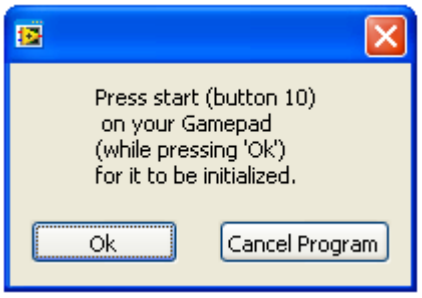
Application Note: Gamepad MicroDrive Control with limits.

The “Gamepad MicroDrive Control with limits” program is used to control a single, USB-enabled Mad City Labs Micro-Drive™ using a gamepad plugged into the computer. This program was created using the National Instruments LabVIEW 2009 development environment.

Use the VI to control a MicroDrive.

This program is used to control a single USB-enabled Mad City Labs Micro-Drive™ using a gamepad plugged into the computer. Other features of this program include: the ability to configure the Gamepad's control sticks and buttons, the ability to setup software limits, the ability to record and return to positions, and M1/M2/M3 encoder readouts.

Once opened the program attempts to grab exclusive control of the Micro-Drive™ and Gamepad, therefore, it will be necessary to close all other programs that use either the Micro-Drive™ or the Gamepad. The window depicted below appears at the beginning of the program, each time the program is opened.

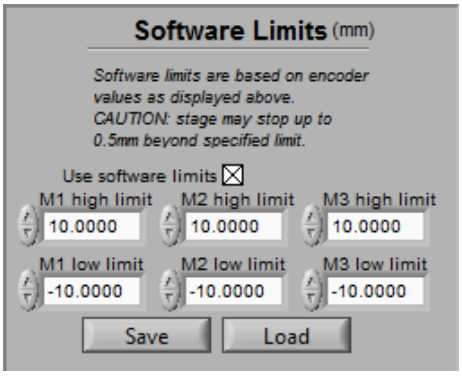


Initialize the Gamepad.

When you see the window shown at left, press and hold button number 10 on your gamepad, then press the “Ok” button to initialize the gamepad and continue using the program. This window will reappear immediately if the gamepad cannot be initialized (see troubleshooting section).

Software Limits.

LabVIEW code has been added to this program which can compare the current Encoder reading to a specified limit, and stop the Micro-Drive™ if it is attempting to move beyond this limit. Because all calculations and resulting commands come from the executing LabVIEW program, this feature is susceptible to fluctuations in the program's processing speed, and to USB latency, and this feature will have no lasting effect after the program has ended. Unlike the “hardware” limits, which protect the Micro-Drive™ from extending beyond its range of motion, the Software Limits cannot be relied upon to work consistently.



Setup software limits.

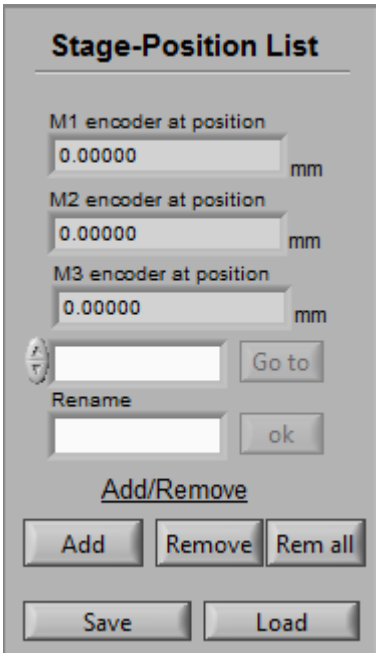
Check the “Use software limits” box to enable the program to stop the Micro-Drive™ from moving beyond the specified encoder values – the “Read encoders while moving” option must be enabled to use Software Limits.

The limit controls refer to the encoder readings displayed above. If an encoder exceeds a specified limit while the Micro-Drive™ is moving, the Micro-Drive™ is commanded to stop. Additionally, the Micro-Drive™ will not be allowed to begin moving in the direction of an exceeded limit.

Software limits will illuminate the limit LEDs of the Single Step Controls area.

Stage Position List.

Use the Stage Position List area to keep a record of encoder readings. Any of the recorded positions can be recalled and automatically returned to so long as the program remains open, the Micro-Drive™ remains on, and the encoders are not reset.



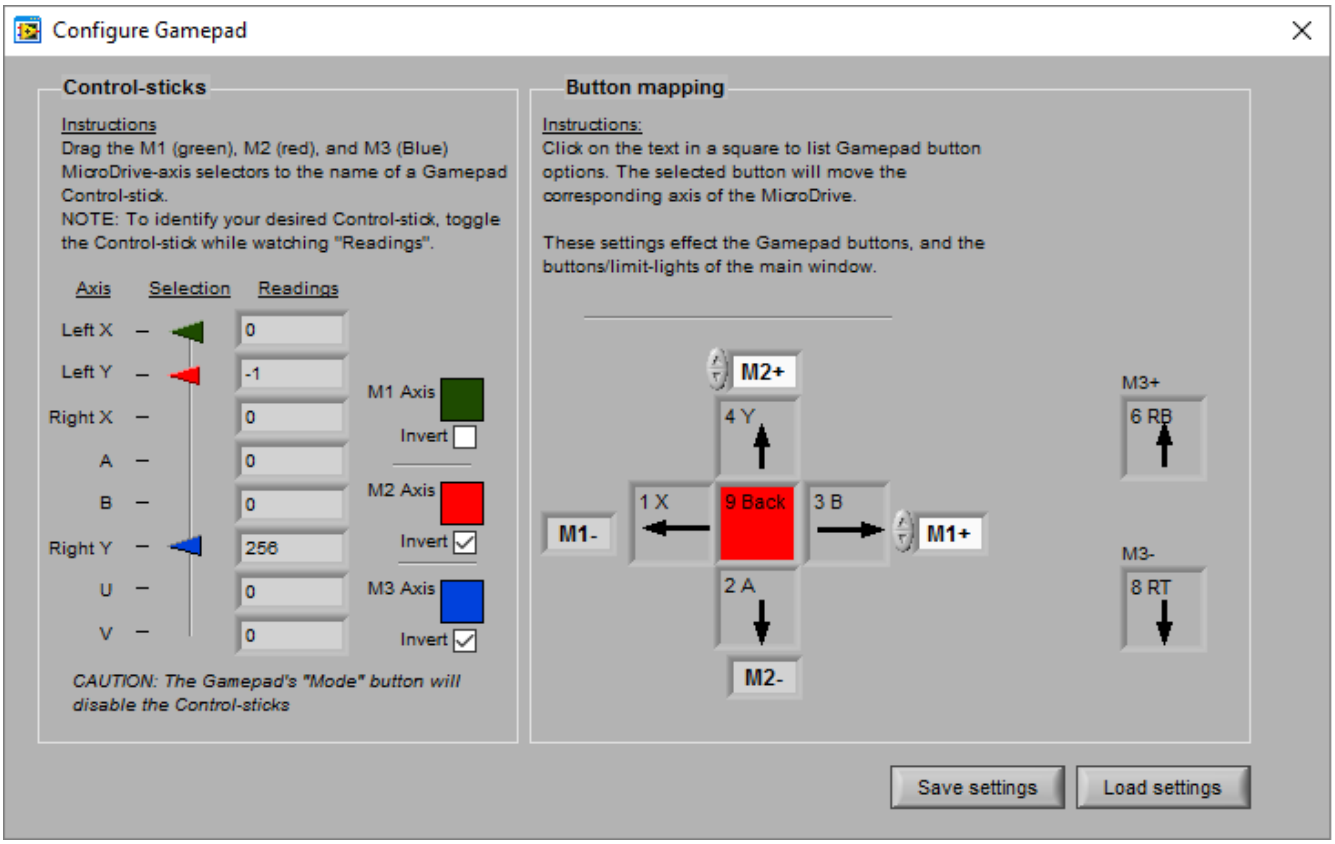
Record and return to positions.

Use the “Add” button to add the current encoder reading to the position list. Positions in the list can be named, automatically returned to, removed, or saved/loaded to/from disk.

Caution: Powering off/on the Micro-Drive™ has the same effect as resetting the encoders, which “zeros” the encoder's position reading, rendering the recorded positions of the Stage Position List irrelevant.

Configure the Gamepad.

The Configure Gamepad window is used to view/configure the Gamepad's settings, and to view/test your available control-sticks – a typical Gamepad has two control-sticks, “Left X” and “Left Y”. All available settings can be saved/loaded to/from disk using the buttons located at the bottom-right of the window. Use the on-screen instructions for more information on this window.



Troubleshooting.

- *A message appears at the beginning of the VI: “Failed to load MicroDrive! ReInit?”*

  This message appears when the program has made a call to the MCL_InitHandle() function of the MicroDrive dll, and the function has returned a zero instead of a valid Micro-Drive™ handle.

  - Verify the Micro-Drive™ is on and is plugged into the computer via USB.
  - Close all programs and reopen only this program. This program cannot use the Micro-Drive™ while another program has a handle to the Micro-Drive™.
  - Verify the Micro-Drive™ USB drivers were installed correctly by looking for the Micro-Drive™ in the Device Manager program.

- *The gamepad initialization window immediately reopens after clicking the “Ok” button.*

  This message should only appear once at the beginning of the program, and the instructions *must* be followed to continue using the program. The window reopens immediately if the instructions were not followed, or if the Gamepad was not detected.

  - Verify the Gamepad is on and is plugged into the computer via USB.

- Close all programs and reopen only this program. Another program may have had control of the Gamepad, or this program may not have successfully initialized the Gamepad before reaching this test.
- Toggle the Gamepad's “mode” button and try again.

- *The Software Limits stop the Micro-Drive™ far beyond the specified encoder readings.*

  The Software Limits feature is highly susceptible to fluctuations in processing speed and USB latency. Ultimately, it may not be possible to achieve your desired accuracy without editing the programs code.

  - Close other programs which may be taking processing power away from this program.
  - Reduce the velocity of the Micro-Drive™.
  - Compensate for the discrepancy by narrowing your limits.

- *The positions of the Stage-Position List are not accurate or are completely wrong.*

  The List contains only a record of the encoder readings, which may not be enough information to return to a previously observed structure. Also, each reading magnitude is relative to the motion since the last time the encoders were reset, or since the Micro-Drive™ was powered on.

  - Before resetting the encoders, or powering down the Micro-Drive™, always return to the (0, 0, 0) position.

Editing the Software.

This program was created using the LabVIEW 2009 Development Environment. All Associated VIs can be found on the installation CD for the MicroDrive, or in the MicroDrive folder created for you during installation of the Micro-Drive™ software.

To begin editing, open the “Gamepad MicroDrive Control with limits.vi” VI – all other VIs in the folder are SubVIs of this VI. Use the notes posted across the Block Diagram to understand the various sections of code.

To simplify program flow the VI does not use Global Variables, and makes minimal use of Local Variables. All code is contained within a single Flat Sequence Structure, which begins with initialization procedures and ends with the main/program loop, and with de-initialization procedures.