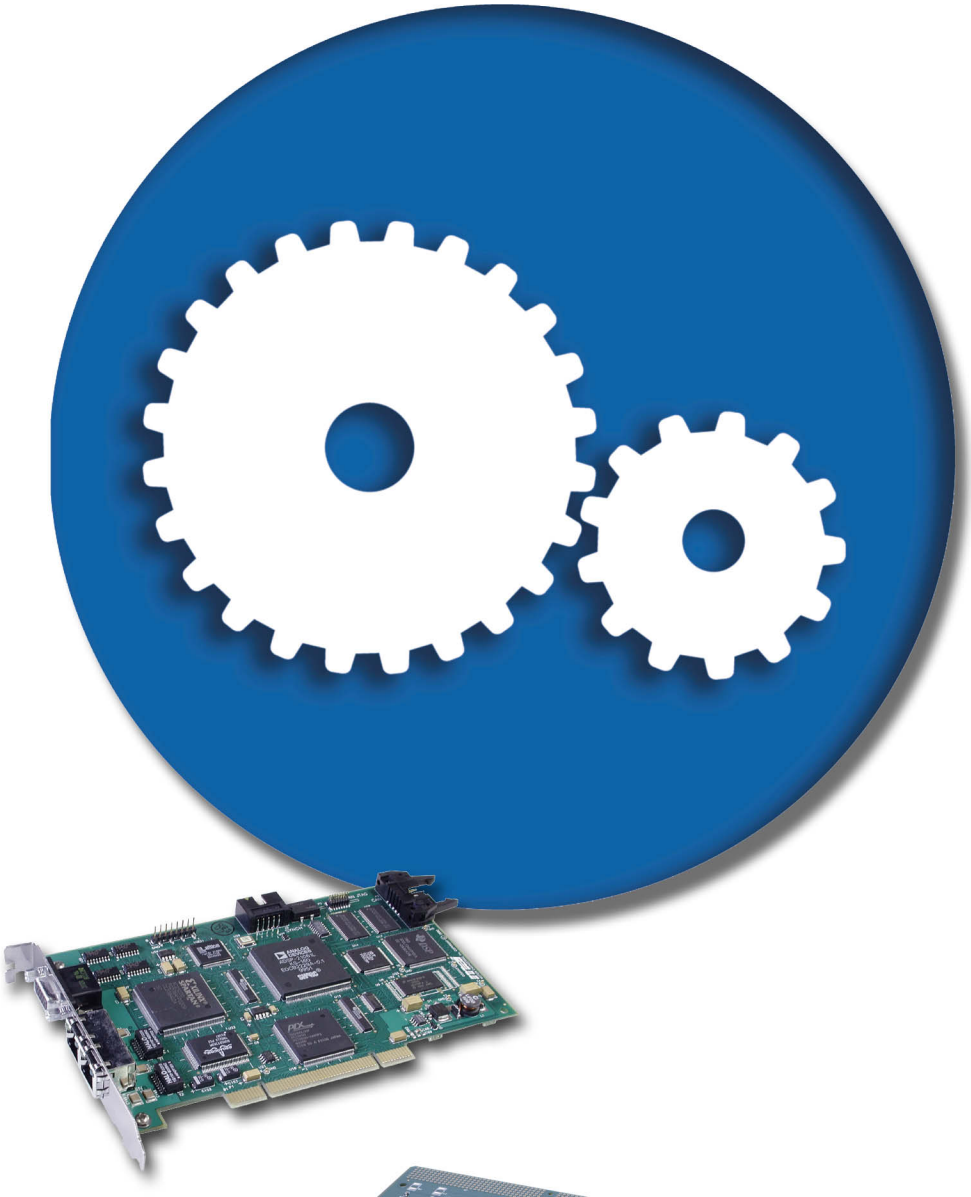
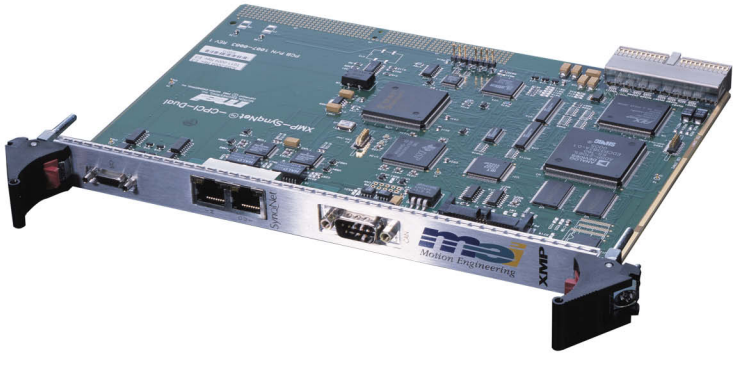
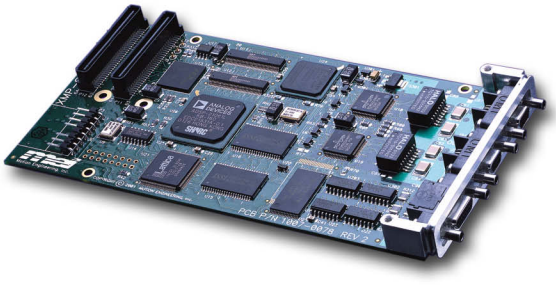
XMP-SynqNet Hardware

Quick Start Guide







Motion Engineering

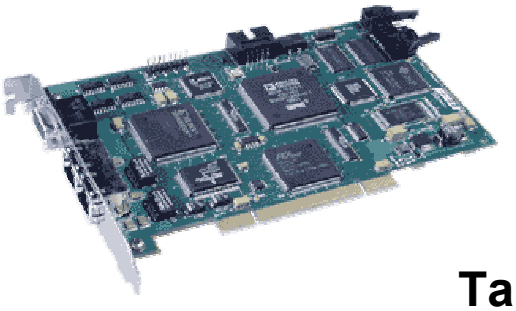
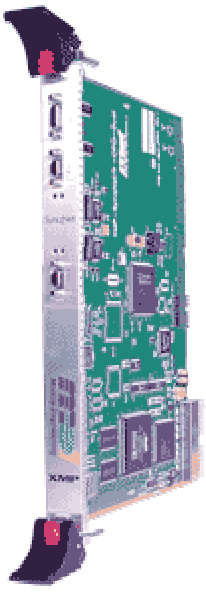


Table of Contents



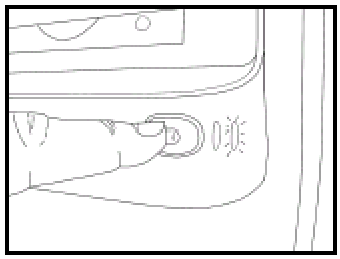
Safety Warnings

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.)

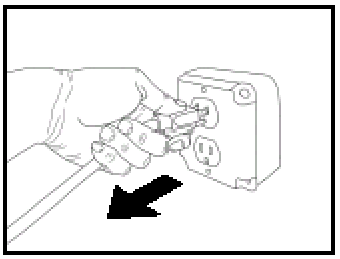
Standard safety rules prevail during installation of any hardware. Some are summarized below for the XMP. For more information, refer to local occupational safety regulations and the manufacturer of your motion drive.

Turn Off All Power Before Installing Equipment

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



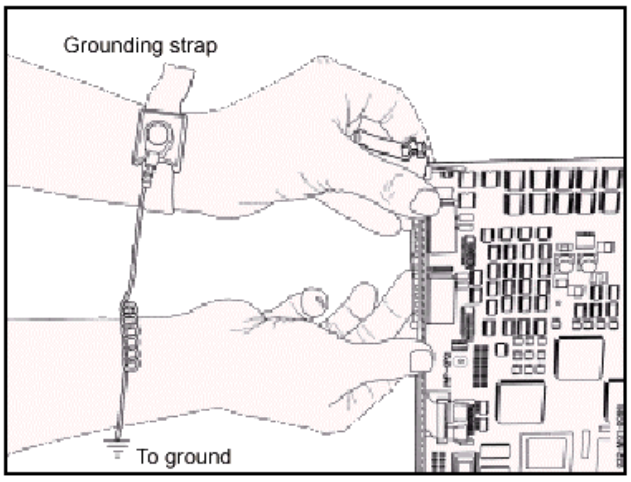
Switch OFF equipment.



Unplug from source of power.

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.



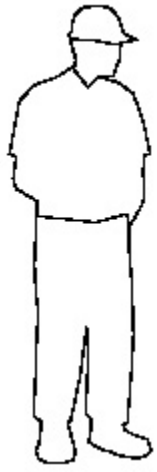
Grounding straps should be worn at all times when handling XMP-SynqNetTM electrical components and connection hardware.

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!

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.



Install the MDK (software)

The MDK (software) can be accessed from MEI's ftp site (ftp://ftp.motioneng.com) or from the MDK InstallShield CD-ROM. By default, all of the files are copied to the following directory: C:\MEI. The InstallShield will install the following features and libraries:

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

Installation Steps

Step 1

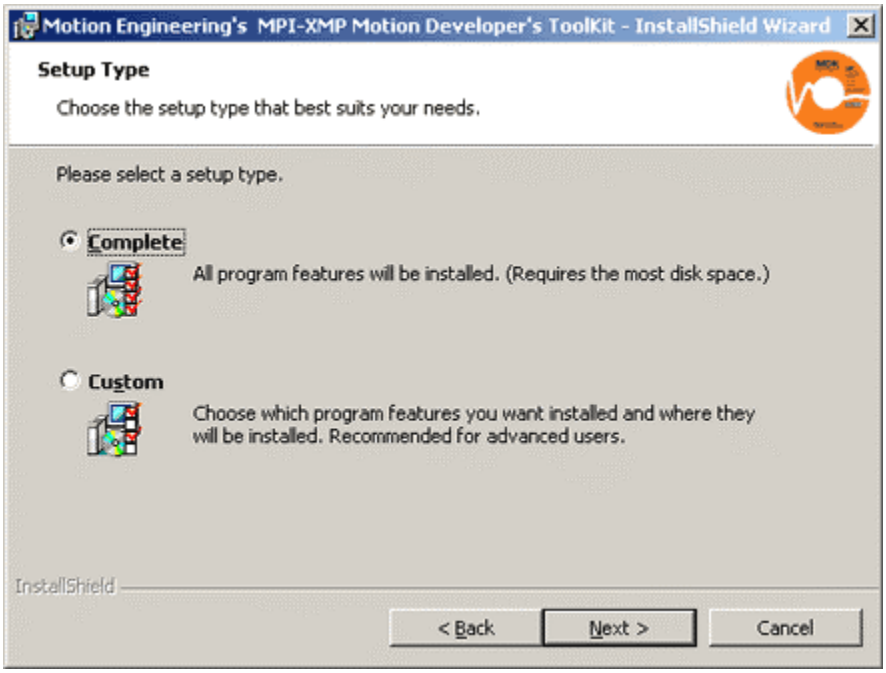
Click on the **<version#>_WinNTSetup.exe** file.

Step 2

The InstallShield Wizard for Motion Engineering's MPI-XMP Motion Developer's Toolkit should appear. Click **Next**.

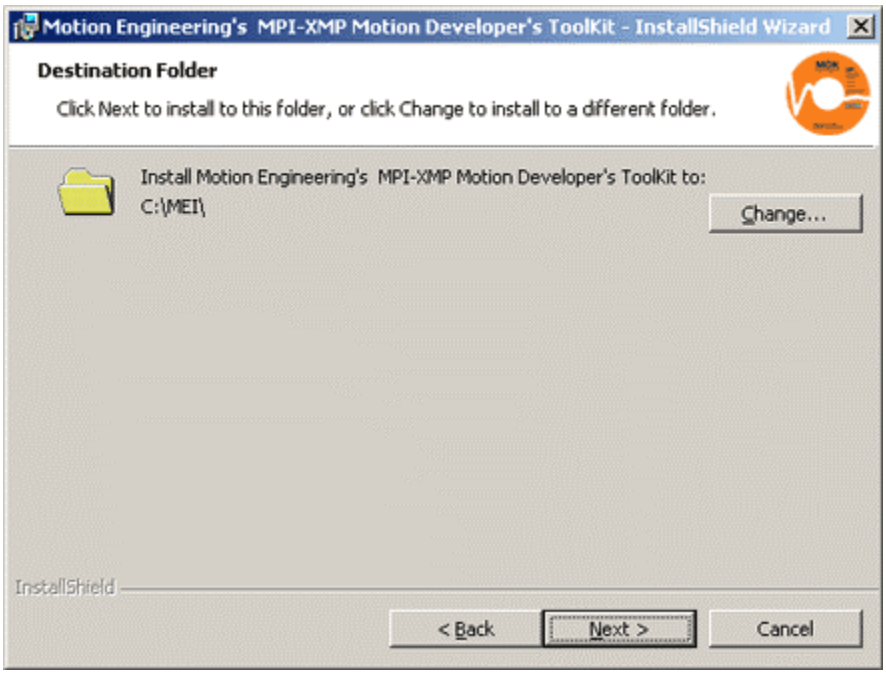
Step 3

If you are installing the MDK for the first time, select "Complete" and click **Next**.



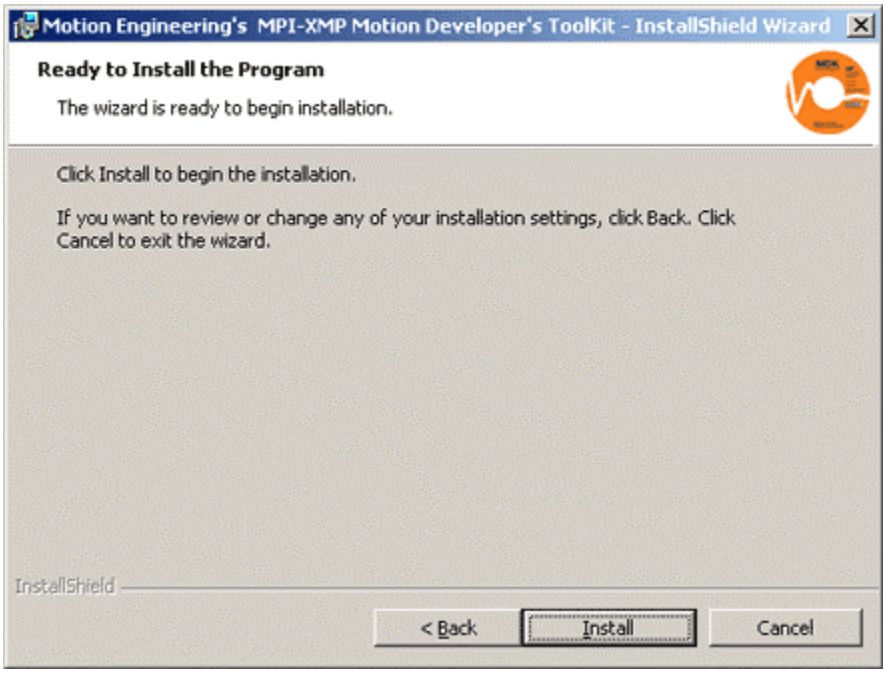
Step 4

The default directory for the installation of all files and settings is **C:/MEI**. If you wish to change the directory, click the **Change** button and select the desired directory. Click **Next**.



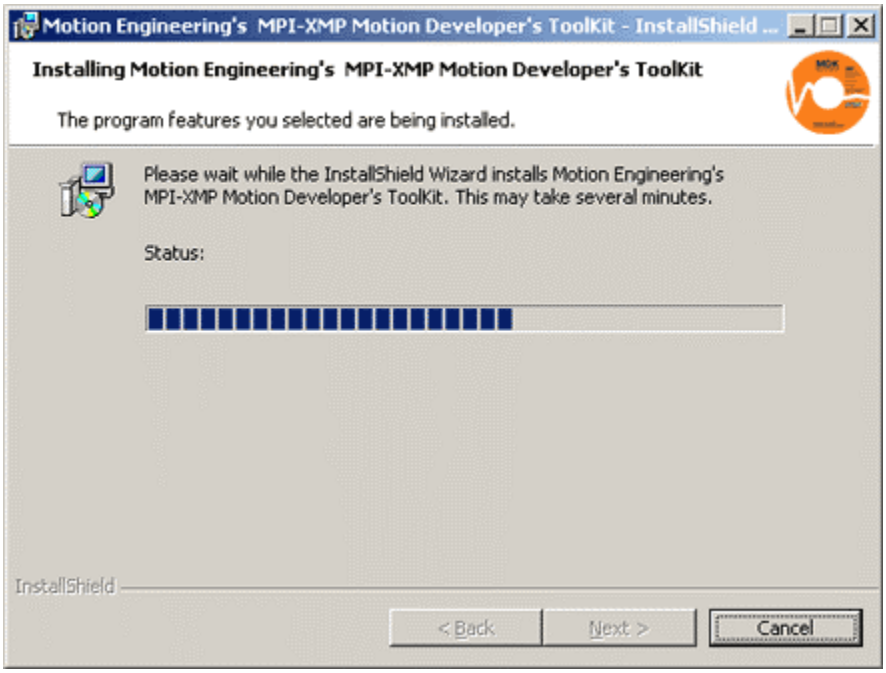
Step 5

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

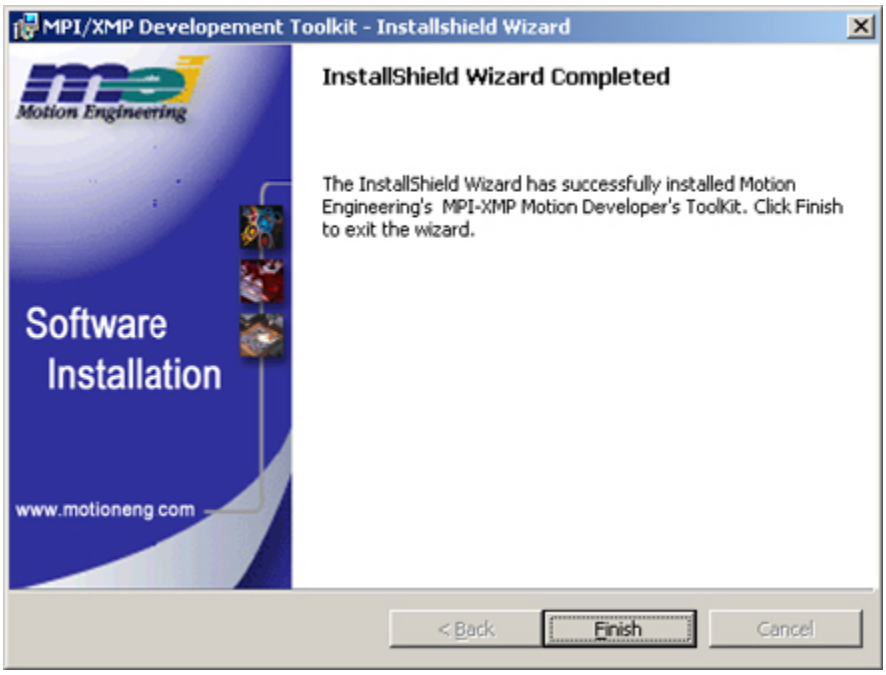


Step 6

A series of windows will appear showing the progress of the installation.

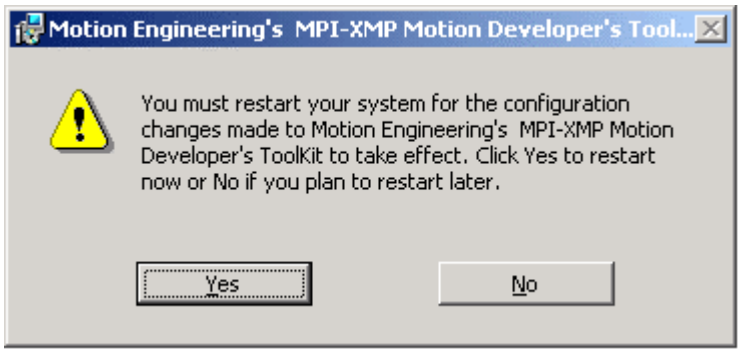


The following confirmation window will appear if the installation was successful. Click Finish to exit the InstallShield.



Step 7

After you click the Finish button, you will be prompted to Reboot your system. You can either reboot now or later.

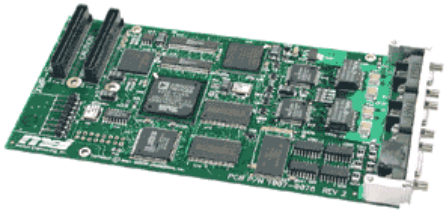


Install Controller

Select the type of controller you are installing.

CPCI pg 10

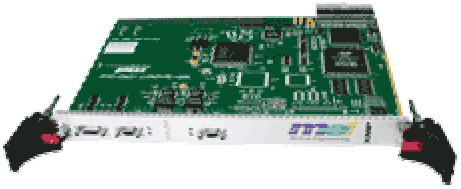
PCI pg 13



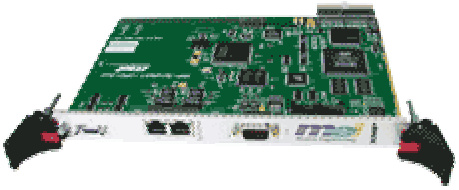
PMC pg 15

CPCI

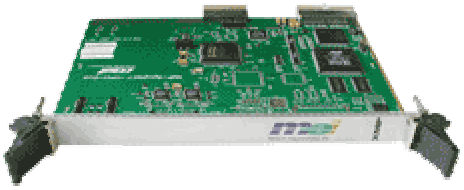
Compact PCI (CPCI) utilizes a card-type computer chassis, having a multi-pin backplane. The main advantage is smaller sizing and simplified access to electronics. There are two sizes of the CPCI: -6U and -3U. (CPCI-3U controllers are still pending from MEI.) The CPCI-6U is the larger of the two form factors and connects to the backplane bus via the jumper connector at J1. The installation of the CPCI-6U is described below.
There are currently three types of XMP-SynqNet-CPCI controllers:



XMP-SynqNet-CPCI-uD
PN: T011-0003



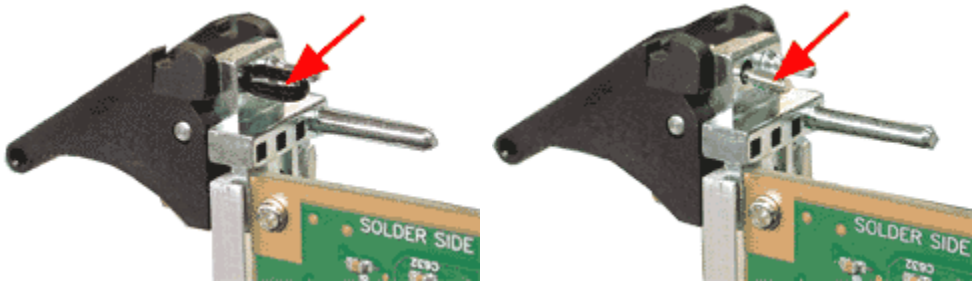
XMP-SynqNet-CPCI-RJ-CAN
PN: T011-0004



XMP-SynqNet-CPCI-Rear I/O
PN: T011-0005

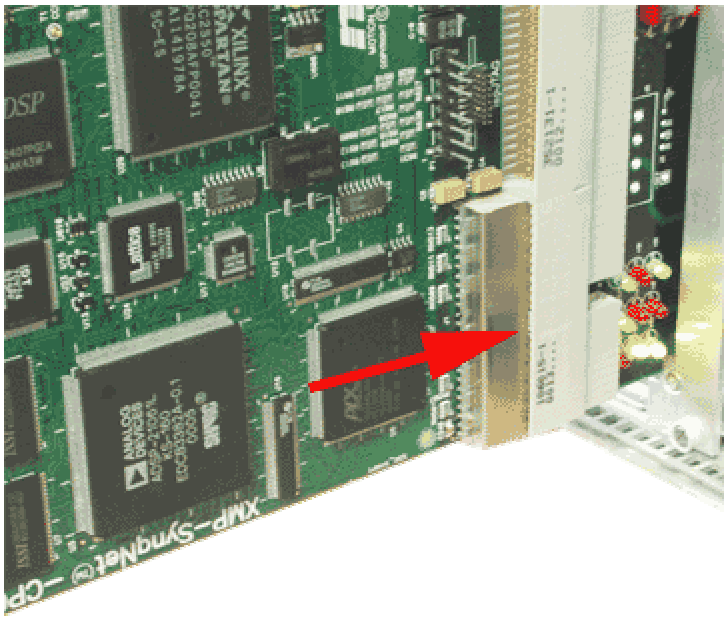
Remove Black Caps

Each board has two screws which have been covered with black caps in order to ensure that the screw was not lost during shipment. Remove the black caps on the screws.

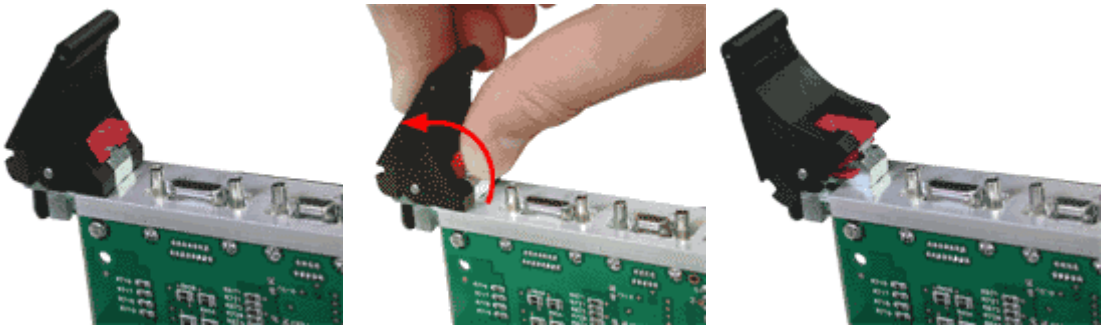


Install PCB into the host machine

Push the backplane bus connector at J1 into the mating connector on the host machine.

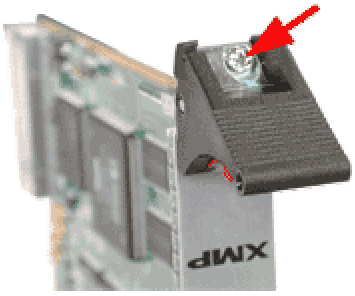


Use the locks on both ends of the bracket to fully secure the board to the host machine. Align the bracket with the machine's frame and push the connector inwards until it snaps in place. To unlock the connector, press the red lever and push out.



Locked Position To unlock connector Unlocked Position

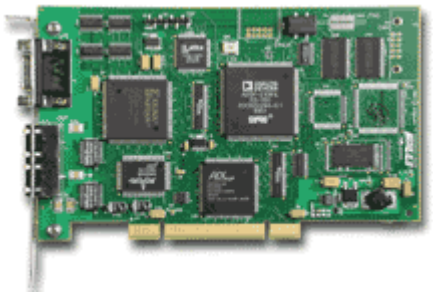
For added security, use a Philips screwdriver and fasten the outer screw on each connector to the system's frame.



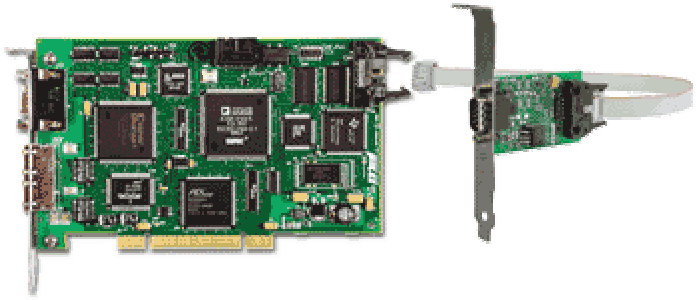
Here is a photo of a properly installed XMP-CPCI controller.

PCI

The standard XMP-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 connectors on the rear panel.
There are currently two types of XMP-SynqNet-PCI controllers:



XMP-SynqNet-PCI-RJ
PN: T014-0002
UL Certification: File# E254128

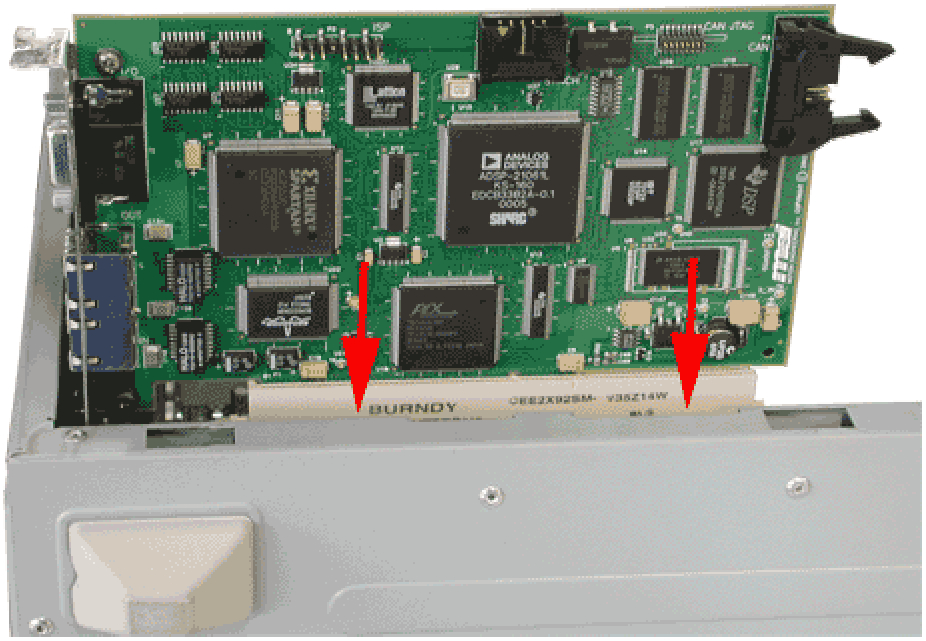


XMP-SynqNet-PCI-RJ-CAN
PN: T014-0001

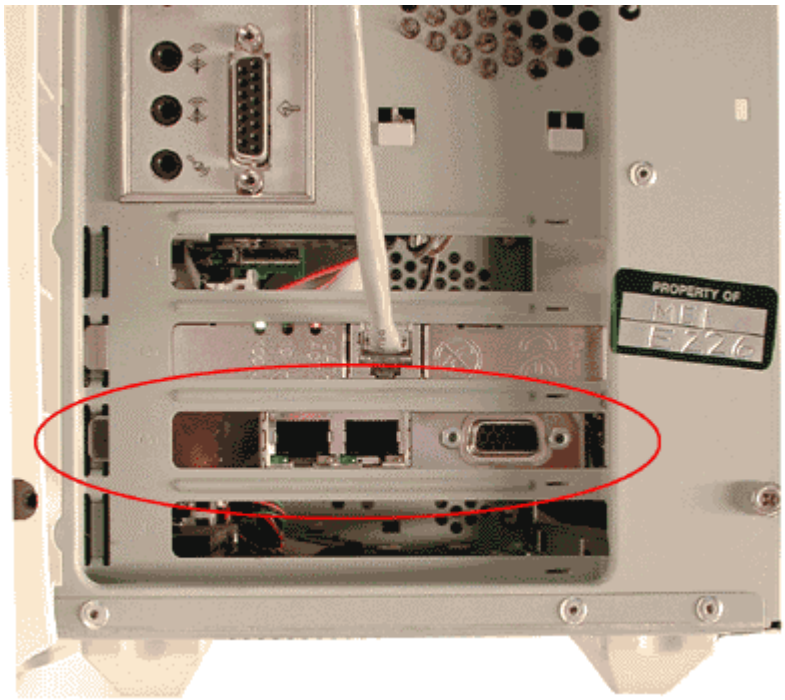
CAUTION
This hardware is for use only with compatible UL listed personal computers that have Installation Instructions detailing user installation of card cage accessories.

Install PCB into the host machine

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



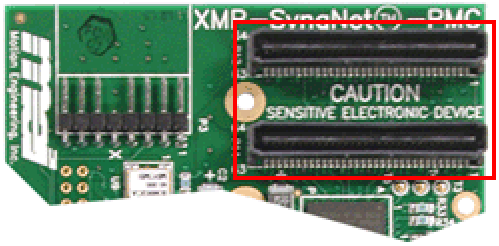
Below is a photo of an installed XMP-SynqNet-PCI-RJ-CAN controller in a standard PCI slot on a CPU.

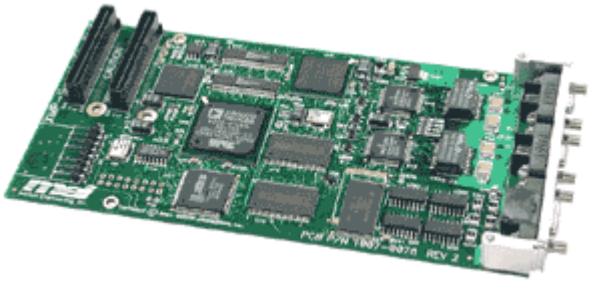


PMC

PMC to PCI | PMC to CPCI | PMC to motherboard

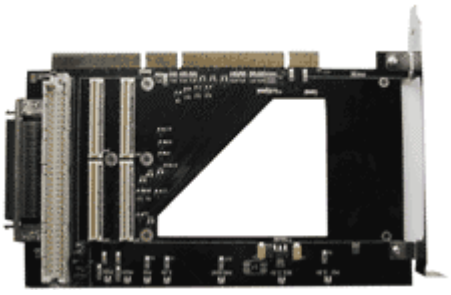
PMC stands for PCI Mezzanine Card. It is an ultra-compact motion controller that provides a direct connection to SynqNet motion control networks and can be readily customized to fit the requirements of most applications. On the XMP-SynqNet-PMC controllers, the bussing occurs via the mezzanine connectors, which are mounted at one corner of the card (see photo below). PMC and CPCI adapter cards are also available, which allow the installation of the PMC card into a standard PCI or CPCI slot.





XMP-SynqNet-PMC
PN: T009-0001

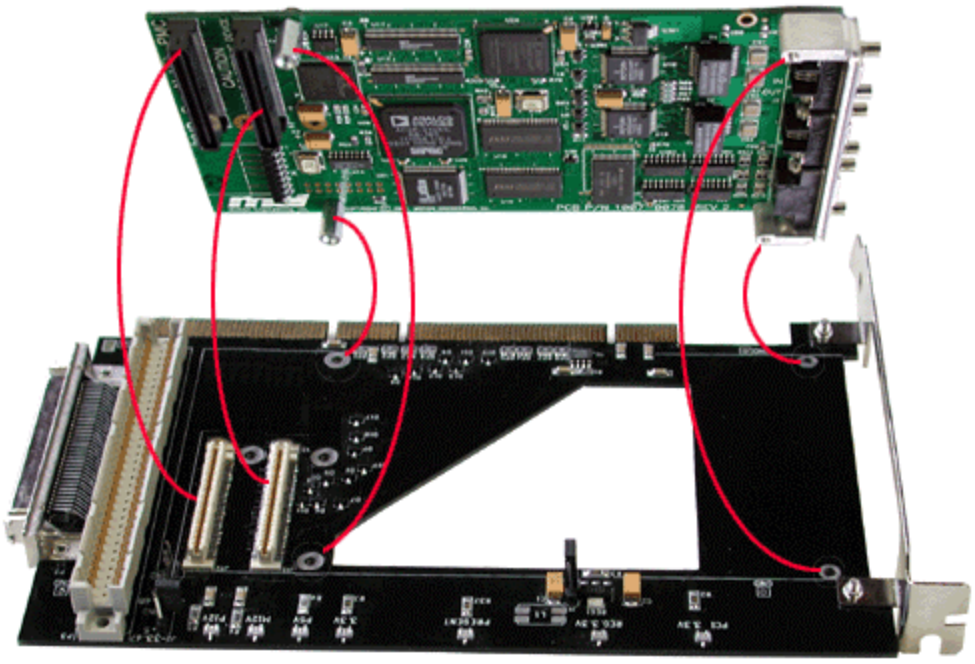
PMC to PCI Adapter Card



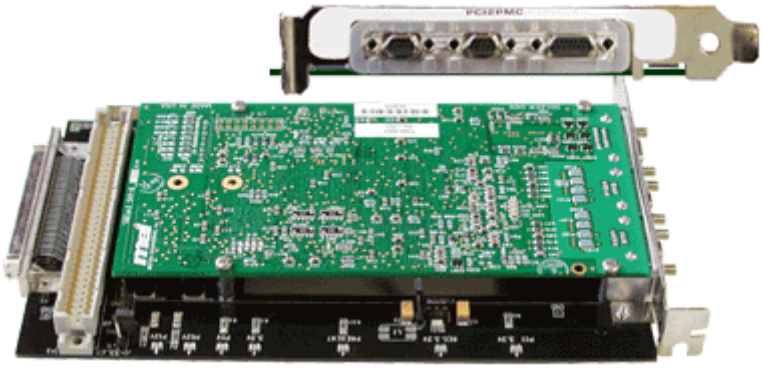
PMC to PCI Adapter Card
MEI PN: 8001-0031

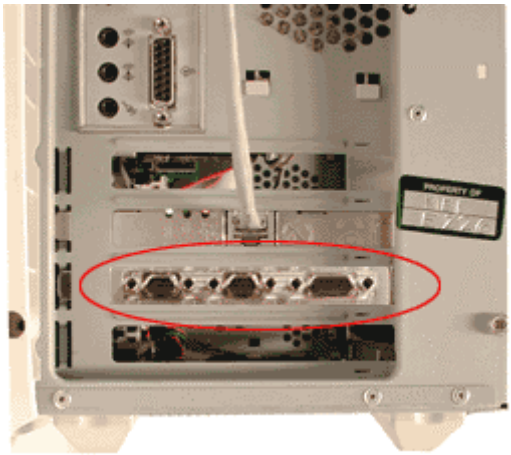
Dynamic Engineering
PN: PCI2PMC
www.dyneng.com

When mating an XMP-SynqNet-PMC card to a compatible PCI converter card, be sure that the mezzanine connectors and stand-offs all line-up correctly. Secure the two boards with the screws provided.



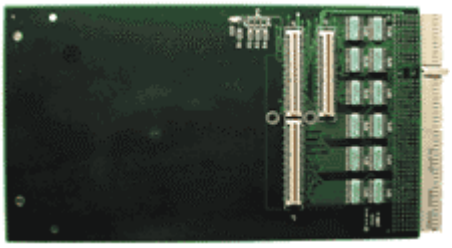
Below is a picture of a properly installed PMC card on a PCI adapter card. It can now be installed into any standard PCI slot.





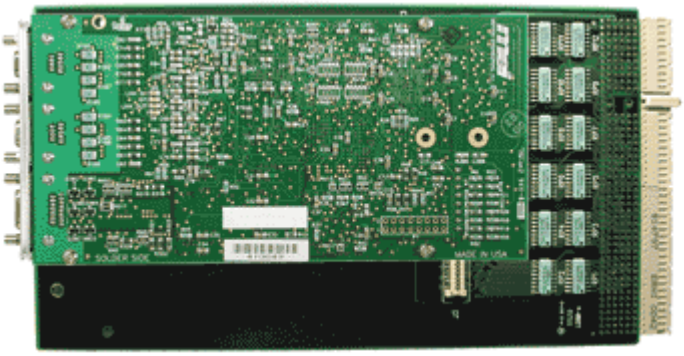
PMC to CPCI Adapter Card

When mating a XMP-SynqNet-PMC card to a compatible CPCI converter card, be sure that the mezzanine connectors and stand-offs all line-up correctly. Secure the two boards with the screws provided.



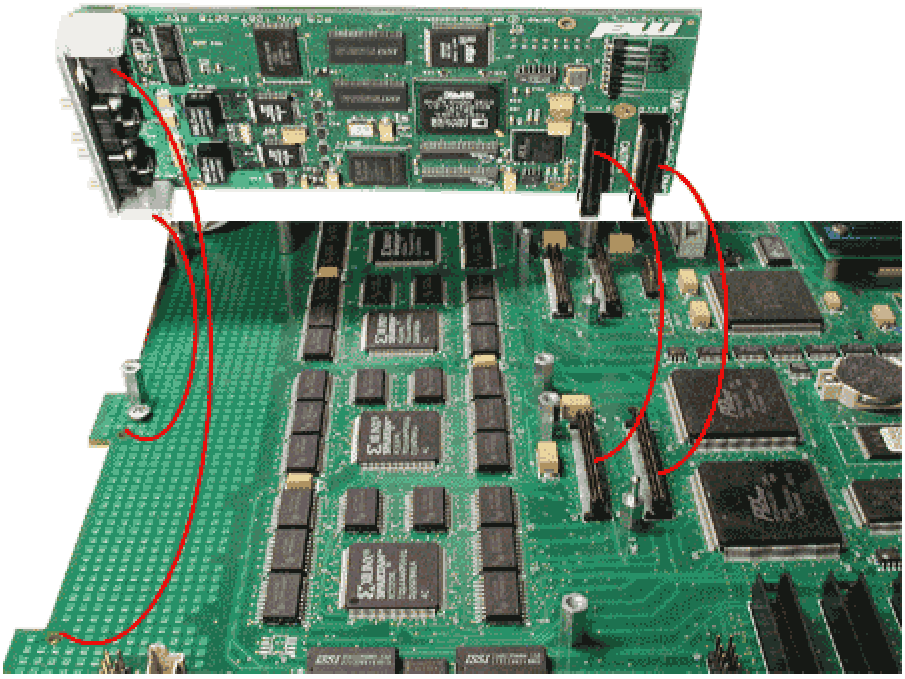
PMC to CPCI Adapter Card
Catalyst Enterprises, Inc.
PN: 384-0040-001
www.catalyst-ent.com

Here is a properly installed PMC on a CPCI adapter card. It can now be installed into any standard CPCI slot.

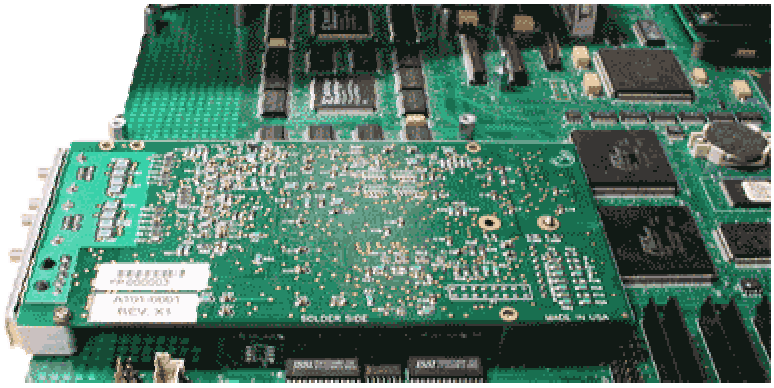


PMC to Motherboard

You can also install the PMC card directly onto a motherboard that has mezzanine connectors.



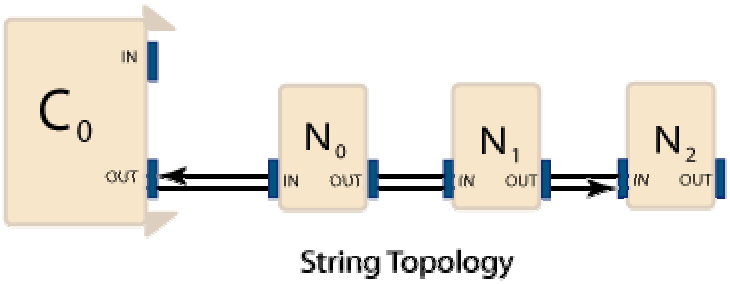
Here is a picture of a properly installed PMC card on a motherboard.



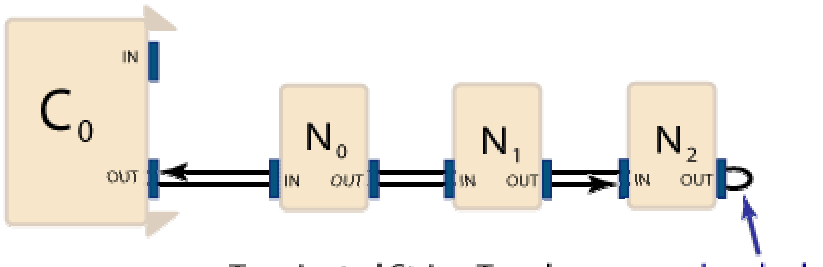
Connect Hardware

Pick a Topology

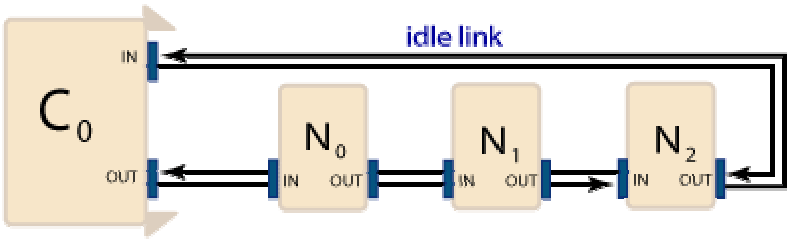
The next step is to set up the hardware of the system based upon the selected topology. Currently, SynqNet supports the following three topologies:



String Topology



Terminated String Topology

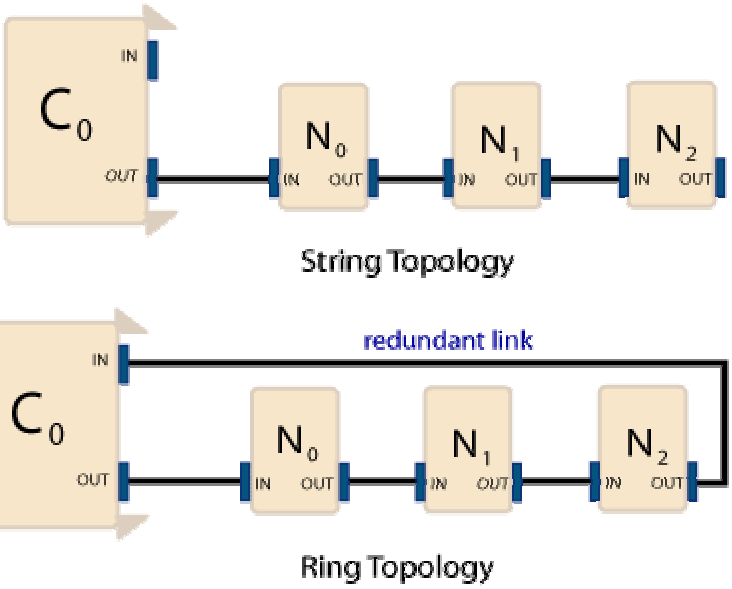


Ring Topology

For more information about the various topolgies, please see the Node, Cable, Motor, Drive Addressing section under the SynqNet Technology page.

Cable Connections: Controller to Node(s)

The type of cables needed to connect the controller to the node(s) will vary based upon the type of controller, the particular hardware features, and the type of nodes you are using in the SynqNet Network. However, regardless of these variables, the cables will be wired the same way. For example, you will always connect a cable from an OUT port and into an IN port. The following diagram will clearly illustrate this connection pattern. For more information about cables and connectors, see the XMP-SynqNet Hardware section.



Types of Connectors and Cables

Depending on the type of SynqNet ports (RJ45 or Micro D) on your Controller and Drive, you will need to use one of the corresponding cables to connect them to each other. Please see the Cables section for a list of the various cables.
The following table lists some of the common connectors and their matching cables

Feature	Connector	Cable
Controller I/O	Controller I/O	N/A
Micro-D	Micro-D	C005-0002, C006-0001
RJ-45	RJ-45	C007-0003, C006-0001
Rear I/O Bus	Rear I/O Bus	N/A
CAN	CAN	N/A

Power On Nodes and Check LEDs

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

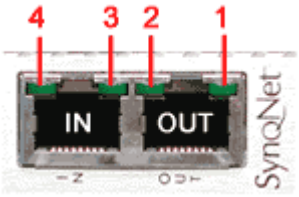
Each **controller** will have four green LEDs:

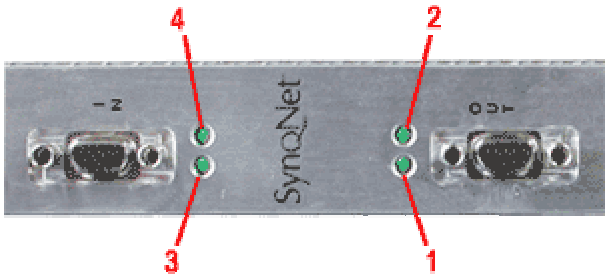
- Two LEDs (3 and 4) at the IN port.
- Two LEDs (1 and 2) at the OUT port.
- For more information, please see the Controller LEDs section.

Each **node** will have four green LEDs:

- Two LEDs (1 and 2) at the IN port.
- Two LEDs (3 and 4) at the OUT port.
- For more information, please see the Node LEDs section.

On the Controller:





LED 1 and 3 = Link Activity

- On (Link Active)
- Off (Link NOT Active)

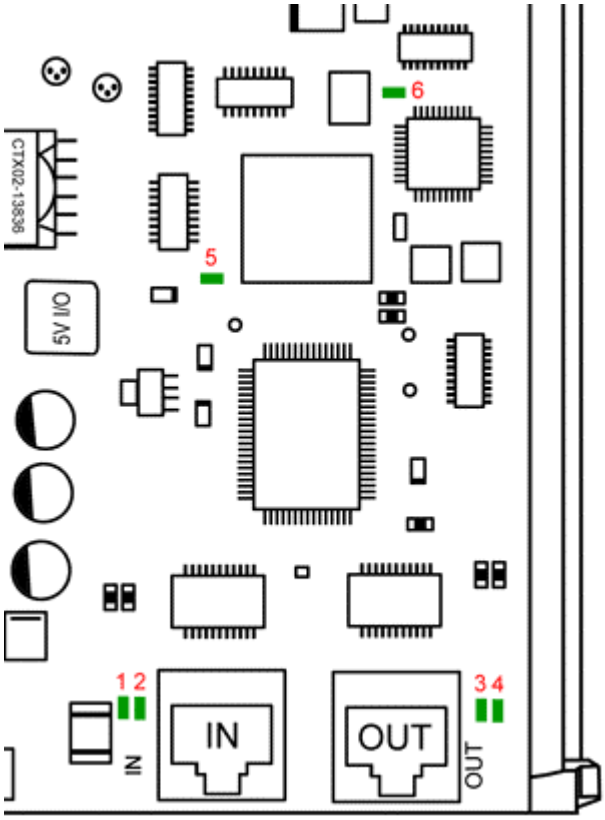
LED 2 and 4 = Network Activity

- On (Cyclic Phase--Tx and Rx are Active)
- Off (Shutdown Phase--Idle State)
- Blink (Discovery Phase--only Tx is Active)

On the Node:

Node LEDs on the RMB-10V2

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



The RMB-10V2-SynqNet is shown above.

Each LED has a particular function which is described in further detail below.

Node LED Table

LED	Port	Meaning	Controlled by	Meaning
LED1	IN	Link Activity	PHY	ON = Link active. ***Normal Operation.***
				OFF = Link inactive
LED2	IN	Node State	MAC	*See Node State Table below.*
LED3	OUT	Link Activity	PHY	ON = Link active. ***Normal Operation.***
				OFF = link inactive
LED4	OUT	Repeater	MAC	*See Node State Table below.*

LED5	FPGA	FPGA	MAC (FPGA)	ON = no nodeAlarm. ***Normal Operation.***
				OFF = Unpowered or Reset
				Blink = nodeAlarm. (node fault or network fault). See Node Alarm.
LED6*	FPGA Boot Status	FPGA Boot Status	Bowsprit CPLD	ON (bright) = runtime image has been loaded.
				ON (dimmed) = boot image has been loaded.

* - LED6 is for Bowsprit design only (not on RMB-10V Rev 1 & 2).

Node State Table

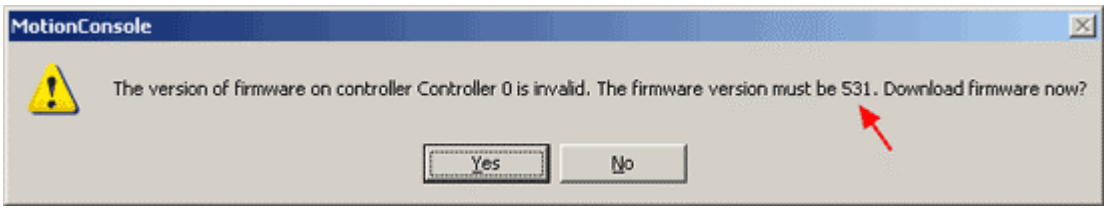
Node State	LED2	LED4*	
		Repeater OFF	Repeater ON
Unpowered	OFF	OFF	OFF
Reset	OFF	OFF	OFF
Undiscovered	BLINK .37Hz	OFF	OFF
Discovered	BLINK .75Hz	OFF	BLINK (same phase as LED2)
SYNQ operation	ON	OFF	ON
SYNQ lost	BLINK 1.5Hz	OFF	BLINK (opposite phase to LED2)

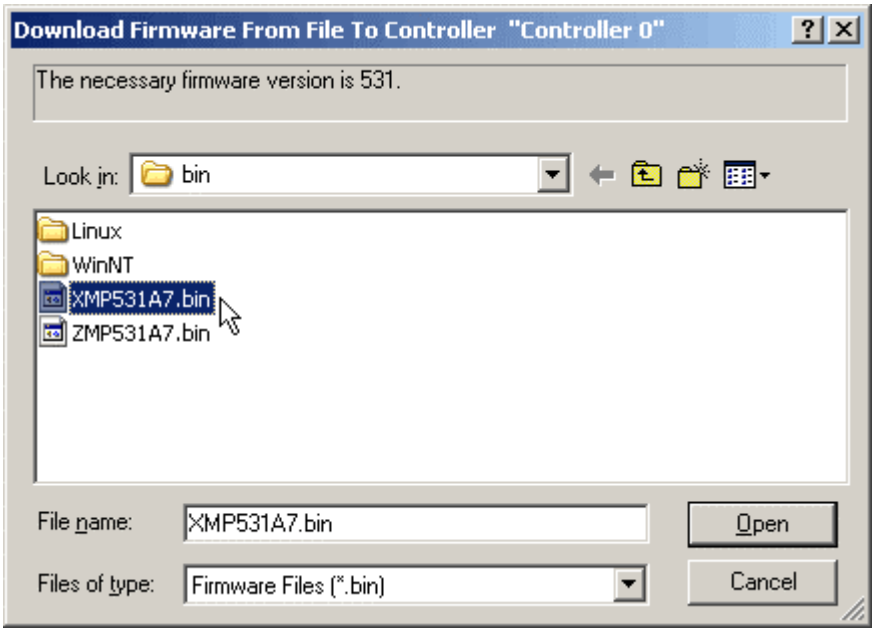
***** - The repeater is OFF on all states when it is on the last node on the network.

Motion Console

Download Controller Firmware

Motion Engineering's motion controllers are shipped with NULL firmware. Therefore, the first step is to download the proper firmware for the controller. When you start Motion Console for the first time, it will automatically prompt you to download firmware to the controller and will also tell you which version should be downloaded. In the example below, you should download firmware version 531.



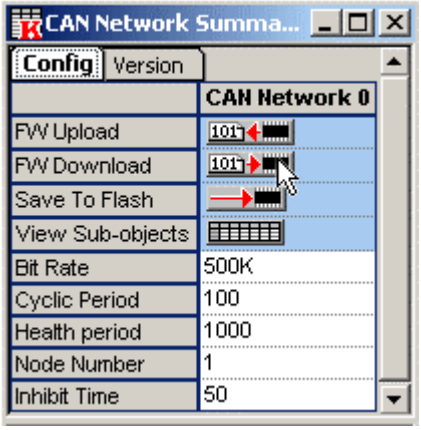


The next window will ask you to browse for the firmware file. Choose the **XMPxxxxx.bin** ("xxxxx" represents the firmware version) firmware file from the **mei\xmp\bin** directory. The standard software release includes one XMP controller firmware file. In this example, we will download **XMP531A7.bin**.
If you have installed custom software, there will be an additional firmware file in the same directory. Each custom firmware file is numbered: X1Pxxxxx.bin, X2Pxxxxx.bin, etc. If you are using custom firmware, select the proper custom XnPxxxxx.bin file from the same directory.
Select the proper firmware version and click **Open**.

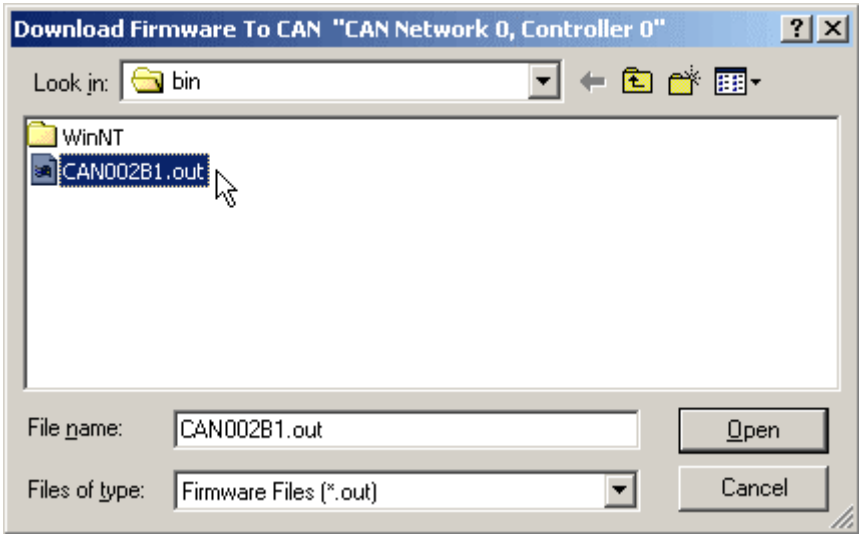
When the verification window appears, click **Yes**. It will take approximately 30 seconds to download the firmware to the controller.

For CAN Controllers

If you are installing a CAN controller, you must also download the appropriate CAN firmware with Motion Console. It can also be downloaded using the CAN Flash Utility, CANFlash.exe. In the CAN Network Summary window, click the **FW Download** button.



The next window will ask you to browse for the firmware file from the **mei\xmp\bin** directory. The CAN firmware is distinguishable by its ***.out** extension.

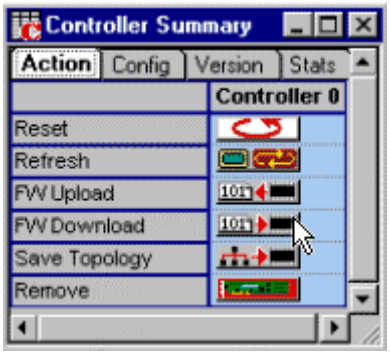


In this example, we will download **CA002B1.out**.

Troubleshooting

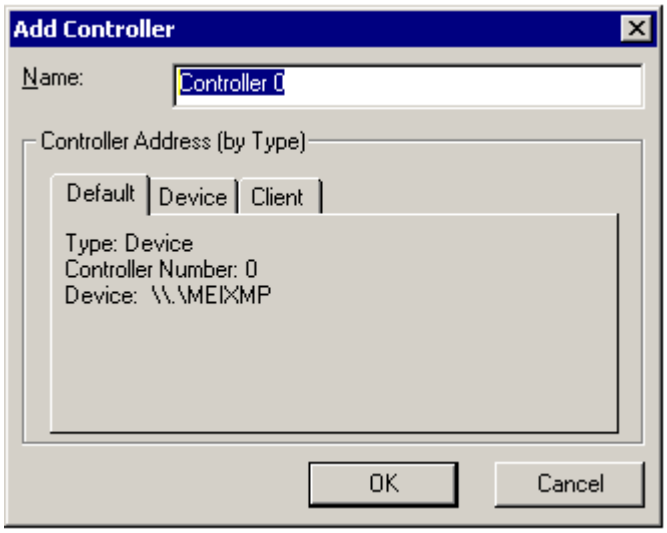
What if I accidentally downloaded the wrong version or need to change the firmware version on the controller?

Once you have loaded firmware onto the controller for the first time, you can also manually change the version of firmware on the controller 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\xmp\bin** directory.

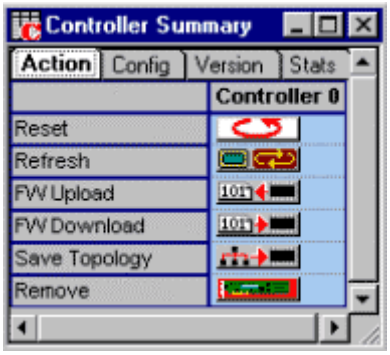


Add New Controller

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 pops-up will allow you to give the controller a unique identification in the Name field. For this example, we will use the default name, Controller 0.

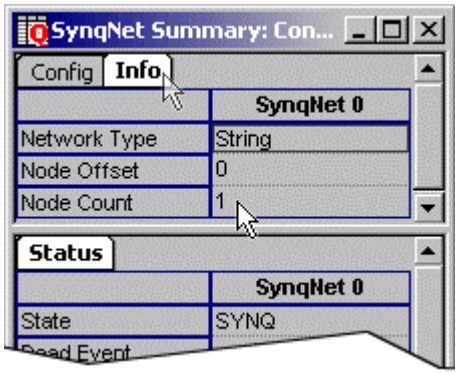


The **Controller Summary** window will appear next.



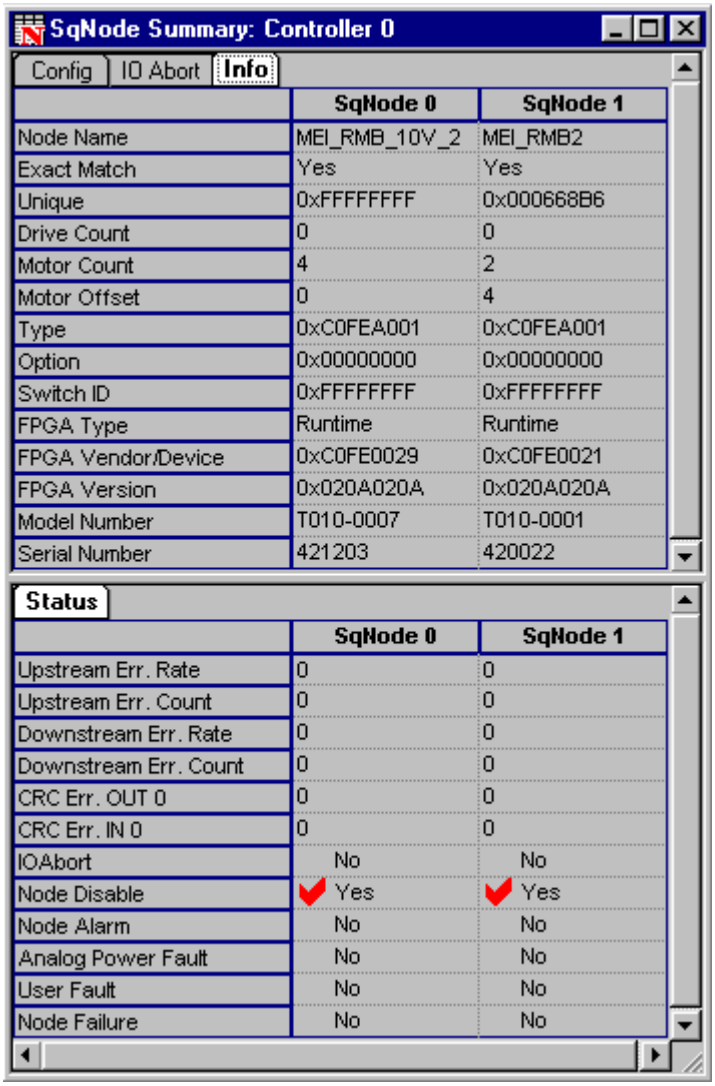
Check Network Information

After the proper firmware has been downloaded for the controller, check the Network Information to make sure that the proper number of nodes were found. Click on the  button to open the SynqNet Summary Window. Under the Info tab, it shows 1 node since the SynqNet Network that was used for this example had one RMB-10V installed.
A node refers to any SynqNet node, such as a SynqNet Drive or an RMB-10V (for analog) that is installed on a SynqNet network.



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 will find the nodes in the order that they are connected. The hardware setup used for this example had two nodes. Therefore, the SqNode Summary Window shows two nodes: SqNode 0 and SqNode 1. This window also shows the address information of each node.



TIP: Before proceeding on to Step 9, it is helpful to first minimize the Motion Console window.

Troubleshooting

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

If the Link LEDs are not turned ON, make sure 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 has been verified, check to make sure that the cables are connected to the right ports.

If the Link LEDs still do not turn ON, the power has been 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 please 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. Please proceed to the next step, Download Node FPGAs.

A node is improperly ordered...

SynqNet will find 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 to determine if a node is not in the correct order. 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 will only tell you which nodes it 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.

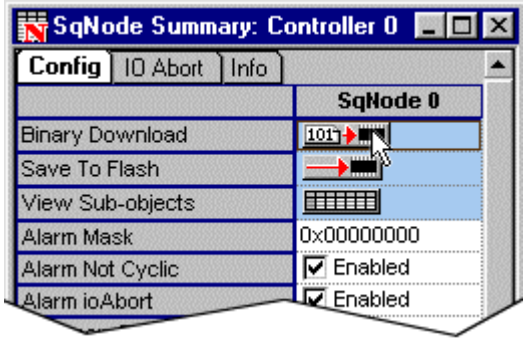
Download Node FPGAs

Motion Engineering'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, you will first need to download the appropriate FPGA (runtime) image.
To find the appropriate FPGA (runtime) image that should be downloaded for your node, please refer to the Node Binary Files: Product Table.
There are two ways to download the Node FPGA:

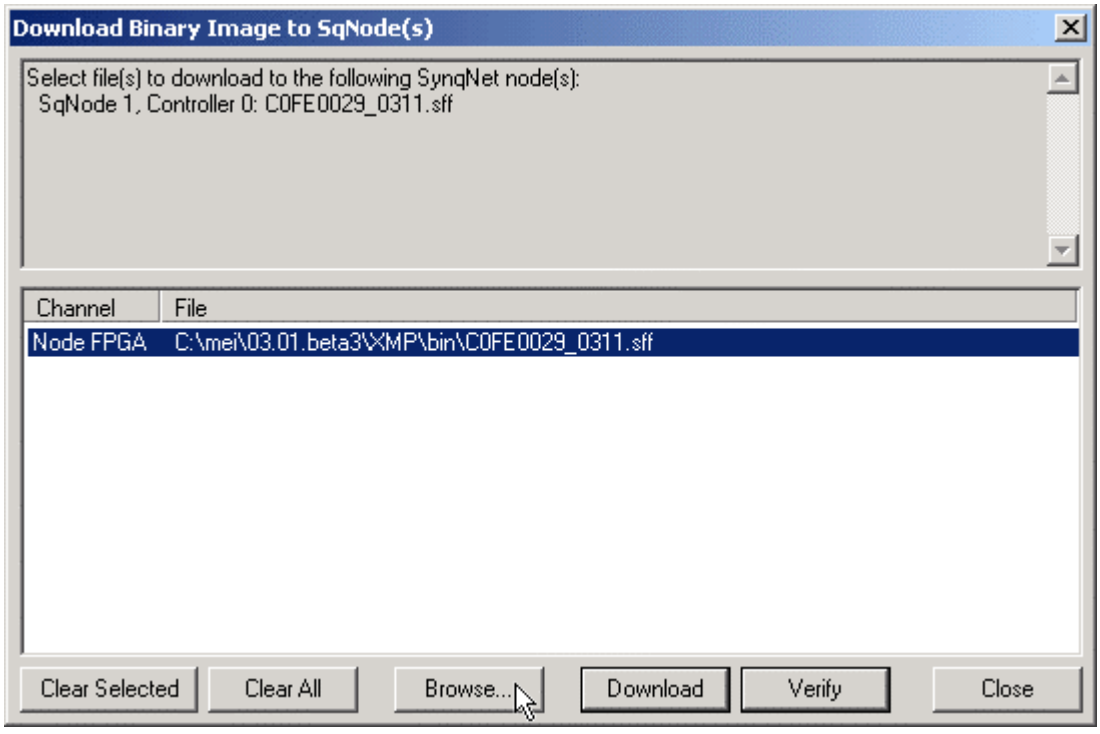
- via Motion Console
- via Command Prompt

Motion Console Download

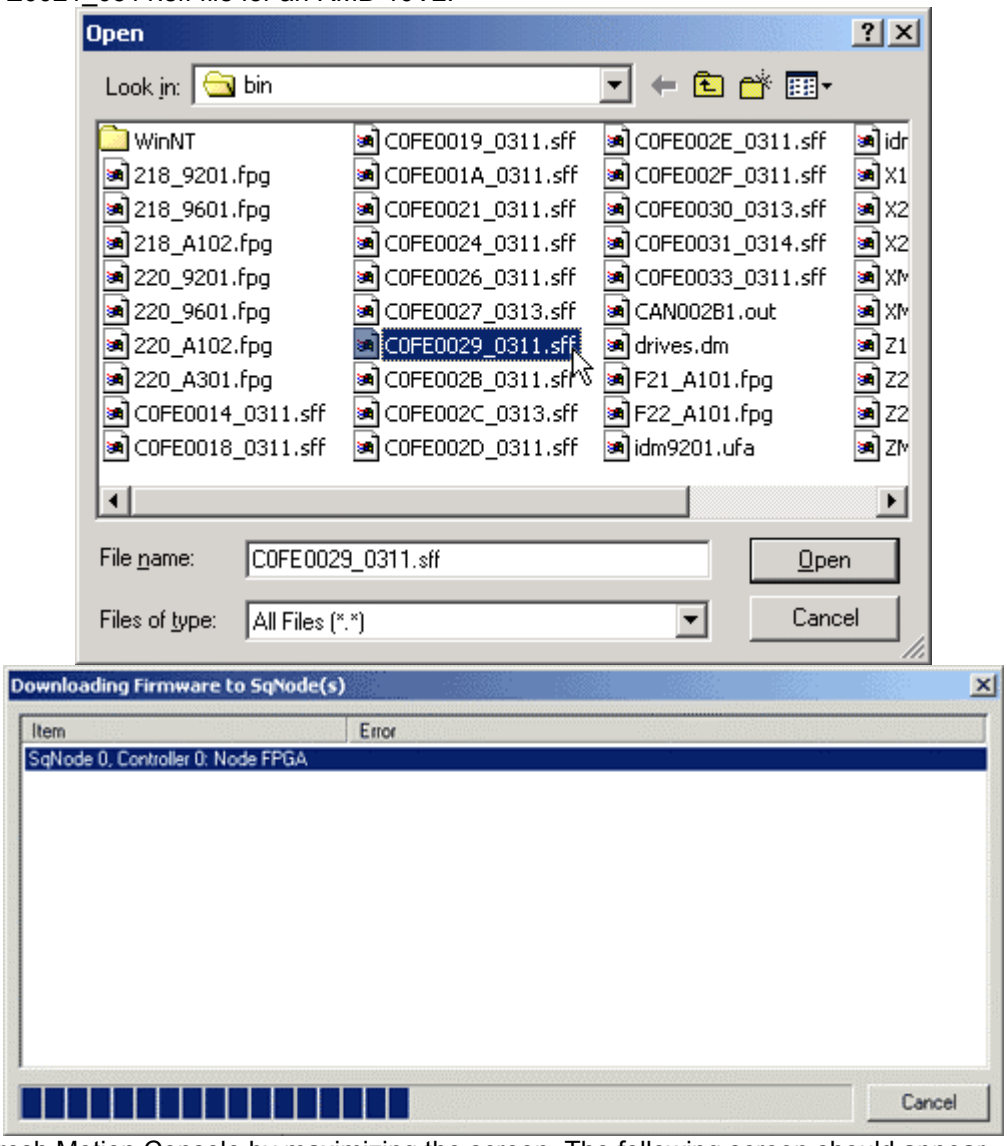
In the SynqNet Node Summary window, click on the Binary Download button.



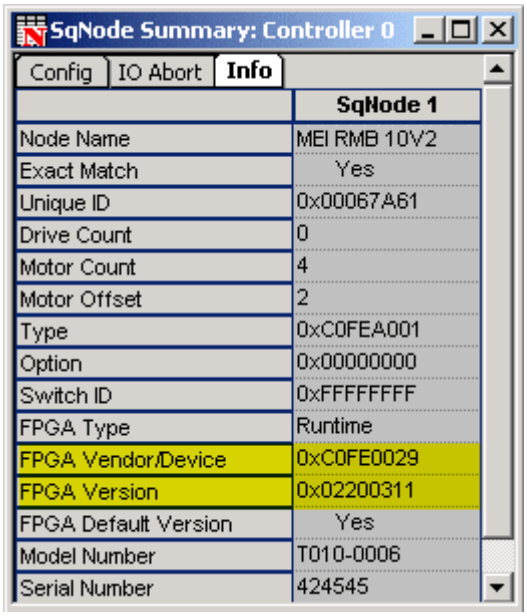
The following window will appear next. To search for the correct binary FPGA image file, click Browse.



Find the appropriate FPGA file and select Open. In this example, we are downloading the C0FE0021_0311.sff file for an RMB-10V2.



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



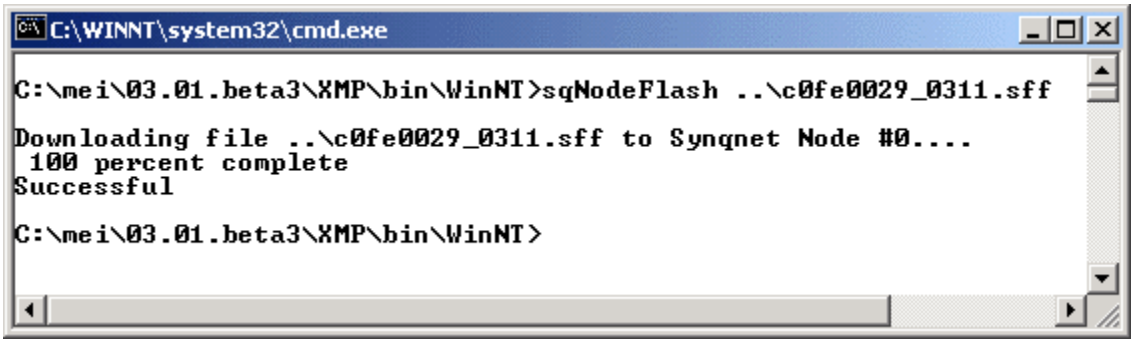
Command Prompt Download

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

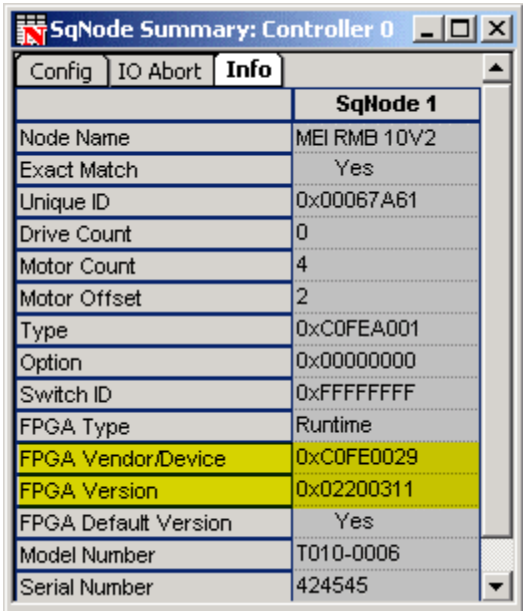
C:\MEI\XMP\bin\WinNT\

Type the following command:

C:\MEI\XMP\bin\WinNT\sqNodeFlash -node 0 -file ..\c0fe0029_0311.sff

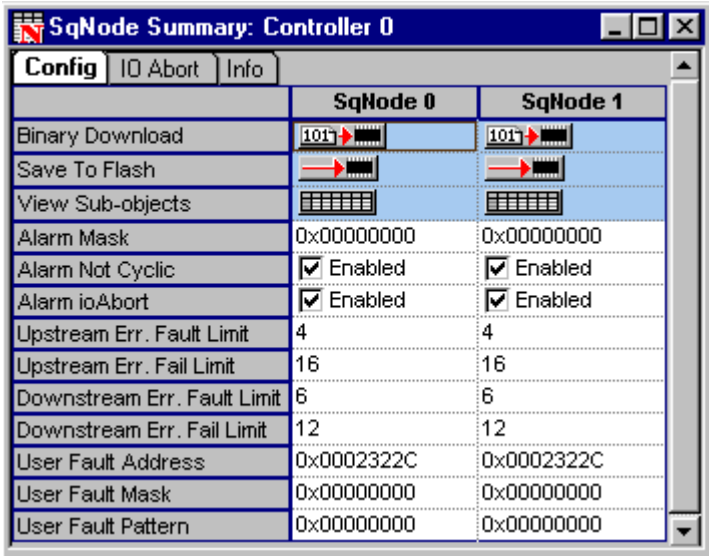


The selected FPGA file has been downloaded after all of the pages have been counted. Refresh Motion Console by maximizing the screen. The following screen should appear. Notice that the "FPGA Vendor/Device" now reflects the downloaded FPGA: 0xC0FE0029.



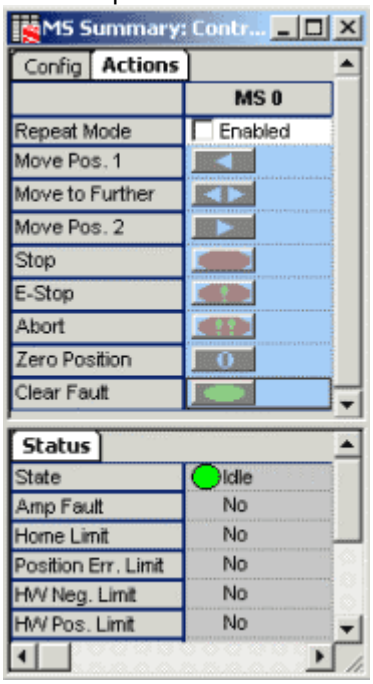
Check Node Configuration

After the proper drive firmware has been downloaded, click on the button to check the SqNode Summary window to make sure that the proper number of drives were found. This window provides the node configuration for each drive installed on the system. SynqNet will find the drives in the order that they are connected. The hardware setup used for this example had two drives.

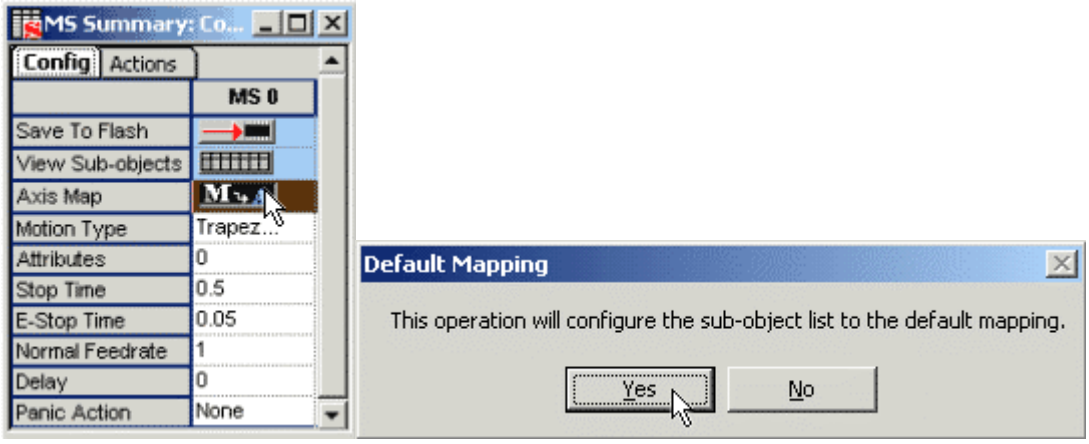


Map the Axes

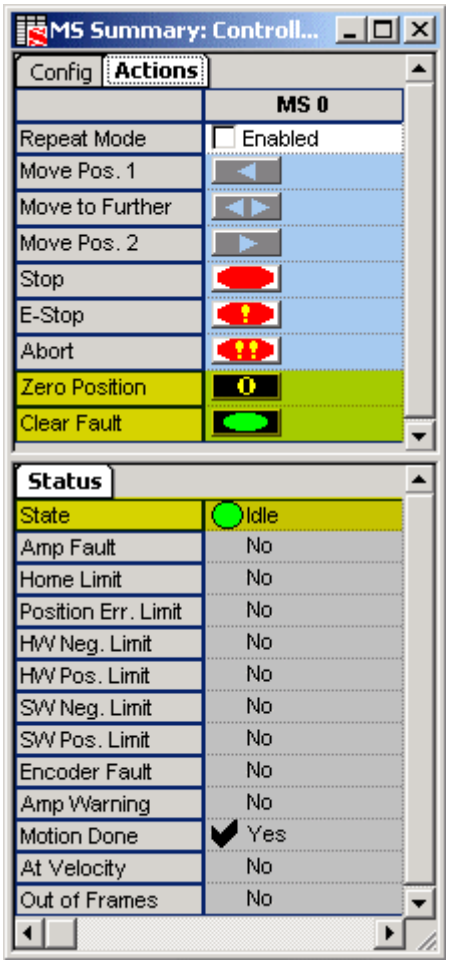
Click on the  button to open the Motion Supervisor window and click the Actions tab. Before you can control and move a motor, it must first be mapped to a Motion Supervisor. If the buttons are faded out under the Actions tab (shown below), it means that no axes have been mapped (assigned) to a Motion 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.
Then click **Yes** to configure the default mapping.



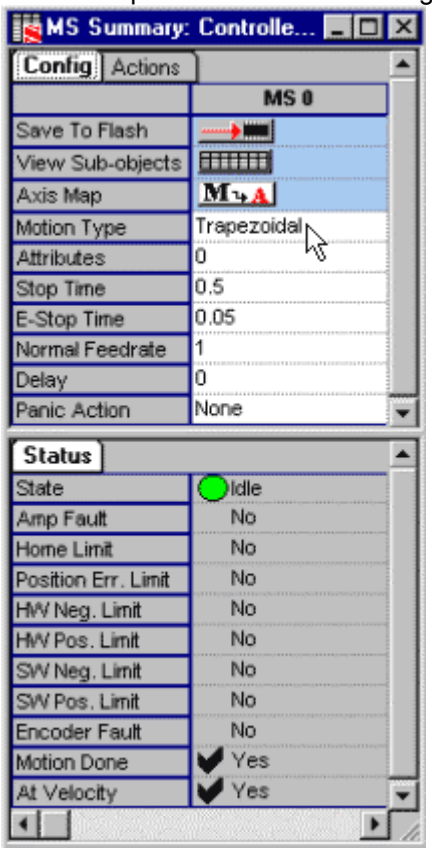
Under the Actions tab, click the **Zero Position Button** to reset the position so that the current position is zero. Then click the **Clear Fault Button**. You cannot move a motor if there are any errors that have not been cleared out. Be sure that the State under the Status tab shows **Idle**.


MS Summary: Controll...
Config
Actions
MS 0
Repeat Mode
Enabled
Move Pos. 1
Move to Further
Move Pos. 2
Stop
E-Stop
Abort
Zero Position
Clear Fault
Status
State
Idle
Amp Fault
No
Home Limit
No
Position Err. Limit
No
HW Neg. Limit
No
HW Pos. Limit
No
SW Neg. Limit
No
SW Pos. Limit
No
Encoder Fault
No
Amp Warning
No
Motion Done
Yes
At Velocity
No
Out of Frames
No

Tune the Servo Control Loop

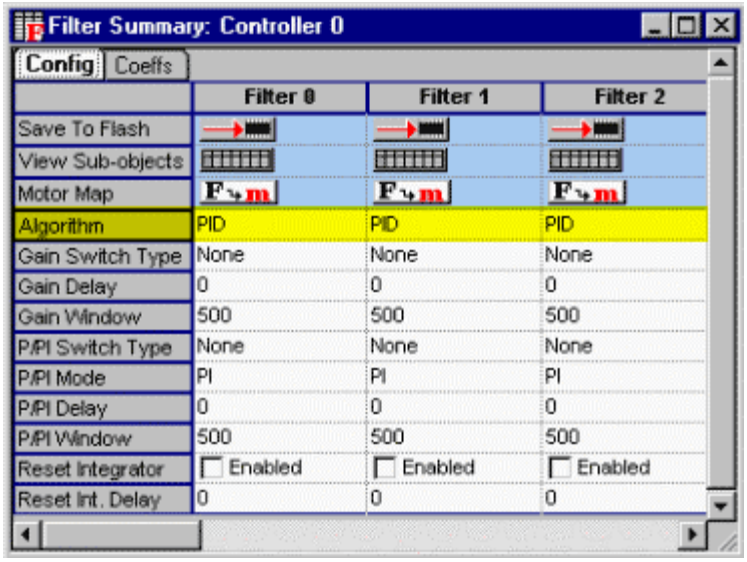
After you have verified the hardware setup of the SynqNet Network and Mapped the Axes, you can now tune the servo control loop in order to make a move.

Click on the  button to open the Motion Supervisor Summary window.
Verify that the Motion Type is set to Trapezoidal under the Config tab.

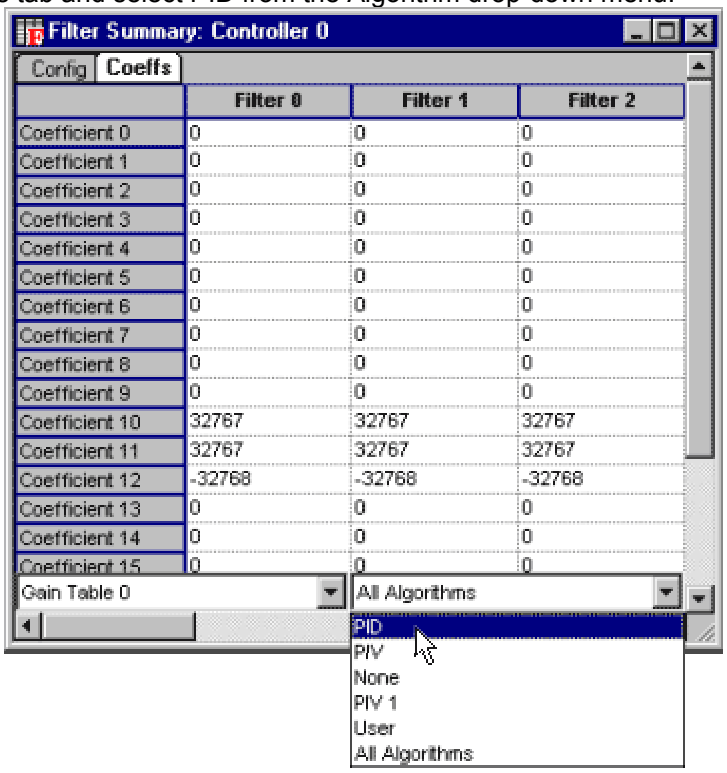


Go to the Actions tab and click the Clear Fault Button.

Click on the  button to open the Filter Summary window.
Verify that the Algorithm is set to PID under the Config tab.



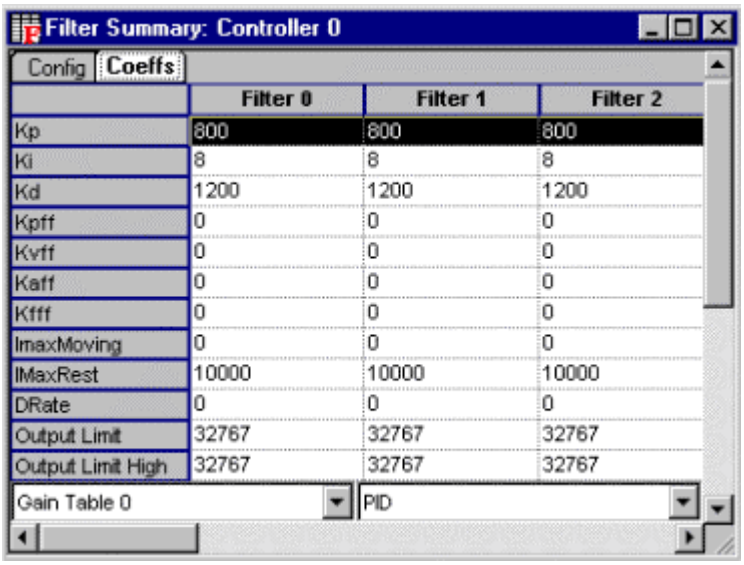
Go to the Coeffs tab and select PID from the Algorithm drop-down menu.



WARNING!
Before entering any tuning parameters, find out what are safe tuning parameters to use. Otherwise, you may damage your motors.
For our example we will use the following parameters:

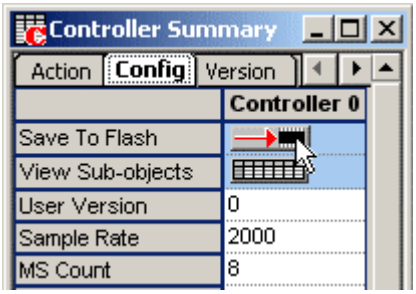
(Example Parameters Only. Not to be used for every system.)

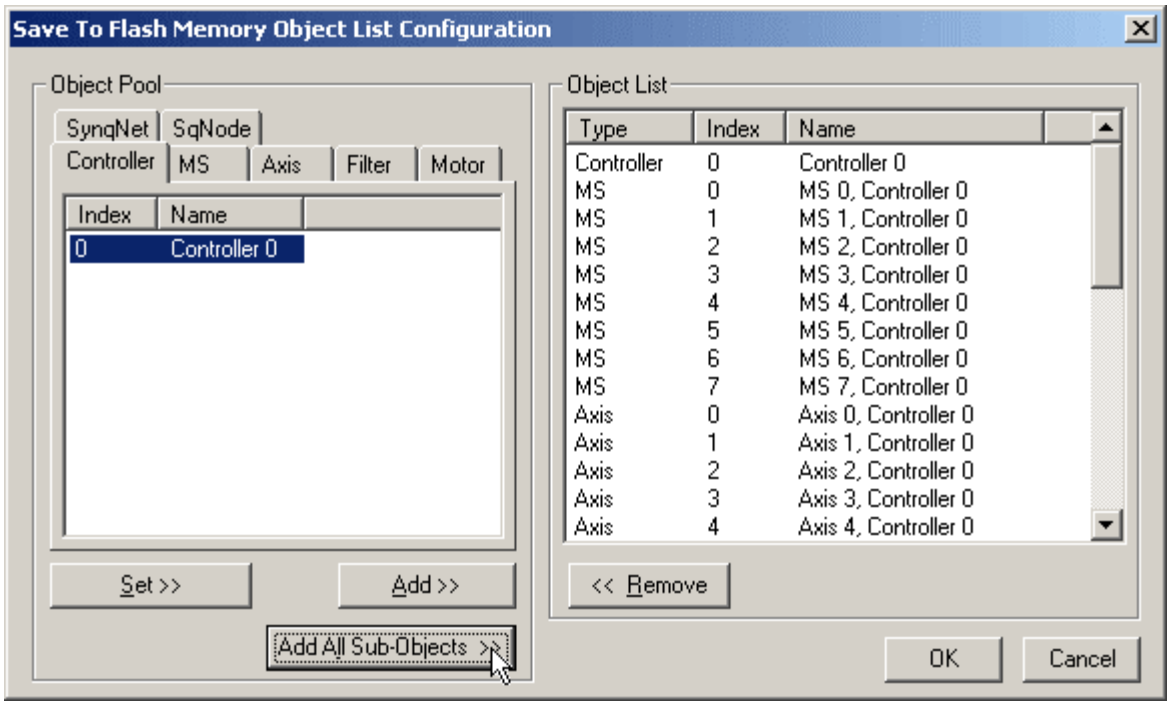
- 800 for Proportional Gain (Kp)
- 8 for Integral Gain (Ki)
- 1,200 for Derivative Gain (Kd)
- 10,000 for Integrator Maximum at Rest (IMaxRest)



Save to Flash

After you have entered the Filter parameters, it is a good idea to save the parameters to Flash memory. (Motor Summary settings cannot be saved to flash memory.) To save all of your settings to the controller's flash memory, open the Controller Summary window, click the Save to Flash button and then click the Add All Sub-Objects button.

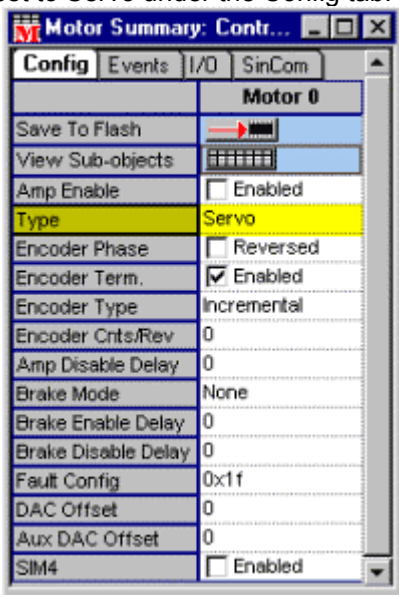




Move a Motor

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

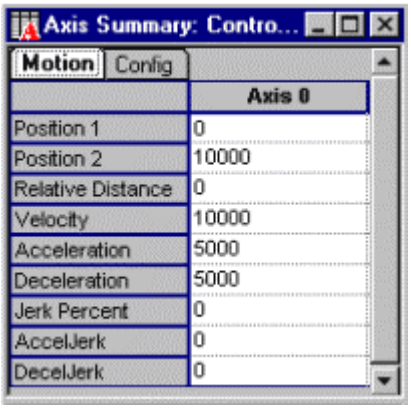
Click on the  button to open the Motor Summary window.
Verify that the motor Type is set to Servo under the Config tab.



Click on the  button to open the Axis Summary window.
Under the Motion tab, enter the following parameters:

Example Parameters Only.
Not to be used for every system.

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

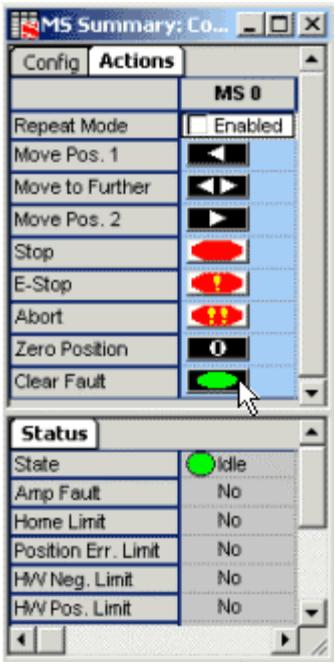


Enable Amp

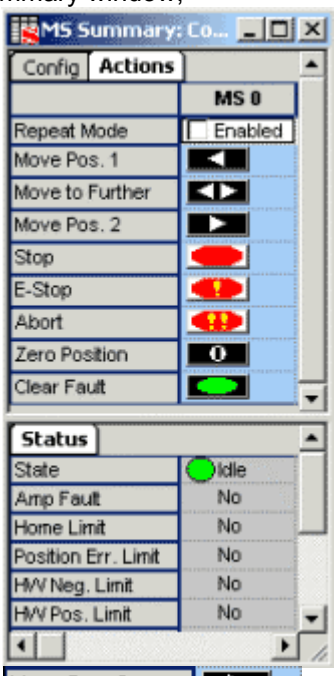
In the Motor Summary window, check the Enabled checkbox for Amp Enable to enable the amp. As a safety precaution, you cannot move a motor if the amp is not enabled.
NOTE: If you cannot click the Enabled checkbox, you probably have on of the following problems:

- You may have not mapped your axes. See Map the Axes.
- You may have some faults on the controller that you need to clear out by clicking the Clear Fault button on the Motion Supervisor Summary Window, under the Actions

tab.



Under the Motion Supervisor Summary window,



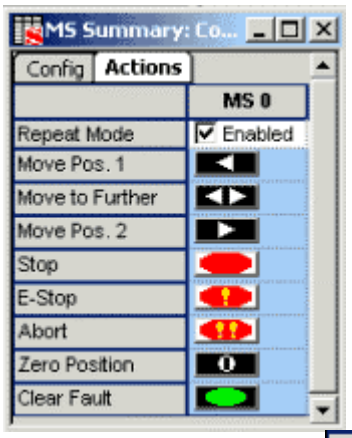
Click on the Move Pos. 2 button 

, 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 in the Motion Supervisor Summary window.



Click the Move to Further button or the Move Pos. 2 button 

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

Congratulations! You have successfully moved a motor using SynqNet.

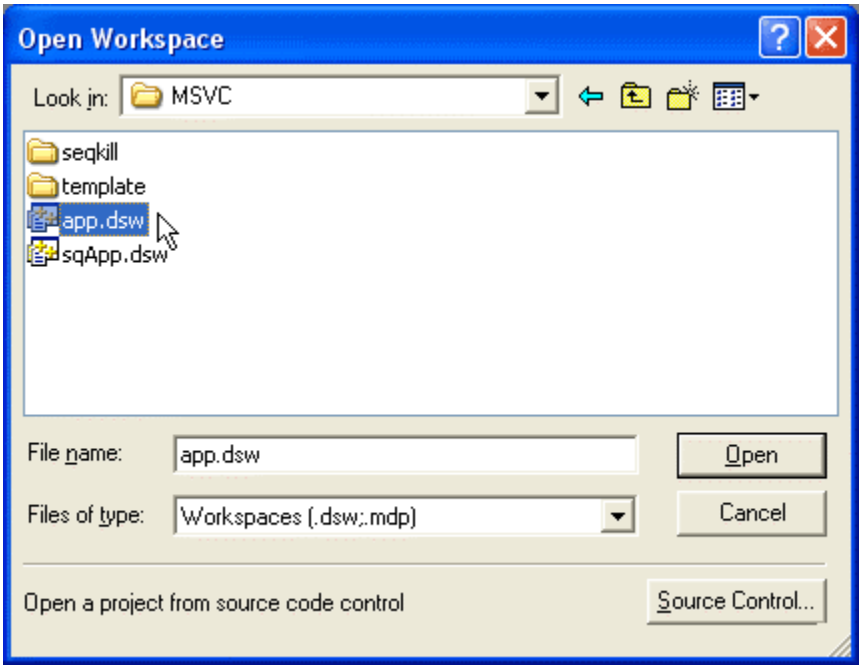
Microsoft Visual C/C++

This section is an overview of running an executable C-program via Microsoft Visual C/C++. If you are not currently running MS VIsual C/C++, this section will not apply. Even though the XMP 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.

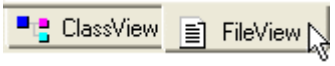
2. Go to File > Open Workspace. Browse for **app.dsw**.

   Default location: **C:\MEI\XMP\APP\WinNT\MSVC**.



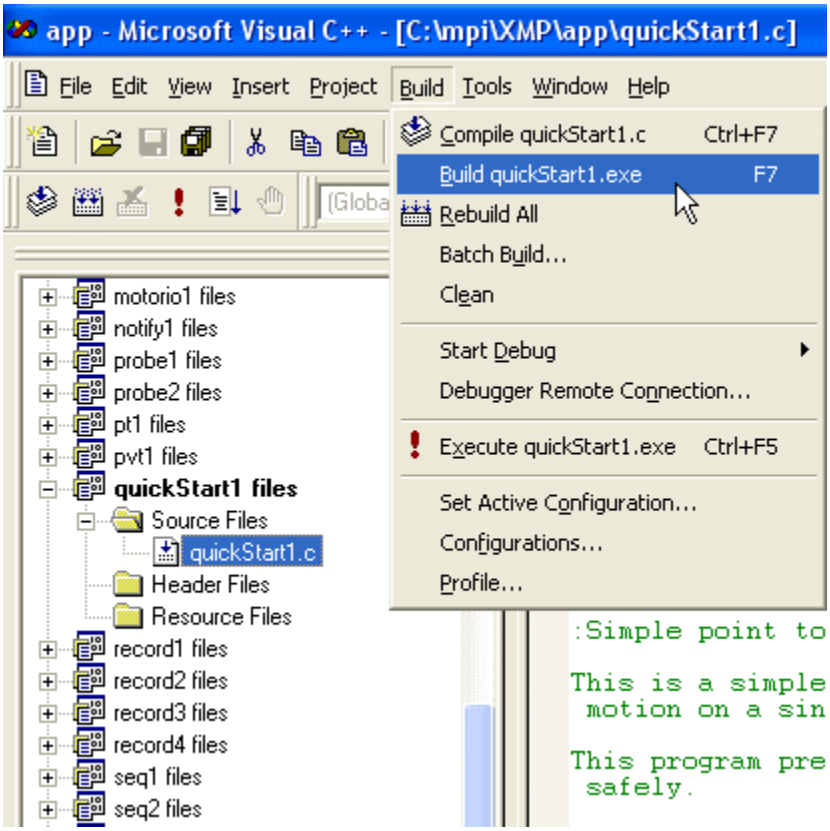
3. The file type should be set to display Makefile [.mak] and upon doing so, the app.mak file appears. Open **app.dsw**. If you are asked whether the project should be converted to the verson of Visual C/C++ you are running, click **Yes**.

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



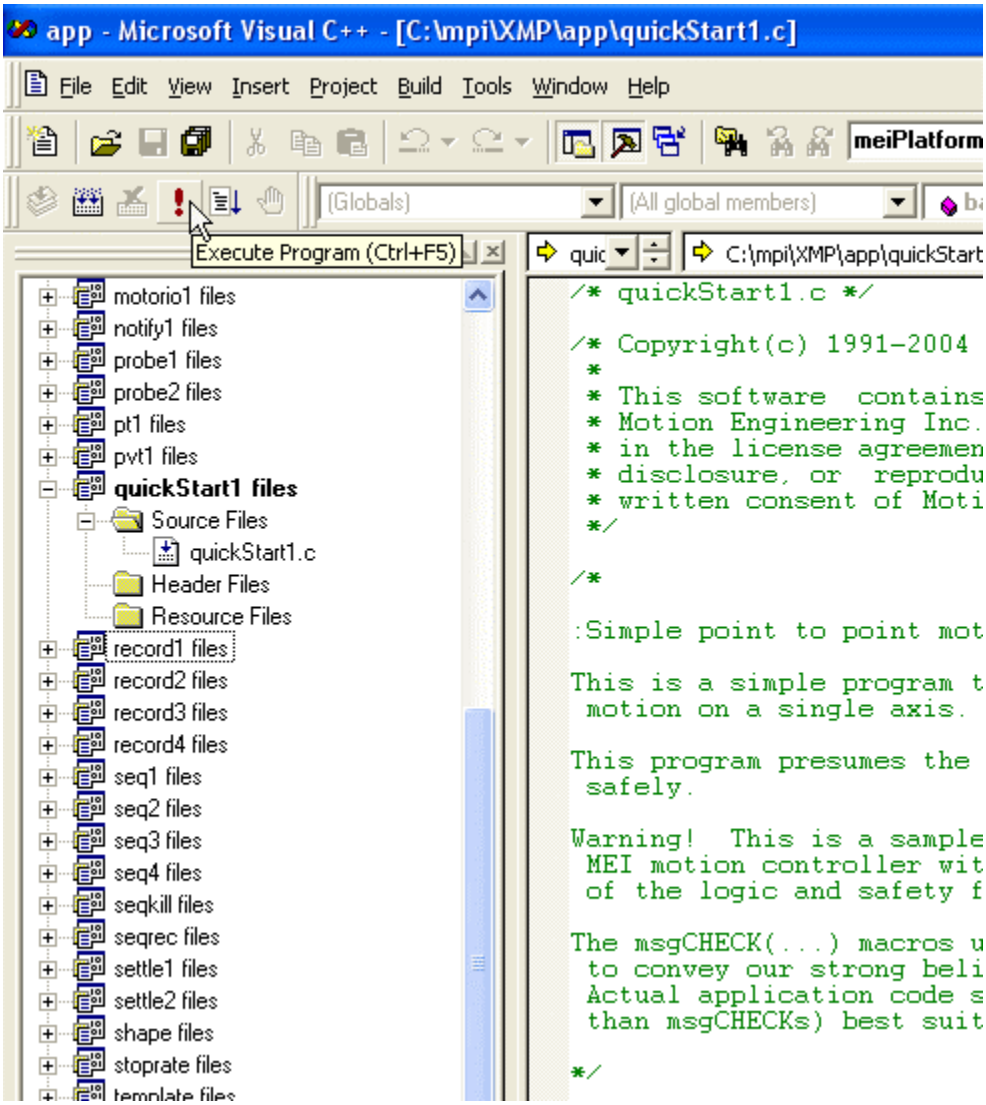
5. Right click on the **quickStart1** files and "Set as Active Project."
   (This should set the **quickStart1** files in bold.)

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



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

8. Click the execute button  and the program will now be carried out. At any time you can stop the motion by hitting any key.



9. Open Motion Scope and you can view certain parameters by selecting the Trace button and adding the parameters you want to graph.