

Linear Shaker Control

Safety First

1. Stay away from the table, when the accumulators are charged even though the pump is turned off it can still move unexpectedly!
2. Make sure to start the controller (dSpace or Analog) before turning on the pump!
3. Relieve the pressure in main line before the pilot line!

Start Up

1. Check to see if the panel door of pump control box is closed, and switch is set to "ON".
2. Close all the valves.
3. Check all cables, connect laptop to dSpace controller, turn on the power of dSpace system, and start dSpace controller. If you have restarted the shaker control program, it will ask you if you want to stop RTP. Click "yes"
4. Turn on the power of pump, then, set to "High"
5. Click the checkboxes of "Setup page" as seen in figure 1.
 - "Data Acquisition Online"
 - "Pump Switched On"
 - "High pressure on"
 - After accumulators are fully charged "Accumulator Charged"
 - Adjust Bias
 - "Initial Zero Executed"
 - "Zero Table"
 - "All system Ready"
 - "Reset Controller"

Now the shaker is ready to operate

Displacement control

- Make sure "Controller" in "Signal Page" is set to "Displacement Based" and "Displacement Mode" is set to "PD" as in Figure 2.

- Go to “Displacement Setting” page and select command type (“Sine wave”, “Square wave”, “Noise”, or “Recorded profile”), see figure 3.
- In case of “Noise” amplitude is controlled by command scaling (maximum amplitude) and frequency range of signals is 0-5Hz (using low pass filter)

Force (Acceleration) Control

- Set the “Controller” in “Signal Page” to “Force Based”.
- Go to Force Setting Page, adjust the balance of accelerometer. To do that, double-click the axis of upper graph in “Force Settings”, then rotate the knob of signal conditioner (Ch.1; x-axis) so that the measurement (red line) can be set to zero(or as close as possible) figure 4.
- Go back to “Signal Page” and choose proper control mode, either “LQG” or “Adaptive”. (Now the shaker is in acceleration control mode. Because the controller tries to maintain the table acceleration as given value, the table displacement can be drifting even though there was no command input. So, start the command soon once you set the zero balance)

Recorded Profile (Displacement or Acceleration control)

- Press “Load Data File” in “Signal Page”. Data file should be stored in a *.mat file and the command signal, regardless of the control mode, must be stored as variable names: data_new, ref, time. User should aware of type of input signal (whether it is displacement or acceleration input)
- Program will ask you the type of the profile (force, accel, or disp)
- A Matlab graph window will pop up showing the appropriate scale factor and initial position. Adjust initial position of the table using “Table Offset”. The movement towards the cylinder is positive (+) direction.(Maximum stroke is +/- 14”)
- If you specify that the profile is “force” based, the program will derive the acceleration by dividing the input profile by the “Table Mass” value in the “Setup Page”.

- Select the appropriate unit. Be careful about the units, the program doesn't distinguish whether it is displacement profile or acceleration profile.
- Program will display the shape of the profile but this is not scaled.
- Check "Verify Profile"
- Choose "Recorded profile" in "Displacement Based" or "Force Setting"

Data Capture

- If you want to collect the data, go to "Data Acquisition Page", then press "Start Data Capture". Answer the questions. Sampling rate should be set to a factor of 5000 and not greater than 5000. See figure 5.
- Press the "Start" button to run the profile, "profile running" and/or "data captured" marks will appear.
- It is better to end the data capture before the re-initialization (see below). Once you press the stop button, control type and mode in the header information of the output *.mat file will have default value (Displacement and PD) regardless of actual control algorithm.

Restart/Reinitialize

- After finishing a certain task, it is better to restart the controller. To do this, go to "Setup Page", press "STOP" button. This will set to controller mode to default value (displacement, PD control etc) and hold the table to current position (even in the middle of the operation). To restart, adjust bias using "Zero table" and "Bias value" if needed, then check "All system ready" and "Reset Controller".

Generate Report

- Press "Generate Report" in "Data Acquisition" page. Program will ask you something but press "no".

Finishing

- Press the "Emergency Stop" of power panel of the shaker.
- Be sure to relieve the pressure before turning off the dSpace controller

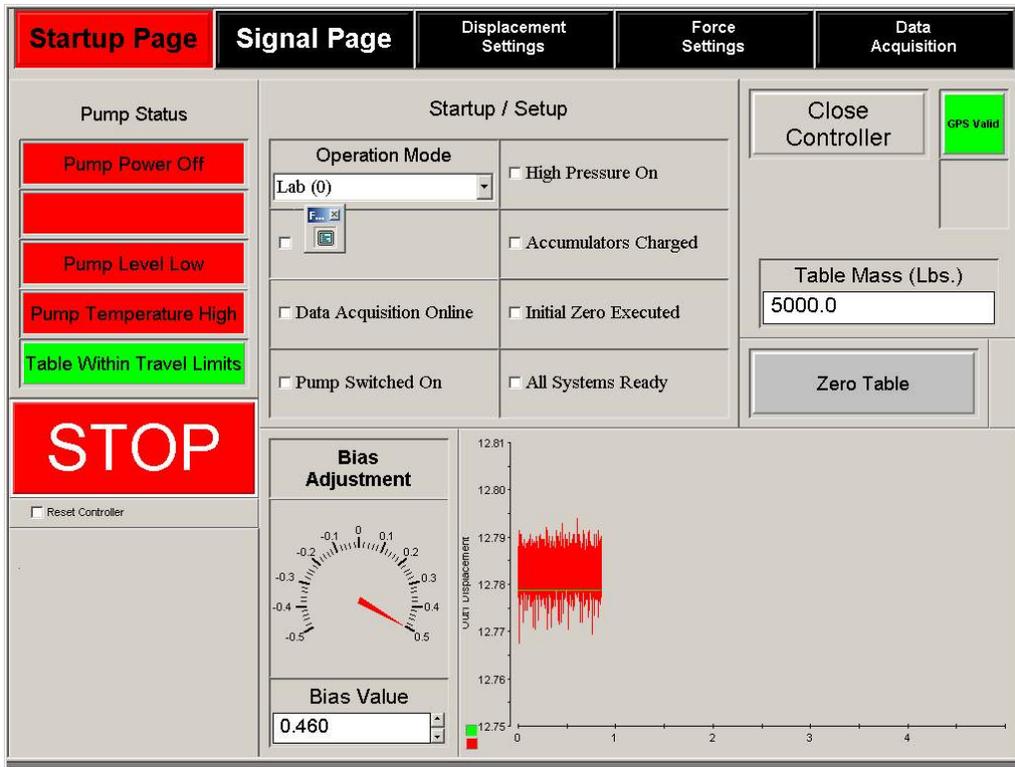


Figure 1.

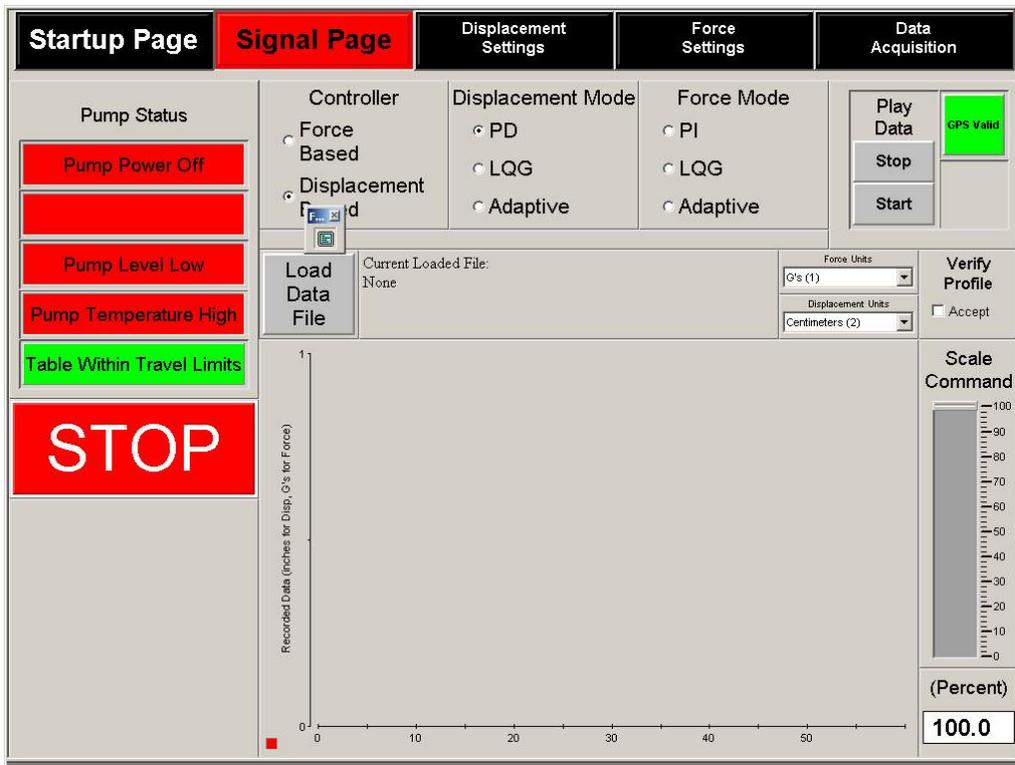


Figure 2.

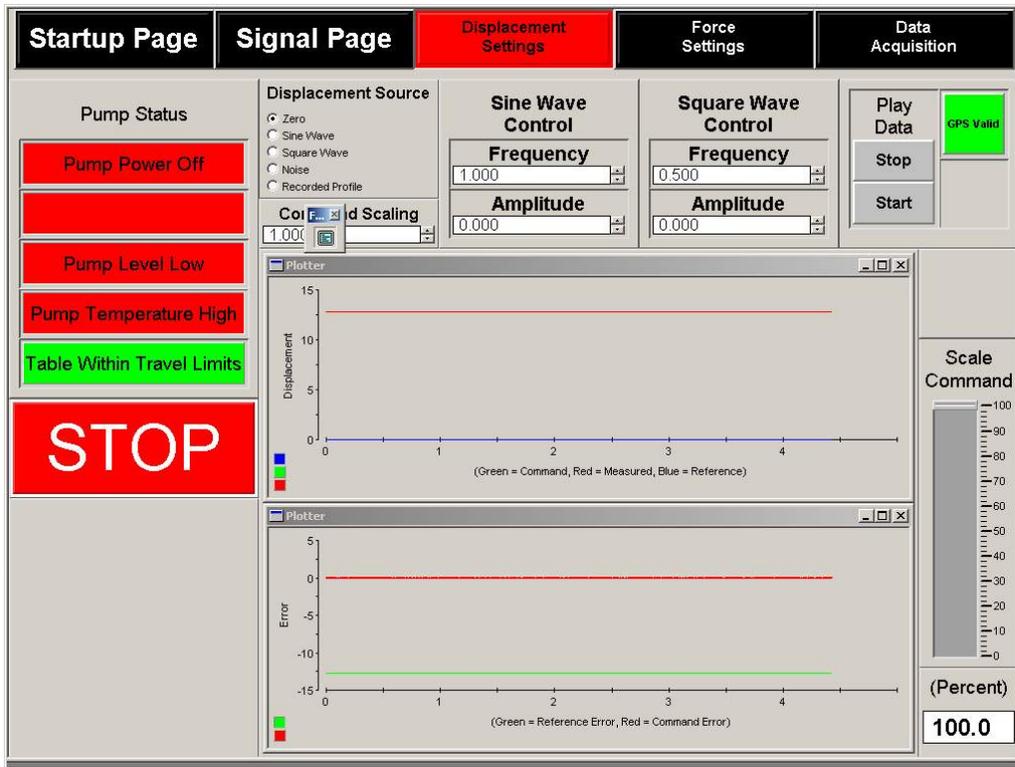


Figure 3.

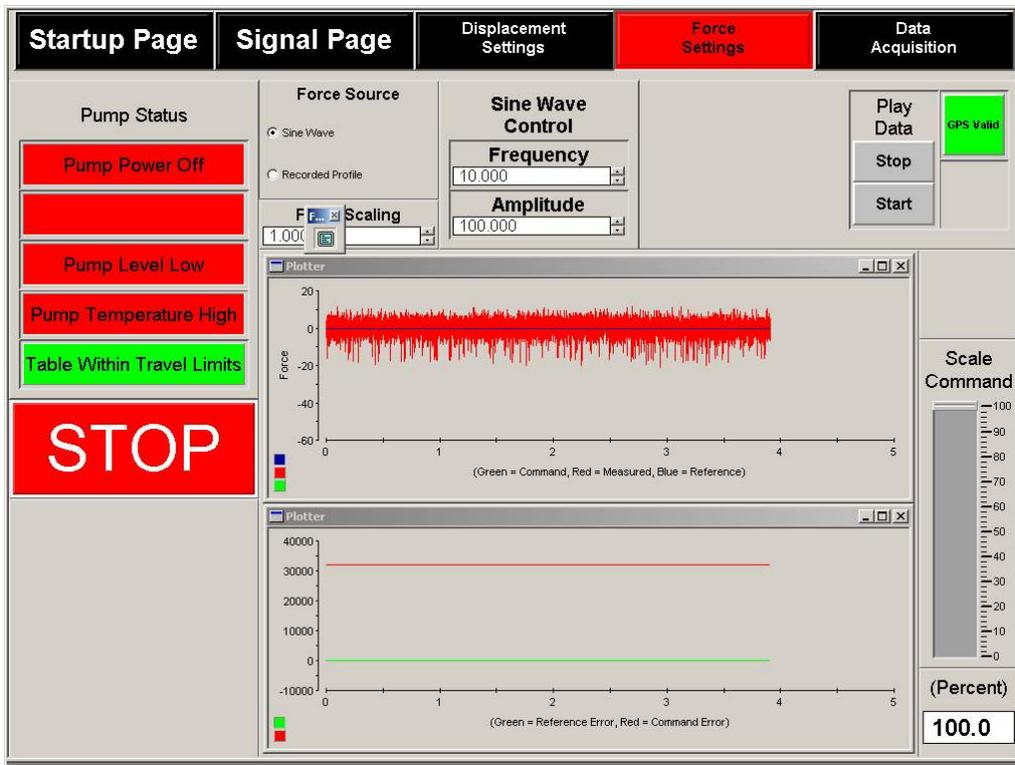


Figure 4.

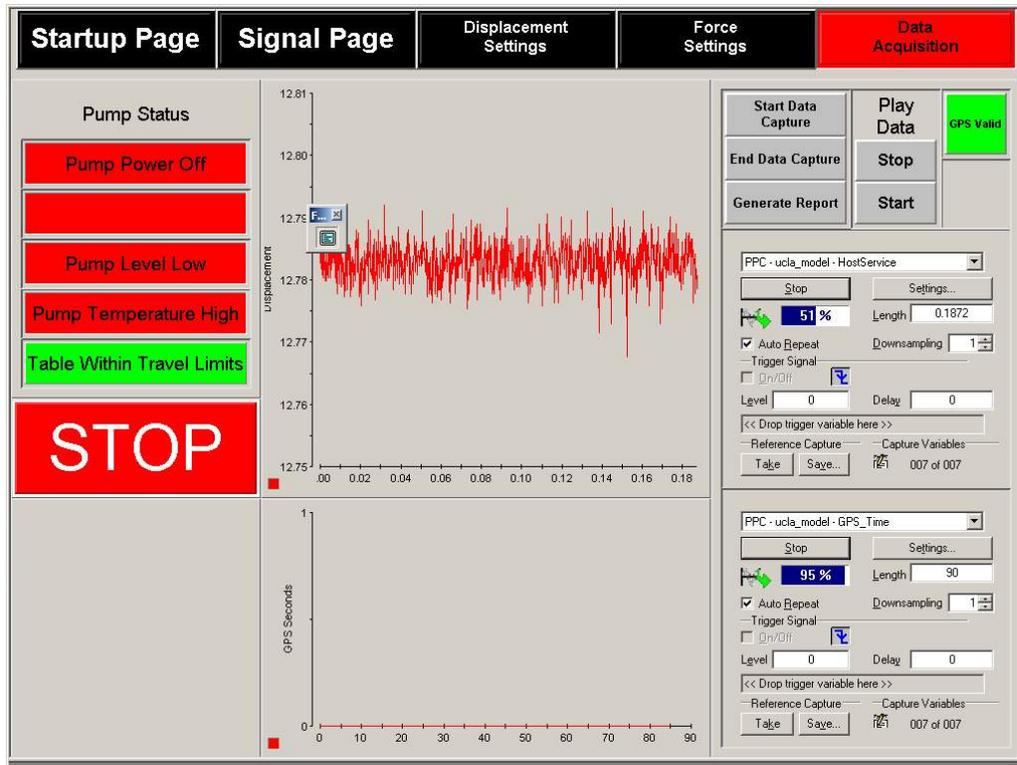


Figure 5.

System ID

1. Open "System ID" icon on desktop
2. Select "Displacement ID" or "Force ID"
3. To adjust PD gain (in case of Displacement ID),
 - Check "set PID gains", adjust values of K_p and K_d manually (default values are 0.076 and 0.0015 respectively)
 - Uncheck "set PID gains"
4. To adjust gains for LQG control
 - Press "set ID Level"
 - Increase ID level about 2
 - Press "Start System ID". The program will collect the data for 20 seconds.
 - "Shut down the pump" pop-up window will appear the shut down the shaker.