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Getting Started with NI-Motion™ for NI 73*xx* Motion Controllers

This document provides instructions for installing and getting started with the NI-Motion driver software and National Instruments PXI/PCI-73*xx* motion controllers. Refer to the user manual or technical reference material that came with your computer for specific instructions about the computer.

Refer to the *Documentation* section at the end of this document for a list of the documents included with the NI-Motion driver software and the NI 73*xx* motion controller.

What you Need to Get Started

The following items are necessary for getting started with the NI 73*xx* motion controller:

- ❑ A computer with an available PXI or PCI slot
- ❑ NI 73*xx* motion controller
- ❑ NI-Motion driver software
- ❑ One of the following software packages and documentation:
  - LabVIEW
  - LabWindows™/CVI™
  - Microsoft Visual C++
  - Microsoft Visual Basic
- ❑ NI Motion Assistant (optional)

Safety Information



Caution The following section contains important safety information that you *must* follow when installing and using the device.

Do *not* operate the device in a manner not specified in this document. Misuse of the device can result in a hazard. You can compromise the safety protection built into the device if the device is damaged in any way. If the device is damaged, return it to National Instruments (NI) for repair.

Do *not* substitute parts or modify the device except as described in this document. Use the device only with the chassis, modules, accessories, and cables specified in the installation instructions. You *must* have all covers and filler panels installed during operation of the device.

Do *not* operate the device in an explosive atmosphere or where there may be flammable gases or fumes. If you must operate the device in such an environment, it must be in a suitably rated enclosure.

If you need to clean the device, use a soft, nonmetallic brush. Make sure that the device is completely dry and free from contaminants before returning it to service.

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Operate the device only at or below Pollution Degree 2. Pollution is foreign matter in a solid, liquid, or gaseous state that can reduce dielectric strength or surface resistivity. The following is a description of pollution degrees:

- Pollution Degree 1 means no pollution or only dry, nonconductive pollution occurs. The pollution has no influence.
- Pollution Degree 2 means that only nonconductive pollution occurs in most cases. Occasionally, however, a temporary conductivity caused by condensation must be expected.
- Pollution Degree 3 means that conductive pollution occurs, or dry, nonconductive pollution occurs that becomes conductive due to condensation.

Note NI 73*xx* devices are intended for indoor use only.

You *must* insulate signal connections for the maximum voltage for which the device is rated. Do *not* exceed the maximum ratings for the device. Do not install wiring while the device is live with electrical signals. Do not remove or add connector blocks when power is connected to the system. Remove power from signal lines before connecting them to or disconnecting them from the device.

Operate the device at or below the measurement category[1] marked on the hardware label. Measurement circuits are subjected to *working voltages*[2] and transient stresses (overvoltage) from the circuit to which they are connected during measurement or test. Installation categories establish standard impulse withstand voltage levels that commonly occur in electrical distribution systems. The following is a description of measurement categories:

- Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS[3] voltage. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.
- Measurement Category II is for measurements performed on circuits directly connected to the electrical distribution system. This category refers to local-level electrical distribution, such as that provided by a standard wall outlet (for example, 115 AC voltage for U.S. or 230 AC voltage for Europe). Examples of Installation Category II are measurements performed on household appliances, portable tools, and similar devices/modules.
- Measurement Category III is for measurements performed in the building installation at the distribution level. This category refers to measurements on hard-wired equipment such as equipment in fixed installations, distribution boards, and circuit breakers. Other examples are wiring, including cables, bus bars, junction boxes, switches, socket outlets in the fixed installation, and stationary motors with permanent connections to fixed installations.
- Measurement Category IV is for measurements performed at the primary electrical supply installation (<1,000 V). Examples include electricity meters and measurements on primary overcurrent protection devices and on ripple control units.

[1] Measurement categories, also referred to as *installation categories*, are defined in electrical safety standard IEC 61010-1.

[2] Working voltage is the highest rms value of an AC or DC voltage that can occur across any particular insulation.

[3] MAINS is defined as a hazardous live electrical supply system that powers equipment. Suitably rated measuring circuits may be connected to the MAINS for measuring purposes.

Installing NI-Motion

You must install the NI-Motion driver software *before* installing an NI 73*xx* motion controller for the first time. If you are upgrading from a previous version of NI-Motion, it is not necessary to remove the NI 73*xx* controller before installing the upgrade. The upgrade does not affect the existing Microsoft Windows configuration.

Tip Refer to the `NI-Motion ReadMe.htm` file for last-minute information about NI-Motion.

Complete the following steps to install the NI-Motion driver software:

1. Insert the NI-Motion CD into the CD-ROM drive to display the NI-Motion installation screen.
2. If you have autorun enabled, `autorun.exe` runs automatically. Otherwise, double-click `autorun.exe`.
3. Follow the onscreen instructions.
4. Download the updated firmware to your controller(s).

Note You must update the firmware on your NI 73*xx* controller(s) before you can use them with the corresponding version of NI-Motion. Refer to the *Firmware Updates* section for detailed instructions.

Installing NI 73*xx* Motion Controllers

The following sections explain how to install PXI and PCI motion controllers.

Note When adding or removing a controller from a Windows Vista/XP/2000 system, you must be logged on with administrator-level access. After you have restarted the system, you may need to refresh Measurement & Automation Explorer (MAX) to view the new controller.

PXI Controllers

1. Power off and unplug the chassis.

Caution To protect yourself and the computer from electrical hazards, the computer *must* remain unplugged until the installation is complete.

2. Choose an unused peripheral slot and remove the filler panel.
3. Touch a metal part on the chassis to discharge any static electricity that might be on your clothes or body. Static electricity can damage the controller.
4. Insert the PXI controller into the chosen slot. Use the injector/ejector handle to fully secure the device into place.
5. Attach the front panel of the PXI controller to the front panel mounting rails of the chassis with the slot screws on the chassis.

Caution Make sure you have correctly connected all safety devices before you power on the motion system. Safety devices include inhibits, limit switches, and emergency shut down circuits.

Caution Always power on the computer containing the NI 73*xx* motion controller and initialize the controller before you power on the rest of the motion system. Power off the motion system in the reverse order.

6. Plug in and power on the chassis.

PCI Controllers

1. Power off and unplug the computer.

Caution To protect yourself and the computer from electrical hazards, the computer *must* remain unplugged until the installation is complete.

2. Open the computer case to expose access to the PCI expansion slots.
3. Touch a metal part on the chassis to discharge any static electricity that might be on your clothes or body. Static electricity can damage the controller.
4. Choose an unused +3.3 V or +5 V PCI slot, and remove the corresponding expansion slot cover on the back panel of the computer.

Caution Do *not* insert or remove an NI PCI-7390 motion controller from your system without first disconnecting the +24 V power supplies from all NI PCI-7390 devices. Failure to do so may result in damage to your system and/or NI PCI-7390.

5. Gently rock the controller into the slot. The connection may be tight, but do *not* force the controller into place.

Note Check that the bracket of the device aligns with the hole in the back panel rail of the computer chassis.

6. Secure the mounting bracket of the controller to the back panel rail of the computer.
7. Replace the cover.

Caution Make sure you have correctly connected all safety devices before you power on the motion system. Safety devices include inhibits, limit switches, and emergency shut down circuits.

Caution Always power on the computer containing the NI 73*xx* motion controller, then, if applicable, the +24 V external power supply, and then initialize the controller before you power on the rest of the motion system. Power off the motion system in the reverse order.

8. Plug in and power on the computer.

Firmware Updates

Firmware is software that is loaded onto the NI 73*xx* motion controller. Firmware allows you to update the NI 73*xx* motion controller with new features and updates. The latest firmware is automatically installed on the computer when you install the latest version of NI-Motion. You must download the firmware to the NI 73*xx* motion controller.

Complete the following steps to download firmware to an NI 73*xx* motion controller:



1. Click the MAX icon on the desktop, or select **Start»All Programs» National Instruments»Measurement & Automation** to open MAX.
2. Expand **Devices and Interfaces**, and then expand **NI Motion Devices** in the configuration tree.



3. Select the motion controller for which you want to download firmware. An exclamation point on the NI 73*xx* motion controller icon indicates that the firmware is outdated and must be updated.
4. Click the **Firmware** tab at the bottom of the window. An exclamation point appears for each firmware sector that requires an update.



5. Click the **Update Firmware** button at the top of the window to update all the firmware files on your device.

Tip To find NI-Motion updates, visit `ni.com/motion` and select **Drivers & Downloads**. For support questions, visit `ni.com/support/motion`.

LabVIEW Real-Time Module Setup

Using NI 73*xx* motion controllers with the LabVIEW Real-Time Module and a remote PXI system is very similar to using NI-Motion with an NI PCI-73*xx* motion controller in the host machine. The only difference is that you must map the remote PXI system to the local machine before you configure and initialize the motion system. Figure 1 shows a remote NI 73*xx* motion controller mapped to the local machine. The IP address in the device name indicates that it is a remote device.

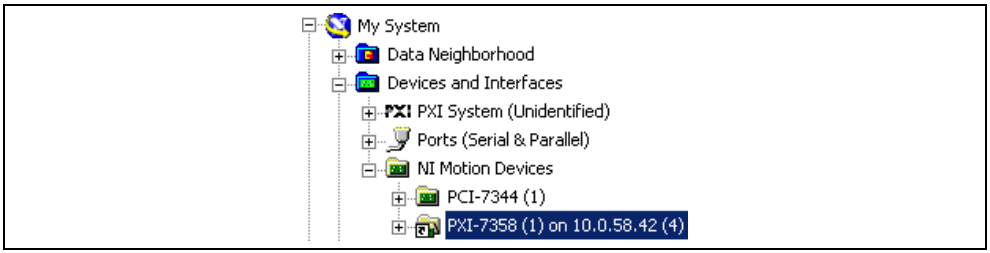


Figure 1. Mapped Remote NI 73*xx* Controller

When the NI 73*xx* motion controller is initialized, you can create a deterministic, real-time motion control application using the LabVIEW Real-Time Module and target the application to the remote device in the PXI system. Refer to the *Remote Systems* topic in the *Measurement & Automation Explorer Help for Motion* for information about mapping the remote system to the local machine.

Configuring the Motion Control System

Before you configure a motion control system, install the motion hardware, including the NI 73*xx* motion controller, motors, drives, encoders, Universal Motion Interface (if necessary), limits, and home switches. Refer to the appropriate hardware documentation for installation instructions.

Note You must have a complete hardware setup to configure and test a servo motion control system.

Note National Instruments recommends you connect the NI 73*xx* motion controller Axis Inhibit outputs to the drive. Inhibit outputs are typically used to disable a servo or stepper drive for power saving, safety, or specific application reasons. Refer to the *Measurement & Automation Explorer Help for Motion* for information about inhibit outputs.

National Instruments recommends you use MAX to configure and test the motion control system. Refer to the *Measurement and Automation Explorer Help for Motion* for step-by-step configuration procedures.

NI Motion Assistant

National Instruments Motion Assistant is a graphical prototyping tool you can use to prototype motion control applications. Motion Assistant contains the following features: simple and complex moves, graphical prototyping, and code creation.

Simple and Complex Moves

Motion Assistant offers several move types that represent the most often used moves in motion control. Supported moves include the following:

- Reference moves include home and index moves.
- Straight-line moves create simple point-to-point movement for basic motion applications.

- Arc moves enable circular, three-dimensional, and helical arc types.
- Contouring moves allow any trajectory specified by a series of coordinates.
- CAD moves create a move profile based on an imported CAD file.

Graphical Prototyping

Motion Assistant is a fully graphical interface that makes it easy for you to prototype a motion application by creating a series of moves. The position, velocity, and acceleration of the moves are all graphed and editable in two and three dimensions.

Code Creation

When you are finished creating a prototype of a motion control application, you can use the Motion Assistant code creation feature to export LabVIEW or C/ C++ code. You can use the exported code to complete the application in LabVIEW, C, or C++. You also can use Motion Assistant to generate code recipes that you can use to code a motion control application in other text languages, such as Microsoft Visual Basic.

The code generation feature of Motion Assistant also creates placeholders in the generated code or code recipes for non-motion code, such as data or image acquisition, in any location you specify.

Advanced Features

Motion Assistant supports the digital output and position compare output features that are available on NI 73*xx* motion controllers. These features are designed to be used with motion control to synchronize or coordinate external processes with moves.

The digital output feature allows you to write to an ancillary digital output line on the NI 73*xx* motion controller under the following move conditions:

- Before Move Completes
- After Move Completes
- After Blend Completes

The position compare output feature allows you to write to the position compare output lines on the NI 73*xx* motion controller at a specified position in the move. If you are using an NI 7350 motion controller, you can configure multiple or periodic position compare outputs. Both options add multiple position compare outputs to a single move.

Hardware Support

Motion Assistant requires that either the actual controller or the virtual representation of an NI 73*xx* motion controller be installed in the computer. Refer to the *Motion Assistant Help* for more information.

Using Motion Assistant Without Hardware

If you do not have an NI 73*xx* motion controller, you can use a virtual NI 73*xx* motion controller in MAX to preview the functionality of Motion Assistant. Follow the instructions in the *Motion Assistant Help* to install a virtual NI 73*xx* motion controller.

Documentation

This section summarizes each document included with the NI 73*xx* motion controller and the NI-Motion driver software. Use this information to determine which document is most useful for the task you are performing:

- **NI 73*xx* user manual**—Describes the electrical and mechanical aspects of the NI 73*xx* motion controller, and contains information about installing and operating the device.
- ***NI-Motion Help***—Contains information about selecting a motor, designing a basic move, designing a multi-axis move, incorporating image and data acquisition into motion applications, and working with common motion concepts, such as contouring and breakpoints. This document is task-based and takes you through each phase of designing and executing a motion application.
- ***NI-Motion Readme***—Contains system requirements, installation instructions, descriptions of any changes made to the software, information about new features in the release, and information about late-breaking known issues that are not documented in other NI-Motion documents.
- ***NI-Motion Function Help***—Contains function reference files for C and Visual Basic and provides details about each function, including a description of the function, a list of the function parameters, illustrations, and error codes.
- ***NI-Motion VI Help***—Contains LabVIEW VI reference files and provides details about each VI, including VI descriptions, lists of control and input terminals, usage, illustrations, and error codes.
- ***Measurement & Automation Explorer Help for Motion***—Provides information about using MAX to configure the NI 73*xx* motion controller as well as some advanced conceptual information about topics such as Bode analysis and control loop parameters.

Where to Go for Support

The National Instruments Web site is your complete resource for technical support. At `ni.com/support` you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

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