

# OASIS-4I CONTROLLER USER GUIDE

Revision 3.2

Objective Imaging Ltd.

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# INTRODUCTION

Thank you for purchasing the OASIS-4i four axis stepper controller for the PCI bus! The OASIS-4i is an advanced, high-performance controller designed for the most demanding imaging and microscopy applications. The  $\frac{3}{4}$  length PCI form factor of the OASIS-4i ensures a highly integrated solution for automation control.

This guide provides an overview of how to physically install the OASIS-4i card into your system, install the required driver software, and configure the controller for your particular setup. Various hardware options for the OASIS-4i card, such as joystick units and plug-in daughter modules, are also described.

Note that your OASIS-4i 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.

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## OASIS-4i Applications

The OASIS-4i 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-4i can be configured to support automated components from a variety of 3<sup>rd</sup> party vendors, and Objective Imaging supplies a range of cabling options that ensure simple connection of the OASIS-4i to a particular configuration.

## Optional components

Various hardware options are available to provide additional functionality, such as:

- Video autofocus, using the OASIS-AF plug-in daughter module
- Digital camera trigger synchronization, using the OASIS-DC1 module, for digital autofocus and fast mosaic imaging

- A 5<sup>th</sup> axis option, using the OASIS-XA1 module, providing for instance a second filter wheel control axis
- RS-422 encoder input interfaces
- Four axis shutter control, using the OI-SC4 external controller
- Two- and three-axis joystick control, as well as specialized support for Leica Microsystems input devices

Figure 1 gives a schematic overview of the OASIS controller family of products.

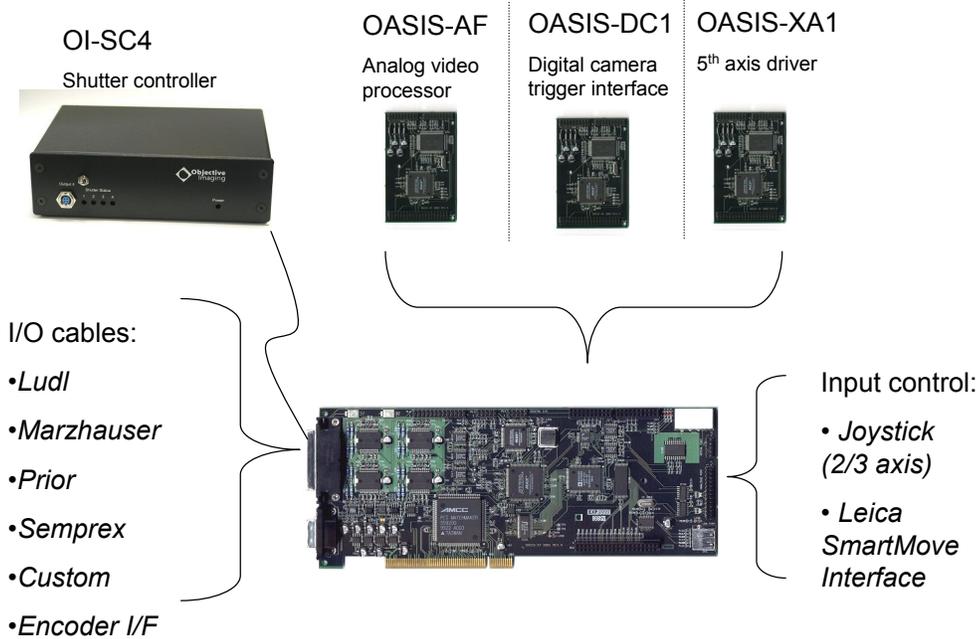


Figure 1. OASIS-4i controller and options.

Details regarding installation and use of the various hardware options are given below in the section *Options and Accessories*.

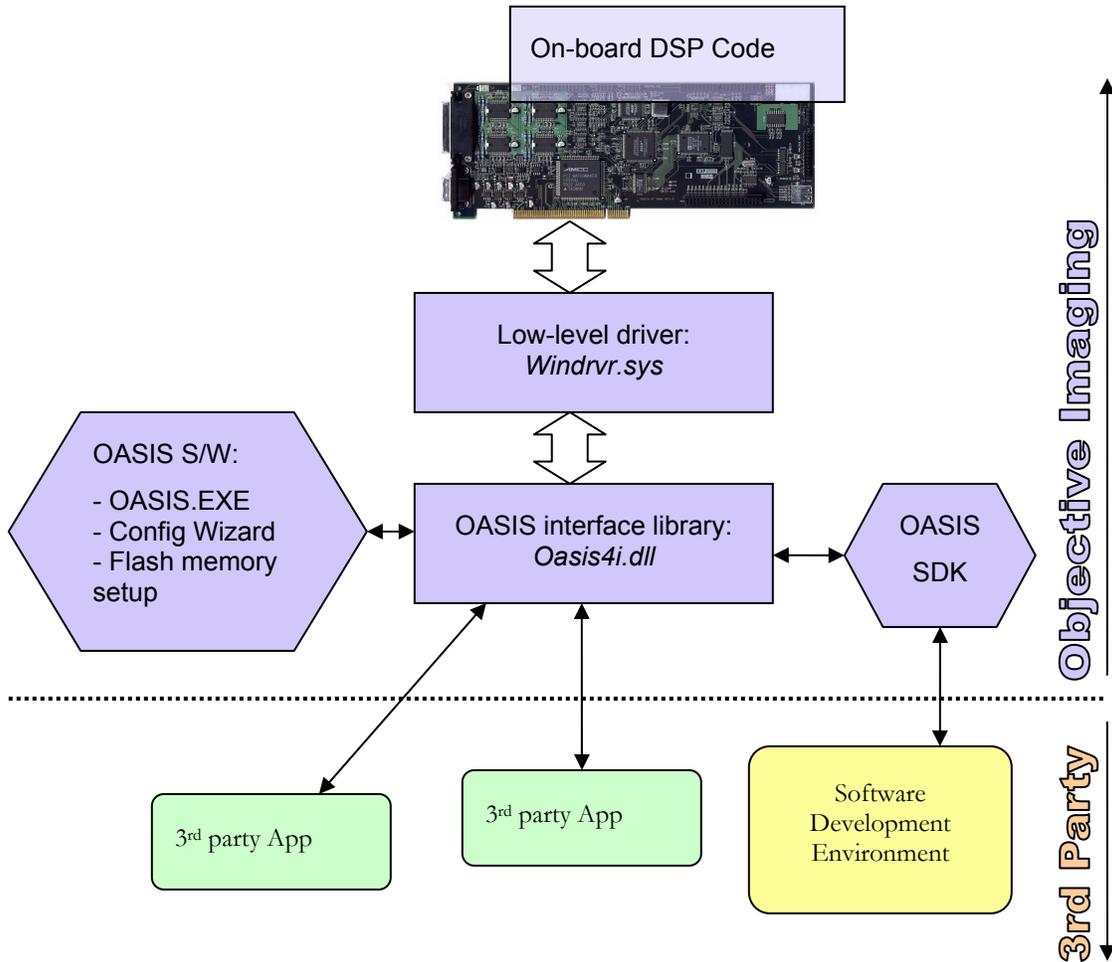
## Software Structure

In addition to the physical hardware items associated with the OASIS-4i 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 3<sup>rd</sup> Party Software/System.** In this scenario, you will be using the OASIS hardware in conjunction with a 3<sup>rd</sup> party application that includes support for the OASIS-4i 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-4i controller.

The figure below illustrates the OASIS software architecture:



You can see there are three critical software components that are used by the OASIS-4i controller:

1. On-board DSP code that provides the fundamental controller functionality.
2. A low-level driver called *Windrvr.sys* that provides PCI communication support between your computer and the OASIS-4i card.
3. The *Oasis4i.dll* dynamic link library (DLL) file that exposes the functionality of the OASIS-4i controller to software applications on your computer.

All three of these components—one on the OASIS-4i card itself and two on the associated Windows PC—make up the necessary foundation for your use of the OASIS-4i 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-4i controller. These include:

- **OASIS Configuration Wizard.** This utility guides you through the fundamental steps of configuring the OASIS-4i controller for your particular hardware setup.
- **OASIS Flash Memory Setup application.** This utility gives you access to the full settings available in the OASIS-4i'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-4i 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-4i 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

## Warning!

This board contains static sensitive components. Please take the necessary precautions when handling and installing the board, to prevent damage or malfunction.

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## Installation Requirements

In order to install the OASIS-4i card into your system, you will need the following:

- PC with one three-quarter length PCI slot available
- Windows® XP or Windows® 2000 operating system
- CD-ROM drive
- One free (hard disk style), power connector, with 2A at 12V available
- Cross-head screwdriver
- OASIS-4i Installation CD

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## Installation Process

The OASIS-4i installation process consists of three distinct steps:

1. **Hardware Installation.** In this step, you will physically place the OASIS-4i 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-4i card to match your particular system setup.

Once these steps are complete, the OASIS-4i card is generally ready for use. However, if you are using a 3<sup>rd</sup> party application, you may need to install additional software so that your application package can use the OASIS-4i 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-4i.

## Connector Identification

Refer to the following diagram for information regarding the various connectors available on the OASIS-4i card.

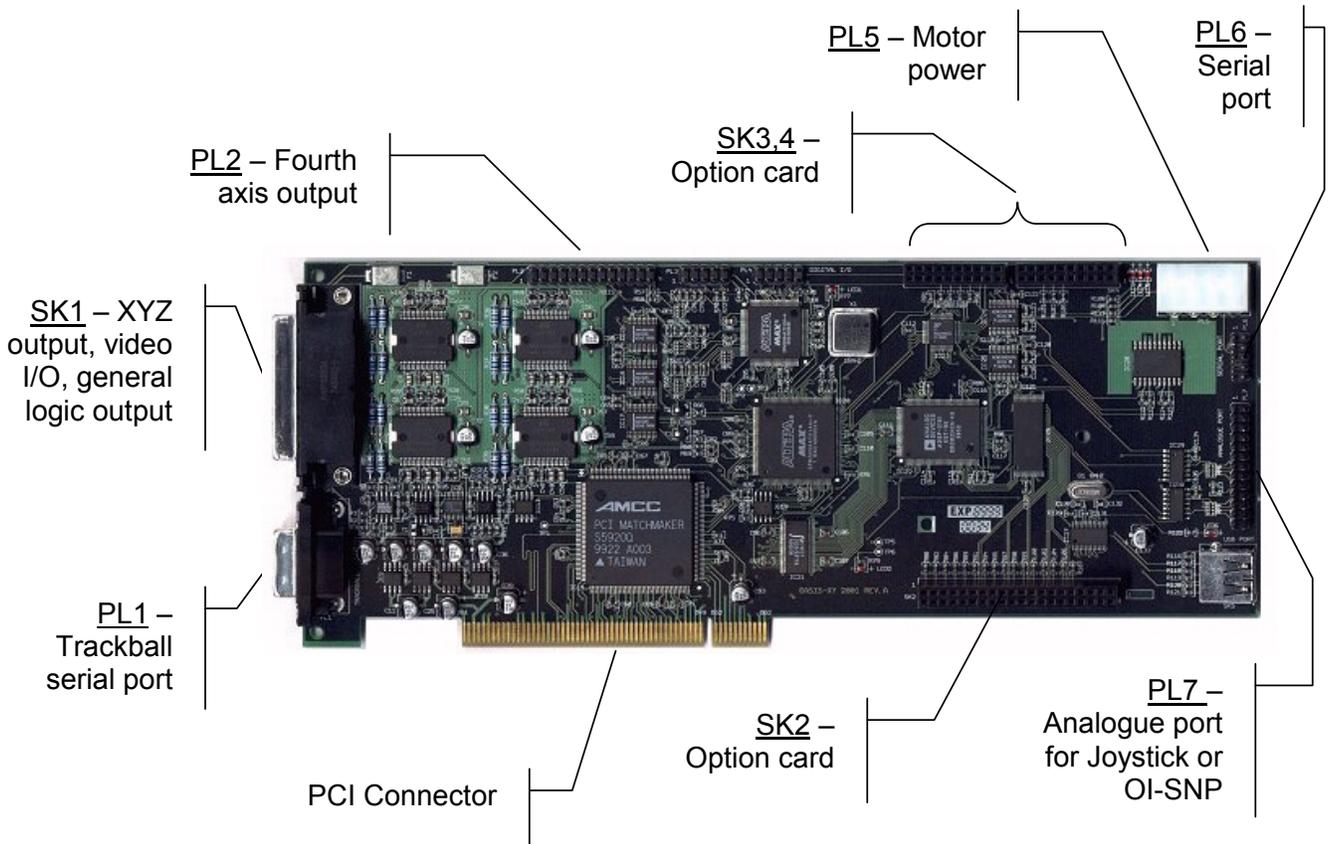


Figure 2. OASIS-4i Connectors.

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# Hardware Installation Procedure

## *Preparing the PC case*

- 1) Switch off the PC and unplug it from the mains to disable any standby power.
- 2) Remove the system unit cover or side panel.
- 3) Select a suitable PCI slot with no obstructions (preferably one with adequate air-flow from the auxiliary fan), and remove blanking panel as necessary.

## *Fitting the card*

- 4) Ground yourself to an antistatic mat or other grounded source to discharge static electricity before handling the board.
- 5) Pick up the board (still in its anti-static sleeve), by grasping the metal edge bracket with one hand, and remove the sleeve.
- 6) Taking care to hold the edges of the board, avoiding contact with the electronic components, position it over the PCI slot and locate the tip of the metal bracket in the slot of the PC chassis, before pushing the board firmly but gently home with a slight rocking action.
- 7) Secure the bracket with a retaining screw.

## *Connecting power and options*

- 8a) If intending to use the 4th axis, you will need to fit an adapter plate to another spare slot and the interconnecting cable to PL2 the 4th axis output. Be careful to attach pin 1 of the ribbon cable (with the red stripe), to pin 1 of PL2, which is marked on the board (towards metal bracket).
- 8b) If fitting a joystick or OI-SNP (Leica SmartMove interface), you will need to fit an adapter plate to another spare slot and the interconnection cable to PL7, the Analogue Port. Be careful to attach pin 1 of the ribbon cable (with the red stripe), to pin 1 of PL7, which is marked on the board (towards the power connector).
- 8c) If intending to use the OASIS-XA1 5<sup>th</sup> axis module, please refer to the OASIS-XA1 documentation for connection details.
- 8d) If intending to use the OASIS-DC1 module, please refer to the OASIS-DC1 documentation for connection details.
- 9) Connect a spare power connector from the PC power supply to PL5 at the rear of the board. Preferably the OASIS-4i should be the only device drawing power from this lead. The on-board motor drive components get their power via the +12V from this connector.

## *Making external connections*

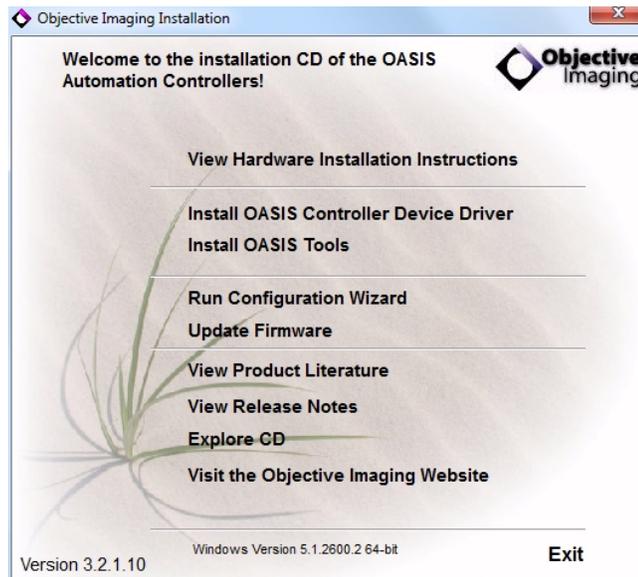
- 10) Replace PC system cover or side panel.
- 11) If using a Kensington Expert Mouse 5.0 serial trackball or other serial control device, connect it to PL1, the 9-pin trackball serial port below the 44-way main connector.
- 12) Connect the appropriate cable from SK1, the 44-way XYZ and video in/out connector, to your desired XY stage, focus adapter (Z) and video source as required. Notice that this 44 way connector is keyed to prevent insertion of an incorrect cable.
- 13) You are now ready to switch on the PC and proceed with the driver installation for your operating system.

Warning: Do not connect or disconnect motor cables while the PC is powered on. The OASIS-4i card may be applying power to the motors, in which case a connection or disconnection could damage the OASIS-4i card.

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## Driver Installation

- 1) Switch on PC and boot into Windows.
- 2) If the 'Add New Hardware Wizard' appears, choose Cancel.
- 3) Insert the OASIS Installation CD or navigate to the folder where you downloaded and unzipped the installation download.
- 4) Run the Setup.exe from the main installation disk.



- 5) Click on the 'Install OASIS Controller Device Driver' option. A message will indicate the drivers were installed and registered correctly.
- 6) Click on the 'Install OASIS Tools' option to install the Configuration Wizard, the Flash Configuration program and the OASIS Application utility. These utilities will be useful in configuring the OASIS-blue controller for your particular hardware situation.



# CONFIGURING THE OASIS-4i CONTROLLER

The OASIS-4i controller is designed to work with a wide range of different types of automation hardware. For instance, there are a number of manufacturers of XY motorized stages for microscopes, and each manufacturer uses different styles of connectors, wirings for limit switch logic, and other features specific to their make and model of stage.

In order to drive these different types of hardware, the OASIS-4i controller must be configured accordingly. Most of these configuration settings are stored in the onboard flash memory of the OASIS-4i card, permitting the correct start-up conditions when the card is powered up and initialised.

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## OASIS Configuration Wizard

The easiest way to configure the card is to run the OASIS Configuration Wizard (Figure 3). The wizard provides step-by-step instructions for defining the settings most appropriate for your particular system, and actually consists of three wizards:

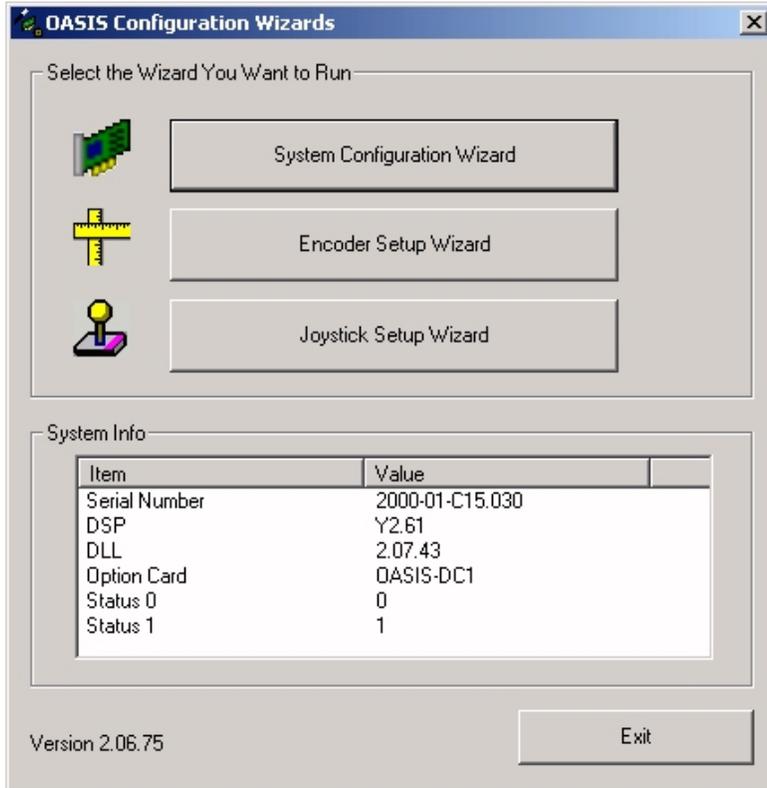
1. **System Configuration Wizard.** This wizard performs the basic tasks of defining the hardware you have connected to the OASIS-4i controller.
2. **Encoder Setup Wizard.** This wizard is used to enable the use of encoders and specify their resolution and polarity.
3. **Joystick Setup Wizard.** This wizard allows you define what input control device(s) you have connected to the OASIS-4i 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-4i controller.
- **DSP.** This reports the current DSP code revision running on your OASIS-4i controller.
- **DLL.** This displays the current version of the OASIS-4i DLL installed on your computer.

- **Option Card.** If an option card is installed on your OASIS-4i controller, the type of card will be displayed, as well as additional information relevant to the type.

When installing an OASIS-4i card, you would typically run each wizard in turn to ensure proper configuration for your setup.



**Figure 3. 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-4i card match the make and model of automation hardware connected to it.

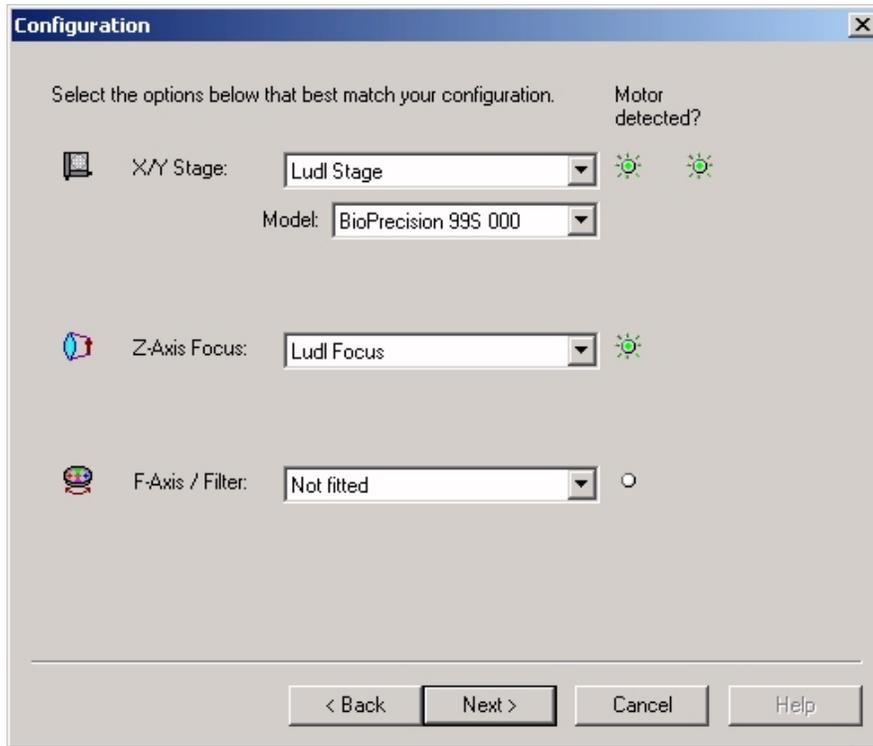
The wizard includes a listing of the various makes and models of XY stage, focus drives, and filter wheels, and can setup the card based on known default values for the particular device. The wizard can also auto-detect the settings of your particular systems—such as limit switch polarity, axis and limit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

After displaying the start page (Figure 4), the wizard displays the configuration page (Figure 5), 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 4. OASIS System Configuration Wizard.



**Figure 5. 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.

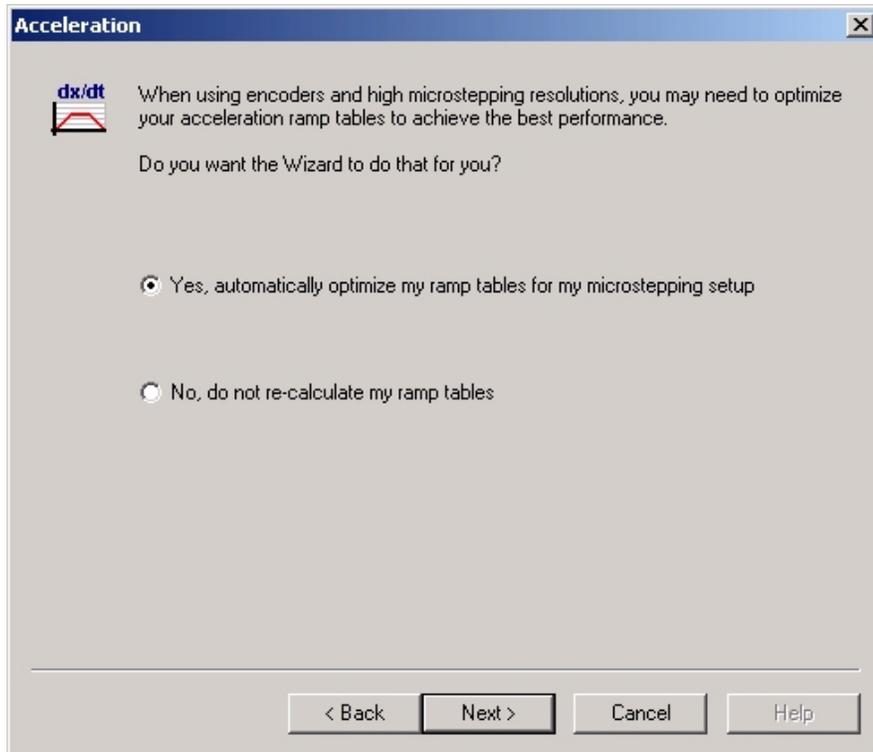
The drive direction setting also can accommodate for the side of the microscope onto which a motorized focus drive is mounted. A given direction of turning of the motor will result in opposing fine focus movement depending on whether the motor is mounted on the left or right side of the microscope, so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



**Figure 6. Setting the drive direction.**

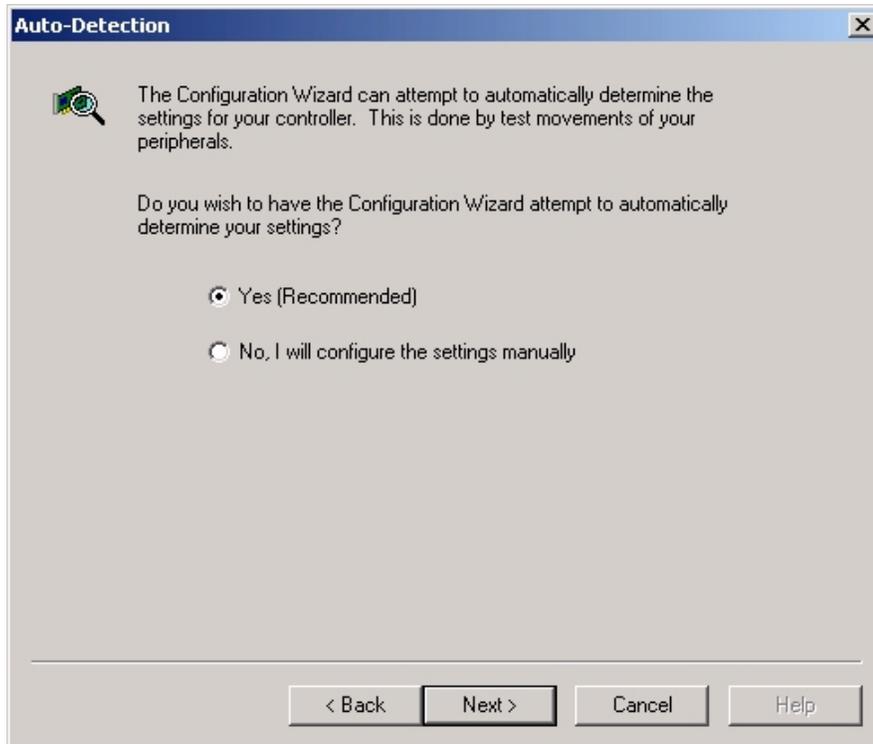
Following the drive direction page is the automatic ramp calculation page (Figure 7). Selecting to have the wizard automatically optimize your ramp tables will result in default tables that have been adjusted to match the microstepping currently defined for the OASIS-4i controller. See the section below, *Speed and Acceleration* in the *Principles of Operation* chapter for further information regarding acceleration ramp tables.

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.



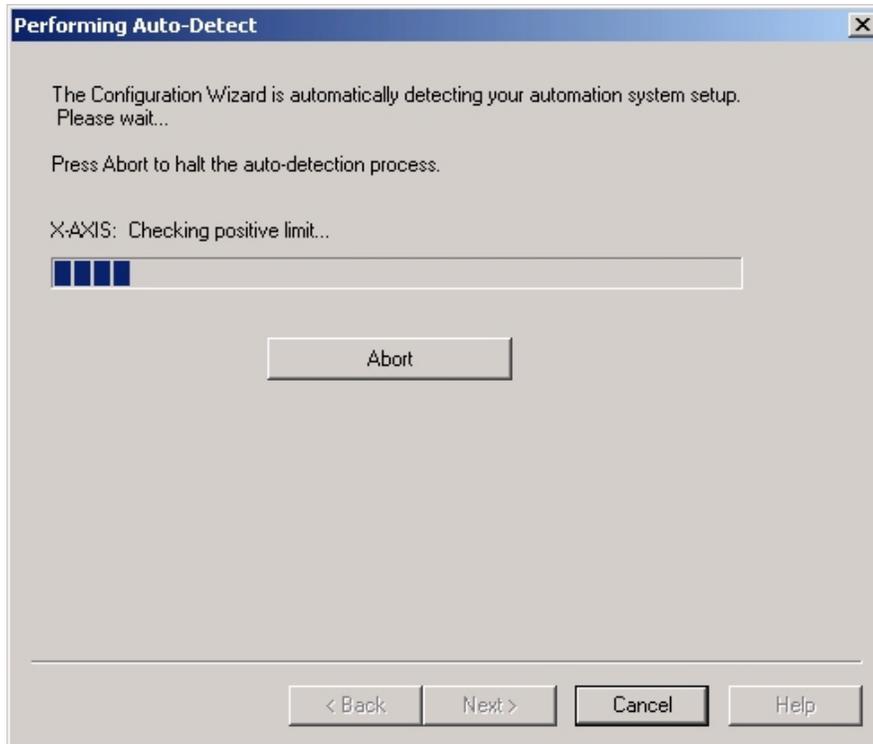
**Figure 7. Automatic ramp calculation.**

Following the acceleration page, you will be presented with the option to have the configuration wizard automatically determine your setup (Figure 8).



**Figure 8. 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 9), 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 9. 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 10). Next, the stage's estimated pitch values are shown, along with the expected and actual travel measured between the limits for each axis (Figure 11).

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.

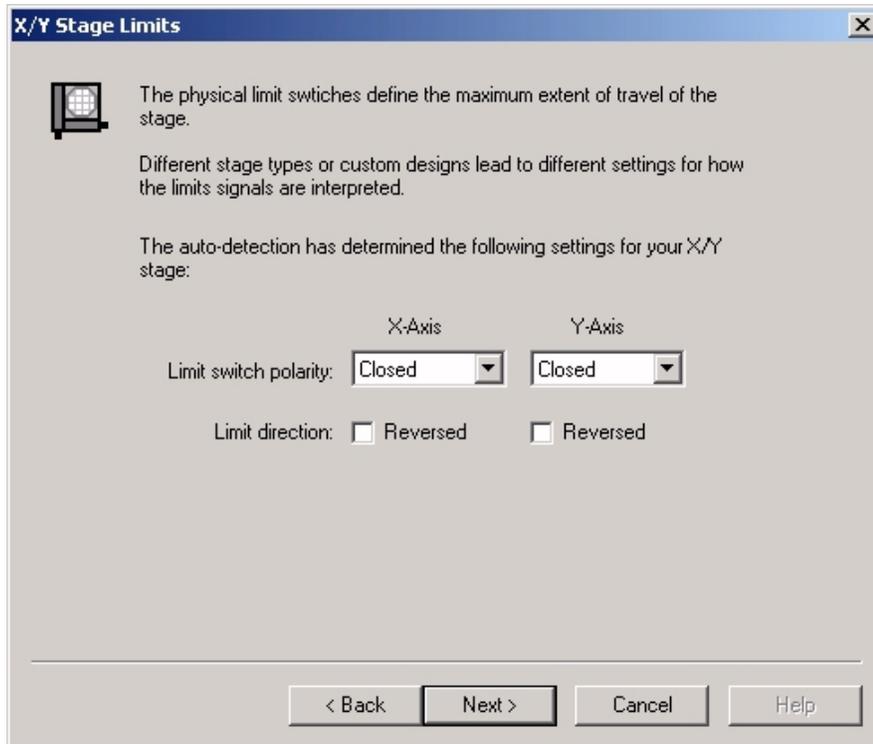


Figure 10. Stage settings showing limit switch definition.

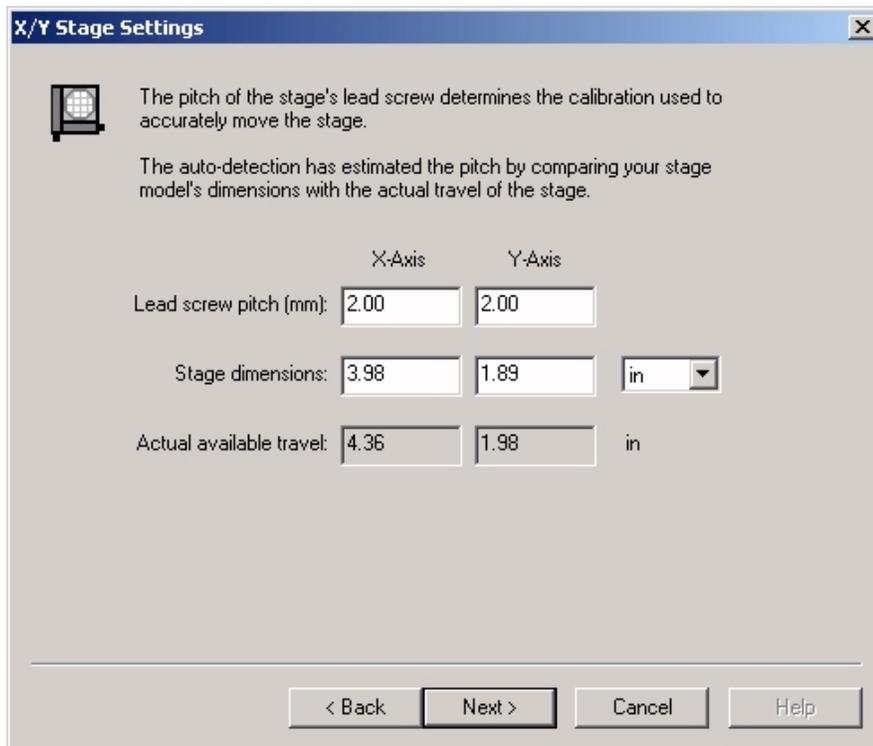


Figure 11. Stage settings show estimated lead screw pitch and available travel.

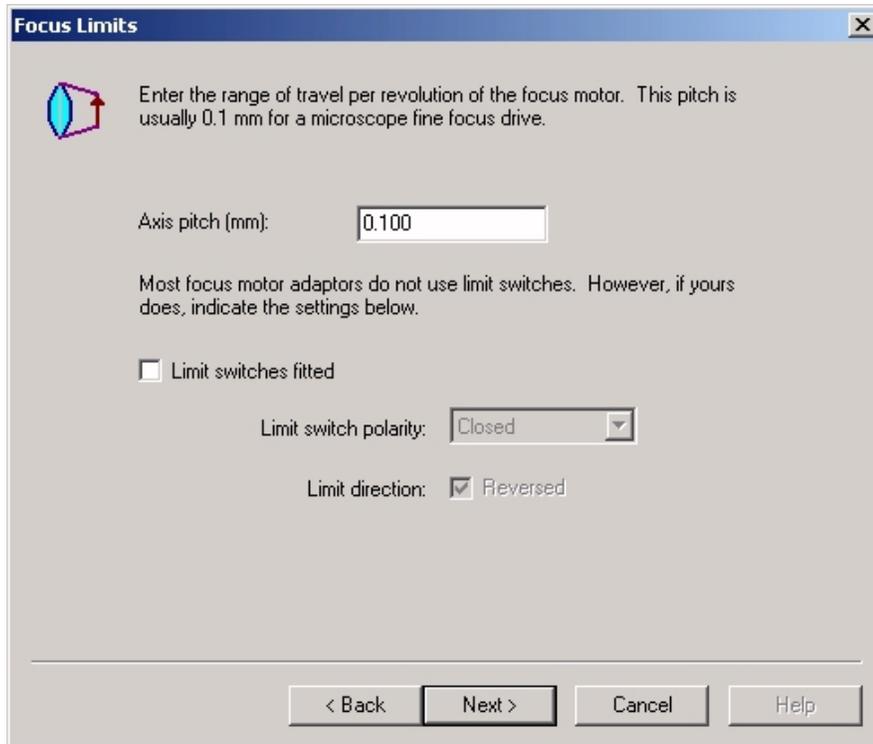


Figure 12. Focus settings, including pitch and limit settings.

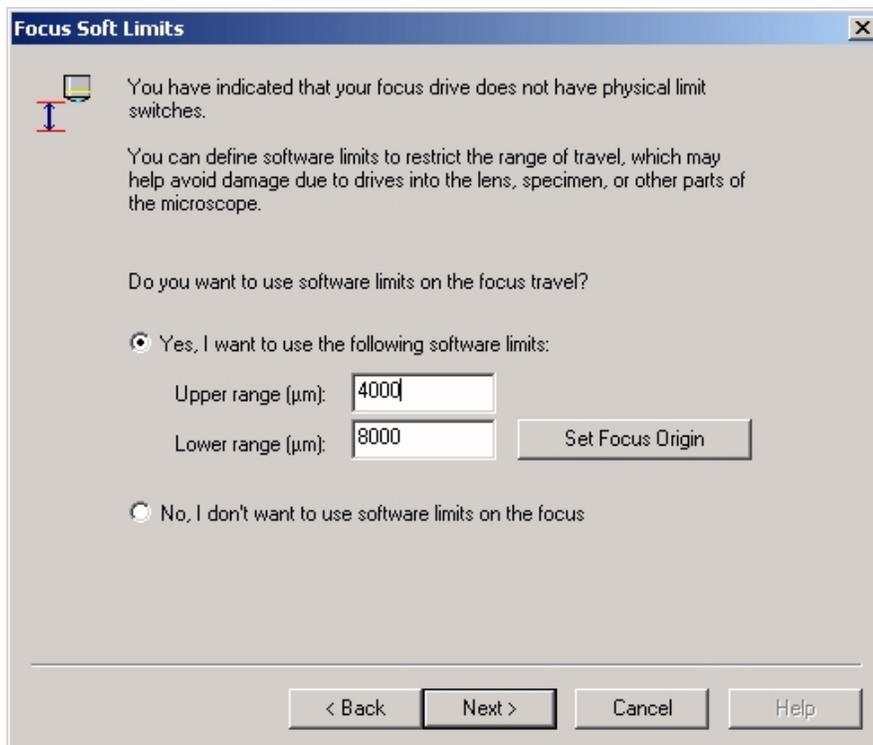
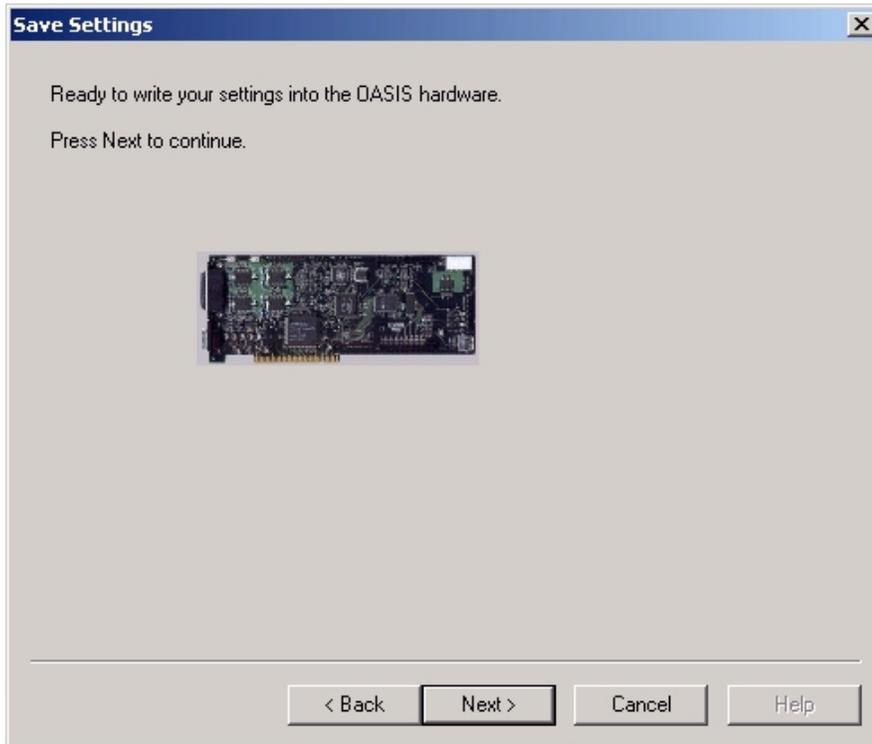


Figure 13. Focus soft limit definition.

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 14. 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-4i controller (Figure 14). Once the flash is updated, you may quit the wizard and start using your OASIS-4i controller, or you may elect to run the Encoder Setup Wizard and/or the Joystick Setup Wizard.

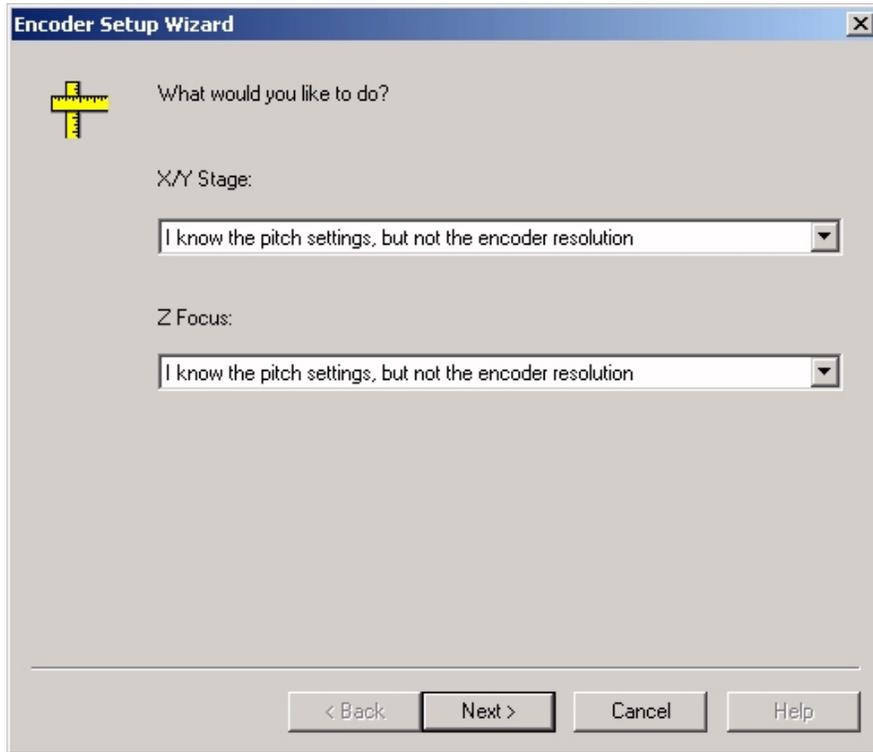
## Encoder Setup Wizard

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-4i controller.

The Encoder Wizard starts by asking how you would like to proceed in defining the encoders (Figure 15). 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 15. Encoder setup method selection.**

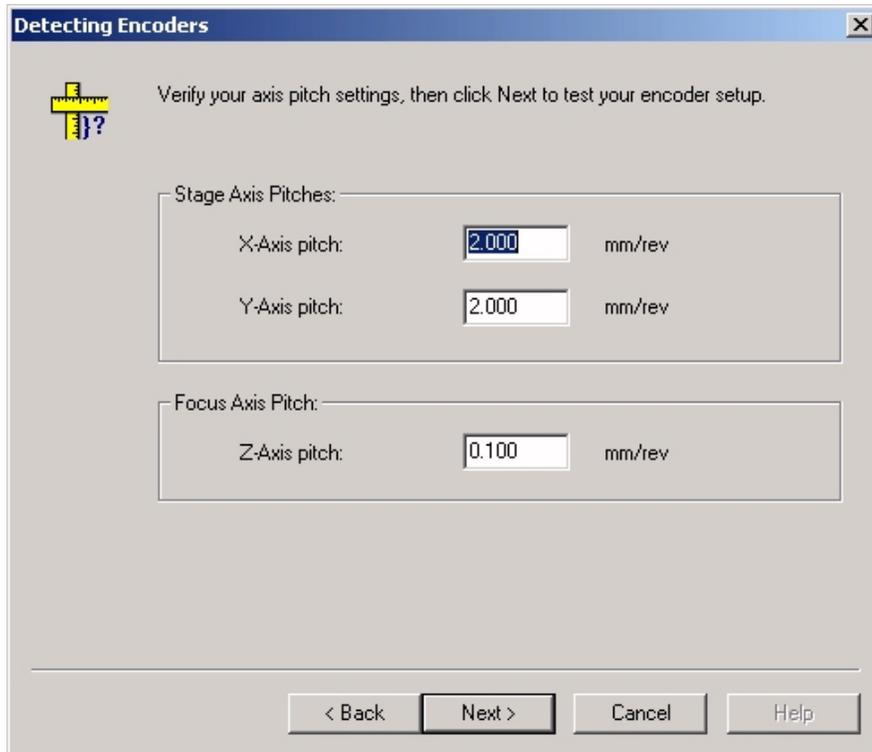
The wizard then displays the information page where either the pitch value or encoder resolution is entered, depending on the method you chose for the XY stage and Z focus (Figure 16).

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 16. Encoder wizard information page.**

The results are displayed in the encoder settings page (Figure 17). 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-4i 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 18). 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. See the section on *Speed and Acceleration* in the *Principles of Operation* chapter for further details on acceleration ramps.

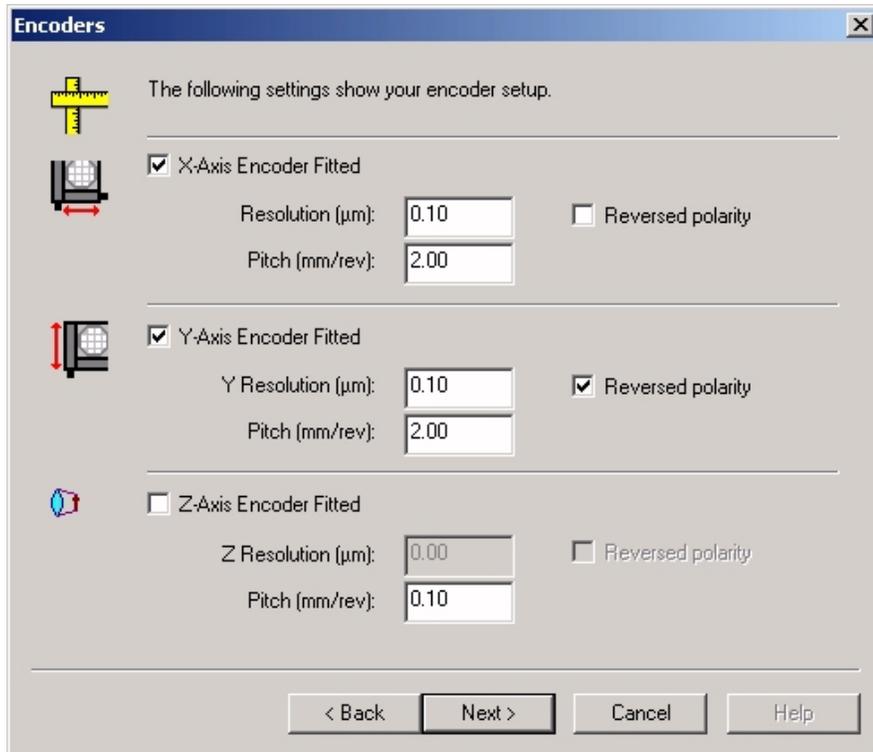
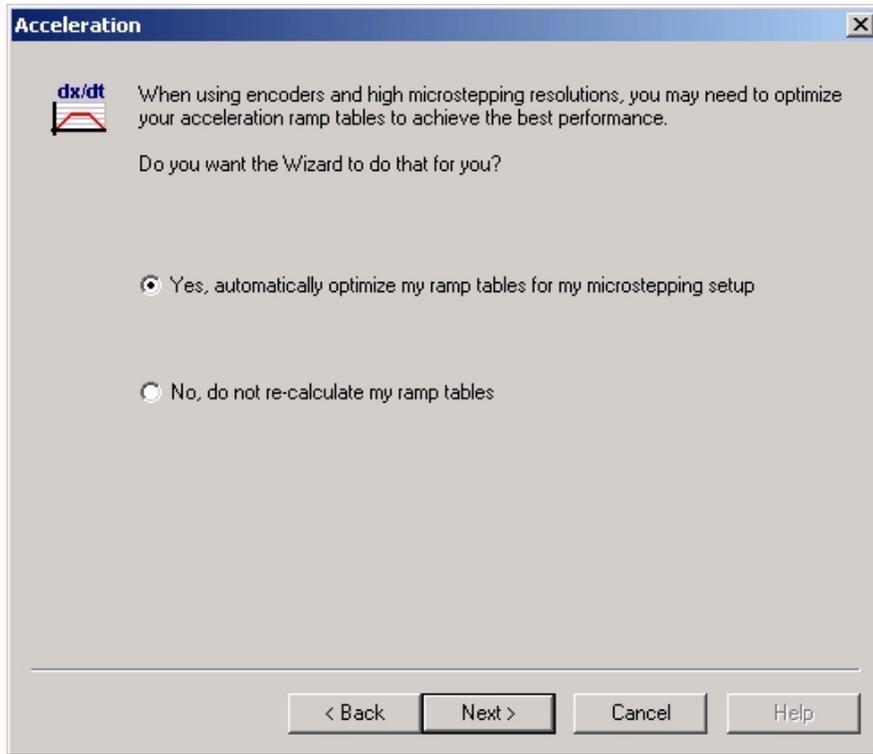
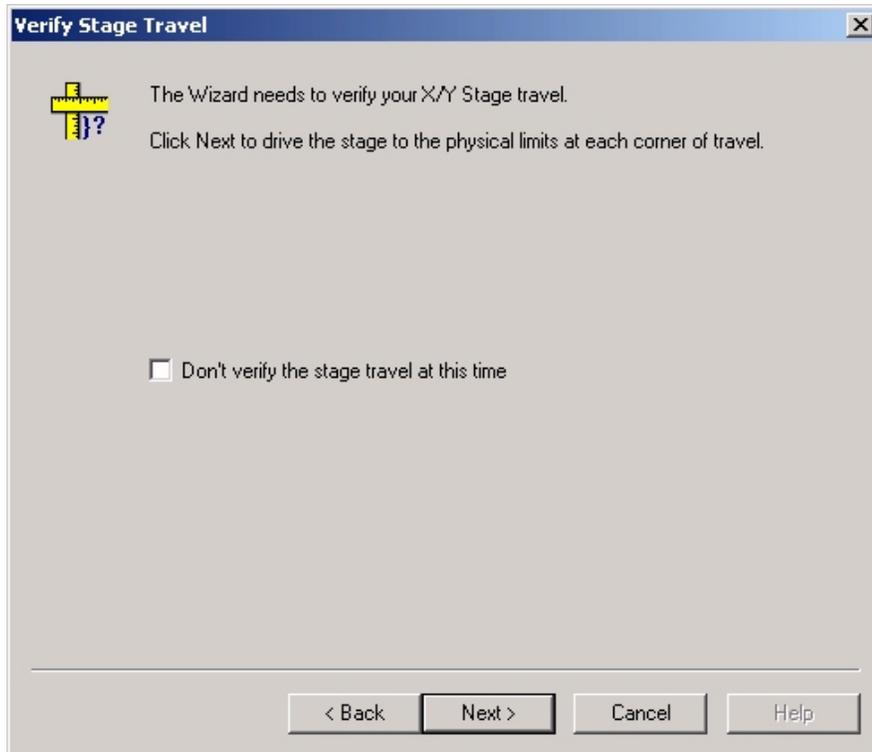


Figure 17. Encoder settings.



**Figure 18. Automatic ramp calculation.**

The final step in the encoder wizard before the settings are actually written into the OASIS-4i 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 19. Stage initialization after encoder setup.**

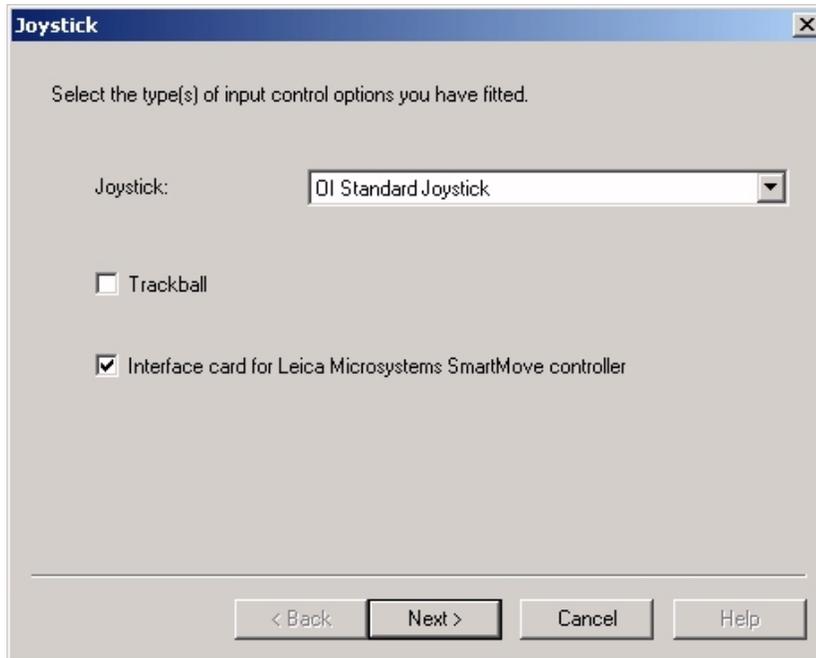
Note that you have the option to skip the stage travel verification, but you should only do this if you intend to initialize the stage in another application before attempting to use it. For instance, if you are using Surveyor to perform mosaic imaging acquisition, you should first initialize the stage 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 20) 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 (See the section *OI-SNP* in the *Options and Accessories* chapter for further details on this interface).

Note that it is possible to have more than one device connected to the OASIS-4i 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 20. 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 22). 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-4i flash memory, and you are returned to the main wizard screen.

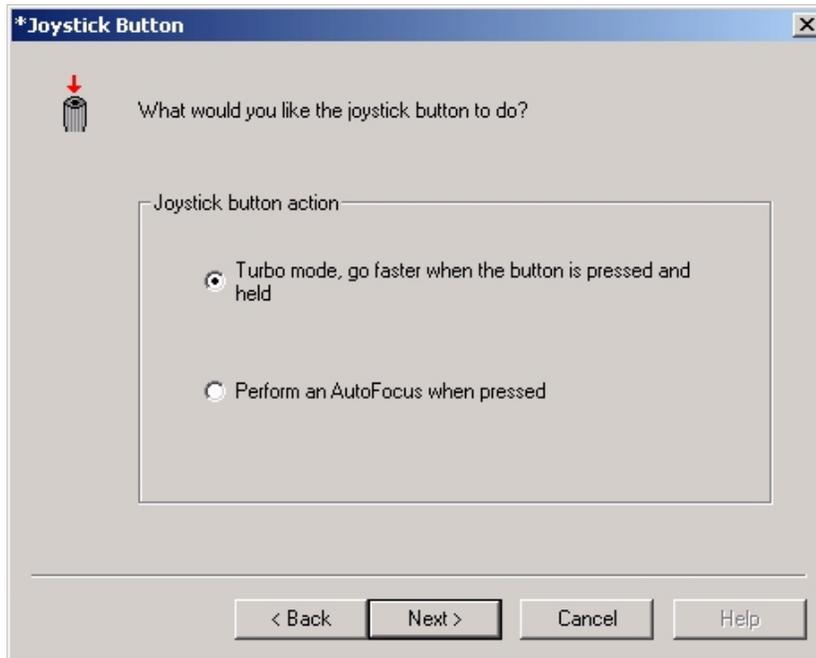


Figure 21. Joystick button definition.

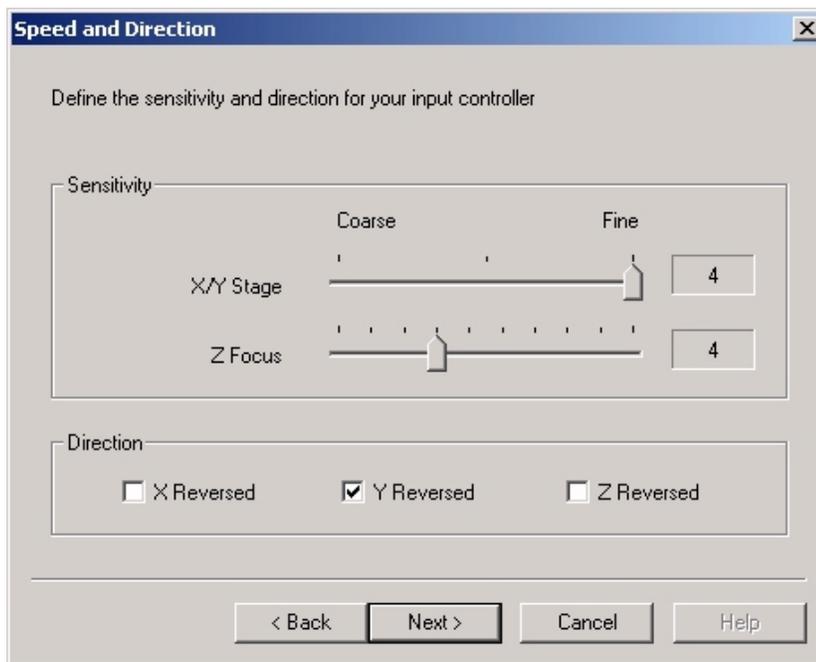
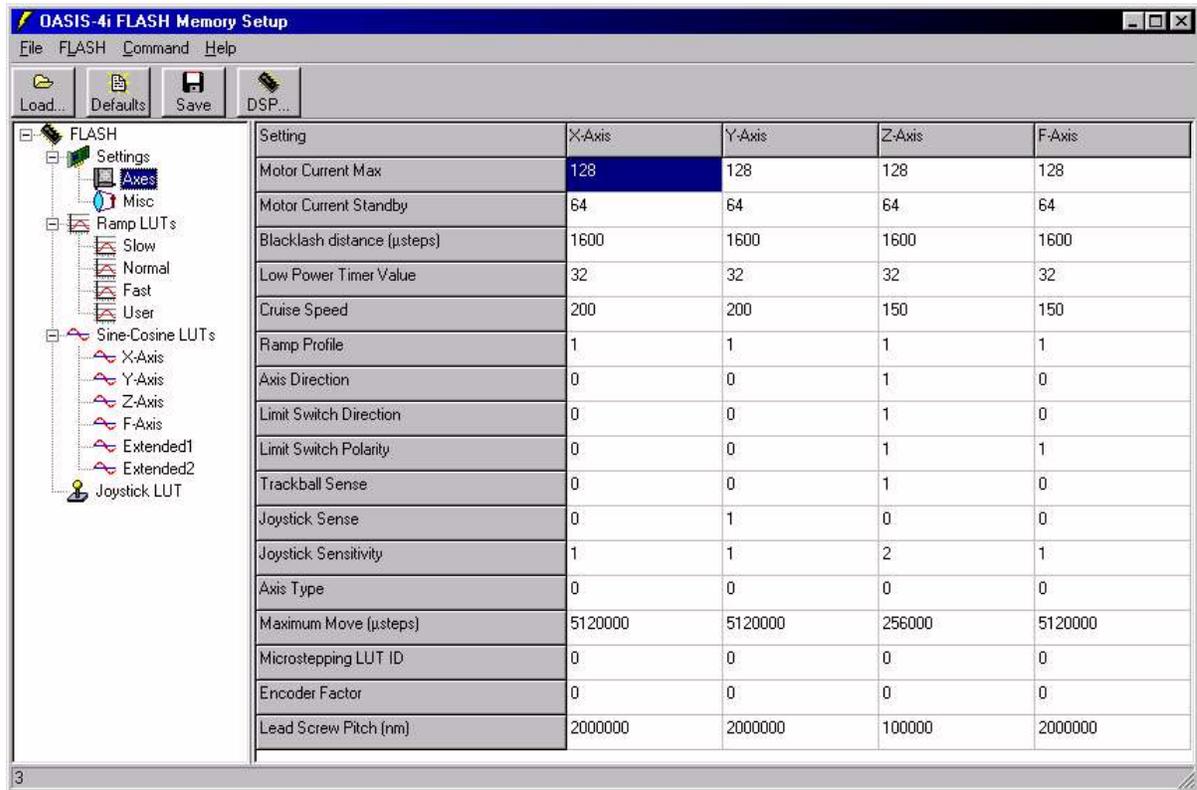


Figure 22. Joystick speed and direction settings.

# OASIS Flash Memory Configuration Utility

Individual flash memory settings may be modified using the OASIS Flash Memory Setup utility (Figure 23).



**Figure 23. OASIS Flash Memory Setup application.**

The flash configuration utility provides a means to adjust the following settings for each axis:

- Maximum motor current
- Standby motor current
- Backlash correction distance
- Standby power timer interval
- Power-on cruise speed
- Power-on ramp profile
- Axis direction (clockwise or counter clockwise)
- Limit switch direction
- Limit switch polarity
- Trackball sense (direction)
- Joystick sense (direction)
- Joystick sensitivity
- Axis Type
- Maximum acceptable move command distance

- Microstepping setup
- Encoder setup
- Calibration lead screw pitch

Also, advanced settings such as autofocus settings, acceleration ramp tables, motor drive tables, and joystick deflection tables are defined in the OASIS-4i flash memory.

See section ***Error! Reference source not found.*** in the *Principles of Operation* chapter for further details on using the Flash Memory setup application.

---

## What Next?

Once the OASIS-4i card has been installed and configured, the next step depends on your situation.

If you are the user of a 3<sup>rd</sup> party imaging application, you would next need to perform any further installation required to support the OASIS-4i card within you application. Please refer to your imaging application's documentation for further instructions.

If you are a developer of applications that will use the OASIS-4i controller, you should next install the OASIS-4i Tools from the OASIS CD. This will copy the full OASIS software utilities, SDK libraries and include files, and support documentation to your development system. Please refer to the OASIS-4i SDK DLL manual for further details regarding integration of the OASIS-4i into your system software.

## OPTIONS AND ACCESSORIES

### Joystick Units

The OI-JOY2 and OI-JOY3 joystick units are designed to plug into the analogue port of the OASIS-4i controller board. The 26-pin analogue port is PL7, which can be found at the rear edge of the board, and is attached to the joystick unit via a ribbon cable attached to a PC expansion slot mounting plate. Pin 1 of PL7 is marked on the OASIS-4i board (refer to diagram below) and should line up with the red wire on the ribbon cable. The mounting plate can then be fitted to a spare PC slot, or if none are available, the 25-way D connector can be unscrewed from the plate, and mounted directly to a 25-way D cut-out on the back of the PC.

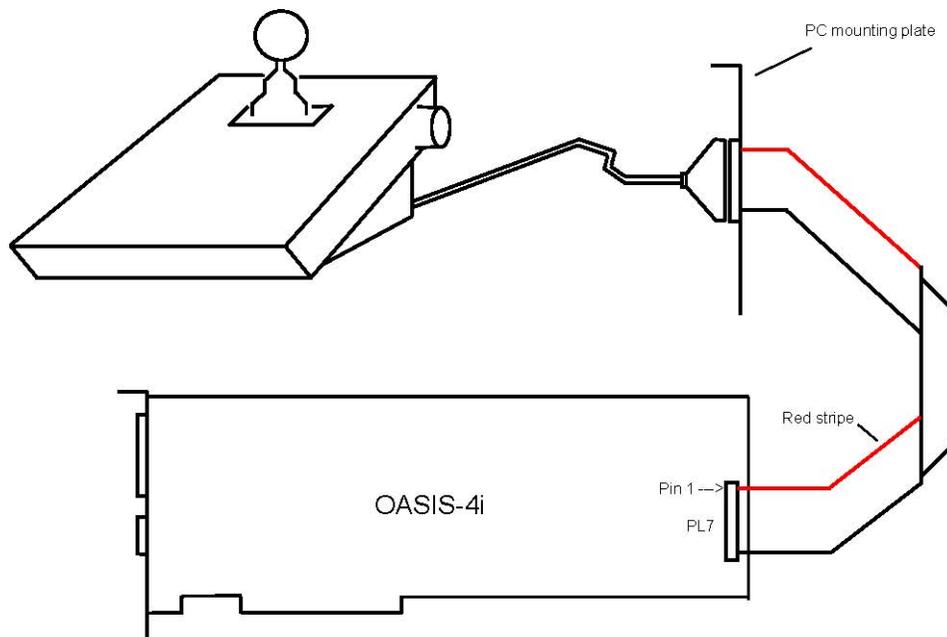


Figure 24. Connection of joystick to OASIS-4i controller.

## Operation

There are three controls on the OI-JOY3, the joystick, the digiknob and the pushbutton.

The joystick controls X and Y movement of the stage, and speed of movement is proportional to the deflection via a cubic law, which means that small deflections should equate to a slow enough speed for high magnification work, whilst full deflection will drive the stage at full speed.

The digiknob controls the Z (focus) axis and here the speed of Z movement is proportional to the rate of change of rotation of the digiknob, so at slow rotational speed the Z motor appears to be 'locked' to the digiknob, but if turned faster then the Z motor will turn proportionally faster still, to ease the amount of turning necessary to adjust the focus over a long range.

The pushbutton can be configured to perform either an automatic focus or as a sensitivity action for XY movements.

Power for the joystick unit is provided via the OASIS-4i board.

## Software Control

By default, all three axes are enabled at power-up, and the direction of movement fixed. However, it is possible to enable or disable the axes individually, and change the direction of movement, using DLL function calls. Please refer to the DLL documentation on the installation CD for more information.

It is also possible to change the power-up conditions by altering the appropriate settings in the Flash memory. This may be achieved using either the OASIS Joystick Setup Wizard or the Flash Memory Setup application, both of which can be found in the \UTILS folder on the installation CD.

## Adjusting Joystick Sensitivity using the Configuration Wizard

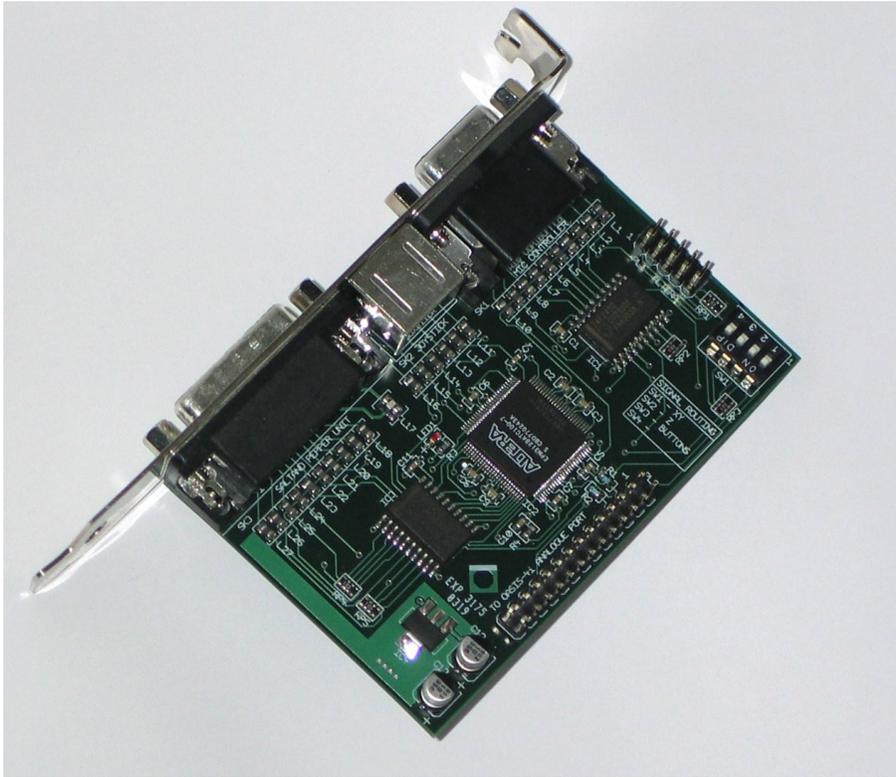
The joystick sensitivity may be adjusted using the Joystick Setup Wizard. See the section *Joystick Setup Wizard* in the *Configuring the OASIS-4i Controller* chapter for further details.

## Adjusting Joystick Sensitivity using the Flash Memory Setup Application

You may also directly enter the joystick sensitivity in the Flash Memory Setup application. See the section ***Error! Reference source not found.*** in the *Principles of Operation* chapter for further details.

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# OI-SNP



The OI-SNP interface card is designed to allow the OASIS-4i PCI Controller Card to use the Leica Microsystems SmartMove input device as a control for manual positioning of X, Y and Z axes.

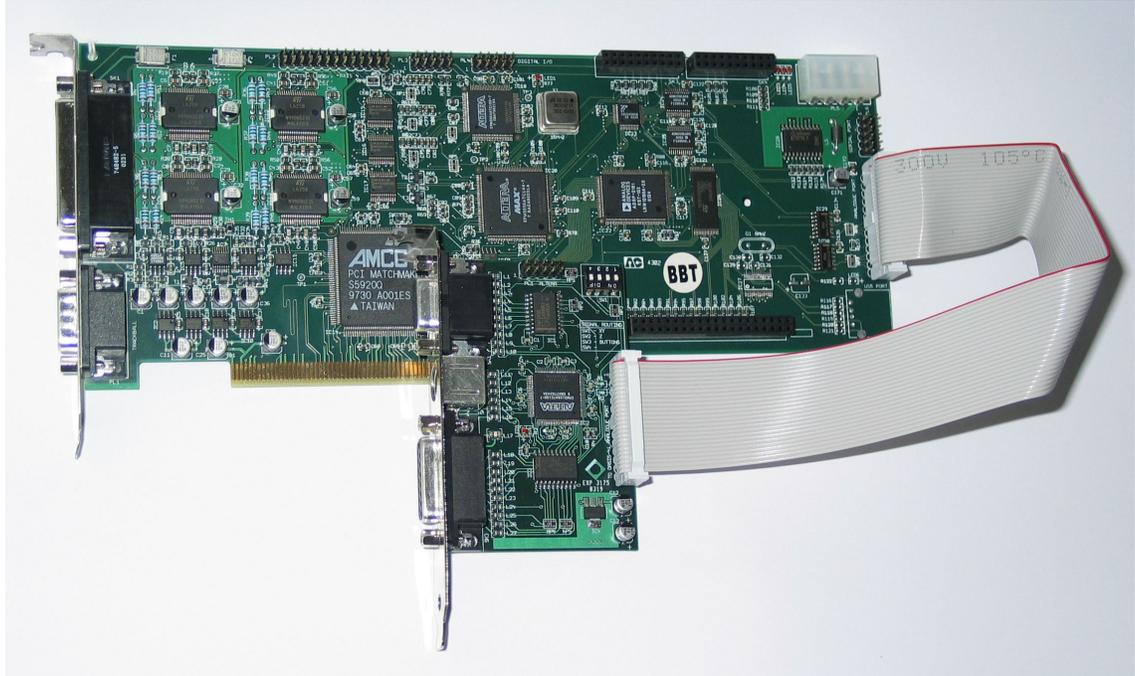
The Leica Microsystems SmartMove device provides an ergonomic manual input controller for automated XY stage and Z focus movement, used with the Leica Microsystems range of automated microscope stands. Objective Imaging's OI-SNP interface card allows the SmartMove to be used with standard 3<sup>rd</sup> party stages and focus adaptors that are controlled via the OASIS-4i controller. The OI-SNP allows each axis of the SmartMove to be independently configured for use with either built-in microscope control or OASIS-4i control.

## Installation

**NOTE: Please observe anti-static precautions when handling any electronic components.**

1. Switch off and unplug the PC from the mains supply before starting the installation procedure.
2. The OI-SNP is mounted to a PC back-plate for easy mounting in a PC slot near to the OASIS-4i card. Fix the OI-SNP to the PC chassis with the usual locking screw, unless the PC has a different method for holding cards in place.

3. Attach the supplied 26 way ribbon cable between PL2 on the OI-SNP and PL7 on the OASIS-4i card, taking care to align pin 1 on each connector with the red stripe on the ribbon cable, as shown below. Pin 1 is marked on the silk-screen of both cards.



**Figure 25. OI-SNP connected to OASIS-4i controller.**

## Connectors

The bottom connector on the PC bracket is a 15 way female D-type socket which connects the Leica SmartMove controller.

The 8 way mini-DIN socket in the middle of the bracket is for attaching an OI-JOY2 or OI-JOY3 joystick unit (via an adapter cable or with a modified joystick cable connector).

The top connector on the PC bracket is a 15 way High-Density D-type socket which connects to the Leica CTRMIC controller 'XYZ Control' input. This is to allow pass-through of some or all of the SmartMove controller signals to the CTRMIC Controller.

## Configuration

On the top right hand corner of the OI-SNP PCB is a 4 way DIP-switch that controls the following functions:

**Table 1. OI-SNP DIP switch settings**

<b>Switch</b>	<b>ON</b>	<b>OFF</b>
1	XY controlled by Leica CTRMIC	XY controlled by OASIS-4i
2	Z controlled by Leica CTRMIC	Z controlled by OASIS-4i
3	Buttons controlled by CTRMIC	Buttons controlled by OASIS-4i
4	Z control input is Leica SmartMove	Z control input is OI-JOY3 joystick digiknob

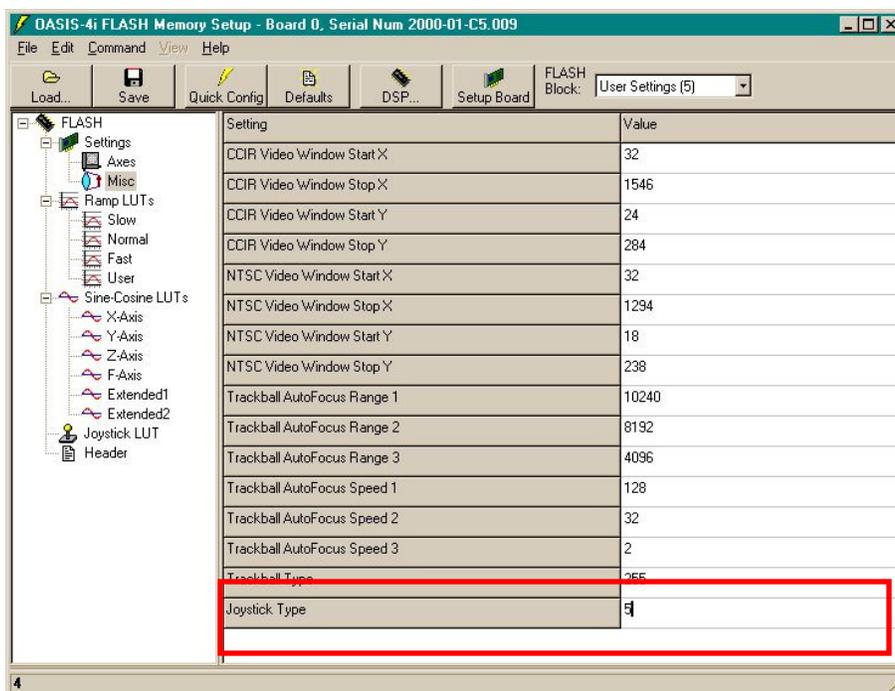
For example if the OASIS-4i is being used to control the XY stage, and the CTRMIC controller is being used to control Z, the lamps and the turret, then set switch 1 to OFF, and switches 2 and 3 to ON. The CTRMIC controller's XYZ-Control input must be connected to the OI-SNP module's top connector (SK1), for the signals to be passed through to it.

## Operation

The DSP code stored in the OASIS-4i may need updating before the OI-SNP module can be used. Contact Objective Imaging if in doubt as to which version of DSP code is compatible.

Once the OASIS-4i DSP code has been updated, it will also be necessary to change a Flash memory setting to select the Smart Move Controller as the input device. Normally this is done using the OASIS Joystick Setup Wizard (see the section *Joystick Setup Wizard* in the *Configuring the OASIS-4i Controller* chapter for further details).

The OASIS-4i Flash Memory Setup application may also be used to configure the OI-SNP. If you run this program and go to the 'Settings -> Misc' page, you will see a 'Joystick Type' value near the foot of the page, as shown.



This value can be set to the following options:

**Table 2. Joystick Type settings.**

Value	Input type
1	OI Standard 2 or 3 Axis Joystick, joystick button is autofocus
2	OI Standard 2 or 3 Axis Joystick, joystick button is turbo-mode
3	Leica Lamp Controller
4	Leica Joystick Unit
5	Leica SmartMove + OI Joystick, joystick button is autofocus
6	Leica SmartMove + OI Joystick, joystick button is turbo-mode

It is not necessary to have a joystick fitted as well as the SmartMove device, but it is possible to have both. The normal value for use of the OI-SNP with the Leica SmartMove would be 5.

After changing the value, press the 'Save' button on the toolbar to store it in the Flash memory.

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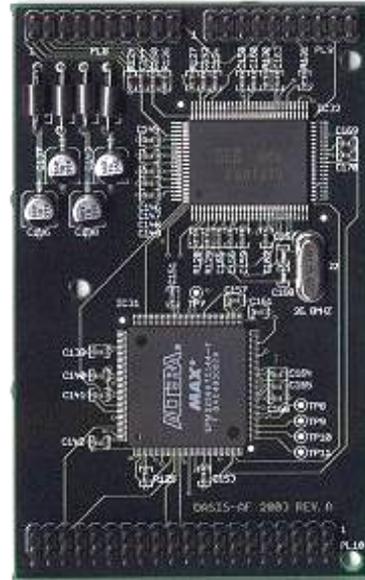
# OASIS-AF

The OASIS-AF Module is an optional plug-in daughter board that can be fitted to the OASIS-4i Four Axis Controller to automate microscope focus adjustment dependent on image content and user defined parameters. The OASIS-AF Autofocus module extends the capability of the OASIS-4i Four Axis Controller by providing real time video image processing hardware.

By continuously measuring the characteristics of each video frame to produce a goodness-of-focus score, the OASIS-AF module enables rapid, automatic selection of the best point of focus.

Video-rate measurements of total area and chord length data for detected image details are also performed by the OASIS-AF hardware for applications such as blank field and rare event identification.

For a detailed explanation of the autofocus and video processing capabilities of the OASIS-AF module, see the sections ***Error! Reference source not found.*** and ***Error! Reference source not found.*** in the *Principles of Operation* chapter.



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# OASIS-DC1

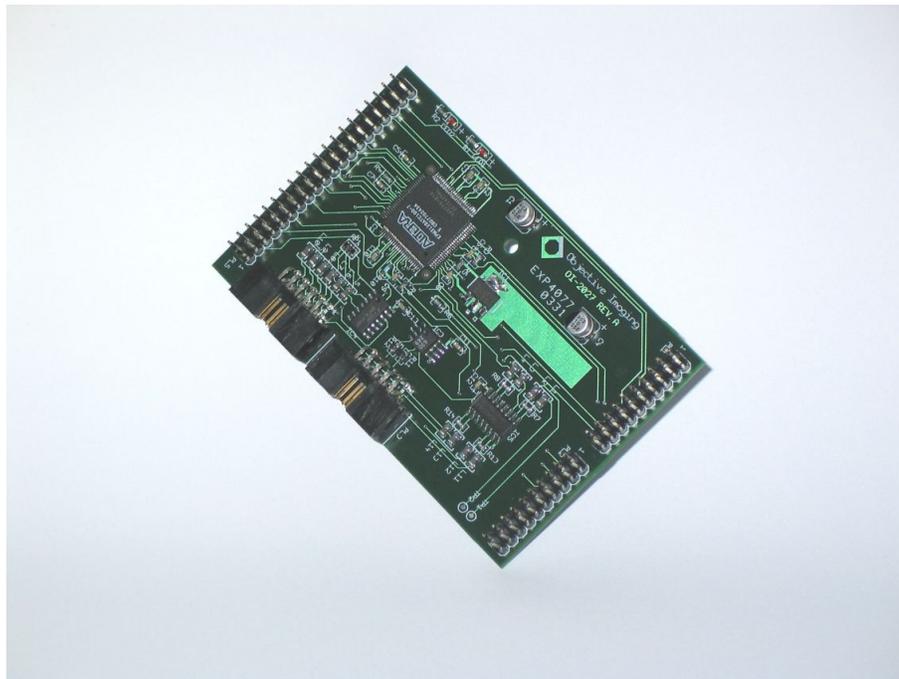


Figure 26. OASIS-DC1 module.

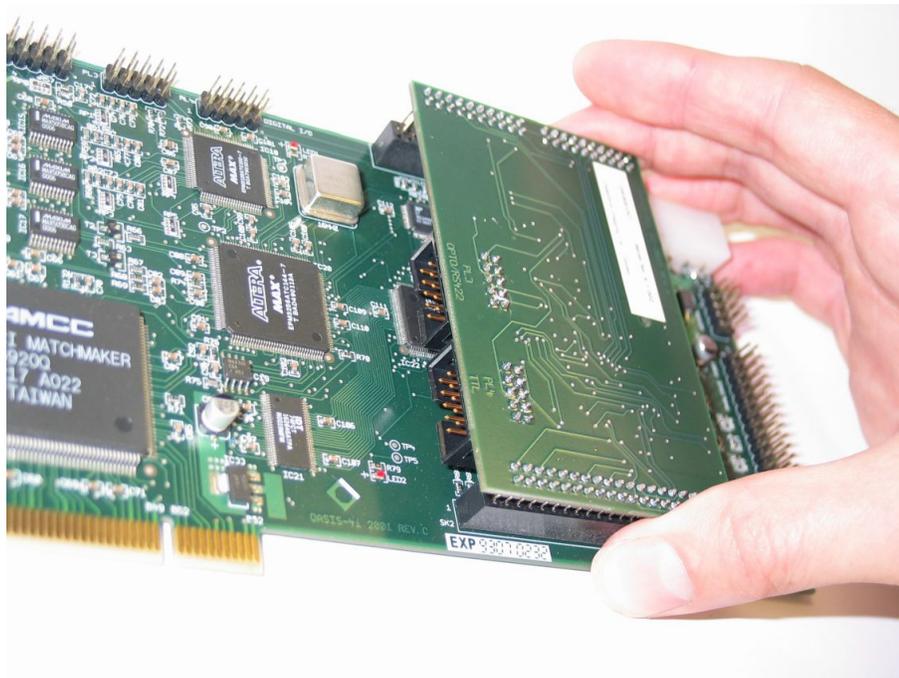
The OASIS-DC1 module is designed to allow the interface of timing signals from certain digital cameras to the OASIS-4i PCI Controller Card. This allows the use of the rapid scanning and mosaic imaging feature of the Surveyor application called Turboscan and also the possibility of providing autofocus capability with these cameras. A list of suitable cameras is supplied in below in the section *Supported digital cameras*.

## Installation

**NOTE: Please observe anti-static precautions when handling any electronic components.**

The OASIS-DC1 is fitted as a 'daughter' card to the OASIS-4i PCI Controller Card. To fit the OASIS-DC1 you will need to remove the OASIS-4i from the host PC if already installed, and carefully press fit the OASIS-DC1 on to the three connectors SK2, SK3 and SK4 as shown in Figure 27.

Make sure that the connector pins on the OASIS-DC1 module line up exactly with the mating sockets on the OASIS-4i card. There should be no pins visible when the module is correctly installed.



**Figure 27. Placing the OASIS-DC1 onto the OASIS-4i controller.**

Attach the supplied 9-way ribbon cable to the appropriate connector on the OASIS-DC1 module, either PL3 for opto-isolated or RS422 signals, or PL4 for TTL compatible signals (see Figure 28). If you have ordered this product to suit a particular camera, then the ribbon cable should be marked with the correct connector name. Re-install the OASIS-4i and DC1 in the PC and fix the other end of the ribbon cable to a spare PC cover-slot or chassis cut-out, as necessary. Reconnect any cables associated with the OASIS-4i and finally connect the timing signals from the camera to the OASIS-DC1 via the cable supplied. This cable should be clearly marked to indicate where on the camera it should be attached.

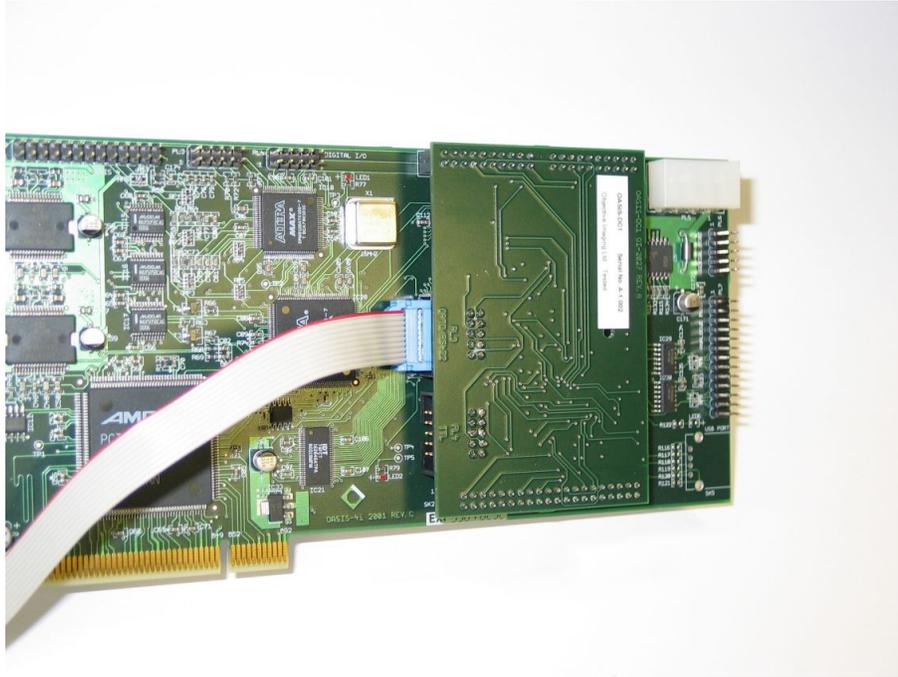


Figure 28. Ribbon cable connected to OASIS-DC1 module.

## Configuration

The OASIS-4i controller's on-board DSP code must be of version Y2.37b or later in order to control the OASIS-DC1.

Contact Objective Imaging if in doubt as to which version of DSP code is compatible.

## Operation

The OASIS-DC1 is controlled via the application software. Please refer to the relevant application guide for any necessary setting information.

## Supported digital cameras

The following digital cameras have been tested for use with the OASIS-DC1 module. If a camera of interest is not listed, please contact Objective Imaging for compatibility information.

Table 3. Digital cameras supported by OASIS-DC1 module.

Manufacturer	Models	OASIS-DC1 Connector	Comments
QImaging Corp.	QICAM, Retiga	PL4	Requires additional +5V power supply for trigger signal. This can be achieved using the appropriate OASIS-4i main connector “-5V” option.
Leica Microsystems	DFC300FX, DFC350FX, DFC320, DFC480, DC500	PL3	Only revision 2 models or later with appropriate trigger output.
Sensovation	EZ-45	PL3	
JVC	KY-F1030	PL3	

## Connector pin-out information

Table 4. OASIS-DC1 PL3, Opto/RS-422 ribbon cable to 9-way D-type

Pin on OASIS-DC1 PL3	Signal	Pin at 9-way D-type
1	RS-422 A+	1
2	RS-422 A-	6
3	RS-422 C+	2
4	RS-422 C-	7
5	Opto input 1+	3
6	Opto input 1-	9
7	Opto input 2+	4
8	Opto input 2-	9
9	GND	5

Table 5. OASIS-DC1 PL4, TTL/RS-422 ribbon cable to 9-way D-type

Pin on OASIS-DC1 PL4	Signal	Pin at 9-way D-type
1	TTL input 1	1
2	TTL input 2	6
3	TTL input 3	2
4	TTL input 4	7
5	RS-422 B+	3
6	TTL output 1	8
7	RS-422 B-	4
8	TTL output 2	9
9	GND	5

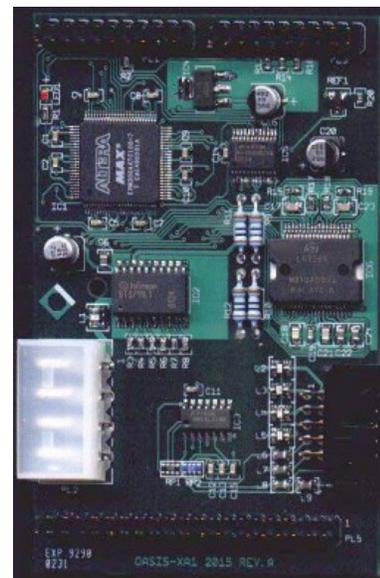
## OASIS-XA1

The OASIS-XA1 module is designed to increase the drive capability of the OASIS-4i board from four motors up to five. Software control of this 5<sup>th</sup> axis is very similar to that used for controlling the F-axis, typically used for driving filter-wheels, although it should be noticed that there are a few differences which will be described later. The XA1 module fits to the OASIS-4i board in place of the Video Processor (Autofocus) module, therefore it is not possible to have both the OASIS-XA1 and OASIS-AF or OASIS-DC1 modules fitted at the same time.

### Installation

**NOTE: Please observe anti-static precautions when handling any electronic components.**

With the OASIS-4i board removed from its host PC and on the workbench, remove the existing OASIS-AF or OASIS-DC1 module (if fitted), which attaches to connectors SK2, SK3 and SK4, and fit the XA1 module firmly in its place. Take care to line up the pins of the XA1 connectors with the holes of the mating connectors on the OASIS-4i. The OASIS-4i and XA1 module may now be replaced in the PC.



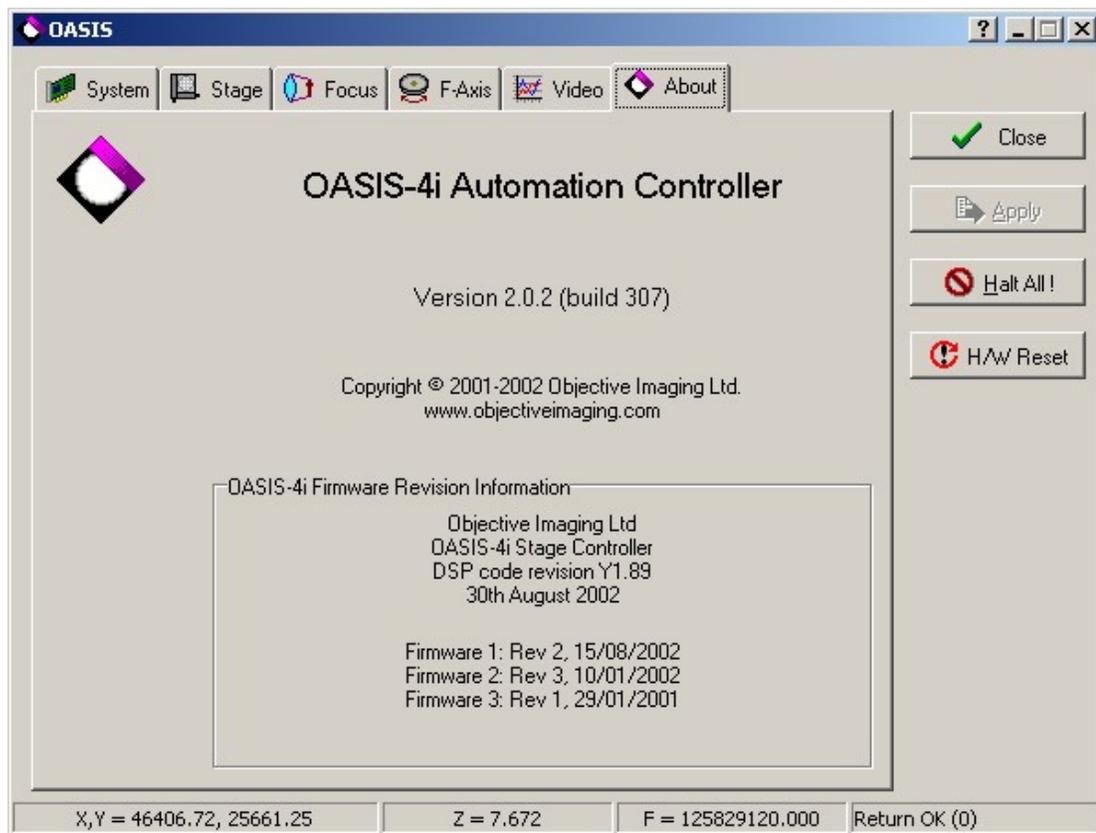
(Please refer to the OASIS-4i hardware installation instructions earlier in this document if needed.)

Power for the 5<sup>th</sup> axis motor is provided via a separate connector than that used for the other 4 axes. Usually a spare lead from the PC power supply is available which has two of the appropriate four pin connectors in series. These connectors should be plugged in to PL5 on the OASIS-4i and PL2 on the XA1 module, respectively.

The motor itself plugs into PL4 on the XA1 module, usually via a 9-pin female D-type to 10-pin IDC female header cable (OI part no. OIC-9002). This connector is polarised so it should not be possible to fit it the wrong way round or out of line.

## Configuration

In order for the software to be able to use the XA1 hardware, the OASIS-4i firmware and DSP code need to be of a certain revision. You can check the appropriate revision codes by looking at the 'About' tab of the OASIS application utility.



In the OASIS-4i Firmware Revision Information section, the DSP code revision should be Y1.89 or later, and Firmware 1 should be Revision 2 or later.

With the other four axes it is possible to configure some operational parameters in non-volatile Flash memory, using the OASIS-4i Flash Memory Setup application. At this time there are no equivalent settings for the 5<sup>th</sup> axis. The main difference between the 5<sup>th</sup> axis and the other four is

that the micro-step resolution is fixed at 3200/rev. In practice this should be more than adequate for controlling filter-wheels, etc. The ramp profile is also fixed at the equivalent of a 'normal' ramp profile for the other axes. Otherwise the functionality is the same as for the F-axis, with a 'home' switch input available for the initialisation of filter-wheels, along with positive and negative limit switch inputs.

## Wiring Information

When using the 10-pin IDC to 9-pin female D-type internal cable (OIC-9002), use the following pin information for connection to external devices.

**Table 6. OASIS-XA1 9-way D-type connector information**

Pin	Signal
1	Motor phase A+
2	Motor phase B+
3	GND
4	Limit input, positive
5	+5V
6	Motor phase A-
7	Motor phase B-
8	Limit input, negative
9	Home switch

## OASIS-XA1 Specifications

- Optional 5th axis stepper motor driver module.
- Max. output current 1.25 A/phase.
- Max. Input voltage +28V.
- Microstepping resolution 3,200 /rev.
- Acceleration/deceleration ramps and speed software programmable.
- Inputs - 1 x home-switch (TTL with 4K7 pull-up) for filter-wheel initialization
- 2 x limit switch (TTL with 4K7 pull-up)
- Outputs - Bipolar stepper-motor drive (PWM switching)

- +5V @ 0.25A max.

---

## Interface Kit for Ludl Systems

This unit is designed to provide an easy connection route between the OASIS-4i PCI controller card and Ludl BioPrecision stages and focus adapters. In addition the unit provides buffering and interpolation for Ludl rotary encoders and Heidenhain (or similar) linear encoders.

### Connectors

Referring to the picture above, the top three 15 way male D-type connectors are for X, Y and Z encoders which work on the complementary TTL or RS422 format, such as Heidenhain and Renishaw linear types.



Figure 29. Motor and Encoder interface kit for Ludl devices.

Please use the short adapter cables with a revision A unit (which can be determined by looking at the first letter of the serial number) to ensure compatibility with these models of encoders. The pin-out information for these connectors (when using the adapter cable) is as follows:

Table 7. Encoder connector details.

Pin	Signal
1	Encoder A+
2,10	0V
3	Encoder B+

4,12	+5V
9	Encoder A-
11	Encoder B-

The lower three female 15 way D-type connectors are for direct connection to Ludl X, Y and Z axes. They each provide power and signal connection for Ludl rotary encoders (TTL).

The pin-out information for these connectors is as follows:

**Table 8. Motor connector details.**

Pin	Signal
1	Encoder channel A
2	Encoder channel B
3,4	0V
7	+5V
8	Limit, negative direction of travel
9	Limit, positive direction of travel
10	Motor phase 1 out
12	Motor phase 1 in
13	Motor phase 2 out
15	Motor phase 2 in

The two BNC connectors on the right of the unit provide a means of inputting standard video to the OASIS-4i, for video processing or autofocusing, and a buffered video output signal.

## Configuring the Unit



**Figure 30. Location of DIP switches on bottom of unit.**

On the underside of the unit (see Figure 30) there are 8 DIP-switches which allow the selection of either rotary (via the motor connector), or linear (via the separate encoder connector) encoder type, for each axis, and also whether or not the encoder signals should be used directly or interpolated by a factor of 4, before being fed to the OASIS-4i.

The switches, reading from left to right, have the following functions:

**Table 9. Interface DIP switch settings.**

Switch	OFF	ON
1 (left bank)	X encoder direct	X encoder with 4x interpolation
2 (left bank)	Y encoder direct	Y encoder with 4x interpolation
3 (left bank)	Z encoder direct	Z encoder with 4x interpolation
4 (left bank)	Test use only	
1 (right bank)	X encoder (RS-422) via separate connector	X encoder via motor cable
2 (right bank)	Y encoder (RS-422) via separate connector	Y encoder via motor cable
3 (right bank)	Z encoder (RS-422) via separate connector	Z encoder via motor cable
4 (right bank)	Test use only	

**Note:**

If the two test switches (both labelled 4) are left in the ON position, then the green LED of the opposite side of the box from the connectors will be permanently on whilst the unit is powered up.

When interpolation is enabled on an axis, then both edges of both encoder phases A and B are used to update the counters. This is normally necessary to achieve the resolution as stated on the encoder.

**General Notes**

The captive main cable to the OASIS-4i board has been kept purposely short to minimize the noise induced on the encoder inputs from the switching motor currents. It is not recommended that this cable be extended.



# PRINCIPLES OF OPERATION

This section reviews the basic principles of operation for the OASIS-4i controller. Topics covered include calibration of movements, microstepping resolution, speed and acceleration settings, physical vs. soft limits, and encoder support.

---

## Calibration of Movements

The basis for motion operations performed by the OASIS-4i is control of the two phases of the stepper motor. By applying current to the phases in sequence, rotation of the motor is achieved. Using a technique called *microstepping*, the full rotation of the stepper motor can be divided into a number of discreet small steps. For instance, many stepper motors used in microscopy provide 200 steps per revolution. Using half-stepping, a controller can achieve 400 steps per revolution, or a resolution of 0.9 degrees per step.

The OASIS-4i controller by default is set to a resolution of 12,800 microsteps per revolution and can be configured with up to 51,200 microsteps per revolution.

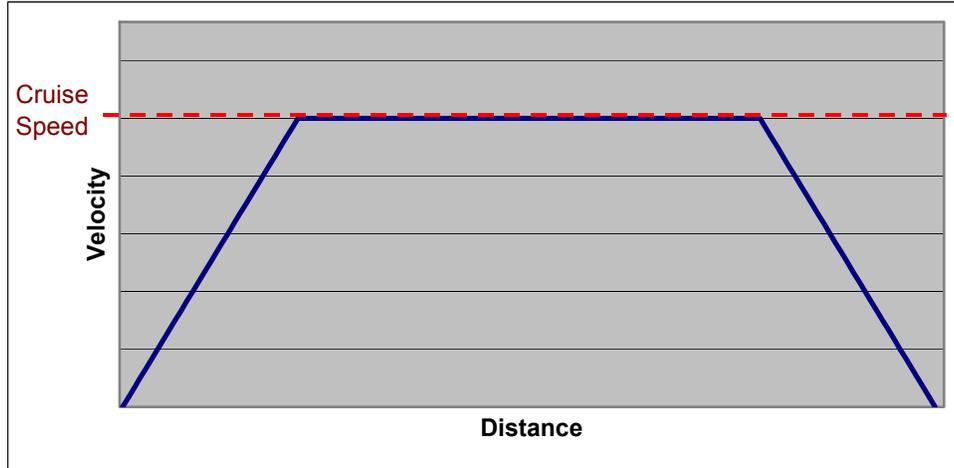
For XY stages and Z focus drives, the revolution of the motor is translated to linear motion using a gearing device such as a lead screw. The OASIS software permits calibration of movement by indicating the pitch of the lead screw. When a 2 mm lead screw is used, for instance, the 12,800 microstepping gives 0.15625 microns per step (2000 microns per revolution, subdivided into 12,800 discrete microsteps). If 20,000 microsteps are used with a 2 mm lead screw, the smallest controller step size would be 0.1 micron.

Note that the controller resolution is independent from the mechanical accuracy and precision of the actual stage and focus drive hardware.

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# Speed and Acceleration

A commanded movement is performed by accelerating an axis to a top speed, cruising at that speed for a required length of time, then decelerating as the destination position is approached so that the axis is stopped at the target position.



**Figure 31. Speed vs. time for a typical move using linear acceleration.**

Figure 31 shows a linear acceleration profile. The velocity increases linearly until a given cruising speed is reached. Once the target destination approaches, the axis is decelerated in a similar fashion in order to stop at the desired location. The job of the OASIS-4i controller is to determine the precise nature of this move to ensure accurate positioning.

**Table 10. The first 7 entries in a linear ramp table.**

Index	Timer Interval (microsections)	Step Size (microsteps)
0	244	1
1	227	1
2	212	1
3	397	2
4	374	2
5	354	2
6	335	2

The OASIS-4i uses four pre-defined ramp profile lookup tables to define acceleration and deceleration. Each table consists of 512 values indicating a timer value and step size. By default,

these tables are configured for Slow, Normal, Fast, and User-defined acceleration profiles and are normally referred to using these names.

Table 10 shows an example ramp table, showing a sequence of microsecond timer intervals and step sizes. The acceleration is performed by running through successive indices in the table after stepping the indicated steps size and waiting the corresponding timer interval.

In the example, note the transition from 1 microstep to 2 microsteps that occurs at index 3 and the corresponding increase in the timer interval to compensate. This is required in order to keep the timer interval above a 200 microsecond value, which allows for simultaneous servicing of up to five axes by the DSP.

### Selecting the Table

Each axis independently uses one of the four pre-defined tables for its acceleration profile.

The default ramp table for each axis is stored in the Flash memory, and may be modified using the Flash Memory Setup application. The table may also be selected under software control, such as with the OASIS application or a 3<sup>rd</sup> party application that supports this feature of the OASIS-4i controller.

### Defining the Table

Each of the four ramp tables is stored in the Flash memory of the OASIS-4i controller. The Flash Memory Setup application allows you to calculate new linear and S-curve tables, or specify your own individual table values, and save them to any of these locations. See the documentation for the Flash Memory Setup application later in this chapter for more information on defining your own ramp tables.

## Cruising Speed

The cruising speed defines the maximum speed at which a given axis will be driven. The OASIS-4i controller allows you to specify the desired cruise speed separately for each axis. The cruise speed is a value between 0 and 511, which corresponds to the desired maximum index to use in the acceleration ramp table associated with that axis.

For example, a cruise speed of 300 means that the controller will ramp up to index 300 in the acceleration ramp table, and then continue to drive at the rate found at index 300 until deceleration is required near the final destination.

The default cruise speed for each axis is stored in the Flash memory, and may be modified using the Flash Memory Setup application.

---

## Physical and Soft Limits

As mentioned above, the coordinate system for each axis is defined in units of microns. Each axis has a range of travel, which is defined by both negative and positive software limit values. In cases where hard limit switches are fitted, as with a motorised XY stage, an automatic initialisation may be performed to search for these limit switches in X and Y.

Figure 32 gives a graphical example of the physical situation. A motor is connected to a lead screw that is used to convert the rotational motion of the motor into a translation of a device such as a XY stage. The physical, hard limit switches are found near the end of the physical limits of travel. Within that range are the software limits, defining the range in which the

controller allows movement. An axis origin defines the 0 position value, to which all other positions are referenced. In reality, the range of travel is broken down into a larger number of very fine steps, corresponding to the microstepping resolution of the motor controller.

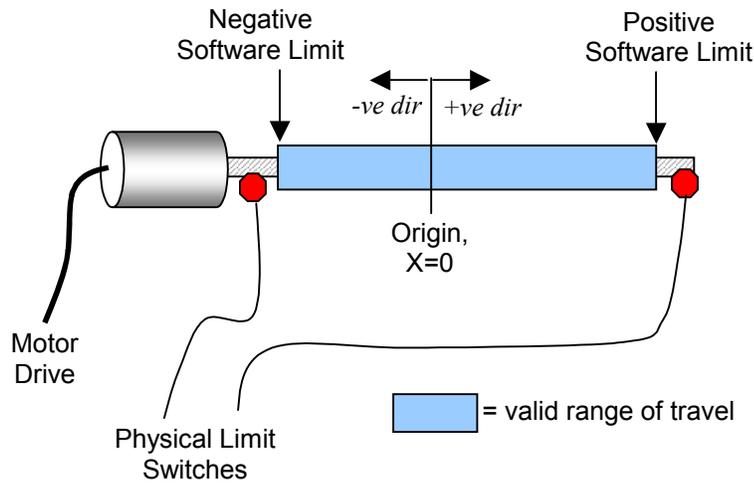


Figure 32. Physical and software limits, with range of travel.

## Stage Initialization and Soft Limits

Most XY stages are fitted with physical limit switches at the positive and negative ends of travel for each axis. The available range of travel for each axis therefore can be determined by driving towards the physical limits and measuring the travel available between the limits at each end. This *initializes* the stage travel, after which the position of the stage relative to the range of travel is known.

The stage initialization provided by the OASIS software also automatically sets the software limits just inside the physical limit positions. The size of this margin between the software and hardware limits is based on the current cruise and ramp to ensure there is enough time to decelerate without hitting the physical limits once the software limit is encountered.

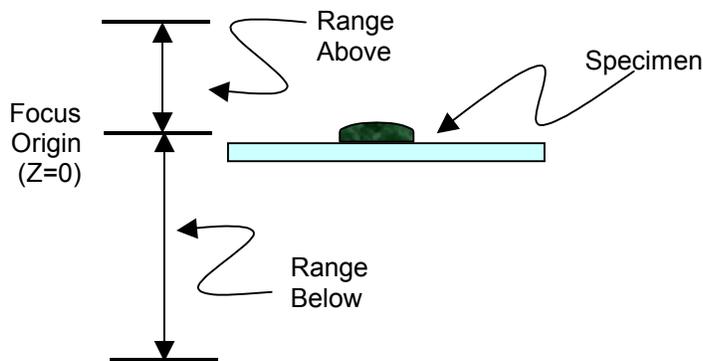
## Focus Initialization and Soft Limits

In many cases, retrofit focus motors do not have hard limits, but instead simply wind the fine focus mechanism clockwise and counter-clockwise without the protection of end of travel limit switches. This can be problematic as eventually a hard stop will be encountered, possibly with damaging results, for instance, if the specimen is driven into the objective lens.

The OASIS-4i software supports focus initialization for setting the focus origin and soft limits for travel to help prevent out-of-range movements.

1. Sets the current position to the origin ( $Z=0$ );
2. Sets the positive software limit a given micron distance above the current position;
3. Sets the negative software limit a given micron distance below the current position.

The physical situation is illustrated in Figure 33.



**Figure 33. Focus initialization.**

This configuration, where the focus origin is considered the nominal in-focus position and specific ranges of travel are defined above and below that, works well for microscopy applications, where consideration must be given to prevent large movements that may damage the specimen or the optical system.

## Maximum allowed move protection

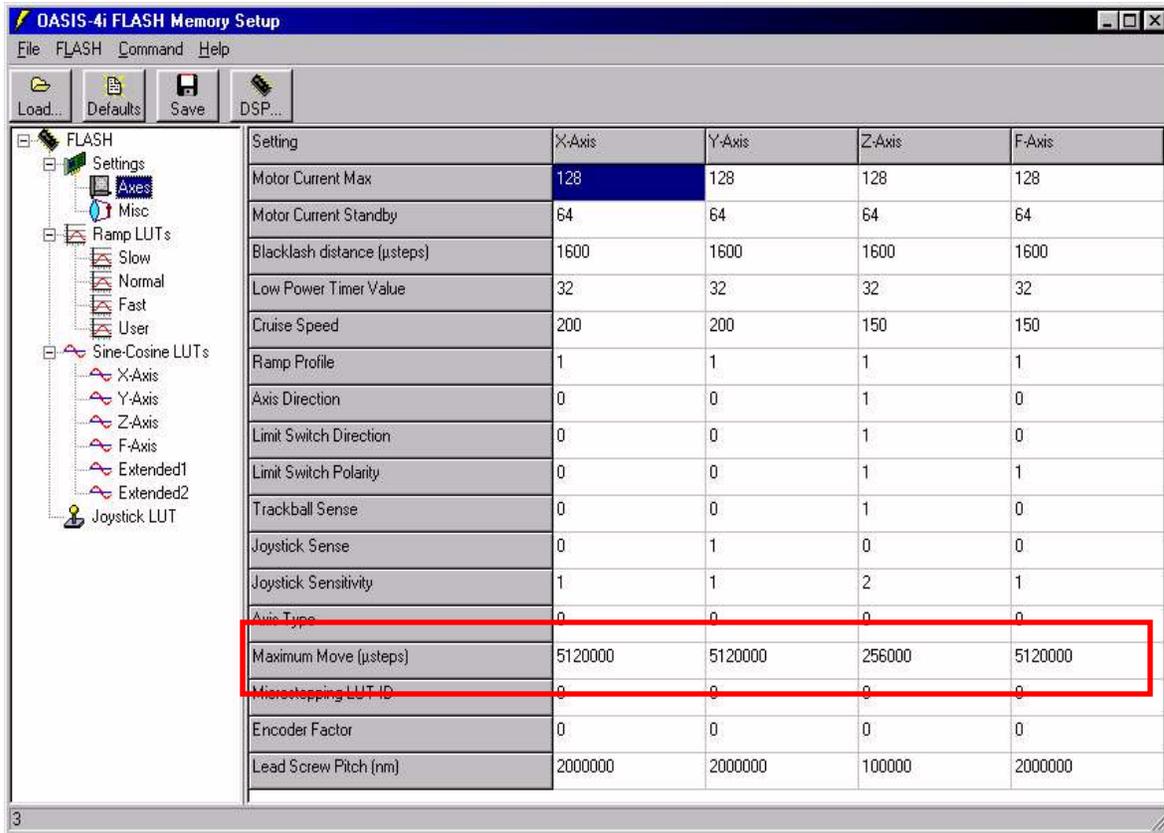
In order to further protect against large movements that may damage the specimen or optical components of a microscope, the OASIS-4i controller also uses a 'Maximum Move' value, which is a microstep value the DSP uses to reject large move requests. The actual Maximum Move value is set in the Flash memory.

This method helps prevent physical collisions when for instance in a situation where the software limits have not been properly set and a very large move has been called, for example, in cases where the Z axis has not been initialised and is in an unknown state. A call to move to an absolute position may in such a case result in a very large movement, potentially causing damage to the specimen or the optical system. If such a move is beyond the Maximum Move value, the DSP refuses the move, i.e., the axis is not driven at all.

### Changing the maximum move value

The Maximum Move value is stored in the OASIS-4i flash memory. To change the value for the maximum allowed move on a given axis:

1. Close all applications that access the OASIS-4i controller.
2. Start the OASIS-4i Flash Memory Setup application.
3. Select the FLASH->Settings->Axes option in the left pane to reveal the settings for each axis.
4. Select the value under Maximum Move for the axis that you wish to change, and enter the new value, in microsteps.
5. Click Save on the main toolbar to write the settings to flash memory then shut down the OASIS-4i Flash Memory setup application.



## Encoders

Encoders are position-sensing devices that provide feedback indicating movement of a sensor relative to a scale. Encoders may be fitted to a given axis in order to provide an independent feedback mechanism to sense manual movements of the axis (for instance if the stage hardware permits turning by hand) and also may be used during movements to ensure accuracy of positioning.

The OASIS-4i controller accepts TTL and, using optional interfaces such as the Interface Kit for Ludl Systems, RS-422 encoder inputs and may be configured to use these to perform closed-loop operations. The setup of the encoder parameters is accomplished in either the OASIS Encoder Wizard or the Flash Memory Setup application. Please refer to these applications' documentation for further details on properly configuring the controller for using encoders.

For accurate stepping, it is important to ensure the microstepping resolution is some multiple of the encoder resolution, and the Flash Memory Setup application allows you to select from various microstepping resolutions in order to achieve the appropriate ratio for a given encoder. The OASIS Encoder Wizard will automatically select the appropriate microstepping resolution for your encoder situation.

For instance, if an encoder with 0.1 micron resolution is fitted to an axis with a 2 millimetre pitch lead screw, then the microstepping resolution should be set to 40,000 steps per revolution to ensure a 2:1 ratio of microsteps to encoder inputs.

## Enabling Encoder Inputs

A secondary counter in the OASIS-4i controller, maintained in addition to the normal microstepping position counter, manages encoder inputs. Closed-loop operation is achieved when the OASIS-4i controller uses the encoder input counter to correct the position information maintained by the microstepping counter.

If an encoder has been configured for an axis, the use of the encoder input signals may be enabled or disabled via software.

When encoder inputs are enabled, all position readouts are given based on the encoder input counter. Therefore the position information is given by the encoder resolution rather than the microstepping resolution. For instance, if a 2 mm pitch axis is configured for 40,000 microsteps per rev and a 0.1 micron encoder is also fitted and enabled, the position values will be provided to the nearest 0.1 micron, rather than the 0.05 micron resolution of the microstepping.

For the X, Y, and Z axes, you can specify via application software whether the encoders are used to perform closed-loop position maintenance. In closed-loop mode, the OASIS-4i controller uses the encoder feedback to ensure that movements are made to within a specified tolerance. Also, the controller will 'servo' the current position, using the encoder signals to ensure that the current position is not changed by any external forces (other than controller movement commands or joystick-type of inputs).

In some high resolution applications where the accuracy and precision of motion is a high priority, such as with the Objective Imaging Surveyor software for fast mosaic imaging, the use of linear encoders on each axis of stage travel is highly desirable.





# TROUBLESHOOTING GUIDE

<i>Problem</i>	<i>Possible Causes</i>	<i>Solution</i>
OASIS-4i card not detected by Windows; Plug-and-Play does not find OASIS-4i card	<ul style="list-style-type: none"> <li>• Card not fully seated into PCI slot</li> <li>• Conflict with another card on PCI bus</li> </ul>	<p>Ensure card is fully seated into PCI slot along entire length</p> <p>Move OASIS-4i card to another free PCI slot</p>
OASIS-4i card is listed as an unknown PCI device in Windows Device Manager	<ul style="list-style-type: none"> <li>• OASIS-4i driver not installed</li> </ul>	<p>Perform driver installation procedure</p>
My 3 <sup>rd</sup> party application software cannot recognize OASIS-4i card	<ul style="list-style-type: none"> <li>• OASIS-4i driver not installed</li> <li>• Application's support library for OASIS-4i card not installed</li> </ul>	<p>Perform driver installation procedure</p> <p>Run application's motorized controller installation procedure; refer to the application documentation for further details</p>
My 3 <sup>rd</sup> party application recognizes the OASIS-4i card, but the motors are not working	<ul style="list-style-type: none"> <li>• Motor power not connected</li> <li>• Motor cable connectors disengaged or faulty</li> </ul>	<p>Ensure OASIS-4i motor power connector (PL5) is fitted with a power supply plug</p> <p>Ensure motors are connected fully fitted at OASIS-4i connector SK1 and at motor end of cables</p>

<i>Problem</i>	<i>Possible Causes</i>	<i>Solution</i>
	<ul style="list-style-type: none"> <li>• OASIS-4i is not properly configured for the type of automation hardware fitted</li> </ul>	Run OASIS configuration wizard to setup the card for your system
	<ul style="list-style-type: none"> <li>• Axis positions are outside the limits of travel</li> </ul>	Run OASIS configuration wizard or 3 <sup>rd</sup> party application options to initialize the axis coordinate system
The system is stalling when making movements	<ul style="list-style-type: none"> <li>• Insufficient power to motor drives</li> <li>• Insufficient power to motor drives</li> <li>• Insufficient power to motor drives</li> <li>• The drive lead screw is damaged</li> </ul>	<p>Adjust maximum motor current using the OASIS Flash Memory Configuration utility</p> <p>Use parallel motor windings to increase current in motor phases</p> <p>Increase motor drive voltage using external 24V power supply</p> <p>Contact automation mechanics manufacturer for service details</p>
The XY stage does not halt when a physical limit is reached	<ul style="list-style-type: none"> <li>• Limit switch direction is incorrect for stage type</li> </ul>	Run OASIS configuration wizard to auto-detect limit switch direction and polarity
An axis is not moving the correct distance when attempting to step a known amount	<ul style="list-style-type: none"> <li>• Axis calibration incorrect</li> <li>• The axis is stalling</li> <li>• Encoder, if fitted, is configured incorrectly</li> </ul>	<p>Set axis pitch or step size using OASIS or 3<sup>rd</sup> party application software</p> <p>See troubleshooting section for stalling during movement</p> <p>Run OASIS configuration wizard for encoders or define encoder settings using OASIS Flash Memory Configuration utility</p>
The Joystick is not working	<ul style="list-style-type: none"> <li>• Internal cable connection</li> </ul>	Verify internal connection from joystick cable connector

<i>Problem</i>	<i>Possible Causes</i>	<i>Solution</i>
	error	plate to PL7 on back end of OASIS-4i card; ensure red stripe on ribbon cable is aligned to Pin 1 on connector PL7

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## If You Need Help

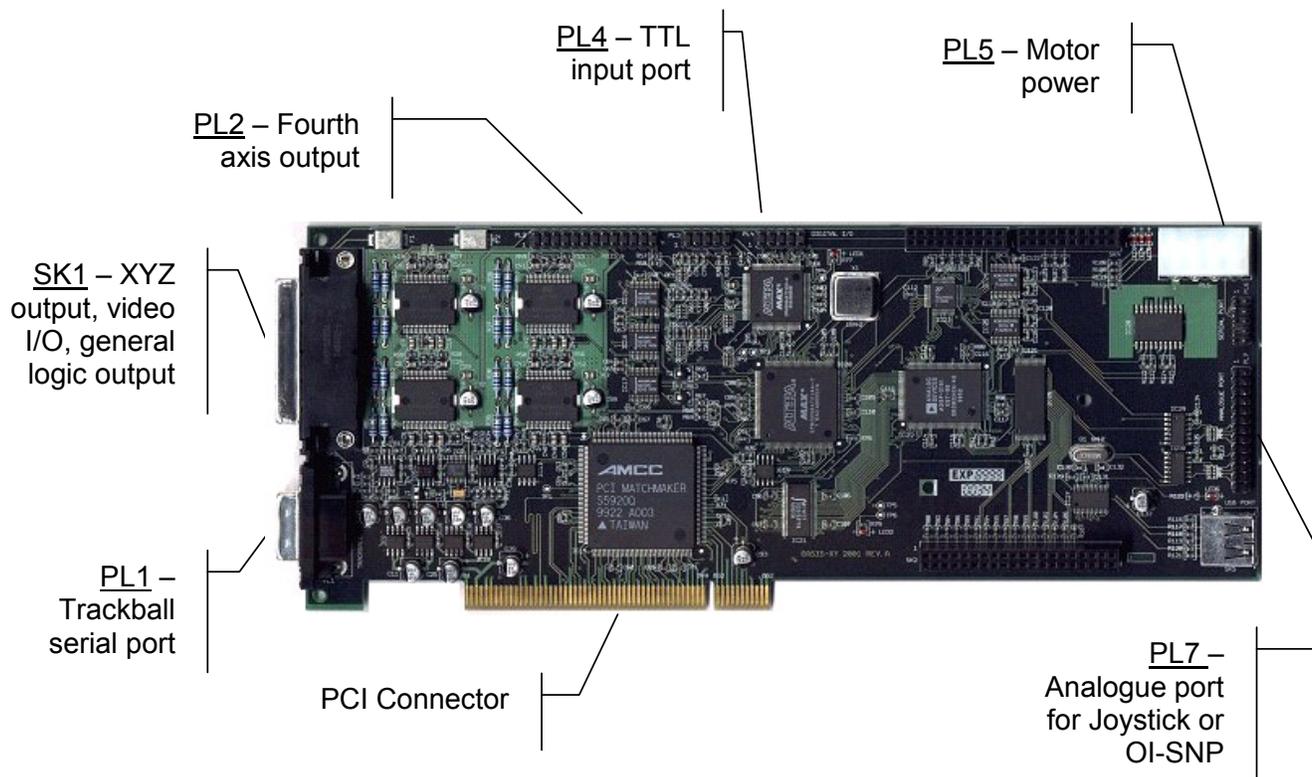
If your OASIS-4i controller was provided as part of an integrated solution, your first contact should be to your system vendor. They will be most familiar with your overall system and any specialized configuration details.

To contact Objective Imaging directly, please visit [www.objectiveimaging.com](http://www.objectiveimaging.com) for contact details for your area.



# CONNECTOR INFORMATION

Refer to the following schematic for connector placement on the OASIS-4i card.



## SK1 - 44-way HD-type female - XYZ, video, and digital outputs on front panel.

The main connector for XY stage, Z focus, video I/O, XYZ encoder input, and digital output signalling.

Pin	Signal	Pin	Signal
1	Video in (Y)	23	I/O Control 2
2	Ground (Video in Y)	24	Y Encoder B
3	Z-axis Cosine Out	25	Y Encoder A
4	Z-axis Sine Out	26	Ground
5	Z-axis Sine Return	27	No Connect
6	Z-axis Cosine Return	28	X Encoder B
7	Y-axis Cosine Out	29	X Encoder A
8	Y-axis Sine Out	30	Ground
9	Y-axis Sine Return	31	Video out (Y)
10	Y-axis Cosine Return	32	Ground (Video out Y)
11	X-axis Cosine Out	33	Video out (C)
12	X-axis Sine Out	34	Ground (Video out C)
13	X-axis Sine Return	35	Z Limit -ve
14	X-axis Cosine Return	36	Z Limit +ve
15	Key (No connect)	37	Open Collector Output 1 (100R current limit resistor)
16	Key (No connect)	38	+ 5V (Fused - 1A)
17	Video in (C)	39	Y Limit -ve
18	Ground (Video in C)	40	Y Limit +ve
19	I/O Control 1	41	Open Collector Output 2 (No current limit resistor)
20	Z Encoder B	42	+12 V (Fused - 1A)
21	Z Encoder A	43	X Limit -ve
22	Ground	44	X Limit +ve

## PL2 - 25-way D-type female - F-axis connector

Fourth axis connector designed to be connected to filter wheels, motorized zoom, and general-purpose motor drive. Connected to PL2 via ribbon cable.

Pin	Signal	Pin	Signal
1	F-axis Sine Out	9	F Limit +
2	F-axis Sine Return	10	F Limit
3	F-axis Cosine Out	11	N/C
4	F-axis Cosine Return	12	N/C
5	F Encoder A	13	Home Input
6	F Encoder B	14	+5V
7	N/C	15	+5V
8	N/C	16 - 25	0V

## PL1 – 9-way D-type male - Trackball/Mouse port on front panel

RS232 port designed to connect to a serial mouse or trackball.

Pin	Signal
1	N/C
2	data receive
3	data transmit
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	N/C

## PL7 – 26-way header male – Analogue/Joystick port

Pin	Signal	Pin	Signal
1	VRef	14	GND
2	GND	15	DSP Serial Port Data transmit
3	Joystick X Input	16	GND
4	GND	17	DSP Serial Port gated SCLK
5	Joystick Y Input	18	GND
6	GND	19	DSP Serial Port Receive Frame Sync (RFS)
7	GND	20	N/C
8	N/C	21	DSP Serial Port Data Receive
9	+5V	22	N/C
10	N/C	23	DSP IRQE (Focus Digi-knob A signal)
11	DSP Serial Port gated SCLK	24	N/C
12	GND	25	TTL Input (Focus Digi-knob B signal)
13	DSP Serial Port Transmit Frame Sync (TFS)	26	N/C

## PL4 – 10-way header male - TTL input port

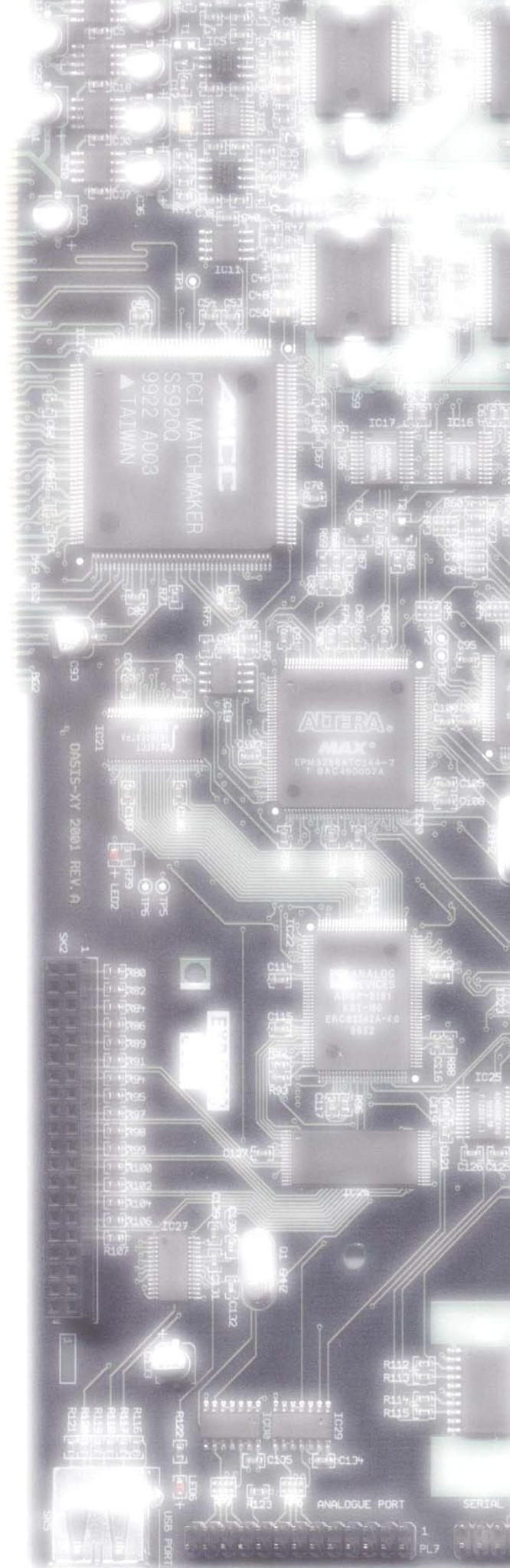
TTL/3.3V compatible input port.

Pin	Signal
1	Input 0
2	GND
3	Input 1
4	GND
5	Input 2
6	GND
7	Input 3
8	GND
9	+3.3V
10	GND

# OASIS-4I SPECIFICATIONS

<b>Stepper Performance</b>	Axes	4 (Independently controlled)
	Micro-step resolution	1/64 Full-step (0.028 degrees with 200 step/rev motor)
	Maximum speed	512 KHz (micro-steps/sec), 8 KHz (half-steps/sec)
	Minimum speed	32 Hz (micro-steps/sec), 1 Hz (half-steps/sec)
	Maximum motor current	0.5A to 1.25A/phase in 5mA steps
	Maximum motor supply voltage	+30V (typically +12V)
	Minimum motor supply voltage	+10V
	Command overhead (Move XYZ)	<10 $\mu$ s
	Controller Response time (Move XYZ)	<20 $\mu$ s
	Acceleration/deceleration profiles	Preset slow/normal/fast or user definable
	Position counter accuracy	32 bits
<b>General</b>	Processor (DSP)	ADSP-2181
	Processor clock frequency	32 MHz
	Non-volatile memory	1-Mbit Flash for program and user configuration storage
	Reset method	Hardware watchdog, software, (PC reset selectable as required)
	Switch-on time	<1 s - fully functional
<b>Bus Interface</b>	Type	PCI 2.2 Compliant
	Bus-master	No
	Operating Frequency	to 33 MHz
<b>System Safety</b>	Watchdog timer function	Resets board on processor fail
	Watchdog timeout	1.6 s
	Drive current limit	4 A max per motor
	Drive current limit response time	4 ms (typical)
	Thermal shutdown	Yes
	Temperature monitor	Yes
	Drive voltage monitor	Yes
	Hardware limit switch inputs	Definable N/O or N/C
	Software limits	User defined
	Software	Stop individual or all axes command
<b>I/O</b>	Encoder inputs	Phase-quadrature, +5V, each axis
	Maximum count rate	512 KHz
	O/C output - current limited	1 (100 Ohm in series)
	O/C output - unprotected	1 (100 mA max)
	Home input (filter-wheel)	1 (10k pull-up to +5V)
	General Purpose I/O	4 (3.3V)
	+12V	Via 44-way connector (resettable fuse protected 1.1A)
	+5V	Via 44-way connector (resettable fuse protected 1.1A)
	S232 ports	2 (1 used for Trackball/mouse control of XYZ axes)
	Analogue port	1 (joystick interface)
	Phase-quadrature I/P	1 (for Z axis control)
	SVHS video I/P	1 (75R terminated for use with optional Autofocus module)
	SVHS video O/P	1 (buffered video in, 75R drive)

<b>Power Req'm't (Max)</b>	+5 V (±5%)	1.75A
	+12 V (±5%)	100 mA
	-12 V (±5%)	50 mA
	10-28V (motor supply)	1.4 x motor phase current x number of axes driven simultaneously
	PC Power Supply	PC power of 250W or higher is required (in some models the fitting of an additional cooling fan is recommended)
<b>Connectors</b>	Drive / Encoder / Limit I/O connector	44-way female high-density d-type with screw fixings
	Trackball / Mouse connector	9-way male d-type (standard serial port)
	4 <sup>th</sup> axis	25-way female d-type with screw fixings (optional)
	RS232	9-way male d-type (standard serial port) (optional)
	Motor power	4-way male disk-drive power connector (normally connected to PC power supply)
<b>Physical Dimensions</b>	Length / Height (excluding connectors)	248 mm x 102 mm (9-3/4" x 4")
<b>Environment</b>	Operating temperature	0 to 35 °C (ambient)
	Storage temperature	0 to 70 °C



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