

MSMA Lateral Loading Device

By

Matthew Batten, Cody Burbank, Thaddeus Grudniewski,
Jonathan McCurdy, and Joy Weber
Team 10

Operations Manual

Document

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Department of Mechanical Engineering
Northern Arizona University
Flagstaff, AZ 86011

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1.0 List of Parts and Tools

1.1 Exploded View Diagram

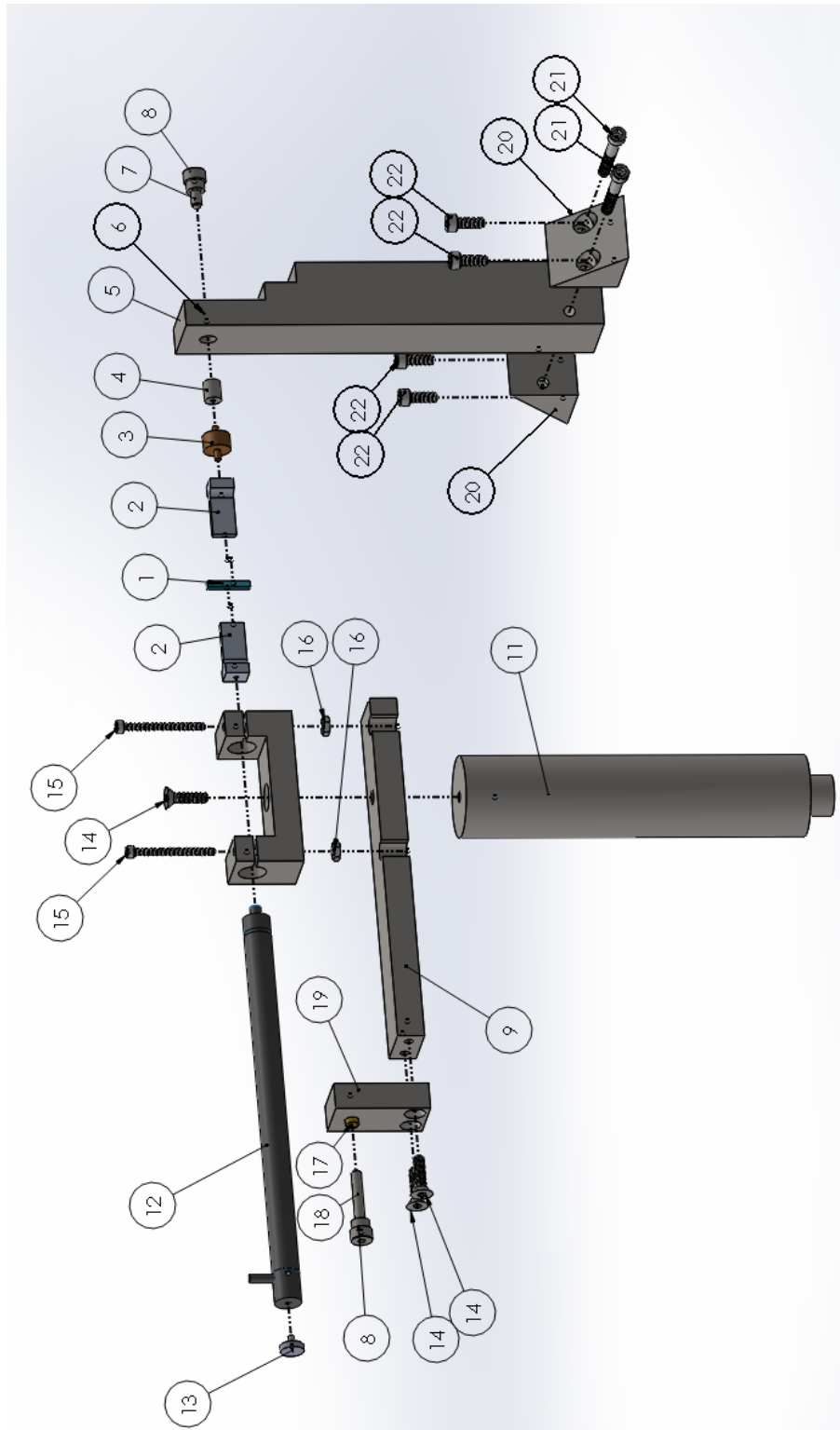


Figure 1.1: Exploded View of Testing Assembly

1.2 Parts List and Nomenclature

Item No.	Nomenclature
1	MSMA Sample
2	Microtip
3	Force Sensor
4	Sensor Slip Cylinder
5	Sensor Tower
6	Screw Bushing (Short)
7	Fine Adjustment Screw (Short)
8	Thumb Knob
9	Actuator Stop Bottom
10	Actuator Mount
11	Actuator Tower
12	Actuator
13	Actuator Tip
14	Countersink Screw
15	Socket Head Cap Screw
16	Nut
17	Screw Bushing (Long)
18	Fine Adjustment Screw (Long)
19	Actuator Stop Back
20	Bracket
21	Socket Head Cap Screw
22	Socket Head Cap Screw

2.0 Assembly

The assembly is broken down into steps and their corresponding pictures below.

Step 1: Bolt down the aluminum base plate that the magnetic dipoles are attached to so as to prevent rotation.

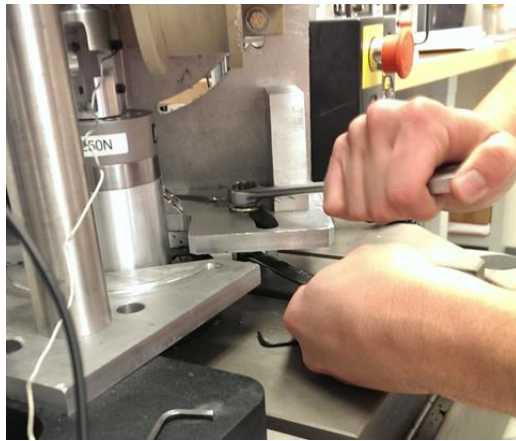


Figure 2.1: Base Plate Tightening

Step 2: Install the triangular bracket with through holes towards the front side of the Instron. Do not tighten the screws all of the way.

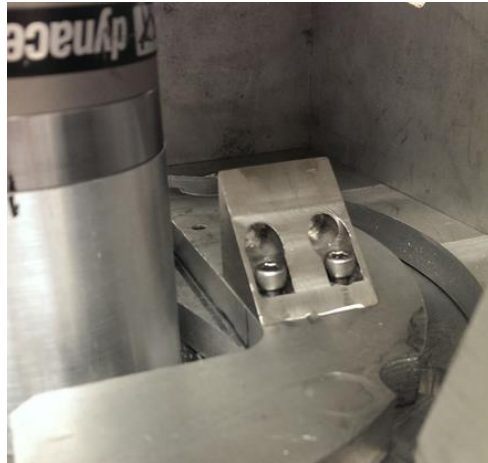


Figure 2.2: Triangular Bracket Installation (I)

Step 3: Install other triangular bracket with tapped holes near back side of Instron. Do not tighten screws all of the way.



Figure 2.3: Triangular Bracket Installation (II)

Step 4: Without the MSMA sample in place, slide the sensor tower down from above the magnetic dipoles and place in between triangular brackets. Ensure that the fine adjustment thumb screw is on the opposite side of tower as the MSMA sample. Tighten down the two screws which run horizontally through the triangular brackets and sensor tower.

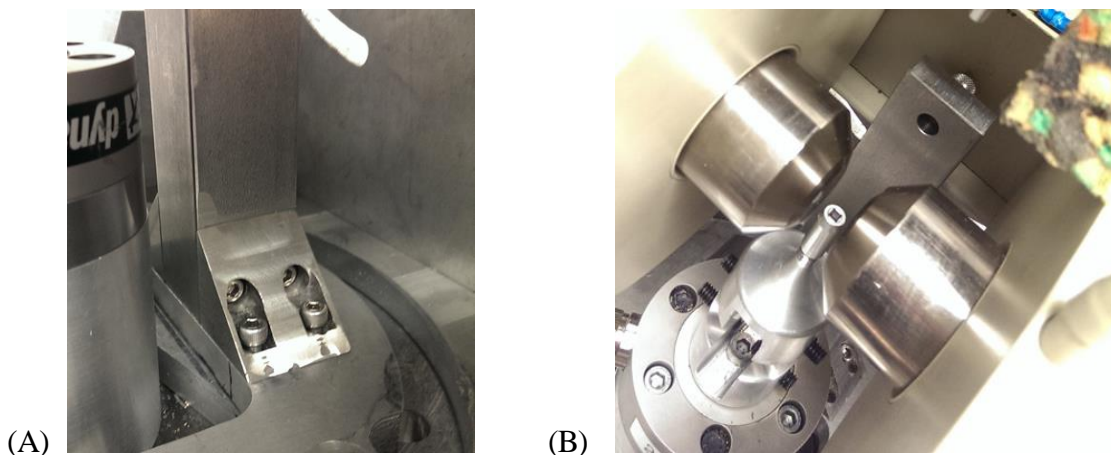


Figure 2.4: (A) Force Sensor Tower Installation View I, (B) View II

Step 5: Install the microtip, force sensor, and slip cylinder assembly in the sensor tower. This should slide directly into the front end hole opposite the thumb screw.

Step 6: Slide the sensor tower left or right, until the sensor microtip is aligned correctly. Tighten down the 4 screws which mount the triangular brackets to the aluminum base plate.



Figure 2.5: Lining Up of Micro Tip and MSMA

Step 7: Install MSMA sample in the Instron machine as per usual.

Step 8: Install the cylindrical actuator tower to the aluminum base plate by screwing it into the provided tapped hole. Tighten down with channel-locks or other appropriate tool.

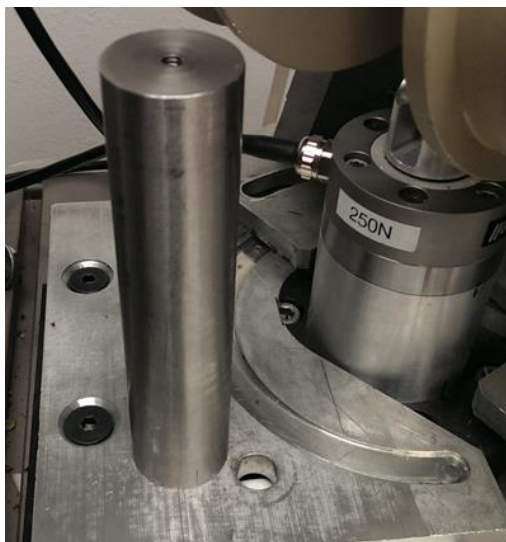
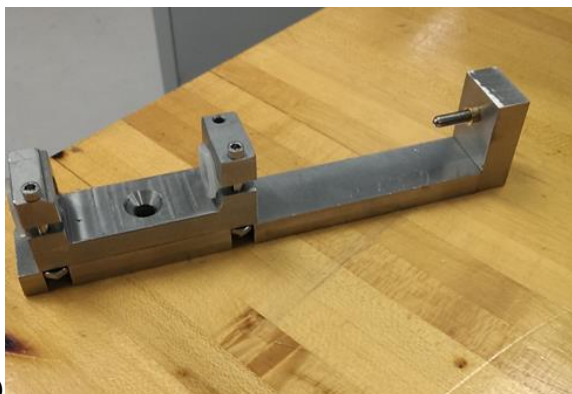


Figure 2.6: Installation of Actuator Tower

Step 9: Combine the actuator mount as seen below, install on the top of the cylindrical tower, leaving the back plate with the adjustable thumb screw in the down position.



(A)



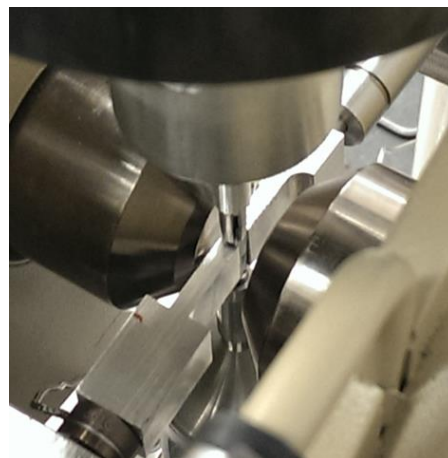
(B)

Figure 2.7: (A) Actuator Mount Assembly (B) Actuator Tower and Mount Assembly

Step 10: Slide the actuator into the actuator mount. Then screw the microtip onto the actuator, ensuring that the microtip aligns with the MSMA sample. Remove actuator as necessary to tighten mounting screw.



(A)



(B)

Figure 2.8: (A) Assembled Actuator Mounting System (B) Micro-Tip and MSMA Contact

Step 11: Rotate back plate into up position and tighten screws.



Figure 2.9: Actuator Mount with Thumbscrew Installed

Step 12: Use thumb screw to adjust actuator until the microtip just meets up with the MSMA sample, and loosely tighten the two screws located on top of the actuator mount allowing slight movement in the lateral direction.

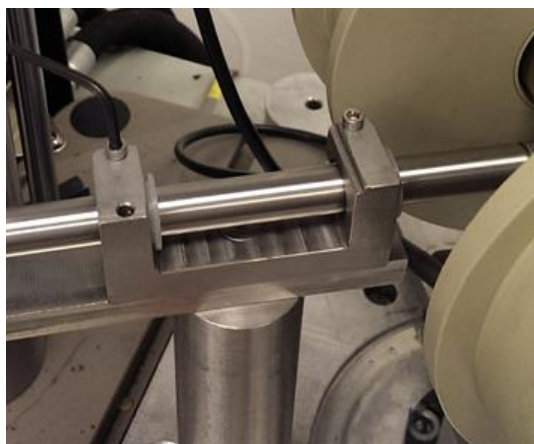


Figure 2.10: Tightening of the Actuator Mount Set Screws

Load Cell Set-Up:

The red wire is positive excitation, and the black wire is negative. Apply 5 volts of power of excitation to the sensor using a power generator. Never apply more than 5 volts, permanent damage to the force sensor will result. The white wire is positive output, and the green wire is negative output. Hook up these output wires to channel AI4 on the provided DAQ. Hook the DAQ up to the computer via the USB cable.



Figure 2.11: Closeup of DAQ Connection

Actuator Set-Up

Failure to follow these steps in order may result in damage to the actuator and or T-cube controller.

- 1) Connect the T-cube controller to a power outlet.



Figure 2.12: Connecting to the Power Source

- 2) Connect the T-cube controller to the computer.



Figure 2.13: Connecting to the T-cube

3) Connect the actuator to the T-cube controller



Figure 2.14: Connecting the Piezoactuator

When disassembling the actuator setup, perform these steps in the opposite order, ensuring that the USB is ejected before removing.

3.0 LabView

Open the MSMAFeedbackControl LabView file, be sure to do this using a 32 bit version or the APT software will not be properly emulated in the program. Once open the program can be initiated using the run arrow in the upper left hand corner.

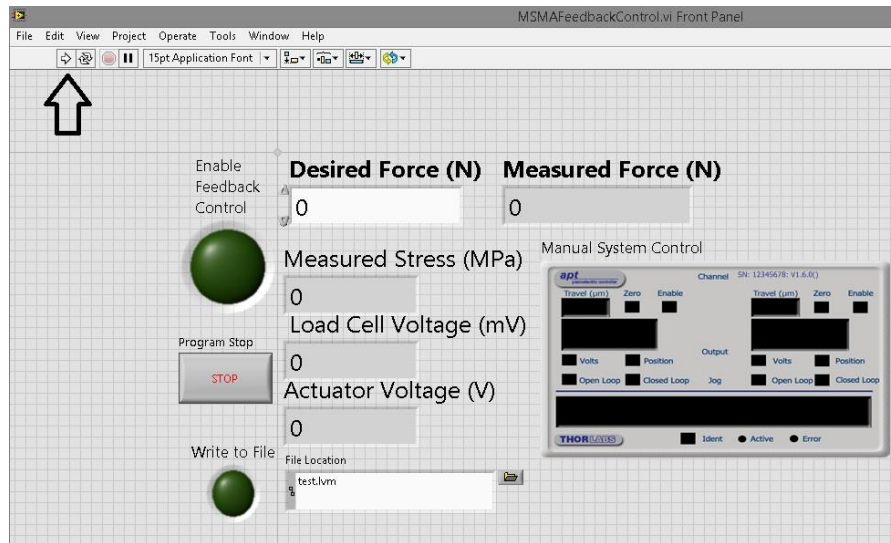


Figure 2.15: MSMA Testing Program Initiation

After the program is initiated the user will need to input the desired force.

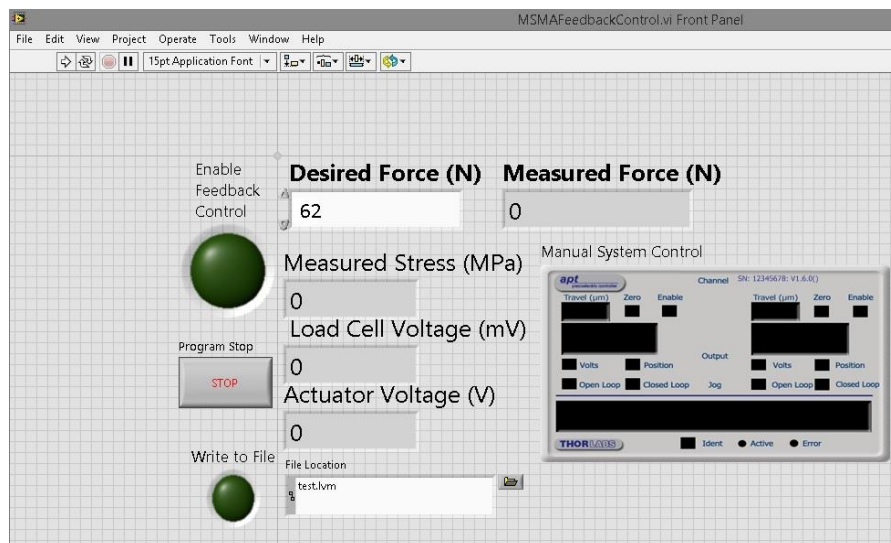


Figure 2.16: Input of Desired Force

Using the precision screw on the back end of the actuator the user will then adjust the measured force to closely match the desired force for the test. Once the forces are fairly close the user can activate the feedback control Boolean (green button) to initiate the feedback control.

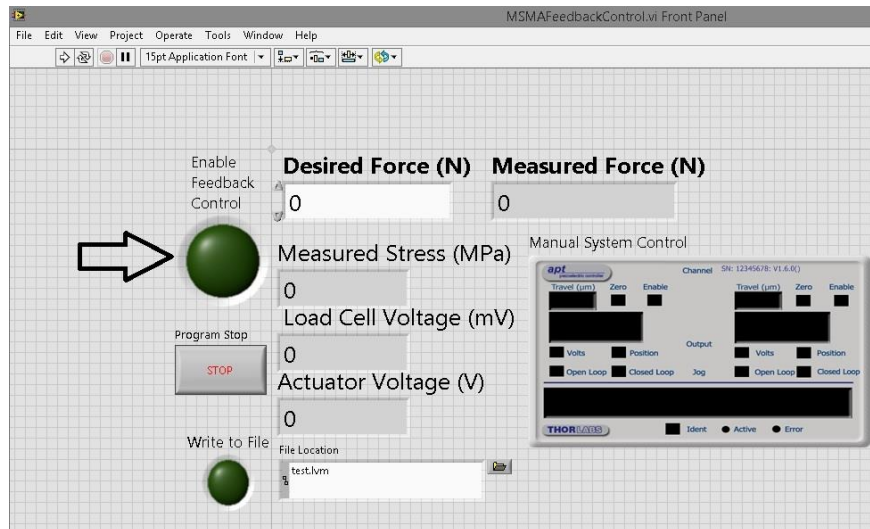


Figure 2.17: Enabling of Feedback Control Boolean

If the user would like to write the measured stress to an excel file they can identify a file location and activate the write-to-file Boolean.

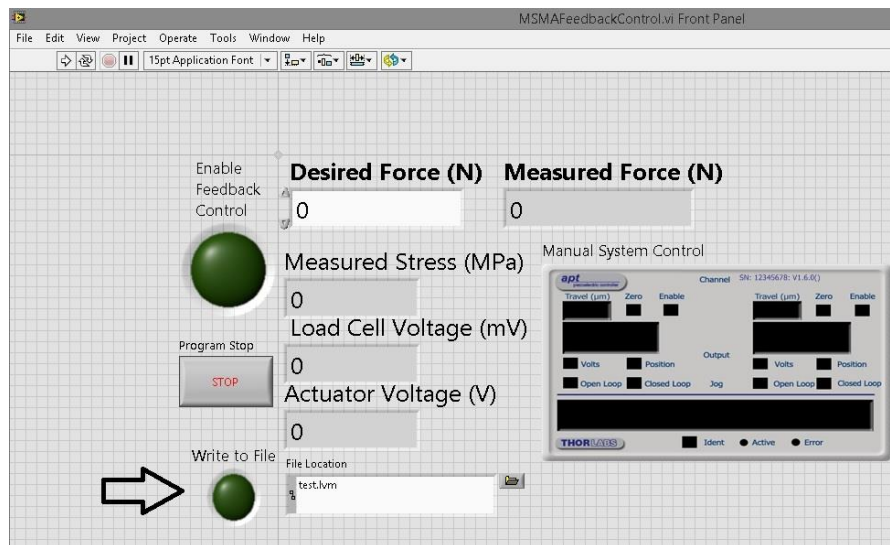


Figure 2.18: Enabling of Write to File Boolean

Once the user has completed their test they can click the Stop button and the program will end.

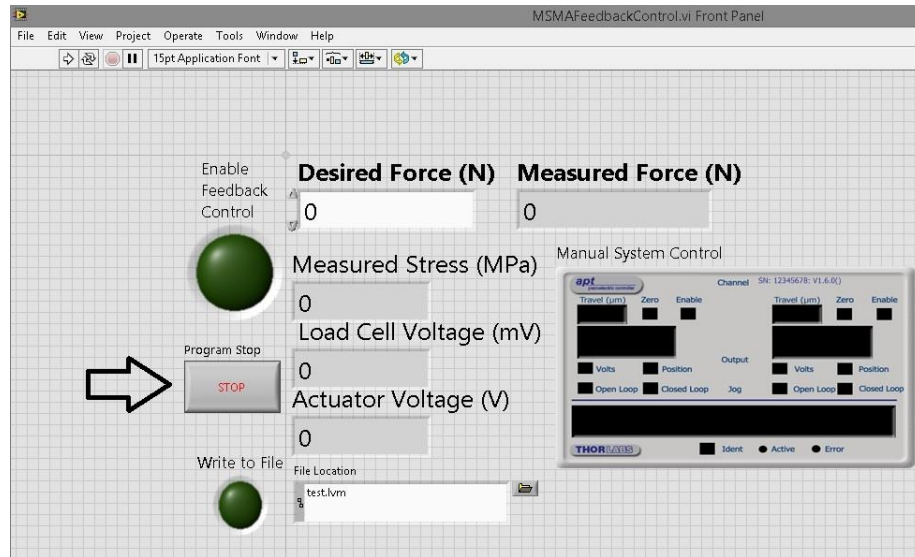


Figure 2.19: Program Stop

If the user needs to adjust the voltage applied to the actuator for any reason they can use the manual system control to set the voltage to anything between a 0-75V range. If this manual control is required, the user should ensure that the feedback is not enabled.

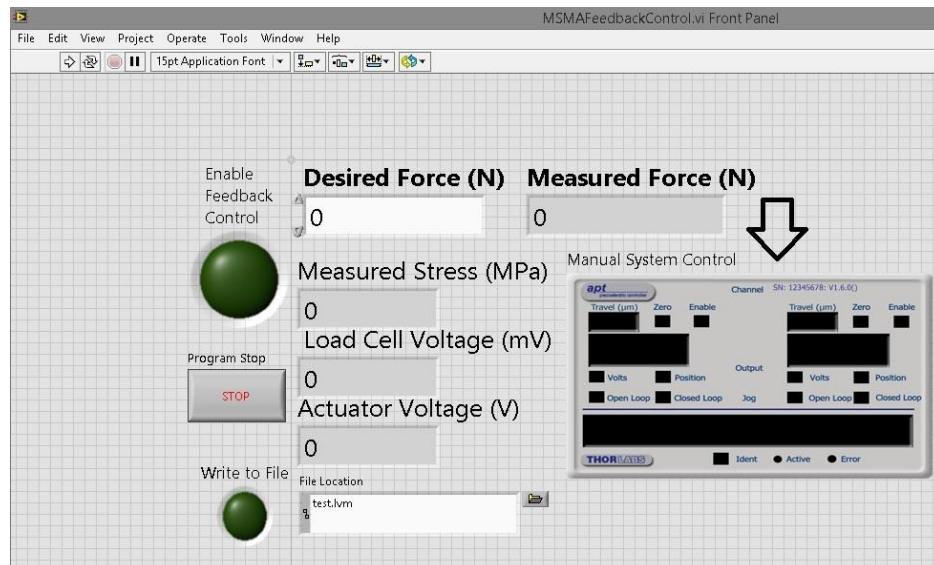


Figure 2.20: Manual System Control

4.0 Testing

As previously mentioned during testing the user will first want to assemble and power all components and then enable the LabView program. From there they will need to set the desired force on the program. Once that force is set the user will use the thumb screw to adjust the

placement of the actuator and attempt to get an output reading on the “Measured Force” as close to the “Desired Force” as possible.

Once these forces are fairly close the user can enable the feedback control, and if they would like the write to file. After that the user can initiate their normal MSMA vertical loading tests. After the test the user will need to unselect the write to file Boolean if they have initiated the recording. Then they will want to deselect the feedback control and stop the program. The program is capable of either completely correcting the change in stress or reducing the fluctuation depending on the forces applied during the normal test.