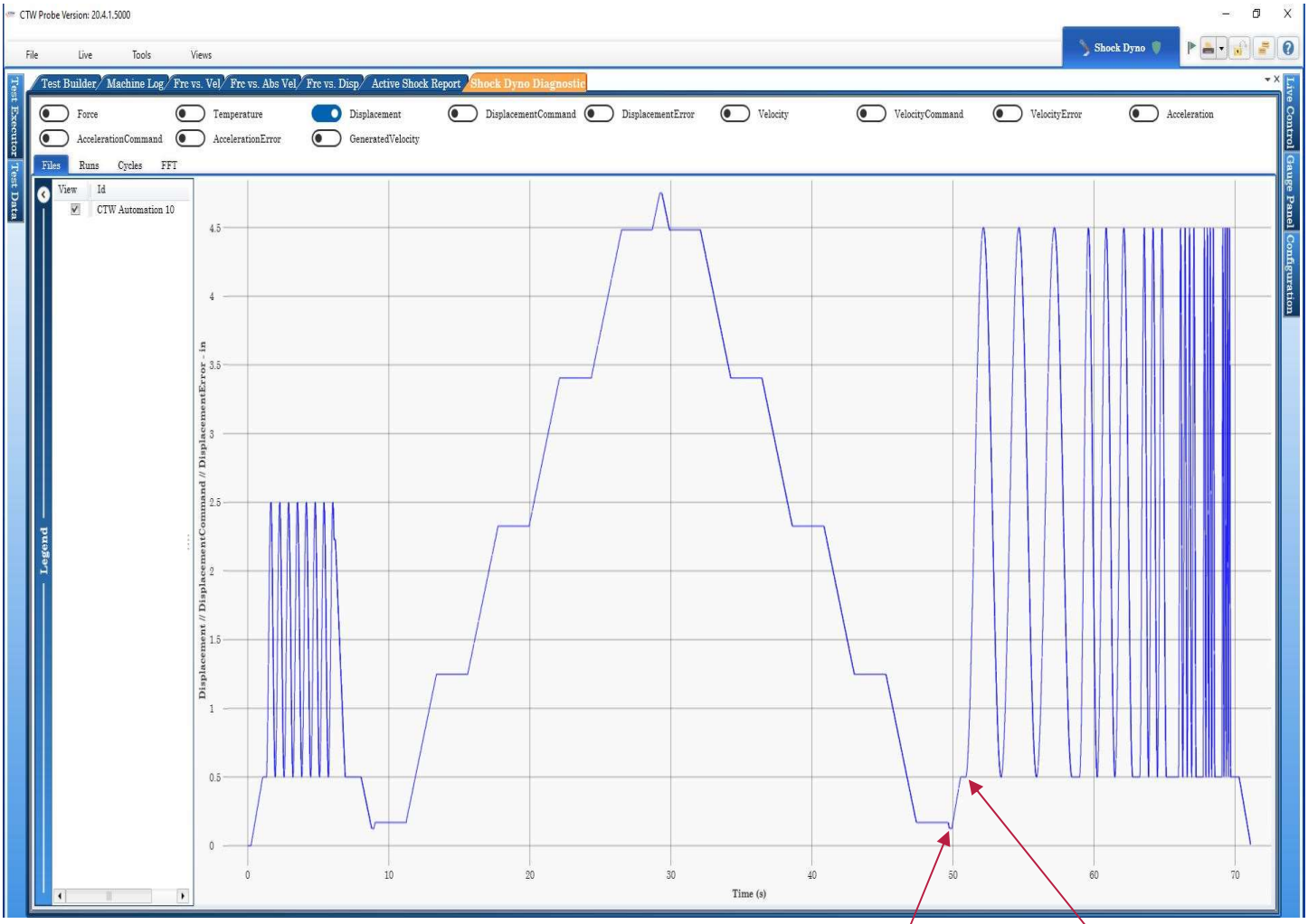
Rod Force Multi Point further notated

Building a Test Sequence – step by step (cont)

9 – **Move to Position:** use this command to get ready to begin your Speed Tests.

Note: the CTW Probe software works from a absolute position (NOT OFFSET). After the Rod Force test you will need to move the actuator to your desired position to begin.

In the example below the actuator ends the Rod Force Mulit Point Test at "Position Start". This Test moves to 0.50" before startting the first Test Speed.



Full view of Displacement signal for the Test example.

At the end of the Rod Force Multi Point – the actuator finished at the Start Position and then the Move To Position told it to go to 0.50".

Start Position Rod Force

Move to 0.500"

Building a Test Sequence – step by step (cont)

10 thru 17 – **Run Test Speed:** this command allows you to enter Test Speeds for the test.

From this command you can run a Sine or Triangle wave. You can vary the amplitude (under certain restrictions) and velocity in each direction based on a number of parameters.

- Acceleration Limit G – this parameter puts a limit on the actuators ability to accelerate. Typically left at "0". However when using Triangle waves it reduces the turn around stress on the system. In this case "10" (G's) is adequate.

- Amplitude (+) / (-) – these options actually work on the wave form based on a offset mid-point. Meaning the (+) is Compression Closed / Rebound Open phase while the (-) is the Compression Open / Rebound Closed phase.

- Cycles To Run – specify how many cycles to run during this Test Speed

- Cycle To Select – defines which cycle to use for the data capture to be used for graphing and numerical report

- Run Name – a name can be given to this Test Speed

- Speed (+) and (-) – speed of compression and extension can be specified and be different

- Wave Type – Sine or Triangle

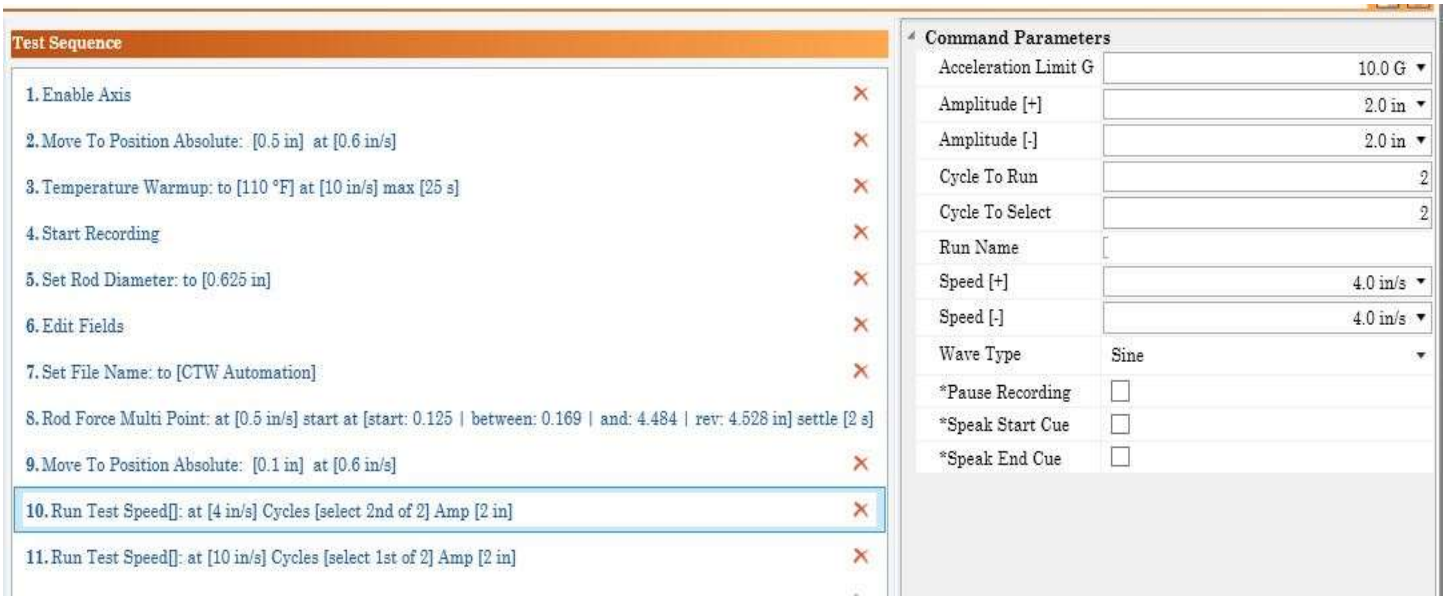
- Pause Recording – turns off data recording for this Test Speed

- Speak End Cue – audible prompt

- Speak Start Cue – audible prompt

Building a Test Sequence – step by step (cont)

10 thru 17 – **Run Test Speed:** this command allows you to enter Test Speeds for the test.



Test Speed – Sine wave

Test Speed – Triangle wave

Building a Test Sequence – step by step (cont)

13 – **GAINS:** this command allows you to add parameters to the actuator movement. The goal being to get the desired movement to follow the actual movement.

Gains – Caution

** Please be aware and understand that there is a very large difference in Gains and PID loop settings between the CTW LA Series and the Roehrig EMA. If you are unsure, contact CTW.

Push Gains – LA series of linear actuators

Push Gains are Performance Gains to best control motion when performance is needed. This command allows the User to send tailored "gain" settings for a particular specimen or test velocity. These can be used to get a better performance in a given area. Please consult CTW for what these should be and what possibilities exist for changing.

- Push Gains should be added above 10 in/sec <> 250 mm/sec Test Speeds.

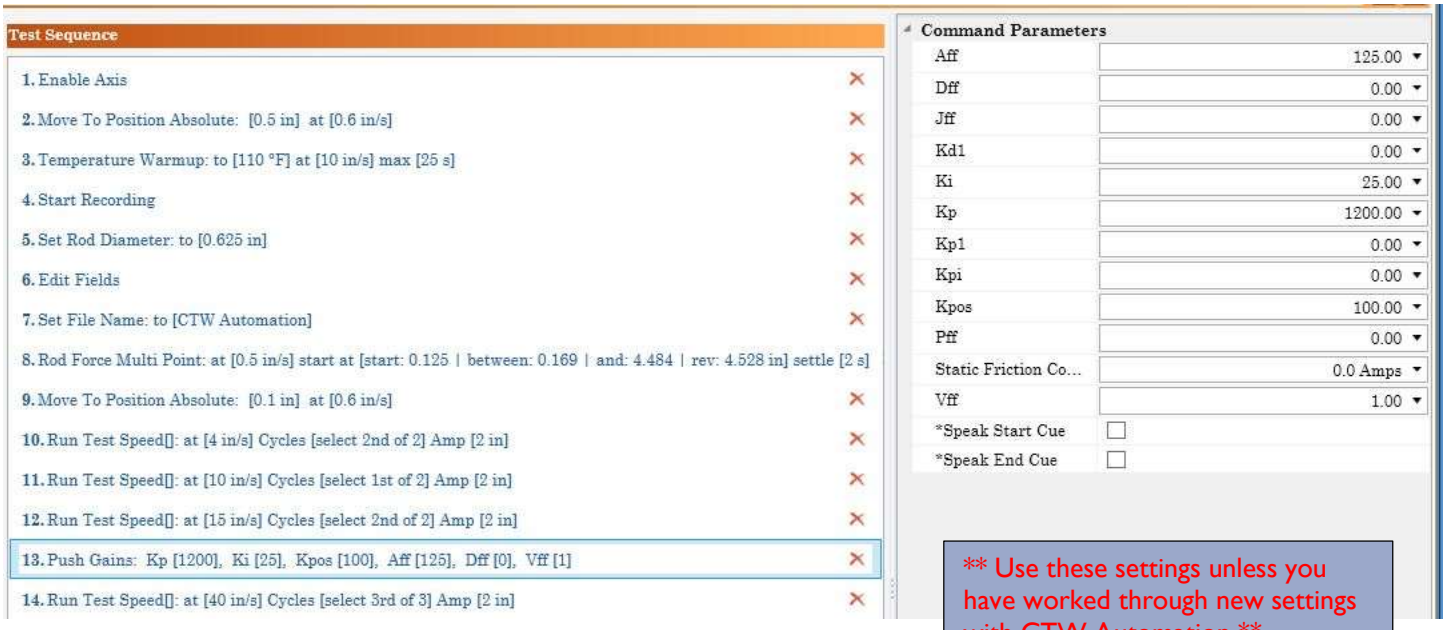
- If the Test has a PUSH Gain command you are required to finish with a POP gain.

Gains – Caution

** Please be aware and understand that there is a very large difference in Gains and PID loop settings between the CTW LA Series and the Roehrig EMA. If you are unsure, contact CTW.

Push Gains – LA series of linear actuators

Push Gains are Performance Gains to best control motion when performance is needed. This command allows the User to send tailored "gain" settings for a particular specimen or test velocity. These can be used to get a better performance in a given area. Please consult CTW for what these should be and what possibilities exist for changing.



** Use these settings unless you have worked through new settings with CTW Automation **

Gains – Table for LA Series

CTW General Table of Pop (soft) and Push (performance) Gains ranges of current use, please work with Automation technicians before trying settings outside of these ranges.

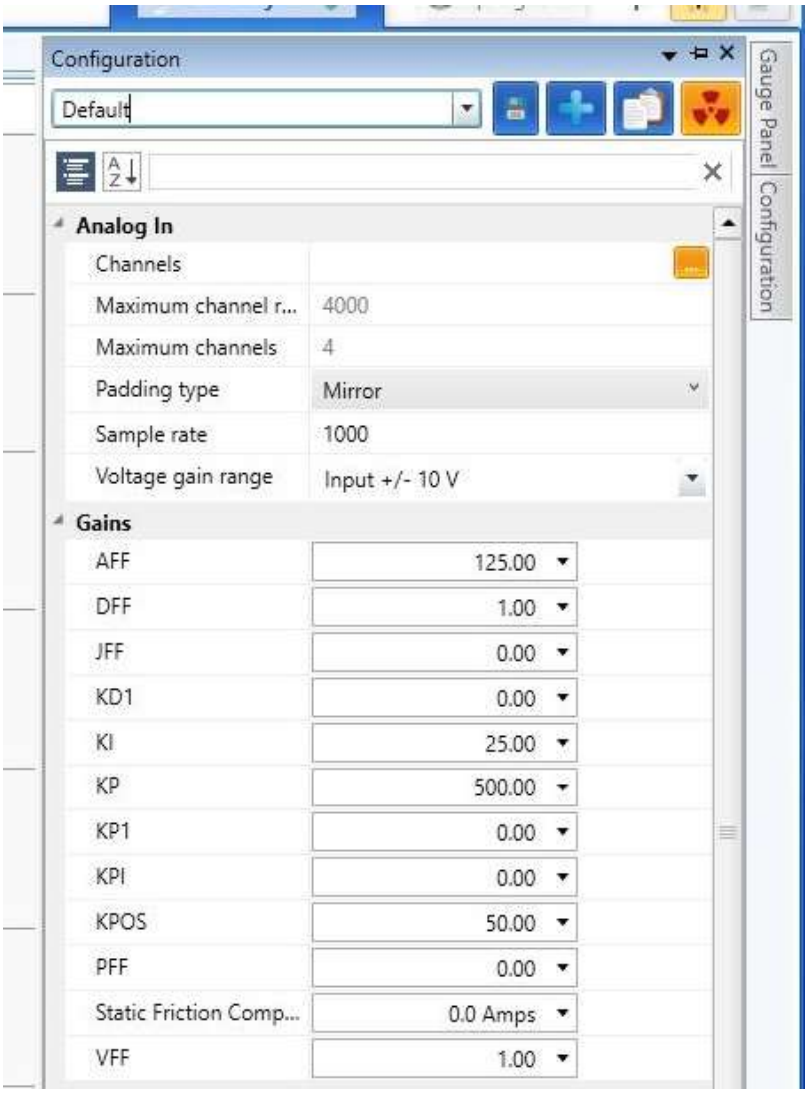
	POP Gains "soft"	PUSH Gains - Performance		General Range
AFF	125	125	125	125
DFF	0	0	0	0
JFF	0	0	0	0
KD1	0	0	0	0
KI	25	25	25	25
KP	500	1000	1200	500 - 1400
KP1	0	0	0	0
KPI	0	0	0	0
KPOS	50	100	150	50 - 175
PFF	0	0	0	0
Static Friction Comp	0	0	0	0
VFF	1	1	1	1

LA-48 PUSH and POP GAINS Table 4-2020

Building a Test Sequence – step by step (cont)

Pop Gains – LA Series of actuators

Pop Gains are non-Performance movement gains. Pop Gains are stored in the Configuration area and are meant to provide a nominal setting for movement only with no regard to performance or frequency response. These are "soft" gains meant to move from one position to another, such as MoveToPosition, Rod Force and Warm-up commands without any additional requirements.



Pop Gains

Pop Gains

These Gains are used for general movement of the machine and are intended not for performance but simply to allow for smooth movement from one command to the next. The machine will use these at all times unless a "Push Gain" command is used.

End of LA Series of gains

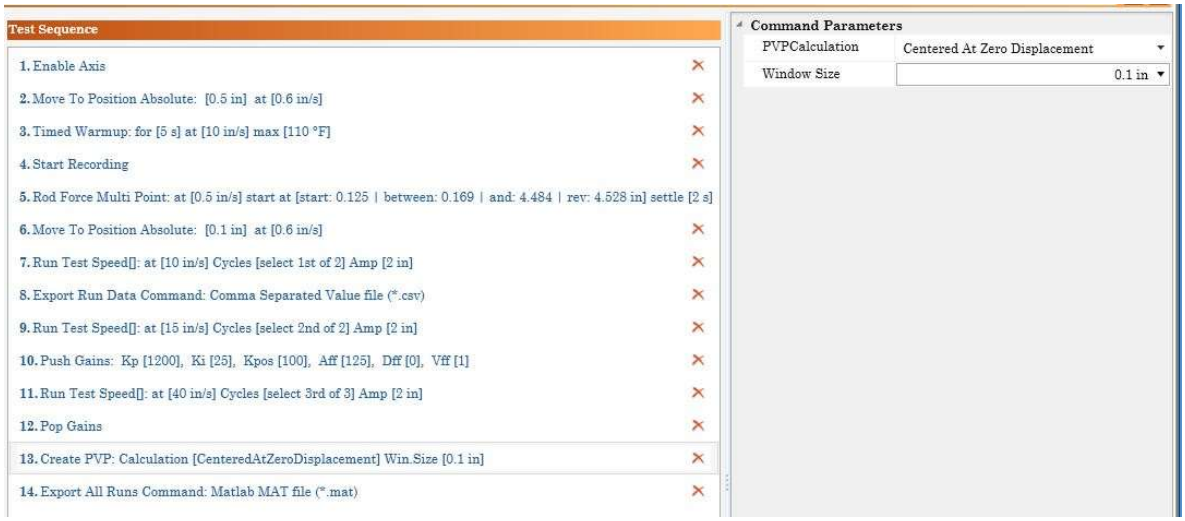
Building a Test Sequence – step by step (cont)

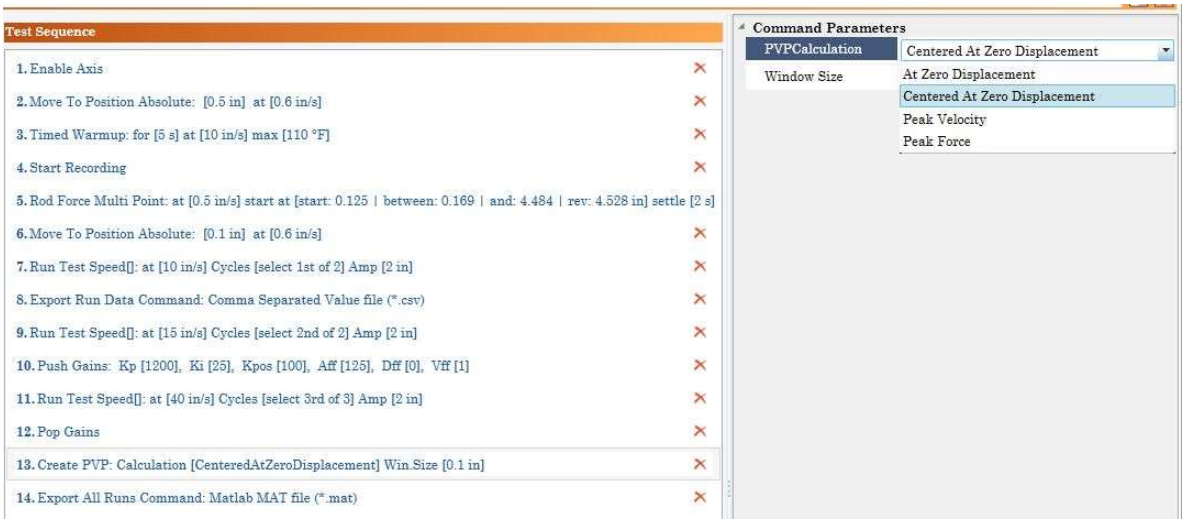
18 – **POP GAINS:** this command returns the actuator Gains to the default gains. These are best for non-critical movement. The User should always return to POP gains after the last speed for actuator stability. Complete Gain details can be found above.

Note: If you use the Push Gain command you MUST use the POP gain command in tandem.

19 – **Create PVP:** this command allows the user to create a PVP from the given Test Speeds data.

You can create a PVP from the Data using Peak Velocity, Peak Force or using a averaging window centered around mid-stroke of the Test Speed. From the drop down menu, chose your PVP type and then a window to use for the data.





Building a Test Sequence – step by step (cont)

20 – **Export Run Data & All Runs:** this command allows the User to automatically create a export file of the data. Some users need the data to be in a MAT / XLXS / CSV / JSON or HTML format for futher analysis and/or data base work.

Export Run Data – only exports the preceeding Test Speed. This is done when you only need the data from one particular speed.

Export All Runs – use this to export all the speeds in a given Test.

At the end of the Test, files will be saved in the Format chosen with the same name as the Data File.

Building a Test Sequence – step by step (cont)

21 – **Stop Recording:** this command officially ends the recording phase of the Test Sequence. If the user did not have a Set File Name command in the Test, then this command also prompts the Save as Screen to appear.

22 – **Move to Zero:** this command moves the actuator back to "Zero" or what we call Home.

23 – **Disable axis:** this turns the actuator "off". It cannot be made to move again until Enabled.

Note: If this command is done at anytime before Move To Zero, the actuator will fall with the force of gravity.

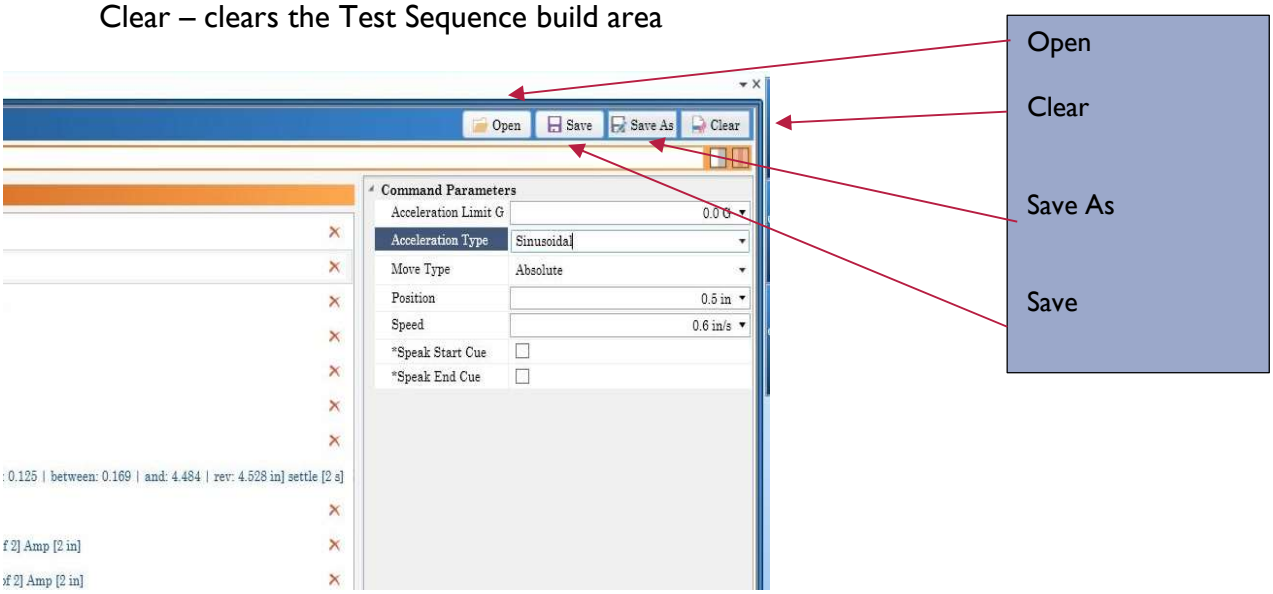
Now you need to save your Test Sequence, give it an approriate name.

Open – Opens a already existing Test Sequence

Save – saves the Test to whatever name is in the save bar (caution – you might over write an existing Test)

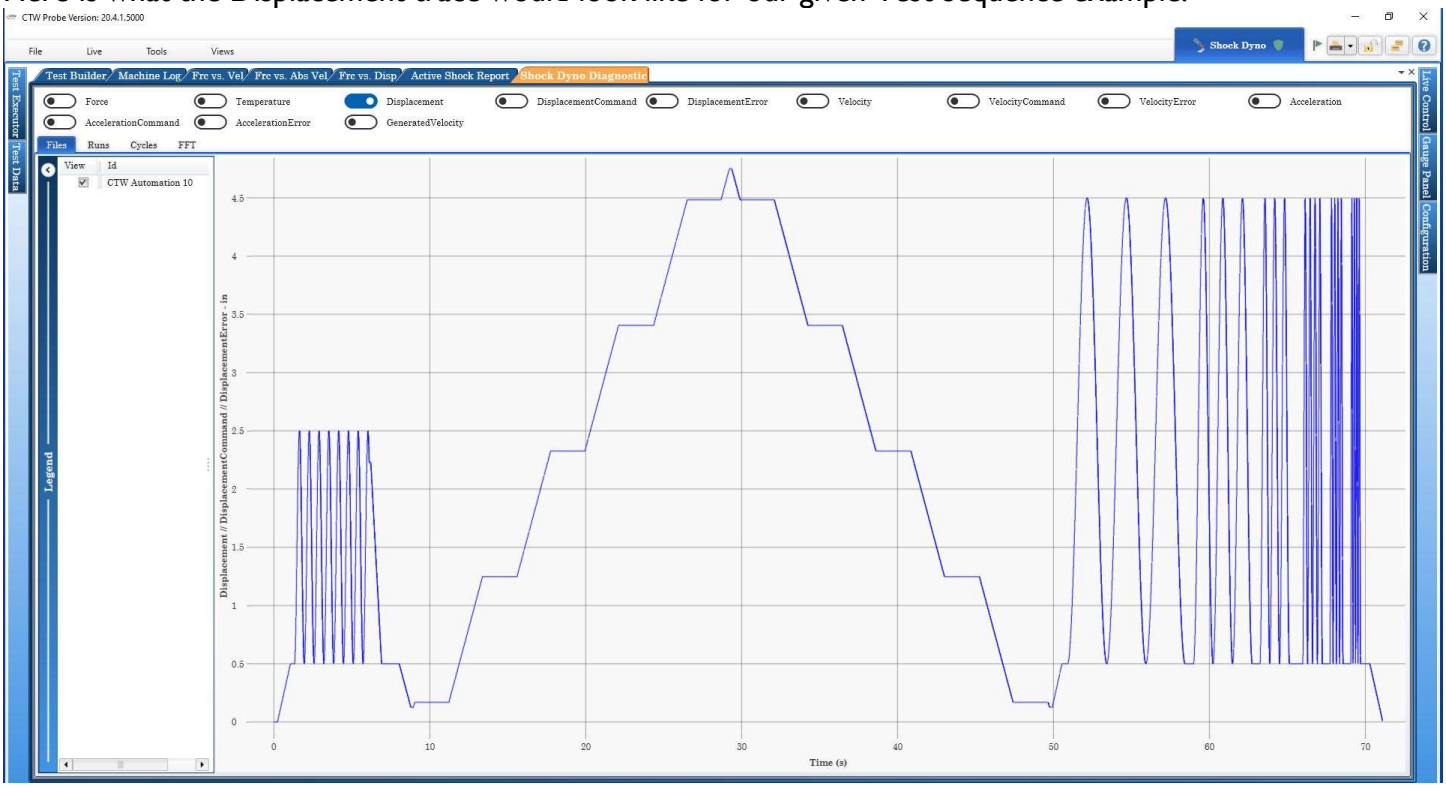
Save As – allows you to save and give a unique Name to the Tests

Clear – clears the Test Sequence build area

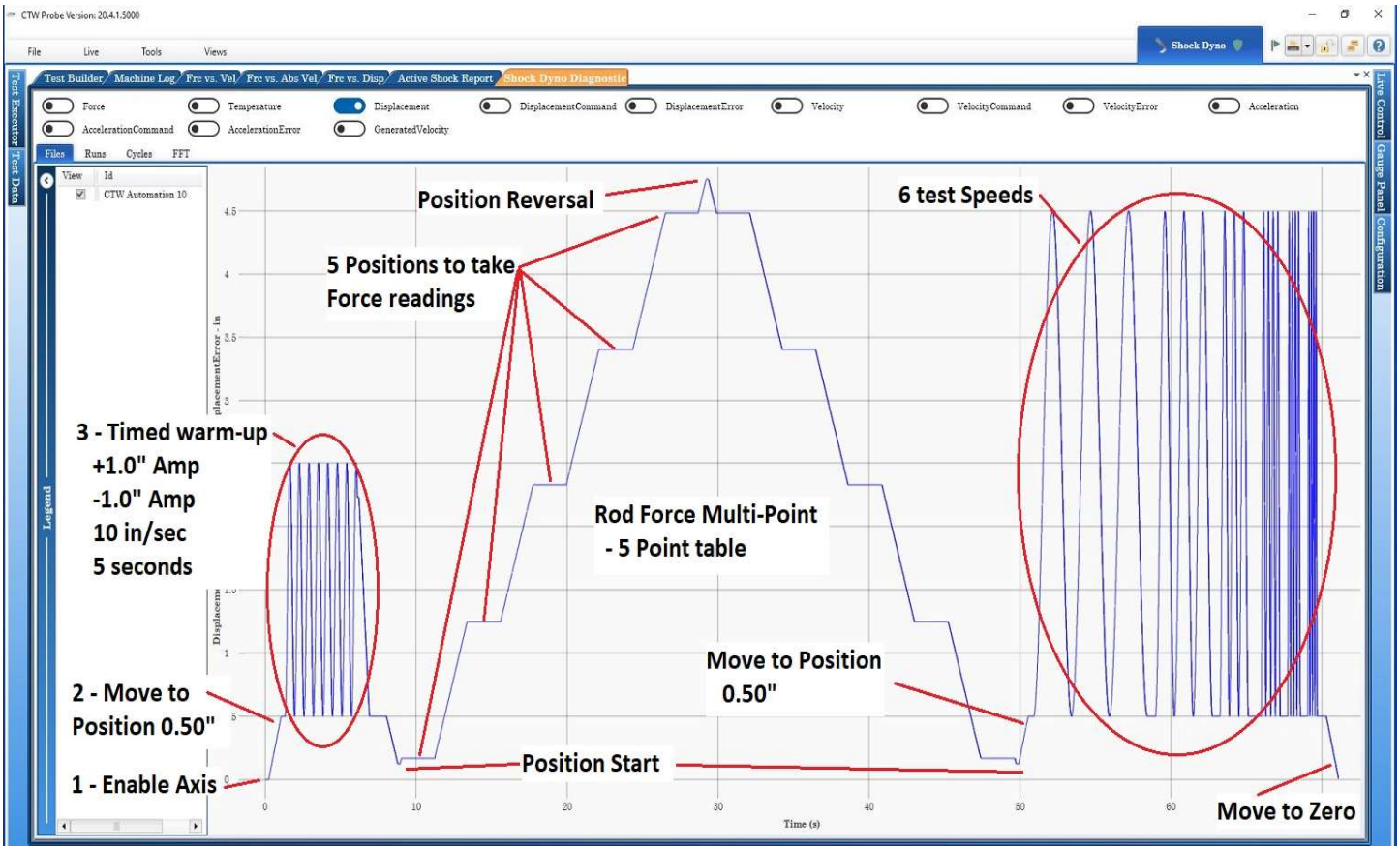


Building a Test Sequence – step by step (cont)

Here is what the Displacement trace would look like for our given Test Sequence example.



With annotation



Section VII – Executing a Test

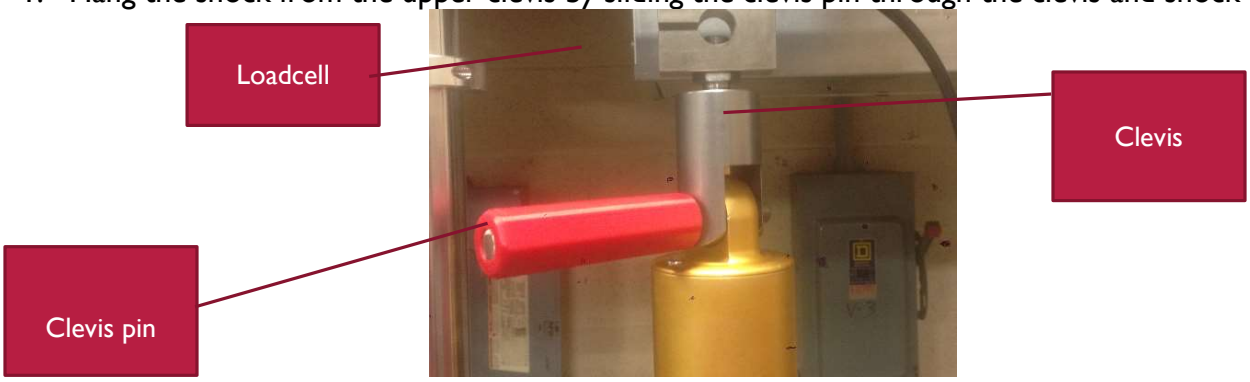
Executing a Test Sequence

The "Test Execution" window is the panel you perform a standard dyno test from. You must properly load the shock into the machine and select the test you want to perform, then execute the test. If you have just entered the LA software, remember you must Home the axis as described in the Starting the Software section (above).

Loading a Damper in the test area

The shock should be fully extended before it is installed in the dyno. If you are testing twin tube non-pressurized shocks pull the shock shaft out of the body until fully extended. The LA does not need to have the crossbar preloaded provided the damper is secured in the fixtures properly. It could be a safe practice to put a few mm of preload on the damper just to move the piston off of the end of the top nut.

1. Hang the shock from the upper clevis by sliding the clevis pin through the clevis and shock eye.



2. From the "test execution" page click the "zero force" button. This removes the weight of the shock or any offset in the loadcell out of the data.

Zero Force – performs a tare of the load signal. You want to remove the weight of the damper and fixtures.

3. Loosen the crossbar handles and lower the crossbar until you can install the lower clevis pin into the shock. If you are testing a mono tube gas pressurized shock the shock will hold the crossbar up while you insert the lower pin, if it is an unpressurized shock you will need to tighten one handle.

4. Lower the crossbar to compress the shock slightly, this prevents the shock from becoming over extended. Tighten the crossbar handles.

5. Tighten the clevis by turning clevis handles clockwise until snug. Check to make sure you have enough shock travel to prevent bottoming out the shock. You are now ready to run your test.

Executing a test

Once you have the shock properly loaded into the dyno you are ready to run a test and collect data.

1. From the "Test execution" window on the left side of the page, click the "load" button to select a test. If you have no test created see the "create test" section of the manual; you can create as many tests as you like. Keep in mind a test is just a series of commands, the collected data from those commands is what we will be looking at. Tests are stored your computers document folder at 'Documents/CTW Automation/Tests'. Tests can be copied and pasted into other computers.

2. To start the dyno and perform the selected test click the "Execute" button in the lower left corner. This will start the dyno and automatically step through each step of the test. Each step will be highlighted as the dyno runs that step.

3. At the end of the test when the dyno has completed all steps, the "save" window will open. Name the test when the "save test" window appears after the test is complete. As a default your data will be saved in a data folder in 'Documents/CTW Automation/Data'. You can save data anywhere you wish. Data is saved just like any document in Windows so you can save data to any location.

Section VIII – Graphing and Data

Displaying and viewing Test data

After running and saving a test the data will display automatically. You can also open saved data buy using the FILE/OPEN pull down menu.

The graph below depicts the data on the force vs absolute velocity graph compared to the position of the crank bearing on the yoke. We break one cycle of the crank head into four quadrants. Each defines what is happening to the shock in that quarter.
The shock shaft (and shock piston) is constantly being accelerated or decelerated by the offset bolt in the dyno yoke. When the dyno changes direction, from compression to rebound at the top of the stroke, and rebound to compression at the bottom of the stroke, there is a momentary pause between the up and down direction. At that point the dyno records the zero velocity points. When the crank bearing is at its highest offset, mid stroke, that is where the dyno records the peak velocity. With a sample rate of 1000 sample per second, the software is checking the velocity and the force 1000 times each second and putting a point on the graph at that force and velocity intersection. The line we look at on the graph is really a series of collected points that the software connects together.

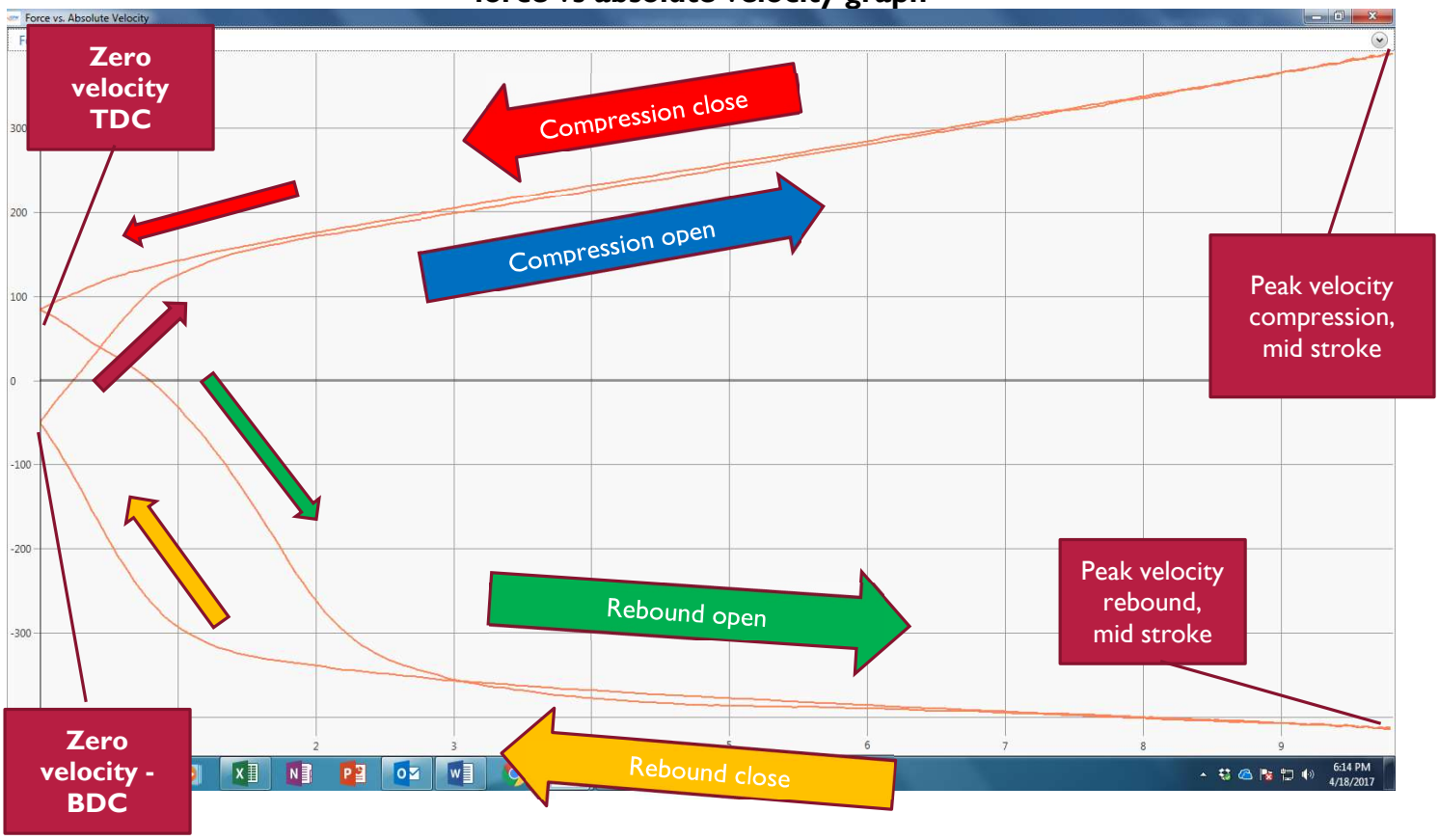
Four quadrants of a Standard Sine Wave
Compression open – From BDC to mid stroke in the compression direction the shock is being accelerated, the graphs shows the force related to that increase in velocity. As velocity increases force increases. The parts inside the shock define how quickly the force chances. Sometime in this quarter the compression valve stack will open

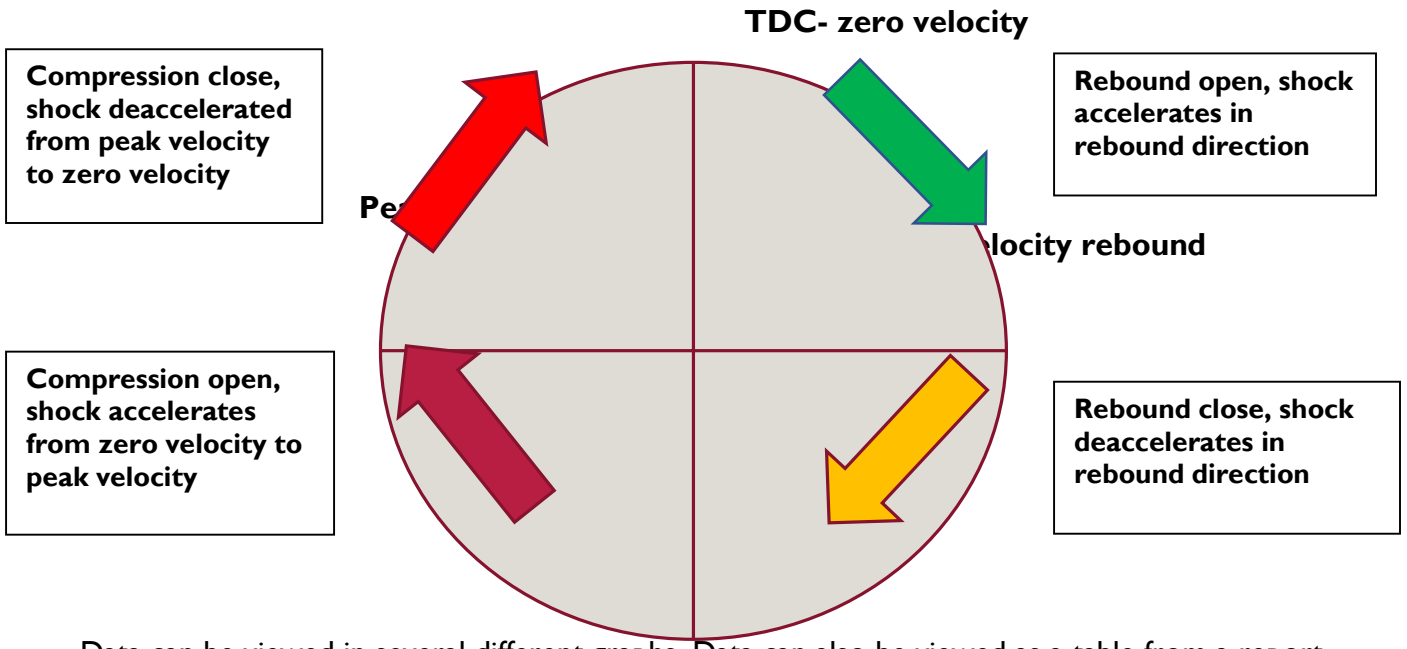
Compression close - At mid stroke the shock has reached its peak velocity and then must slow down to go back to zero velocity at TDC. As the shock slows down the shim stack in the shock will close

Rebound open – From top dead center the dyno and shock move back down pulling the shock shaft in the rebound direction. Shim stack on the rebound side of the piston opens in this quarter.

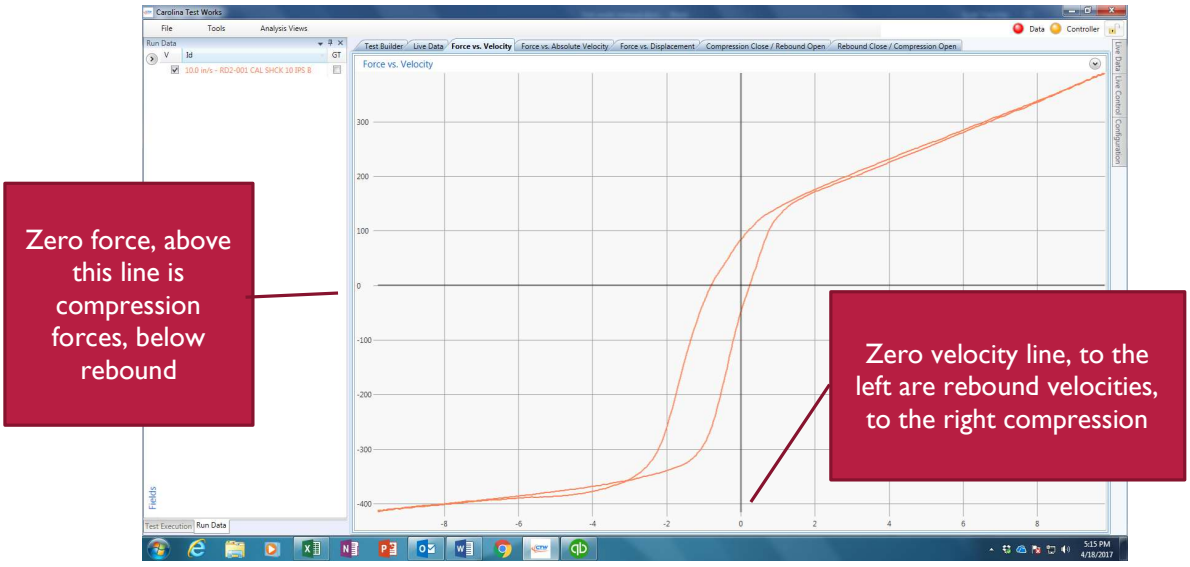
Rebound close – Finally the shock slows down from peak velocity at mid stroke in rebound back to zero velocity at BDC. One complete cycle has been run and graphed.

force vs absolute velocity graph



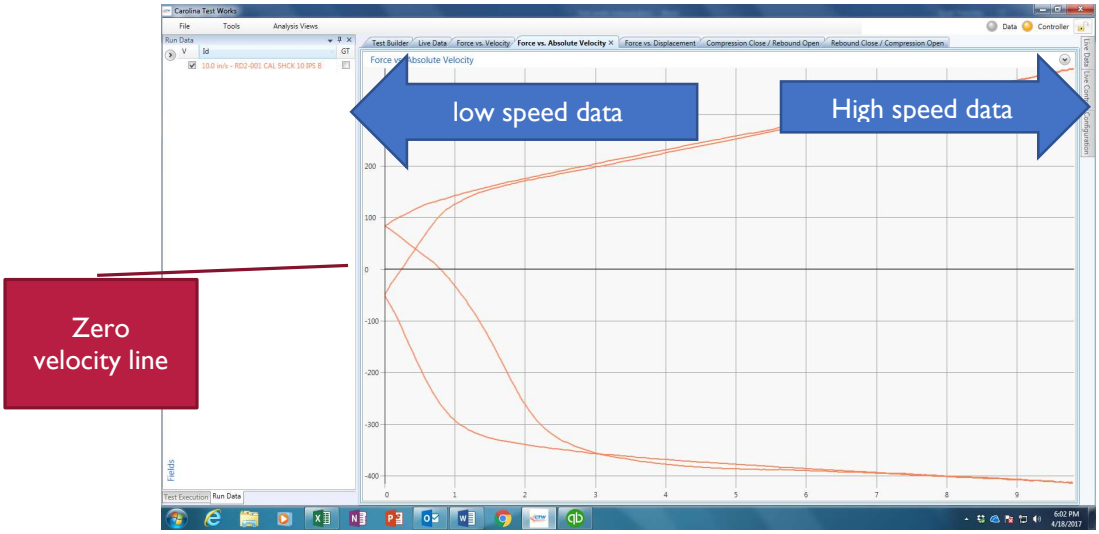


Data can be viewed in several different graphs. Data can also be viewed as a table from a report.
Force vs velocity – This graph displays a complete cycle of data, one complete revolution of the crank and one complete stroke of the yoke and shock, from BDC back to BDC. Forces above the zero force line are forces produced moving in the compression direction, while below the zero line are forces produced as the shock shaft is moved in the rebound direction. Rebound velocity is a negative number.



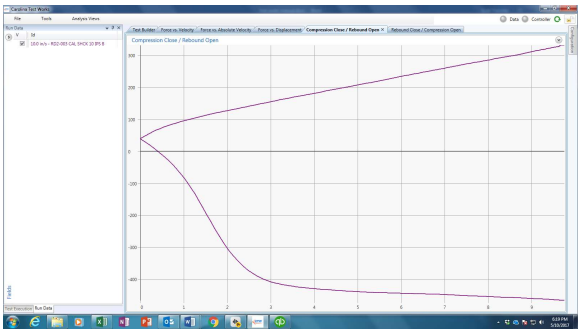
Force vs absolute velocity

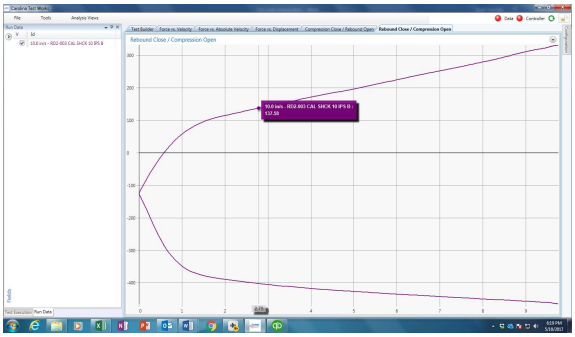
The most common graph type used for shock analysis. This graph displays the exact same data as the Force vs velocity graph above. The zero velocity line is moved to the left of the graph, so the rebound lines are "folded over" and all the velocities are in a positive direction. Just like for F vs V graph all forces above the zero force line are compression forces, below are rebound.



Compression open/rebound close, rebound open/compression close

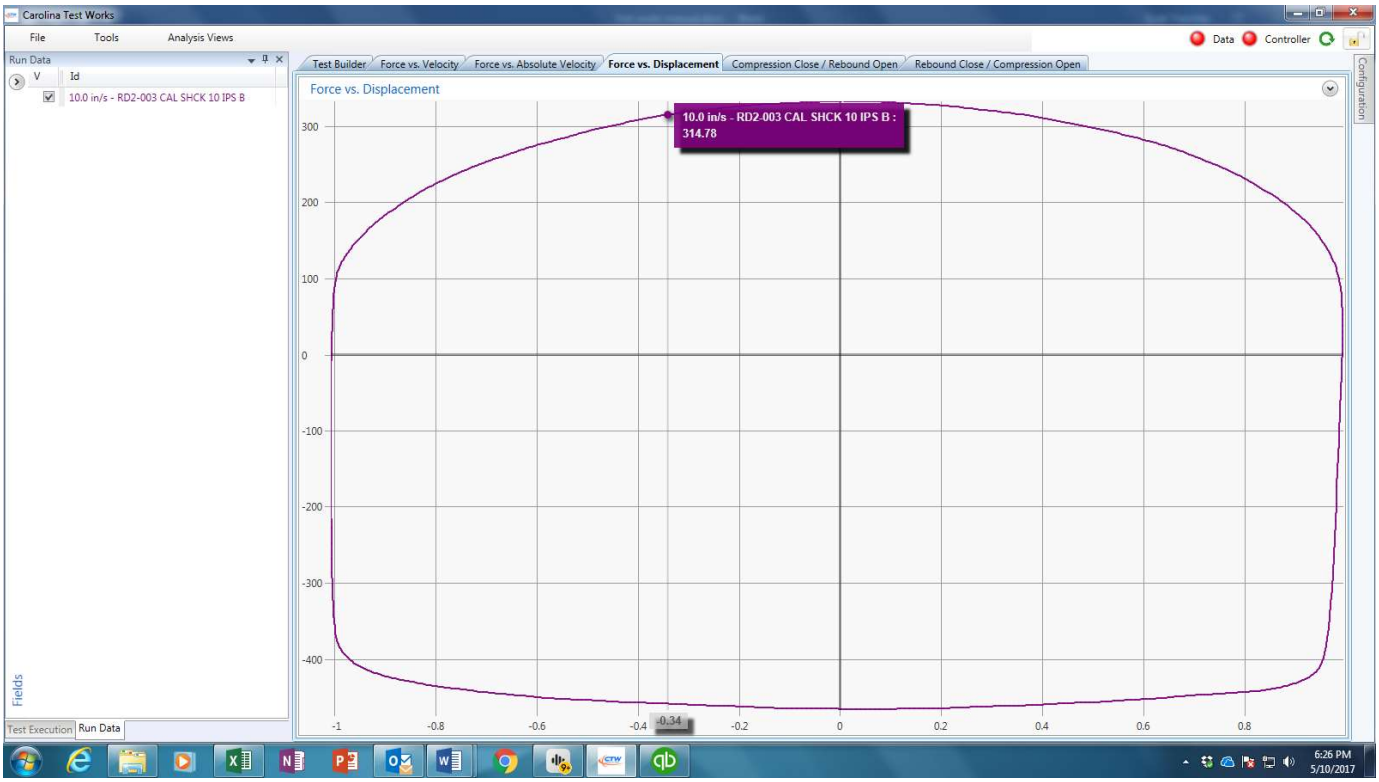
Both theses graphs are the force vs absolute velocity graph just cut in half. The graph is cut at the peak velocity points. Same data as Force vs absolute velocity just displayed in two graphs





Force vs Displacement

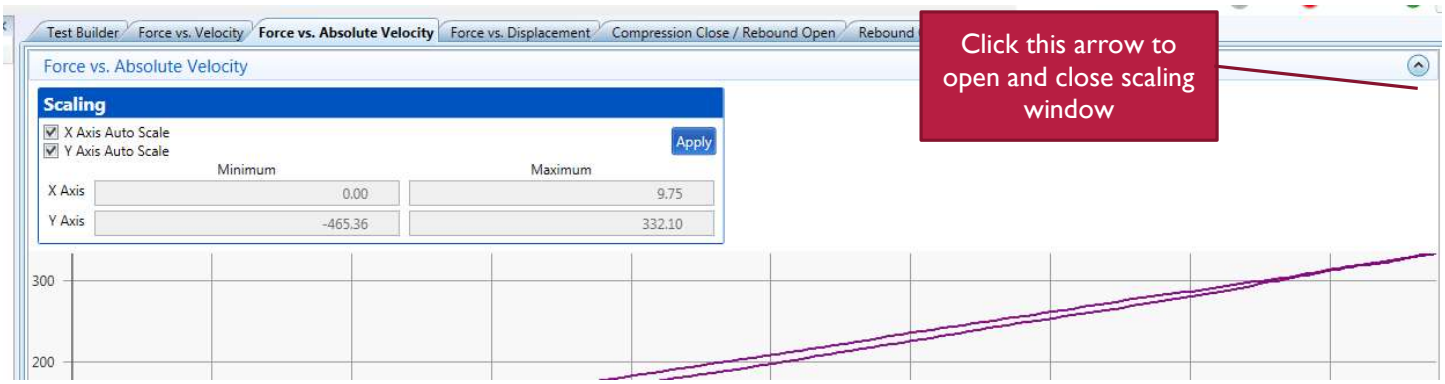
This graph still displays the force on the Y axis but now displacement is on the X axis. So we are looking at the force at any given displacement.



Other features and tools

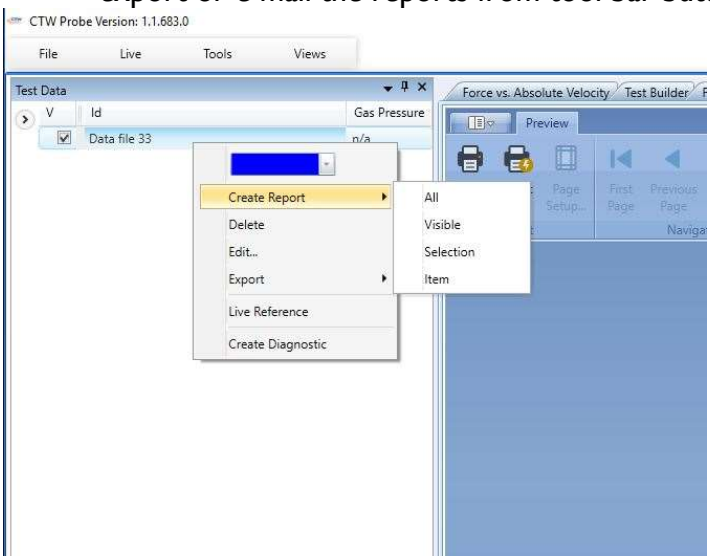
Scaling

As a default, the program will "auto scale" the graph to fit the data trace just inside of the paper. So the scaling on the page will increase or decrease depending on the velocity or force your shock produces. If you want to lock the graph scaling you can do that by clicking on the arrow in the upper right-hand side of the graph, this will open the scaling page. Remove the check from auto scale, type in your minimum and maximum for each axis, and hit apply when done. Each graph type scales independently.



Creating a Report

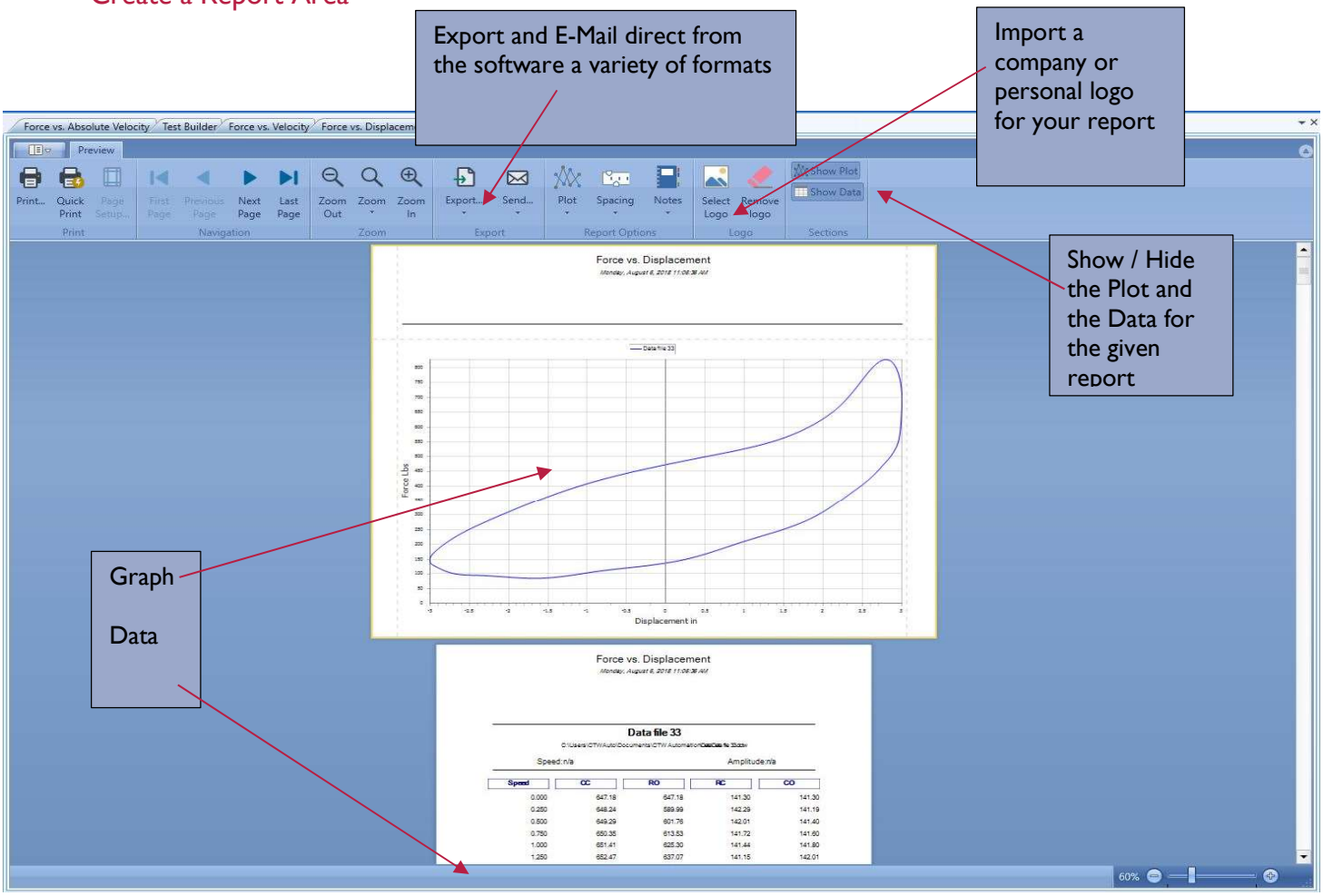
Collected data can be displayed as a text report. In the "data display" column right click on any open data files name. You will be alble to select any or all of the open data file to produce a report. Reports show up as a tabbed page at the top of the screen. If you have a lot of reports open the "thumbnail button at the top of the page will list the page as thumbnails on the left side of the report. You can also export or e mail the reports from tool bar buttons at the top of the report page.



Right click on the Data File and chose "Create Report" and pick your method.
All – uses all data in the legend field
Visible – uses the data that is displayed (or checked)
Selection – the one(s) that are highlighted
Item – the data you clicked on

Methods to Create a Report

Create a Report Area



Print and Quick Print

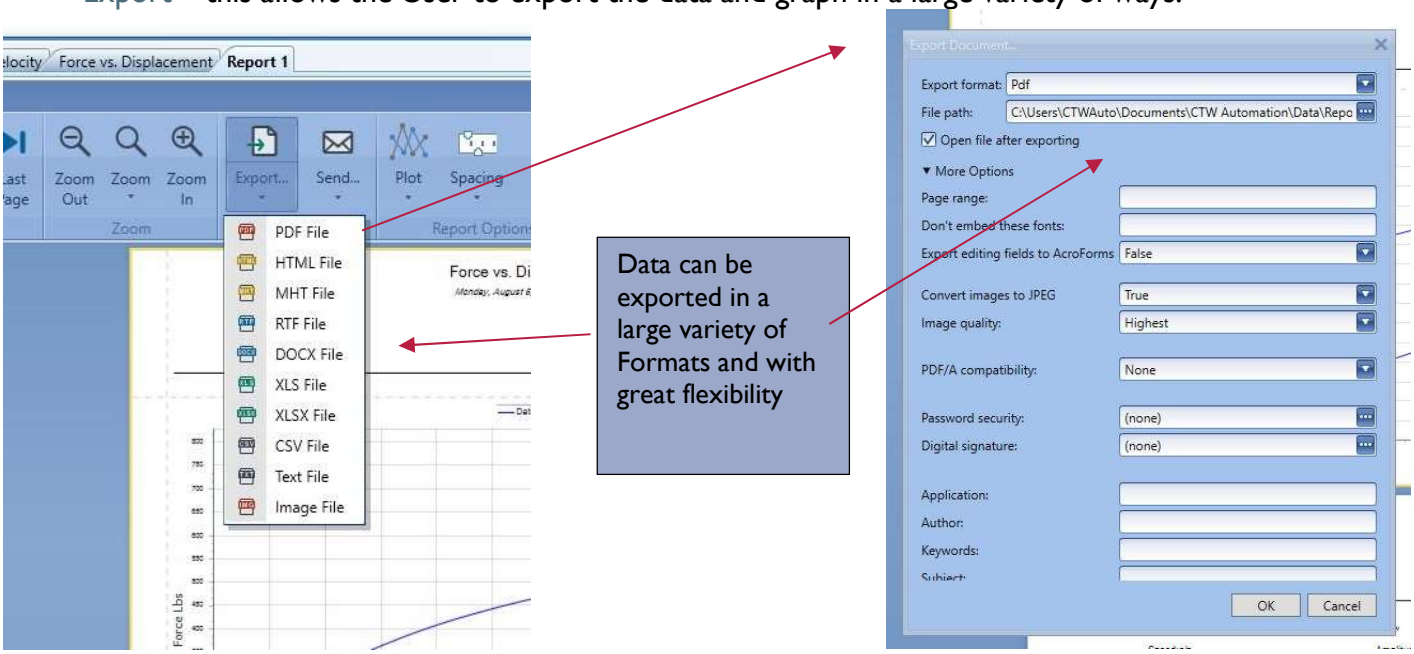
Printing is done from the report page using two tool bar buttons at the top of the report page. Quick print will print whatever graph or report you have displayed using the default printer settings. Custom print allows the user to select print features and pages.

If you want to add some notes to your printed graph page click on the "notes" tab at the top of the page. Notes will be added above the graph.

Navigation – allows for scrolling thru the pages quickly.

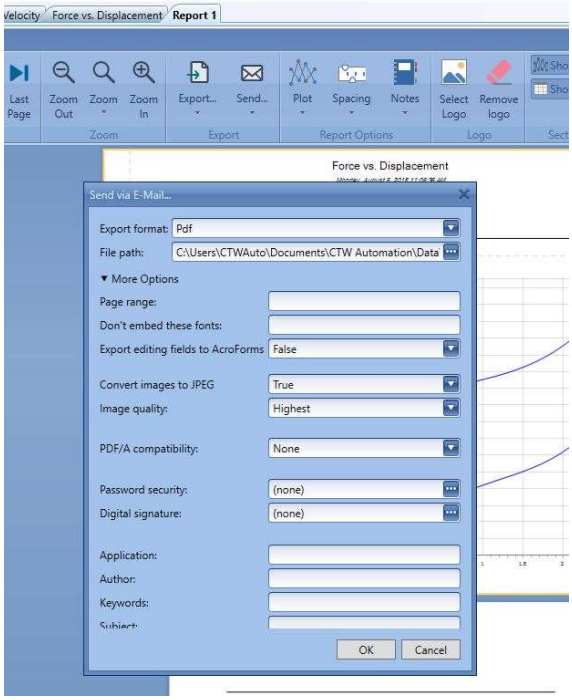
Zoom – the User can Zoom in and out as well as use the Zoom scroll bar at the bottom right corner.

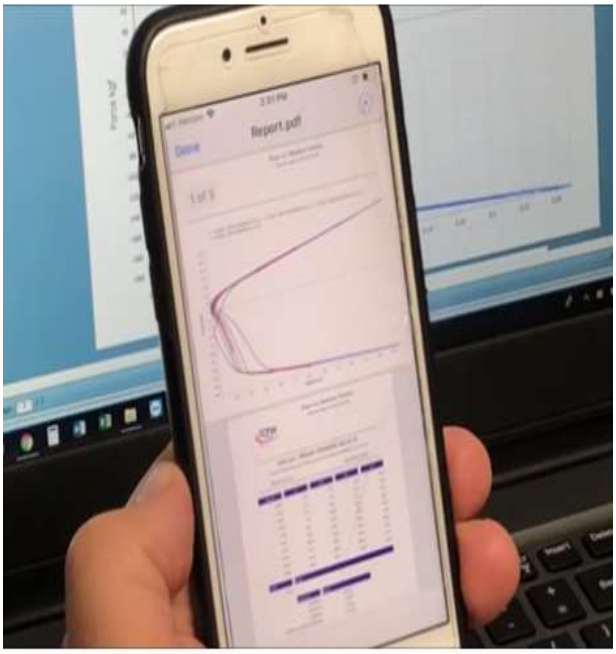
Export – this allows the User to export the data and graph in a large variety of ways.



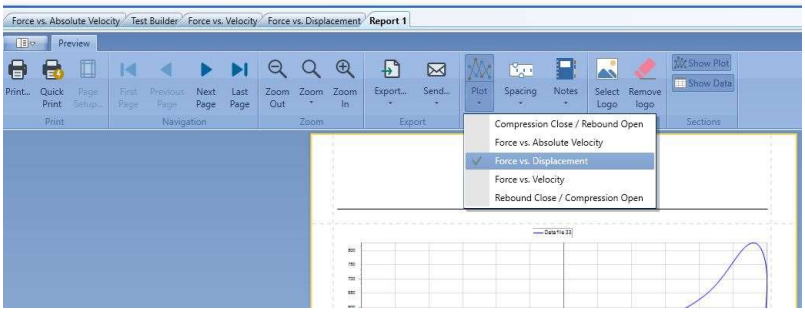
Export Feature and additional details

Send – this allows the User to e-mail directly from the software using whatever e-mail system is currently on the computer. These can go to whomever you chose and can be a variety of formats. If you can open mail on you phone or table, you can have quick access to your graphs and data.





Plot – chose what Graph to display on the Report.



Spacing – chose the spacing for the Velocity data
Notes – add notes to the report

Add logo - The add logo tool bar button allows the user to import their company or team logo to print on the reports.
Show Plot / Show Data – this allows the User to turn on/off the display of the Graph and Data

Additional Information and Help

CTW Automation has created its own YouTube Channel that contains videos demonstrating the software. This will continue to be a good way to find more details about the machine and its function. A yearly Support contract can be obtained to offer e-mail / phone and remote access help with yur questions and concerns. This can be in operating the machine in question, understanding the software or interpreting graphs and data. Contact sales for more information and to attain a Support contract. CTW has a FaceBook Group page for Users to ask questions of CTW as well as their fellow damper technicians from a broad range of fields. From racing to manufaturing, from service centers to individuals, from bicycles to motorcycles to scooters, off road, on road and everything else.

Edit Fields: How to use, change and select

The CTW Probe Software has a very powerful way to allow the User to have a "notes" section that is saved with each and every data collection. This feature is called the "Field Set" and using it allows you to create a page of information that is customized to your needs for information and record keeping.

These "Fields" can be thought of as a notes page where you can keep important information concerning the damper build and data collection. This information can be anything that the User wants including items like: including shock valving, piston, bleeds, customer names, type of race car, or location of that shock on the car. Multiple different Fields can be created and saved and then called out for different needs. Sometimes you need a lot of information and sometimes you just need a few items for a given test. It is all up to the User. This information is later used in the Report section after the collection is finished and can be printed out with the graphs.

We need to first learn how to create and edit our Fields to make them usable. Then we will learn how to bring them into a given Test sequence.

How to create and Edit a Field Set

User created Fields are stored as a "*.SET" file type and can be stored anywhere on the computer. Field files can be copied and pasted into multiple computers, making it easy to have the same fields layout on different computers or dynos. You can even share them with other CTW users.

The generic "demo.SET" file that is preloaded with the software is located at:

In Documents in the "CTW Automation/Tests" folder.

You can modify this file or save it as a different name. You can also have multiple files saved to create different note sections that might be specific to a particular shock or track or customer. The user can then select from these saved "*.SET" files when building a test. You should think of these as lines on a piece of paper that you are using for notes; this is just the computer language to make it happen.

To Edit, create or copy a Field file.

Below are the five basic ways to create your Field lines for entering notes. They allow you to have a wide variety of ways to enter data and notes about your shock.

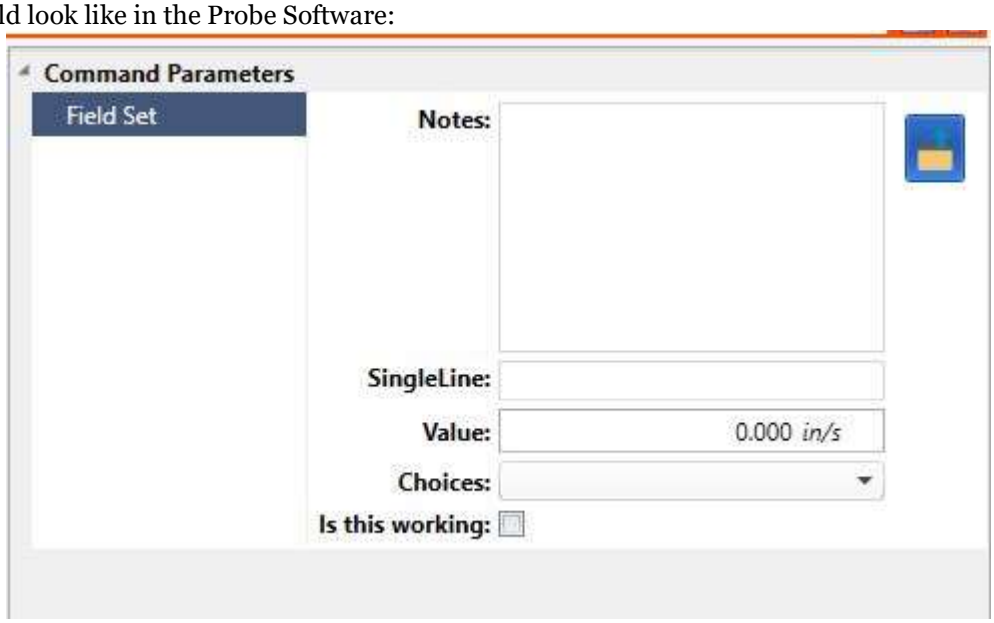
Field types are:

1. **String** – Allows one line of text.
2. **Multiline string** – allows unlimited lines of text. Use this field to type sentences or paragraphs.
3. **Value** – enter a single value by typing or with a scroll bar. In the demo 0-9.75 in/sec
4. **Choose** – Allows the user to select from a user defined list, in the demo A, B, C, D are the options available.
5. **Check-** adds true/false

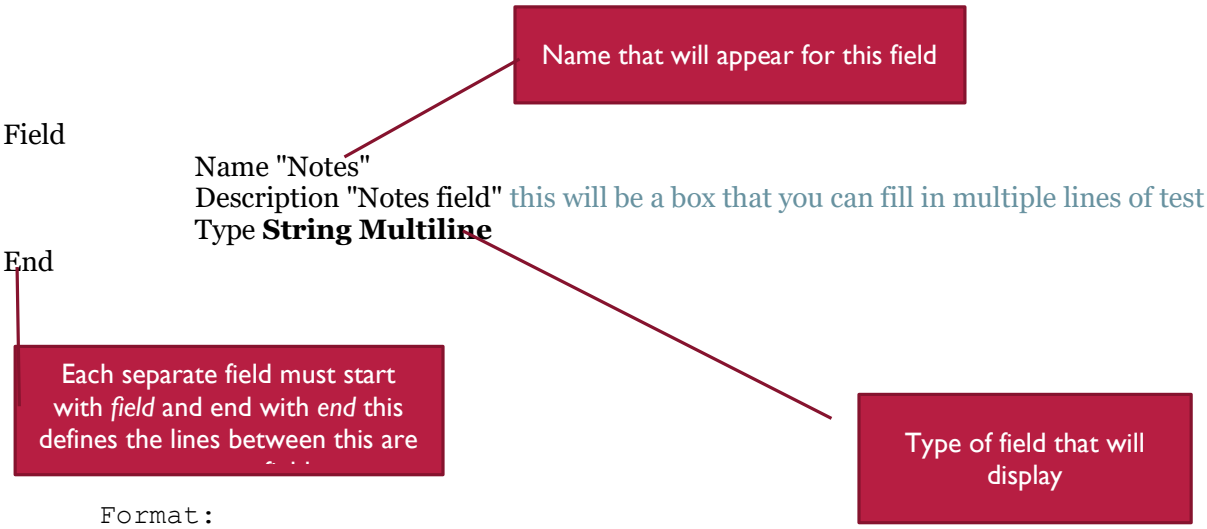
Basic field layout

```
FieldSet
        Name "Demo"
        Description "Demo field set"

        Field
                Name "Notes"
                Description "Notes field" this will be a box that you can fill in multiple lines of test
                Type String Multiline
        End

        Field
                Name "SingleLine"
                Description "A line of text" single line will give you a single line to type text
                Type String
        End

        Field
                Name "Value"
                Description single line with a scroll arrow on the right
                Type Value in/s Min 0 Max 9.75
        End

        Field
                Name "Choices"
                Description pull down list of options the user defines
                Type Choice "a", "b", "c", "d"
        End

        Field
                Name "Is this working"
                Description check box
                Type Check
        End
End
```

This is what it would look like in the Probe Software:



Description of an individual field




```
Format:
     Line 1 – Field Name
     Line 2 – Description (optional)
     Line 3 – Type (See below.)
```

Formatting of the "Type" line

Multiline String - Type String Multiline

No other entries required or allowed

String- Type String

No other entries required or allowed

Value -Type Value XXXX Min YYYY Max ZZZZ

XXXX = units of value. YYYY = minimum allowable value. ZZZZ = maximum allowable value.

Choose - Type Choice XXX, YYY, ….

After the word "Choice" the user builds the list of choices. Each item must be enclosed in quotes. The different items must be separated by a space.

Check – Type Check

No other entries required or allowed

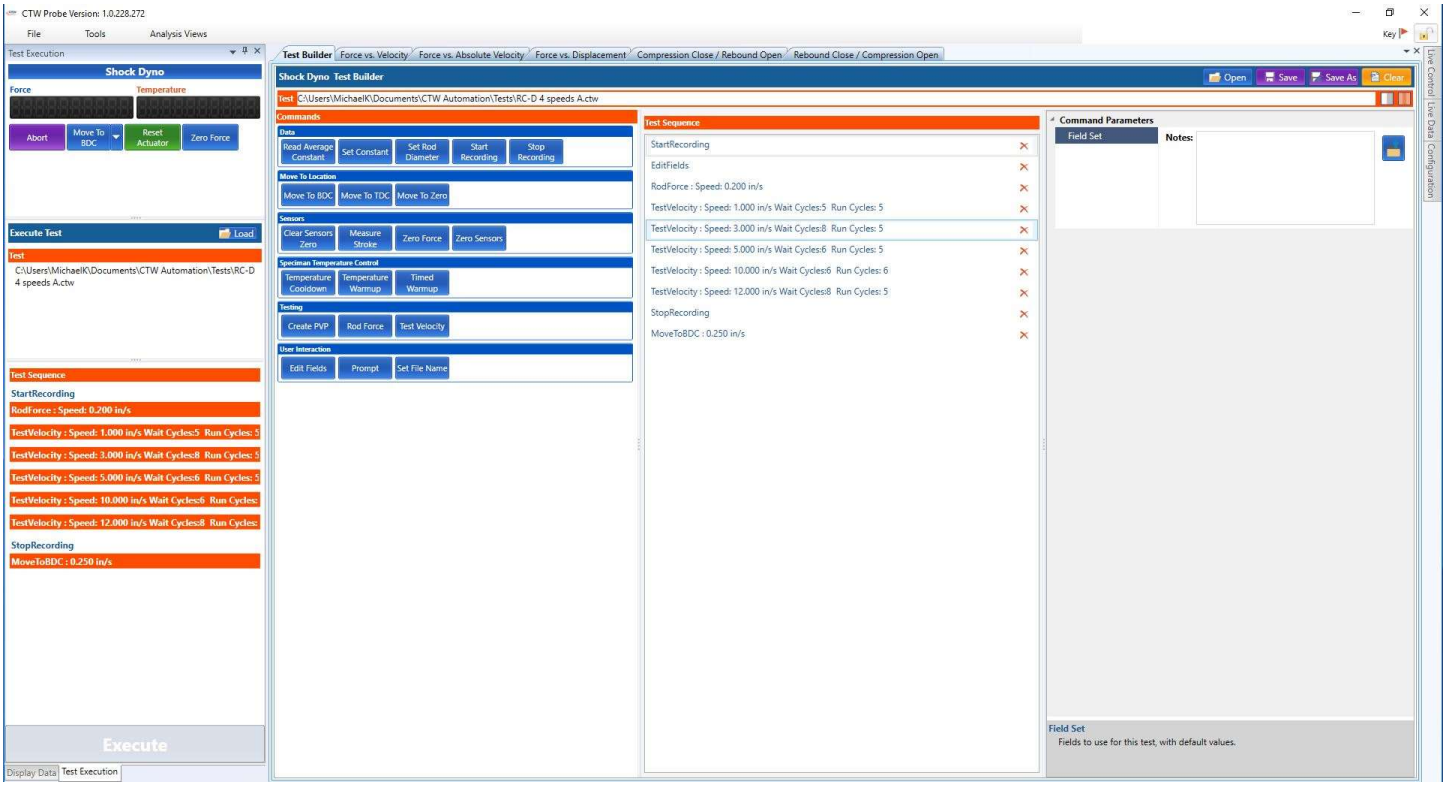
Remember the "description" is only used in the .set, not visible on the create field window

User modified field file example

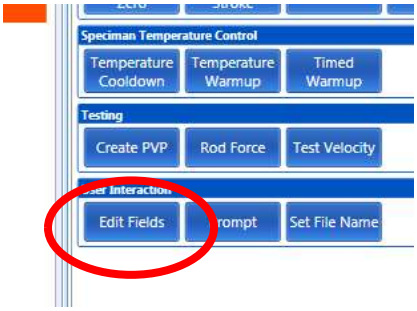
```
FieldSet
	Name "customer notes"
	Field
		Name "Notes"
		Type String Multiline
	End
	Field
		Name "race track"
		Type String Multiline
	End
	Field
		Name "piston"
		Type String Multiline
	End
	Field
		Name "bleed"
		Type String
	End
	Field
		Name "shock length"
		Type Value in Min 0 Max 15
	End
	Field
		Name "rebound shim"
		Type Choice "a", "b", "c", "d", "e"
	End
	Field
		Name "corner"
		Type Choice "RF", "RR", "LF", "LR"
	End
	Field
		Name "custom build"
		Type Check
	End
End
```

How to use the Fields within the CTW Probe Software

Below is the Test Builder page from CTW Probe software. You choose which Field Set you want in the Start Recording box. The right column has a File Folder image, click on this and select which Field Set you want for this Test.



Then using the "Edit Fields" command, add this to your Test. It is best to add just after the "Start Recording". Then, during the Test (when the dyno is running) a window will show up on the screen for you to enter all the information that you have called out in the Field Set. This information will be saved with the data collection and will appear in the report for that collection.



Test Builder – "Edit Fields" tab

Report with no data entered, user modified fields example above

2.500	0.18	0.14	0.13	0

Field	Value
bleed	
corner	
custom build	False
Notes	
piston	
race track	
rebound shim	
shock length	0.00000 in

Report with data entered from user modified example above.

Field	Value
bleed	.02
corner	RR
custom build	True
Notes	enter note DIRT modified2500 LBS set up used in feature, driver said to tight
piston	DL penske
race track	Ransomville speedway 5/5/17100 lap feature
rebound shim	c
shock length	8.00000 in

Fields can be modified after a data file is saved. Right click on the file name in the data display column. Select “edit”. File editor window allows the user to modify any field.