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PXI-8231

Getting Started with AKD EtherCAT® Drives and the LabVIEW™ NI SoftMotion™ Module

This document describes how to install and configure the AKD EtherCAT servo drive using the LabVIEW NI SoftMotion Module. The system uses either a CompactRIO Reconfigurable Embedded system, a PXI system, or an NI Industrial Controller as the EtherCAT master, one or more AKD EtherCAT servo drives, and the LabVIEW Development System.



Tip If you encounter any problems during setup, refer to the [Tips and Troubleshooting](#) section for assistance.

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What You Need to Get Started



Caution Before installing the drive, review Chapter 2, *Safety*, in the *AKD Installation Manual* that shipped with the drive. Failure to follow safety instructions may result in injury or damage to equipment.

You need the following items to get started.

Hardware

- ☐ NI Real-Time Controller:
 - NI Real-Time CompactRIO controller with two Ethernet ports
 - NI Real-Time PXI embedded controller with two ethernet ports. If your controller does not meet this requirement, install one of the following Ethernet PXI modules for EtherCAT use:
 - NI PXI-8231
 - NI PXI-8232
 - NI Industrial Controller
- ☐ +24 VDC power supply for the CompactRIO controller or Industrial Controller (not applicable for PXI controllers)
- ☐ +24 VDC power supply for the AKD EtherCAT servo drive



Note Check your hardware documentation for power supply requirements.

- ☐ Ethernet connection and cable for the RT controller
- ☐ Ethernet cable and EtherCAT connection for the AKD EtherCAT servo drive
- ☐ AKD EtherCAT servo drive and associated AKM series servo motor and encoder



Note Refer to ni.com for information about AKD EtherCAT servo drive and AKM series servo motor compatibility.

Software

- ☐ LabVIEW 2010 or later
- ☐ LabVIEW 2010 Real-Time Module or later
- ☐ LabVIEW 2010 NI SoftMotion Module or later
- ☐ NI-RIO 3.5.0 or later
- ☐ NI-Industrial Communications for EtherCAT 2.0 or later



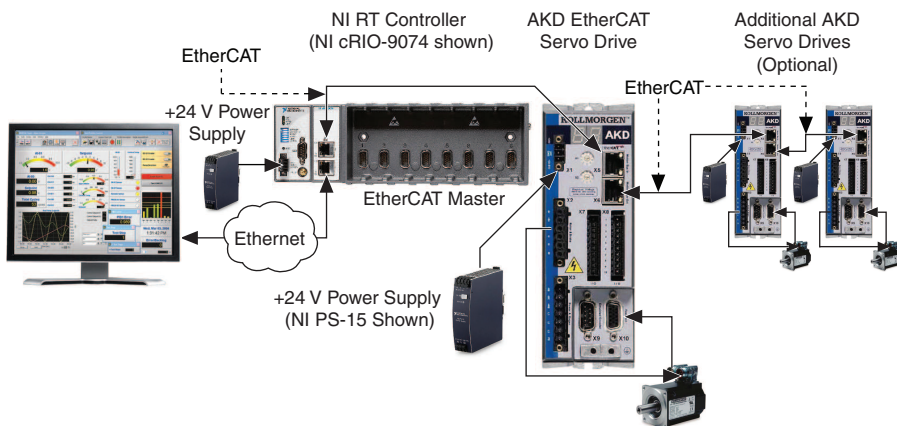
Note For more information about downloading and getting started with EtherCAT hardware drivers, go to ni.com/info and enter Info Code `ecatdriver`.



Note Refer to the *NI SoftMotion ReadMe* to ensure the installed version of NI-Industrial Communications for EtherCAT is compatible with your installation of the NI SoftMotion module.

Figure 1 shows a simplified connection diagram.

Figure 1. AKD EtherCAT Servo Drive Connection Diagram



Related Documentation

The following documents contain additional information that you may find helpful. All referenced documents ship with the product and are available at ni.com/manuals.

- *AKD Installation Manual*—Use this document to learn additional information about the electrical and mechanical aspects of the AKD EtherCAT servo drive, including important safety information.
- Documentation for the CompactRIO or PXI controller (shipped with the hardware and available at ni.com/manuals).
- *LabVIEW NI SoftMotion Module Help*—Use this help file to learn about using the NI SoftMotion Module in LabVIEW including information about programming with and using the NI SoftMotion Module with LabVIEW. To access this help file from LabVIEW, select **Help»LabVIEW Help**, then expand the *LabVIEW NI SoftMotion Module* book on the **Contents** tab.
- NI Industrial Communications for EtherCAT software documentation.

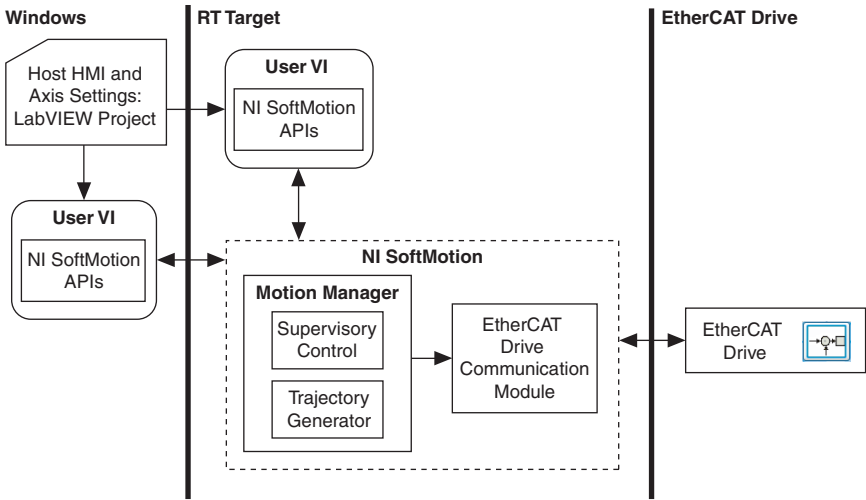
- *LabVIEW Help*—Use the *LabVIEW Help* to access information about LabVIEW programming concepts, step-by-step instructions for using LabVIEW, and reference information about LabVIEW VIs, functions, palettes, menus, tools, properties, methods, events, dialog boxes, and so on. The *LabVIEW Help* also lists the LabVIEW documentation resources available from National Instruments. Access the *LabVIEW Help* by selecting **Help»LabVIEW Help**.
- *Getting Started with the LabVIEW Real-Time Module*—Use this document to learn how to develop a real-time project and VIs, from setting up RT targets to building, debugging, and deploying real-time applications. Access the *Getting Started with the LabVIEW Real-Time Module* PDF by selecting **Start»All Programs»National Instruments»LabVIEW»LabVIEW Manuals»RT_Getting_Started.pdf**.

NI SoftMotion Module Overview

The LabVIEW NI SoftMotion Module allows you to create deterministic motion control applications using the LabVIEW Development System.

The following figure shows the NI SoftMotion Module architecture when you are using NI SoftMotion with the AKD EtherCAT servo drive.

Figure 2. NI SoftMotion and AKD EtherCAT Servo Drive Architecture



Use the LabVIEW Project to configure all your axis settings and test your configuration. When your hardware configuration is complete, you use NI SoftMotion to create move profiles. Refer to the *NI SoftMotion Module Help*, available by selecting **Help»LabVIEW Help**, for information about using the NI SoftMotion Module to create motion applications. Use the NI Example Finder to browse and search installed NI SoftMotion Module examples. Select **Help»Find Examples** to launch the NI Example Finder.

Hardware and Software Configuration

This section covers the hardware and software setup for the EtherCAT master and AKD EtherCAT servo drive, and contains instructions about using the NI SoftMotion Module to configure and test your system.



Note This document uses a CompactRIO controller as the EtherCAT master. Refer to [Configuring a PXI or Industrial Controller Master](#) for setup instructions for those devices.

The following procedure assumes the device is configured with the factory default settings it shipped with. If the device has been previously configured, use Kollmorgen WorkBench software to restore it to the default settings before proceeding. Refer to the *Parameter Load/Save* topic in the *Using Parameters and the Terminal Screen* section of the Kollmorgen WorkBench help for more information.

Step 1: Set Up the CompactRIO System

Complete the following steps to set up the CompactRIO hardware.

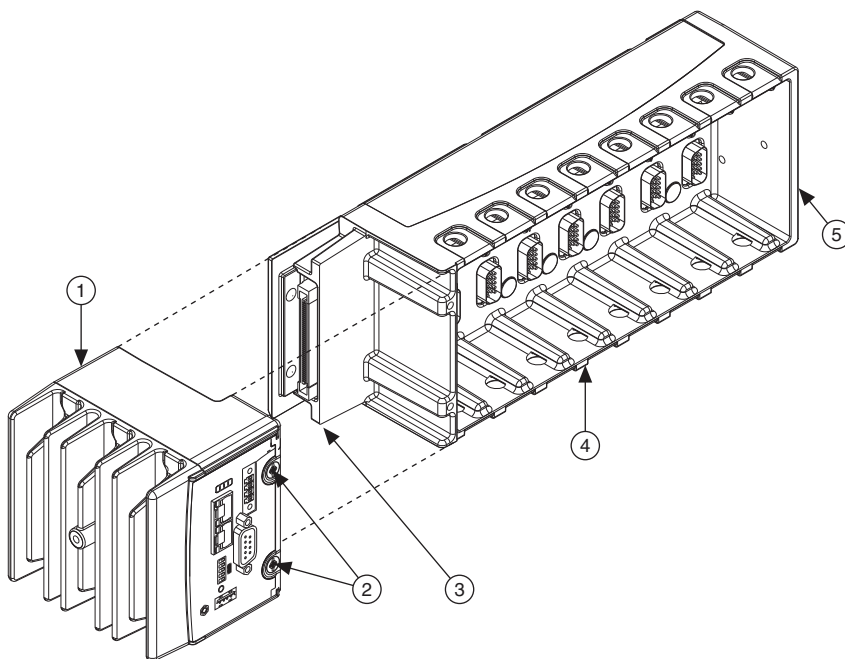
1. Install the real-time CompactRIO controller on the chassis if you are not using an integrated controller and chassis.



Note Write down the controller serial number before installing the controller onto the chassis. You will be unable to read the serial number after you have mounted the controller.

- a. Make sure that no power is connected to the controller or the chassis.
- b. Align the controller with the chassis as shown in Figure 3.

Figure 3. Installing the Controller on the Chassis (Eight-Slot Chassis Shown)



1	Controller	4	Reconfigurable Embedded Chassis
2	Captive Screws	5	Grounding Screw
3	Controller Slot		

- c. Slide the controller onto the controller slot on the chassis. Press firmly to ensure the chassis connector and the controller connector are mated.
- d. Using a number 2 Phillips screwdriver, tighten the two captive screws on the front of the controller.

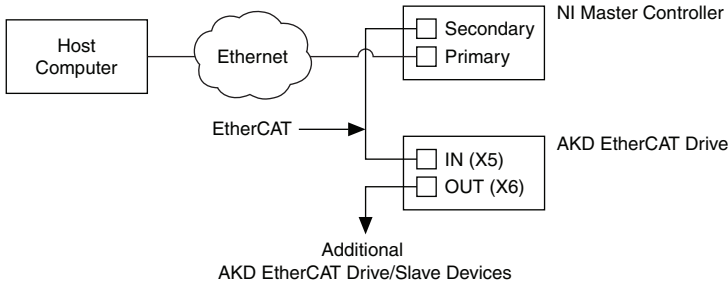
2. Connect the controller to a power supply and an Ethernet network on the same subnet as the development computer. Refer to the controller operating instructions for information about connecting the controller to the power supply and Ethernet network.



Note Do not plug in or turn on any power to the system until after all required hardware connections are made.

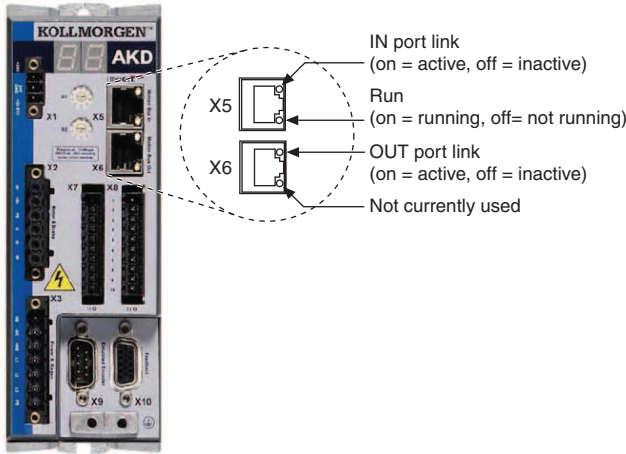
3. Connect the secondary port of your EtherCAT Master directly to the X5 Motion Bus IN port (top port) on the AKD EtherCAT servo drive using a standard Category 5 Ethernet cable. The secondary port is the top port (LAN PORT #2). You may expand the deterministic Ethernet network by connecting an additional AKD EtherCAT drive or other slave devices to the X6 Motion Bus OUT port (bottom port) on the first AKD EtherCAT drive.

Figure 4. Connecting the AKD EtherCAT Drive to the Network



The LED indicators on the AKD Motion Bus IN and Motion Bus OUT ports display the communication status. Figure 5 shows the LED indicators on the X5 and X6 connectors.

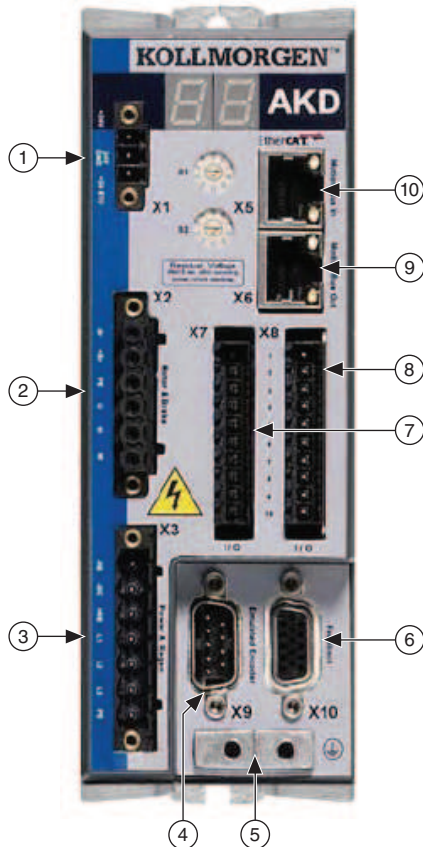
Figure 5. AKD X5 and X6 Motion Bus Connectors



Step 2: Connect the AKD EtherCAT Drive

Figure 6 shows an overview of the connectors on the AKD EtherCAT servo drive.

Figure 6. AKD EtherCAT Servo Drive Connectors



1	24 V Supply, STO (X1)	6	Feedback (X10)
2	Motor, Brake (X2)	7	I/O Connector (X7)
3	AC Input Power (X3)	8	I/O Connector (X8)
4	Encoder Emulation (X9)	9	Motion Bus OUT (X6)
5	Drive Grounding Lug	10	Motion Bus IN (X5)

Mount the Drive and Connect the Protective Earth

1. Mount the drive to a conductive metal plate. Refer to the *AKD Installation Manual* for dimensions and additional information specific to the drive model.
2. Connect the protective earth (PE) to either ground screw on the drive grounding lug. Figure 6 shows the location of the grounding lug on the drive.

Connect the Logic Power Supply to the X1 Connector

The +24 V power supply provides the logic power to the AKD EtherCAT servo drive. Complete the following steps to connect the +24 V power supply to the drive.



Note Do not plug in or turn on the +24 V power supply until all required hardware connections are made.

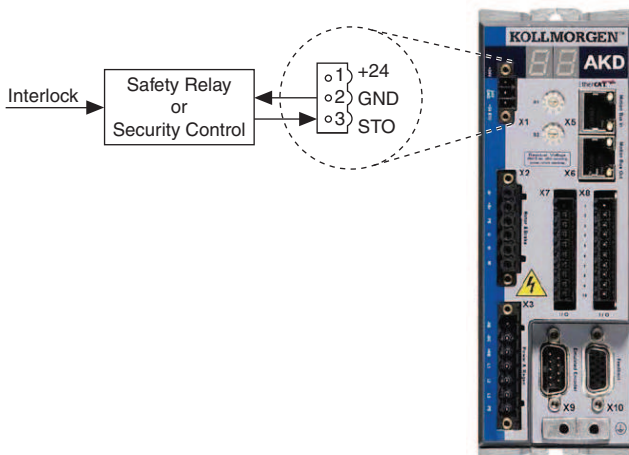
1. Connect the +24 V power supply (+) terminal to the +24 terminal on the AKD X1 connector.
2. Connect the +24 V power supply return (-) terminal to the GND terminal on the AKD X1 connector.
3. Connect the STO terminal and GND terminal to the output of a safety relay or security control. The safety relay must comply with the requirements of the SIL 2 according to IEC 61800-5-2, PL d according to ISO 13849-1, or Category 3 according to EN-954. Refer to the *AKD Installation Manual* for more information.



Note If the STO functionality is not required, connect the STO terminal directly to the +24 terminal on the AKD X1 connector to bypass any external safety circuitry.

Figure 7 shows the AKD EtherCAT servo drive X1 connector pinout.

Figure 7. AKD X1 Connector



Connect the Hardware Enable on the X8 Connector

The Enable input (X8, pin 4) requires external connection to enable the output stage on the drive. The enable signal allows either a sinking or sourcing configuration. Refer to Figure 9 for the X8 connector pinout. Refer to Chapter 8, *Electrical Installation*, in the *AKD Installation Manual* for connection information.

Connect the Motor and Encoder to the AKD Drive

All AKM series servo motors available from NI come pre-wired for direct connection to the AKD EtherCAT servo drive X2 Motor connector and X10 Feedback connector. Figure 8 shows the location of the connectors.

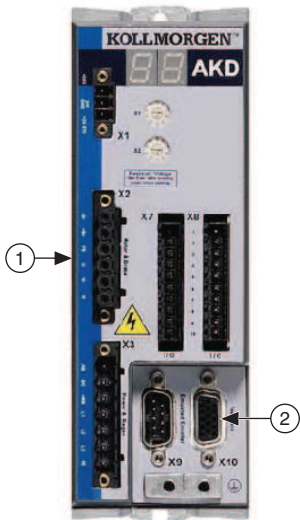
1. Connect the motor 6-pin connector to the AKD EtherCAT servo drive X2 Motor connector.



Note The X2 connector also provides connection for the drive to control the +24 V holding brake for motors that have a brake. Refer to the *AKD Installation Manual* for information about the holding brake if your motor contains an internal brake.

2. Connect the motor DSUB feedback connector to the AKD EtherCAT servo drive X10 Feedback connector.

Figure 8. Motor and Encoder Connections



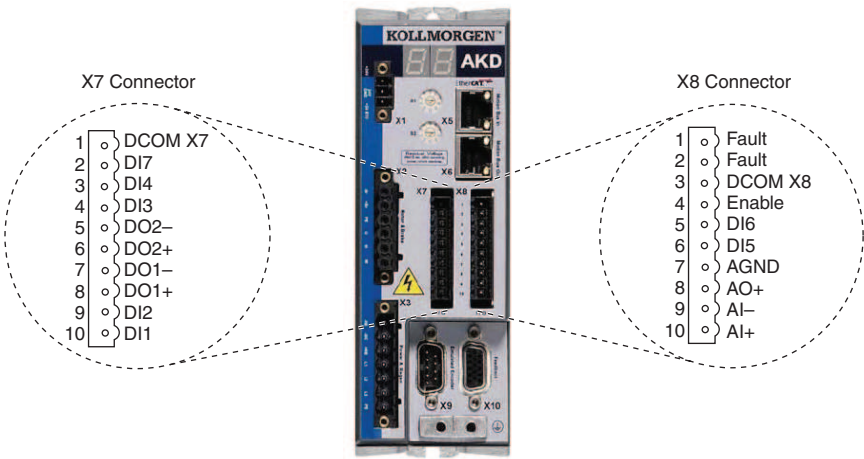
1 Motor Connector (X2)

2 Feedback Connector (X10)

Connect Additional I/O On the X7 and X8 Connectors

Use the AKD X7 and X8 connectors to connect additional I/O such as limit switches, position capture inputs, or other I/O as required by your application. Refer to the *AKD Installation Manual* for information about connecting digital input and output devices to the AKD EtherCAT servo drive. Figure 9 shows the X7 and X8 connector pinout.

Figure 9. AKD X7 and X8 Connectors



NI SoftMotion digital inputs and outputs are 0-based, while the digital inputs and outputs on the AKD EtherCAT servo drive are 1-based. This means that Digital Input 1 on the AKD corresponds to DI0 in the NI SoftMotion software. Table 1 shows the preset signal mapping for the AKD EtherCAT servo drive in the NI SoftMotion software.

Table 1. AKD to NI SoftMotion Signal Mapping

AKD Connector Terminal	NI SoftMotion Pin	Signal Mapping
DI1 (X7 pin 10)	DI0	Home
DI2 (X7 pin 9)	DI1	Capture
DI3 (X7 pin 4)	DI2	Forward Limit
DI4 (X7 pin 3)	DI3	Reverse Limit

You can connect the AKD EtherCAT servo drive to sourcing or sinking digital output devices depending on how the DCOM terminal on each connector is wired.

- **Sourcing**—Connect DCOM to the negative terminal on the +24 V supply.
- **Sinking**—Connect DCOM to the positive terminal on the +24 V supply.

Connect the AC Input Power

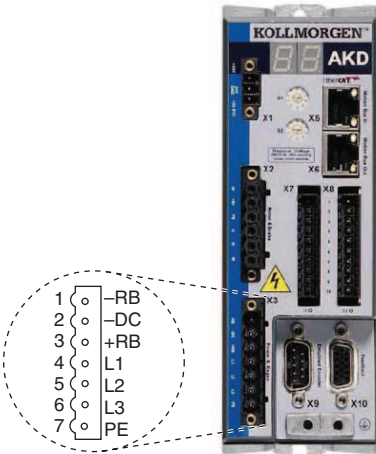
Connect the X3 mains supply connector to AC input power. Pins 4 through 7 contain the AC power signals. The X3 connector also provides signals for an external brake (regen) resistor (\pm RB) and DC bus link (-DC). Refer to the *AKD Installation Manual* for information about using these terminals.



Note Do not turn on AC power until all required hardware connections are made.

Figure 10 shows the location and pin assignment for the X3 connector.

Figure 10. AKD EtherCAT Servo Drive X3 Connector



AC input power can be connected for either a three-phase or single-phase operation.



Note External filtering and fusing are optionally provided by the user. Refer to the *AKD Installation Manual* for information about filter and fuse requirements.

Figure 11 shows three-phase connection.

Figure 11. AC Input Power Three-Phase Connection

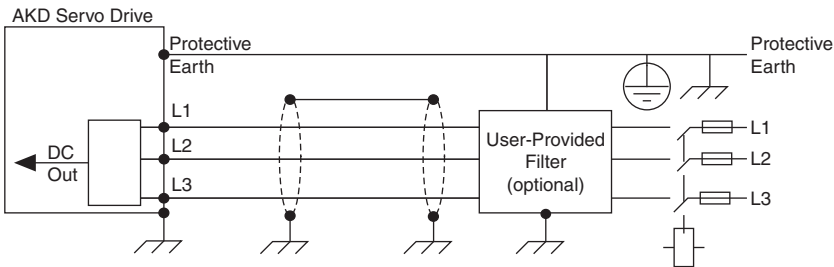
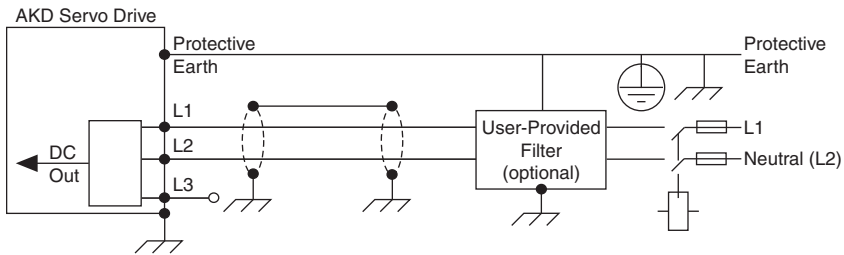


Figure 12 shows single-phase connection.

Figure 12. AC Input Power Single-Phase Connection



Confirm Drive Connections

After all hardware connections have been made complete the following steps to confirm the AKD hardware setup.

1. Power on the RT controller.
2. Apply AC power to the AKD drive.
3. Turn on the +24 V power supply. After logic power is supplied to the drive, the drive displays the following sequence of flashes in the LED indicators.
 - a. --
 - b. []
 - c. Drive IP address, flashed sequentially
 - d. Drive status, either the operation mode or the fault or warning code if there is a fault or warning condition. The operation modes are as follows:
 - o0—torque mode (current mode)
 - o1—velocity mode
 - o2—position mode



Note If the drive shows a fault or warning code, refer to the *AKD Fault and Warning Messages Card* that came with the drive or the *NI SoftMotion Module Help* for more information about the fault or warning, including possible solutions. You can use the **Interactive Test Panel** dialog box or the Clear Faults method to clear the drive faults. AKD drive warnings are only displayed on the drive LED indicators and are not available through NI SoftMotion.

Step 3: Install Software on and Configure the NI RT Controller

Complete the following steps to configure the controller and install software on it.

1. Launch Measurement & Automation Explorer (MAX) on the development computer by clicking the NI MAX icon on the desktop, or by selecting **Start»All Programs»National Instruments»NI MAX**



2. Select the controller under **Remote Systems** in the **Configuration** pane. If you do not see the controller, you may need to disable the firewall on the development computer.
3. Verify that the **Serial Number** in the **Identification** section matches the serial number on the device.
4. If you are using a PXI controller or you do not want to format the disk on the controller, eliminating all installed software and files, power on the controller and skip to step 9.



Note If you need to format the PXI controller, refer to the *Measurement & Automation Explorer Help* for instructions.

5. Set the **Safe Mode** switch on the controller to the **On** position.
6. Power on the controller. If it is already powered on, press the **Reset** button on the controller to reboot it.
7. Right-click the controller under **Remote Systems** in the **Configuration** pane and select **Format Disk**. Click **Yes** on the dialog box that appears.
8. When MAX finishes formatting the disk, set the **Safe Mode** switch to the **Off** position and press the **Reset** button on the controller to reboot it.
9. Select the **System Settings** tab and type a descriptive name for the system in the **Name** field.
10. (Optional) Complete this step only if the target has an empty IP address (0.0.0.0). Select the **Network Settings** tab and select **DHCP or Link Local** from the **Configure IPv4 Address** list to assign an IP address or select **Static** to specify a static IP address in the **IPv4 Address** section.
11. Click **Save** on the toolbar and let MAX reboot the system.
12. When the new system name appears under **Remote Systems**, expand the controller item in the tree, right-click **Software**, and select **Add/Remove Software**.
13. Select a recommended software set that includes NI-RIO 3.5.0 or later with NI Scan Engine Support and the following add-ons enabled:
 - LabVIEW NI SoftMotion Module
 - NI-Industrial Communication for Ethercat

14. Click **Next** to install the selected software on the controller. Click **Help** if you need information about installing recommended software sets.
15. When MAX finishes installing the software on the controller, select the controller under Remote Systems in the Configuration pane.
16. Click the **Network Settings** tab and expand **More Settings** in the **eth1** section.
17. Select **EtherCAT** from the **Adapter Mode** list.



Note These settings are not available if NI-Industrial Communications for EtherCAT is not installed to the target.

18. Some RT controllers can configure the Packet Detection of the Ethernet Adapter. If the option is available for your target, in the **eth0 (Primary)** section click **More Settings** and change **Packet Detection** to **Polling**. Leave the **Polling Interval** at 1 ms.

When you have completed these steps the **Network Settings** tab will look similar to Figure 13.


Figure 13. Network Settings Tab

Ethernet Adapter eth0 (Primary)	
Adapter Mode	TCP/IP Network
MAC Address	00:80:2F:11:39:64
Configure IPv4 Address	DHCP or Link Local
IPv4 Address	10.2.199.14
Subnet Mask	255.255.255.0
Gateway	10.2.199.1
DNS Server	130.164.12.8
▼ Fewer Settings	
Preferred Link Speed	Autonegotiate
Packet Detection	Polling
Polling Interval	1 ms
Ethernet Adapter eth1	
Adapter Mode	EtherCAT
MAC Address	00:80:2F:11:39:65

19. Click **Save**.
20. Reboot the controller when prompted.
21. Close MAX.

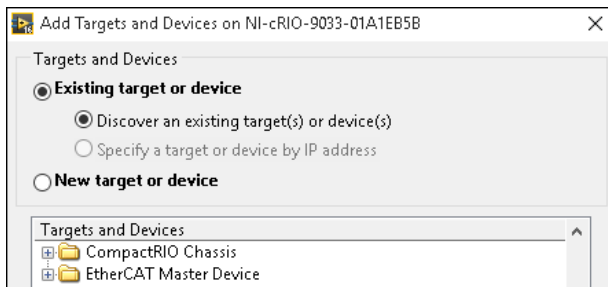
Step 4: Creating a Project and Adding an NI SoftMotion Axis

Complete the following steps to create a LabVIEW project and add an NI SoftMotion axis associated with the AKD EtherCAT servo drive.

1. Launch LabVIEW.
 2. Select **File»Create Project or Project»Create Project** to display the **Create Project** dialog box. You can also click the **Create Project** button on the Getting Started window. The **Create Project** dialog box includes a list of templates and sample project you can use to ensure that the project you create uses reliable designs and programming practices.
 3. Select **Blank Project** from the list of templates.
 4. Click **Finish**.
 5. Select **Help** and make sure that **Show Context Help** is checked. You can refer to the context help throughout the tutorial for information about items on the block diagram.
 6. Right-click the top-level project item in the **Project Explorer** window and select **New»Targets and Devices** from the shortcut menu to display the **Add Targets and Devices** dialog box.
 7. Make sure that the **Existing target or device** radio button is selected.
 8. Expand **Real-Time CompactRIO**, **Real-Time PXI**, or **Real-Time Industrial Controller** as appropriate for your hardware.
 9. Select the controller to add to the project and click **OK**.
 10. Complete the following additional steps if you are using a CompactRIO controller.
 - a. If you have LabVIEW FPGA installed, the **Select Programming Mode** dialog box appears. Select **Scan Interface** to put the system into Scan Interface mode.
-  **Tip** Use the **CompactRIO Chassis Properties** dialog box to change the programming mode in an existing project. Right-click the CompactRIO chassis in the **Project Explorer** window and select **Properties** from the shortcut menu to display this dialog box.
- b. Click **Continue**.
 11. In the LabVIEW **Project Explorer** window, right-click the master controller and select **New»Targets and Devices**.

12. In the **Add Targets and Devices** dialog window shown in Figure 14, select **Existing target or device** and expand the category **EtherCAT Master Device** to auto-discover the EtherCAT port on the master controller. Click **OK** to add the master. It will automatically try to discover any connected EtherCAT slaves. An EtherCAT master device can be added manually at any time.

Figure 14. Adding the EtherCAT Master



Note When all the slave devices are discovered, the LabVIEW **Project Explorer** window lists each slave device and any installed C Series modules. If the AKD EtherCAT drive does not appear in the **Project Explorer** window after this step, confirm that the NI Scan Engine is in Configuration mode and repeat steps 11 and 12. Refer to the [Tips and Troubleshooting](#) section for more information.

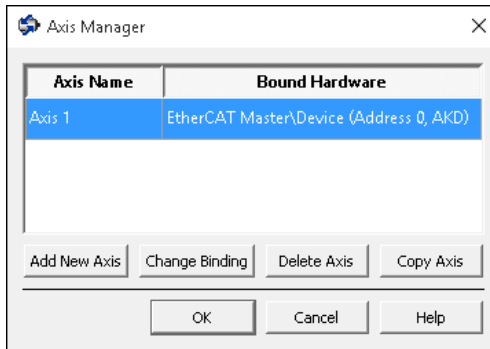
13. Right-click the controller item in the **Project Explorer** window and select **Properties** from the shortcut menu to display the **RT Target Properties** dialog box. Select **Scan Engine** from the **Category** list to display the Scan Engine page.
14. Set the **Scan Period** to 8 ms or lower, then click **OK** to close the **RT Target Properties** dialog box.



Note The **Scan Period** setting is used to determine the AKD EtherCAT drive Cycle time and Cycle exp settings, ignoring any values in the **EtherCAT: Advanced:Initial Commands** dialog box in the LabVIEW Project. These settings must match for proper communication between the drive and the EtherCAT master.

- Right-click the controller item in the **Project Explorer** window and select **New» NI SoftMotion Axis** from the shortcut menu to open the **Axis Manager** dialog box, shown in Figure 15.

Figure 15. Axis Manager Dialog Box



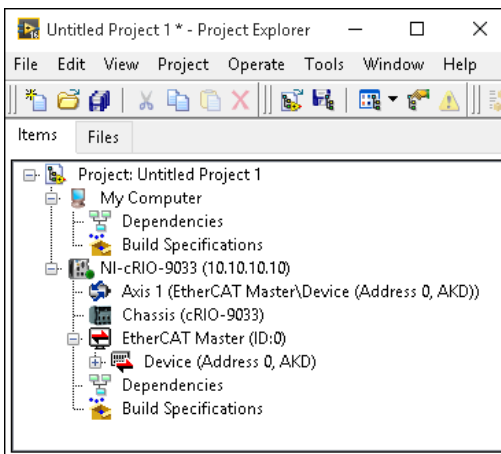
- Click **Add New Axis** to create an NI SoftMotion axis associated with the AKD EtherCAT drive. Axes are automatically bound to an available drive. You can double-click the axis name to rename the axis and give it a descriptive name.
- Click **OK** to close the **Axis Manager** dialog box. The new axis is added to the **Project Explorer** window.



Note You cannot associate more than one axis with the same AKD EtherCAT drive.

When you have finished these steps your LabVIEW project should look similar to the image in Figure 16.

Figure 16. Project Explorer Window with AKD EtherCAT Servo Drive Axis




Step 5: Install Kollmorgen WorkBench and Configure the Drive

Kollmorgen WorkBench is available on the CD that came with the AKD servo drive and is also available from ni.com/updates. Complete the following steps to install Kollmorgen WorkBench.

1. Insert the KollMorgen WorkBench CD in the CD-ROM drive.
2. Double-click `Full Setup.exe` to launch the installer.
3. Follow the onscreen instructions to complete the installation.

Complete the following steps to configure the drive settings with Kollmorgen WorkBench.

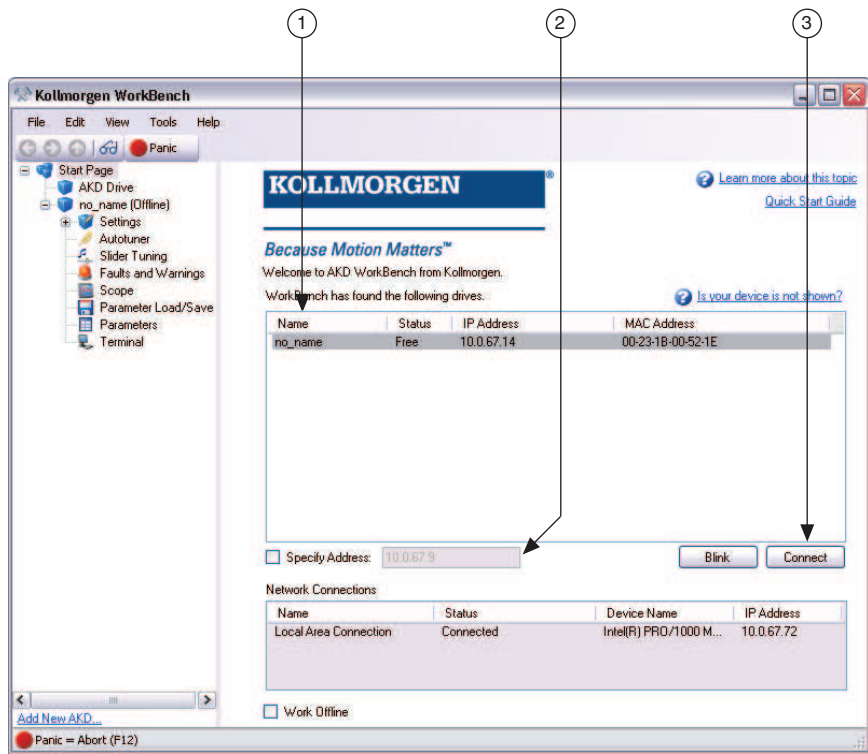
1. Launch the Kollmorgen WorkBench software by clicking the Kollmorgen WorkBench icon on the desktop () , or by selecting **Start»All Programs»Kollmorgen»Kollmorgen WorkBench**.
2. Select the drive to configure from the list and click **Connect**.



Note If the drive is not in the list, refer to the [Configuring a PXI or Industrial Controller Master](#) section of this document for possible solutions.

Figure 17 shows the Kollmorgen WorkBench **Start** page.

Figure 17. Kollmorgen WorkBench Start Page



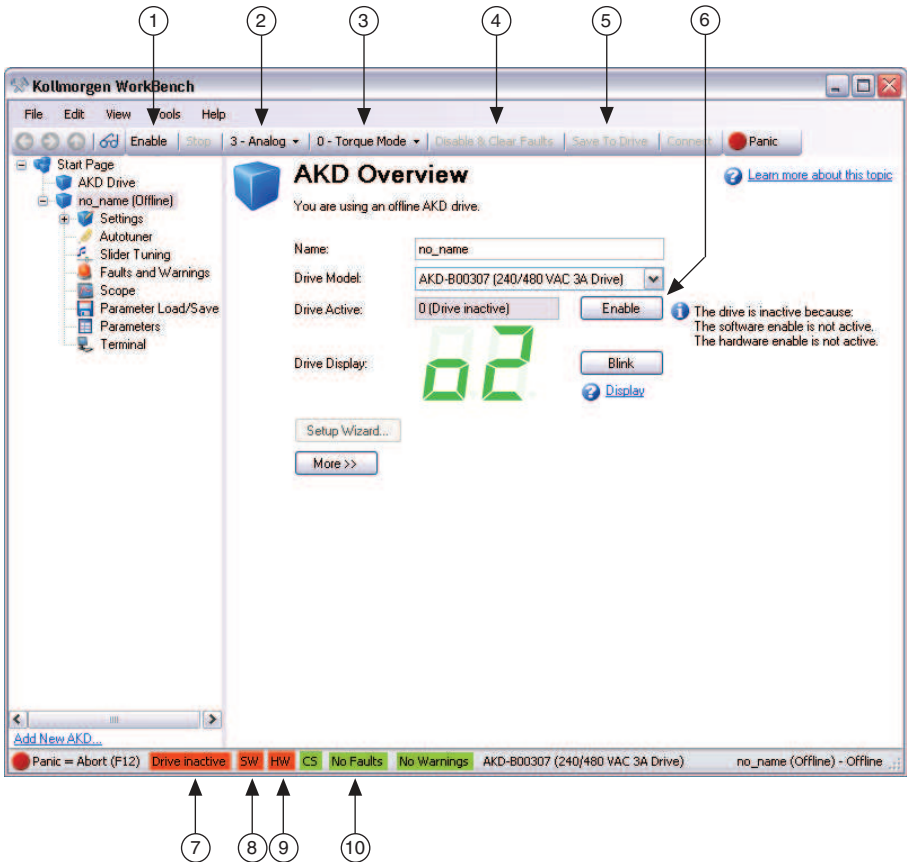
1 Available Drives

2 Specify Address

3 Connect to Drive

3. Open the **Parameter Load/Save** page from the configuration tree and click **Factory Defaults** to return the drive settings to the factory default values. Any drive settings not updated in this document are assumed to be the default values.
 4. (Optional) Change the name of the drive from the default name of `no_name` on the **AKD Overview** page to a more descriptive name.
- Figure 18 shows the **AKD Overview** page.

Figure 18. Kollmorgen WorkBench Overview Page



1 Software Enable/Disable

2 Command Source

3 Operation Mode

4 Clear Faults

5 Save Configuration Settings to Drive

6 Software Enable/Disable

7 Drive Active Indicator

8 Software Enable Status Indicator

9 Hardware Enable Status Indicator

10 Fault Indicator

Step 6: Tune the System using Kollmorgen WorkBench

In this section you will tune the axis associated with your AKD EtherCAT servo drive using the Kollmorgen WorkBench.

Kollmorgen WorkBench is software provided by Kollmorgen that allows you to configure your AKD servo drive, such as maximum motor current, encoder resolution, and I/O scaling. For information about tuning the drive with WorkBench, refer to the *Tuning Your System* topic in the installed *Kollmorgen WorkBench Help*.

Step 7: Configure the AKD EtherCAT Servo Drive Axis

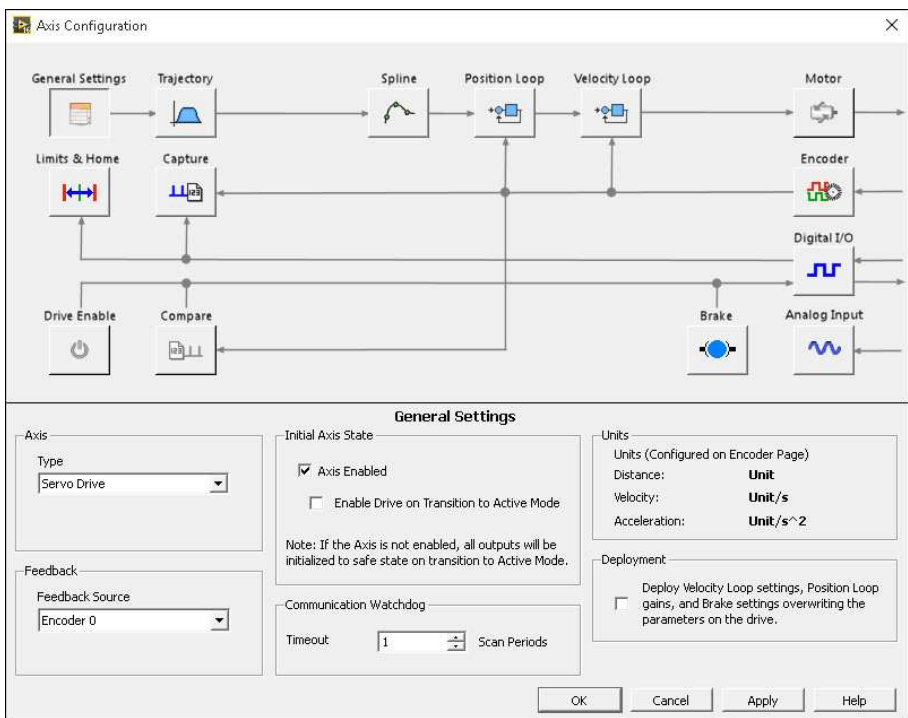
In this section you will configure the axis associated with your AKD EtherCAT servo drive using the **Axis Configuration** dialog box.

Complete the following steps to configure the axis I/O settings for use with the AKD EtherCAT servo drive.

1. Right-click the axis in the **Project Explorer** window and select **Properties** from the shortcut menu to open the **Axis Configuration** dialog box.

Figure 19 shows the parts of the **Axis Configuration** dialog box for AKD EtherCAT servo drives.

Figure 19. Axis Configuration Dialog Box for AKD EtherCAT Servo Drives



2. On the **General Settings** page, confirm that the **Axis Enabled** checkbox contains a checkmark and that the **Enable Drive on Transition to Active Mode** checkbox does not contain a checkmark.
3. On the **General Settings** page, in the **Deployment** section, there is an option to deploy configured settings to the drive. This is unselected by default, as the default drive settings work well for most applications. When selected, the drive settings will be overwritten by the Velocity Loop settings, Position Loop gains, and Brake settings configured with the **Axis Configuration** dialog box. National Instruments recommends leaving this option unselected and using WorkBench to configure the drive. Refer to [Step 5: Install Kollmorgen WorkBench and Configure the Drive](#) for more information.



Note The Position Error Limit, set on the Position Loop page, will always be deployed to the drive regardless of your deployment selection.

4. Complete the following additional steps if you do not have limits and home connected at this time:
 - a. Click the **Limits & Home** button.
 - b. Clear the **Enable** checkbox in the **Forward Limit**, **Reverse Limit**, and **Home Switch** sections.



Note These configuration settings disable limits for initial setup and testing purposes. National Instruments recommends connecting and enabling limits in your final application.

5. Click the **Encoder** button and set the display **Units** for the application. For initial setup, set the **Units** to **revand Counts per Unit** to 1,048,576.



Note Regardless of the type of feedback or custom scaled units in Kollmorgen WorkBench, the AKD will scale the EtherCAT feedback to 2^{20} (or 1,048,576) counts per revolution. If a linear permanent magnet motor is used, the units will be 2^{20} counts per magnetic pole pitch. This configuration can be used to set any custom unit by changing the counts per unit value.

6. Configure any additional I/O settings according to your system requirements.
7. Click **OK** to close the **Axis Configuration** dialog box.



Caution Make sure all hardware connections are made and power is turned on before deploying the project. Deployment may switch the NI Scan Engine to Active mode. Refer to the *Deploying and Running VIs on an RT Target* topic in the *LabVIEW Help* for more information about deployment and for troubleshooting tips.

8. Right-click the controller item in the **Project Explorer** window and select **Deploy All** to deploy the axis information.
9. Select **File»Save Project** to save the project.

Step 8: Enable and Test the Drive using LabVIEW

Use the Interactive Test Panel to test and debug your motion system and configuration settings on the selected axis. With the Interactive Test Panel you can perform a simple straight-line move, monitor feedback position and position error information, I/O and move status information, change move constraints, get information about software errors and faults, and view position or velocity plots of the move.



Caution The test parameters in this steps assume that the units have been scaled to revolutions as described in the preceeding step. If the motor is already connected to a mechanical system, ensure that moving the motor shaft for 10 revolutions at 1 revolution per second will not damage any components.

Complete the following steps to test your setup after configuring and tuning the axis.

1. Right-click the axis in the **Project Explorer** window and select **Interactive Test Panel** from the shortcut menu. Opening this dialog box sends the axis settings to the hardware and activates the I/O on the module.
2. On the **Move** tab, set the **Target Position** to 10.
3. On the **Move Constraints** tab, configure the following settings:
 - a. Set **Velocity** to 1.00 Rev/sec
 - b. Set **Acceleration** to 10.00 Rev/sec²
 - c. Set **Deceleration** to 10.00 Rev/sec²
 - d. Set **Acceleration Jerk** to 100.00 Rev/sec³
 - e. Set **Deceleration Jerk** to 100.00 Rev/sec³
4. Click the **Start** button on the bottom of the dialog box. The move should proceed for 10 revolutions at a velocity of 1 revolution per second.
5. Use the **Status** and **Plots** tabs to monitor the move while it is in progress.

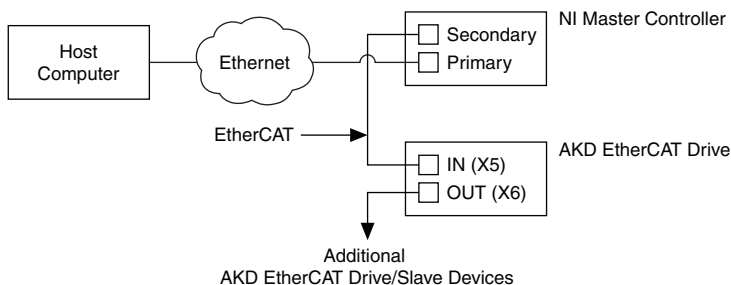
Your system is now configured and ready for motion application development.

Configuring a PXI or Industrial Controller Master

Complete the following steps to use a PXI or Industrial Controller as the EtherCAT master.

1. Connect the controller to an Ethernet network on the same subnet as the development computer. Refer to the controller operating instructions for information about wiring the controller to the power supply and Ethernet network.
2. Connect the secondary port of your EtherCAT Master directly to the IN port (top port) on the AKD EtherCAT servo drive using a standard Category 5 Ethernet cable. You may expand the deterministic Ethernet network by connecting an additional AKD EtherCAT drive or other slave devices to the OUT port (bottom port) on the first AKD EtherCAT drive.

Figure 20. Connecting the AKD EtherCAT Drive to the Network

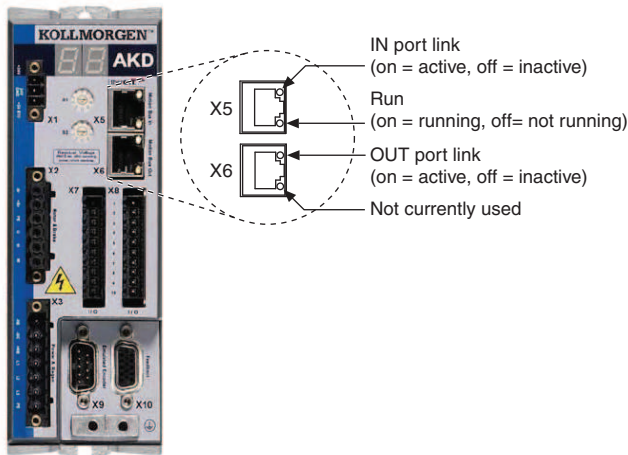




Note Do not plug in or turn on any power to the system until after all required hardware connections are made.

The LED indicators on the AKD Motion Bus IN and Motion Bus OUT ports display the communication status. Figure 5 shows the LED indicators on the X5 and X6 connectors.

Figure 21. AKD X5 and X6 Motion Bus Connectors



3. Install software on the RT target as described in [Step 3: Install Software on and Configure the NI RT Controller](#).
4. Disable **Legacy USB Support** in the PXI master PC BIOS, if it is enabled.

Tips and Troubleshooting

The Drive Does Not Enable

If, after going through all steps in this document, the AKD EtherCAT servo drive does not enable, verify the following settings:

- Make sure that the hardware enable is connected to the +24 V power supply as described in [Connect the Hardware Enable on the X8 Connector](#).
- The software enable must be enabled. Verify that the NI Scan Engine is in active mode and that Drive Enable is active. You can use the **Interactive Test Panel** dialog box or the Power function to enable the drive.
- The drive must not be in a fault state. You can use the **Interactive Test Panel** dialog box or the Clear Faults function to clear the drive faults.



Tip Refer to the *AKD Fault and Warning Messages* card that came with the drive or the *NI SoftMotion Module Help* for fault information and solutions.

The Axis Does Not Appear To Move

The AKD will scale the EtherCAT feedback to 2^{20} (or 1,048,576) counts per revolution. If a linear permanent magnet motor is used, the units will be 2^{20} counts per magnetic pole pitch. Ensure that the move parameters in the **Interactive Test Panel** and encoder feedback scaling in the **Axis Configuration** dialog box are consistent.

NI SoftMotion features multiple **Axis Control Modes** (position, velocity, torque, or automatic mode). An axis will not respond to commands from the interactive test panel if it is not in the corresponding mode. If your axis does not appear to move, use the Axis Control Mode property to change the control mode. For more information, refer to the *NI SoftMotion Help*.

The Drive Is Not Automatically Added to the LabVIEW Project

The NI Scan Engine must be in Configuration mode to detect and add EtherCAT slave devices to the EtherCAT bus. Complete the following steps to check and switch the NI Scan Engine mode:

1. Right-click the EtherCAT master and select **View in System Manager** from the shortcut menu.
2. In the **Scan Engine Mode** section, check the Scan Engine mode.
 - If the Scan Engine mode is **Active**, click the **Change to Configuration** button and attempt to add the AKD EtherCAT servo drive again.
 - If the Scan Engine mode is **Fault**, click the **Clear All Faults** button in the **Faults** section, then click the **Change to Configuration** button and attempt to add the AKD EtherCAT servo drive again.

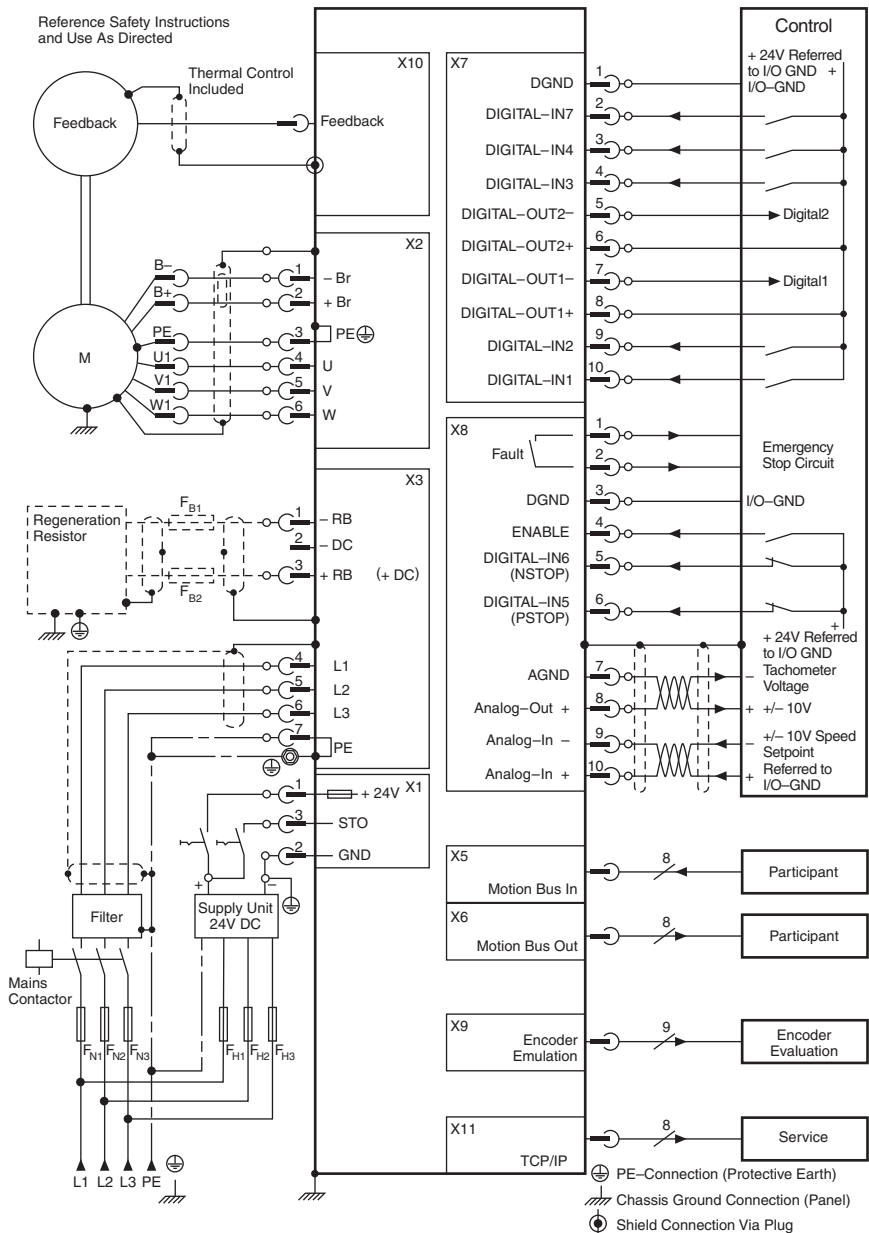
The Drive Returns a Synchronization Fault or Warning

Verify the following settings if the AKD EtherCAT drive returns fault or warning code 125 (Synchronization Lost):

- Check the EtherCAT input connection (X5).
- Use a shielded ethernet cable (FTP/STP) for the EtherCAT master to AKD drive connection.
- Confirm that the NI Scan Engine scan period is 8 ms or lower.

Wiring Diagram

Figure 22. AKD Wiring Diagram



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