# QMP SynqNet™ Controller
## Quick Start Guide

**Edition March, 2012**

T131-0001 QMP-SynqNet-PCI-RJ-1200

Keep all manuals as a product component during the life span of the product.
Pass all manuals to future users / owners of the product.

KOLLMORGEN

Because Motion Matters™

### Record of Document Revisions

| Revision | Remarks |
|---|---|
| 1/23/2012 | Preliminary edition |

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## March 2012

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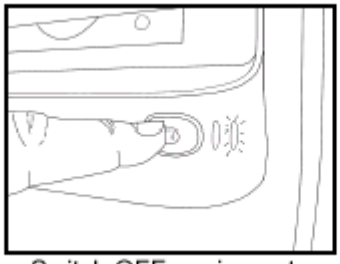
# 1 SAFETY WARNINGS

During installation, solid electrical contact must be ensured at connectors; otherwise, noise and power problems will develop. (Connections should be verified through inspection and testing.).

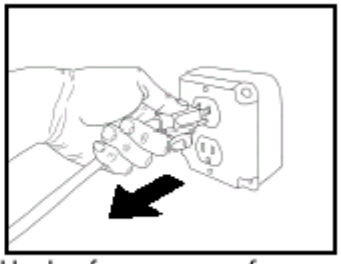
Standard safety rules prevail during installation of any hardware. Some are summarized below for the QMP. For more information, refer to local occupational safety regulations and the manufacturer of the motion drive.

## 1.1 Turn Off All Power Before Installing Equipment

Before installing any motion control equipment, including QMP controllers, power should be switched OFF. Unplug all power plugs from their sources of power.



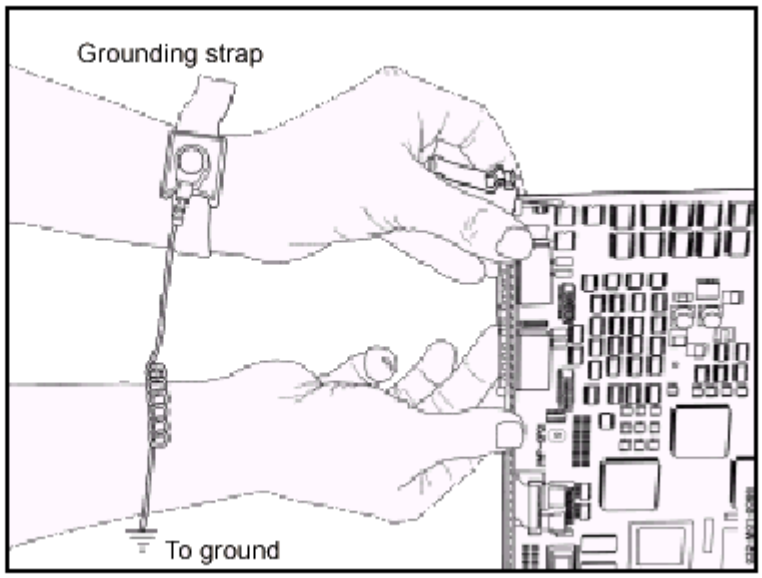
Switch OFF equipment.



Unplug from source of power.

## 1.2 Observe ESD Precautions

To prevent damage to controller and drive electronics due to electrostatic discharge (ESD), service personnel are cautioned to observe proper grounding during handling of components.



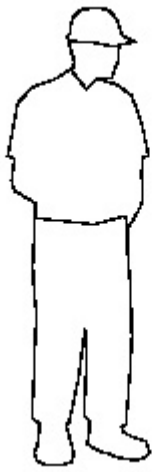

**NOTE:** Grounding straps should be worn at all times when handling QMP-SynqNet electrical components and connection hardware.

## 1.3 Define and Clear a Safety Zone

During installation and testing of motion control hardware-software, a safety zone should be defined around moving components and kept clear of personnel, hands, fingers and loose hardware. During repowering of the system, motion control components may behave erratically due to misconnected lines, or wrongly configured software settings. Sudden and unexpected moves by components can cause injury, property damage, or even death!

***Warning!*** Under NO circumstances should a motion system be tested or operated while personnel are within the safety zone.

Additionally, beware of flying debris from unsecured hardware operating at high speeds. The use of safety shielding is highly recommended.



# 2 INSTALL THE MDK SOFTWARE

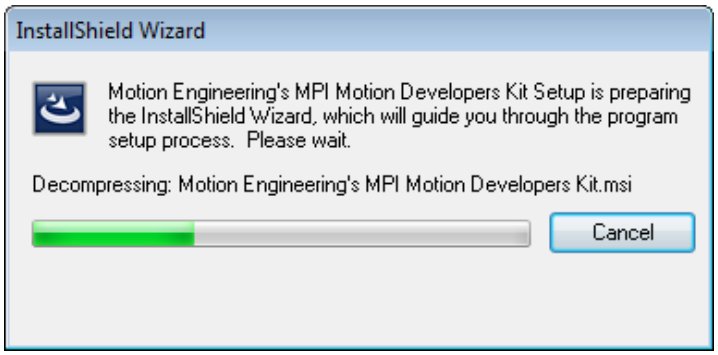
The MDK software is accessed from the MDK InstallShield CD-ROM. By default, all of the files are copied to the following directory: C:\Program Files (x86)\MEI\MDK\04.02.xx\. The InstallShield installs the following features and libraries:

- Motion Programming Interface (MPI)
- Motion Console
- Motion Scope
- VM3
- On-line Documentation

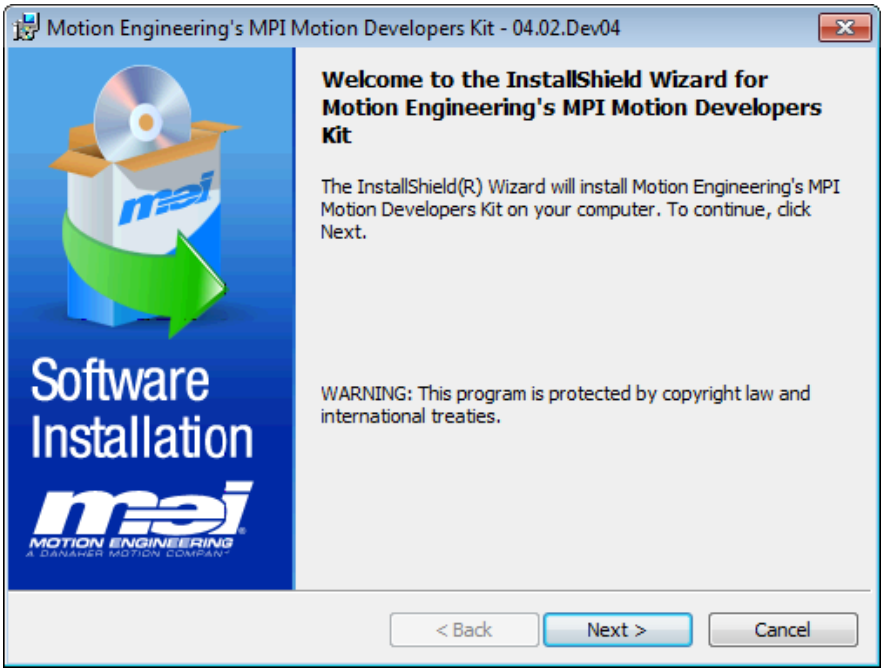
## 2.1 Installation Steps

The process of installing the MDK (software) is explained in following seven steps.

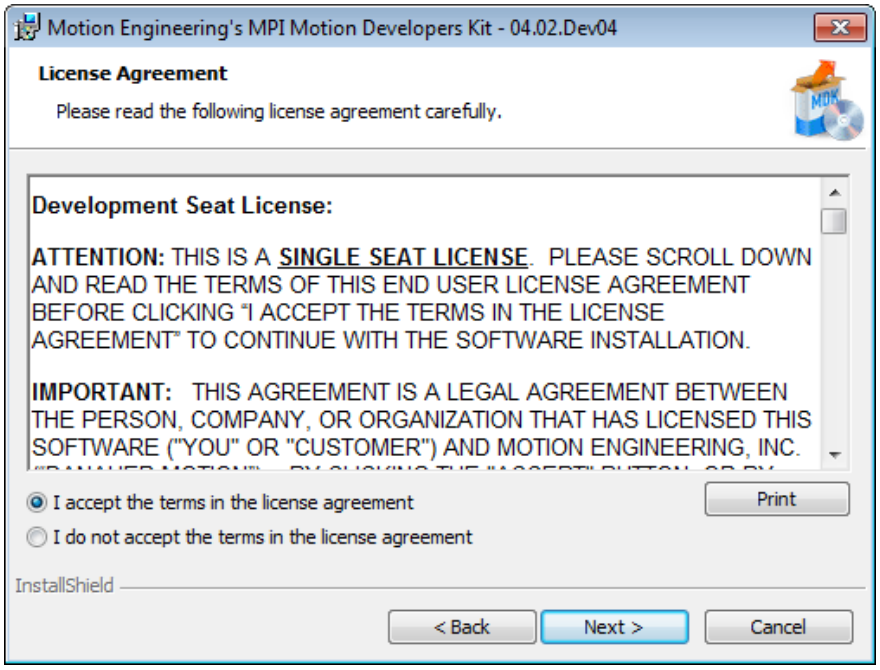
1. Click on the **WinNTSetup.exe** or **Win32Setup.exe** file.



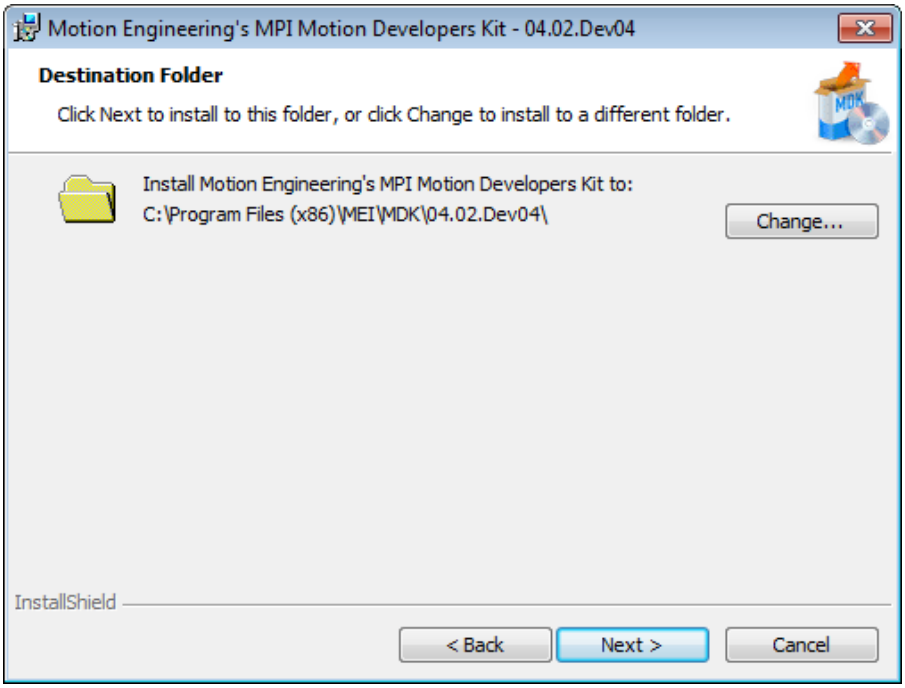
2. The InstallShield Wizard for Kollmorgen's MPI-QMP Motion Developer's Kit displays. Click **Next**.



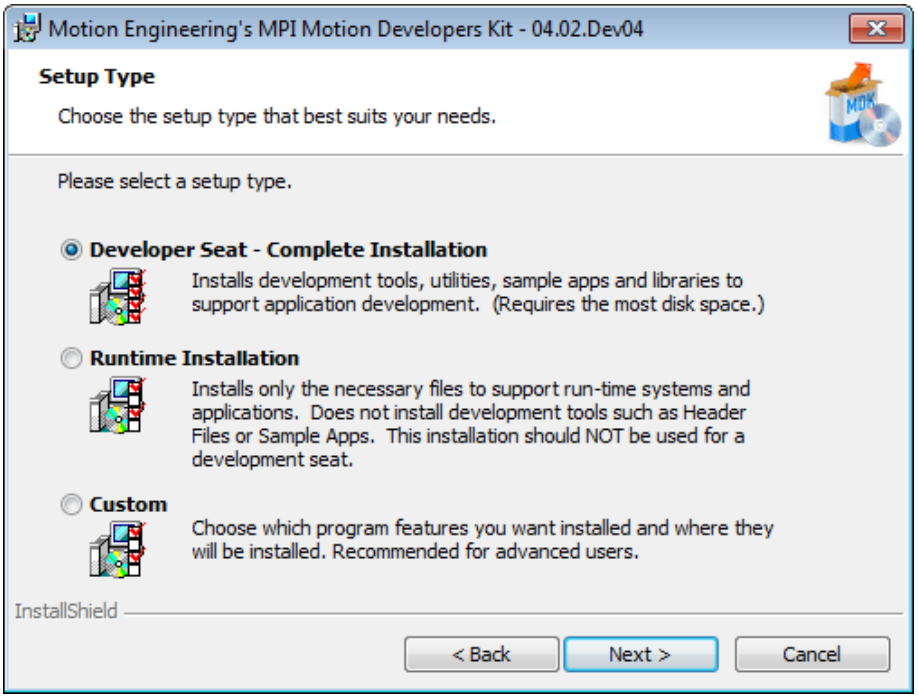

3. Read and accept the terms of the license agreement before continuing the installation. Select "I accept the terms in the license agreement" and click **Next**.



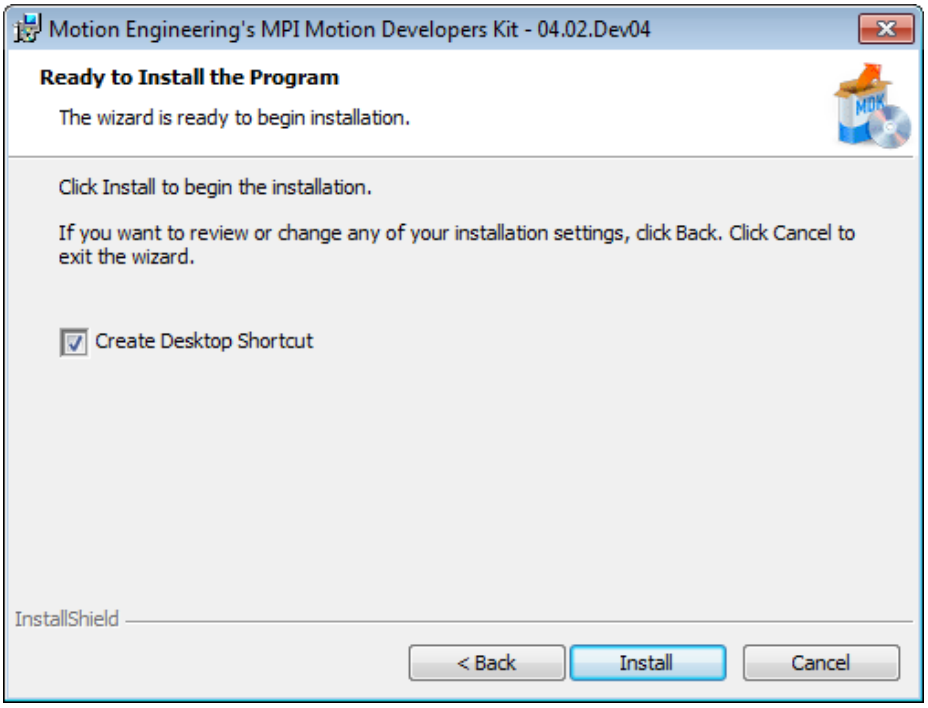
4. The default directory for the installation of all files and settings is C:\Program Files (x86)\MEI\MDK\04.02.xx\. We recommend not changing the default installation directory unless directed to do so by an applications engineer. Click **Next**.



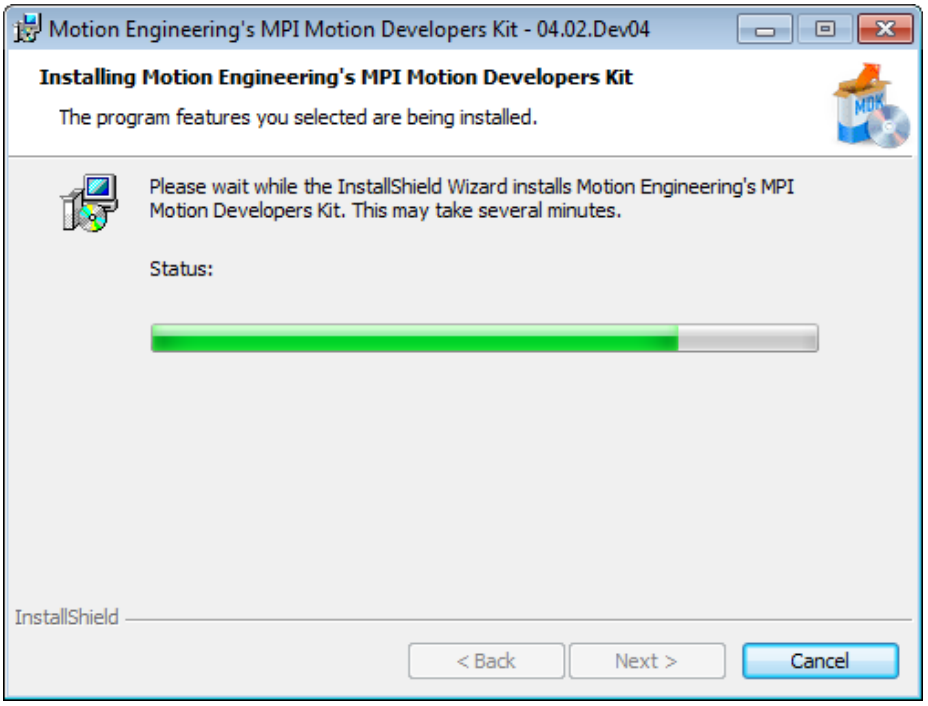

5. Select the appropriate setup type for this environment and click **Next**.



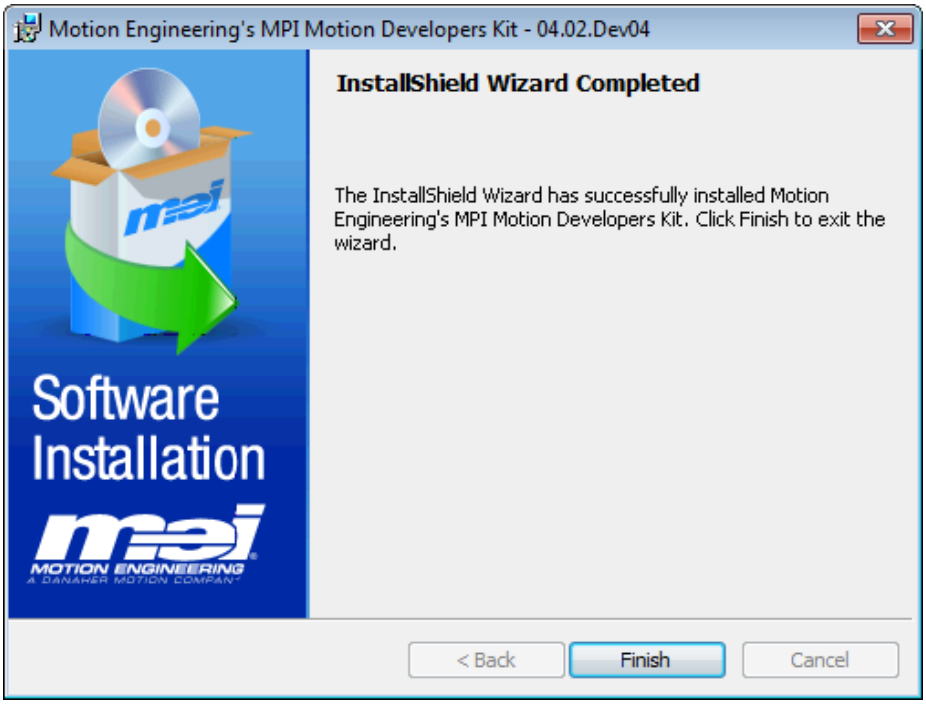
6. The InstallShield is now ready to install all of the files and settings. Click **Install**.




A series of windows displays the progress of the installation.



7. The following confirmation window displays if the installation was successful. Click **Finish** to exit the InstallShield.



# 3 INSTALL THE MOTION CONTROLLER

The standard QMP-SynqNet-PCI motion controller has a universal PCI interface, which operates in either 3.3V or 5V signaling backplanes. The 120-pin edge connector plugs into the host PCI bus slot. All motion control I/O is through the RJ-45 and HD15 connectors on the rear panel.

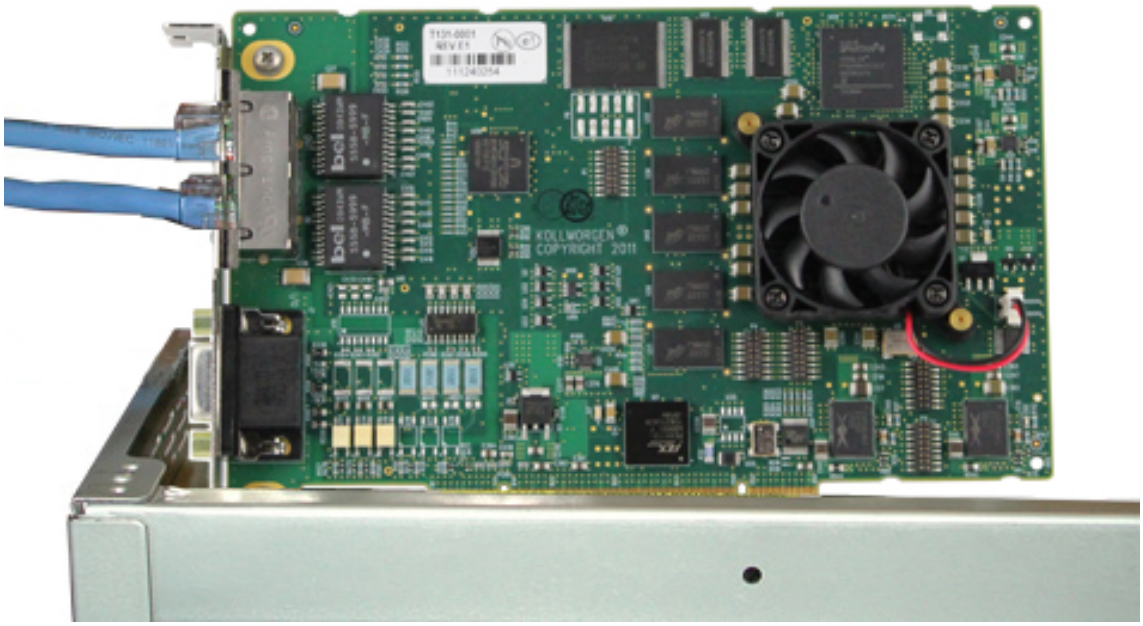
**QMP-SynqNet-PCI-RJ-1200**
PN: T131-0001

UL Certification: File# E254128

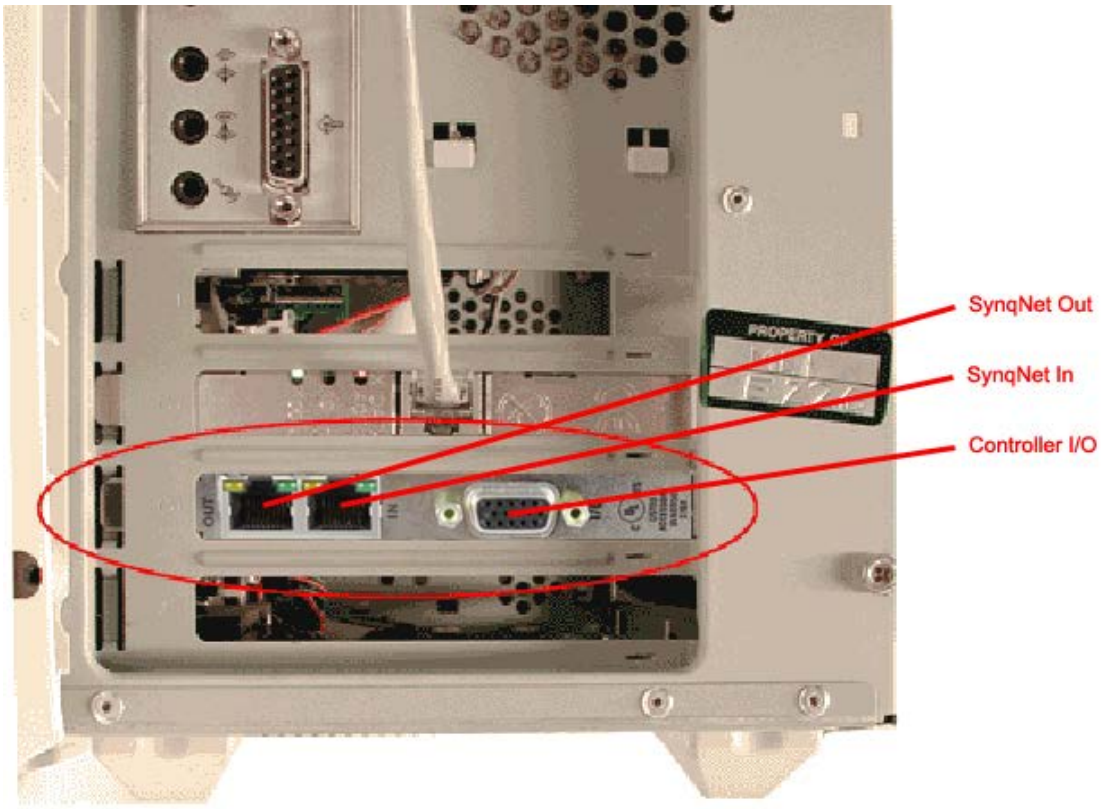
***CAUTION!*** This hardware is for use only with compatible UL listed personal computers that have installation instructions detailing user installation of card cage accessories.

## 3.1 Install PCB into the Host Machine

Push the 120-pin edge connector into the mating connector on the host machine.



The following image displays an installed QMP-SynqNet-PCI controller in a standard PCI slot on a CPU.

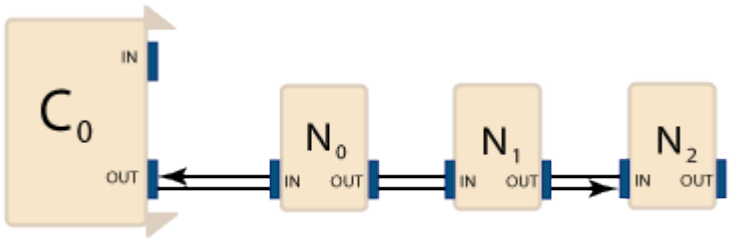


# 4 CONNECT THE HARDWARE

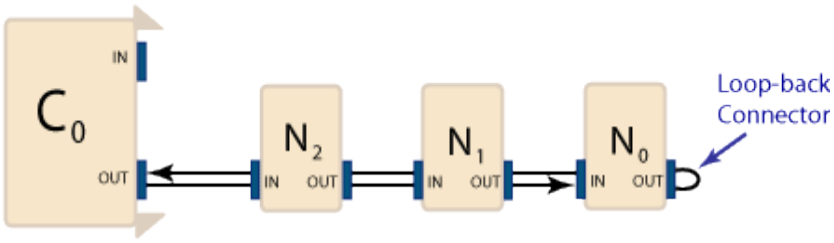
This section covers the necessary requirements for connecting a SynqNet motion control system. The cables used to connect SynqNet components depends on the types of connectors on each piece of hardware.

## 4.1 Pick a Topology

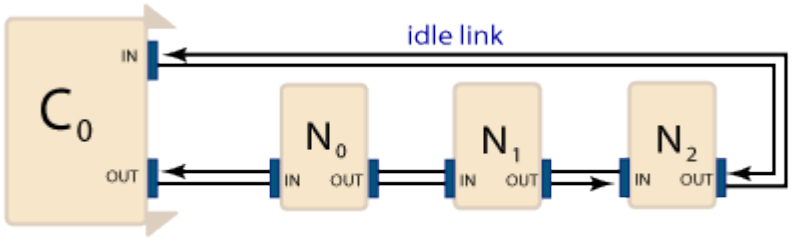
The next step is to set up the hardware of the system based upon the selected topology. Currently, SynqNet supports the following three topologies:




String Topology




Terminated String Topology

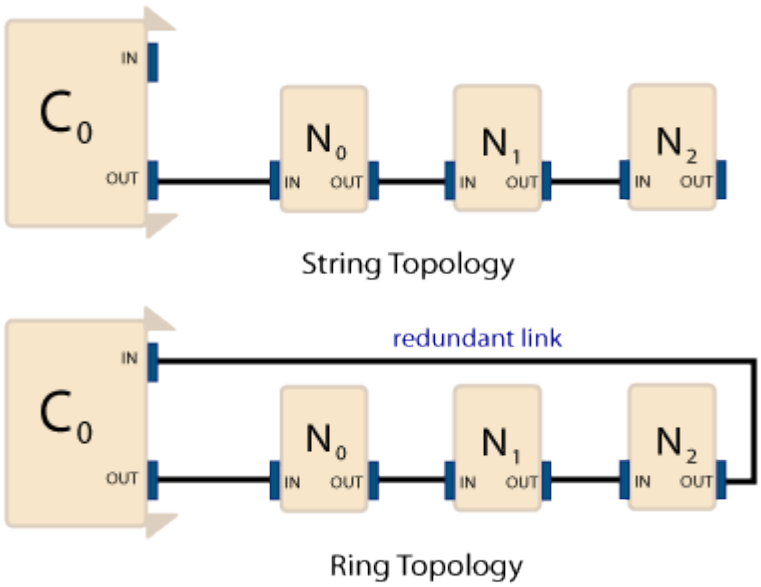



Ring Topology

More information about the various topologies can be found on the Node, Cable, Motor, Drive Addressing website (http://support.motioneng.com/Technology/SynqNet/addressing_diag.htm).

## 4.2 Cable Connections: Controller to Nodes

The type of cables needed to connect the controller to the nodes will vary based upon the type of controller, the particular hardware features, and the type of nodes being used in the SynqNet Network. However, regardless of these variables, the cables are wired the same way. For example, a cable from an OUT port will always connect into an IN port. The following diagram clearly illustrates this connection pattern. For more information about cables and connectors, see the SynqNet Interface Cable website (http://support.motioneng.com/Hardware/Accessories/cables_synq.htm).




### 4.2.1 Types of Connectors and Cables

Depending on the type of SynqNet ports (RJ45 or Micro-D) on the Controller and Drive, use one of the corresponding cables to connect them to each other. The following table lists some of the common connectors and their matching cables.

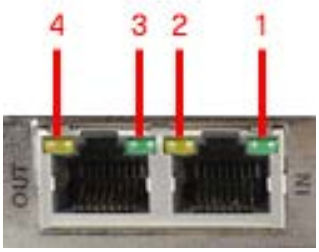
| Feature | Connector | Cable |
|---|---|---|
| Controller I/O | HD-15 | C001-0037 |
| | Micro D15 | C001-0036 |
| SynqNet | Micro D9 | C005-0002, C006-0001 |
| | RJ-45 | C007-0003, C006-0001 |

### 4.2.2 Power On Nodes and Check LEDs

After all of the nodes are connected with the proper cables, power-up the system. To verify that the Nodes are connected correctly and that each node is receiving a network and power signal, inspect the LEDs at each connector.

Each **controller** has four LEDs:

- Two LEDs (1 and 2) at the IN port
- Two LEDs (3 and 4) at the OUT port.

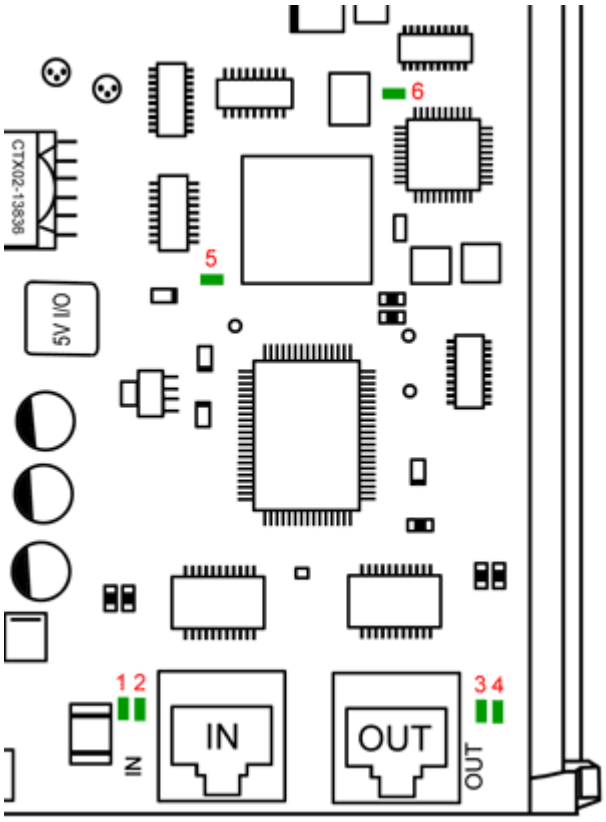



QMP-SynqNet-PCI-RJ-1200

**SynqNet Connectors: RJ-45**
For more information, see the Controller LEDs section.
http://support.motioneng.com/Hardware/SynqNet-QMP/leds_controller.htm

Each **node** has four green LEDs:

- Two LEDs (1 and 2) at the IN port.
- Two LEDs (3 and 4) at the OUT port.




**Node LEDs on the RMB-10V2-SynqNet**

- LED1 - Link Activity
- LED2 - Node State
- LED3 - Link Activity
- LED4 - Repeater
- LED5 - FPGA
- LED6 - FPGA Boot Status

The RMB-10V2-SynqNet is displayed above.

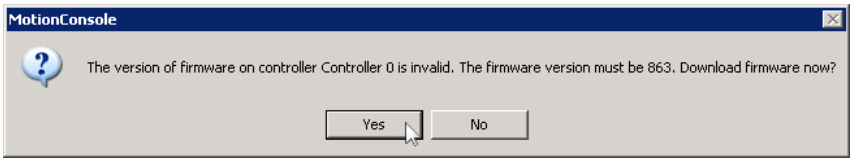
Each LED has a particular function. See the Node LEDs page for details.
http://support.motioneng.com/Hardware/SynqNet-XMP/leds_node.htm

# 5 MOTION CONSOLE

Before the QMP controller is ready to begin spinning a motor, the motion console must be properly initialized. This section describes how to configure a controller and set up a basic servo loop to test that the system works properly.

## 5.1 Download Controller Firmware

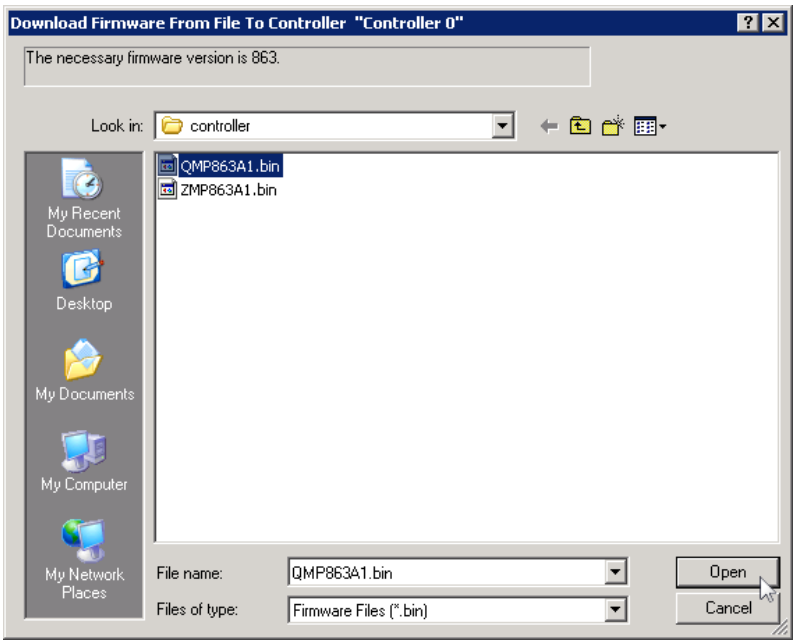
Kollmorgen's motion controllers are shipped with NULL firmware. Therefore, the first step is to download the proper firmware for the controller. When starting the Motion Console for the first time, it automatically prompts to download firmware to the controller and indicates which version should be downloaded. In the example below, firmware version 863 is downloaded. Click **Yes** to download the firmware.




The next window requires locating the firmware file. Choose the **QMPxxxxx.bin** ("xxxxx" represents the firmware version) firmware file from the mei\controller directory. The standard software release includes one QMP controller firmware file. **QMP863A1.bin** is used in this example.

If custom software is installed, there will be an additional firmware file in the same directory. Each custom firmware file is numbered: Q1Pxxxxx.bin, Q2Pxxxxx.bin, etc. If custom firmware is required, select the proper custom QnPxxxxx.bin file from the same directory.

Select the appropriate firmware file and click **Open**.

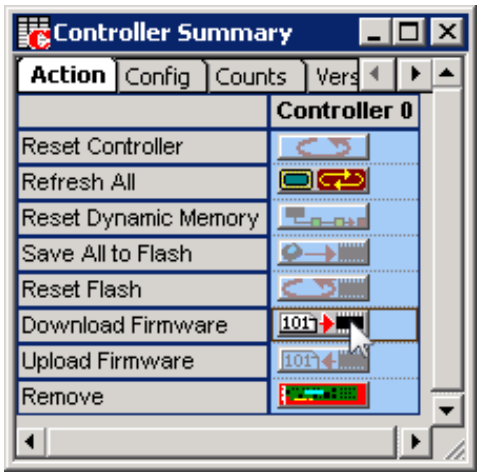


When the verification window displays, click **Yes**. It will take approximately 30 seconds to download the firmware to the controller.

### 5.1.1 Troubleshooting

**What if I accidentally downloaded the wrong version or need to change the firmware version on the controller?**

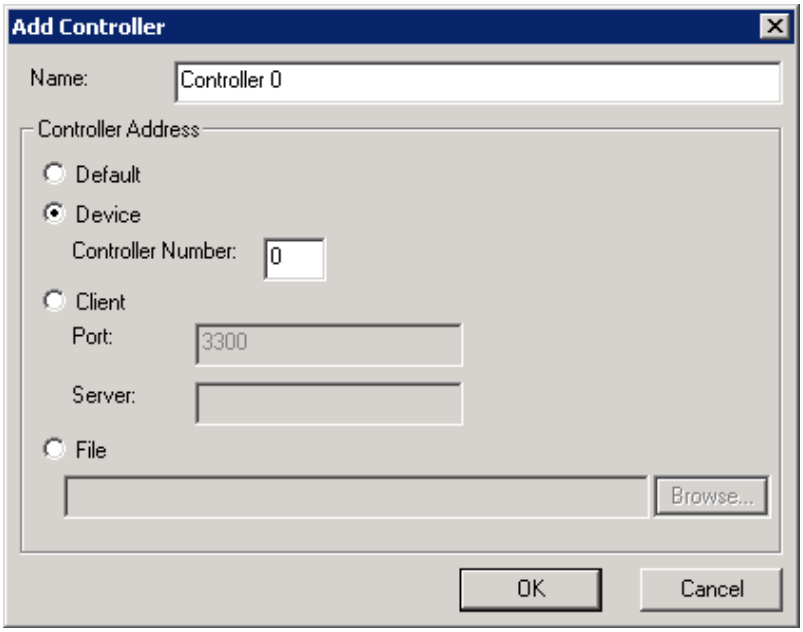
Once firmware is loaded onto the controller for the first time, the version can be changed manually in Motion Console's Controller Summary window. Under the **Action** tab, click the **FW Download** button and then select the correct firmware file from the **mei\controller** directory.



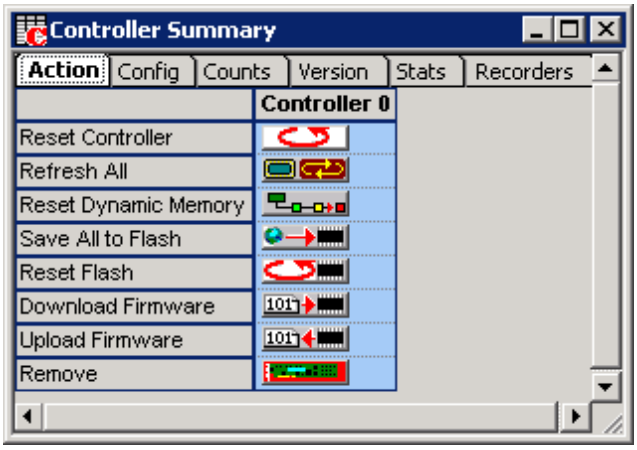
## 5.2 Add New Controller

The first step is to add a new controller in Motion Console. Click on the **Add New Controller** icon on the toolbar.

The window that displays allows the controller to be uniquely identified by updating the Name field. For example, the default name, Controller 0 is used. Enter a name for the controller and click **OK**.



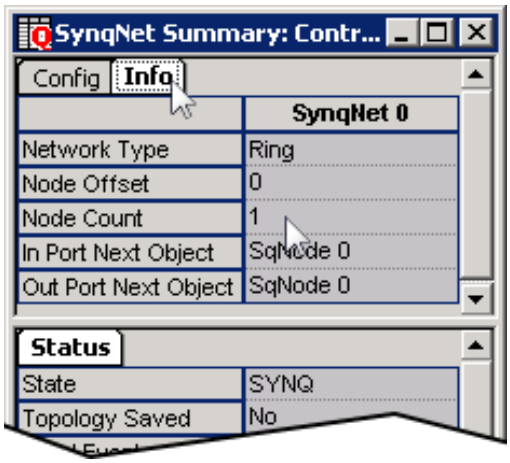

The **Controller Summary** window displays.



## 5.3 Check Network Information

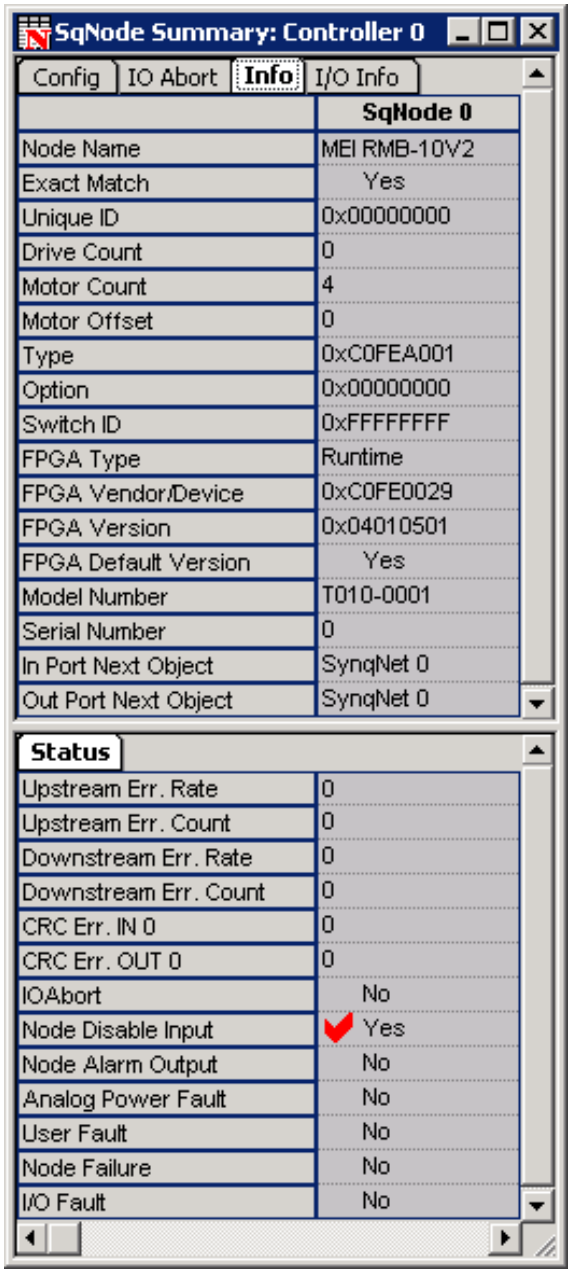
After the proper firmware is downloaded for the controller, check the Network Information to verify that the proper number of blocks were found. Click on the button to open the SynqNet Summary Window. Under the Info tab, the value for node count is 1 since the SynqNet Network that was used for this example had one RMB-10V2 installed.

A node refers to any SynqNet node, such as a SynqNet Drive or an RMB-10V2 (for analog) that is installed on a SynqNet network.



## 5.4 Check Node Information

Click on the button to view the SqNode Summary window. This window provides specific information about the nodes installed on the system. SynqNet finds the nodes in the order that they are connected. The hardware setup used for this example had one node. Therefore, the SqNode Summary Window displays one node: **SqNode 0**. This window also displays the address information of each node.




**TIP:** Before proceeding, it is helpful to first minimize the Motion Console window.

### 5.4.1 Troubleshooting

**Some of the Link LEDs on my node/drive are not ON...**

If the Link LEDs are not turned ON, verify that the drive has power. If the drive has power and Link LEDs are not ON, disconnect and reconnect the connector.

If the LEDs are not ON and the power is verified, check that the cables are connected to the right ports.

If the Link LEDs still do not turn ON, the power is verified, and the connections are correct, replace the cable. Another way of verifying if the cable is bad is to switch the cables. If the ports' LEDs light up with one cable and not with the other, then that cable is bad. Also, after the cables have been replaced, be sure to reset the controller in order to reinitialize the network.

For more information about the locations and meanings of LEDs see the Controller LEDs and Node LEDs sections.

**The RMB/SynqNet Node does not work straight from the box...**

All RMB nodes are supplied without any FPGA image and will need to be programmed before being used. Proceed to the next step, Download Node FPGAs.

**A node is improperly ordered...**

SynqNet finds the nodes in the order that they are connected. If a node is improperly ordered, retrace the wiring from the controller to the last node. Use the serial number and address information, or use the drive identification information (model number, serial number, address, etc) to determine if a node is not in the correct order. If the same node types are improperly ordered, the problem can be found during motor feedback verification.

**SynqNet initialized successfully, but all of the nodes were not found...**

SynqNet only displays the nodes which are found on the network. The most common cause of a node not being found is a result of a bad cable connection or a bad cable. The first step is to verify that the LEDs on the SynqNet In/Out ports are ON. If they are not on, disconnect and reconnect the connector. If the LEDs still do not turn ON, replace the cable.

## 5.5 Download Node FPGAs

Kollmorgen's SynqNet nodes are shipped with boot FPGA images (*.sff). The boot image contains minimal functionality to allow the node to be accessed by the SynqNet controller. To use the node, first download the appropriate FPGA (runtime) image.

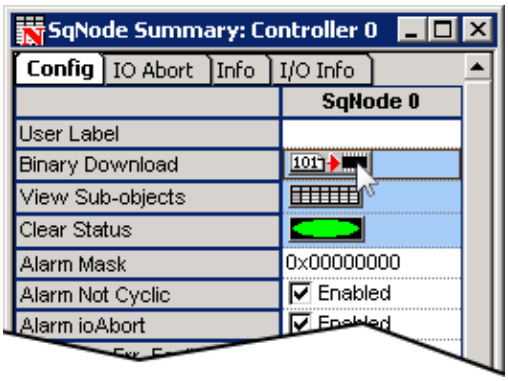
To find the appropriate FPGA (runtime) image that should be downloaded for each node, refer to the Node Binary Files: Product Table (http://support.motioneng.com/Hardware/Drives/FPGA/fpga_feat_tbl.htm).

There are two ways to download the Node FPGA. By using:

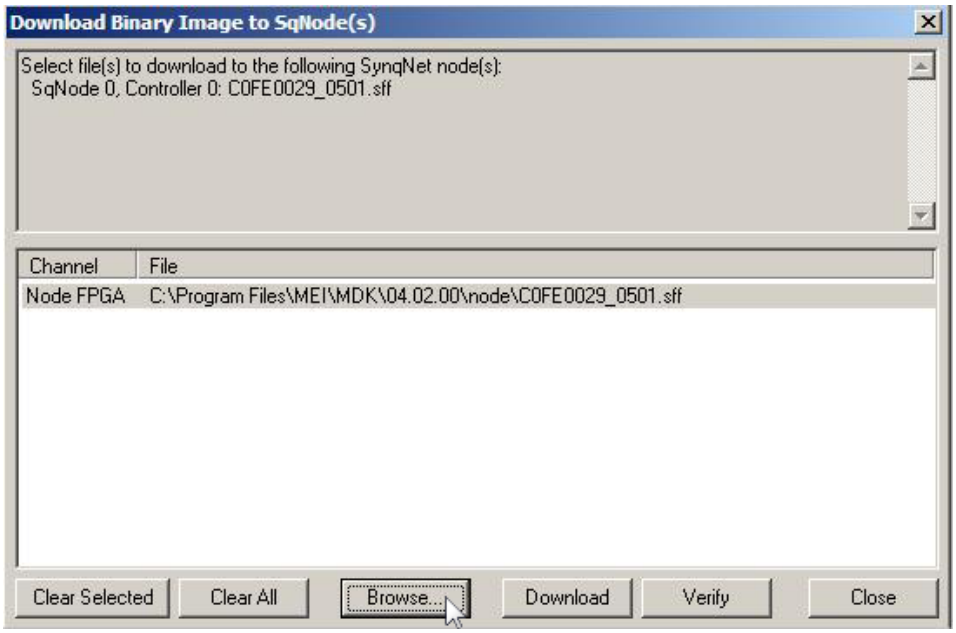
- Motion Console
- Command Prompt

### 5.5.1 Motion Console Download

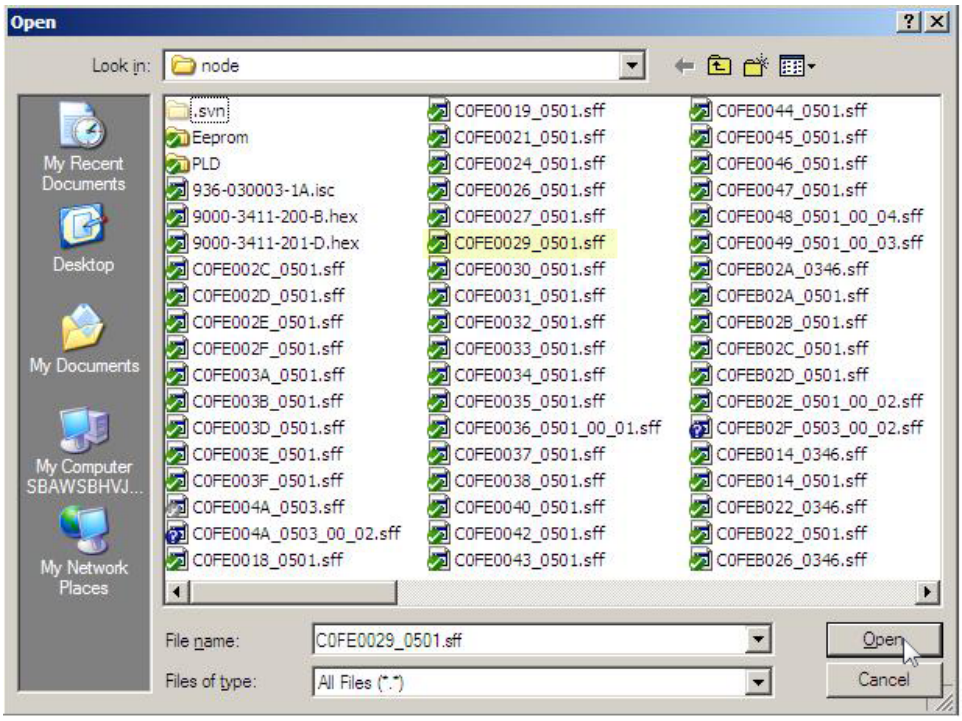
In the SynqNet Node Summary window, click on the **Binary Download** button.



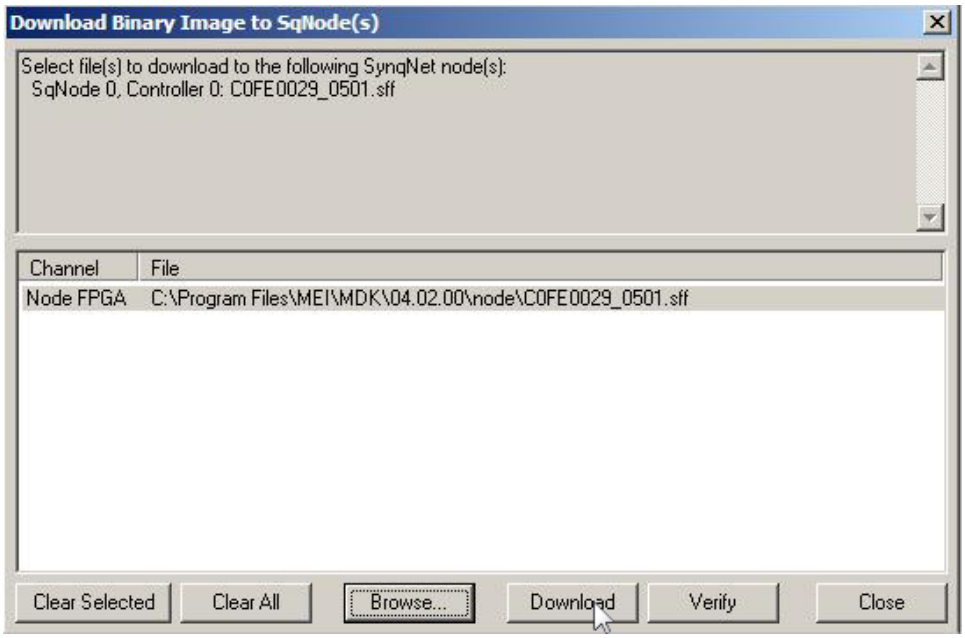

The Download Binary Image to SqNodes window displays, Click **Browse**.



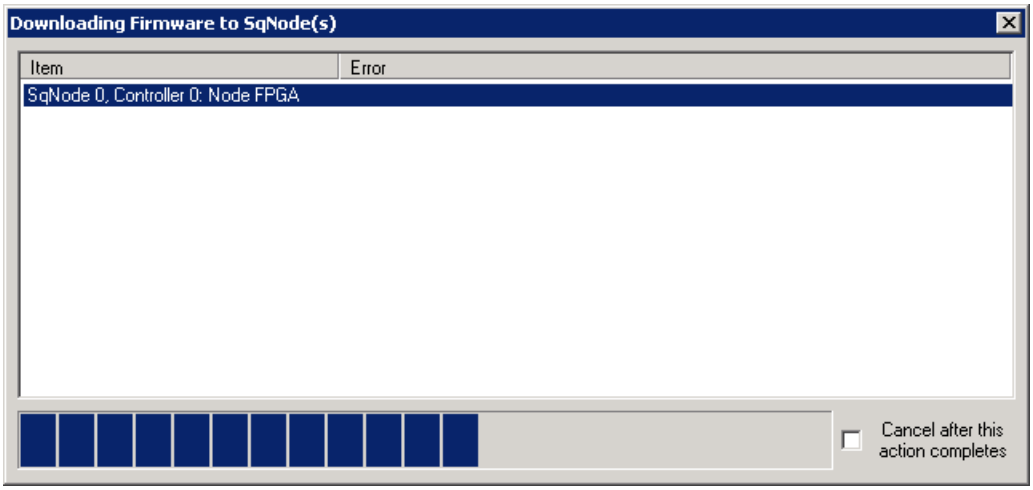

Find the appropriate FPGA file and select **Open**. In this example, we are downloading the **C0FE0029_0501.sff** file for an RMB-10V2.



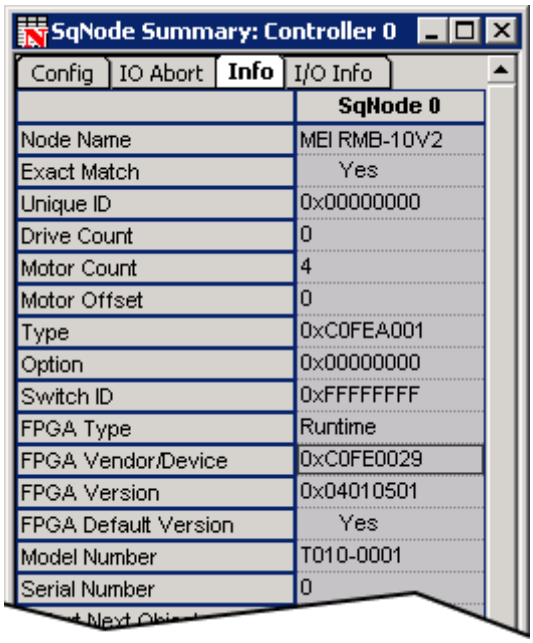

Once the appropriate FPGA file has been selected, click **download**.


Download Binary Image to SqNode(s)
Select file(s) to download to the following SynqNet node(s):
SqNode 0, Controller 0: C0FE0029_0501.sff
Channel
File
Node FPGA
C:\Program Files\MEI\MDK\04.02.00\node\C0FE0029_0501.sff
Clear Selected
Clear All
Browse...
Download
Verify
Close

The downloading Firmware to SqNodes window displays the status of the download.



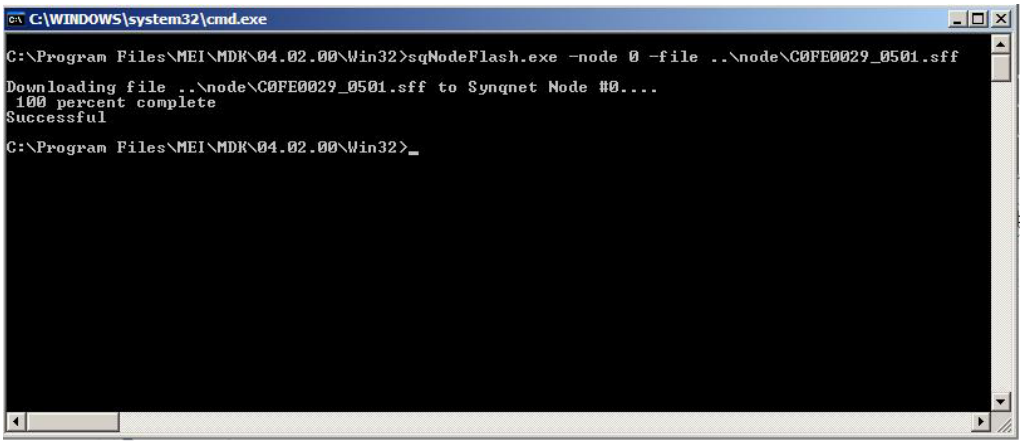

Refresh Motion Console by maximizing the screen. The following screen displays. Notice that the "FPGA Vendor/Device" now reflects the downloaded FPGA: **0xC0FE0029**.



### 5.5.2 Command Prompt Download

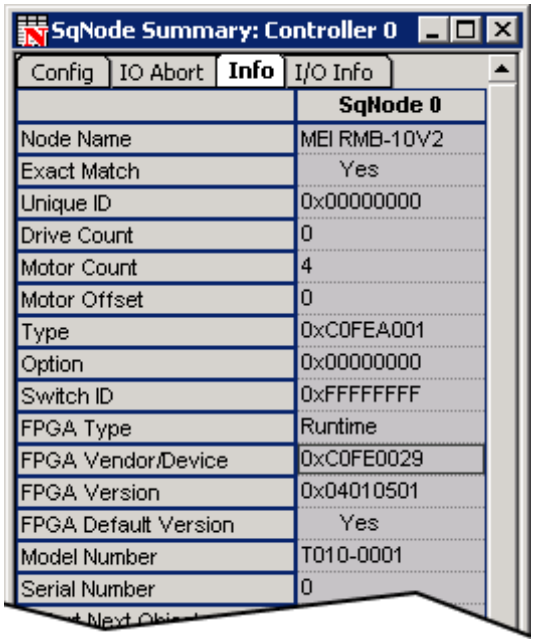
Open a Command Prompt window and proceed to the following directory to download the proper *.sff file:

C:\Program Files\MEI\MDK\04.02.00\win32\sqNodeFlash.exe -node 0 -file ..node**c0fe0029_0501.sff**




The selected FPGA file is downloaded after all of the pages have been counted.

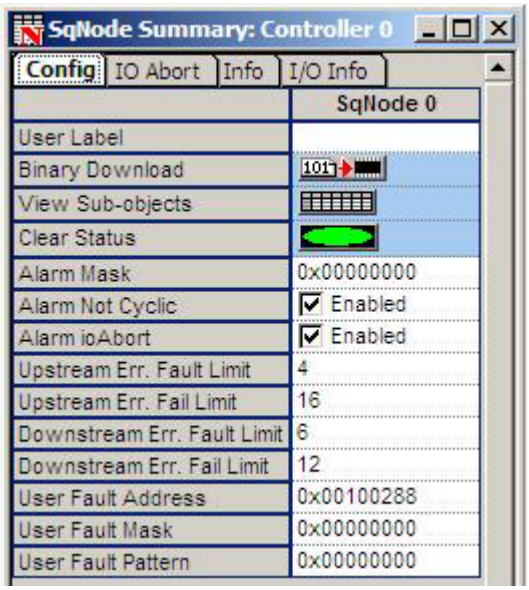
Refresh Motion Console by maximizing the screen. The following screen displays. Notice that the "FPGA Vendor/Device" now reflects the downloaded FPGA: **0xC0FE0029**.



## 5.6 Check Node Configuration

After the proper drive firmware is downloaded, click on the button to open the SqNode Summary window and verify that the proper number of drives were found.

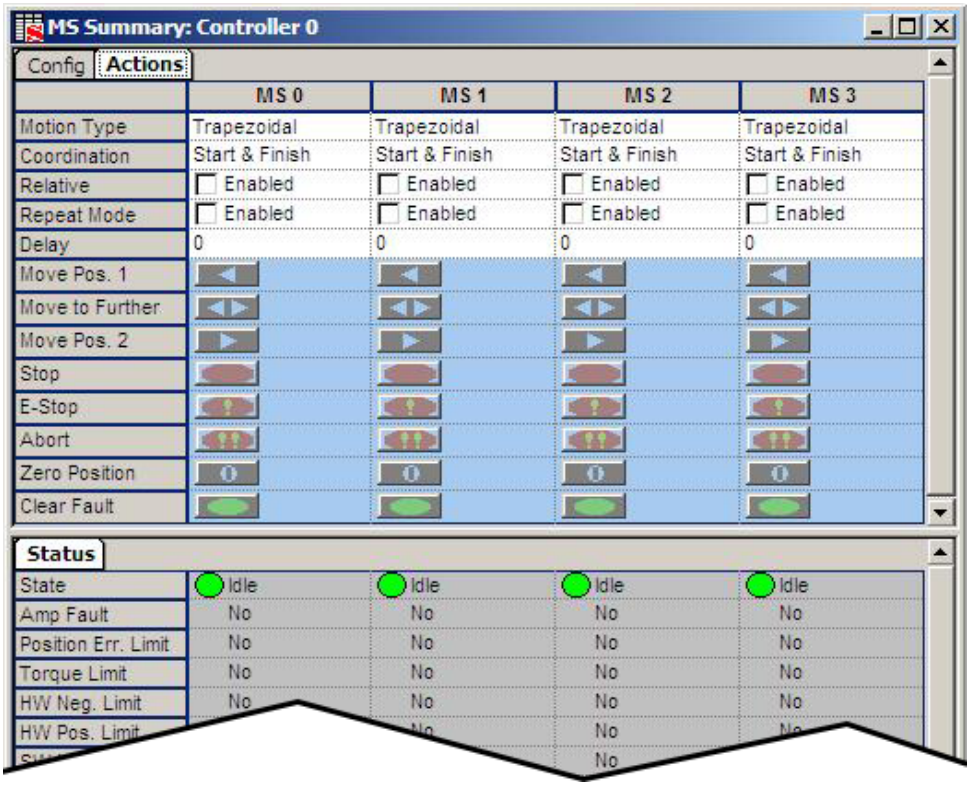
This window provides the node configuration for each drive installed on the system. SynqNet finds the drives in the order that they are connected. The hardware setup used for this example had one drive.



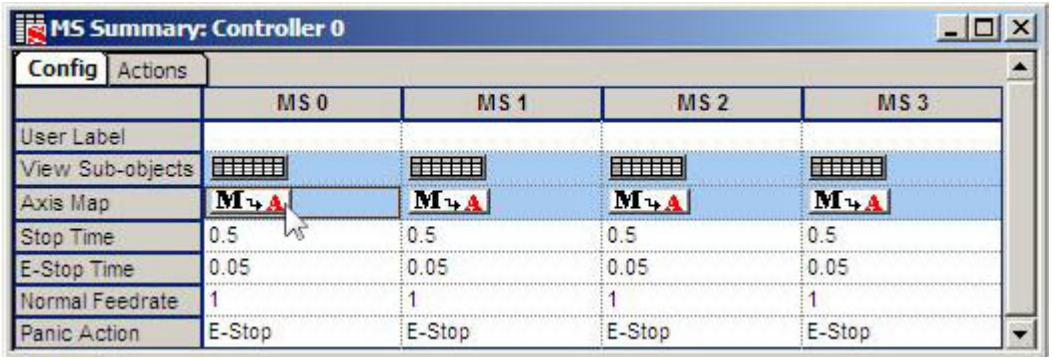
## 5.7 Map the Axes

Click on the button to open the Motion Supervisor window and click the **Actions** tab.

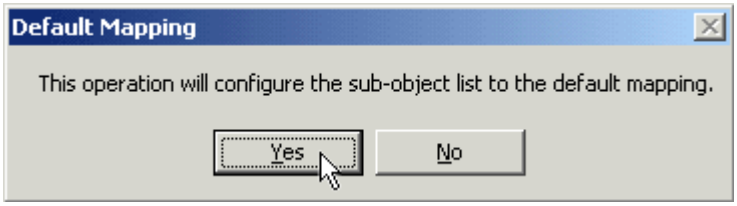
Before controlling and moving a motor, it must first be mapped to a Motion Supervisor. If the buttons are faded out under the Actions tab (displayed below), it means that no axes have been mapped (assigned) to a Motion Supervisor.



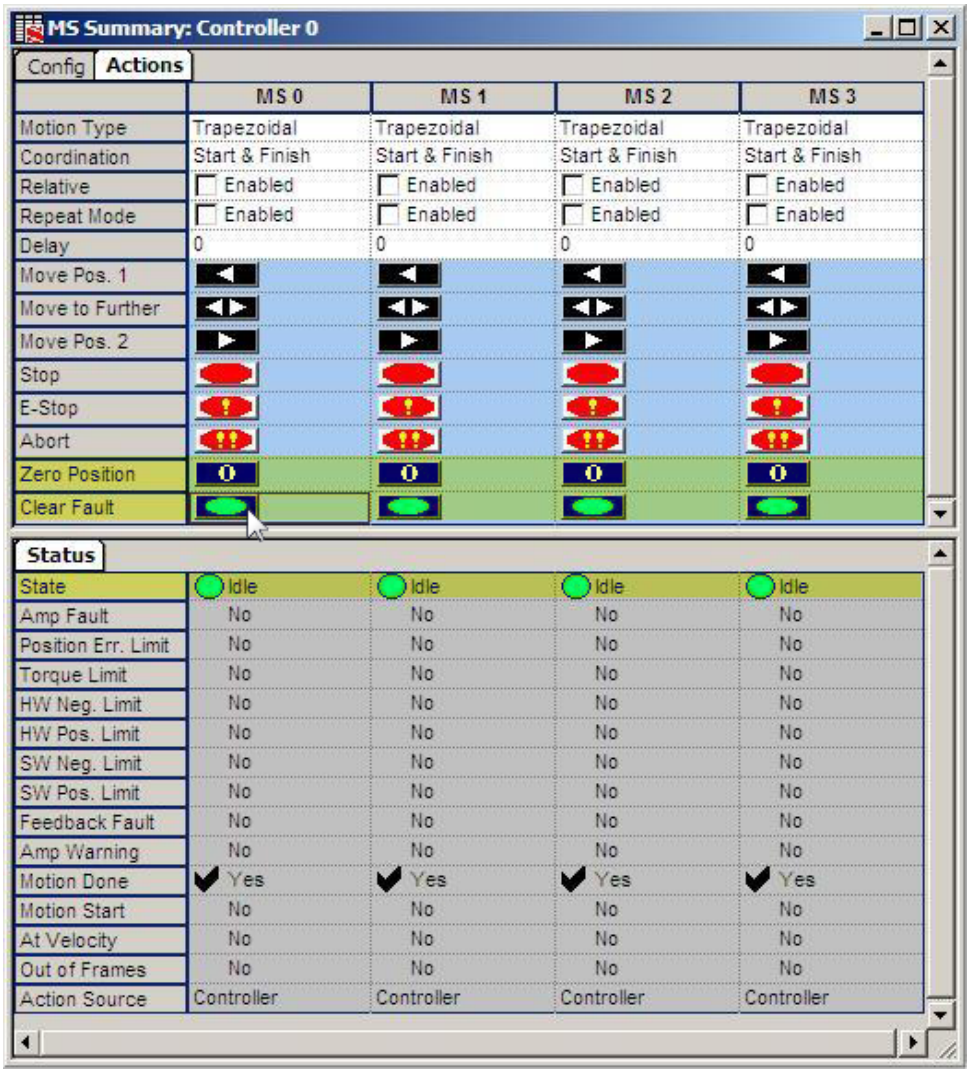

To use the default mapping of axes (map Axis 0 to Motion Supervisor ) click on the **Config** tab and **Shift** + **Left-Click** on the **Axis Map** button. This will automatically map Axis 0 to Motion Supervisor 0.



Click **Yes** to configure the default mapping.




Under the **Actions** tab, click the **Zero Position** button to reset the position so that the current position is zero. Then click the **Clear Fault** button. A motor cannot move if there are any errors that have not been cleared out. Be sure that the State under the Status tab displays **Idle**.

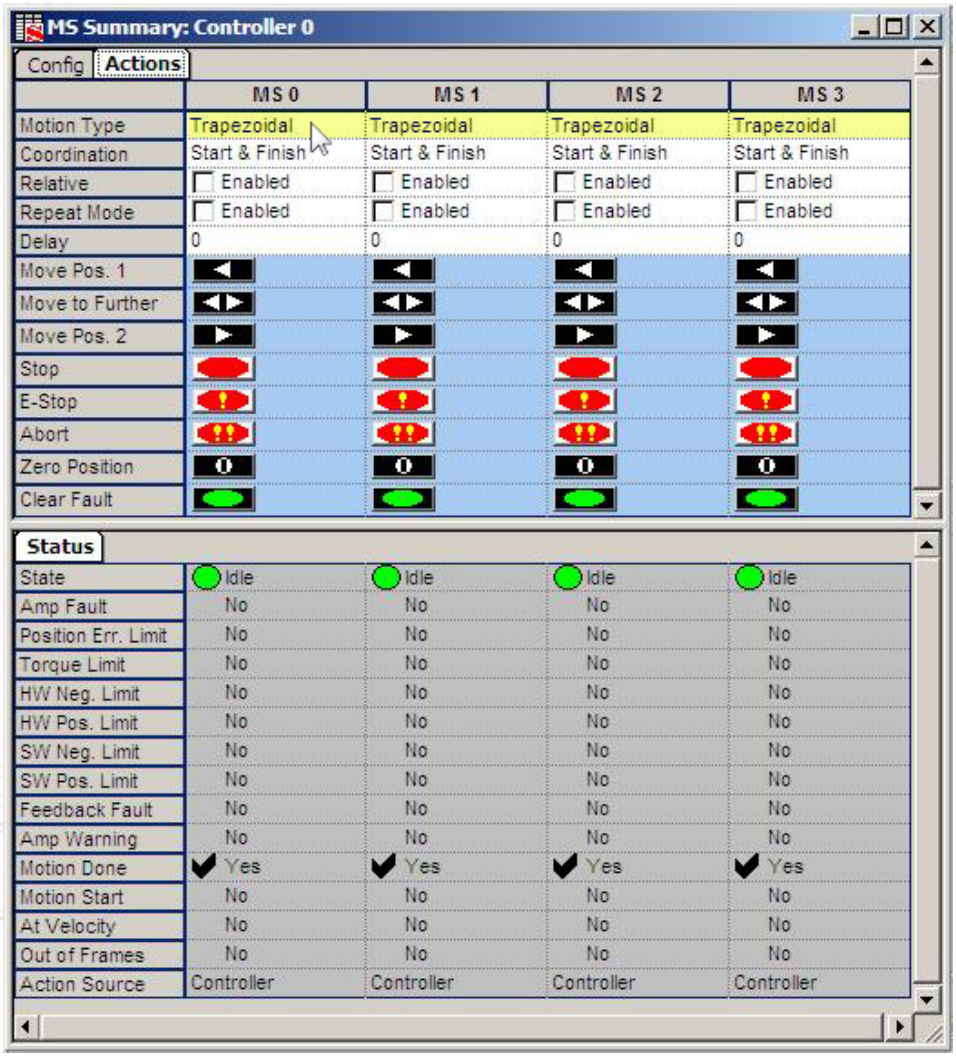


## 5.8 Tune the Servo Control Loop

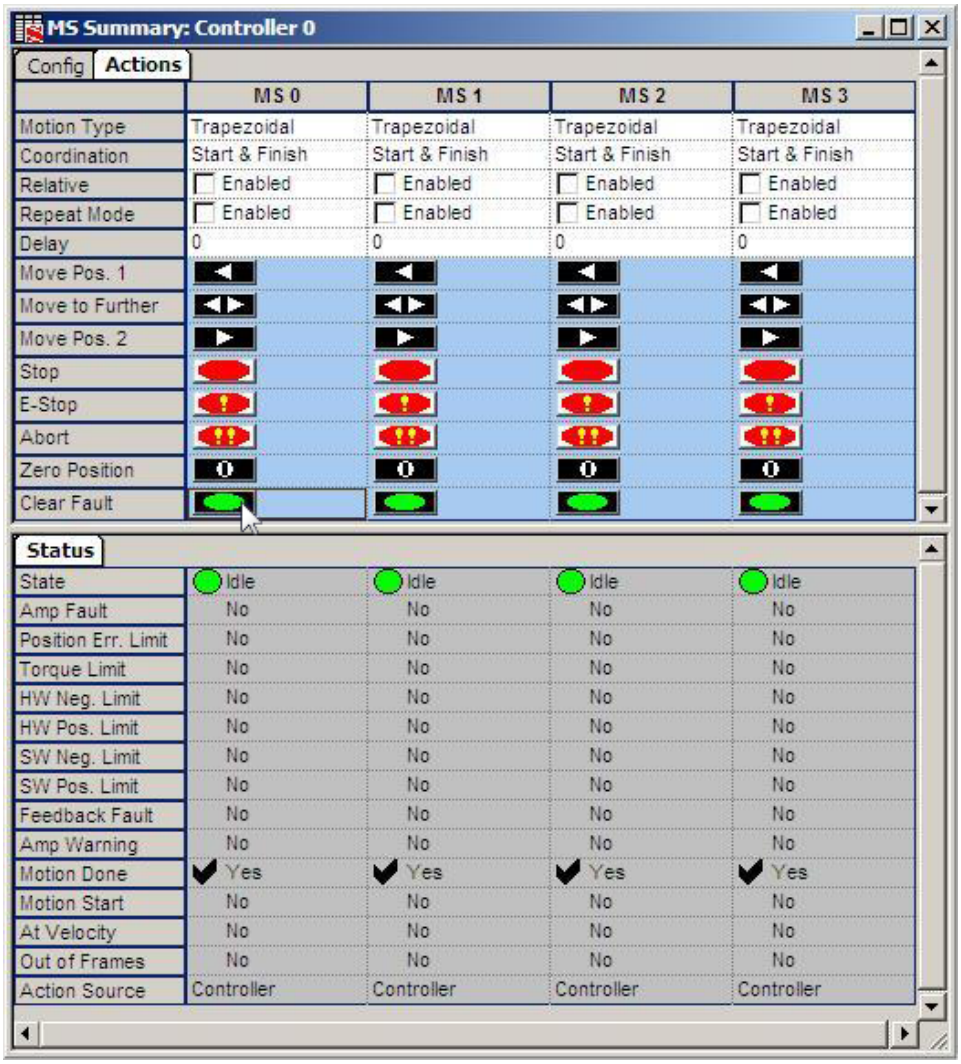
After verifying the hardware setup of the SynqNet Network using the various Motion Console summary windows, now tune the servo control loop in order to make a move.

Click on the button to open the Motion Supervisor Summary window.

Verify that the Motion Type is set to **Trapezoidal** under the Actions tab.

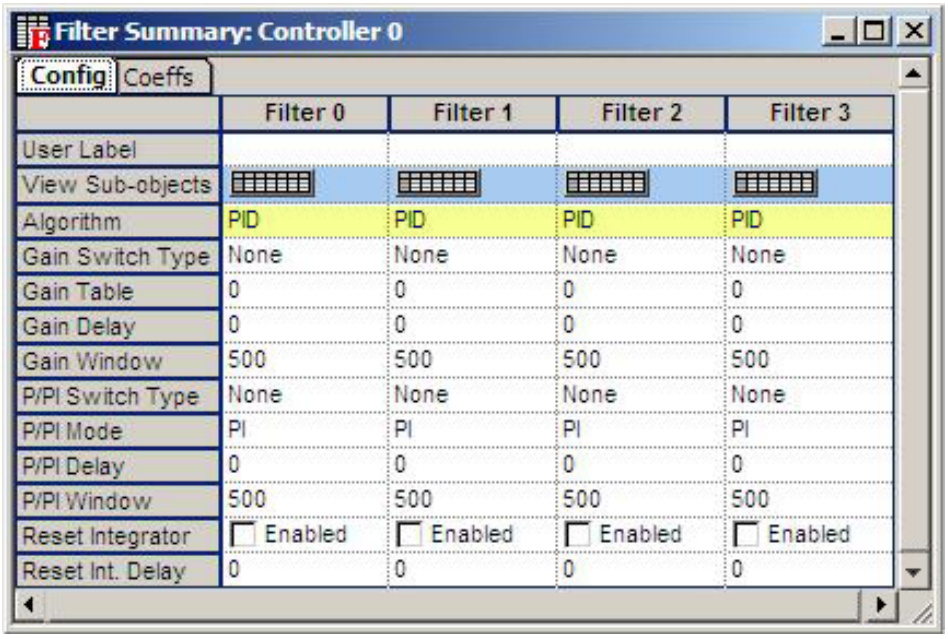


Click the **Clear Fault** button to dismiss any errors.

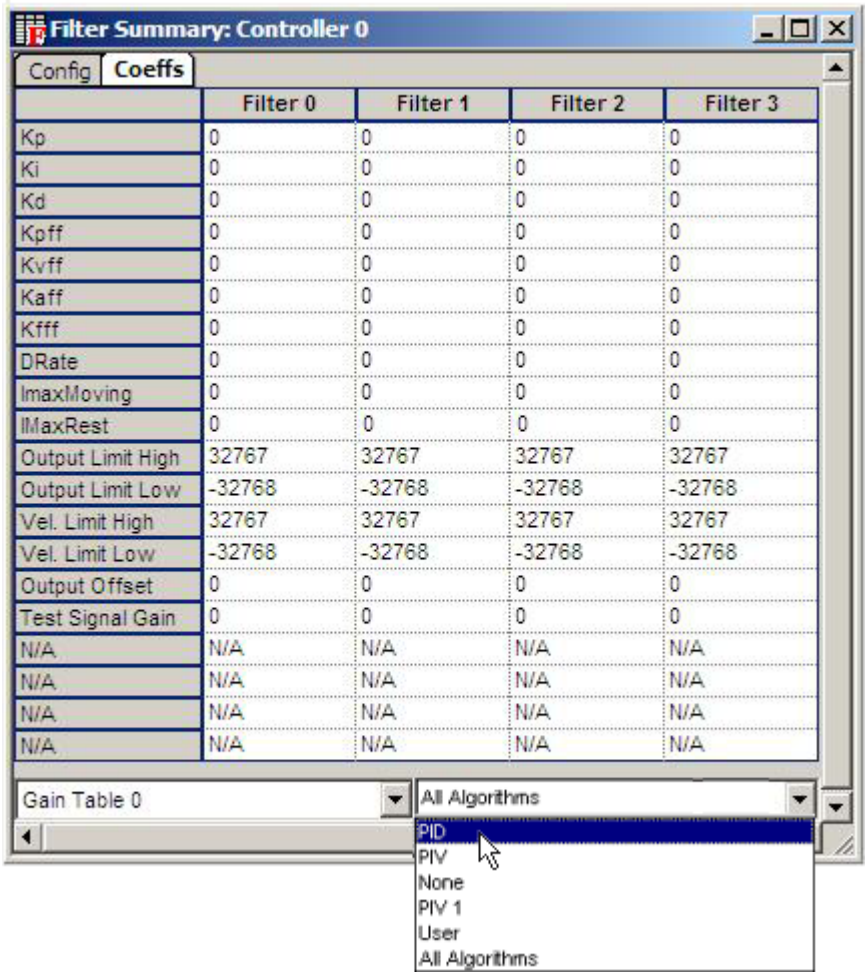


Click on the button to open the Filter Summary window.

Verify that the Algorithm is set to **PID** under the Config tab.



Go to the **Coeffs** tab and select **PID** from the Algorithm drop-down menu.

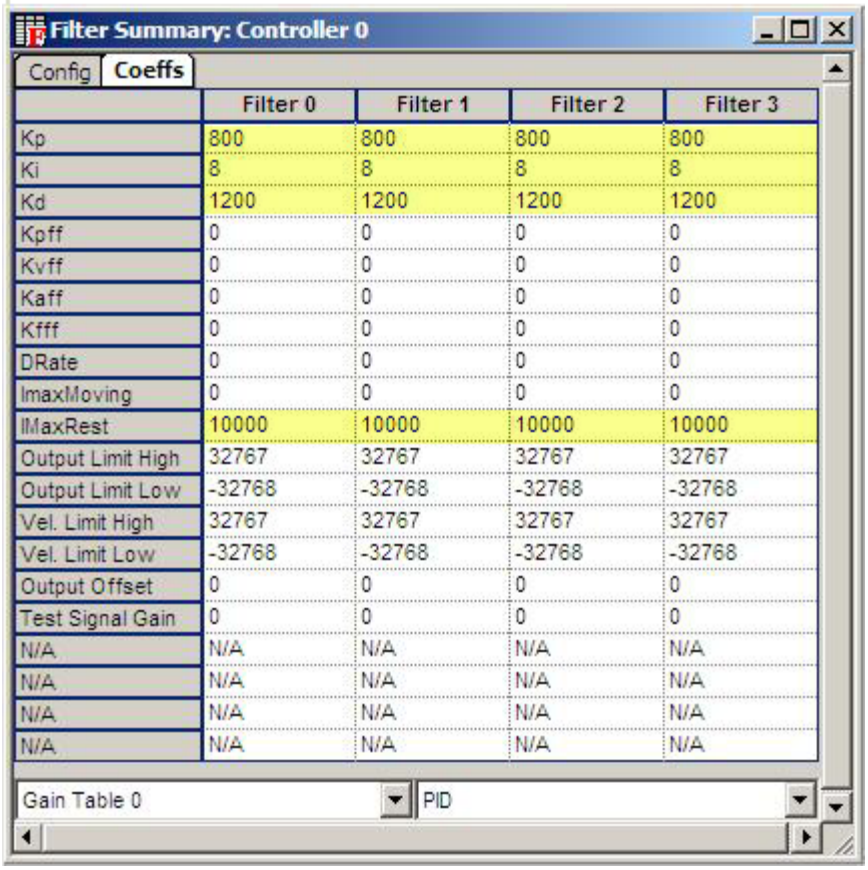


***WARNING!*** Before making any changes, determine what tuning parameters are safe to use. Otherwise, the motors could be damaged.

For our example we will use the following parameters:

***WARNING!*** **Example Parameters Only (Not to be used for every system)**

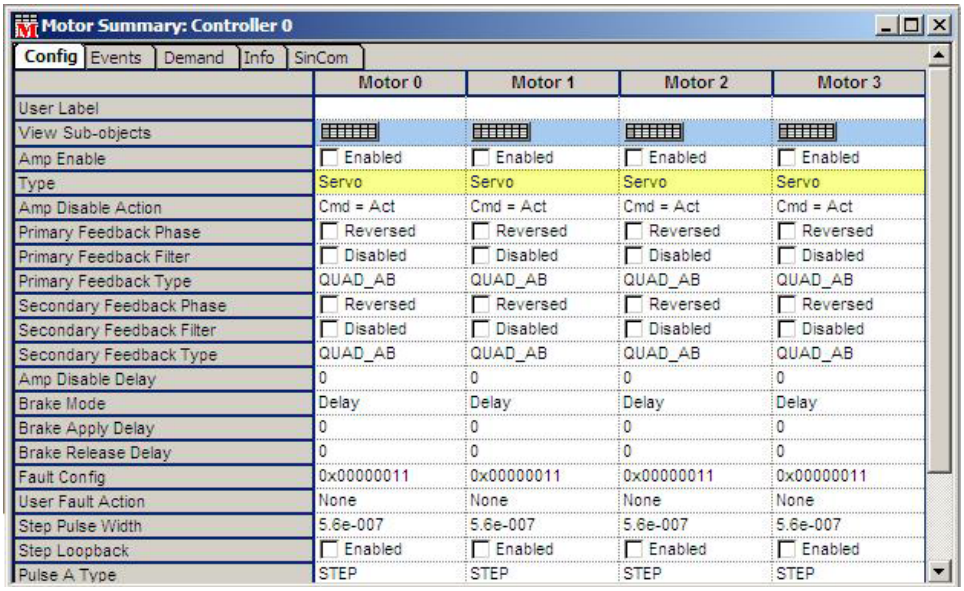
- 800 for Proportional Gain (Kp)
- 8 for Integral Gain (Ki)
- 1,200 for Derivative Gain (Kd)
- 10,000 for Integrator Maximum at Rest (IMaxRest)



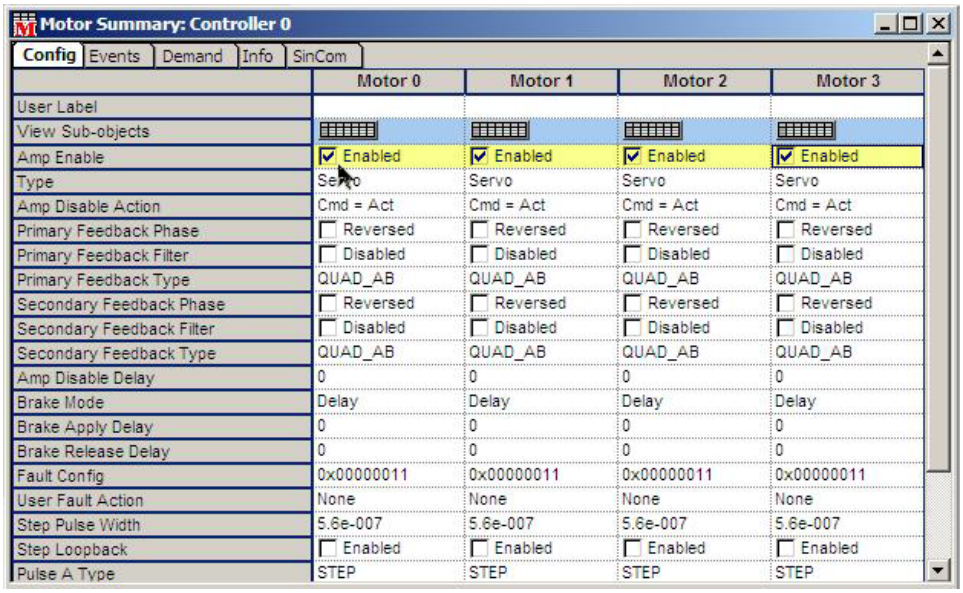

| | Filter 0 | Filter 1 | Filter 2 | Filter 3 |
|---|---|---|---|---|
| Kp | 800 | 800 | 800 | 800 |
| Ki | 8 | 8 | 8 | 8 |
| Kd | 1200 | 1200 | 1200 | 1200 |
| Kpff | 0 | 0 | 0 | 0 |
| Kvff | 0 | 0 | 0 | 0 |
| Kaff | 0 | 0 | 0 | 0 |
| Kfff | 0 | 0 | 0 | 0 |
| DRate | 0 | 0 | 0 | 0 |
| ImaxMoving | 0 | 0 | 0 | 0 |
| IMaxRest | 10000 | 10000 | 10000 | 10000 |
| Output Limit High | 32767 | 32767 | 32767 | 32767 |
| Output Limit Low | -32768 | -32768 | -32768 | -32768 |
| Vel. Limit High | 32767 | 32767 | 32767 | 32767 |
| Vel. Limit Low | -32768 | -32768 | -32768 | -32768 |
| Output Offset | 0 | 0 | 0 | 0 |
| Test Signal Gain | 0 | 0 | 0 | 0 |
| N/A | N/A | N/A | N/A | N/A |
| N/A | N/A | N/A | N/A | N/A |
| N/A | N/A | N/A | N/A | N/A |
| N/A | N/A | N/A | N/A | N/A |

Click on the button to open the Motor Summary window.

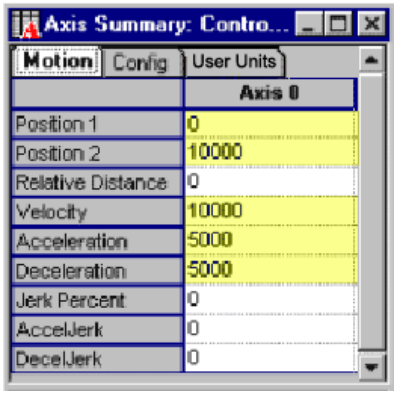
Verify that the motor Type is set to **Servo** under the Config tab.




Set the Amp Enable checkbox to Enabled.



Click on the button to open the Axis Summary window.



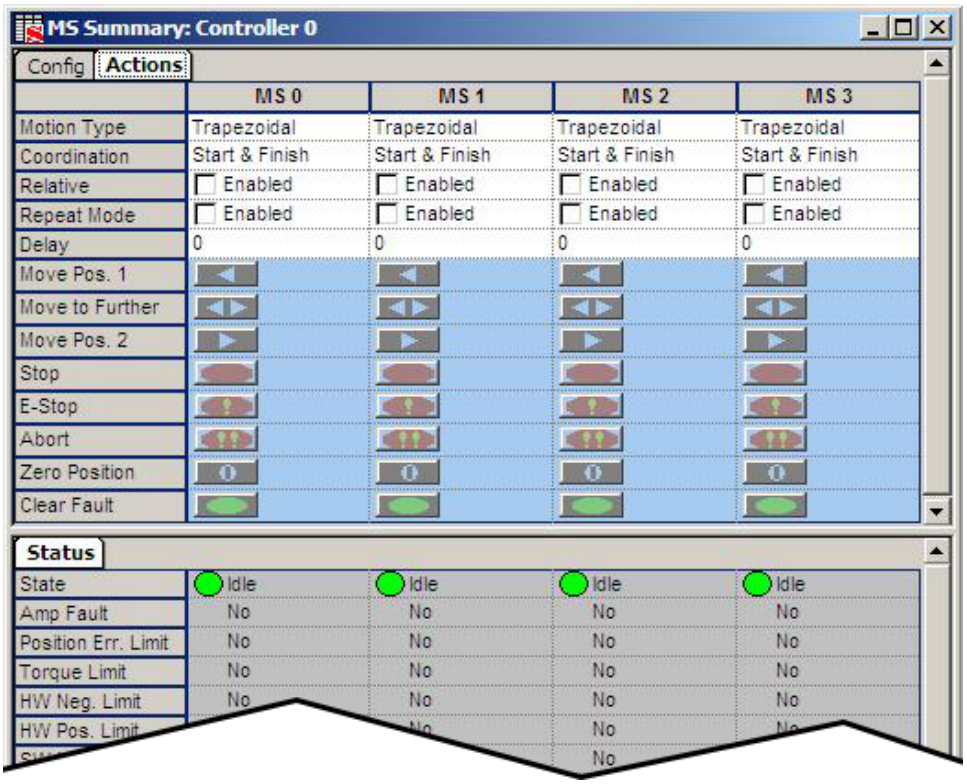

Under the Motion tab, enter the following parameters:

- 10000 for Position 2
- 0 for Position 1
- 10000 for Velocity
- 5000 for Acceleration
- 5000 for Deceleration

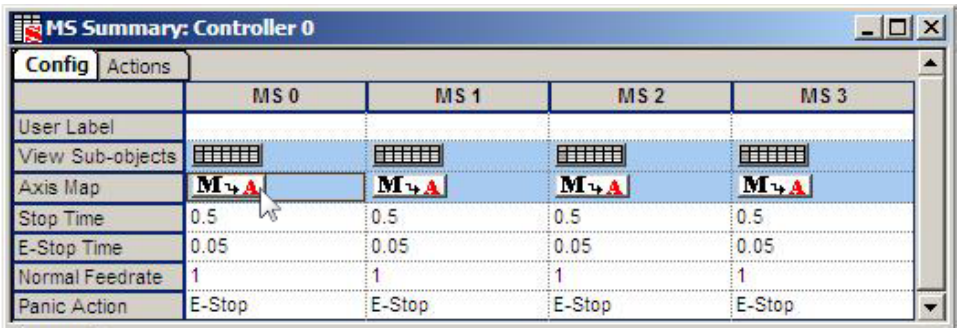
## 5.9 Move a Motor

The final step is to execute a basic move on the motor.

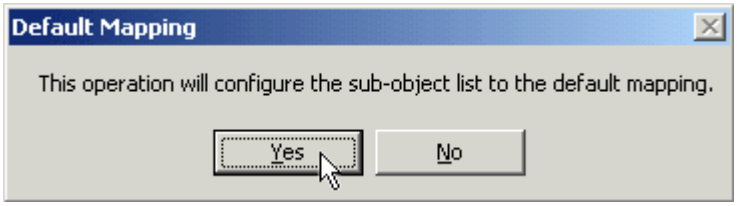
Click on the button to open the Motion Supervisor window and click the **Actions** tab. If the buttons are faded out (displayed below), first map the Axes.



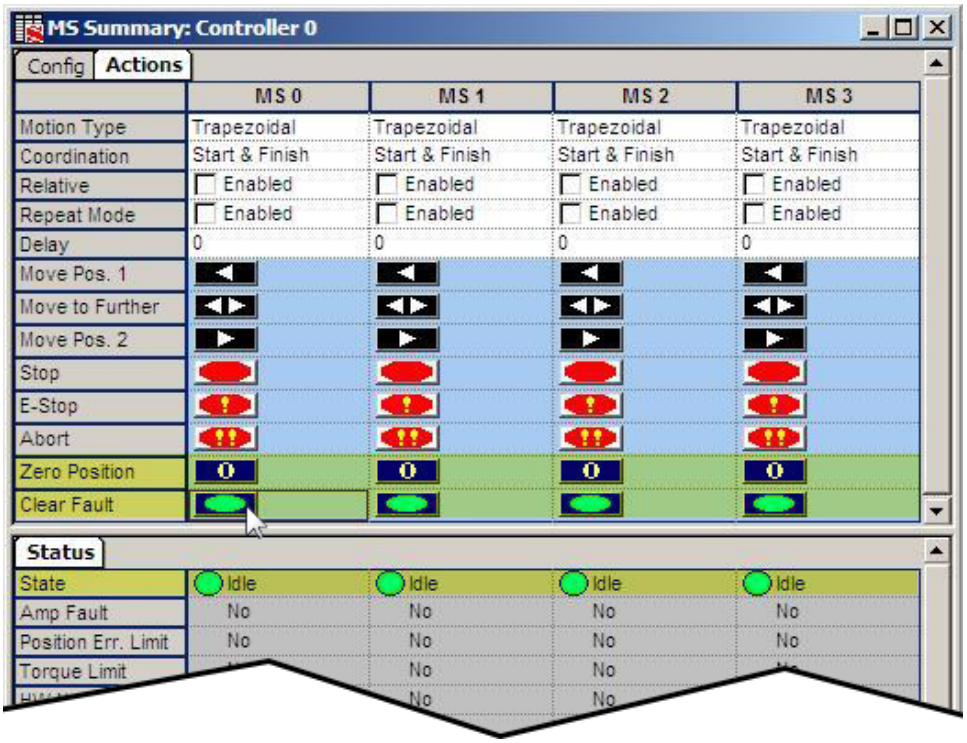
Click on the **Config** tab and **Shift** + **Lt-Click** on the **Axis Map** button.




Click **Yes**, to configure the default mapping.




Under the Actions tab, click the **Zero Position** button and click the **Clear Fault** button. Be sure the State under the General Status tab displays **Idle**.



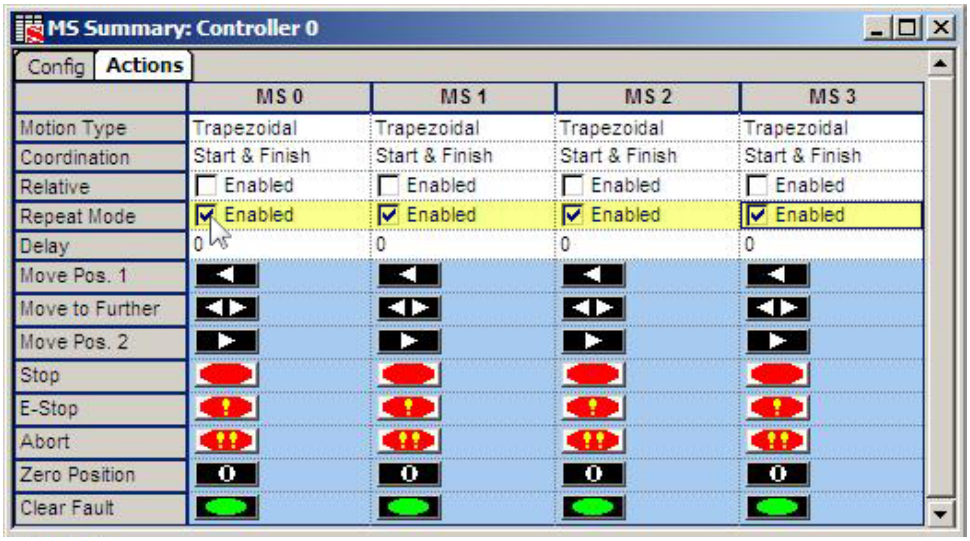
Click on the Move Pos. 2 button

, and the command will be executed on the motor (Axis 0) and move 10000 counts to Position 2.

Click on the Move Pos. 1 button

, and the motor will move 10000 counts back to Position 1.

To continuously move back and forth from Position 1 to Position 2, check the Enabled check box.




Click the Move Pos. 2 button

, and the motor will move back and forth from Position 2 to Position 1.

Motion Console has successfully moved a motor using SynqNet.

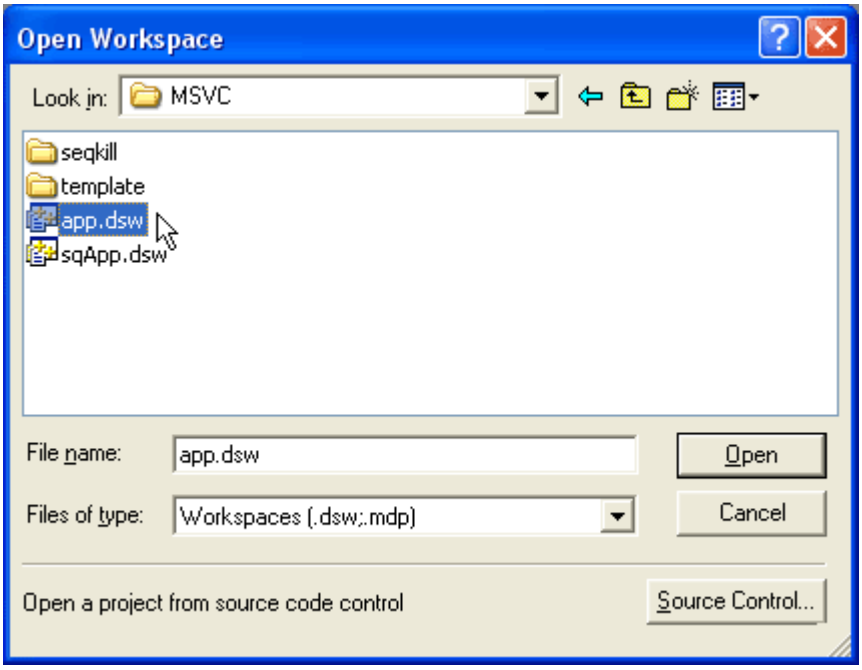
# 6 MICROSOFT VISUAL C/C++

This section is an overview of running an executable C-program using Microsoft Visual C/C++. If MS VIsual C/C++ is not being used, this section does not apply. Even though the QMP can be controlled by a C-program written on many different platforms, this section only covers MS Visual C/C++.

1. Open Visual C/C++ Version 6 or higher.

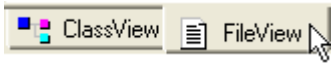
2. Go to **File > Open Workspace**. Browse for **app.dsw**.

   Default location: C:\MEI\QMP\APP\WinNT\MSVC.



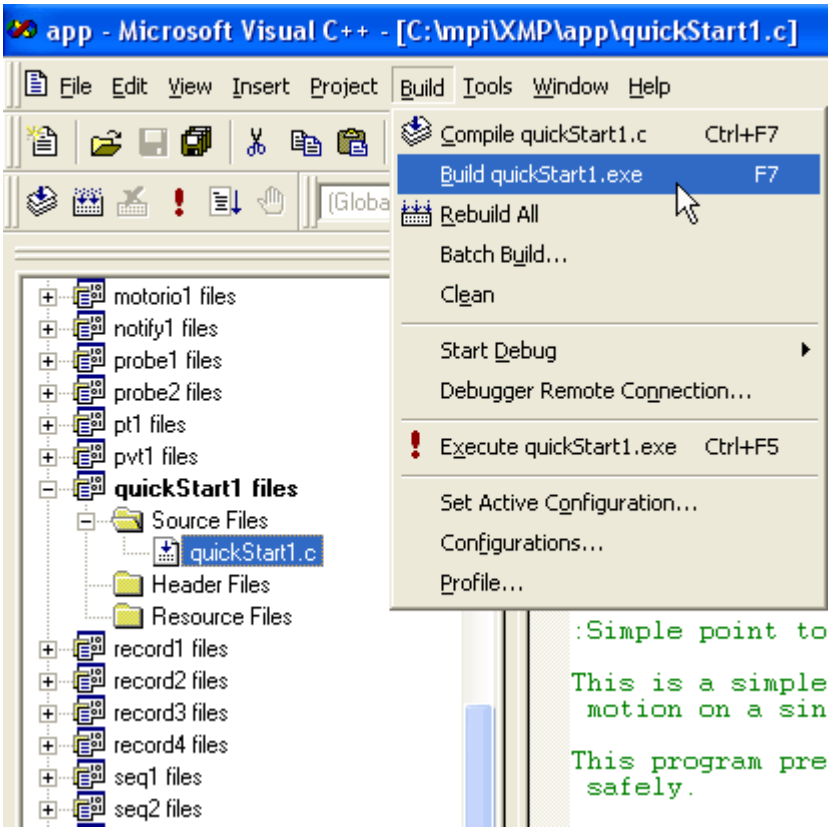

3. The file type should be set to display Makefile [.mak] and upon doing so, the app.mak file displays. Open **app.dsw**. If asked whether the project should be converted to the current version of Visual C/C++ being run, click **Yes**.

4. Change to File View and select **quickStart1** files.



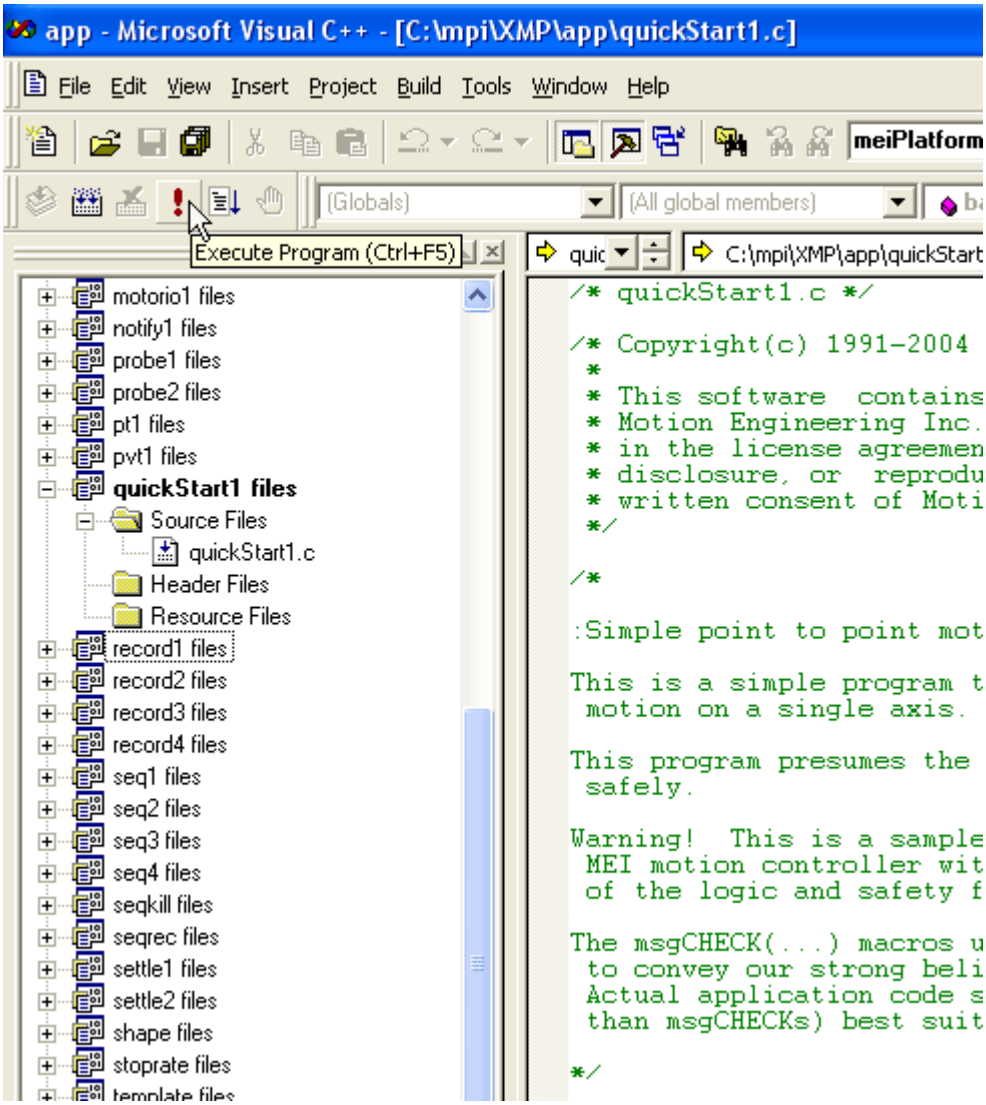

5. Right click on the **quickStart1** files and "Set as Active Project."
   (This should set the **quickStart1** files in bold.)

6. Click on **quickStart1.c** in the "Source Files" sub directory. Go to the **Build** menu and select **Build quickStart1.exe**.




7. Verify that there are no errors or warnings in the dialog box.

8. Click the execute button and the program will now be carried out. Motion can be stopped at any time by hitting any key.




9. Open Motion Scope and view certain parameters by selecting the **Trace** button and add additional parameters to graph.

**About Kollmorgen**

Kollmorgen is a leading provider of motion systems and components for machine builders. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions that are unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

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