

GETTING STARTED

NI SoftMotion™ Controller

For Copley Controls CANopen Drives

This document provides step-by-step instructions for installing and getting started with the NI SoftMotion Controller for Copley Controls Corporation Accelnet and Xenus CANopen drives and the LabVIEW Real-Time Module.

Refer to the [Related Documentation](#) section of this guide for a list of additional documents associated with the NI SoftMotion Controller. Many of these documents are available in Portable Document Format (PDF) on ni.com/manuals.

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Conventions

The following conventions are used in this guide:

»

The » symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»Page Setup»Options** directs you to pull down the **File** menu, select the **Page Setup** item, and select **Options** from the last dialog box.



This icon denotes a tip, which alerts you to advisory information.



This icon denotes a note, which alerts you to important information.



This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

bold

Bold text denotes items that you must select or click in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

italic

Italic text denotes variables, emphasis, cross-references, or an introduction to a key concept. Italic text also denotes text that is a placeholder for a word or value that you must supply.

monospace

Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

Related Documentation

This section summarizes the documentation associated with the NI SoftMotion Controller. Use this information to determine which document is appropriate for your task. Many of the documents listed are available as PDFs on ni.com/manuals.

- *NI SoftMotion Controller ReadMe*—This document contains information about changes and new features in the NI SoftMotion Controller, system requirements, and known issues.
- *Measurement & Automation Explorer Help for Motion*—This help file provides information on using MAX to configure your motion controller.
- *NI-Motion ReadMe*—This document contains information about changes and new features in the NI-Motion software, system requirements, and known issues.

- *NI-Motion User Manual*—This document provides task-based information to guide you through each phase of designing and executing a motion application. This document contains information on selecting a motor, designing a basic move, designing a multi-axis move, incorporating machine vision and data acquisition into motion applications, and other common motion concepts, such as Bode analysis, contouring, and breakpoints.
- *NI-Motion VI Help*—This help file for LabVIEW applications provides detailed information about each VI, including a description, control and input terminals, usage, illustrations (diagram or code), and error codes.
- *NI-Motion Function Help*—This help file for C and Visual Basic applications includes dedicated function reference files, and provides detailed information about each function, including a description of the function, a list of the function parameters, illustrations, and error codes.
- Refer to the documentation included with your NI CAN interface card for specific information about the NI CAN interface card and NI-CAN driver software.
- Refer to the documentation included with your Copley Controls CANopen drive for specific information about the Copley Controls CANopen drive and Copley Controls CME 2 configuration software.

Required Software

The following sections describe National Instruments software packages that are required for setting up and developing your motion control application.

Measurement & Automation Explorer (MAX)

MAX, the National Instruments configuration utility, installs with the NI SoftMotion Controller. You can use MAX to configure your motion controller and other National Instruments hardware devices and to update your National Instruments software.



To run MAX, double-click the MAX icon on your desktop, or navigate to **Start»Programs»National Instruments»Measurement & Automation**.

Figure 1 shows the MAX configuration window demonstrating an installed NI SoftMotion Controller.

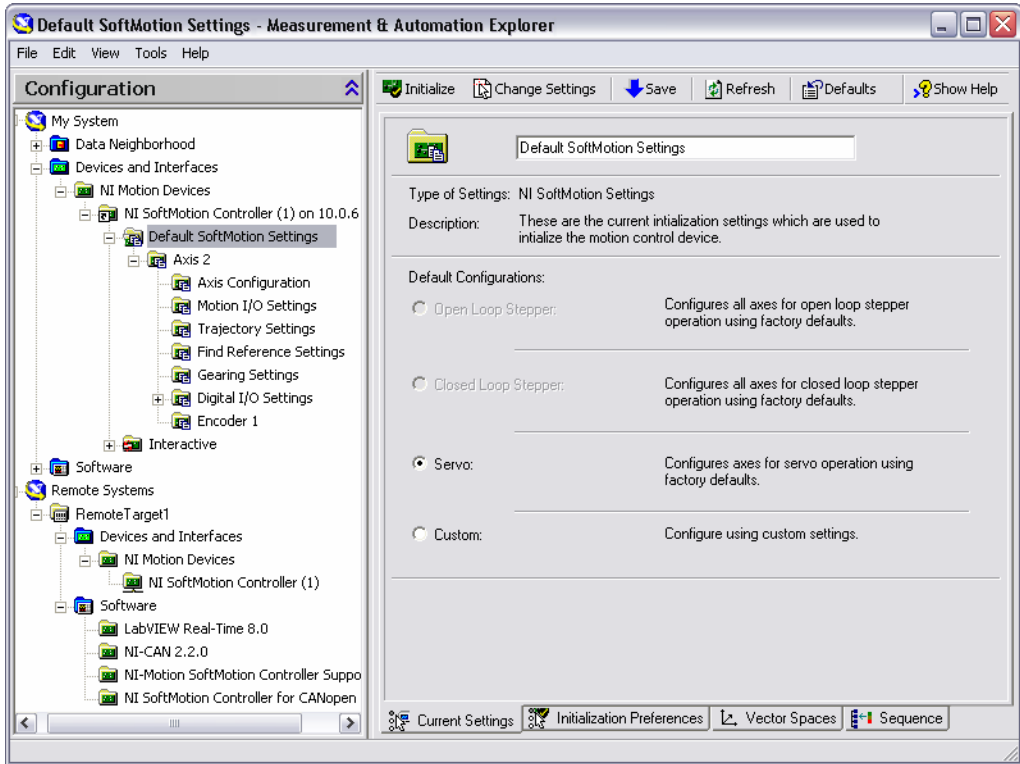


Figure 1. MAX Configuration Window

NI-Motion

NI-Motion is the driver software for National Instruments motion controllers. You can use NI-Motion to create motion control applications using LabVIEW, C/C++, and Microsoft Visual Basic.

Refer to the *NI-Motion User Manual* for more information about creating motion control applications using NI-Motion.

Step 1. Verify Components Before Installation

Before you begin installing and configuring your motion control system, make sure you have the following hardware and software components available for installation:

Hardware

- Development computer running Windows 2000/XP for configuring the CANopen drive and developing your application.
- LabVIEW Real-Time (RT) 8.0 or later target.
 - NI RT Series PXI embedded controller running LabVIEW Real-Time.
 - or*
 - PC running LabVIEW Real-Time.



Note To use the NI SoftMotion Controller on a PC, you must purchase the LabVIEW Real-Time Deployment License for Standard PCs-ETS RTOS (National Instruments part number 777849-03).

- LabVIEW Real-Time Target Software or the LabVIEW 8.0 or later Real-Time Module.
- NI CAN (Controller Area Network) series 2 high-speed interface card and documentation.
- NI-CAN driver software (included on the NI SoftMotion Controller CD).
- Copley Controls Accelnet or Xenus CANopen drive and documentation.
 - Copley Controls Connector/Cable Kit for connecting to your I/O.
 - Copley Controls RS-232 Serial Cable Kit for connecting to the development computer.
 - Copley Controls CANopen Network Kit for connecting to a CAN interface on the RT target.
- Compatible motor and power supply for the drive.

Software

- ❑ NI SoftMotion Controller CD. This CD contains the following NI software products:
 - NI SoftMotion Controller
 - NI-Motion driver software
 - NI-CAN driver software
 - Measurement & Automation Explorer (MAX) configuration software
 - NI Motion Assistant application prototyping software (optional)
- ❑ Copley Controls Motion Explorer (CME 2) 4.0 or later configuration software and documentation.
- ❑ Copley Controls drive firmware 4.12 or later. Drive firmware is available from Copley Controls.
- ❑ Application programming software and documentation.
 - To create applications that run under Windows, use one of the following software packages:
 - LabVIEW
 - LabWindows™/CVI™
 - Microsoft Visual C++
 - Microsoft Visual Basic



Note Refer to the *NI SoftMotion Controller 2.0 ReadMe* for currently supported versions.

- To create applications that run on LabVIEW RT targets, use the LabVIEW 8.0 or later Real-Time Module (ETS).

Step 2. Install Copley Controls Software

Complete the following steps to install the Copley Controls CME 2 configuration software on the development computer.



Note To install software on the computer, you must be logged on with administrator-level access.

1. Insert the CME 2 CD into your CD-ROM drive to launch the CME 2 installation wizard.
2. Follow the installer prompts through the rest of the installation.

The CME 2 configuration software is installed.

Step 3. Connect the CANopen Drive

Complete the following steps to connect your I/O, motor, and power supply to the CANopen drive:



Tip Refer to the CANopen drive documentation for more information about completing the following steps.

1. Connect the I/O necessary for your application to the drive using the Connector Kit available from Copley Controls. Table 1 shows how the NI SoftMotion Controller uses the CANopen Drive terminals.

Table 1. CANopen Drive Terminals Used by the NI SoftMotion Controller

Drive Terminal	NI SoftMotion Controller Signal For Accelnet	NI SoftMotion Controller Signal For Xenus
IN1	Inhibit in/drive fault	Inhibit in/drive fault
IN2	Forward limit	Forward limit
IN3	Reverse limit	Reverse limit
IN4	Home	Home
IN5	E-Stop, polarity is active-low	E-Stop, polarity is active low
IN6	Digital input 0	Digital input 0
IN7	Digital input 1	Digital input 1
IN8	Digital input 2	Digital input 2
IN9	Digital input 3	Digital input 3
IN10	Digital input 4	Digital input 4
IN11	Digital input 5	Digital input 5
IN12	Digital input 6	Digital input 6
Ref +	—	Analog positive input
Ref -	—	Analog negative input
OUT1	Inhibit out/brake	Digital output 0
OUT2	Digital output 0	Digital output 1
OUT3	Digital output 1	Digital output 2
OUT 4	—	Inhibit out/brake

2. Connect the motor and power supply to the drive.
3. Connect the drive to the development computer using the CME 2 RS-232 cable kit available from Copley Controls.

Step 4. Configure the CANopen Drive

Complete the following steps to configure the CANopen drive using the Copley Controls CME 2 configuration software.



Caution The following steps refer to CME 2 version 4.0. These steps may differ in later versions of CME 2.



Tip Refer to the documentation installed with CME 2 for specific instructions about completing these steps.

1. Power on the development computer.
2. Launch CME 2.
3. Configure a communications port on the development computer through which you want to communicate with the drive.
 - a. Select **Tools»Communications Wizard** to launch the Communication Wizard.



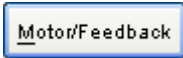
Note If this is the first time launching CME 2, the Communications Wizard dialog box launches automatically when you launch CME 2.

- b. Follow the prompts to specify settings and configure the COM port.
4. Set the drive operating mode to **Position**, and the position loop input to **CAN**.
 - a. Select **Amplifier»Basic Setup**.
 - b. Select **Position** from the Operating Mode drop-down list.
 - c. Select **CAN** from the Position Loop Input drop-down list.
 - d. Click **OK**.
 5. Confirm the firmware on the drive is version 4.12 or later.
 - a. Select **Amplifier»Amplifier Properties** to view the current firmware version.
 - b. If necessary, select **Tools»Download Firmware** to download the latest firmware to your drive.

6. Set the motor/feedback parameters for the motor connected to the drive.



Caution Refer to *Using CME 2 with XXXX*, where XXXX is the name of the drive model, for important information about how these values are calculated. In CME 2, select **Help»Using CME 2 with XXXX** to launch a PDF version of the document.



- a. Click the **Motor/Feedback** button on the functional diagram.
 - b. In the Motor/Feedback dialog box, enter values for the specified parameters. Refer to the motor specifications in the documentation for your motor for the correct values.
 - c. Click the **Calculate** button to generate initial tuning values and limits based on the parameter values entered in step 3.
 - d. Click **OK**.
7. Set the CAN address for the drive. The CAN address for the drive can be set manually, using the address selector switch located on the drive, or programmatically, using CME 2, and can be any integer from 1 to the total number of activated axes.

Complete the following steps in CME 2 to programmatically set the CAN address and bit rate for the drive:

- a. Click the **CAN Configuration** button on the functional diagram.
- b. Select the appropriate bit rate from the Bit Rate drop-down list.



Tip Use the highest bit rate your drive supports. In noisy environments, setting a lower bit rate may improve signal integrity.



Note The bit rate you select in CME2 must match the baud rate you set in MAX in [Step 10. Configure the CANopen Settings](#).

- c. In the CAN Configuration dialog box, select **Use Programmed Value** to set the address for the CAN Address Configuration.
- d. Enter the correct CAN address in the programmed value textbox. This number matches the address set on the drive using the CAN address selector switch.



Note The CAN address can be any integer from 1 to the total number of activated axes. For example, if the NI SoftMotion Controller is licensed for four axes, the CAN address can be any number between 1 and 4.



Note You may activate and connect up to 30 drives to the NI SoftMotion Controller.

- e. Click **OK**.

- f. Power cycle the drive so that the CAN address changes take affect.



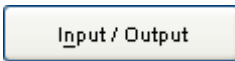
Note Each CANopen drive in your system must have a unique CAN address that is less than or equal to the number of licensed axes on the NI SoftMotion Controller. Otherwise, the system will not recognize the drive. Refer to the [Duplicate CAN Addresses](#) section for more information.

8. Tune the current, position, and velocity loops.



Tip Refer to *Using CME 2 with XXXX*, where XXXX is the name of the drive model, for detailed information about tuning the Current, Velocity, and Position Loops. In CME 2, select **Help»Using CME 2 with XXXX** to launch a PDF version of the document.

9. Configure the drive I/O.



- a. Click the **Input/Output** button on the functional diagram.
- b. For IN1, select **Amp Enable-LO Enables** from the drop-down list.
- c. Select **Not Configured** from the drop-down list for the remaining inputs and outputs.
- d. Select either **Pull Up +5 V** or **Pull Down** for the drive digital inputs depending on your motion control system.

Other than configuring IN1 and the digital inputs for pull up or pull down, it is not necessary to use CME 2 to configure the drive I/O. The NI SoftMotion Controller uses the I/O settings specified in Table 1. However, to avoid confusion, National Instruments recommends that you set the drive I/O to **Not Configured** wherever possible.

- e. Click the **Close** button.

10. Configure any additional settings necessary for your application.



11. Save the configuration data to the Flash memory on the drive by clicking the **Save amplifier working memory to flash** button.



Tip To configure multiple drives using the same configuration settings, save the configuration data to a disk before saving it to the Flash memory on the drive. You can then reload the saved configuration settings from the disk and configure additional drives.

12. Select **Amplifier»Control Panel** and verify that the **Under CAN Control** button is selected in the **Control** section.
13. Exit the application. Save the configuration data to disk if desired.

The CANopen drive is configured.

Duplicate CAN Addresses

If you have two or more drives in your system with the same CAN address, complete the following steps to resolve the conflict and assign a unique value to each drive:

1. Set the CAN address of the drive to a unique value and reset the drive.



Note You must cycle power to the drive before changes to the CAN address will take affect.

2. Set the CAN address and bit rate for the drive in CME2. Ensure that the bit rate you select in MAX matches the baud rate you set in CME2.
3. Add the axes in MAX.

Step 5. Install LabVIEW RT Target Support

Complete the following steps to install LabVIEW RT target support on the development computer.



Note If the LabVIEW Real-Time Module 8.0 or later is installed, you can skip this step.

1. On the development computer, insert the LabVIEW Real-Time Target Software CD into the CD-ROM drive to display the installation wizard.
2. Confirm that **LabVIEW 8.0 Real-Time Target Support** or later is selected.
3. Follow the installer prompts through the rest of the installation.

LabVIEW RT target support is installed on the development computer.

Step 6. Install NI CAN Hardware

Install the NI CAN interface card in the RT target. Refer to the *CAN Hardware and NI-CAN Software for Windows Installation Guide* for specific installation instructions.



Note The NI-CAN software is installed during installation of the NI SoftMotion Controller. Refer to [Step 7. Install the NI SoftMotion Controller](#) for more information.

Ensure that the NI CAN interface card is installed in the RT target before proceeding to the next step.

Step 7. Install the NI SoftMotion Controller

Complete the following steps to install the NI SoftMotion Controller on the development computer.

1. Insert the NI SoftMotion Controller CD into your CD-ROM drive to display the NI SoftMotion Controller installation wizard.
2. Click **Install NI SoftMotion Controller**.
3. Follow the installer prompts through the rest of the installation.
4. Refer to the `NI SoftMotion Controller ReadMe.htm` file after installation is complete for last-minute information not contained in this document.

The NI SoftMotion Controller is installed on the development computer.



Tip To find updates for the NI SoftMotion Controller, visit `ni.com/motion` and select **Drivers and Updates**. For support questions, visit `ni.com/support/motion`.

Step 8. LabVIEW RT Target Configuration

Complete the following steps to install software on the RT target and configure the target for use with the NI SoftMotion Controller:

1. Make sure the RT target is connected to the same network as the development computer. If necessary, connect the RT target to the network.



Tip Refer to the *MAX Remote Systems Help* for information about configuring the network settings.

2. Install the NI SoftMotion Controller on the RT target:
 - a. Launch MAX.
 - b. Expand **Remote Systems»RT Target»Software**.
 - c. Click the **Add/Remove Software** button.
 - d. In the LabVIEW Real-Time Software Wizard dialog box, select **NI SoftMotion Controller for CANopen** to install the NI SoftMotion Controller for CANopen software on the RT target. In addition, select any other software required on the RT target for operations such as data or image acquisition. Refer to *Remote Systems Help* for more information about installing software on an RT target. To access this help file from MAX select **Help»Help Topics»Remote Systems**.



Note Selecting **NI SoftMotion Controller for CANopen** automatically selects NI-CAN, LabVIEW Real-Time, NI Motion SoftMotion Controller Support, and any other required files for installation.

3. Right-click the NI SoftMotion Controller in **Remote Systems»RT Target»Devices and Interfaces»NI Motion Devices** and select **Map to local machine** to map the NI SoftMotion Controller on the RT target to a local system such as the development computer. Refer to *Remote Systems and NI-Motion* in the *Measurement & Automation Explorer Help for Motion* for more information.
4. Connect the CANopen drive to the CAN port on the RT target using the CANopen network kit available from Copley Controls.

The RT target is configured.

Step 9. Activate the NI SoftMotion Controller

This section describes how to activate the NI SoftMotion Controller and add axes to the controller.

Complete the following steps on the development computer to activate the NI SoftMotion Controller:

1. Launch MAX.
2. In the MAX configuration tree, expand **My System»Devices and Interfaces»NI Motion Devices** to obtain a list of available motion controllers.
3. Click the name of the motion controller you wish to activate.
4. On the MAX toolbar, click **Activate Device**.
5. Follow the prompts through the rest of the activation process.

The NI SoftMotion Controller is activated.

Step 10. Configure the CANopen Settings

Complete the following steps to configure the CANopen settings using MAX:

1. Click the name of the motion controller to configure.
2. Click the **CANopen Settings** tab.
3. Set the appropriate values for Drive Vendor, Baud Rate, Interface, and Extended. These values *must* match the settings on the CANopen drives.



Note The port number on your NI CAN device will not match the **Interface** value set using MAX. For example, CAN0 corresponds to Port 1 on the first CAN device.

4. Click **Save Settings to Controller**.

Step 11. Add Axes to the Controller

Complete the following steps to add axes to the NI SoftMotion Controller:

1. Right-click the name of the motion controller and select **Add Axis**.
Each drive connected to the controller shows up as an axis, up to the maximum number of axes licensed.
2. Verify that the axis information for each axis is correct in the dialog box that appears, and click **Next**.

To change the axis information, double-click the **Name** and **Axis Number** fields and enter the correct information.



Note If your axes do not appear in the dialog box, verify that you do not have two drives with the same CAN address. Refer to [Duplicate CAN Addresses](#) for information about resolving this issue.

3. Click **Finish**.

Axes have been added to the NI SoftMotion Controller.

Step 12. Initialize the NI SoftMotion Controller

Before you initialize the controller and test your motion control system, verify that all the motion hardware—including motors, amplifiers, encoders, and limits—is correctly installed. Refer to the appropriate hardware documentation for installation instructions.



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

1. Expand **My System»Devices and Interfaces»NI Motion Devices**.
2. Select the NI SoftMotion Controller.
3. Click the **Initialize** button on the MAX toolbar.



The NI SoftMotion Controller installation and configuration is complete. Use the MAX configuration software to configure the axes and NI-Motion to program moves.

NI Motion Assistant

National Instruments Motion Assistant is a graphical prototyping tool you can use to prototype motion control applications. Motion Assistant contains features for 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 reset axes to a known location or state.
- 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 series of moves 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 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 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 feature available with NI SoftMotion Controllers. This feature is designed to synchronize or coordinate external processes with moves.

The digital output feature allows you to write an ancillary digital output line to the NI SoftMotion Controller under the following conditions:

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

Hardware Support

The NI SoftMotion Controller supports Motion Assistant reference, straight-line, arc, contoured, and CAD moves. Position compare outputs are not currently supported.