NASSA TC LOGGER-USB

V-1.0.3

The TC LOGGER USB Black Box contains a 12v battery. Make sure the battery is fully charged before beginning. A fully charged battery life should be good for several days, however batteries tend to wear out with use and time.

DO NOT RUN THE SYSTEM ATTACHED TO AND EXTERNAL POWER SUPPLY OR CHARGER. IT IS DESIGNED TO RUN ON THE INTERNAL BATTERY ONLY.

Documents mentioned are available on the TC LOGGER USB CD or our WebSite.:

www.tclogger.com

Be sure to read *PRESSURE LINE CONNECTIONS* if you are using a Pressure Transducer.

SYSTEM

2 Input Channels (Thrust channel is mV input, Pressure channel is 0-5 V input)
12 bit Resolution
200 samples per second
USB connection

Hardware Requirements
800 mHz PC or better
Windows XP, Vista or Windows 7
1024x768 or better Screen Resolution
1 USB port

FLIGHT MOTOR THRUST CURVES

Firing Flight Motors does not require, nor use, a Pressure Transducer. All you will be collecting is a Thrust Curve and information about the Motor's functioning. Make a good attempt to know what you are firing. You might be surprised at the results.

MOTOR CHARACTERIZATION PROCEEDURE

When firing motors for Propellant Characterization you will be required to connect the Pressure Transducer. There are a few items that must be addressed when preparing the test motors. Record the information on a *MOTOR DATA FORM*.

Weigh a piece of Caster Tube and arrive at a Grams per inch weight. You will need this to subtract from the solid grain before drilling to determine the density of the propellant. You will also need it to subtract from the Cored Grain Weight when calculating actual Propellant Weight used.

Weigh and label all propellant grains after drilling the core. If the propellant grains were cast properly they should all be very close to the same weight. Record what grains went into each test motor.

Record the nozzle diameter AND the nozzle's exit diameter of each Test Motor to be fired. The document titled *PROPELLANT CHARACTERIZATION PROCEEDURE* outlines the steps to obtain final propellant ballistics for use in motor simulation software programs.

OPERATION

Using the provided USB cable, connect the Interface Box to the computer's USB port. DO NOT power up the Black Interface Box at this time before connecting the Load Cell and, if used, the Pressure transducer.

Begin the Thrust Curve Logger program and power up the interface box. You should get a screen that looks similar to this:
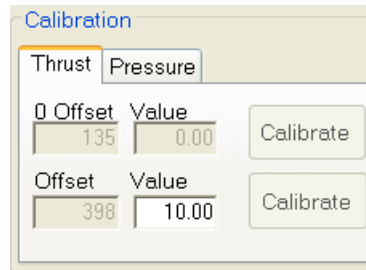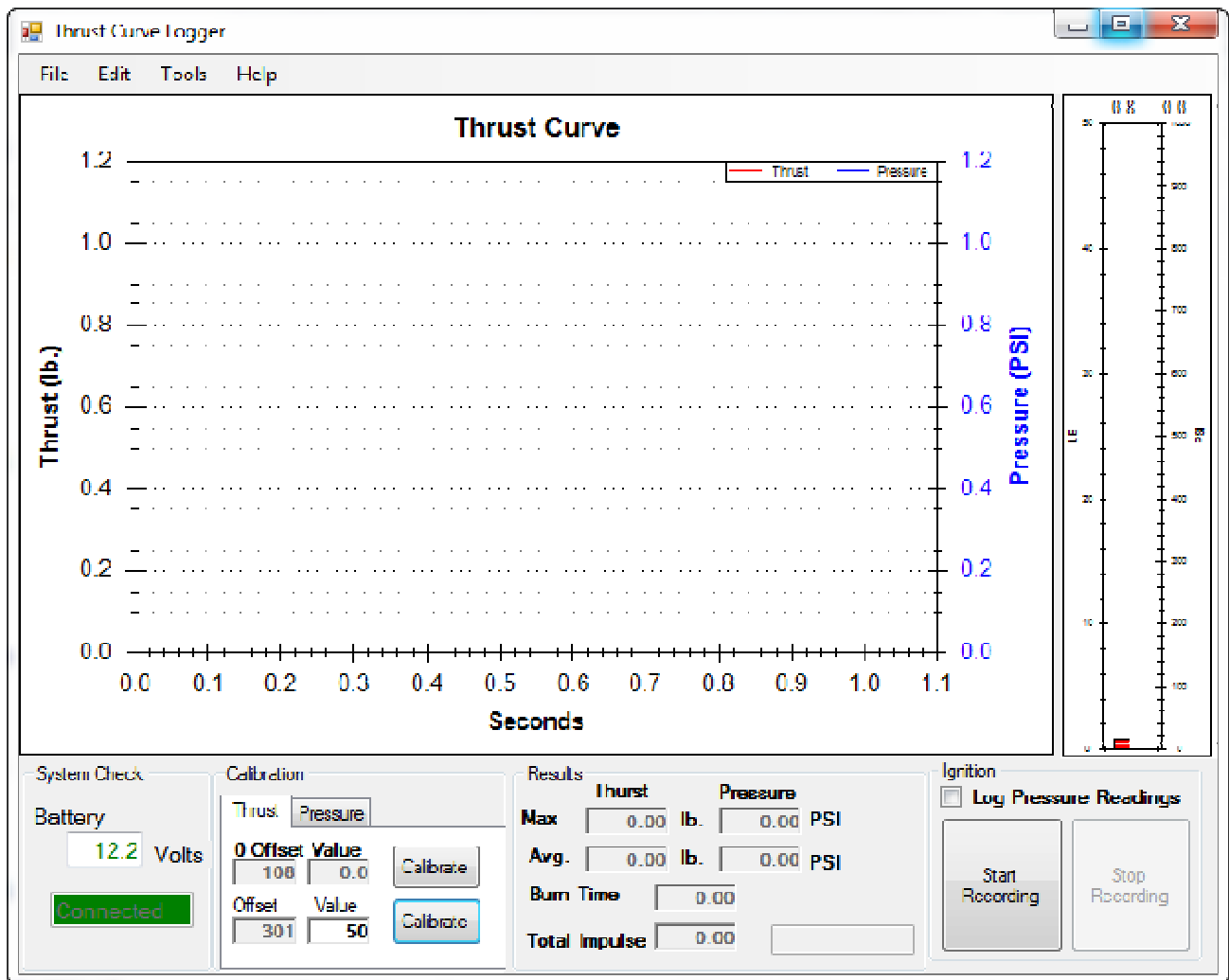

When the screen opens you should see, in the System Check box (lower left corner) these values showing the battery voltage and if you are connected to the Interface Box (green), if you're not (Red).

If you power up the Interface box before starting the program you may see that the program show that it is connected to the interface box but no Battery voltage is detected and no thrust information is displayed. Simply power off then power the interface box back on to connect to the interface box.

CALIBRATE THRUST

The first thing that needs addressed before operations can actually begin is to calibrate the system.

Select the Thrust tab.

With no weight on the load cell in appropriate orientation (horizontal or vertical) click the top Calibrate button, next to *Value=0.00*. This will set *0 Offset* to whatever value the load cell produces without weight. It will show a number and that is what the computer will reference as *Value=0.00*.

Place a known weight on the load cell. (the higher the better up to the maximum of the load cell). Type that known weight into the lower *Value* field, then Click the lower Calibrate button. The *Offset* field will now display whatever value the load cell produces with that known weight.
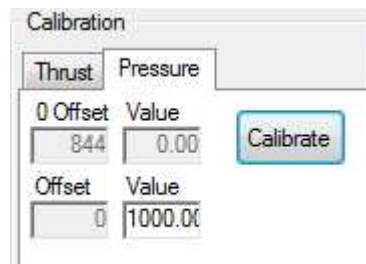
There is a vertical bar graph at the left of the screen. The left bar, Red, is for thrust (lb.), the right bar, Blue, is for pressure (psi).

To confirm calibration, place arbitrary weights on the load cell. The value at the top of the Thrust bar to the left of the window should indicate the correct weight. See the document *CONFIRMING CALIBRATIONS*.

NOTE: *Once this value is set on the computer you need not recalibrate the Thrust unless you are using a different computer. Or, you are using another value Load Cell. This data is stored in a file on that particular computer. If using another computer this data will not be there thus a re-calibration is required.*

CALIBRATE PRESSURE

Select the Pressure tab.

Enter the maximum value for the pressure sensor that you are using into the lower *Value* field. Then press the Calibrate button. Each day you use the system the Pressure Calibrate button should be clicked to adjust for the current atmospheric pressure.
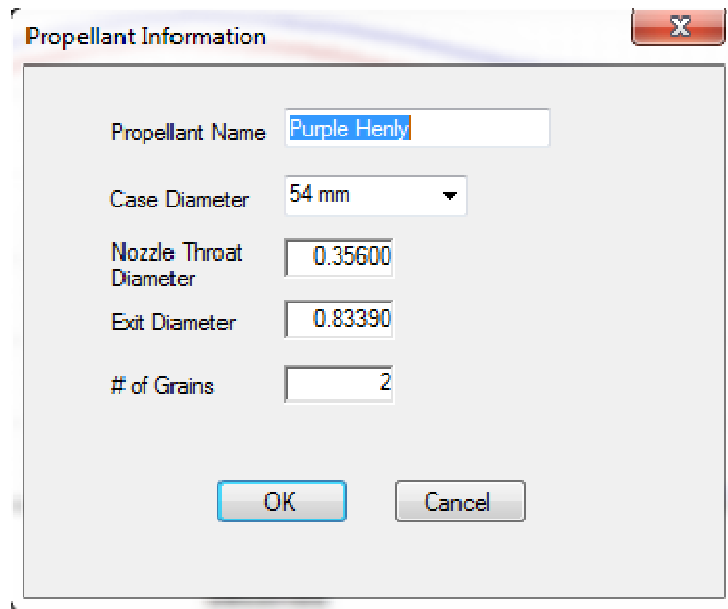
To confirm calibration you can apply arbitrary pressures on the pressure transducer. The Pressure bar at the left of the screen should display that pressure. See the document *CONFIRMING CALIBRATIONS*.

TEST FIRING A MOTOR

If the Motor is to be used for Propellant Characterization and a Pressure Transducer is connected make sure the "*Log Pressure Readings*" check box if checked above the *Start Recoding* Button. Flight motor will not need this so uncheck the box.

Place the motor on the test stand and connect the igniter to your own "launch" controller.

Press the large "*Start Recording*" button, lower right corner below the Thrust & Pressure Bars: it will then become an "*Abort*" button. This will then bring up a window requesting information about this Propellant run.

Whether firing a Test Motor or a Flight Motor you should fill out the requested data fields. This data is optional but will be very useful later when characterizing the propellant. Once you click OK this window will close and the logger will start collecting data. You will see the Red and Blue chart lines searching along the Time Line looking for data. In the case of Flight Motors only the Red line will be seen.

Fire the motor via your ignition system.

Collection has begun.

NOTE: *If the need arises to abort the test, due to misfire, CATO or other anomaly, hit the "Abort" button. Data collection ceases and the Abort Button reverts back to the Start Recording Button.*

When you are ready to restart the same motor (like after replacing an igniter) press the Start Recording Button again. The same window will pop up only this time it is populated with the information you previously entered. Press OK and you are recording again and looking for data.

With a successful firing, after the motor has finished burning, hit the "*Stop Recording*" button. The chart is automatically adjusted for fuel consumption, case weight and the curve is analyzed to find the Max Thrust and Pressure, Avg. Thrust and Pressure, the Burn time, Total Impulse and Motor Classification. These values will be displayed in the Results Area of the screen. This analysis is based on the standard Motor Characterization, not to be confused with Propellant Characterization.

Save the updated data where you normally save your data by going to File/Save. Give the file a unique name to describe what it is. This name will appear on the chart under Thrust Curve (Purple Henly #1 shown on the example)

To fire and collect data on additional motors simply reload the test stand with another motor. Place and connect the igniter and hit the big "*Start Recording*" button on the computer screen, enter applicable information, click *OK* and fire the motor with your ignition system. If you have not already saved the previous motor data the program will remind you to save the data before proceeding.

PROCESSING

Turn the TC LOGGER USB Program on, even without the Interface Box being connected. Select File/Open and load a desired file previously saved.

On screen the thrust curve and data will appear. The motor thrust curve is in Red; the pressure curve will be in Blue.
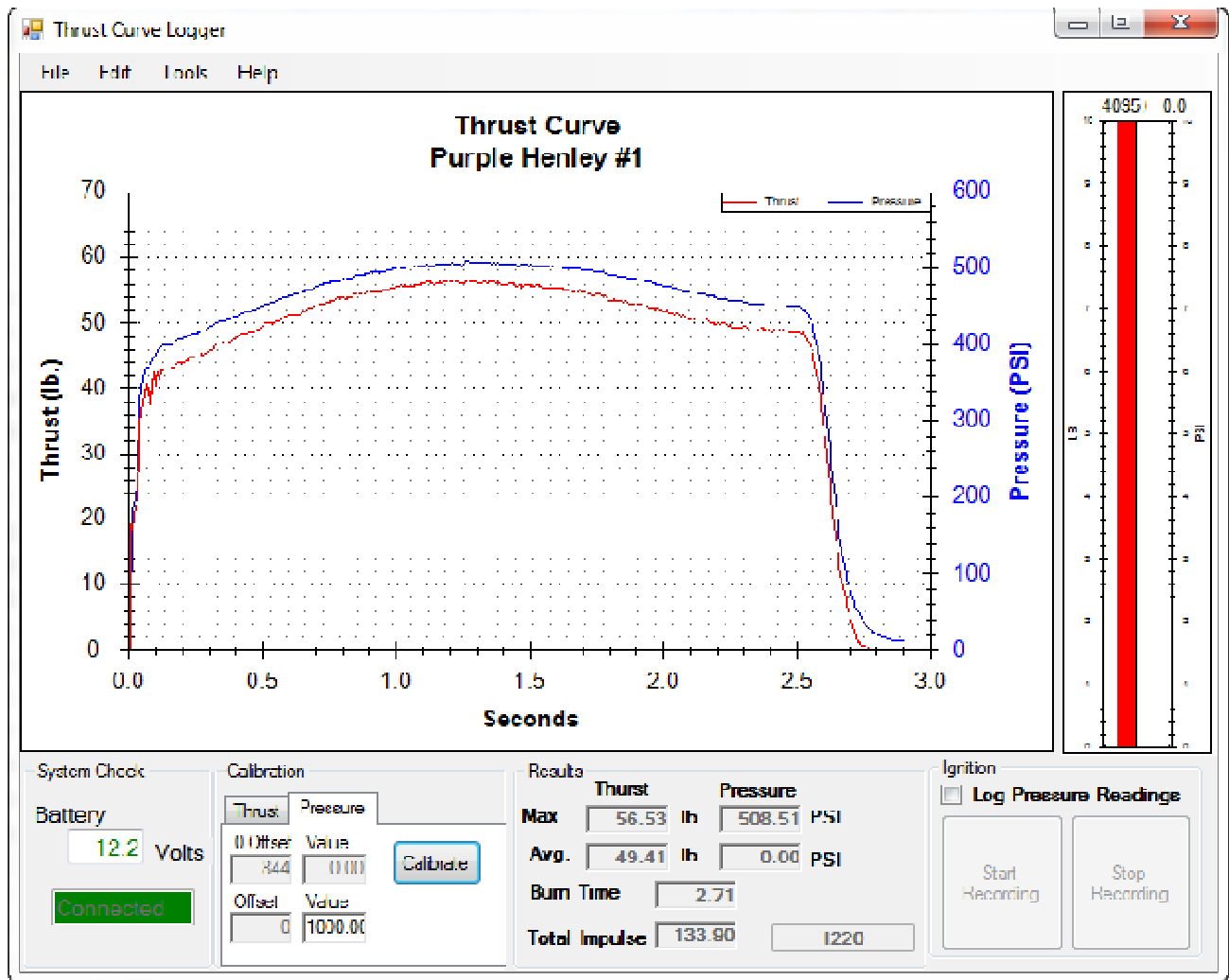
Options.

Under the Tools/Options menu you can select either Pounds or Newtons as the thrust units. Only the thrust curve and the results are affected by this option. The Calibration and the bar graph at the bottom of the screen will always display in pounds.

Under the Edit menu is the Revise Propellant Info. This will bring up the Propellant information screen and allow changes to be made.
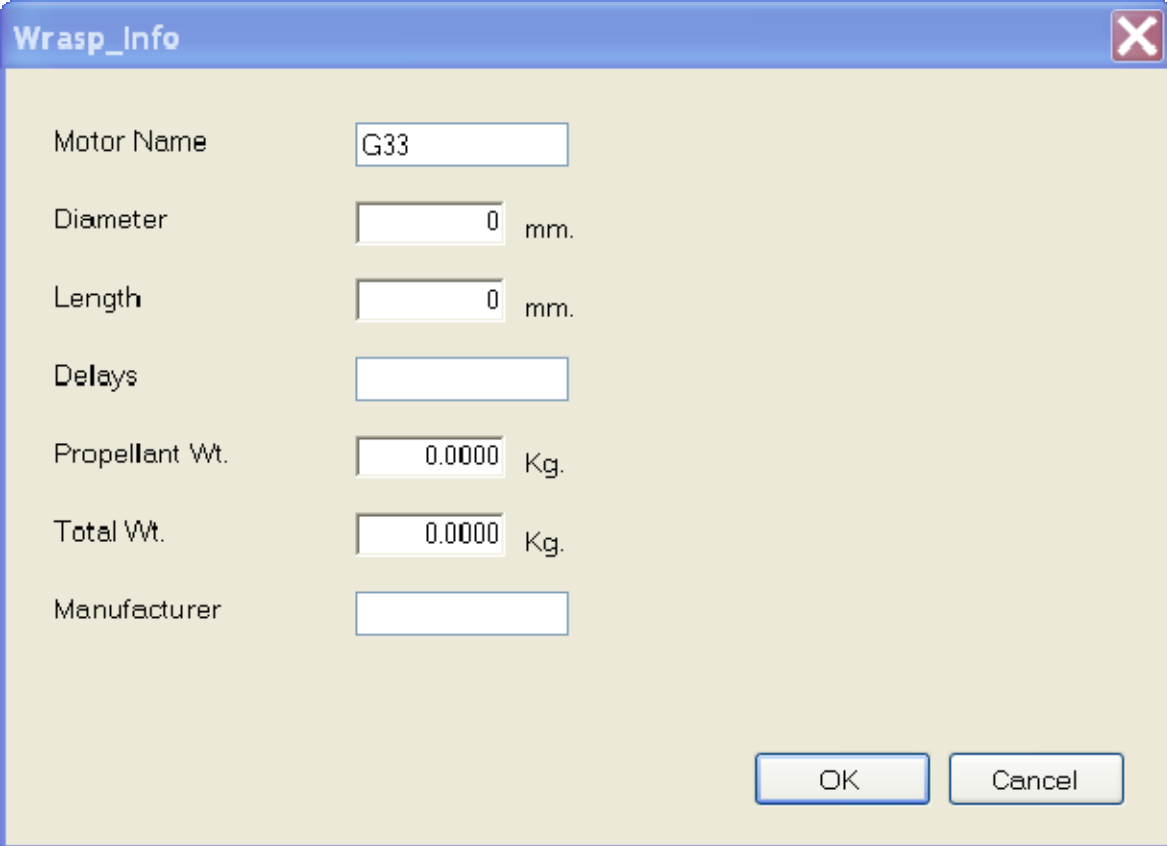
The "*Log Pressure Readings*" check box if checked allows the pressure readings to be recorded which would be required for research motor characterization. Unchecked any pressure readings would be ignored and not recorded which would be typical of commercial motors or research motors where you do not have a pressure sensor on the motor case.

CREATING A WRASP.ENG FILE

To create a Wrasp eng file from a motor burn, open the file for the desired motor. Under the Tool menu Click on the Create Wrasp File option. If this is the first time this file has been used to create a Wrasp file 3 points will be created, one at the beginning of the burn, one at the Max Thrust and one at the end of the burn. If you have previously created a Wrasp file, the previously defined points

will be shown. To add a point, move the mouse to the point on the thrust curve where you want a point and click. To delete a point, hold the Ctrl button down and click on the point you wish to delete. Although some programs can handle more, the standard for Wrasp is no more than 32 points. When you have added enough points click on the "*Done Adding Points*" button at the bottom of the screen.

The Wrasp Information screen will appear to allow you to enter all the information required. All information must be filled in

Clicking OK opens a file save dialog box to request a file name and create the Wrasp file. Cancel exits the process without creating the Wrasp file.

Selected Area Analysis
To find the Average Thrust and Pressure for a selected part of the thrust curve, position the mouse at the position where you wish to start the analysis, press and hold the Shift key down and while holding the left mouse button move the mouse to where you wish to end the analysis. Release the mouse button and a Shaded Area will appear on the chart marking the selected area and 2 horizontal lines marking the Average Thrust and Pressure for the selected area. (Only 1 line if Pressure was not recorded) A check box at the bottom of the screen allows turning this display on or off.

CONNECTOR PIN OUTS

When purchasing the BASIC TC LOGGER USB Three connectors are provided. The first is to connect your own Trickle Battery Charger to charge the Internal Battery. It is simple and straight forward
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The additional 3 Pin & 4 Pin are wired as shown here.
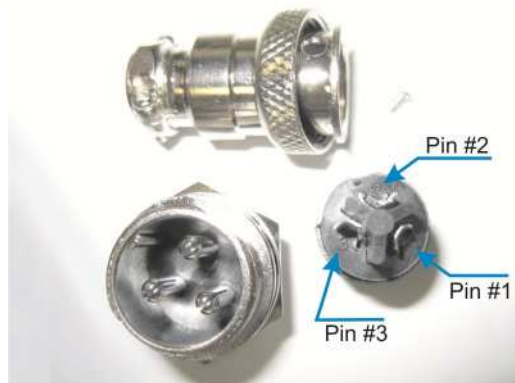
The Load Cell Connector has four(4) Pins as shown in the photo.

        Pin # 1   +10 Volts
        Pin # 2   Gnd.
        Pin # 3   + Signal
        Pin # 4   - Signal
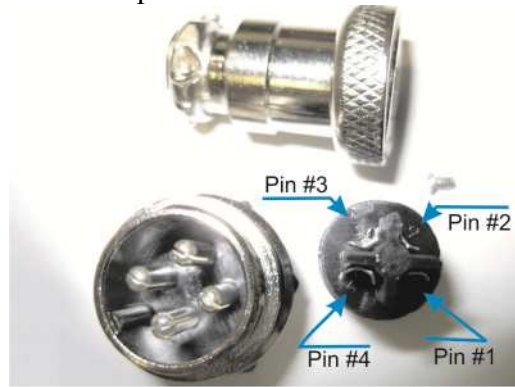
The Pressure Transducer has three(3) Pins as shown in the photo.

        Pin # 1   +10 Volts
        Pin # 2   Gnd
        Pin # 3   Signal
        (0-5 or 1-5 volt output)

Virtually all Load Cells and Pressure Transducer will be the same as far as wiring is concerned.