

**Customers should consult with Mad City Labs technical support before using this software.**

Mad City Labs technical support is available via email ([mclgen@madcitylabs.com](mailto:mclgen@madcitylabs.com)) and phone (+1 608 298-0855, 8:30am – 5:00pm CST). International customers may also consult with their local authorized dealer of Mad City Labs products. Visit <http://www.madcitylabs.com/international.html> for our list of authorized dealers.

### Purpose

The “Mad City Labs Nano-Drive® Diagnostic Tool” is an application for customer use to efficiently gather the diagnostic information on Mad City Labs nanopositioning systems equipped with USB 2.0 digital interface. The software collects information on HV/10 offset errors, response to a sine wave command, and USB/Firmware information.

### Requirements

Mad City Labs Nano-Drive® controller with USB interface

Mad City Labs software drivers must be installed on the user PC

LabVIEW 2009 standard Run Time Engine (RTE) must be installed on the user PC. The LabVIEW RTE was included on the original installation disk. The RTE is also available from the National Instruments website at no cost.

Digital voltmeter with BNC cable.

### Procedure

Before running the software, please perform the following steps.

- Return the nanopositioning stage to the zero displacement position, if possible.
- Disconnect all BNC connections to the Nano-Drive® controller.
- Disconnect all USB connections to the Nano-Drive® controller.
- Remove the nanopositioner from your instrumentation setup and place on a vibration isolation table to ensure nothing can interfere with stage motion.
- Remove all mass loads such as sample holders, objective lenses etc.
- Power off the Nano-Drive® controller. Wait 15 seconds then turn the controller on.
- Connect the USB cable to the USB port .
- Connect the voltmeter to the HV/10 output BNC on the front panel of the Nano-Drive® controller. Ensure that you are connected to the axis you wish to test. You are now ready to run the diagnostic software.

Run the “MCL Diagnostics.exe” program supplied on the installation disk. The application is designed to collect data in the correct sequence and as such some fields will be inaccessible until the previous step is completed.

The application opens to the screen as shown in figure 1. Note that two tests are available, position test and sine wave response.

### Position Test

Successful communication with the Nano-Drive® will result in device information being displayed in the white box in step 1 (Initialize a Device).

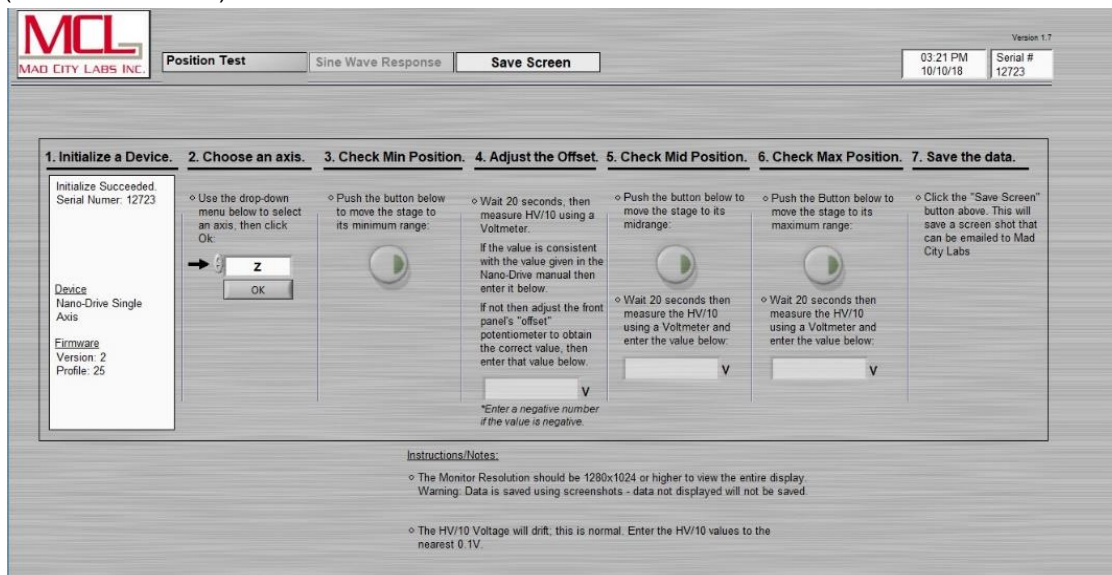


Figure 1: Successful communication with the Mad City Labs' Nano-Drive® controller.

If the application failed to connect to a Nano-Drive®, then a flashing black arrow will point to a description of the problem (see figure 2 below). Confirm the system is properly connected via a working USB cable and the Mad City Labs drivers are properly installed. You *must* close and reopen the MCL Diagnostics application after fixing the issue.

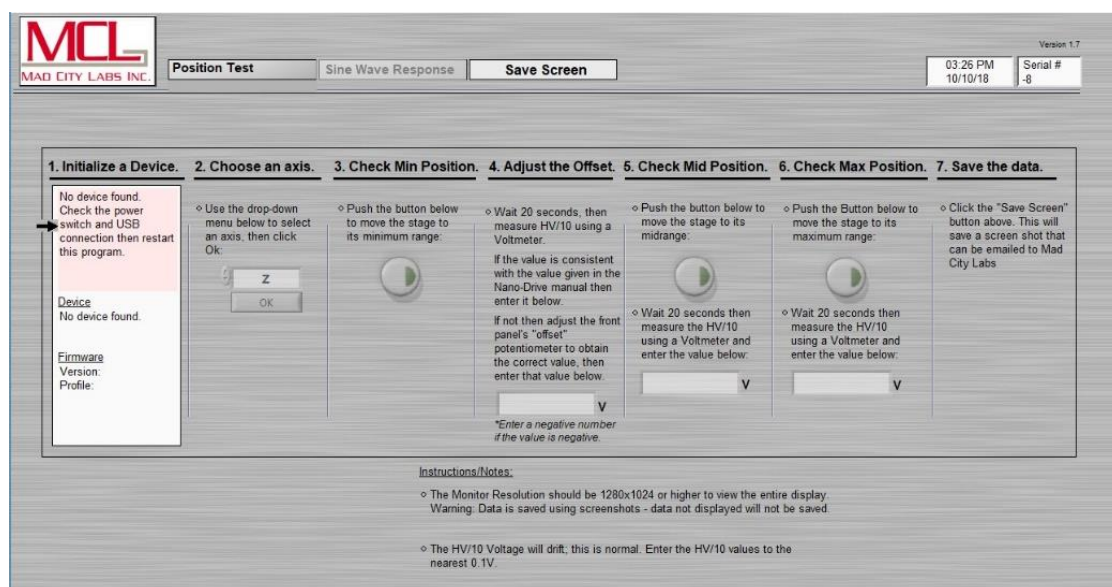


Figure 2: Unsuccessful communication with the Nano-Drive controller. Note that the problem is highlighted in step 1 of the application.

Once successful communication is established a flashing black arrow will prompt the user to select an axis to test in step 2 (Choose an axis). If you wish to check additional axes of the device you will need to close and then reopen the application at the conclusion of each test.

After choosing an axis, you are prompted to left-click the button in step 3. This step commands the selected axis of the nanopositioner to the zero displacement position.

With the system at its zero position, proceed to step 4 of the diagnostic program. You are now prompted to wait 20 seconds and then measure the HV/10 output using a voltmeter. The measured value should fall within the range specified in the Nano-Drive® manual. (A PDF of both the nanopositioning stage and Nano-Drive® controller manual is installed automatically with the software drivers.). If the value measured does not fall within the required range, please adjust the front panel offset potentiometer using the supplied screwdriver until the HV/10 output voltage is within the desired range. The procedure for this adjustment is available in the Nano-Drive® manual. Please note that offset adjustment is only performed at the zero displacement position.

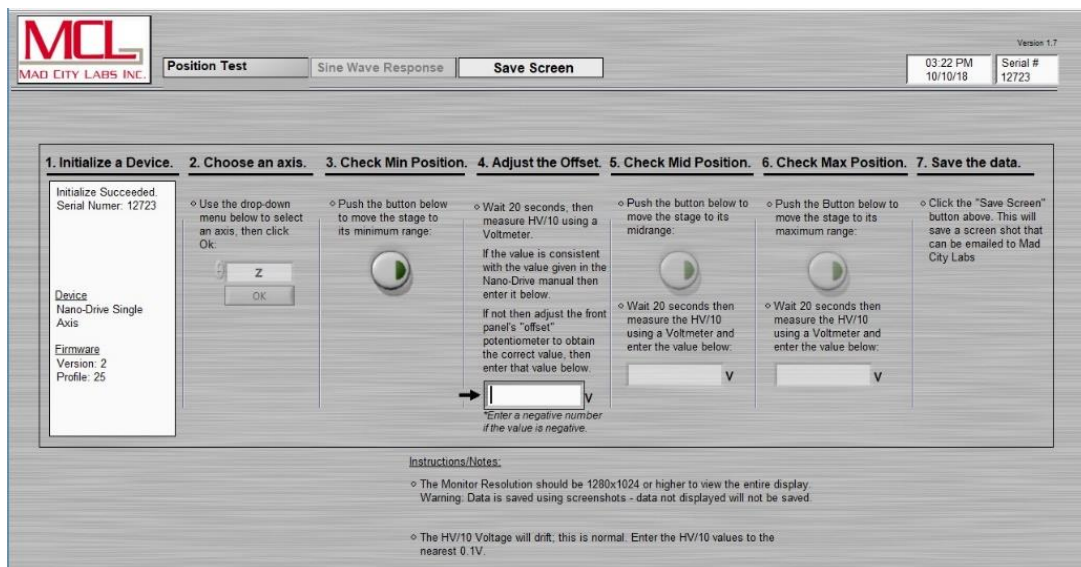


Figure 3: Screen shot of step 4 in the diagnostic procedure. The HV/10 value must be entered into the white box.

After any adjustments, enter the HV/10 value (to the nearest 0.1V value) into the field shown in step 4.

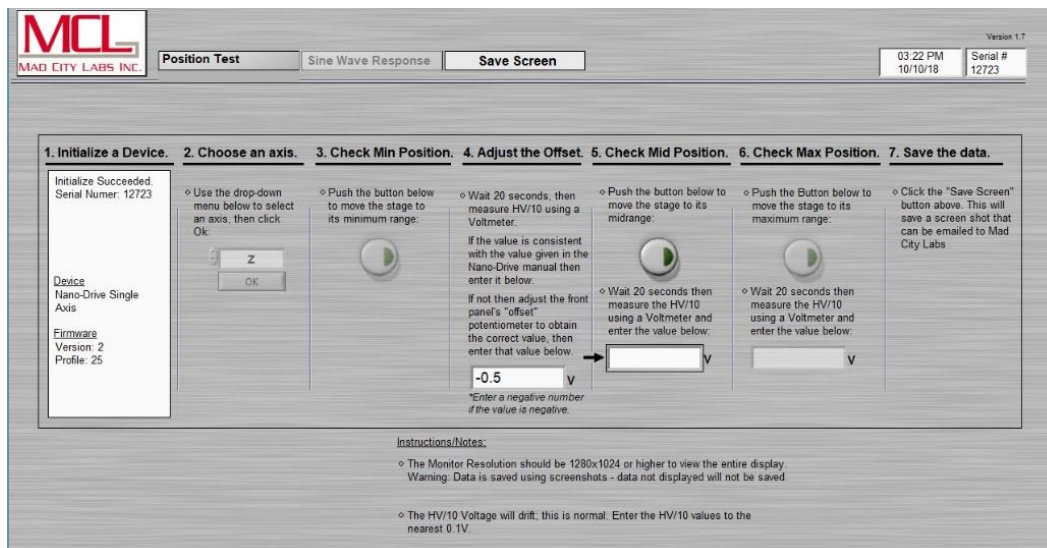


Figure 4: After the HV/10 value has been entered for step 4 the user is prompted to move the stage to the midpoint of displacement.

Continue as prompted to move the stage to the middle position of the stage (step 5). Ensure that you wait 20 seconds after clicking the command button before entering the HV/10 voltage value. Repeat the procedure for step 6 which moves the stage to the maximum displacement position. Finally, left-click the “Save Screen” button, seen in the top-right of the image below.

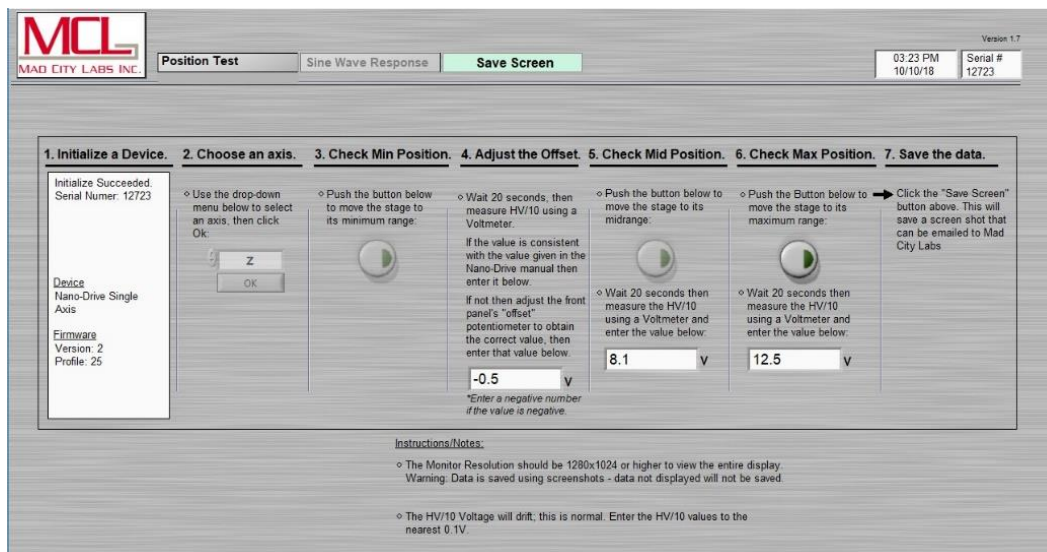
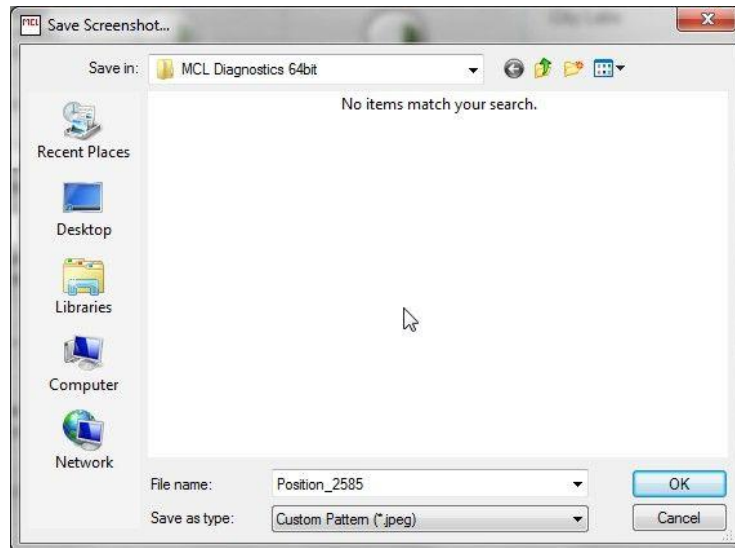


Figure 5: Diagnostic completed with the Save Screen button highlighted to save the data.

After clicking “Save Screen”, a file dialog opens to choose a name and location for a screen shot of the application. The screen shot is saved in JPG format.



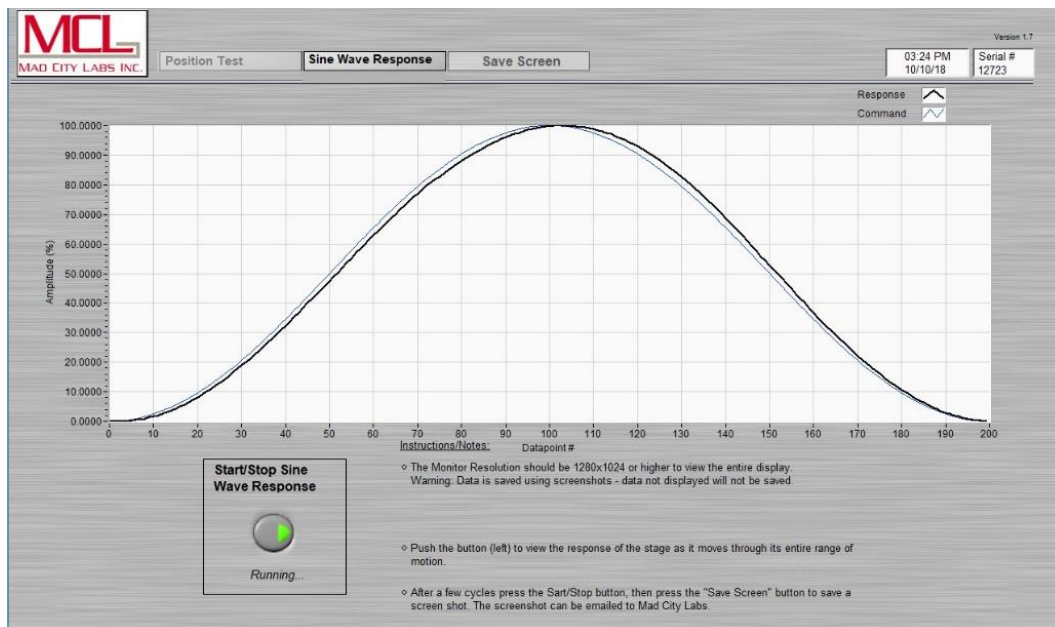
*Figure 6: Screen shot of the diagnostic is saved as a JPG file. User may select a filename. We recommend using a combination of the serial number and the tested axis for identification purposes.*

This process can be repeated for multiple axes of the device. The application must be closed and then reopened to repeat this test on a different axis. If you wish to test the sine wave response of the selected axis you should proceed to the Sine Wave Response test before closing and reopening the application.



### Sine Wave Response

The Sine Wave Response test is a secondary method of checking the response and travel range of the nanopositioning system. As such, the sine wave response button is not active until the position test has been completed. If the sine wave response button remains disabled please check that you have completed all steps of the position test.



*Figure 7: Sine Wave Response screen shot.*

- Click the “Sine Wave Response” button located at the top of the application to access the Sine Wave Response tab.
- Click the “Start/Stop Sine Wave Response” button located below the graph to begin continuously moving the axis with a sine wave input. The graph will update and auto-scale periodically. It is not possible to configure the command waveform. The axis will be commanded through its entire range of motion at approximately 0.5 Hertz.
- Click the “Start/Stop Sine Wave Response” button again to stop commanding the waveform. The graph will show the most recent completed period.
- Left-click the “Save Screen” button to save a screenshot in JPG format.

The resulting screen shots of both the position and sine wave response test can now be emailed to your Mad City Labs technical support person for analysis and evaluation.