Getting Started with NI 9514/16 C Series Modules and AKD Servo Drives

Note If you are a new user of LabVIEW or are unfamiliar with LabVIEW, refer to the *Getting Started with LabVIEW* manual for information about LabVIEW and LabVIEW terminology.

This document explains how to install and configure the AKD servo drives for use with the NI 9514 and NI 9516 C Series drive interface modules.

Tip If you encounter any problems during setup, refer to the *Tips and Troubleshooting* section for assistance.

Contents

NATIONAL INSTRUMENTS

What You Need to Get Started

⚠️ **Caution** Before installing the drive, review Chapter 2, *Safety*, in the *AKD Installation Manual* that came with your hardware or available from ni.com/manuals. Failure to follow safety instructions may result in injury or damage to equipment.

You need the following items to get started.

Hardware

❑ NI 9514 or NI 9516 C Series servo drive interface module

❑ NI real-time controller

– CompactRIO controller and chassis that support the RIO Scan Interface

💡 **Tip** To determine if your controller and chassis support the RIO Scan Interface go to ni.com/info and enter the Info Code rdsoftwareversion.

or

– NI 9144 distributed chassis and compatible RT controller

❑ Power supply for the CompactRIO controller

❑ +24 VDC power supply for the drive interface module and AKD servo drive

❑ Ethernet connection and cable for the CompactRIO controller

❑ Ethernet connection and cable for the AKD servo drive

❑ NI 9514/16 to AKD Drive Cable

❑ AKD servo drive

❑ NI or third-party servo motor and encoder

📝 **Note** AKM series servo motors available from NI contain built-in encoders and come pre-wired for use with the AKD servo drive. National Instruments recommends using one of these motors for the best user experience and system performance.

Software

❑ LabVIEW 2009 SP1 or later

❑ LabVIEW 2009 SP1 Real-Time Module or later

❑ LabVIEW 2009 SP1 NI SoftMotion Module or later

❑ NI-RIO 3.4.0 or later

❑ NI-Industrial Communications for EtherCAT® 1.2 or later, if you are using the NI 9144 distributed chassis

❑ AKD WorkBench software. Refer to the *Step 1: Install Software on and Configure the NI RT Controller* in the *Software Installation and Configuration* section of this document for installation information.

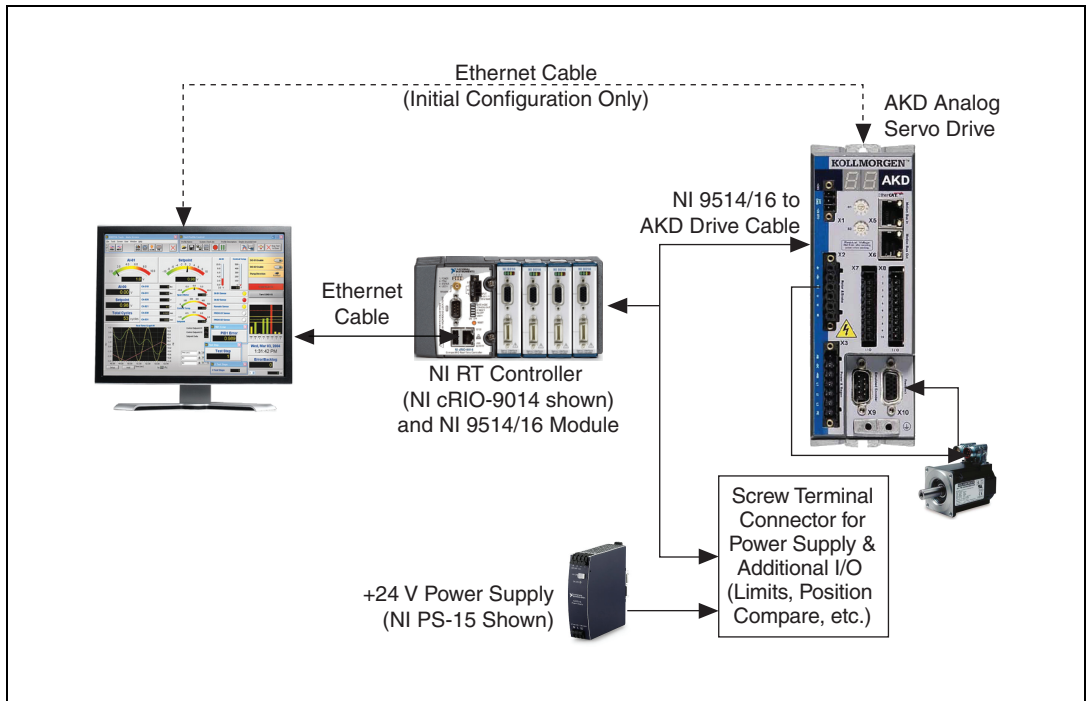Figure 1 shows the required hardware and software.

Figure 1. Required Hardware and Software
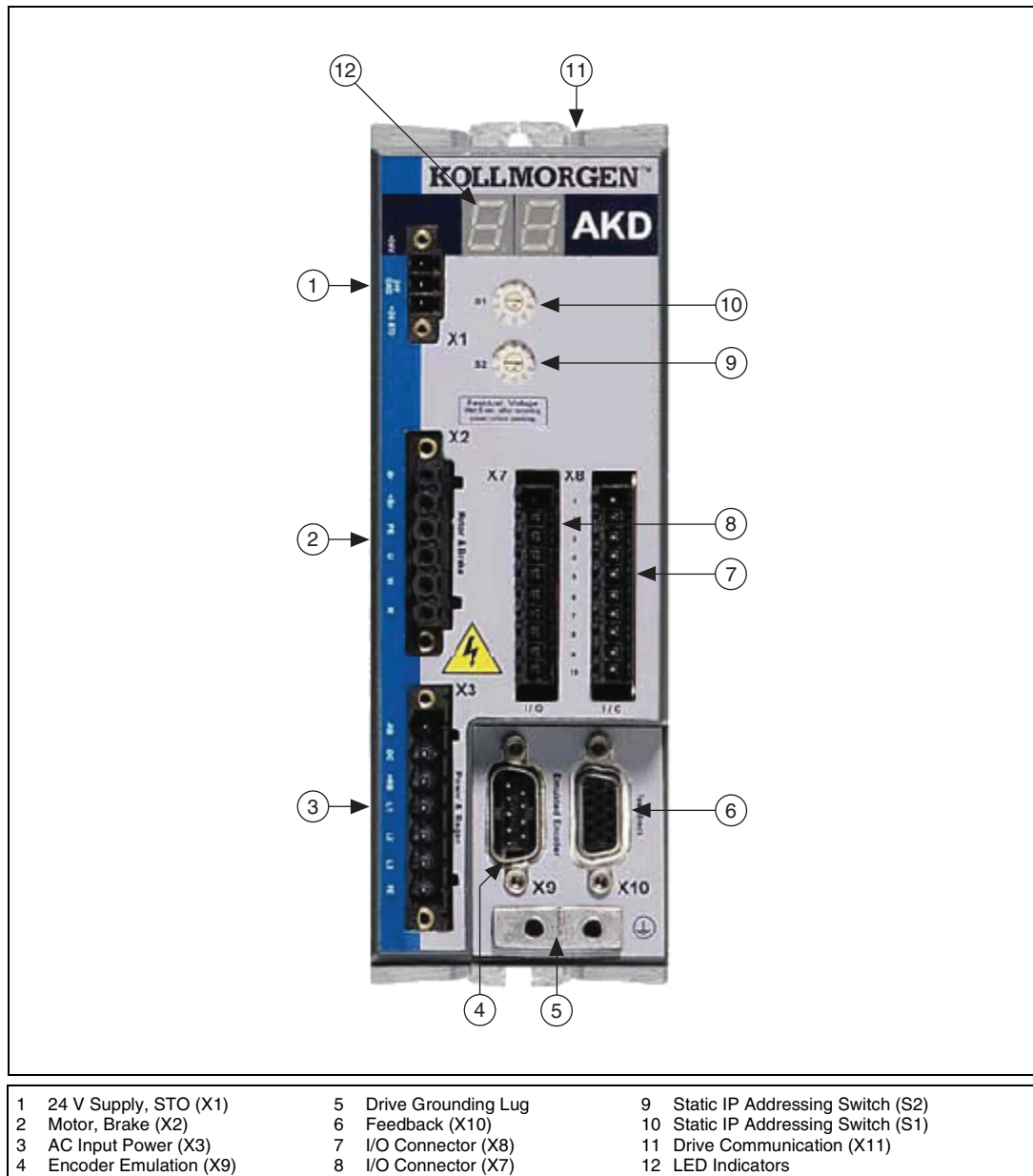
Related Documentation

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.

- Operating instructions for the controller and C Series modules.

- *AKD Installation Manual*—Use this document to learn additional information about the electrical and mechanical aspects of the AKD servo drive, including important safety information.

- *Getting Started with NI 951x C Series Modules and LabVIEW*—Use this document to learn about using the NI 951x modules with LabVIEW, including information about the LabVIEW NI SoftMotion Module. To access this document, select **Start»All Programs» National Instruments»LabVIEW»LabVIEW Manuals» Getting_Started_NI_951x_Modules_LabVIEW.pdf**.

- *LabVIEW NI SoftMotion Module Help*—Use this help file to learn about using the NI SoftMotion Module in LabVIEW including information about function blocks and using the NI SoftMotion Module with the LabVIEW Project. To access this help file from LabVIEW, select **Help» LabVIEW Help**, then expand the *LabVIEW NI SoftMotion Module* book on the **Contents** tab.

- *NI 9144 User Guide and Specifications*—Use this document to learn additional information about how to connect the NI 9144 chassis to a network, how to use the NI 9144 chassis features, and contains the NI 9144 chassis specifications.

- NI Industrial Communications for EtherCAT software documentation.

Hardware Installation and Configuration

This section covers the hardware setup for the CompactRIO system, NI 9514 or NI 9516 C Series module, and AKD servo drive.

Figure 2 shows an overview of the connectors on the AKD servo drive.

1	24 V Supply, STO (X1)	5	Drive Grounding Lug	9	Static IP Addressing Switch (S2)
2	Motor, Brake (X2)	6	Feedback (X10)	10	Static IP Addressing Switch (S1)
3	AC Input Power (X3)	7	I/O Connector (X8)	11	Drive Communication (X11)
4	Encoder Emulation (X9)	8	I/O Connector (X7)	12	LED Indicators

Figure 2. AKD Servo Drive Connectors

Step 1: Set Up the CompactRIO System

Complete the following steps to set up the CompactRIO hardware.

> **Note** If you are using an NI 9144 chassis, refer to *Setting Up a System With An NI 9144 Chassis* in the *Setting Up a Distributed System* section for alternate configuration instructions, then continue with *Step 2: Connect NI 9514/16 to AKD Drive Cable to the C Series Module* in the *Hardware Installation and Configuration* section.

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 install 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.

1	Controller	4	Reconfigurable Embedded Chassis
2	Captive Screws	5	Grounding Screw
3	Controller Slot		
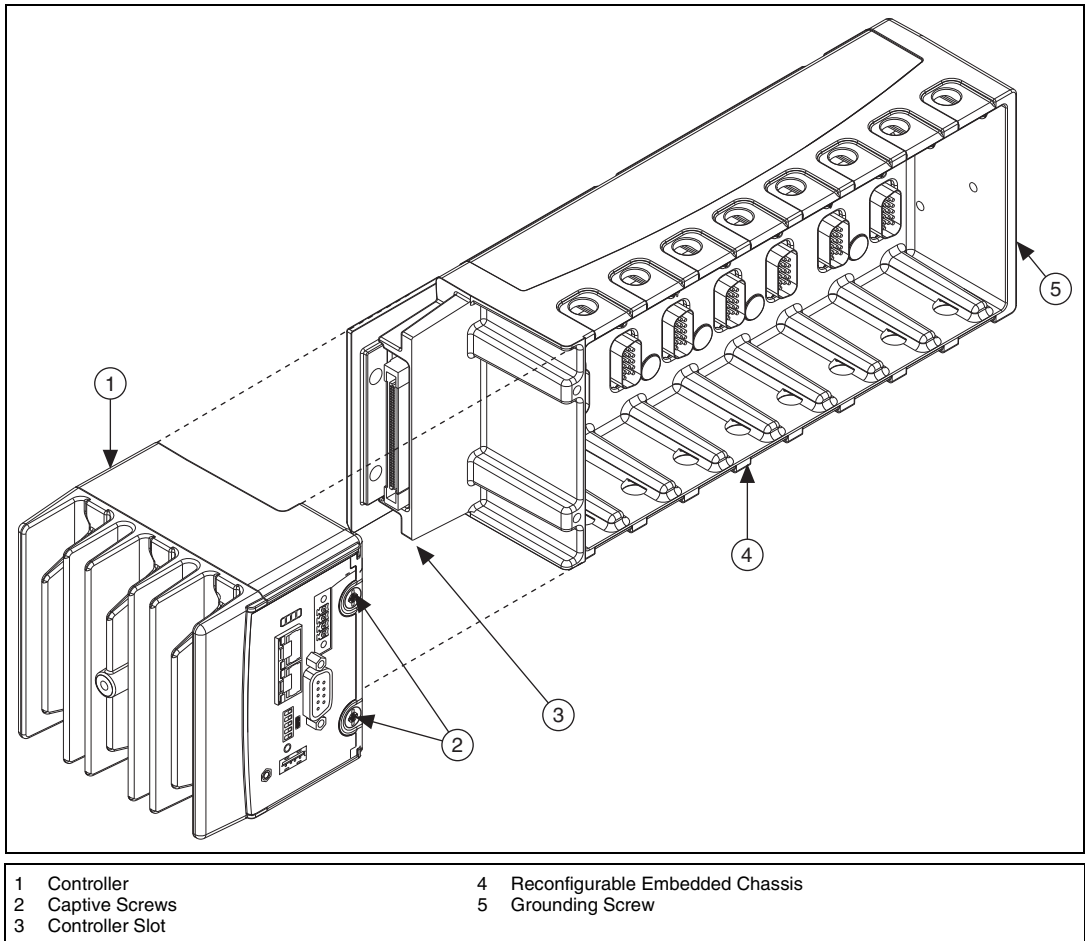
Figure 3. Installing the Controller on the Chassis (Eight-Slot Chassis Shown)

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 wiring the controller to the power supply and Ethernet network.

Note Do not plug in or turn on any power to the system until after you complete *Step 8: Connect the Drive Communication* in the *Hardware Installation and Configuration* section.

3. Install the NI 9514 or NI 9516 module in slot 1, 2, 3, or 4 of the chassis.

Step 2: Connect NI 9514/16 to AKD Drive Cable to the C Series Module

Connect the MDR and DSUB connectors on the NI 9514/16 to AKD Drive Cable to the MDR and DSUB connectors on the C Series module. Figure 4 shows the NI 9514/16 to AKD Drive Cable connectors.
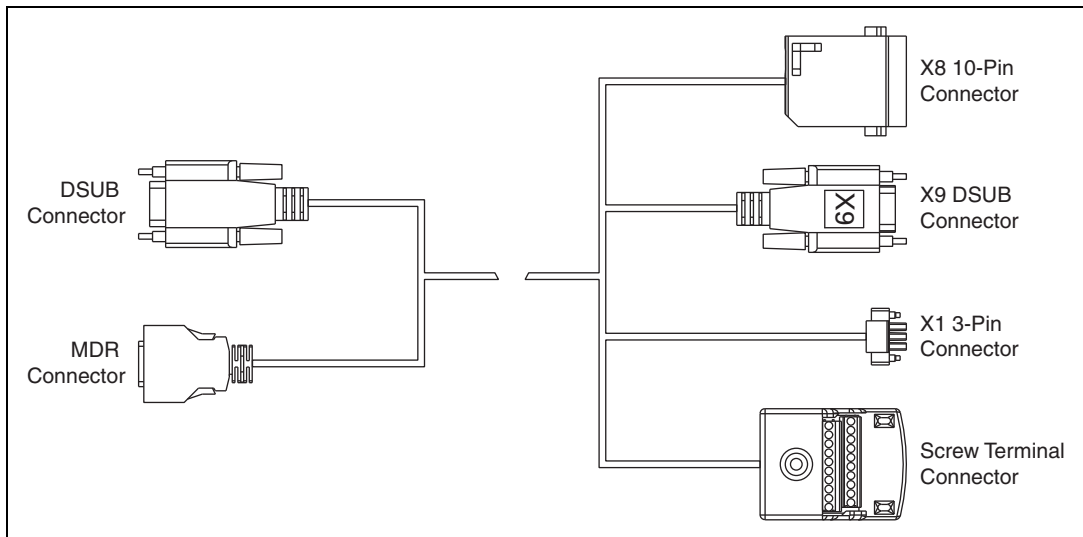
Figure 4. NI 9514/16 to AKD Drive Cable Connectors

The NI 9514/16 to AKD Drive Cable contains the following connections:

- **DSUB Connector**—15-pin DSUB connector containing drive command and drive enable signals.

- **MDR Connector**—20-pin MDR connector containing encoder, limit, home sensor, position compare, and position capture signals.

- **X8 10-Pin Connector**—10-pin connector containing the servo command, enable, and fault signals.

- **X9 DSUB Connector**—9-pin DSUB connector containing emulated encoder output signals from the AKD servo drive.

- **X1 3-pin Connector**—+24 V power supply connection for the AKD servo drive provided through the 20-pin screw terminal connector.

- **Screw Terminal Connector**—20-pin screw terminal connector for external I/O connections.

Table 1 shows the screw terminal connector pinout.

Table 1. NI 9514/16 to AKD Drive Cable Screw-Terminal Pinout

Pin	Signal Name
1	Forward Limit
2	Home
3	Reverse Limit
4	Digital Input 0
5	Vsup
6	Vsup Return
7	Encoder 1 Phase A+ (NI 9516 only)
8	Encoder 1 Phase A− (NI 9516 only)
9	Encoder 1 Phase B+ (NI 9516 only)
10	Encoder 1 Phase B− (NI 9516 only)
11	+5V OUT
12	Position Compare
13	Position Capture
14	COM
15	Reserved
16	Reserved
17	Reserved
18	Reserved
19	Reserved
20	Reserved

Step 3: 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 2 shows the location of the grounding lug on the drive.

Step 4: Connect the Logic Power Supply to the NI 9514/16 to AKD Drive Cable

The NI 9514/16 to AKD Drive Cable requires connection to an external +24 V power supply. The +24 V power supply provides both the logic power to the AKD servo drive and powers the NI 9514 or NI 9516 module.

Note Do not plug in or turn on the +24 V power supply until after you complete *Step 8: Connect the Drive Communication* in the *Hardware Installation and Configuration* section.

Complete the following steps to connect the +24 V power supply to the cable.

1. Connect the +24 V power supply (+) terminal to the Vsup terminal on the NI 9514/16 to AKD Drive Cable screw terminal connector.

2. Connect the +24 V power supply return (–) terminal to the Vsup Return terminal on the NI 9514/16 to AKD Drive Cable screw terminal connector.

Step 5: Connect the NI 9514/16 to AKD Drive Cable to the AKD Servo Drive

Connect the NI 9514/16 to AKD Drive Cable to the AKD servo drive. Refer to Figure 6 for the location of the connectors.

1. Connect the cable X1 3-pin connector to the AKD servo drive X1 3-pin connector. This connector provides +24 V power to both the drive logic and to the safe torque out (STO) input. The STO input must be powered by +24 V for proper drive operation. If you need to use the STO functionality complete the following additional steps:

    a. Disconnect the STO wire from the NI 9514/16 to AKD cable X1 connector and insulate it.

Note The STO and +24V wires are internally connected in the NI 9514/16 to AKD cable. You *must* insulate the STO wire if you disconnect it from the X1 connector.

    b. 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.

   Figure 5 shows the X1 connector pin assignment and wire colors.
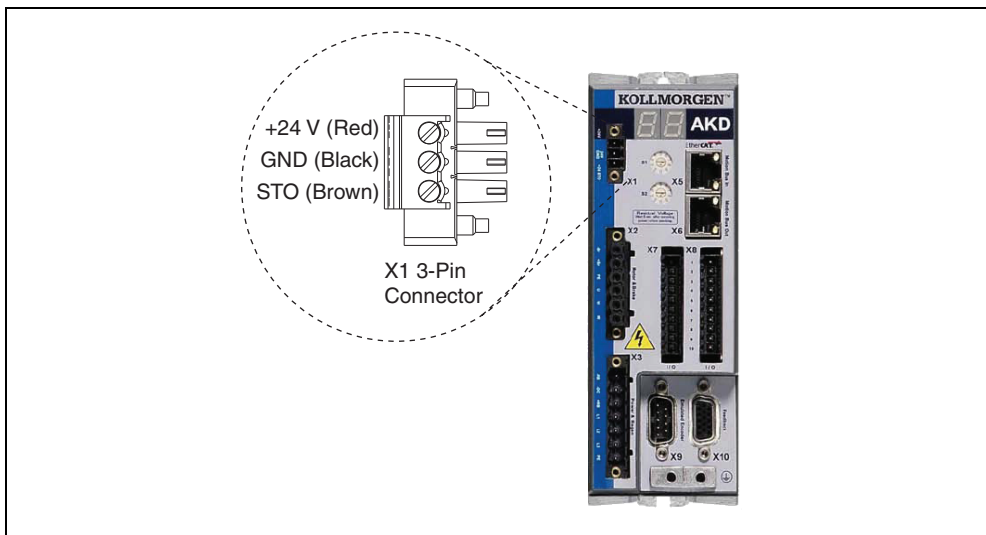
Figure 5. AKD X1 Connector

2. Connect the cable X9 DSUB connector to the AKD servo drive X9 DSUB connector.

3. Connect the cable X8 10-pin connector to the AKD servo drive X8 10-pin connector.

Note You can use the X7 I/O connector for additional I/O but it is not used for connection to the NI 9514 and NI 9516 drive interface modules.

| 1 | +24 V Supply, STO (X1) | 2 | Encoder Emulation (X9) | 3 | I/O (X8) |
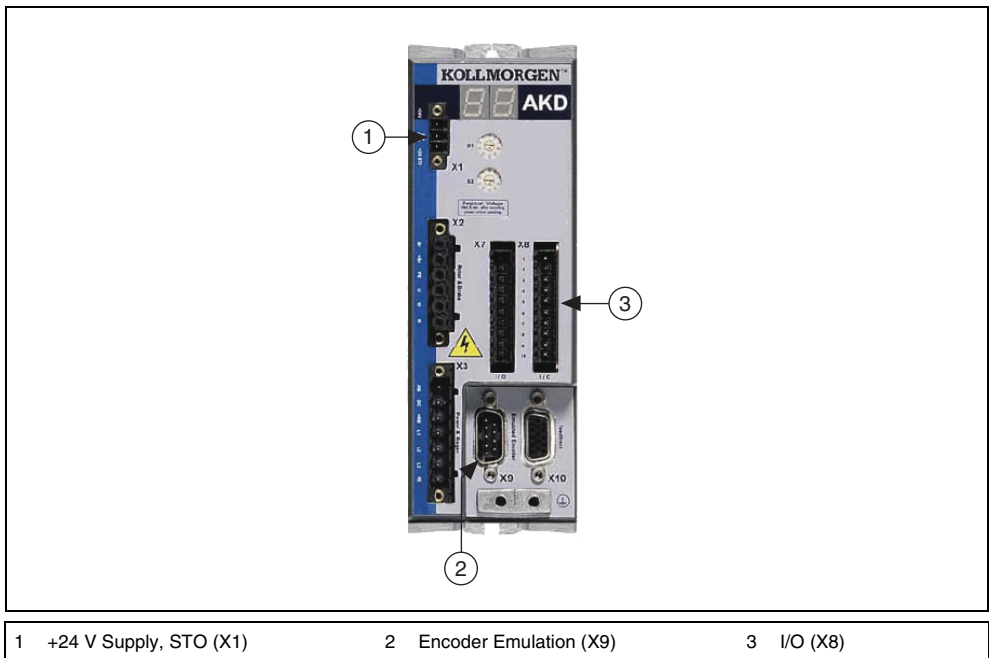
Figure 6. NI 9514/16 to AKD Drive Cable Connections

## Step 6: Connect the Motor and Encoder to the Drive

All servo motors available from NI come pre-wired for direct connection to the AKD servo drive X2 motor connector and X10 feedback connector. Refer to Figure 7 for the location of the connectors.

1. Connect the motor 6-pin connector to the AKD 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 using the holding brake.

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

| 1 | Motor Connector (X2) | 2 | Feedback Connector (X10) |
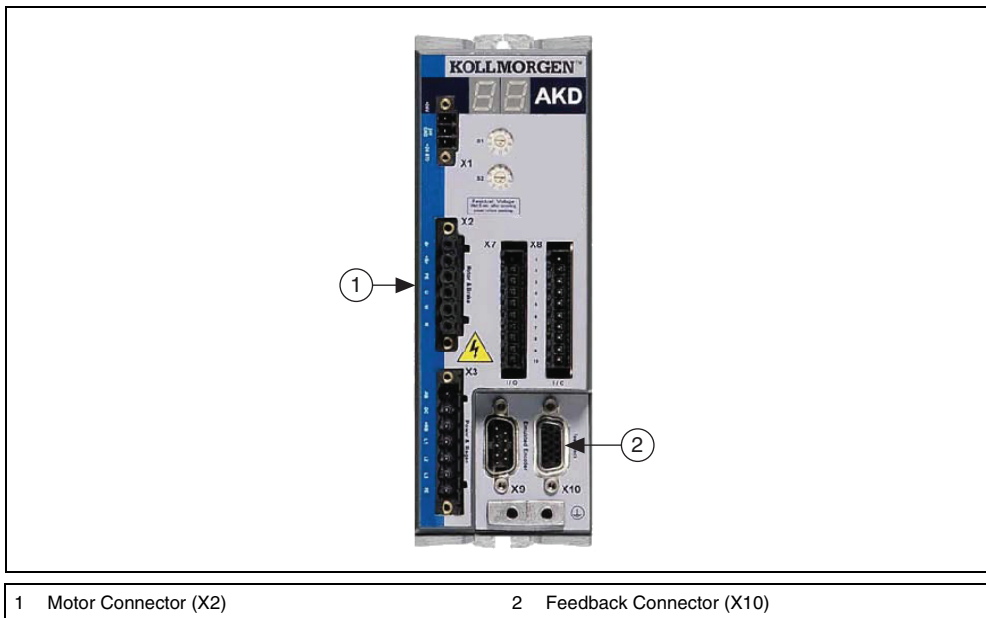
Figure 7. Motor and Encoder Connections

Step 7: 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 (±RB) and DC bus link (–DC). Refer to the *AKD Installation Manual* for information about using these terminals.

Note Do not turn on the AC power until after you complete *Step 8: Connect the Drive Communication* in the *Hardware Installation and Configuration* section.

Figure 8 shows the location and pin assignment for the X3 connector.
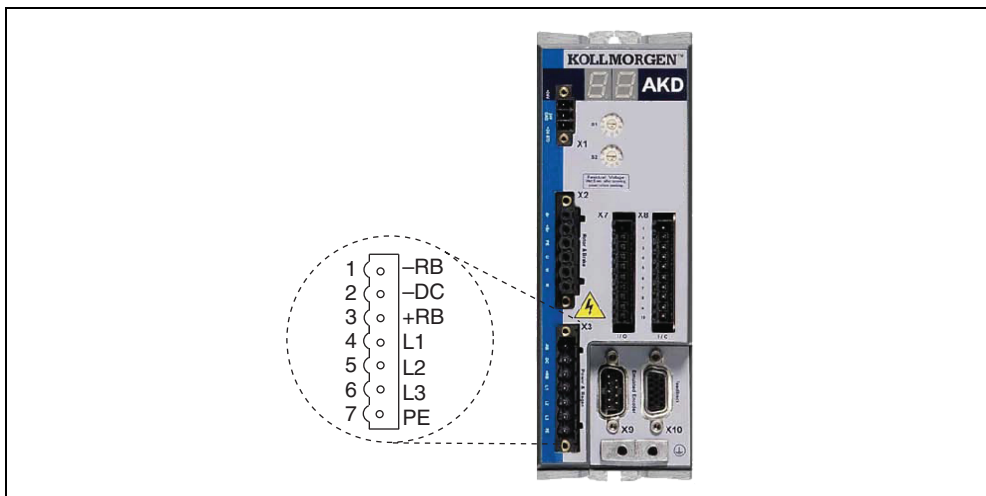
Figure 8. AKD Servo Drive X3 Connector

AC input power can be connected for either a three-phase or single-phase operation.
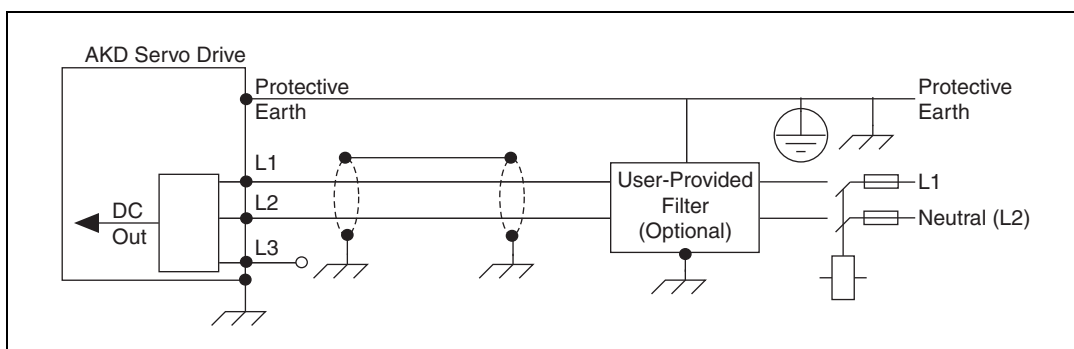
✎ **Note** External filtering and fusing are optionally provided by the user. Refer to the *AKD Installation Manual* for information about filter and fuse requirements.

Figure 9 shows three-phase connection.
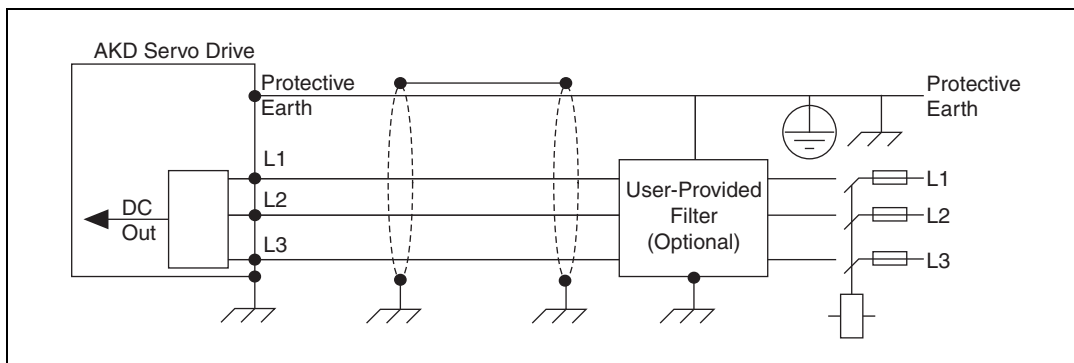
Figure 9. AC Input Power Three-Phase Connection

Figure 10 shows single-phase connection.

Figure 10. AC Input Power Single-Phase Connection

Step 8: Connect the Drive Communication

Complete the following steps to set up the drive for software configuration using Ethernet. These steps assume you are connecting the AKD servo drive using a hub, switch, or router using DHCP. If you cannot use DHCP, refer to *Connecting to the PC Using a Static IP* in the *Tips and Troubleshooting* section for instructions about direct connection using a static IP address.

1. Set S1 and S2 on the drive to 0 to configure the drive for DHCP mode. The drive obtains an IP address from an external DHCP server if one exists on the network. If no DHCP server is present, the drive assumes an automatic private IP address in the form of 169.254.x.x. This process may take up to a minute to complete. Figure 2 shows the locations of S1 and S2.

2. Connect the AKD servo drive X11 service port to a hub, switch, or router using an Ethernet cable. Figure 11 shows the location of the X11 service port on the drive.
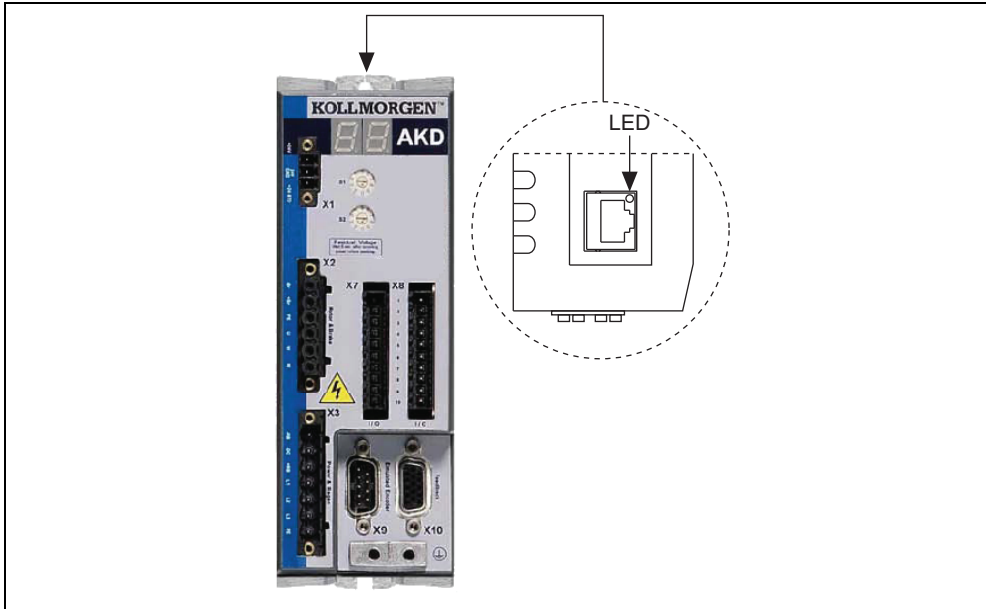

Figure 11. AKD Servo Drive X11 Connector

Step 9: Confirm Drive Connections

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

1. Apply AC power.

2. 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. Figure 2 shows the location of the LED indicators on the AKD servo drive.

   a. $--$

   b. []

   c. Drive IP address, flashed sequentially

   d. Drive status, either current operation mode or the fault code if there is a fault 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 code, click the **Clear Faults** button on the AKD WorkBench software toolbar after you install the AKD WorkBench software in *Step 4: Install AKD WorkBench and Configure the Drive* in the *Software Installation and Configuration* section and connect to the drive to clear the fault state. If the fault reappears, refer to the *AKD Fault and Warning Messages Card* that came with the drive for more information about the fault, including possible solutions. After resolving the cause of the fault, click the **Clear Faults** button on the toolbar again. Figure 17 shows the location of the **Clear Faults** toolbar button in the AKD WorkBench software.

Software Installation and Configuration

This section covers installing and configuring the software for the AKD servo drive and NI 9514 or NI 9516 C Series modules.

> **Note** If you are using an NI 9144 chassis, refer to *Software Installation and Configuration With the NI 9144* in the *Setting Up a Distributed System* section for alternate configuration instructions, then continue with *Step 2: Creating a Project and Adding an NI SoftMotion Axis* in the *Software Installation and Configuration* section.

Step 1: 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 MAX icon on the desktop, or by selecting **Start»All Programs»National Instruments» Measurement & Automation**.

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 do not want to format the disk on the controller, eliminating all installed software and files, power on the controller and skip to step 12.

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 the **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 3.4.0 or later with NI Scan Engine Support.

14. Click **Next** and enable the following add-ons:
    - LabVIEW NI SoftMotion Module
    - NI Scan Engine Support for LabVIEW NI SoftMotion Module

> **Note** If you are using the LabVIEW NI SoftMotion Module 2011 or later, you only need to install LabVIEW NI SoftMotion Module 11.0.0 or later. The Scan Engine support is included in this add-on.

15. Click **Next** to install the selected software on the controller. Click **Help** if you need information about installing recommended software sets.

16. Close MAX.

Step 2: Creating a Project and Adding an NI SoftMotion Axis

Complete the following steps to create a LabVIEW project.

1. Launch LabVIEW by selecting **Start»All Programs»National Instruments»LabVIEW**.

2. Click the **Empty Project** link in the **Getting Started** window to display the **Project Explorer** window. You can also select **File»New Project** to display the **Project Explorer** window.

3. 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.

4. 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.

5. Make sure that the **Existing target or device** radio button is selected.

6. Expand **Real-Time CompactRIO**.

7. Select the CompactRIO controller to add to the project and click **OK**.

8. 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.

9. Click **Discover** in the **Discover C Series Modules?** dialog box if it appears.

10. Click **Continue**.

Note If you are using the NI 9144 chassis refer to *Adding the EtherCAT Master Device To the LabVIEW Project* in the *Setting Up a Distributed System* section for information about adding the EtherCAT master device before continuing.

11. 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.

12. Set the **Scan Period** to 5 ms or lower, then click **OK** to close the **RT Target Properties** dialog box.

13. 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 12.

14. Click **Add New Axis** to create an NI SoftMotion axis associated with the NI 9514 or NI 9516 module. Axes are automatically bound to an available module. You can double-click the axis name to rename the axis and give it a descriptive name.
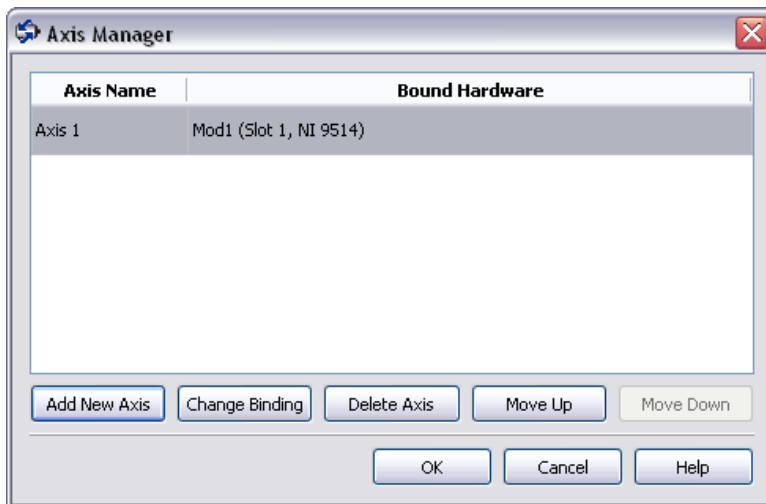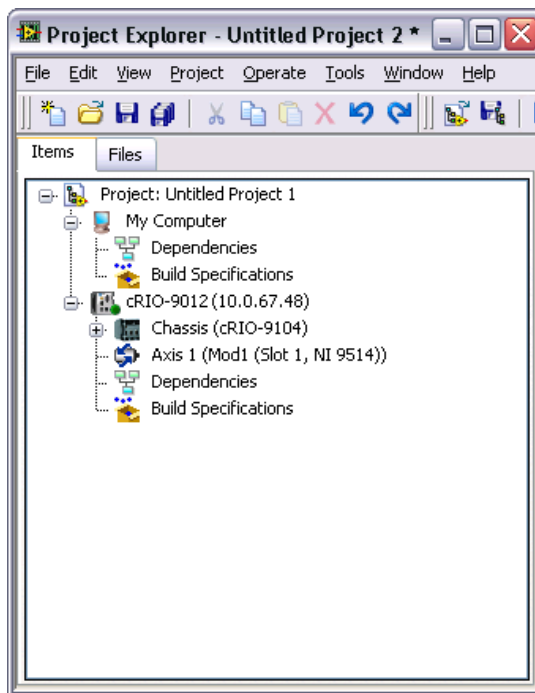
Figure 12. Axis Manager Dialog Box

15. 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 C Series module.

When you have finished these steps your LabVIEW project should look similar to the image in Figure 13.

Figure 13. Project Explorer Window with Modules in Scan Interface Mode

Step 3: Configure the NI 9514 or NI 9516 C Series Modules

Complete the following steps to configure the axis I/O settings for use with the AKD 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 14 shows the parts of the **Axis Configuration** dialog box for NI 9514 and NI 9516 C Series modules.
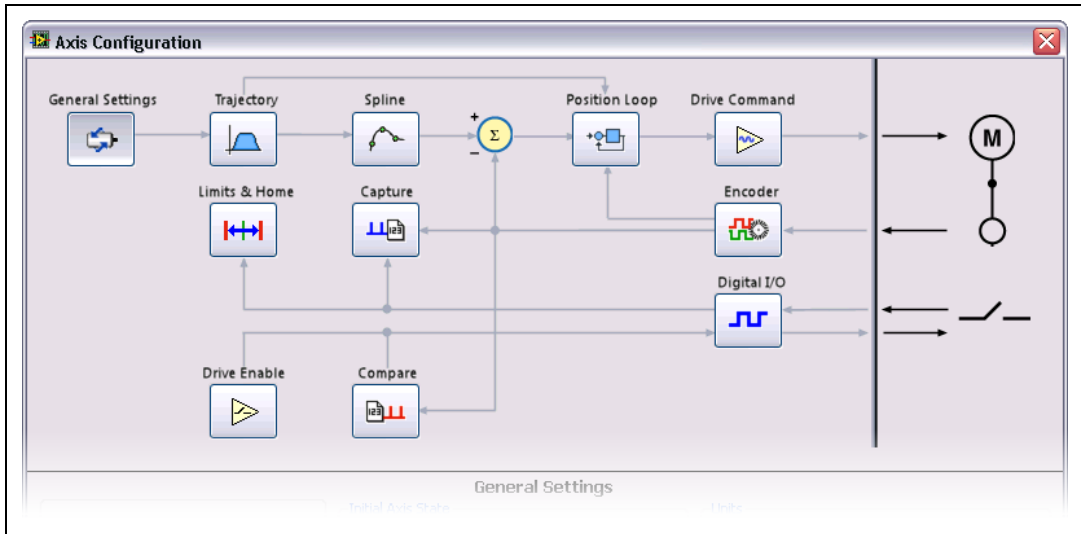
Figure 14. Axis Configuration Dialog Box

Note The **Axis Configuration** dialog box user interface may not match this image exactly depending on which version of the LabVIEW NI SoftMotion Module you are using.

2. Click the **Digital I/O** button to open the **Digital I/O** page and map DI 1 to **Drive Fault/Alarm**.

   a. Double-click the text in the **Mapping** column and select **Drive Fault/Alarm** from the dropdown list.

   b. Ensure that the DI 1 settings match the following:
   - **Input Type**—Sinking
   - **Active State**—Off
   - **Digital Filter**—50 µs

3. Open the **Drive Enable** page and ensure that the Drive Enable settings match the following:
   - **Output Type**—Sourcing
   - **Active State**—On
   - **Safe State**—Off

4. Complete the following additional steps if you do not have limits and home connected at this time:

   a. Open the **Limits & Home** page.

   b. In the **Forward Limit** and **Reverse Limit** sections ensure that the settings match the following:

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

   - Clear the **Enable** checkbox from both **Forward Limit** and **Reverse Limit**.
   - Set the **Active State** for both **Forward Limit** and **Reverse Limit** to **Off**. This prevents a limit warning even though limits are turned off.

   c. Open the **Home** section and clear the **Enable** checkbox.

5. Open the **Position Loop** page and make the following changes in the **Gains** section:

   a. Set **Kp** to **50**.

   b. Set **Kd** to **1000**.

   c. Set **Ki** to **0**.

   Note These values do not result in a properly tuned motor, but may allow you to perform a simple move for testing purposes. After connecting the other mechanical elements of the system, use the Gain Tuning Panel to tune the control loop settings and determine the relative stability of the servo axis. Refer to the *Using the Gain Tuning Panel* topic in the *NI SoftMotion Module* book of the *LabVIEW Help* for detailed information about the Gain Tuning Panel and servo system tuning instructions.

6. Open the **Encoder** page.

   a. In the **Active State** section set the **Line State** for **A**, **B**, and **Index** to **High**.

   b. In the **Index Reference Criteria** section set the **Line State** for **A** and **B** to **Active**.

   c. Type **revolution** in the **Units** text box.

   d. Set the **Counts per Unit** to 8,000. This setting is the encoder resolution in quadrature counts per revolution and must correspond to the AKD WorkBench emulated encoder output **Resolution** setting in lines per revolution multiplied by four. You may want to choose a different resolution depending on your application needs.

   Note You configure the emulated encoder output **Resolution** setting in *Step 4: Install AKD WorkBench and Configure the Drive* in the *Software Installation and Configuration* section.

When you are finished the Encoder Settings page will look similar to Figure 15.
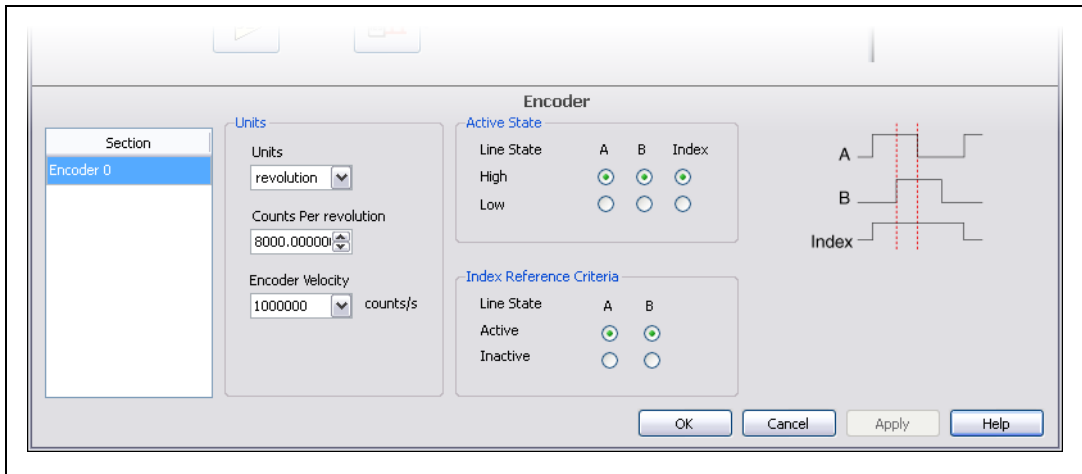
Figure 15. Axis Configuration Encoder Page

7. Configure any additional I/O settings according to your system requirements.

8. Click **OK** to close the **Axis Configuration** dialog box.

9. Right-click the controller item in the **Project Explorer** window and select **Deploy All** to deploy the axis information.

10. Select **File»Save Project** to save the project.

Step 4: Install AKD WorkBench and Configure the Drive

AKD 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 AKD WorkBench.

1. Insert the AKD 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 AKD WorkBench.

1. Launch the AKD WorkBench software by clicking the AKD WorkBench icon on the desktop, or by selecting **Start»All Programs»Kollmorgen»AKD 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 *Tips and Troubleshooting* section of this document for possible solutions.
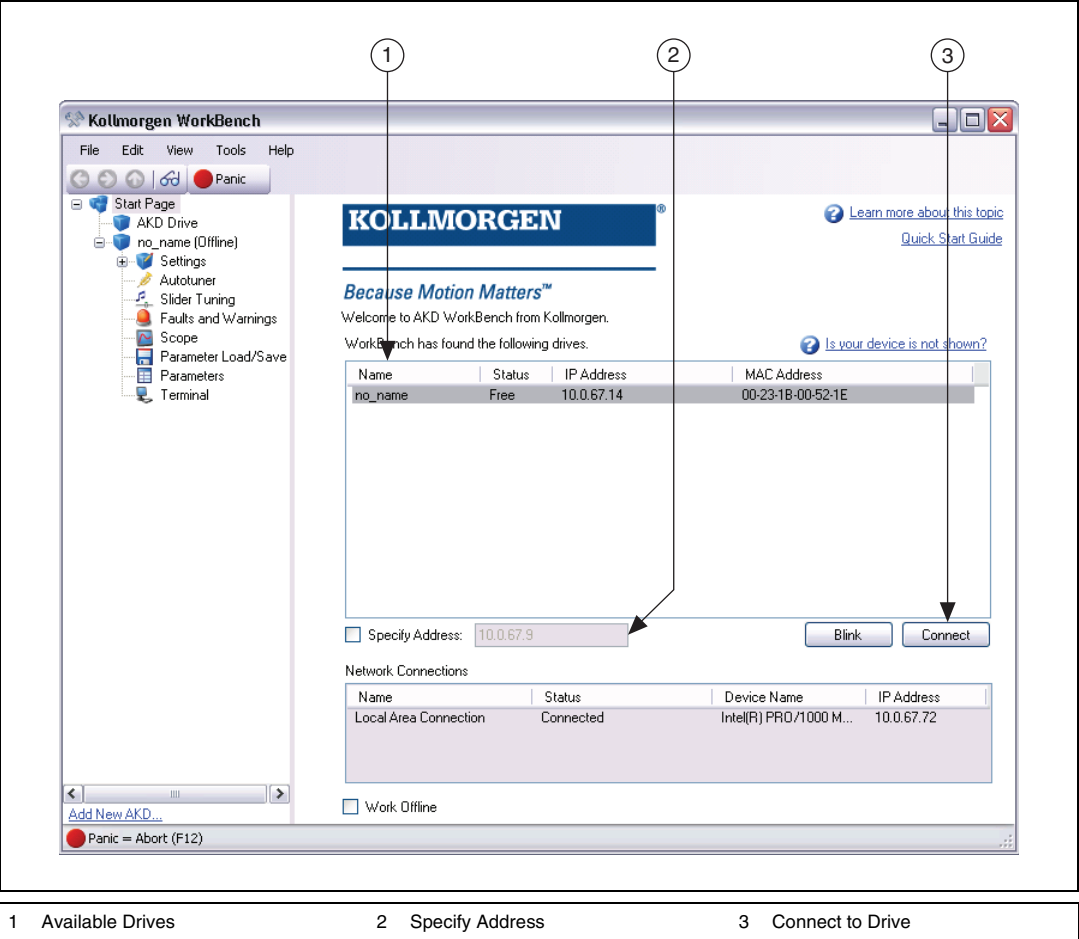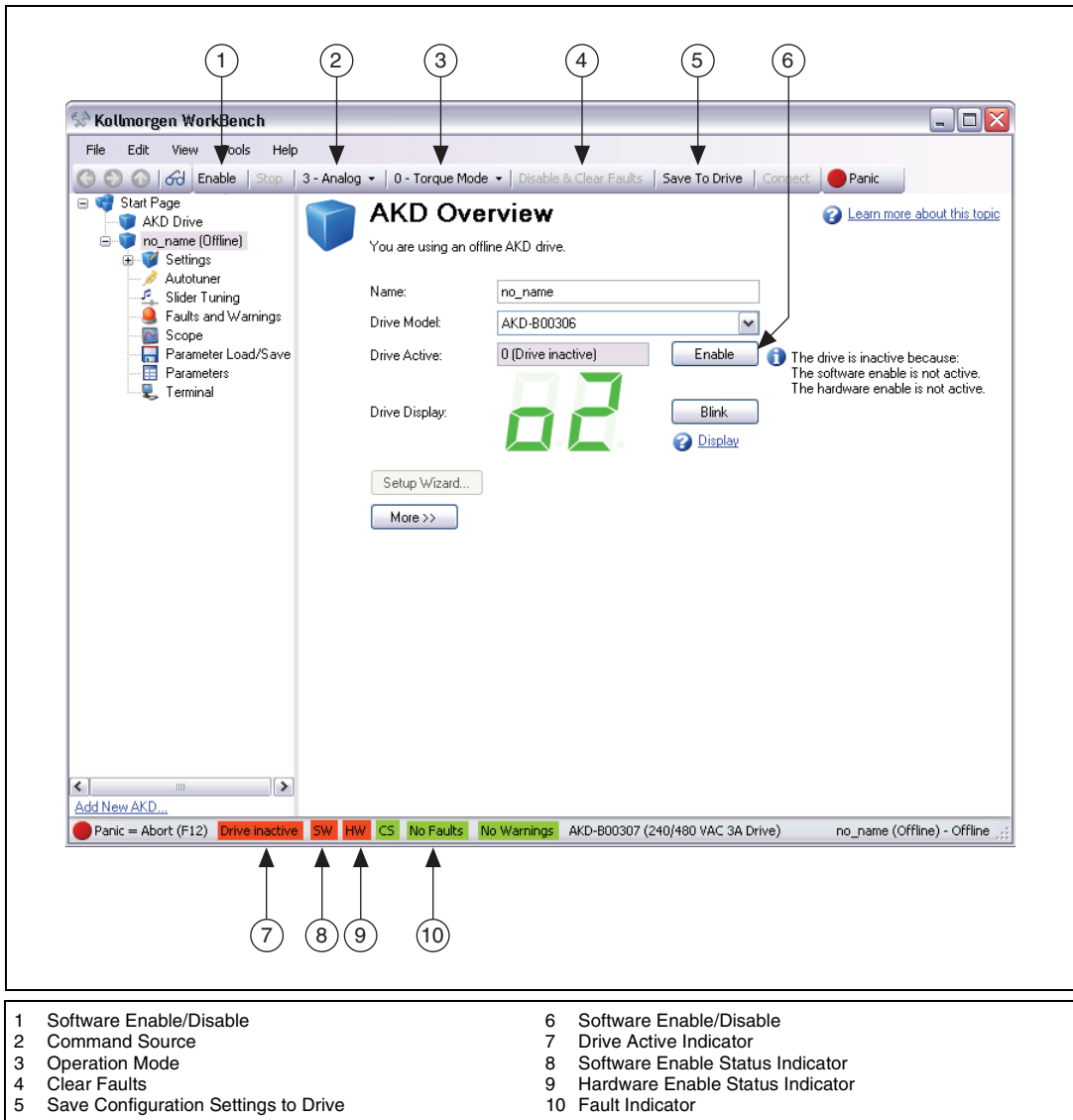
Figure 16 shows the AKD WorkBench start page.

Figure 16. AKD WorkBench Start Page

| 1 | Available Drives | 2 | Specify Address | 3 | Connect to Drive |

3. (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 17 shows the AKD Overview page.

1	Software Enable/Disable	6	Software Enable/Disable
2	Command Source	7	Drive Active Indicator
3	Operation Mode	8	Software Enable Status Indicator
4	Clear Faults	9	Hardware Enable Status Indicator
5	Save Configuration Settings to Drive	10	Fault Indicator

Figure 17. AKD WorkBench Overview Page

4. Configure the command source and operation mode.

a. Open the **Settings** page and set the **Command Source** to **3 - Analog**.

b. Set the **Operation Mode** to **0 - Torque Mode**.

When you have updated these settings the **Settings** page should look similar to the following figure.

| 1 | Command Source Setting | 2 | Operation Mode Setting |
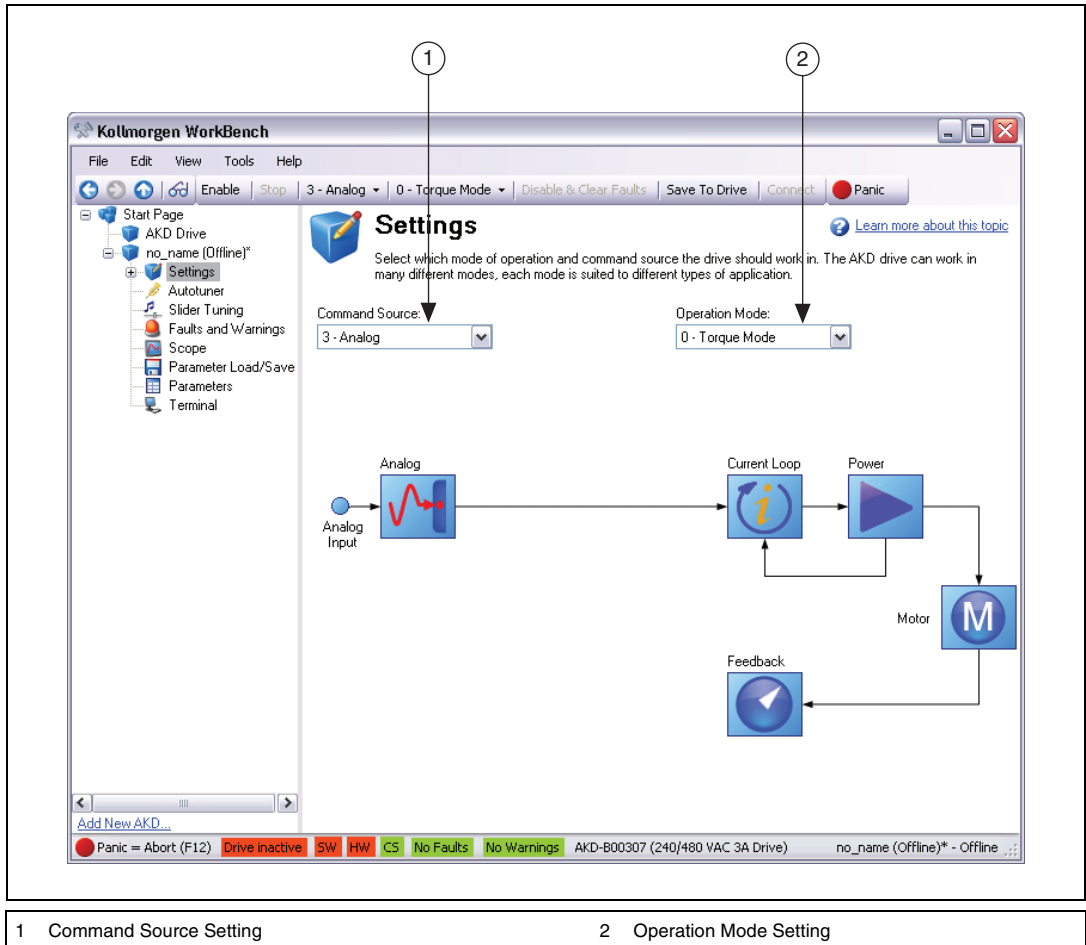
Figure 18. AKD WorkBench Settings Page

5. Configure the emulated encoder output.

   a. Expand the **Settings** tree item and open the **Encoder Emulation** page.

   b. Select **1- Output - With once per rev index pulse** from the **Function** dropdown list.

   c. Set the **Resolution** to 2,000 lines/rev.

✎ **Note** The encoder resolution output value determines the equivalent resolution of an incremental encoder in pulses per revolution (PPR). NI SoftMotion returns encoder positions in encoder counts per revolution. A resolution of 2,000 lines/rev is the same as 8,000 quadrature counts per revolution. You may want to choose a different value depending on your application needs. In general, higher resolution values result in more difficult servo loop tuning; lower resolution values provide less accuracy. If you select a different value for **Resolution**, remember to update the **Counts Per revolution** setting in the **Axis Configuration** dialog box.

   d. Set the **Index Offset** to 0.

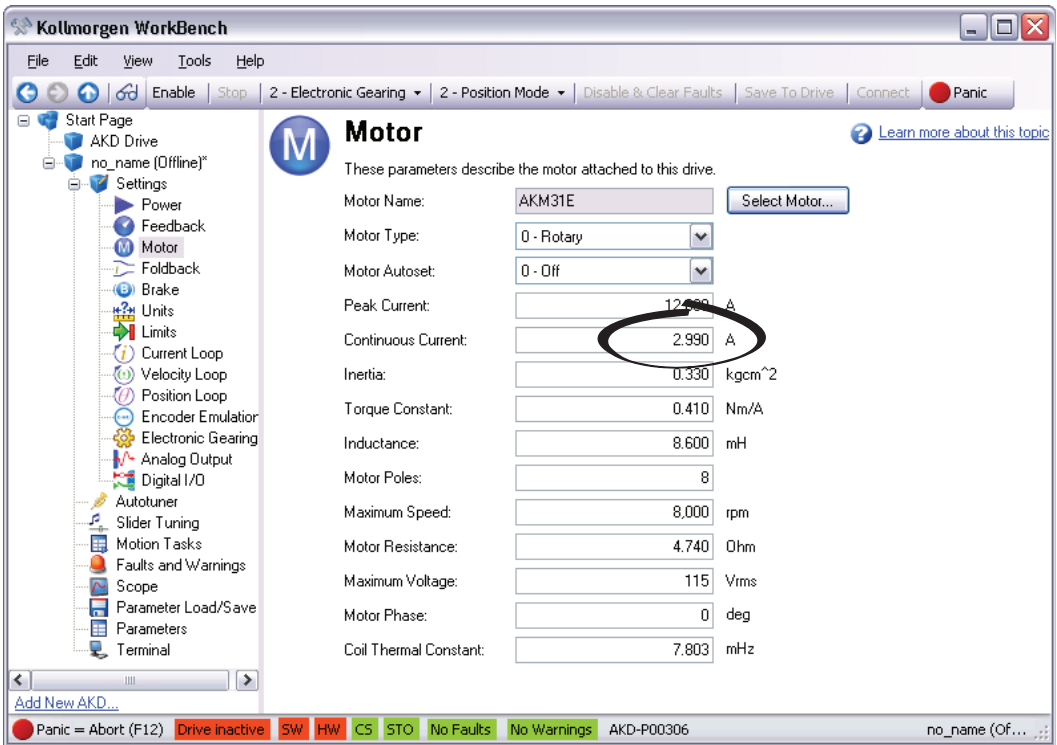Figure 19 shows the AKD WorkBench Encoder Emulation page.
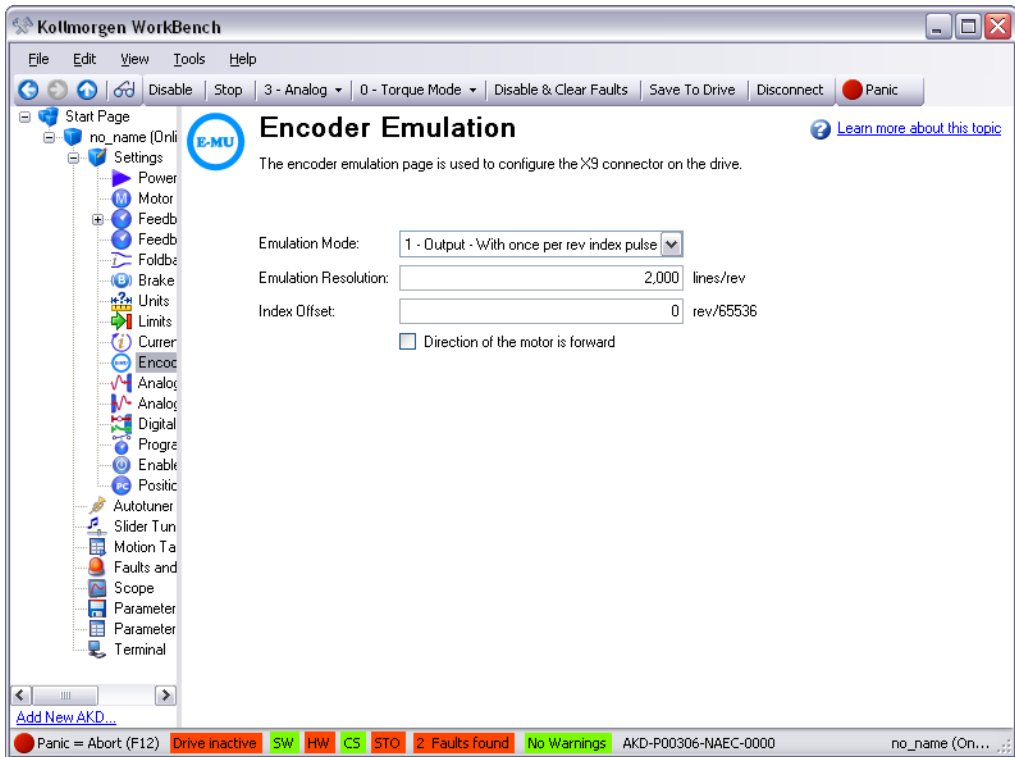
Figure 19. AKD WorkBench Encoder Emulation Page

6. Configure the analog input command scaling.

   a. Expand the **Settings** tree item and open the **Motor** page.

   b. Write down the motor **Continuous Current** value.

   Note Motor continuous current is in Arms.

Figure 20 shows the AKD WorkBench **Motor** page.

Figure 20. AKD WorkBench Motor Page

c. Expand the **Settings** tree item and open the **Analog Input** page.

d. Set the **Scale** to the appropriate Arms/V value based on the following equation:

$$Scale = Motor\ continuous\ current / 10$$

For example, if you have a motor with a maximum current of 3.00 Arms set **Scale** to 0.3 Arms/V.

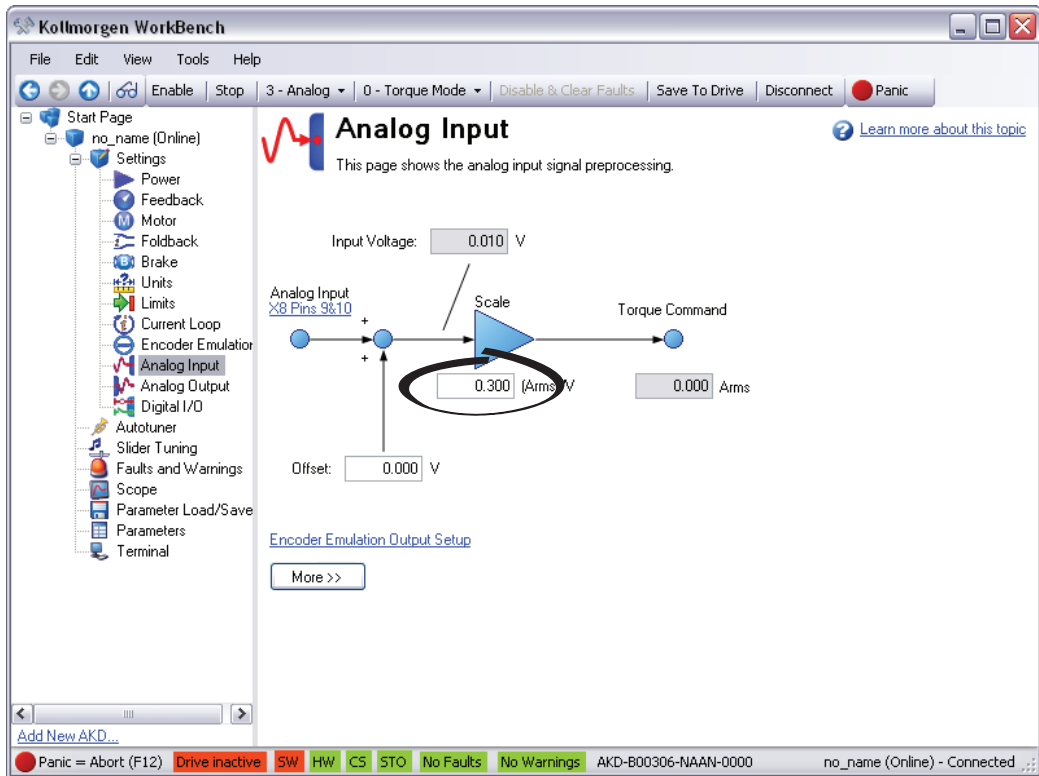Figure 21 shows the analog input scaling setting.

Figure 21. AKD WorkBench Analog Input Scale Setting

7. Configure the software enable signal:

    a. Click the **Parameters** tree icon to list all configurable drive parameters.

    b. Expand the **Drive** section.

    c. Set the **Software enable default** parameter to 1.
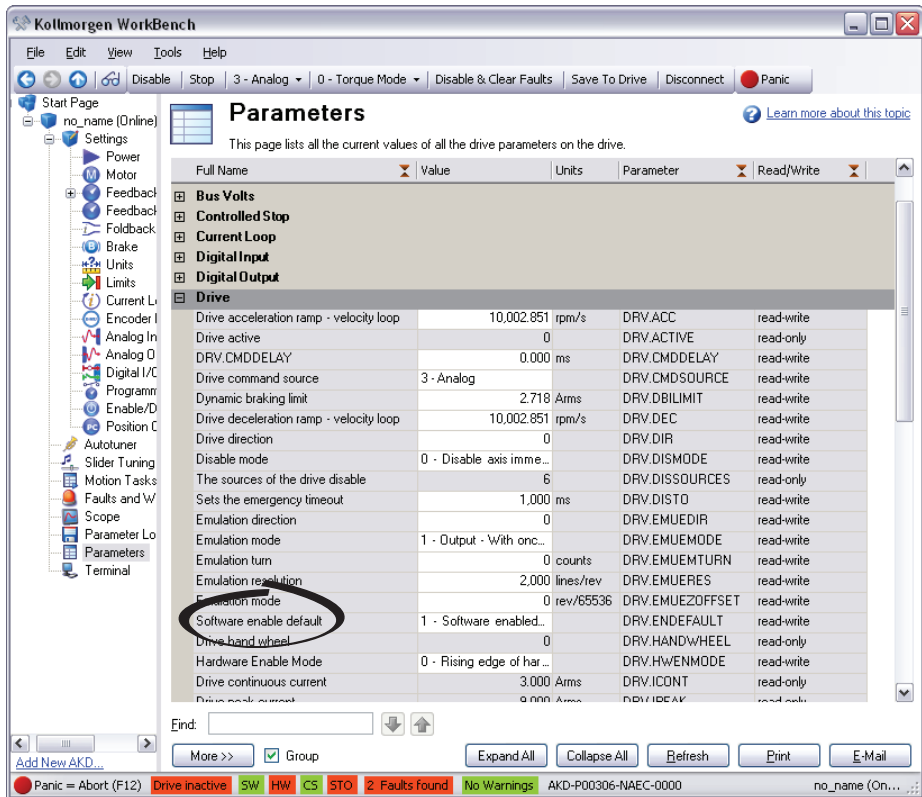
Figure 22 shows the AKD WorkBench parameters page.

Figure 22. AKD WorkBench Parameters Page

8. Activate the software enable on the drive by clicking the **Enable** button on the **AKD Overview** page or on the toolbar. Figure 17 shows the location of the **Enable** button.

9. Save all configuration changes to the drive by clicking the **Save to Drive** toolbar button shown in Figure 17.

Step 5: 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 and monitor feedback position and position error information, move and I/O status information, change move constraints, get information about software errors and faults, and view position or velocity plots of the move.

Complete the following steps to test your setup after configuring the axis using the **Axis Configuration** dialog box and configuring the drive with the AKD WorkBench software.

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 **Target Position** to 25 revolutions.

3. On the **Move Constraints** tab set **Velocity** to 1 revolution/sec. These settings rotate the motor 25 revolutions at 60 RPM. Click the **Help** button for detailed information about the items available in this dialog box.

4. Click the **Start** button on the bottom of the dialog box to start the move with the configured options.

5. Use the **Status** and **Plots** tabs to monitor the move while it is in progress.

6. Finalize the motion system setup by connecting and configuring additional I/O such as limits as required by your system using the 20-pin screw terminal connector. Table 1 shows the screw-terminal connector pinout.

7. Tune the motor with a load connected using the **Gain Tuning Panel** dialog box. Refer to the *Using the Gain Tuning Panel* topic in the *NI SoftMotion Module* book of the *LabVIEW Help* for detailed information about the Gain Tuning Panel and servo system tuning instructions.

Setting Up a Distributed System

Setting Up a System With An NI 9144 Chassis

Complete the following steps to set up the EtherCAT master and configure the distributed network for use with the NI 9144.

1. Install the real-time controller into the CompactRIO or PXI system.

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 wiring the controller to the power supply and Ethernet network.

✎ **Note** Do not plug in or turn on any power to the system until after you complete *Step 8: Connect the Drive Communication* in the *Hardware Installation and Configuration* section.

3. Connect the secondary port of your EtherCAT Master directly to the IN port (top port) on the NI 9144 chassis using a standard Category 5 Ethernet cable. If you are using the NI cRIO-9074 as your EtherCAT Master, the secondary port is top port (LAN PORT #2). If you are using a PXI system, you must add a PXI-8231/8232 network card for the secondary port. You may expand the deterministic Ethernet network by connecting an additional NI 9144 chassis or other slave devices to the OUT port (bottom port) on the first NI 9144 chassis.
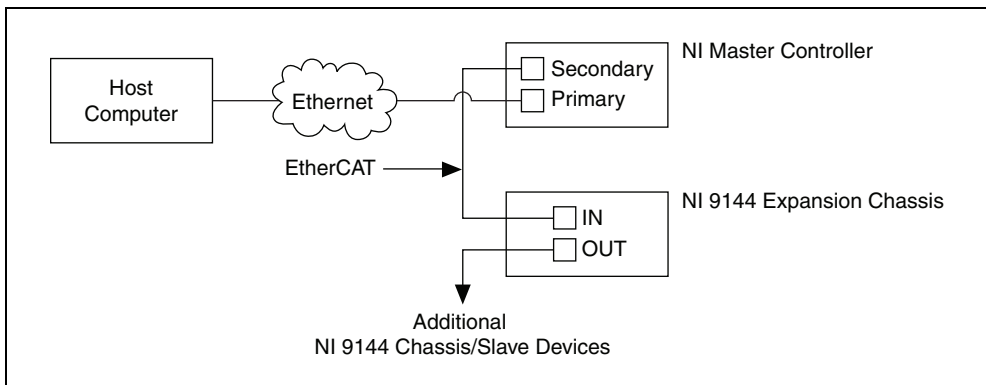
Figure 23. Connecting the NI 9144 Chassis to Network

4. Install the NI 9514 or NI 9516 module in slot 1, 2, 3, or 4 of the NI 9144 chassis.

5. If using the NI 9144 chassis with a PXI master controller, disable **Legacy USB Support** in the host PC BIOS, if it is enabled.

6. Continue with *Step 2: Connect NI 9514/16 to AKD Drive Cable to the C Series Module* in the *Hardware Installation and Configuration* section.

Software Installation and Configuration With the NI 9144

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 MAX icon on the desktop, or by selecting **Start»All Programs»National Instruments» Measurement & Automation**.

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 do not want to format the disk on the controller, eliminating all installed software and files, power on the controller and skip to step 12.

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 the **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 3.4.0 or later with NI Scan Engine Support.

14. Click **Next** and enable the following add-ons:
    • LabVIEW NI SoftMotion Module
    • NI Scan Engine Support for LabVIEW NI SoftMotion Module
    • IndCom for EtherCAT Scan Engine Support

Note If you are using the LabVIEW NI SoftMotion Module 2011 or later, you only need to install LabVIEW NI SoftMotion Module 11.0.0 or later. The Scan Engine support is included in this add-on.

15. Click **Next** to install the selected software on the controller. Click **Help** if you need information about installing recommended software sets.

16. When MAX finishes installing the software on the controller, select the controller under Remote Systems in the Configuration pane.

17. Click the **Network Settings** tab.

18. Select **EtherCAT** from the **Adapter Mode** list.

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

19. 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 24.

Figure 24. Network Settings Tab

20. Click **Save**.

21. Close MAX.

22. Continue with *Step 2: Creating a Project and Adding an NI SoftMotion Axis* in the *Software Installation and Configuration* section.

Adding the EtherCAT Master Device To the LabVIEW Project

If you are using the NI 9144 chassis, complete the following steps to add the EtherCAT master device and detect the C Series modules.

1. In the LabVIEW **Project Explorer** window, right-click the master controller and select **New» Targets and Devices**.

2. In the **Add Targets and Devices** dialog window shown in Figure 25, select **Existing target or device** and expand the category EtherCAT Master Device to auto-discover the EtherCAT port on the master controller. An EtherCAT master device and modules can be added manually at any time.

Figure 25. Adding the EtherCAT Master

When all the slave devices are discovered, the LabVIEW **Project Explorer** window lists each slave device and any installed C Series modules.

3. For more information about configuring the deterministic Ethernet network, the NI 9144 chassis, and the C Series modules, refer to the *Related Documentation* section of this document.

Tips and Troubleshooting

The Drive Does Not Enable

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

- The Drive Enable line from the NI 9514 or NI 9516 C Series module must be active. Figure 17 shows the location of the hardware enable indicator in the AKD WorkBench software.
- The software enable must be enabled. This setting is available on the upper toolbar in the AKD WorkBench software. Figure 17 shows the location of the software enable indicator and toolbar button.
- The drive must not be in a fault state. Click the **Clear Faults** button on the toolbar to clear the fault state after determining and fixing the source of the fault. Figure 17 shows the location of the Fault indicator and **Clear Faults** toolbar button.

💡 **Tip** Refer to the *AKD Fault and Warning Messages* card that came with the drive for fault information and solutions.

Cannot Communicate With the Drive Using Ethernet

Confirm that the link LEDs on the drive and PC are both illuminated. Figure 11 shows the location of the link LED on the drive.

Connecting to the PC Using a Static IP

1. Use the S1 and S2 rotary switches on the drive to set a static IP address. The IP address is `192.168.0.S1S2`. For example, if S1 is set to 2 and S2 is set to 3 the IP address is `192.168.0.23`.

✎ **Note** If you change S1 or S2 when the +24 V power supply is powered on, you must unplug the network cable from the drive for at least three seconds to reset the IP address.

2. Connect the AKD servo drive to the computer directly using an Ethernet cable. Figure 11 shows the location of the X11 service port on the drive.

3. Select **Start»Control Panel»Network Connections** to open the **Network Connections** dialog box.

4. Select the network connection type corresponding to the port you used to connect the AKD servo drive. This will most likely be **Local Area Connection**.

5. Click **Properties**, then select **Internet Protocol (TCP/IP)** from the list.

6. In the **Internet Protocol (TCP/IP)** dialog box, select **Use the following IP address**.

7. Change **IP address** to `198.168.0.100`.

8. Change **Subnet mask** to `255.255.255.0`.

Verify that S1 and S2 are set to non-zero values.

The Motor Responds Poorly

Use the Gain Tuning Panel dialog box to change the control loop settings for the motor. Refer to the *Using the Gain Tuning Panel* topic in the *NI SoftMotion Module* book of the *LabVIEW Help* for detailed information about the Gain Tuning Panel and servo system tuning instructions.

Cannot See the AKD Servo Drive in the AKD WorkBench Software

Manually enter the drive IP address by enabling the **Specify Address** checkbox on the AKD WorkBench software Start Page shown in Figure 16. To obtain the drive IP address either press the B1 button on the top of the drive or disconnect and reconnect the Ethernet cable. In either case, the LED displays the digits and dots of the IP address in sequence. Figure 26 shows the location of the B1 button.
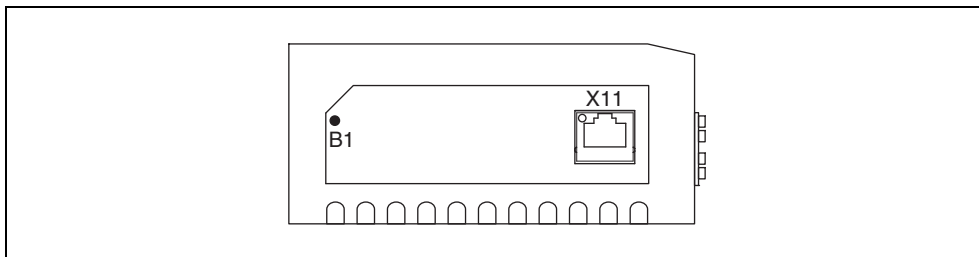
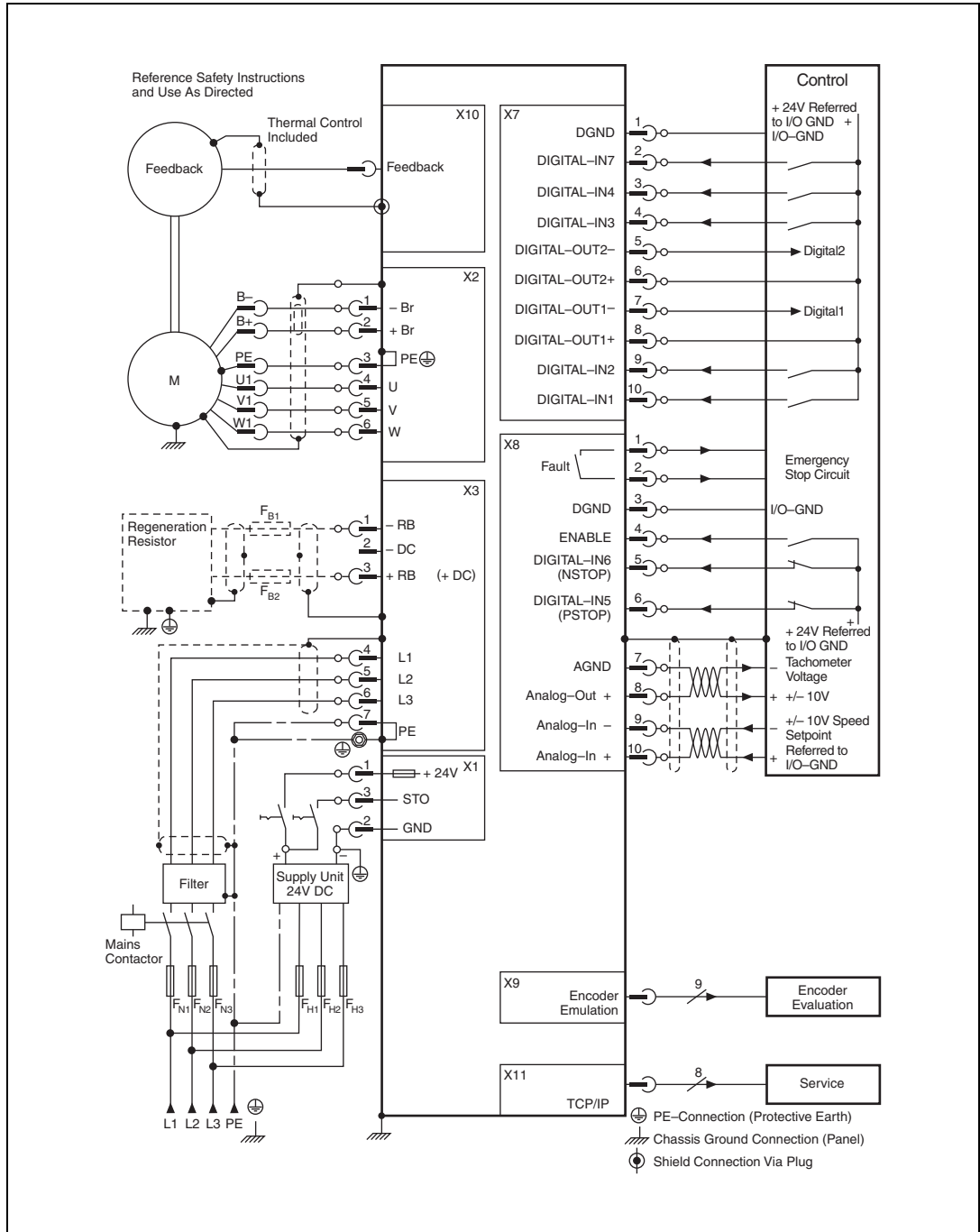**Figure 26.** AKD Servo Drive B1 Button

Wiring Diagram

Figure 27. AKD Wiring Diagram

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