

OASIS CONTROLLER SOFTWARE USER GUIDE



Revision 3.0.s

Objective Imaging Ltd.

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The equipment described in this document contains static sensitive components. Please take the necessary precautions when handling and installing the board, to prevent damage or malfunction.

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INTRODUCTION

Thank you for purchasing the OASIS four axis stepper controller for the PCI bus! The OASIS is an advanced, high-performance controller designed for the most demanding imaging and microscopy applications. The compact PCI form factor of the OASIS ensures a highly integrated solution for automation control.

This guide provides an overview of the utility software included with your OASIS controller: the Configuration Wizard, OASIS Flash Memory Configuration, and OASIS Controller applications.

Note that your OASIS controller may have been provided as part of an integrated automation system. There may be aspects of your system configuration that are specialized for your application. In these situations, please contact your system vendor for details regarding your configuration before proceeding.

OASIS Applications

The OASIS controller is intended to address a wide range of automated applications in microscopy. The four-axis design of the controller makes it ideally suited for use with automated microscopes with a combination of the following components:

- Motorized XY stage, for fast and precise translation of the specimen
- Motorized Z focus drive, for autofocus and Z-stack acquisition
- Motorized filter changer(s), for wavelength selection, e.g., fluorescence

The OASIS can be configured to support automated components from a variety of 3rd party vendors, and Objective Imaging supplies a range of cabling options that ensure simple connection of the OASIS to a particular configuration.

Software Structure

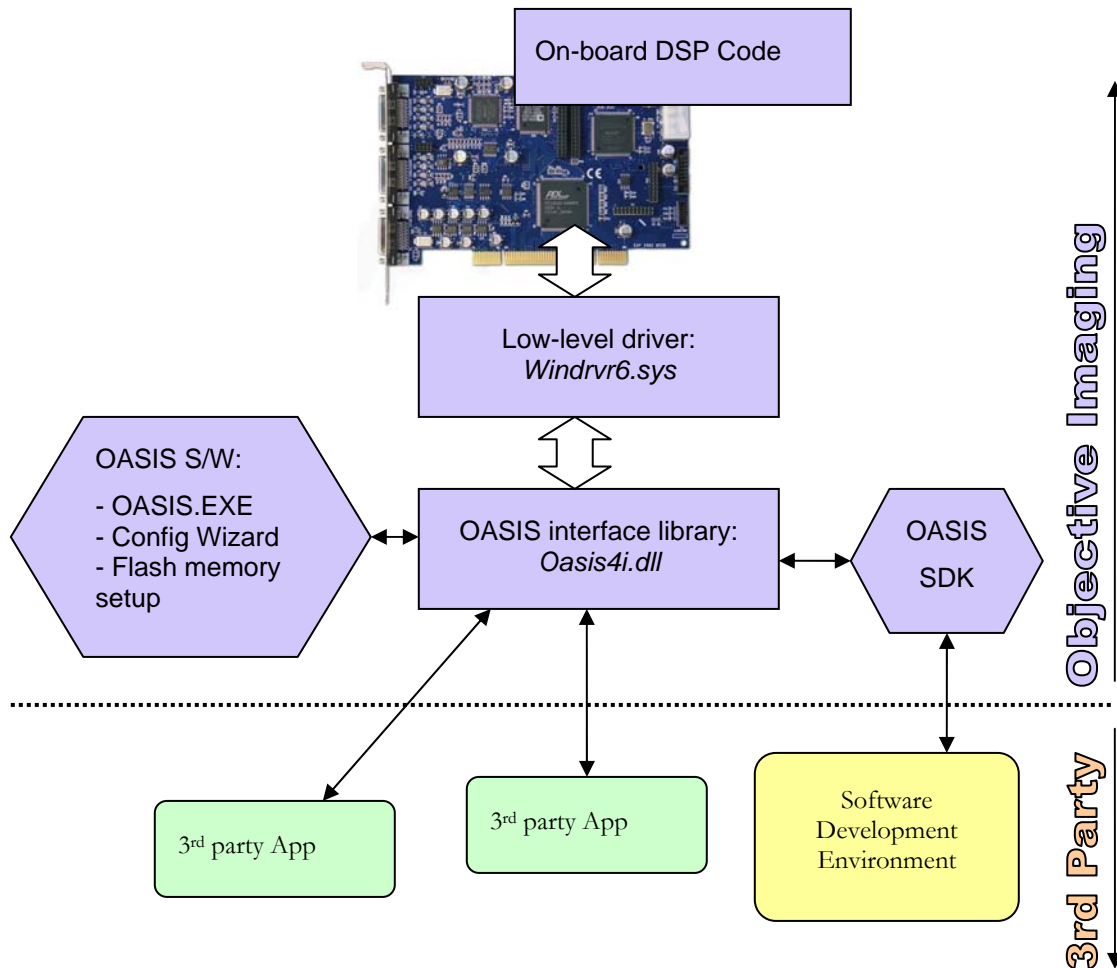
In addition to the physical hardware items associated with the OASIS controller, there is also a corresponding software architecture. How you relate to the specific aspects of the OASIS software depends on what type of user you are:

- **End User of 3rd Party Software/System.** In this scenario, you will be using the OASIS hardware in conjunction with a 3rd party application that includes support for the OASIS card. Examples of these applications include Leica Microsystems' Workstation platforms for imaging, Media Cybernetics' Image-Pro® with the Scope-

Pro™ plug in, Olympus MicroSuite™, and Soft Imaging System's analySIS®, among others.

- **Software Application Developer.** In this scenario, you will be developing your own custom or flagship application based on the library of functions available for the OASIS controller.

The figure below illustrates the OASIS software architecture:



You can see there are three critical software components that are used by the OASIS controller:

1. On-board DSP code that provides the fundamental controller functionality.
2. A low-level driver called *Windrvr6.sys* that provides PCI communication support between your computer and the OASIS card.
3. The *Oasis4i.dll* dynamic link library (DLL) file that exposes the functionality of the OASIS controller to software applications on your computer.

All three of these components—one on the OASIS card itself and two on the associated Windows PC—make up the necessary foundation for your use of the OASIS controller. The

installation procedure described in the next section explains how to ensure these items are present and working properly on your system.

In addition to these three critical components, several additional software utilities are provided with the OASIS controller. These include:

- **OASIS Configuration Wizard.** This utility guides you through the fundamental steps of configuring the OASIS controller for your particular hardware setup.
- **OASIS Flash Memory Setup application.** This utility gives you access to the full settings available in the OASIS's flash memory, allowing you to customize aspects the controller such as maximum and standby motor currents, acceleration ramps, sine-cosine drive tables, and other settings, as needed.
- **OASIS Controller Application.** This application offers basic functionality for stage, focus, and filter changer control. It is useful for verifying that your system is working properly, as well as for defining various software settings such as the target cruise speeds for movements.
- **OASIS SDK.** This software developer's kit provides the headers, import libraries, and documentation needed to integrate the OASIS controller into your own applications.

Some aspects of these software utilities are described later in the relevant section on installation and configuration of the OASIS controller. The OASIS SDK is documented in detail in the *OASIS Automation Controller Software Library Reference Manual* ('OASIS_DLL_Manual.pdf') included on the OASIS installation CD.

INSTALLATION

Installation Requirements

In order to install the OASIS card into your system, you will need the following:

- PC with relevant OASIS controller hardware installed
- Windows® XP or Windows® 2000 operating system
- CD-ROM drive
- OASIS Installation CD

Installation Process

The OASIS installation process consists of three distinct steps:

1. **Hardware Installation.** In this step, you will physically place the OASIS card inside your computer.
2. **Driver Installation.** After installing the hardware, you need to install the driver software so that Windows recognizes the card and application software can use it.
3. **Configuration.** You will need to configure the OASIS card to match your particular system setup.

Once these steps are complete, the OASIS card is generally ready for use. However, if you are using a 3rd party application, you may need to install additional software so that your application package can use the OASIS controller to drive the motorized components of your system. Refer to your application / system documentation for further details on how to configure the application for use with OASIS.

To install the OASIS Software Utilities:

1. Insert the OASIS CD.
2. Choose to Install OASIS Tools (see Figure 1).

3. Follow the on-screen instructions.
4. When finished, the OASIS software may be accessed either via desktop icons or Windows Start menu selections under Objective Imaging.

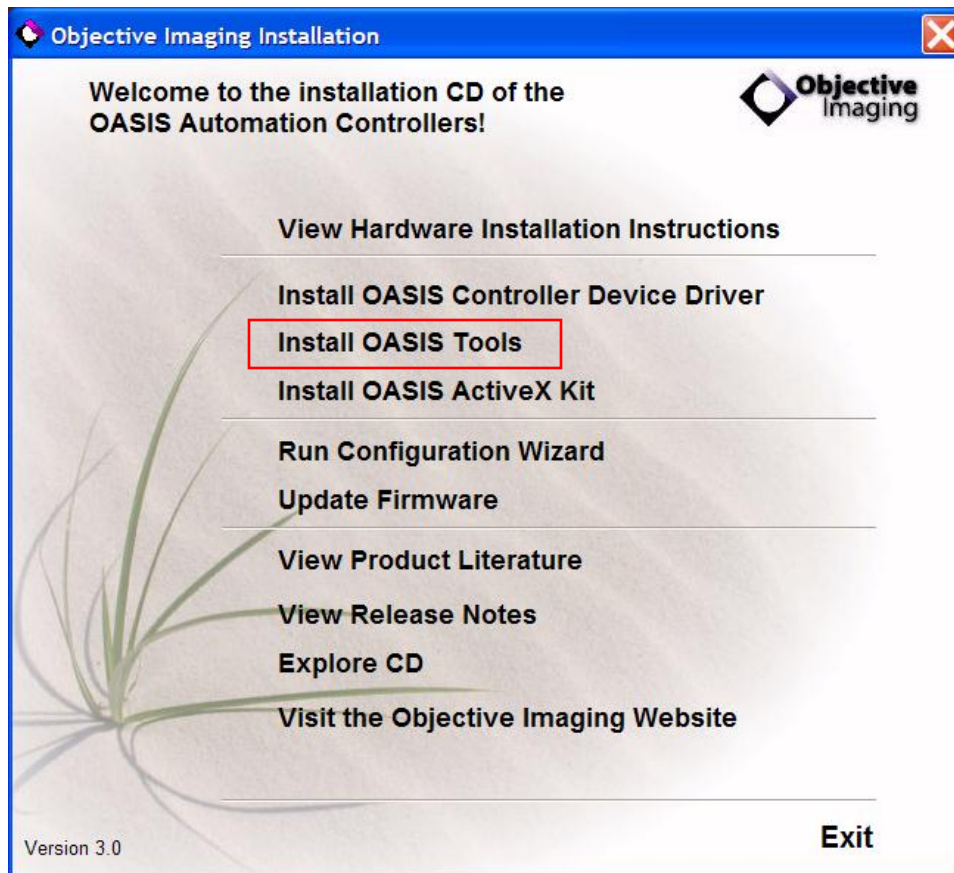


Figure 1. OASIS Installation Screen.

OASIS CONFIGURATION WIZARD

The easiest way to configure the card is to run the OASIS Configuration Wizard (Figure 2). The wizard provides step-by-step instructions for defining the settings most appropriate for your particular system, and actually consists of three wizards:

1. **System Configuration Wizard.** This wizard performs the basic tasks of defining the hardware you have connected to the OASIS controller.
2. **Encoder Setup Wizard.** This wizard is used to enable the use of encoders and specify their resolution and polarity.
3. **Joystick Setup Wizard.** This wizard allows you define what input control device(s) you have connected to the OASIS controller, and set the details of their operation, including sensitivity and direction.

Also displayed in the main screen of the OASIS Configuration Wizard are:

- **Serial Number.** This is the serial number assigned to your particular OASIS controller.
- **DSP.** This reports the current DSP code revision running on your OASIS controller.
- **DLL.** This displays the current version of the OASIS DLL installed on your computer.
- **Option Card.** If an option card is installed on your OASIS controller, the type of card will be displayed, as well as additional information relevant to the type.

When installing an OASIS card, you would typically run each wizard in turn to ensure proper configuration for your setup.

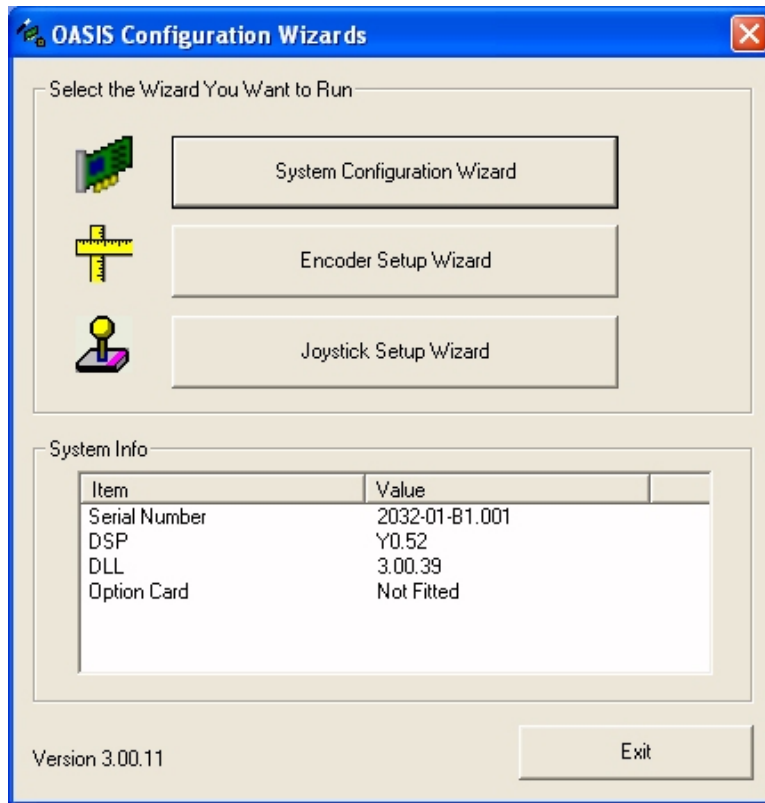


Figure 2. OASIS Configuration Wizards

Each of the wizards is described in the following sections.

System Configuration Wizard

The System Configuration Wizard performs the primary tasks of ensuring the motor and limit settings of the OASIS card match the make and model of automation hardware connected to it.

The wizard includes a listing of the various makes and models of XY stage, focus drives, and filter wheels, and can setup the card based on known default values for the particular device. The wizard can also auto-detect the settings of your particular systems—such as limit switch polarity, axis and limit directions, and encoder settings (if fitted)—by performing various movements to test and measure your system’s characteristics.

After displaying the start page (Figure 3), the wizard displays the configuration page (Figure 4), allowing you to indicate the make and model for your XY stage, Z focus, and F-axis connection, if necessary.

Green LED icons in the configuration page indicate whether a motor has been detected for the given axes.



Figure 3. OASIS System Configuration Wizard.

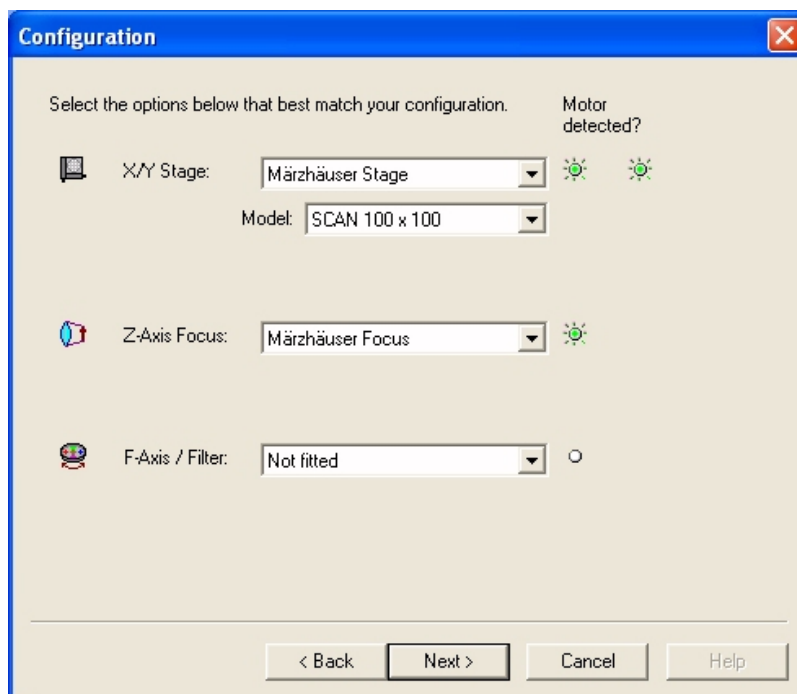


Figure 4. Overall system configuration.

The next step in the wizard is to define whether any of the axes drive directions are to be reversed. Reversing the drive direction will change the “sense” of positive vs. negative on that axis. For instance, if a clockwise turn of the motor is producing a positive motion on the axis, then reversing the drive direction will result in a negative motion when the motor is turned clockwise. Setting the drive direction may be useful in ensuring the desired direction of stage travel relative to the view in the eyepieces or camera mounted on the microscope.

The drive direction setting also can accommodate for the side of the microscope onto which a motorized focus drive is mounted. A given direction of turning of the motor will result in opposing fine focus movement depending on whether the motor is mounted on the left or right side of the microscope, so reversal of the motor drive direction may ensure the expected result of positive and negative movements of the focus for your setup.

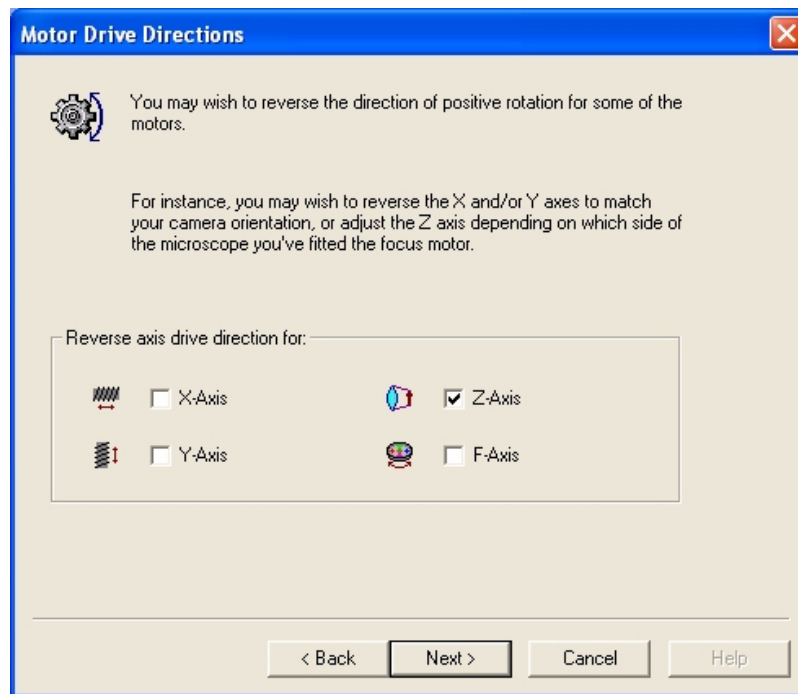


Figure 5. Setting the drive direction.

Following the drive direction page is the automatic ramp calculation page (Figure 6). Selecting to have the wizard automatically optimize your ramp tables will result in default tables that have been adjusted to match the microstepping currently defined for the OASIS controller.

Note that the Encoder Wizard will also present the option to optimize the acceleration ramps, since the microstepping resolution may be adjusted by that wizard based on the encoder resolutions.

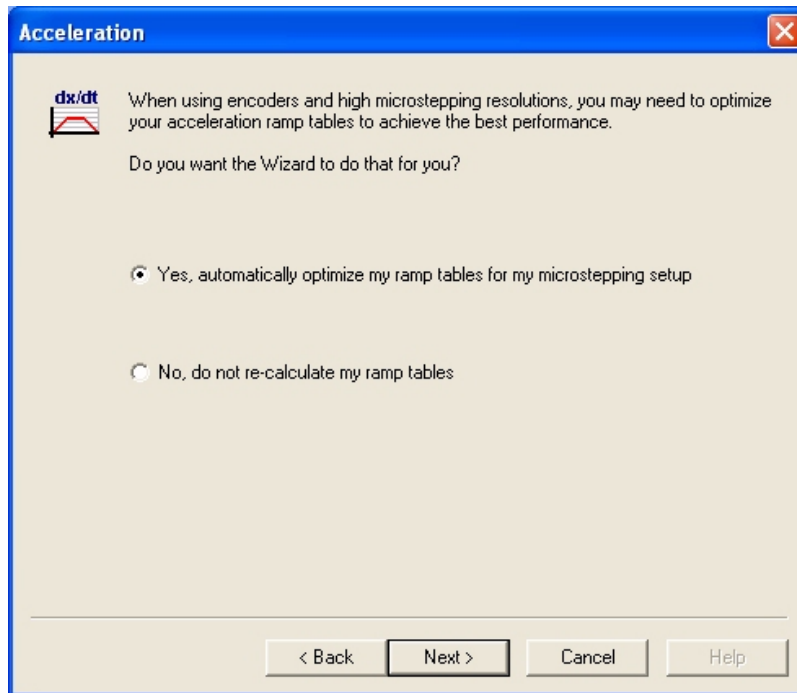


Figure 6. Automatic ramp calculation.

Following the acceleration page, you will be presented with the option to have the configuration wizard automatically determine your setup (Figure 7).

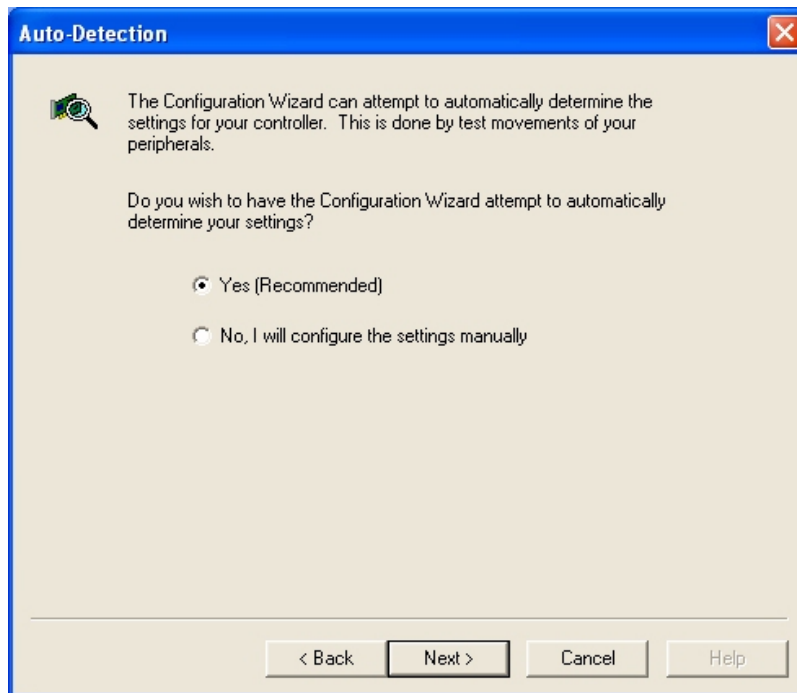


Figure 7. Auto-Detection selection.

During auto-detection, the wizard verifies the limit switch polarity (which may be either open or closed logic) for each axis where a motor has been detected. The wizard then drives each axis of the XY stage to the limits in turn (Figure 8), verifying that the expected limit is sensed for the direction of travel. The range of travel is measured between the limits and is compared to the expected value for the make and model of stage selected in the configuration page in order to estimate the pitch of each axis.

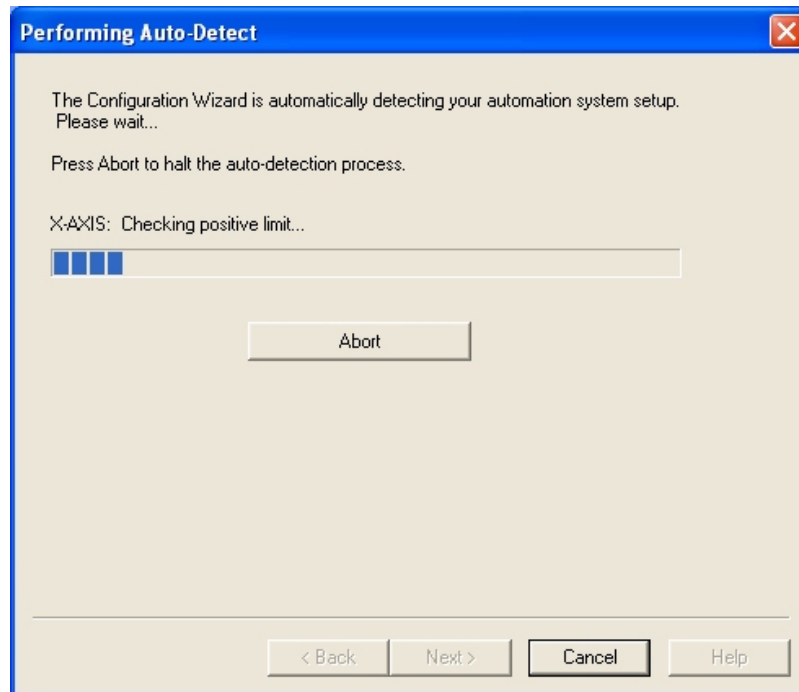


Figure 8. Auto-detection in progress.

Once the auto-detection is complete, the wizard displays the settings page for each component for verification of the settings.

For the XY stage, the limit switch polarity is displayed, as well as the limit direction indicating whether it was reversed to match the axis drive direction (Figure 9). Next, the stage's estimated pitch values are shown, along with the expected and actual travel measured between the limits for each axis (Figure 10).

For the focus drive, the current pitch value is displayed, corresponding to the amount of travel of the focus drive for one revolution of the motor. For many microscopes the fine focus travels 100 microns (0.1 mm) per turn, though other variations also exist. Please check with your microscope manufacturer for the amount of travel expected per turn on your fine focus drive.

The focus page also shows a setting allowing selection of physical limits fitted, with polarity and direction options. The wizard does not attempt to automatically detect physical limits on the focus drive since most external focus drive systems are not fitted with limits and thus unrestrained travel of the focus could lead to collisions with the objective or condenser.

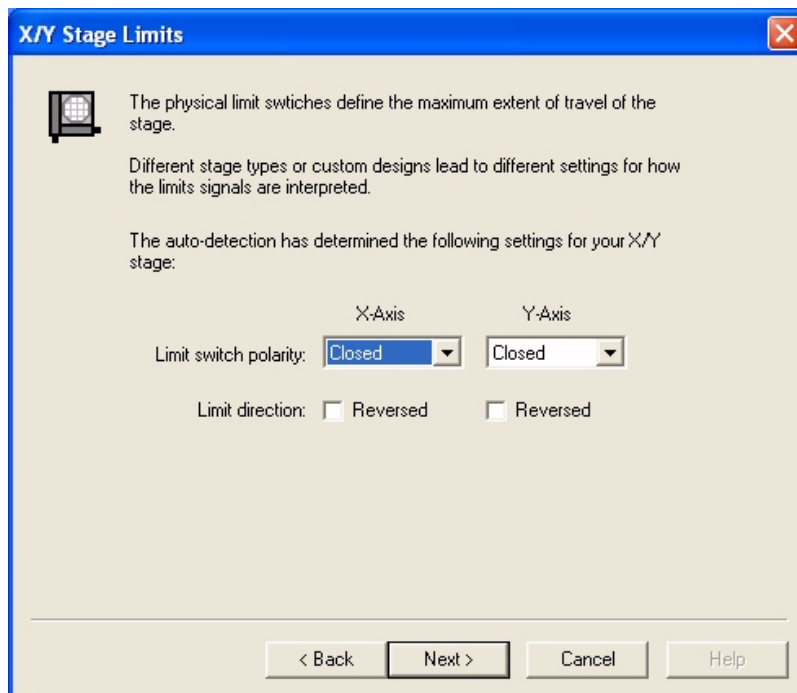


Figure 9. Stage settings showing limit switch definition.

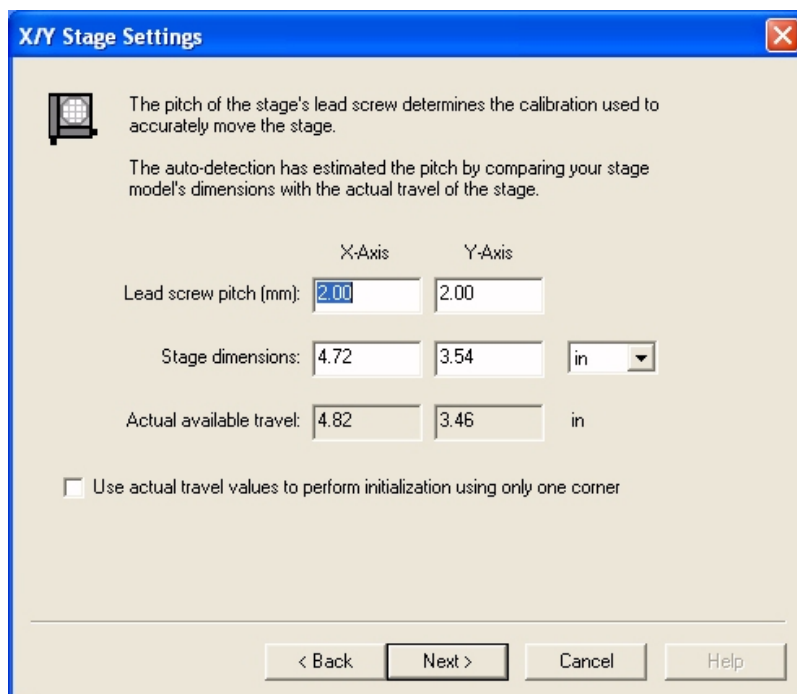
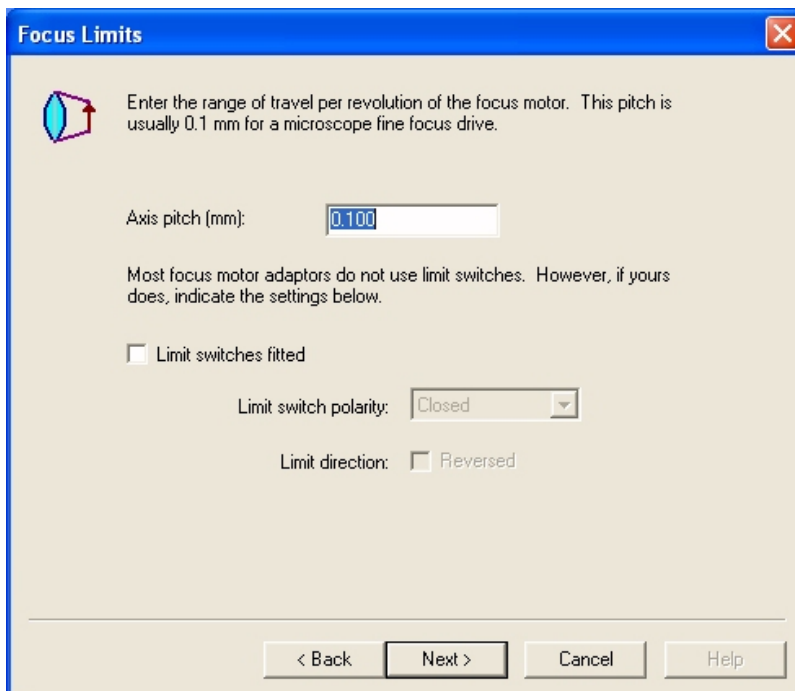


Figure 10. Stage settings show estimated lead screw pitch and available travel.



Focus Limits

Enter the range of travel per revolution of the focus motor. This pitch is usually 0.1 mm for a microscope fine focus drive.

Axis pitch (mm):

Most focus motor adaptors do not use limit switches. However, if yours does, indicate the settings below.

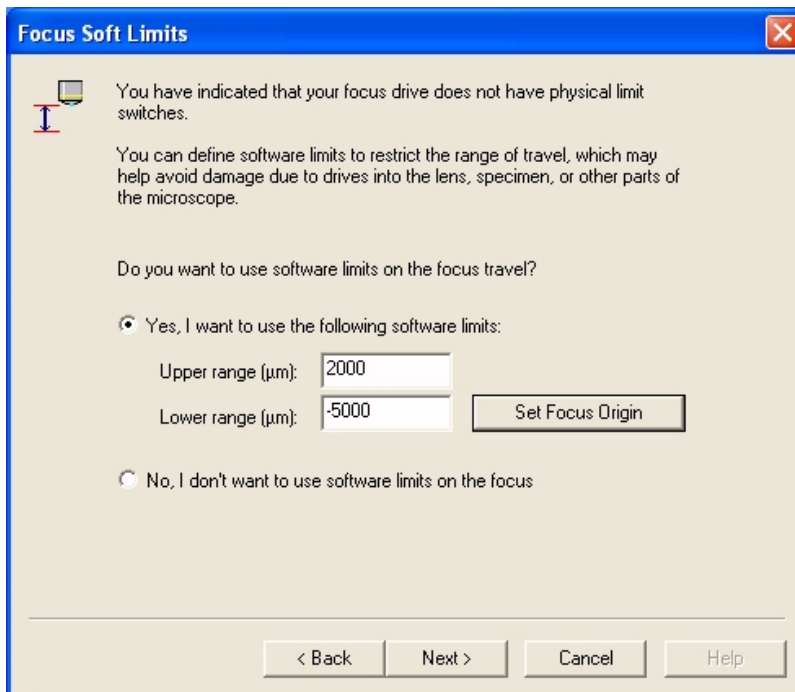
☐ Limit switches fitted

Limit switch polarity:

Limit direction: ☐ Reversed

< Back Next > Cancel Help

Figure 11. Focus settings, including pitch and limit settings.



Focus Soft Limits

You have indicated that your focus drive does not have physical limit switches.

You can define software limits to restrict the range of travel, which may help avoid damage due to drives into the lens, specimen, or other parts of the microscope.

Do you want to use software limits on the focus travel?

☒ Yes, I want to use the following software limits:

Upper range (μm):

Lower range (μm):

☐ No, I don't want to use software limits on the focus

< Back Next > Cancel Help

Figure 12. Focus soft limit definition.

To accommodate focus drive systems with no limit protection, the wizard displays a page allowing you to initialize the focus drive by setting the origin position and defining software limits above and below the current position.

Note that if you elect not to use software limits on focus drives without physical limits, collisions between the specimen and the objective lens, or between the sub-stage optics and the stand are possible. It is recommended that you use software limits to avoid damage to your microscope and specimen.

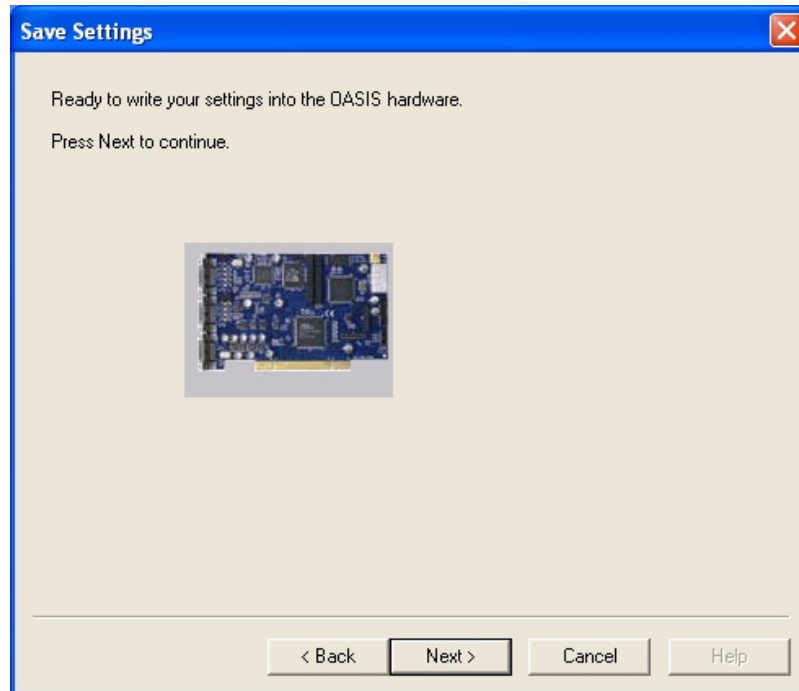


Figure 13. Writing the changes to flash memory.

The final step of the wizard writes the changes made to your configuration into the flash memory of the OASIS controller (Figure 13). Once the flash is updated, you may quit the wizard and start using your OASIS controller, or you may elect to run the Encoder Setup Wizard and/or the Joystick Setup Wizard.

Encoder Setup Wizard

The Encoder Setup Wizard automatically detects the presence, resolution, and polarity of encoders on the X, Y, and Z axes. The wizard also verifies that your microstepping resolution and acceleration ramps are optimized for the resolution of encoders that are connected to the OASIS controller.

The Encoder Wizard starts by asking how you would like to proceed in defining the encoders (Figure 14). For the XY stage and Z focus you can select to:

- Indicate the pitch settings and have the wizard determine the encoder resolutions
- Indicate the encoder resolutions and have the wizard determine the axis lead screw pitch
- Enter the values manually

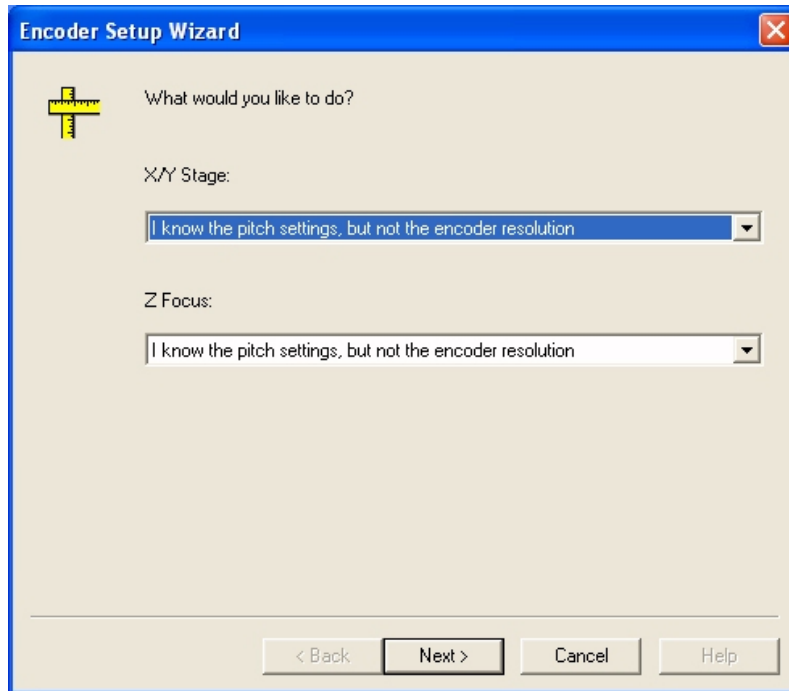


Figure 14. Encoder setup method selection.

The wizard then displays the information page where either the pitch value or encoder resolution is entered, depending on the method you chose for the XY stage and Z focus (Figure 15).

For instance, if you know that your XY stage has a 2 mm lead screw, but are uncertain of the encoder resolution, you would choose the option “I know the pitch settings, but not the encoder resolution” in the method selection page. You will then be prompted to verify the pitch value in the information page, i.e., 2 mm for the X and Y axes of the stage.

Alternatively, if you know the encoder resolution but wish the wizard to determine the pitch, choose the option “I know the encoder resolution, but not the pitch” in the method selection page. You will then be prompted to enter the encoder resolution, e.g., 0.1 micron.

Once the information has been entered and you select “Next”, the wizard will perform moves on the X, Y, and Z axes. The distance moved is compared to the encoder feedback to determine if encoders are fitted. If so, the relative values of motor to encoder counters are used to calculate either the encoder resolution (based on your input of pitch) or the pitch value (based on your input of encoder resolution).

The direction of travel is also compared to the encoder polarity to ensure positive motion of the motor also results in positive changes in the encoders.

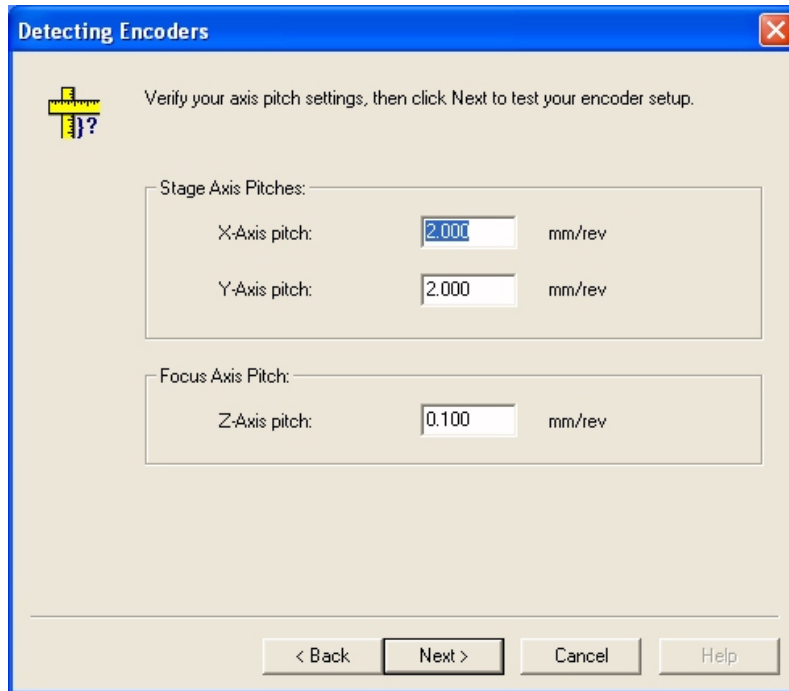


Figure 15. Encoder wizard information page.

The results are displayed in the encoder settings page (Figure 16). This page indicates whether encoders were detected, as indicated by the “fitted” options. The results from the axis pitch and encoder resolution measurements are also shown, as well as the encoder polarity. You may manually make changes to the values displayed, if needed.

Based on these values, the wizard verifies that the microstepping resolution of the OASIS controller is sufficient to support the encoder resolution. Ideally the microstepping of the motor should be greater than the encoder resolution to ensure full benefit of the encoder feedback.

For instance, with a 2 mm lead screw and 0.1 micron encoders, an ideal microstepping is 40,000 steps per rev, since this leads to a step size of 0.05 microns (2,000 microns divided by 40,000 steps). Thus there will be two microsteps available per encoder count, allow more precise positioning in closed-loop situations.

Once the microstepping has been automatically determined by the wizard, you are given the option to re-calculate the acceleration ramp tables (Figure 17). This may be required since the acceleration ramp tables are based on microstep values. When the microstepping resolution is changed, the ramp table should be matched to the new microstepping in order to achieve the same actual speed on the axis.

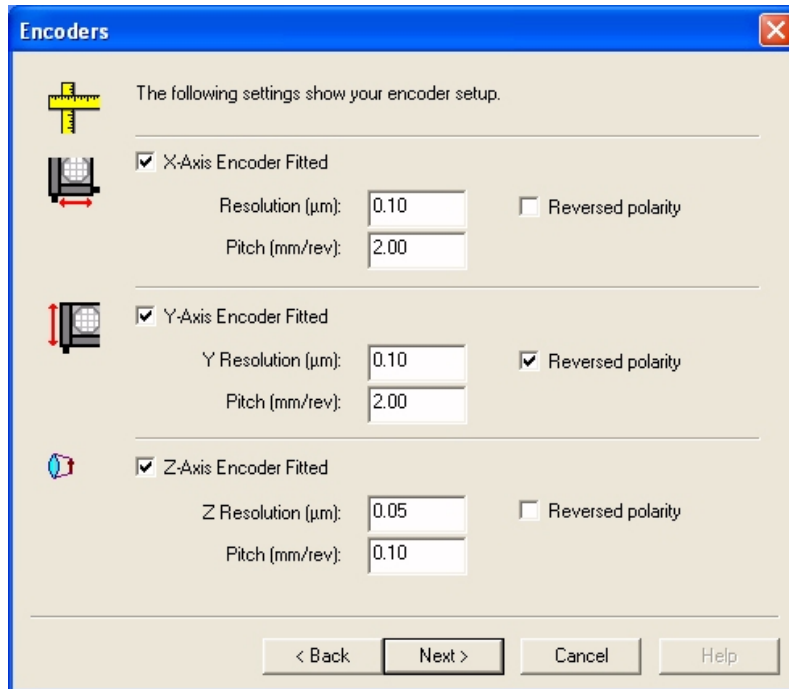


Figure 16. Encoder settings.

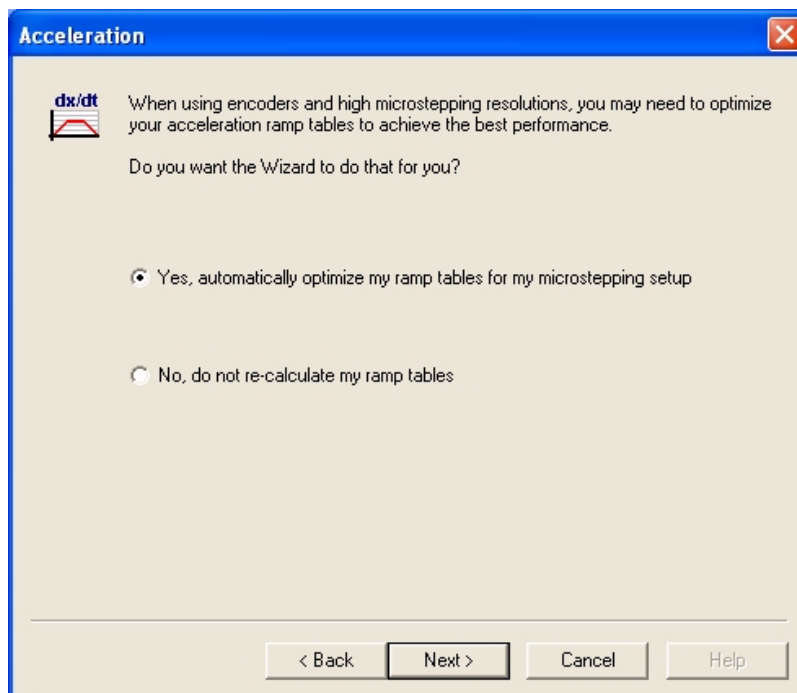


Figure 17. Automatic ramp calculation.

The final step in the encoder wizard before the settings are actually written into the OASIS flash memory is to initialize the XY stage to verify the range of travel. This is necessary to ensure the

settings are set correctly and to account for effects the changes in microstepping and encoder resolution may have had on the known range of travel of the stage.

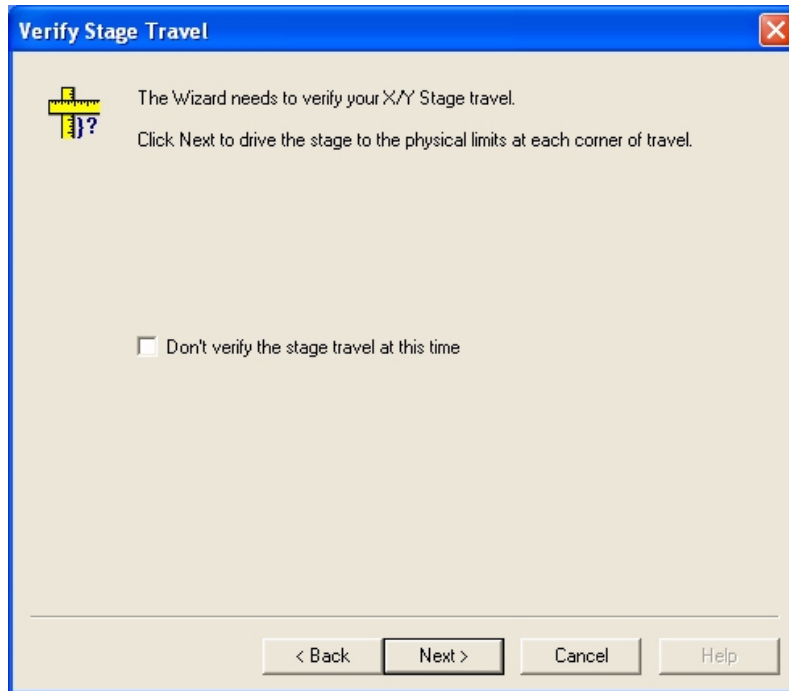


Figure 18. Stage initialization after encoder setup.

Note that you have the option to skip the stage travel verification, but you should only do this if you intend to initialize the stage in another application before attempting to use it. For instance, if you are using Surveyor to perform mosaic imaging acquisition, you should first initialize the stage in Surveyor before attempting any scans.

Joystick Setup Wizard

The Joystick Setup Wizard simplifies configuration of the type of input controller present on the system.

The main page of the Joystick Wizard (Figure 19) prompts you for the type of joystick fitted, as well as selections for indicating whether you have fitted a trackball or Leica Microsystems SmartMove input device interface.

Note that it is possible to have more than one device connected to the OASIS card at a time. For instance, it is possible to have the OI-SNP interface for the Leica SmartMove, an OI joystick unit, and a trackball all fitted. However, in most cases only one type of input controller is used.

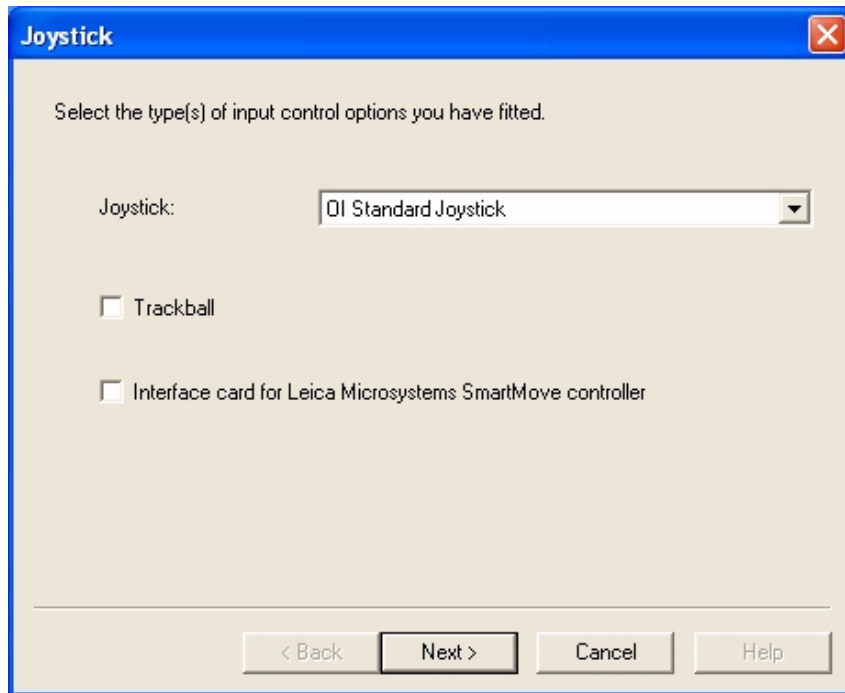


Figure 19. Joystick main page.

If a joystick is fitted, you are given the option of defining the desired action for the button. Two options are available:

- **Turbo mode.** In this mode the joystick will use the fastest sensitivity setting when the button is pressed and held.
- **Autofocus.** In this mode, the button press initiates a video autofocus. Note that this option will have no effect for systems not fitted with the OASIS-AF video autofocus module.

Next the wizard presents the joystick settings page (Figure 21). This page allows you to set the XY and Z joystick sensitivities, providing more coarse or fine movements for deflections of the XY joystick and turns of the Z joystick digiknob.

You may also reverse the sense of travel of the XY joystick deflection and Z digiknob turns in this page.

Note that changes to the joystick direction values do not affect the axis direction of travel, i.e., the sense of positive and negative direction of the axis. The joystick settings only affect the relative direction of travel for joystick operations.

Once the settings for the joystick are complete, the changes are written into the OASIS flash memory, and you are returned to the main wizard screen.

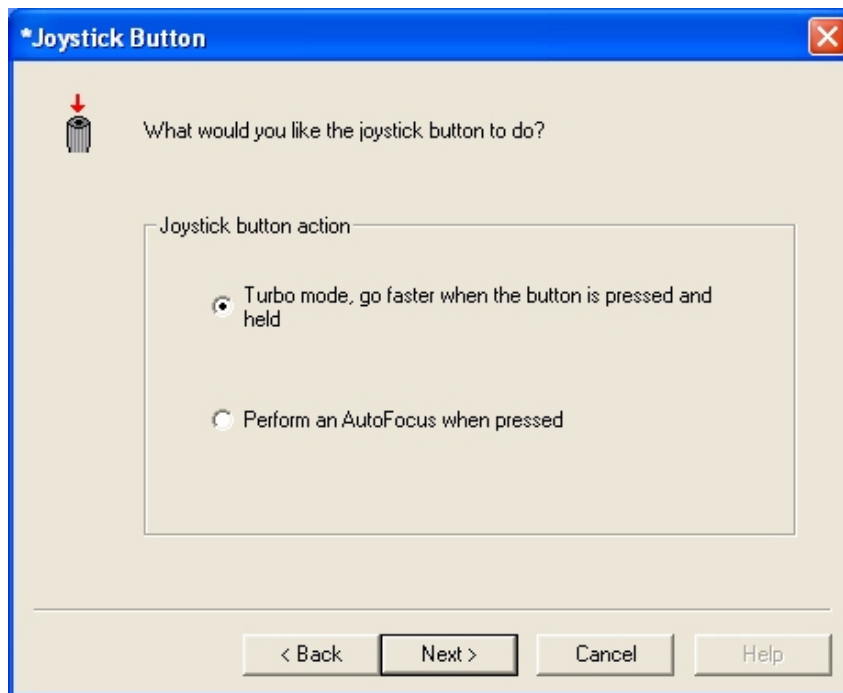


Figure 20. Joystick button definition.

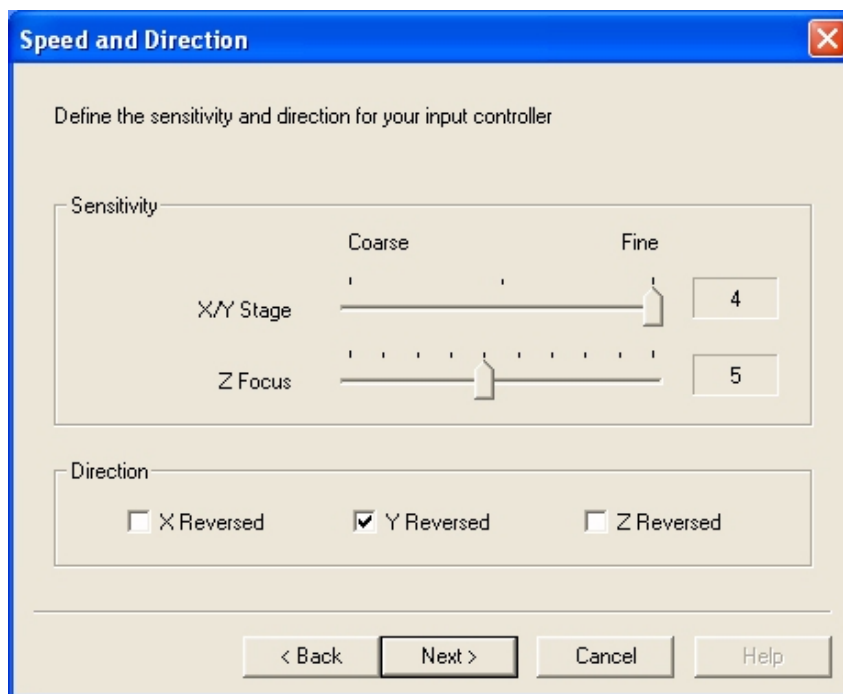


Figure 21. Joystick speed and direction settings.

THE OASIS APPLICATION

One of the utilities included with the OASIS controller is the *OASIS Controller Application*. If you have chosen to install the OASIS Tools (or SDK) from the OASIS installation CD, you will have been given the option to install a shortcut to the OASIS Controller Application on your desktop. The shortcut will show the Objective Imaging logo along with the description 'OASIS Controller.'

If you haven't installed the OASIS Tools, you can run the OASIS application from the CD. The application executable is called *Oasis.exe*, and you can find it in the *Utils* folder of the CD.

The OASIS application is useful for verifying that your OASIS installation and configuration are working properly on your system, as well as for familiarizing yourself with the capabilities and principles of operation of the controller.

OASIS System Information Page

The main screen of the OASIS application is shown in Figure 22. You will see the OASIS application includes a number of tabs associated with information on the System, Stage, Focus, F-Axis (fourth or filter axis), Video, and About. At the bottom of the OASIS application you will find a status bar indicating the current position values for the XY Stage, Z focus, and F-axis. Also included in the status bar is a panel indicating the condition returned from the last action, e.g., whether the function command returned OK as opposed to some error.

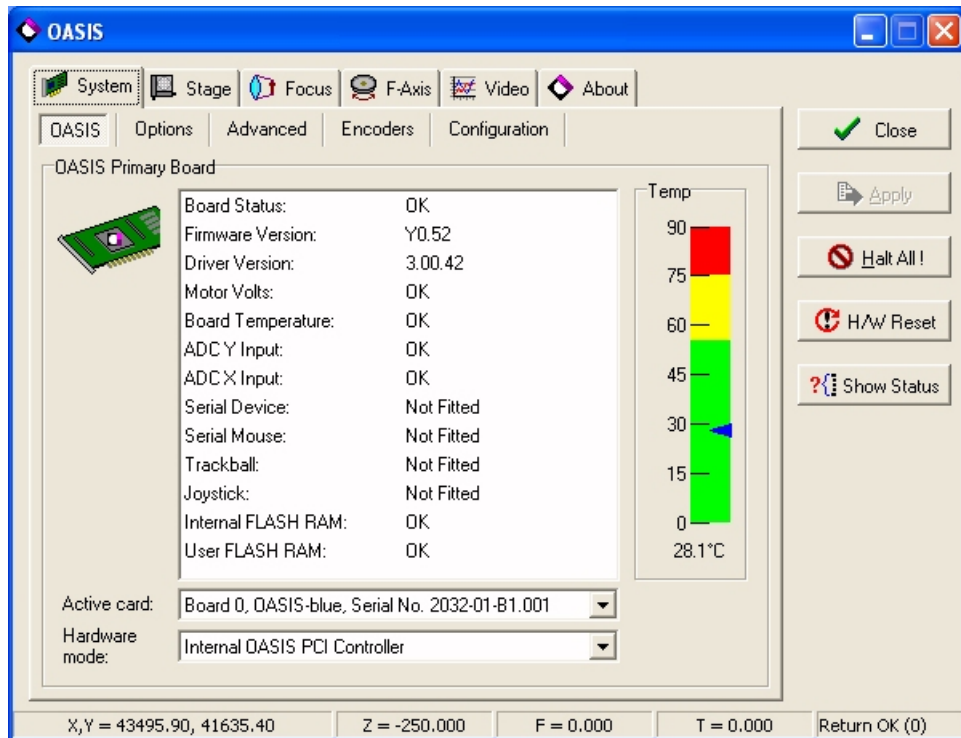


Figure 22. The OASIS application main screen.

Note: To retrieve extended error information on the last command, click on the command return status panel in the status bar at the bottom of the OASIS application.

Main Buttons

| Item | Description |
|--------------------|---|
| <i>OK</i> | Closes the OASIS application. |
| <i>Apply</i> | Applies changes you have made to settings such as cruise speed, ramp table, etc. |
| <i>Halt All</i> | Issues a halt command on axes to stop any motion that may be occurring. |
| <i>H/W Reset</i> | Issues a reset command to the OASIS DSP. This is similar to the effect of re-booting the PC in that the OASIS will go through its start-up sequence as if you had reset the PC. |
| <i>Show Status</i> | Displays the status window indicating the status of each of the axes, such as whether it is on a physical or software limit, motor detection, etc. |

Board Status

This readout gives you information on the overall status of the OASIS controller. This readout will display either of the following values:

Table 1. Board status values.

| Value | Meaning |
|-------------|---|
| “OK” | The OASIS card has been detected and is communicating with your computer properly. |
| “Simulated” | The OASIS card was not found. If a card is indeed present, this reading indicates that attempts to open the card for communication failed; the system has gone into simulation mode since no card was detected. |

Finding the DSP and DLL Version Information

In some circumstance you may need to verify the version information of the on-board DSP code or the OASIS DLL that is running on your system. For instance, if you are installing new hardware options onto the OASIS card, you will need to verify that the OASIS DSP code is at a sufficient revision level to support the new hardware. Also, certainly 3rd party applications may use facilities found in later versions of the OASIS DLL, so you may need to verify the version currently installed to ensure compatibility.

The System page of the OASIS application lists these versions as follows:

Table 2. DSP and DLL version information.

| Setting | Meaning |
|------------------|---|
| Firmware version | Indicates the DSP code version currently running on the OASIS card. |
| Driver version | Indicates the DLL version currently running on your PC. |

Motor Volts

The Motor volts display indicates whether the OASIS card has sensed sufficient input power on connector PL5 for driving the motors. The following displays may occur:

Table 3. Motor volts display indication.

| Value | Meaning |
|--------|--|
| “OK” | Motor power has been detected. |
| “FAIL” | Motor power has not been detected. Recheck power connection at PL5 or your power supply for sufficient voltage (+12V to +30V). |

Board Temperature Readout

The OASIS includes circuitry to monitor the board temperature and a safety feature to automatically limit motor drive current if the board temperature begins rising above acceptable levels.

The System page of the OASIS application displays the current board temperature on a thermometer-style gauge, as well as the actual temperature value. Also, the Board Temperature status flag indicates either ‘OK’ or ‘FAIL’ depending on whether the temperature is sensed to be within acceptable limits.

ADC Inputs

The ADC Y and ADC X display the status of the analogue-to-digital converters used for the XY joystick input. If either of these values appears out of normal position on start up, the display will read ‘FAIL.’

Serial Devices

If a serial device has been connected to the primary serial input port PL1 on the main connector plate, the Serial Device and Serial Mouse displays indicate that the device has been detected, and whether it appears to be a mouse.

Trackball and Joystick

If the serial device is detected to be a trackball, the Trackball flag will show it has been detected. If the analogue joystick is detected, the Joystick flag will indicate it has been detected.

FLASH RAM Status

The OASIS flash RAM is used to store various user settings, factory defaults, as well as the current DSP code. Whenever the flash is modified, a checksum is calculated on the source data and written into the header of the flash block. When the OASIS reads the flash memory to configure itself based on the settings found there, it also calculates the checksum from the data in the flash block.

If the DSP's calculated checksum does not match the checksum from the source data, the FLASH RAM display will indicate 'FAIL'; if they do match, the FLASH RAM display will indicate 'OK.'

The FLASH RAM status displays indicate the checksum integrity of given flash RAM blocks, as follows:

Table 4. FLASH RAM settings.

| Setting | Meaning |
|--------------------|--|
| Internal FLASH RAM | Indicates whether the checksum is correct in the factory FLASH block. |
| User FLASH RAM | Indicates whether the checksum is correct in the user FLASH block, where most current settings are being held. |

OASIS Stage Page

The Stage page of the OASIS application allows you to perform actions and define settings for the XY stage.

Stage Control

The Control area of the Stage page allows you to execute actions related to movement and initialization of the stage (Figure 23).

The Position items include movements to a given XY location, movement followed by autofocus to an XY location (OASIS-AF video autofocus module required), as well as readout and definition of the current XY position.

The Step items permit relative moves in +/- X and +/- Y directions, as well as along the diagonals. The step size is indicated in microns for each axis. A central button with a bull's eye icon returns the stage to the origin location.

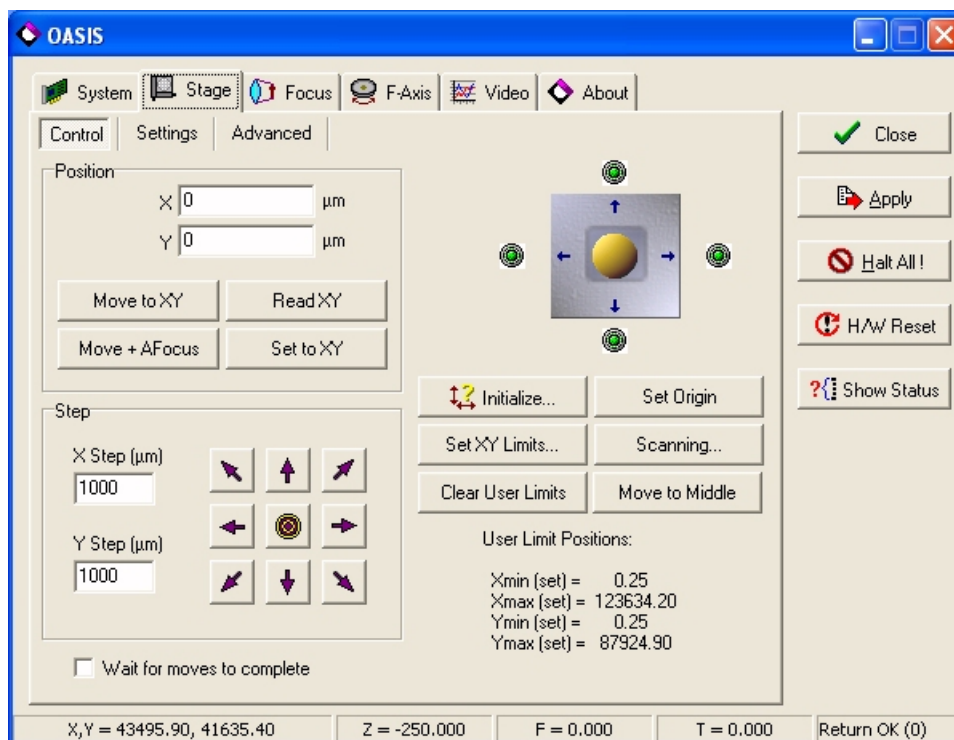


Figure 23. OASIS stage control.

| Item | Description |
|---|--|
| <i>XY position readout</i> | The X and Y coordinate values used for Move to XY, Move + Autofocus, Read XY, and Set to XY. |
| <i>Move to XY</i> | Moves to the specified XY position. |
| <i>Move + AFocus</i> | Moves to the specified XY position and performs and automatic focus (OASIS-AF video autofocus hardware required). |
| <i>Read XY</i> | Reads the current XY positions and displays the result in Position readouts, in microns. |
| <i>Set to XY</i> | Sets the current XY positions to the values as specified by Position, in microns. |
| <i>Step Size</i> | Indicates the step distance for relative moves using the up/down arrow buttons, in microns. |
| <i>Up/down/left/right arrow buttons</i> | Moves the X and/or Y axels in the positive and negative directions by a relative amount given by the Step Size, in microns |

| Item | Description |
|--------------------------|---|
| <i>Bull's eye</i> | Moves the X and Y axes to the origin (zero) position. |
| <i>Initialize</i> | Prompts to determine the stage travel and set software limits based on driving the stage to opposite corners to search for the physical limit switches. |
| <i>Set Origin</i> | Sets the current position to zero, while maintaining the relative position of the soft limits. |
| <i>Clear User Limits</i> | Disables the soft limits on X and Y. |

Note that the current XY stage position readout is found in the status bar at the bottom of the OASIS application window.

The Settings area of the Stage page (Figure 24) allows you to define the movement speed and acceleration, calibrate the stage using the lead screw pitch value, and define and view various other options and settings, as described below.

Stage Settings

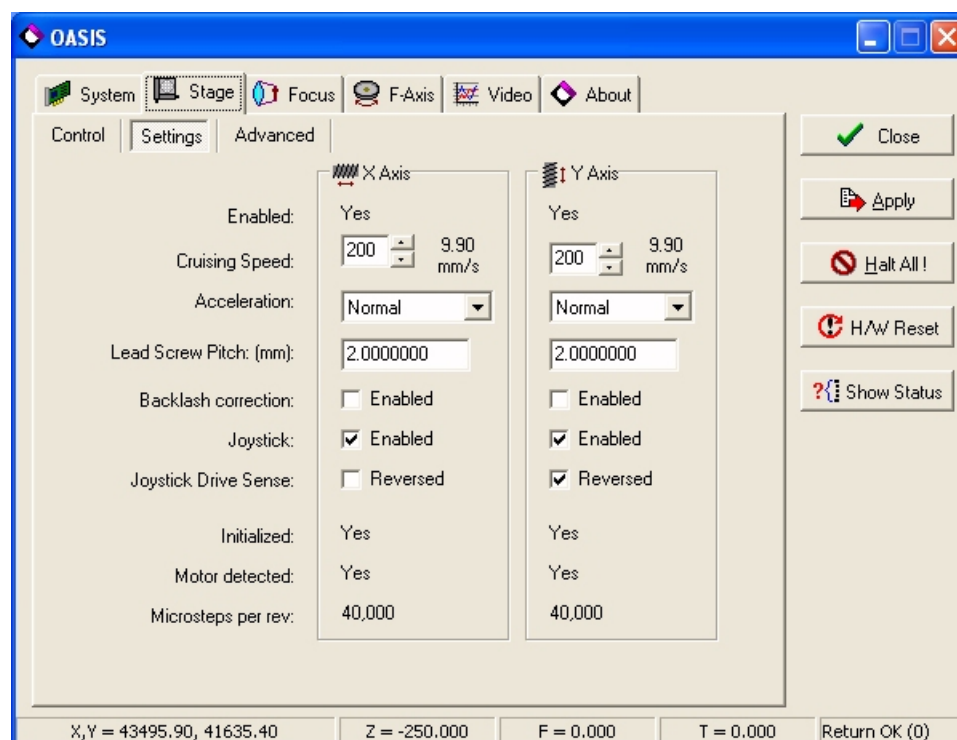


Figure 24. OASIS stage settings.

Use the Apply button in the OASIS application right-hand button group to apply your changes.

| Setting | Description |
|-----------------------------|--|
| <i>Enabled</i> | The axis is present and available for use. |
| <i>Cruising speed</i> | The index in the current acceleration ramp table to be used as the target speed. The actual speed in mm/sec is also displayed. |
| <i>Acceleration</i> | The currently selected acceleration ramp table. Four tables are available: Slow, Normal, Fast, and User |
| <i>Lead screw pitch</i> | The displacement per revolution of the axis, in mm. |
| <i>Backlash correction</i> | Enables backlash correction, ensuring the end point of each movement is approached from the same direction. This is achieved by slightly overshooting the desired position when moving in one direction, then returning to the position from the opposite direction. Movements from the opposite direction are unaffected. The amount of overshoot is specified in the flash memory and can be set using the OASIS Flash Memory Setup application. |
| <i>Joystick</i> | Enables control of the axis via joystick inputs. |
| <i>Joystick drive sense</i> | Reverses the direction of movement for joystick deflections. |
| <i>Initialized</i> | Indicates whether the coordinate system of the axis has been defined. |
| <i>Motor detected</i> | Indicates whether a motor has been detected on the axis. |
| <i>Microsteps per rev</i> | Indicates the current microstepping resolution for the axis. |

Stage Advanced

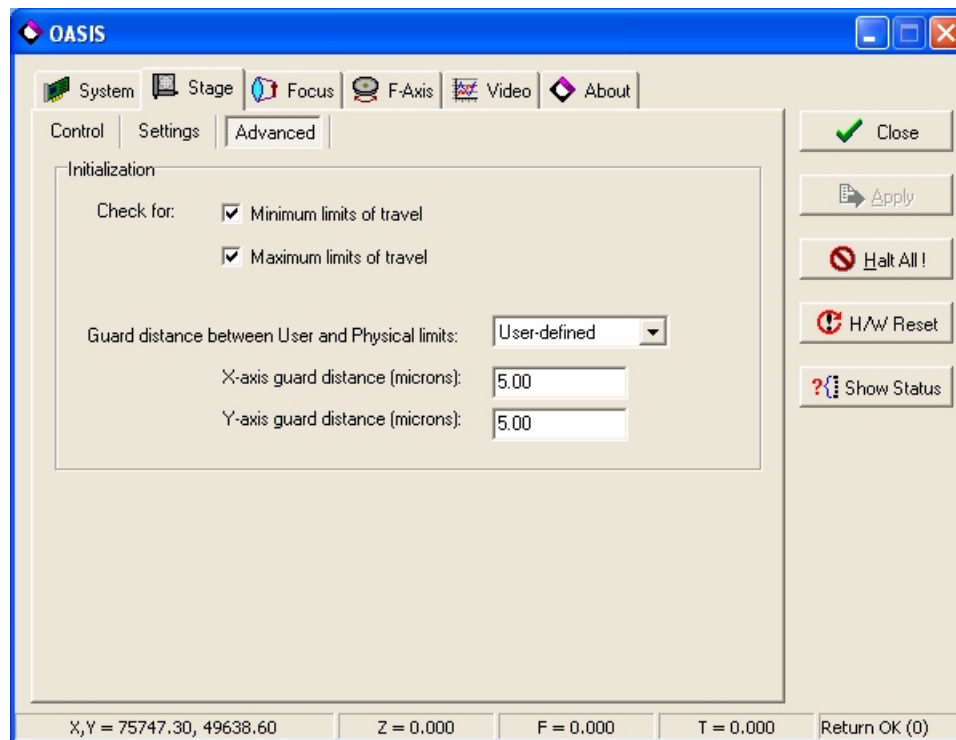


Figure 25. OASIS stage settings.

Use the Apply button in the OASIS application right-hand button group to apply your changes.

| Setting | Description |
|---------------------------------|---|
| <i>Minimum limits of travel</i> | The stage will travel to the minimum limits of travel during initialisation. |
| <i>Maximum limits of travel</i> | The stage will travel to the maximum limits of travel during initialisation. |
| <i>Guard distance...</i> | Indicates whether an automatic or user-defined distance is used for setting of software limits inside the physical limits to act as a guard region. |
| <i>X-axis guard distance</i> | The user-defined guard distance for the X axis, in microns. |
| <i>Y-axis guard distance</i> | The user-defined guard distance for the Y axis, in microns. |

OASIS Focus Page

Z-axis control and settings are available in the Focus page.

Focus Control

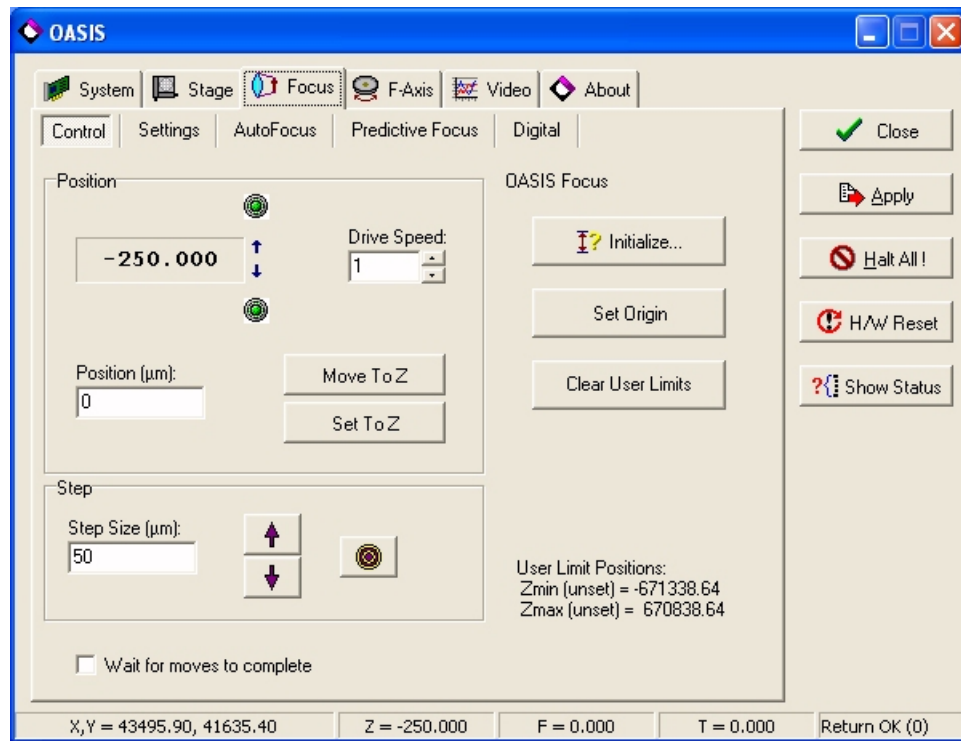


Figure 26. Focus control.

| Item | Description |
|---------------------------|--|
| <i>Z-position readout</i> | Readout of the current focus position, with LED indication of proximity to limit (yellow is close, red means at limit). Small arrows permit continuous drive using Drive Speed setting when pressed. |
| <i>Drive speed</i> | The continuous Z-axis drive speed when using small arrows on position display. |
| <i>Position</i> | Indicates value to use for Move to Z and Set to Z commands. |
| <i>Move to Z</i> | Moves to the Z position as specified by Position, in microns. |
| <i>Set to Z</i> | Sets the current Z position to the value as specified by Position, |

| Item | Description |
|-----------------------------------|---|
| | in microns. |
| <i>Step Size</i> | Indicates the step distance for relative moves using the up/down arrow buttons, in microns. |
| <i>Up/down arrow buttons</i> | Moves the Z in the positive and negative directions by a relative amount given by the Step Size, in microns. |
| <i>Bull's eye</i> | Moves the Z axis to the origin (zero) position. |
| <i>Initialize</i> | Prompts to initialize the Z axis by defining the current position as zero and setting soft limits to provide a limited range of travel above and below the current position. |
| <i>Set Origin</i> | Sets the current position to zero, while maintaining the relative position of the soft limits. |
| <i>Clear User Limits</i> | Disables the soft limits on the focus drive. Note that without appropriate soft limits, it may be possible to damage your equipment when driving the focus too far up or down. |
| <i>Wait for moves to complete</i> | When checked, the application will wait until the move is finished before permitting further action in the Focus page. |

Focus Settings

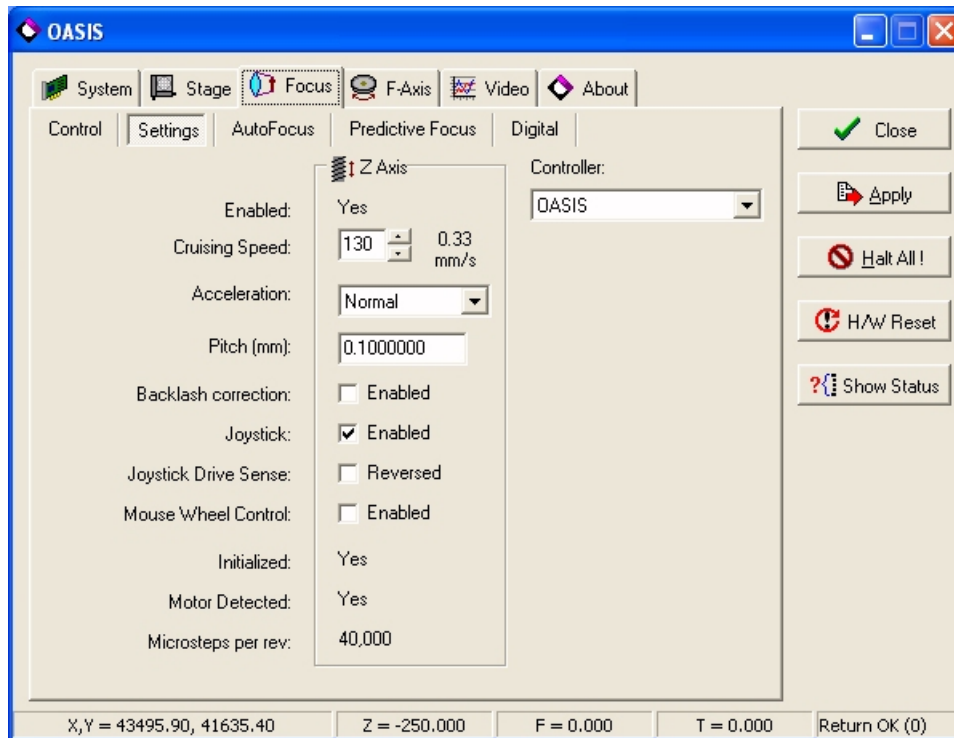


Figure 27. Focus settings.

| Setting | Description |
|----------------------------|--|
| <i>Enabled</i> | The axis is present and available for use. |
| <i>Cruising speed</i> | The index in the current acceleration ramp table to be used as the target speed. The actual speed in mm/sec is also displayed. |
| <i>Acceleration</i> | The currently selected acceleration ramp table. Four tables are available: Slow, Normal, Fast, and User |
| <i>Lead screw pitch</i> | The displacement per revolution of the axis, in mm. |
| <i>Backlash correction</i> | Enables backlash correction, ensuring the end point of each movement is approached from the same direction. This is achieved by slightly overshooting the desired position when moving in one direction, then returning to the position from the opposite direction. Movements from the opposite direction are unaffected. The amount of overshoot is specified in the flash memory and can be set using the OASIS Flash Memory Setup application. |
| <i>Joystick</i> | Enables control of the axis via joystick inputs. |

| Setting | Description |
|-----------------------------|---|
| <i>Joystick drive sense</i> | Reverses the direction of movement for joystick deflections. |
| <i>Mouse wheel control</i> | Allows the wheel on your computer's mouse to be used to move the focus drive. |
| <i>Initialized</i> | Indicates whether the coordinate system of the axis has been defined. |
| <i>Motor detected</i> | Indicates whether a motor has been detected on the axis. |
| <i>Microsteps per rev</i> | Indicates the current microstepping resolution for the axis. |
| <i>Controller</i> | Allows selection for the type of focus drive controller. The OASIS software supports other focus controllers besides the OASIS, including microscopes using the Leica DM SDK and the Olympus BX-61. |

Autofocus

If the OASIS-AF video processing module is fitted, then the Autofocus page will be available, allowing setup and execution of automatic focus operations.

The principle of automatic focus using the OASIS-AF is based on the video-rate *focus score* produced by the OASIS-AF module. The focus score is based on the sharpness of edges in the image present in the video signal. As detail in the image becomes sharper, the focus score increases. As the detail loses sharpness, the focus score decreases. Automatic focus involves maximizing the focus score as a function of the focus position.

The actual autofocus operation may operate by continuously driving the focus over a range, by making discrete steps over a range, or by using a “hunting” operation where the focus is stepped towards the maximum to find the local peak.

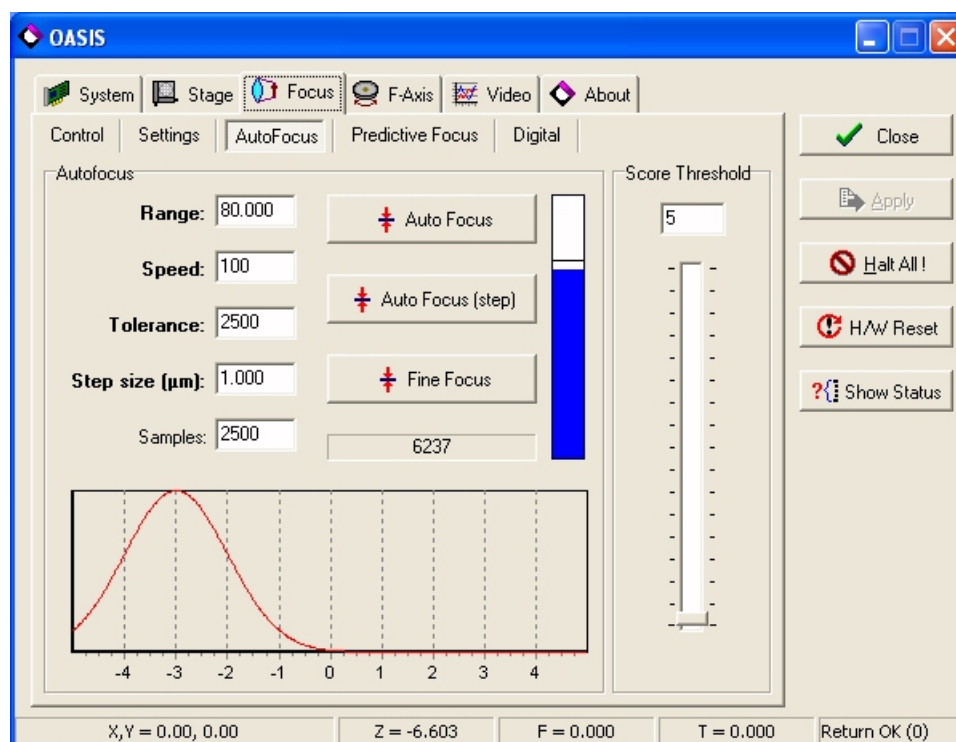


Figure 28. OASIS-AF video autofocus.

| Item | Description |
|--------------------------|--|
| <i>Auto Focus</i> | Performs a focus operation by continuously driving the focus through a given range using the specified speed and tolerance values. |
| <i>Auto focus (step)</i> | Performs a focus operation by making discrete steps through the given range using the specified speed and tolerance values. |
| <i>Fine Focus</i> | Performs a focus operation by hunting of the local focus. The focus is stepped by a given step size, and the focus score is measured. This process is repeated until the local peak of the focus score is identified. |
| <i>Range</i> | Specifies the range of travel over which the focus is to travel when performing the autofocus. |
| <i>Speed</i> | Specifies the cruise speed to be used during the autofocus operation. Since the video input uses a fixed frame rate, faster speed settings result in fewer samples and less precision. Slow speeds result in more samples and more precision. |
| <i>Tolerance</i> | <p>A tolerance that guides the autofocus operation in what to consider a valid peak. Lower values make the algorithm more sensitive to small variations in the focus score.</p> <p>For example, to work out an appropriate value for the autofocus <i>Tolerance</i>, set up your range, speed and <i>Threshold</i></p> |

| Item | Description |
|------------------------|---|
| | parameters on a typical sample until you are happy with the speed, accuracy and reliability. Then compare the difference between the focus score value at the best focus position with that at one end of your focus range (i.e., the minimum focus score value). If you have a reasonable amount of detail in your image you will probably find that this difference is quite a large number. A good suggestion for the starting <i>Threshold</i> value would be about 1/10th of the difference in focus scores. This means that if the difference between maximum and minimum focus score values falls below this <i>Tolerance</i> value, then the focus position will return to its starting point. This is useful for preventing focus 'creep' on blank fields of view. |
| <i>Step size</i> | Specifies the step size to use for the <i>Auto Focus (step)</i> and <i>Fine Focus</i> methods. |
| <i>Samples</i> | Specifies the number of focus score samples that are to be taken at each location during the <i>Fine Focus</i> . The samples are averaged to produce the score at each location. The higher the samples, the less noise in the video signal will affect the result. |
| <i>Score Threshold</i> | The focus score threshold reduces the effect of noise on the focus score value. As the threshold is increased, the score is scaled such that the actual score is decreased. This helps ensure only strong peaks in the focus score profile are considered. |
| <i>Score Plot</i> | Displays the measured focus score vs. position profile from the last auto focus operation. |

Predictive Focus

Predictive focus is a feature available in the OASIS controller whereby the plane of focus relative to the XY movement is used to continuously maintain proper focus.

The plane is set up by measuring three sets of X, Y, and Z values indicating the in-focus Z position at each XY location. The OASIS controller uses these nine values to solve the plane of focus. Thereafter the predictive focus may be enabled, providing continuous maintenance of the predicted focus position for the current XY location, including throughout movements made via software or during joystick operations.

A commanded move of the focus, by software or joystick action, will disable the continuous predictive focus. However, the plane of focus is still stored so that predictive focus can be re-enabled when needed without re-measuring the three sets of XYZ locations.

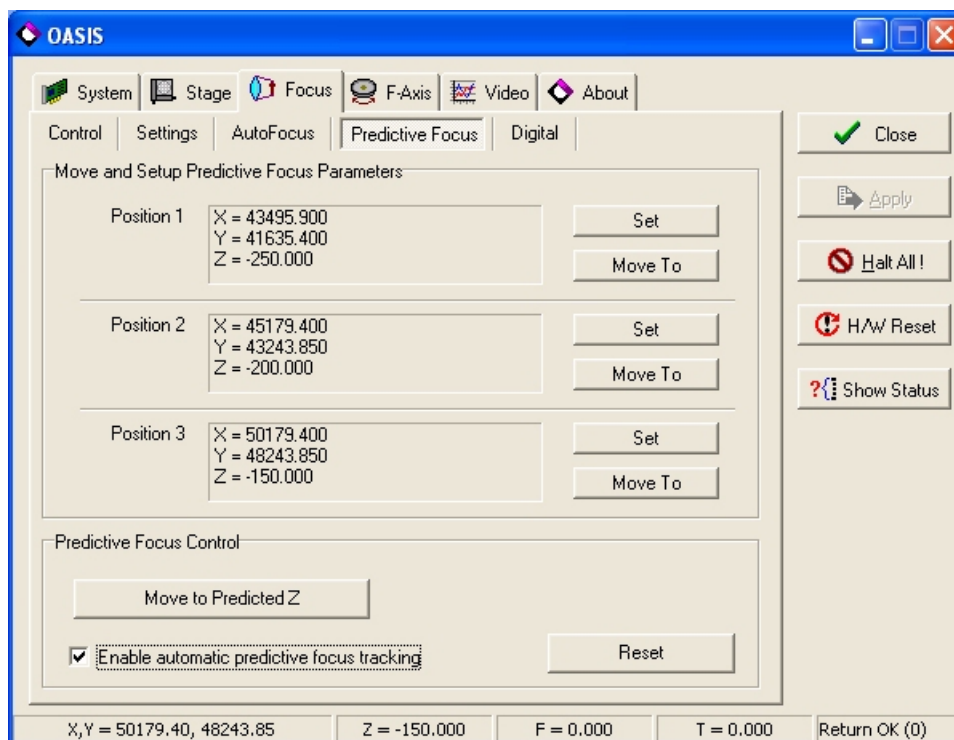


Figure 29. Predictive Focus setup and control.

| Item | Description |
|---|--|
| <i>Position 1</i> | Sets the first set of XYZ locations to be used for predictive focus. Use the associated Set button to read and store the current XYZ position as Position 1. Use the Move To button to return to this position after it has been set. |
| <i>Position 2</i> | Sets the second set of XYZ locations to be used for predictive focus. Use the associated Set button to read and store the current XYZ position as Position 2. Use the Move To button to return to this position after it has been set. |
| <i>Position 3</i> | Sets the third set of XYZ locations to be used for predictive focus. Use the associated Set button to read and store the current XYZ position as Position 3. Use the Move To button to return to this position after it has been set. |
| <i>Move to Predicted Z</i> | Moves to the predicted Z position for the current XY location. |
| <i>Enable automatic predictive focus tracking</i> | When enabled, the focus will continuously track the predicted Z position. |
| <i>Reset</i> | Clears the predictive focus setup. |

OASIS F-Axis Page

The F-Axis of the OASIS is often used for filter wheels, but can be used in other applications such as for the control of zoom lenses that use stepper motors. The F-Axis pages in the OASIS application provide control and settings for the F-Axis. Also, a Filter page permits setup, initialization, and control of a typical motorized filter wheel.

F-Axis Control

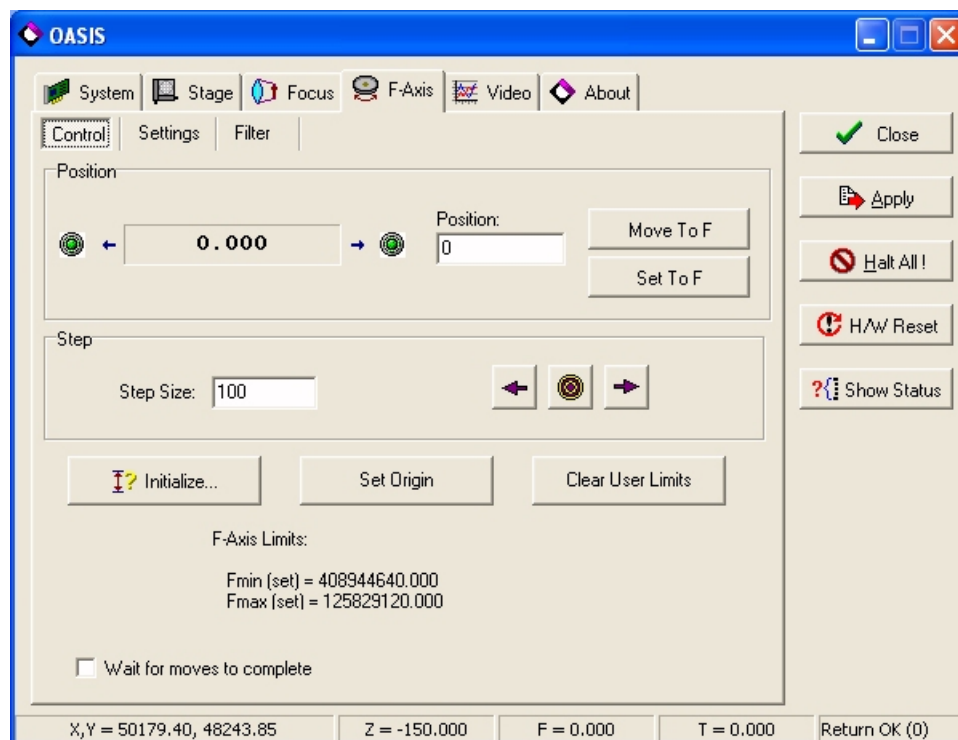


Figure 30. F-Axis control.

| Item | Description |
|---------------------------|---|
| <i>F-position readout</i> | Readout of the current F-Axis position, with LED indication of proximity to limit (yellow is close, red means at limit). Small arrows permit continuous drive using Drive Speed setting when pressed. |
| <i>Position</i> | Indicates value to use for Move to F and Set to F commands. |
| <i>Move to F</i> | Moves to the F position as specified by Position, in calibrated units. |
| <i>Set to F</i> | Sets the current F position to the value as specified by Position, |

| Item | Description |
|-----------------------------------|---|
| | in calibrated units. |
| <i>Step Size</i> | Indicates the step distance for relative moves using the up/down arrow buttons, in calibrated units. |
| <i>Up/down arrow buttons</i> | Moves the F in the positive and negative directions by a relative amount given by the Step Size, in calibrated units. |
| <i>Bull's eye</i> | Moves the F axis to the origin (zero) position. |
| <i>Initialize</i> | Prompts to initialize the F axis by defining the current position as zero and setting soft limits to provide a limited range of travel above and below the current position. |
| <i>Set Origin</i> | Set's the current position to zero, while maintaining the relative position of the soft limits. |
| <i>Clear User Limits</i> | Disables the soft limits on the focus drive. Note that without appropriate soft limits, it may be possible to damage your equipment when driving the focus too far up or down. |
| <i>Wait for moves to complete</i> | When checked, the application will wait until the move is finished before permitting further action in the F-Axis page. |

F-Axis Settings

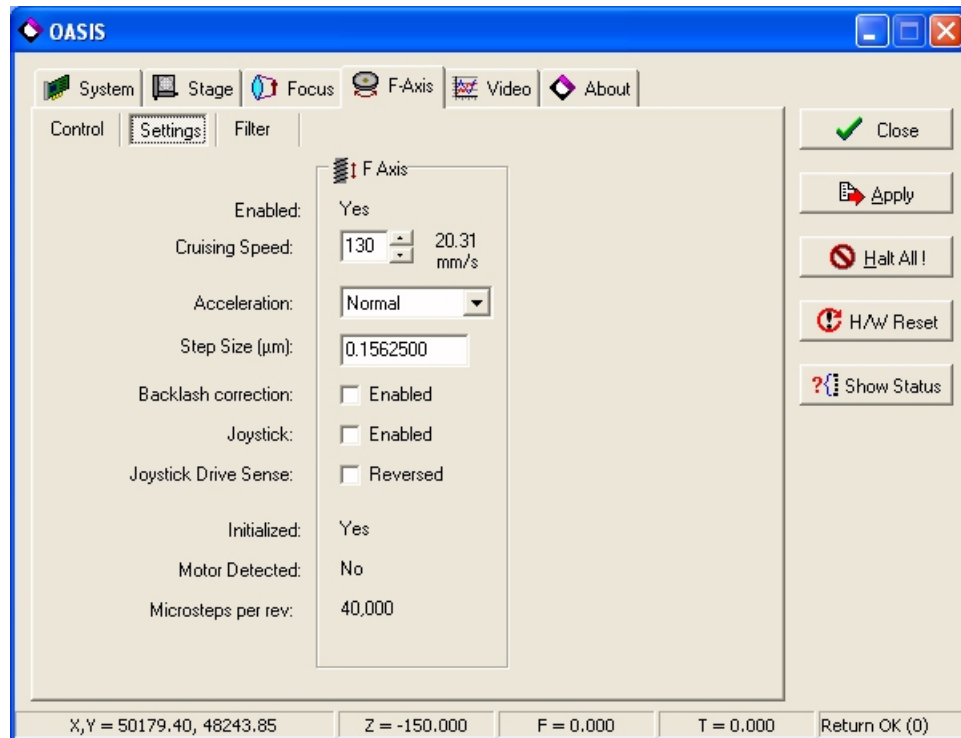


Figure 31. F-Axis settings.

| Setting | Description |
|----------------------------|--|
| <i>Enabled</i> | The axis is present and available for use. |
| <i>Cruising speed</i> | The index in the current acceleration ramp table to be used as the target speed. The actual speed in mm/sec is also displayed. |
| <i>Acceleration</i> | The currently selected acceleration ramp table. Four tables are available: Slow, Normal, Fast, and User |
| <i>Step Size</i> | Specifies the size of each microstep for the F-Axis. |
| <i>Backlash correction</i> | Enables backlash correction, ensuring the end point of each movement is approached from the same direction. This is achieved by slightly overshooting the desired position when moving in one direction, then returning to the position from the opposite direction. Movements from the opposite direction are unaffected. The amount of overshoot is specified in the flash memory and can be set using the OASIS Flash Memory Setup application. |
| <i>Joystick</i> | Enables control of the axis via joystick inputs (if available). |

| Setting | Description |
|-----------------------------|--|
| <i>Joystick drive sense</i> | Reverses the direction of movement for joystick deflections for F-Axis control (if available). |
| <i>Initialized</i> | Indicates whether the coordinate system of the axis has been defined. |
| <i>Motor detected</i> | Indicates whether a motor has been detected on the axis. |
| <i>Microsteps per rev</i> | Indicates the current microstepping resolution for the axis. |

Filter Control

The F-Axis is often used for filter wheel control, and the OASIS application provides an implementation of a filter changer on the F-Axis (as well as an implementation of a second changer on the OASIS-XA1 5th axis module, if fitted).

Typically a filter wheel is free to move through 360 degrees, but contains a home switch allowing the current position to be determined after an initialization where the home switch position is identified.

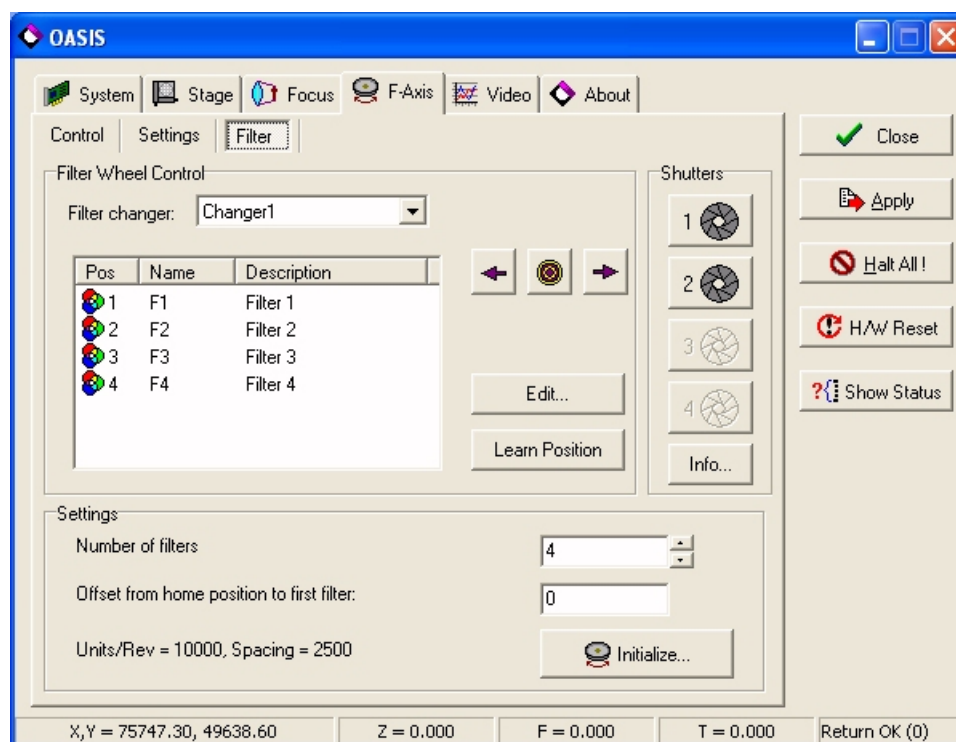


Figure 32. Filter control.

| Item | Description |
|--|--|
| <i>Filter changer</i> | Selects which filter changer is active. For the OASIS, the F-Axis is Changer 1. If the OASIS-XA1 module is fitted, then a second filter changer will be available. |
| <i>Filter list</i> | Lists the name and description of each filter in the filter wheel. |
| <i>Left/Right arrows</i> | Moves the filter changer to the previous and next filter position. |
| <i>Edit</i> | Allows the name and description of the current filter to be set. |
| <i>Learn Position</i> | Sets the currently selected filter's position to the current value for the F-Axis. |
| <i>Number of filters</i> | Specifies the number of filter positions in the filter wheel. |
| <i>Offset from home position to first filter</i> | Specifies the distance, in calibrated units, between the position and the home switch. This value is often either zero or half the filter spacing. |
| <i>Units/rev</i> | Indicates the number of calibrated units per revolution, based on the filter initialization. |
| <i>Spacing</i> | Indicates the spacing between filters, in calibrated units. |
| <i>Initialize</i> | Homes the filter wheel. The <i>Units/rev</i> value will be updated based on the home position data. |
| <i>Shutters</i> | Control the shutter channels of the OASIS-blue or OI-SC4 shutter controller. |

OASIS Video Page

If the OASIS-AF video processing module is fitted, the Video page of the OASIS application will display advanced features available for video measurement and settings.

In addition to focus score calculation used for automatic focus, the OASIS-AF module performs basic image analysis functions on the video image. These include: dual thresholding of light and/or dark features, total detected area, maximum chord length, and maximum gradient values.

Applications for the video-rate measurements of the OASIS-AF include blank field detection for pre-screening of fields during high throughput screening.

Video Control

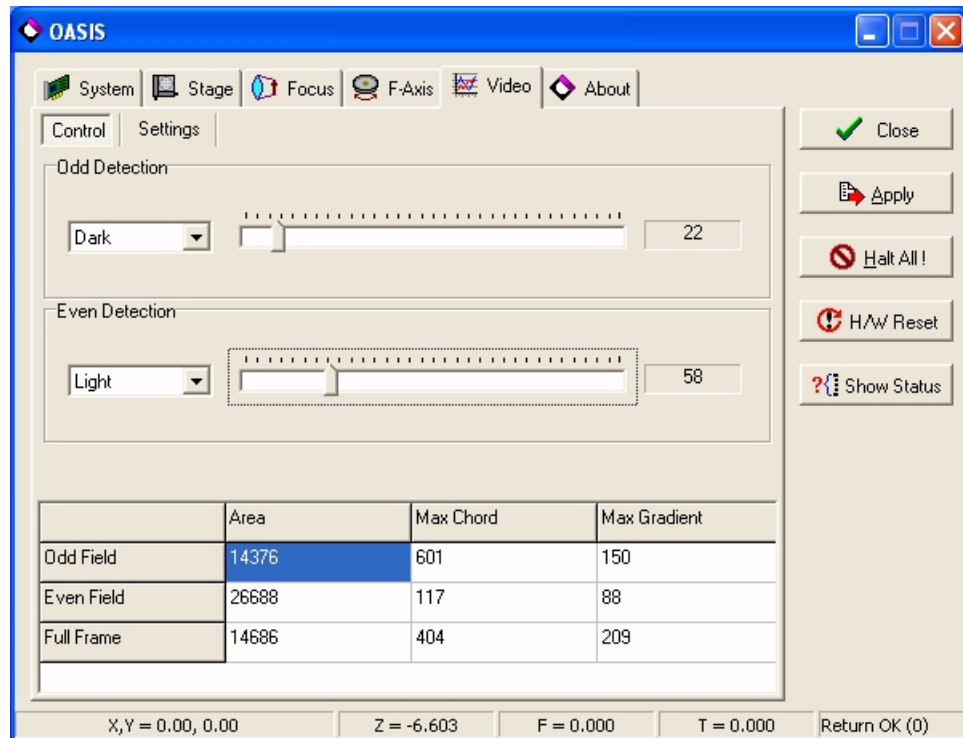


Figure 33. OASIS-AF video processing.

| Item | Description |
|-----------------------|---|
| <i>Odd Detection</i> | Specifies the phase (light or dark) and threshold value for the odd video lines. Light thresholding occurs from the specified threshold to maximum white (255). Dark thresholding occurs from minimum dark (0) to the specified threshold. |
| <i>Even Detection</i> | Specifies the phase (light or dark) and threshold value for the even video lines. Light thresholding occurs from the specified threshold to maximum white (255). Dark thresholding occurs from minimum dark (0) to the specified threshold. |
| <i>Odd Field</i> | Displays the odd field video measurement results for the Area (pixel count), Mac Chord (pixel length), and Mac Gradient (8-bit grey value). |
| <i>Even Field</i> | Displays the even field video measurement results for the Area (pixel count), Mac Chord (pixel length), and Mac Gradient (8-bit grey value). |

Full Frame

Displays the combined even and odd field video measurement results for the Area (pixel count), Mac Chord (pixel length), and Mac Gradient (8-bit grey value).

Video Settings

The OASIS-AF module supports a moveable rectangular region of interest. This window selects the area where focus score and video measurements are to take place.

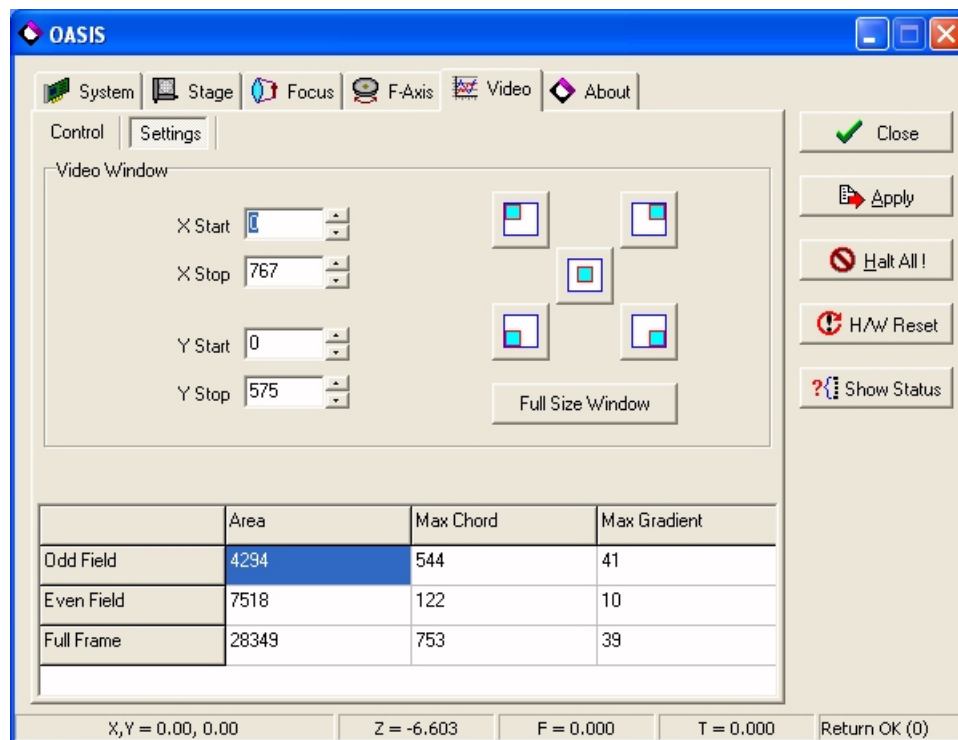


Figure 34. OASIS-AF video window settings.

| Item | Description |
|-------------------------------|---|
| <i>X Start</i> | Specifies the left edge of the video window, in pixels. |
| <i>X Stop</i> | Specifies the right edge of the video window, in pixels. |
| <i>Y Start</i> | Specifies the top edge of the video window, in pixels. Note that this value must be less than the mid-point of the vertical dimension of the image. |
| <i>Y Stop</i> | Specifies the bottom edge of the video window, in pixels. |
| <i>Frame quadrant buttons</i> | Moves the video window to quadrants upper-left, upper-right, |

| Item | Description |
|-------------------------|--|
| | lower-left, lower-right, and centred. |
| <i>Full Size Window</i> | Sets the video window to the full size of the video image. |

OASIS About Page

The OASIS application About page displays version information for the OASIS application, as well as the onboard firmware for the OASIS controller, including DSP and EPROM revision data.

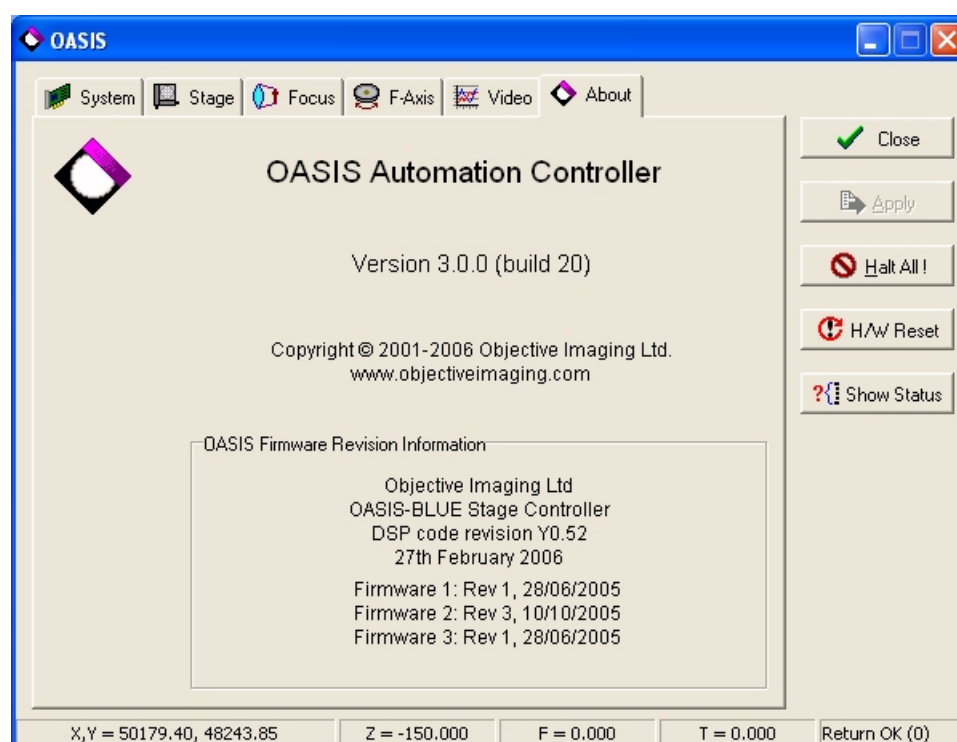


Figure 35. OASIS version information.

FLASH MEMORY

The on-board flash memory of the OASIS controller stores information in a permanent format and is used to customise the configuration of the controller to particular situations. The settings stored in flash represent fundamental parameters that are infrequently altered except when optimising the controller for the various hardware options that have been connected to it.

The executable code that runs the DSP on the OASIS is also stored in flash memory, allowing for simple upgrades from time to time as new versions are released.

The OASIS Configuration Wizards write many of the settings used in the flash based on automatic detection and user input of hardware configuration settings. As various settings are actually interdependent (such as axis and limit directions, microstepping resolution and ramp tables, etc.), it is recommended that you use the OASIS Configuration Wizards where possible to setup the OASIS controller for your particular system.

For advanced configuration, the Flash Memory Setup application is used.

Flash Memory Organization

The Flash memory is divided up into several blocks, three of which are dedicated to configuration settings. The upper-most block (block 7), contains the factory pre-set default settings, much like the default settings of a PC BIOS, which are thought to be the most general purpose and safe settings. Block 7 may not be changed by the user. Block 5 (the user block) is initially programmed with the same settings as found in block 7, the factory presets. However, some of the settings in this block are usually altered by the user to suit their needs. Block 6 is used as temporary storage whilst programming is underway, so that a copy of the user block is available in the event of failure whilst programming (for example, due to power failure).

The lower blocks of flash memory store the DSP code, and are accessible only during updates of the DSP software from the DSP update utility or via the Flash Memory Setup application.

Using the Flash Memory Setup Application

The OASIS Flash Memory Setup application is used to view and modify the settings stored in the user block of flash settings (Figure 36).

On the left is a panel that groups the settings into categories:

- General settings for each axis and miscellaneous items such as joystick type.
- Ramp LUTs list the details of each acceleration ramp.
- Sine-Cosine LUTs defining the actual motor drive microstepping tables.
- Joystick LUT specifying joystick ADC input-to-speed values.

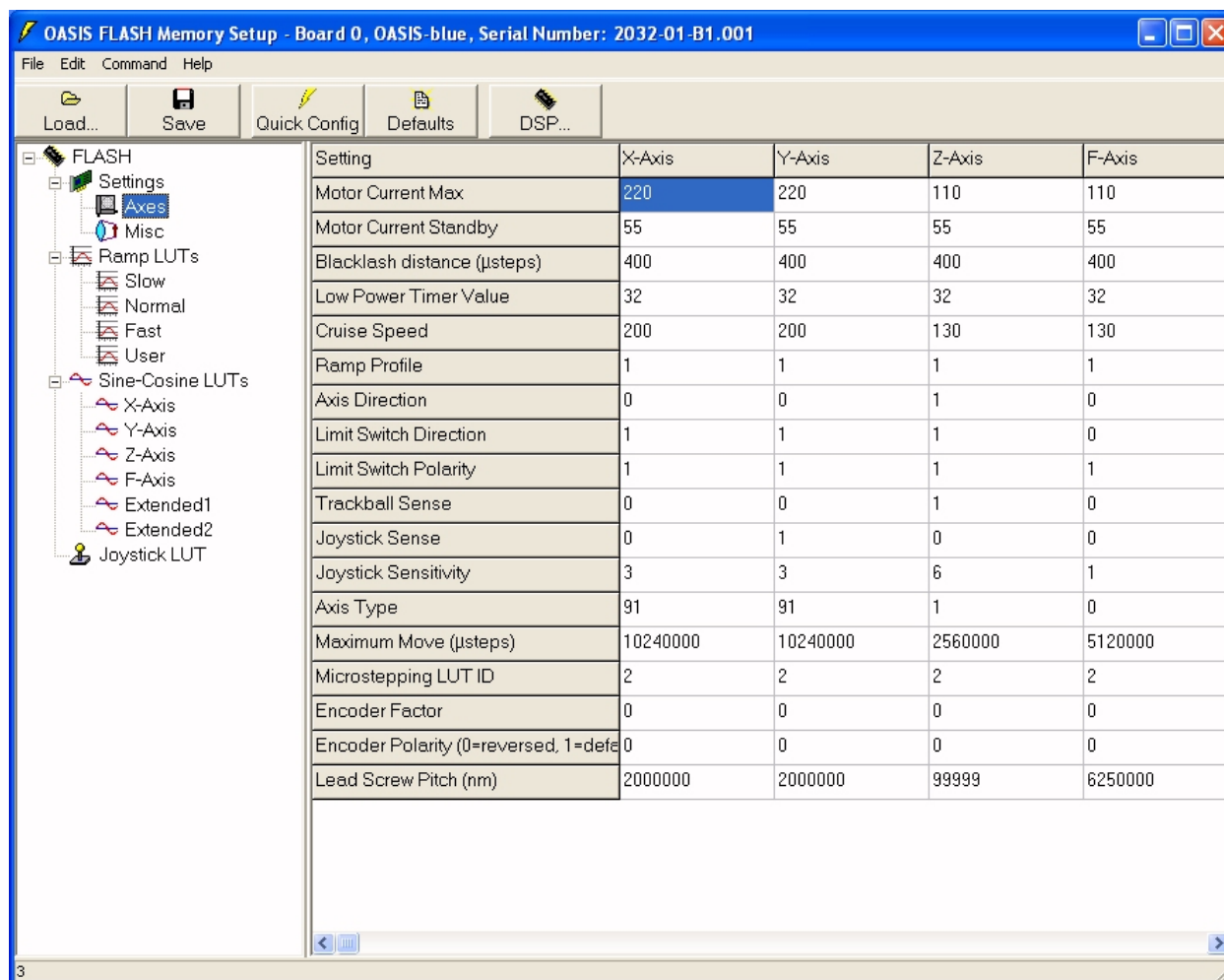


Figure 36. OASIS Flash memory setup application.

Axis Settings

The flash settings for each axis may be set independently by selecting the axis value and entering the desired new value.

Motor Current Max

For each motor (X, Y, Z, and F), you may define the maximum permissible peak current per phase. The maximum value allowed for these settings is 255, which corresponds to a current of 1.25 Amps. The minimum is 0, which corresponds to 0.00 Amps. The relationship is linear such that if a peak current of 0.625 Amps was required, the setting for that axis would be: $0.625/1.25 * 255 = 128$.

We recommend this median value for most small stages. If stalling occurs at high speeds, try a *lower* current setting, if stalling occurs at slow speeds, try increasing the current a little (and possibly a slower acceleration profile).

Motor Current Standby

The motor current standby values follow the same rules as for Motor Current Max. These settings will be used when an axis has been left idle for a defined length of time. Usually these settings are lower than the corresponding 'Motor Current Max.' setting as it is not necessary to keep this current flowing through the motor phases whilst the motor is stationary. This can prevent excessive heat build-up in the motors and the board's output drivers.

Low Power Timer Value

The Low Power Timer settings determine how long it will be, from a motor becoming idle, until the 'Motor Current Standby' settings come into play. A value of 1 corresponds to approximately 32 msec. The maximum value is 65,535 or just over 2000 seconds. The default value is 32 or approximately 1 second.

Backlash Distance (Micro-steps)

For each motor (X, Y, Z, and F), you may define the backlash correction distance. Backlash is enabled or disabled using an application software function. These settings allow you to adjust the amount of correction applied. The maximum value for each setting is 65,535 micro-steps. (There are typically 12,800 micro-steps for every revolution of a 200 step motor.)

Cruise Speed

For each motor (X, Y, Z, and F), you may define the cruising speed (maximum speed). Permissible settings range between 1 and 511. These values correspond to an entry in the 512 location 'Ramp Profile' currently loaded for each axis. Choose settings which give fast, smooth and low noise stage movements. A value of 200 with the normal 'Ramp Profile' is a good starting point for a 2mm/rev lead screw pitch stage.

Ramp Profile

For each motor (X, Y, Z, and F), you may choose from one of four acceleration/deceleration profiles. Permissible settings for each axis are:

| | | |
|---|---|--|
| 0 | - | Slow Ramp Profile |
| 1 | - | Normal Ramp Profile |
| 2 | - | Fast Ramp Profile |
| 3 | - | User Defined Ramp Profile (Currently the same as Normal) |

We recommend a setting of 1 for most applications.

Note: These settings may also be changed under software control.

Axis Direction

For each motor (X, Y, Z, and F), you may choose the direction of rotation that will be regarded as a positive rotation by the software. A value of 0, means a motor shaft will turn clockwise (looking at it from the rear of the motor), for a positive move, and a value of 1, anti-clockwise. This can be useful when trying to match a scan pattern on the screen with what physically happens to the stage, or to accommodate the focus motor being mounted on either side of a microscope.

Please note that it will probably be necessary to change the appropriate 'Limit Switch Direction' setting, described below, if the axis direction setting is altered, as the axis will now drive to the opposite limit switch (if fitted).

Limit Switch Direction

When an axis is moving in the positive direction, only the positive limit switch is checked at every step. Likewise for a move in the negative direction, only the negative limit switch is checked. These settings allow the limit switches for any axis to be swapped over. This is likely to be necessary if the 'Axis Direction' settings are altered, or possibly if some special hardware is being driven.

The usual value is 0. To swap over the limit switches for a given axis, use a value of 1.

Trackball Sense

For the X, Y and Z axes, you may change the direction of movement whilst using the trackball. This is to allow for personal preference and possible 'flipping' of the image in one axis as is the case with some microscopes.

Permissible values for each axis are 0 and 1.

Note: These settings may be changed under software control too.

Joystick Sense

For the X, Y and Z axes, you may change the direction of movement whilst using the joystick. This is to allow for personal preference and possible 'flipping' of the image in one axis as is the case with some microscopes.

Permissible values for each axis are 0 and 1.

Note: These settings may be changed under software control too.

Joystick Sensitivity

For the X, Y and Z axes, you may change the sensitivity of movement whilst using the joystick. This is to suit various lead-screw pitches and magnifications.

Permissible settings for each axis are:

- | | | |
|---|---|--------------------------|
| 0 | - | High speed movement |
| 1 | - | Medium speed movement |
| 2 | - | Slow speed movement |
| 3 | - | Very slow speed movement |

Axis Type

These are intended for reference only and are not currently used.

Maximum Move (Micro-steps)

For each motor (X, Y, Z, and F), you may define the maximum move distance in micro-steps. There are typically 12,800 microsteps for every revolution of a 200 step motor, though other microstepping resolutions are supported.

This is an important safety measure when an axis has no physical limit switches, like several of the available focus adapters. If the controlling software asks the OASIS to move an axis a distance which is greater than the value defined in these settings, then it will refuse to move.

Valid numbers for each axis are from 1 to 2,147,483,648 (2^{31}).

The default settings are 5,120,000 (400 turns), for the X, Y and F axes, and 256,000 (20 turns) for the Z axis.

Miscellaneous Settings

The following video window settings are to allow as much of the cameras field of view as possible, to be used for generating the focus score values and the video data. These may need modifying slightly to suit different camera types.

CCIR Video Window Start X

Horizontal start position offset for CCIR type camera. Default = 32 (2x desired pixel number).

CCIR Video Window Stop X

Horizontal stop position offset for CCIR type camera. Default = 1546 (2x desired pixel number).

CCIR Video Window Start Y

Vertical start position offset for CCIR type camera. Default = 24 (field based).

CCIR Video Window Stop Y

Vertical stop position offset for CCIR type camera. Default = 284 (field based).

RS170 Video Window Start X

Horizontal start position offset for RS170 type camera. Default = 32 (2x desired pixel number).

RS170 Video Window Stop X

Horizontal stop position offset for RS170 type camera. Default = 1546 (2x desired pixel number).

RS170 Video Window Start Y

Vertical start position offset for RS170 type camera. Default = 24 (field based).

RS170 Video Window Stop Y

Vertical stop position offset for RS170 type camera. Default = 284 (field based).

Trackball Autofocus Range 1

When using the Kensington Expert Mouse 5.0 trackball (Part no. 64215), the lower left button repeats the last autofocus command issued, or, one of three predefined autofocus commands, selected by repeated pressing of the lower right button. The autofocus range of the first in the sequence may be adjusted by changing this value. (Values are in micro-steps.)

Permissible values for this setting are between 1000 and 65,535; the default setting is 10,240.

Trackball Autofocus Range 2

The autofocus range of the second in the sequence may be adjusted by changing this value. Permissible values for this setting are between 1000 and 65,535; the default setting is 8,192.

Trackball Autofocus Range 3

The autofocus range of the third in the sequence may be adjusted by changing this value. Permissible values for this setting are between 1000 and 65,535; the default setting is 4,096.

Trackball Autofocus Speed 1

The autofocus speed of the first in the sequence may be adjusted by changing this value. The value is the speed that relates to that position in the currently selected Ramp LUT. Permissible values for this setting are between 1 and 255; the default setting is 128.

Trackball Autofocus Speed 2

The autofocus speed of the second in the sequence may be adjusted by changing this value. The value is the speed that relates to that position in the currently selected Ramp LUT. Permissible values for this setting are between 1 and 255; the default setting is 32.

Trackball Autofocus Speed 3

The autofocus speed of the third in the sequence may be adjusted by changing this value. The value is the speed that relates to that position in the currently selected Ramp LUT. Permissible values for this setting are between 1 and 255; the default setting is 2.

Ramp Profile LUTs

The acceleration ramps used for Slow, Normal, Fast, and User profiles are stored as lookup tables in the OASIS flash memory.

Although individual values may be edited using the Ramp LUTs section in the Flash Memory Setup application, the Flash Memory Setup also provides a tool for generating ramps, found under the Edit menu.

Using the Acceleration Ramp Generator, you can select one of the four ramp tables. The table details and a graphic display are shown. To calculate a new acceleration profile:

1. Select the type of ramp, either linear or S-curve.
2. Define the starting point in the table by entering a start time in microseconds and move distance in microsteps.
3. Define the end target speed in the table by entering a time and microstep distance.

4. Indicate the target cruise index associated with the final point. For instance, a target cruise of 511 indicates the profile should use the last entry of the table as the end-point for the curve. A value of 256 would indicate that the curve should reach the final point at the 256th entry in the table, with the remaining entries taken on the final speed value.
5. To generate the ramp, click the Calculate button.
6. To save the ramp into the flash, click on OK to dismiss the dialog and click the Save button on the main Flash Memory Setup toolbar.

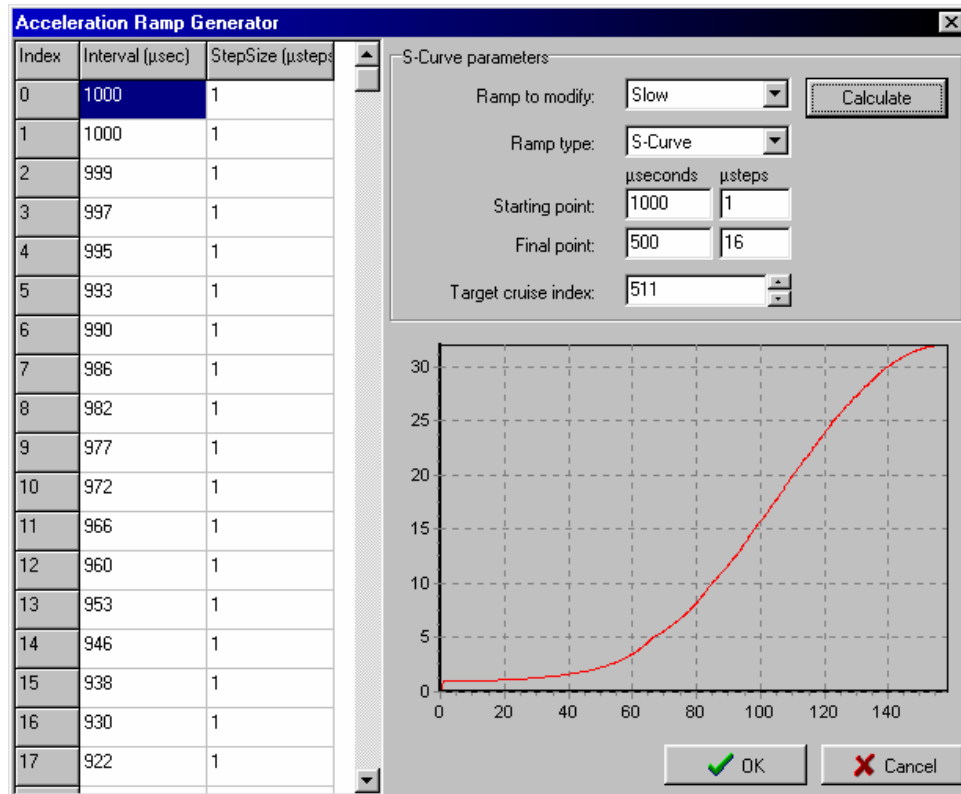


Figure 37. Acceleration ramp generation in the Flash Memory Setup application.

Sine Cosine LUTs

The Sine-Cosine LUTs specify how the microstepping is to take place for each axis. A LUT is available for each axis, as well as two extended tables supporting custom microstepping resolutions.

Note: incorrect setting of the Sine-Cosine LUTs can lead to motor drive problems. Only advanced users should modify these tables.

Joystick LUT

The joystick lookup table specifies how the 8-bit ADC inputs from the joystick unit are translated into speed.

Updating the DSP Code

The code that the DSP on the OASIS board loads on power-up is also stored in other areas of the Flash memory. The Flash Memory Setup application allows the DSP code to be updated in the field, as necessary.

To upgrade it to a later (or earlier) version, first make sure you have a copy of the desired DSP data file, then press the button labelled 'DSP' on the toolbar. Select the data file and the update will proceed. The new code will actually be loaded by the DSP when it is either next reset or powered off and on again.

Axis Settings Menu

Individual axis settings may also be specified by selecting the Axis Settings option under the Edit menu or by double-clicking on the FLASH Settings Axes node on the left pane. Both actions will display the Axis Settings dialog.

Figure 38 shows the Axis Settings dialog, with the Axis selection shown on the left. Clicking on an axis in the list displays the relevant settings in the pages to the right. These pages include:

- Power
- Calibration
- Drive

To change an option, adjust the settings of the axis, selecting between axes as needed. When finished, click OK to update the settings. To save the settings to the OASIS controller Flash memory, click on the Save button in the Flash application's main toolbar.

Axis Power Settings

Each axis may have a maximum power, used when driving the axis, as well as a standby power setting, indicating a holding power that takes effect after a user-defined interval once a movement is complete. (Note that since the motor voltage is normally fixed, e.g., from the +12VDC power input, then power here refers to the current applied to the motors.)

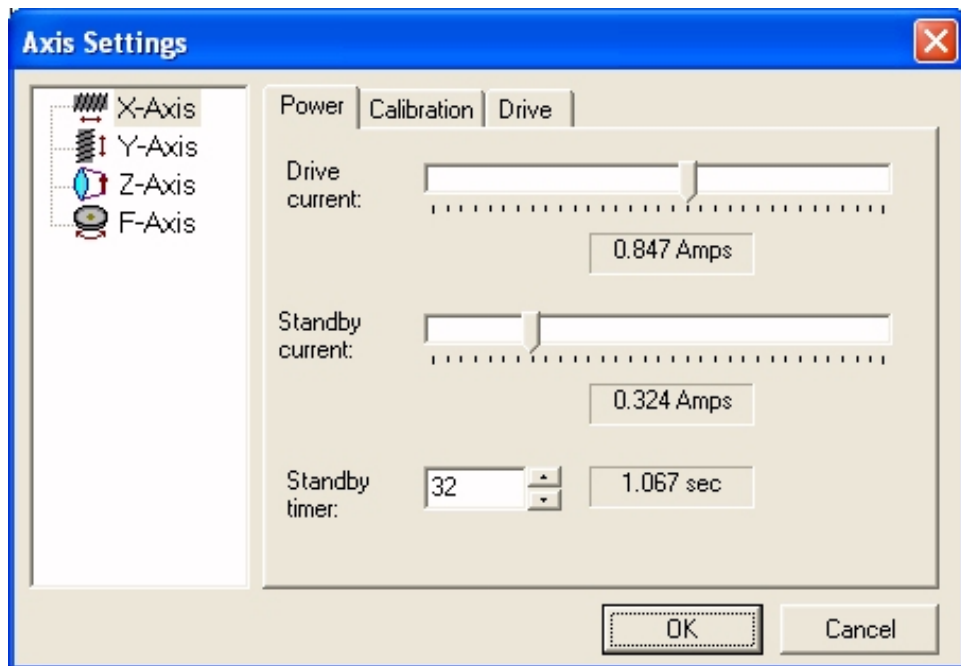


Figure 38. Axis Power Settings dialog.

| Item | Description |
|------------------------|--|
| <i>Drive current</i> | Specifies the maximum drive current to be used for the axis, in Amps. |
| <i>Standby current</i> | Specifies the holding current used when the controller enters standby mode for the axis, in Amps |
| <i>Standby timer</i> | Specifies the timer value to be used when delaying from the end of a move until standby mode is enabled. Each increment is roughly 30 msec in duration. The associated delay time in seconds is shown. |

Axis Calibration Settings

The OASIS controller software library provides calibrated movements when driving an axis. Moves may be specified in microns, with the OASIS library automatically converting the requested distance to microstep distance based on the axis calibration.

Axis calibration is typically specified by the pitch value for the axis, i.e., the distance the axis is expected to travel for one revolution of the motor.

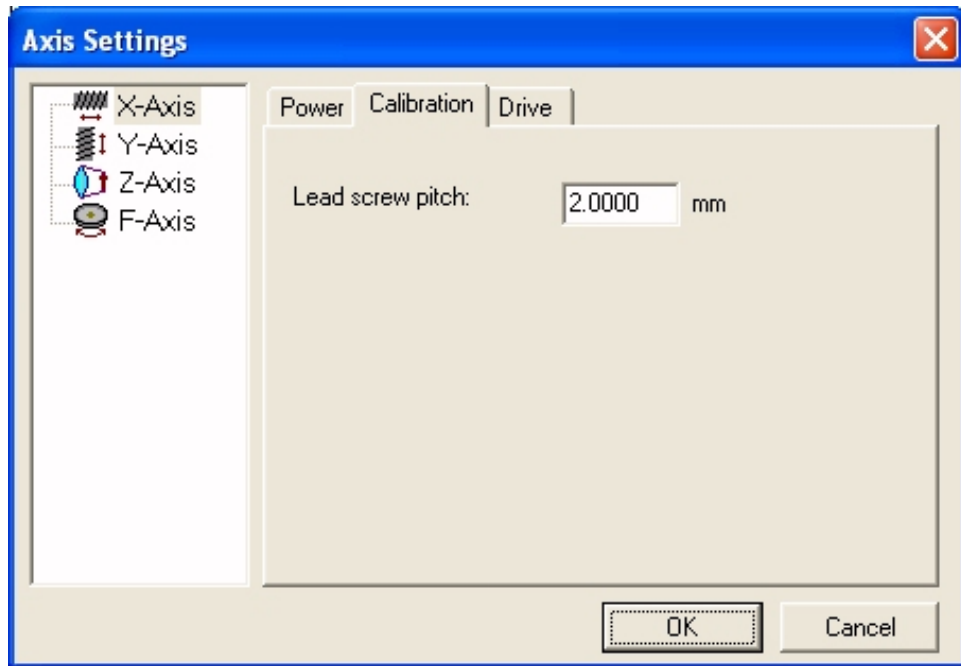


Figure 39. Axis Calibration Settings dialog.

| Item | Description |
|-------------------------|--|
| <i>Lead screw pitch</i> | Specifies the pitch of the axis, i.e., the distance travelled per revolution of the motor, in millimeters. |

Axis Drive Settings

Lower level drive settings indicate which directional sense of positive / negative moves, as well as how the limit switch signals are to be interpreted.

The Axis direction may be reversed, defining the direction through the drive table, and thus the sense of rotation for a given direction. Is a positive move to the left or to the right? The Axis drive direction specifies this.

When driving in a given direction, the OASIS hardware is checking to see if the limit at the end of travel in that direction has been engaged. The limit direction setting specifies which of the limit inputs is associated with a given drive direction.

Limits switch logic may be normally open or closed when engaged, depending on the wiring inside the motorized stage or axis component. The limit polarity is used to specify the type of limit switches fitted.

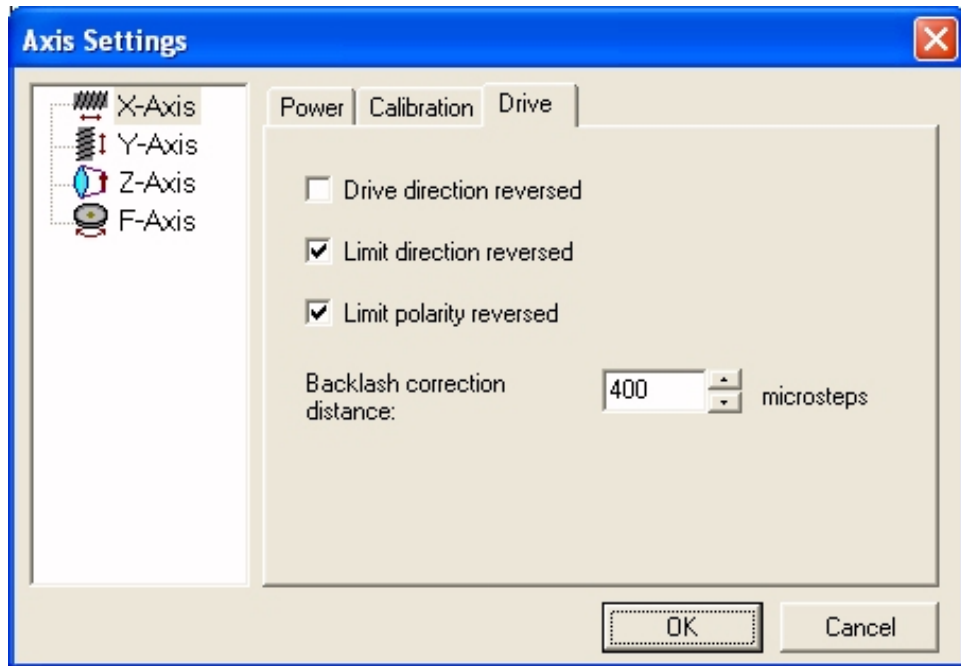


Figure 40. Axis Drive Settings dialog.

| Item | Description |
|-------------------------------------|---|
| <i>Drive direction reversed</i> | Indicates that the axis drive direction is to be reversed. |
| <i>Limit direction reversed</i> | Indicates the limit signals are reversed. |
| <i>Limit polarity reversed</i> | Inverts the polarity of the limit switch, i.e., open vs. closed switch logic. |
| <i>Backlash correction distance</i> | Specifies the amount of backlash correction to apply, in microsteps. |

Configure Microstepping and Encoders Menu

The OASIS controller supports a variety of microstepping resolutions, up to 51,200 steps per rev. Also, when using encoders it is necessary to adjust the microstepping to ensure the proper relationship between the encoder and microstepping counters. The Configure Microstepping and Encoders menu option allows these values to be set.

Configure Microstepping and Encoders

Extended Microstepping Tables

Microsteps for extended table 1: 30000 μsteps / rev

Microsteps for extended table 2: 40000 μsteps / rev

OK Cancel

X-Axis

Microstepping: 40000

☒ Encoder fitted

Encoder Resolution: 0.1 μm

☒ Reverse polarity

Axis pitch: 2.000 mm

Y-Axis

Microstepping: 40000

☒ Encoder fitted

Encoder Resolution: 0.1 μm

☒ Reverse polarity

Axis pitch: 2.000 mm

Z-Axis

Microstepping: 40000

☐ Encoder fitted

Encoder Resolution: 0.1 μm

☒ Reverse polarity

Axis pitch: 0.100 mm

F-Axis

Microstepping: 40000

☐ Encoder fitted

Encoder Resolution: 0.1 μm

☒ Reverse polarity

Axis pitch: 6.250 mm

Figure 41. Configure Microstepping and Encoders dialog.

| Item | Description |
|--------------------------------------|---|
| <i>Extended Microstepping Tables</i> | In addition to the default microstepping table of 12,800 steps/rev, two user-defined extended tables may be created, with the resulting select assigned to an axis. |
| <i>Microstepping</i> | Indicates the microstepping selection for the axis, selected from either of the two extended tables or the default 12,800 steps/rev table. |
| <i>Encoder fitted</i> | Indicates that an encoder feedback mechanism is fitted to the axis. |
| <i>Encoder Resolution</i> | Indicates the resolution of the encoder counter, in microns. This information is combined with the Axis pitch setting to determine the relationship between the microstepping and encoder counters (i.e., the Encoder Factor setting for the controller). |
| <i>Reverse polarity</i> | Indicates that the encoder counter polarity is reversed from the axis drive direction. |
| <i>Axis pitch</i> | Indicates the pitch of the axis, i.e., the distance travelled for each turn of the motor. |

Ramp Generator Menu

A simple means of automatically calculating acceleration ramps is provided using the Ramp Generator menu option under the Edit menu. The ramp generate provides selection of one of the four available ramp tables, with start and ending points for the acceleration curve to be set.

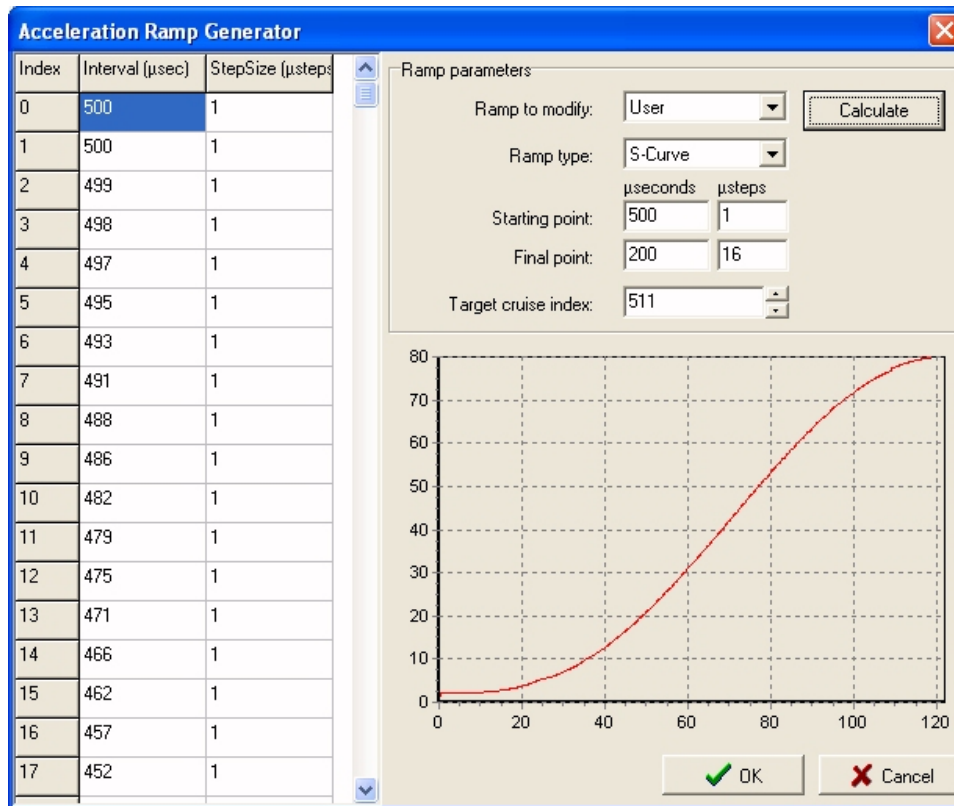


Figure 42. Ramp Generator dialog.

| Item | Description |
|-----------------|--|
| <i>Index</i> | The index in the ramp table, this is also the value used when selecting cruise speed. |
| <i>Interval</i> | The entry's time interval, in microseconds. A value of 500, for instance, indicates a wait period of 500 microseconds after the entry's step size is made. The velocity in microsteps per microsecond at a table entry is the ratio of the StepSize to Interval. |
| <i>StepSize</i> | The entry's step distance, in microsteps. A value of 16, for instance, indicates that the step at location will be a distance of 16 microsteps. The velocity in microsteps per microsecond at a |

| Item | Description |
|----------------------------|--|
| | table entry is the ratio of the StepSize to Interval. |
| <i>Ramp to modify</i> | Specifies which of the four available ramp tables is to be viewed and modified.. |
| <i>Ramp type</i> | Indicates the shape of the velocity curve, either linear for constant acceleration, or S-curve. |
| <i>Starting point</i> | Indicates the first entry in the table, i.e., the initial velocity, defined by the interval in microseconds and step size in microsteps. Typically, you will want the starting point to have a step size of 1 microstep for highest resolution movement. |
| <i>Final point</i> | Indicates the velocity at the target cruise index, i.e., the final velocity of the calculated curve. |
| <i>Target cruise index</i> | Indicates the index desired for then end of the curve. That is, the target cruise specifies at what point in the table the Final point's velocity is attained. If the target cruise is 511, then the entire table contains acceleration data. However, if the target cruise is less than that, say 200, then acceleration only occurs up to index 200, after which movement is at constant velocity. |
| <i>Calculate</i> | Calculates the table's acceleration profile using the indicated values. |



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