

## Use of Auto Zoom and Focus

October 4, 2000

Automatic zoom and focus is available as an option on FTÅ200, 2000, and 4000 series instruments. Stepper motors drive the zoom cell and focus lens under computer control. The current motor position is always stored on disk after any movement. If not disturbed by someone while the computer is off, the motor will be at the same position when the program resumes.

### Home Positions

The "Home" position for each motor is an absolute mechanical position from which everything else is measured. Under ordinary use, the stepper motor will not lose steps and the correct sense of position will be maintained. However, if for some reason a motor is turned while power is removed, it will be necessary to re-home the motor. First, turn off power to the motor drivers. This will allow the motor shafts to be turned manually.

The focus motor is towards the front of the microscope and the zoom motor is behind it, nearer the camera. Each has an intermediate spur gear between the motor shaft and the main gear in the microscope. When power is removed, it is possible to turn the motor shafts by hand. Looking at the motors from the front of the microscope, first turn the shafts slightly counter-clockwise, then turn them clockwise as far as possible. When power is restored, the motors will move slightly to their true home position. When homed correctly, they can be programmed to move the full range (see table below) without hitting the mechanical stop at either end. If the stop is hit, re-home again as it was not quite correct. It is clear when the motor hits a stop: there is a distinct "click" sound. Homes are at step 0. Hitting a stop does not hurt the motor or gear.

Microscope	Minimum Position = Home	Maximum Position
Navitar 61620 Zoom	0	338
Navitar 61620 Focus	0	112
Navitar 61620 Motor Gearing	+32	

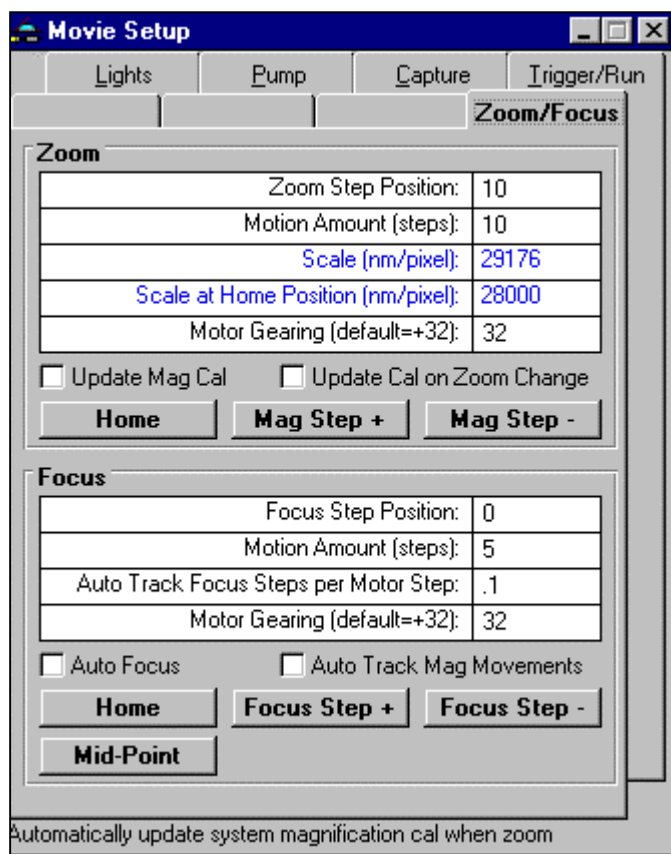
### Zoom Calibration

There is a specific relationship between the *change* in magnification and step position for each microscope. Each microscope is factory calibrated and the results stored in a text file called FtaCal.txt. This file is automatically placed on your disk at installation and a spare copy is on the license diskette. A printed copy is in your manual; you can recreate or edit it manually. The change in magnification is representative of the mechanics of the zoom cell. The *absolute* magnification is also a function of the camera and remainder of the lens. The user can set the absolute magnification at any zoom position by normal calibration techniques, or the factory absolute calibration at step 0 (listed at the end of file) can be used. It is always wise to check the absolute calibration (at some zoom position) because it is slightly affected by temperature and lighting. Once absolute calibration at *some* zoom is verified, the other zoom positions are reliable. The great benefit is not having to re-calibrate after each zoom change.

## Auto Focus

The software can automatically focus the microscope by running the focus lens from one end to the other and then selecting the best averaged focus. Focus itself is measured automatically in the image by the sharpest edges. The user must roughly focus the lens first using the mechanical stage; it is best to have the motor driven focus at mid-position while doing this. It is also necessary that a distinct object be in the image (e.g., the dispense needle). Finally, make sure the camera is not overloaded (no bad colors or dark spots in image) from too much contrast or light. Such artifacts will create a false illusion of focus at incorrect positions.

## Software Controls



**Focus or Zoom Step Position:** Your current position in motor steps.

**Motion Amount:** Steps in move.

**Scale:** Magnification cal; user can not edit; calculated automatically.

**Scale At Home:** Cal at step 0; calculated automatically.

**Motor Gearing:** Overall gear ratio.

**Update Mag Cal:** Use Analysis Setup cal to update zoom absolute cal.

**Update Cal on Zoom Change:** Change Analysis Setup cal when zoom moves.

**Home:** Go to position 0.

**Mag or Focus Step +/-:** Move by Motion Amount steps.

**Auto Track Focus Steps:** Track focus against zoom (see discussion below).

**Auto Focus:** Execute auto focus search routine and choose best average focus.

**Auto Track Mag:** Enable focus tracking.

- You must explicitly enable the automatic change of analysis magnification by zoom changes. This is done by the Update Cal on Zoom Change check box.
- You must explicitly set the absolute calibration in the zoom routine when system cal is changed in Analysis Setup. This is done by the Update Mag Cal checkbox.
- Ordinarily the zoom will maintain focus at low mag if it is focused originally at high mag. Remember to use an open aperture when focusing. If you feel the focus varies with zoom, you can make focus track automatically by measuring the change in Focus Step Position required as zoom changes and manually calculating the required change per zoom step.