



softMC 3

Multi-Axis Motion Controller

Installation Guide

Document Rev. 3.3



Revision History

Doc. Rev.	Date	Remarks
3.3	Dec. 2016	Updated RS232 interface pinout; new ordering format
3.2	Nov. 2016	Updated cabling diagrams and instructions, ordering info.
3.1	Apr. 2016	RS232 correction
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2.1	10 June 2015	Minor fix. Updated ordering options.
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1.0	1 Sept. 2014	Initial release

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Technical Support

If you need assistance with the installation and configuration of the softMC 3 controller, contact Servotronix Technical Support: tech.support@servotronix.com

Ordering Options

	MC	E	06	702	0000
	softMC Motion Controller				
	Fieldbus				
E	EtherCAT				
C	CANopen				
B	EtherCAT and CANopen (<i>702 only</i>)				
	Number of Axes				
04, 06	4, 6 axes				
08, 16, 32	8, 16, 32 axes				
	<i>Other number of axes available upon request</i>				
	Hardware Options				
301	softMC 3 – ARM, for 4 to 6 axes				
702	softMC 7 – Atom, for 8 to 32 axes				
705	softMC 7 – CORE i5, for 8 to 32 axes. <i>Check availability – contact Servotronix</i>				
	Options (<i>when available</i>)				

Software Add-On	
Part Number	Item
FW-MC03-CODESYS	IEC 61131 CODESYS for softMC 3 – <i>upcoming</i>
FW-MC07-CODESYS	IEC 61131 CODESYS for softMC 7

Contents

1	Product Description	7
1.1	Product Overview	7
1.2	Product Package	8
1.3	Technical Specifications	9
1.4	Dimensions	10
2	Safety	11
2.1	Anti-Static Precautions	11
2.2	Installation Precautions	11
2.3	General Safety Precautions	12
3	Installation Preparation	13
3.1	Required Computer System	13
3.2	IP Address	13
3.3	Required Tools	13
3.4	Required Cables	14
3.5	Interfaces	14
4	Installation Procedure	17
4.1	DIN Rail Mounting (Optional)	17
4.2	Cable Connections	17
4.3	Connecting softMC 3 and CDHD – CANopen Models	18
4.4	Connecting softMC 3 and CDHD – EtherCAT Models	19
4.5	Connecting softMC 3 and stepIM – CANopen Models	20
4.6	ControlStudio Software Installation	21
4.7	Serial Communication	21
4.8	IP Address	24
4.8.1	Get an IP Address from a DHCP Server	24
4.8.2	Manually Assign an IP Address Using ControlStudio	24
4.8.3	Define a Fixed IP Address	26

1 Product Description

1.1 Product Overview

The softMC 3 is a multi-axis motion control software and hardware package offering extensive programming capabilities for a variety of automation and robotics applications.

The product has two models that are identical in appearance: EtherCAT and CANopen. They are distinguished by the product label on the back panel.



Figure 1-1. softMC 3 Product Labels

1.2 Product Package

The following table lists all components included in the softMC 3 product package.

Notes: The DIN rail and bracket are assembled at factory.



Both book and DIN rail mounting are supplied. Either can be used.

Power supply adapter and cables are not included in the softMC 3 package.

If any of the components in this list are missing, do not proceed with the installation. Contact Servotronix: tech.support@servotronix.com

Table 1-1. Product Components

Image	Servotronix PN	Item	Qty
	MC-xxx-301-0000	softMC 3 multi-axis motion controller, equipped with SD card loaded with softMC firmware (factory installed)	1
	CONr10000002M47	2-pin terminal block Plug component Nominal current: 8 A Rated voltage (III/2): 160 V Number of positions: 2 Pitch: 3.81 mm Screw connection with tension sleeve 16-28 AWG Phoenix PN:MC 1,5/2-STF-3,81-1827703	1
	CONr10000003M08	3-pin terminal Receptacle housing Current rating: 5 A Rated voltage: 600 V Number of positions: 3 Number of rows: 1 Pitch: 3 mm Molex PN: 43645-0300 (Micro-Fit 3.0™)	1
	CRPr16020069M00	3-crimp terminal Connector socket 24-30 AWG Molex PN: 0016020069	1
	MECr16000009-02	Book mounting bracket	1

Image	Servotronix PN	Item	Qty
	MECr16000008-02	DIN mounting bracket	1
	MECr12015780-00	DIN rail adapter. L=42.6, H=19, W=10 [mm] Phoenix PN: USA 10 - 1201578	1
	SCRr000000M3-60	DIN screw, for attaching DIN rail to bracket	3
	SCRr000000M3-60	Mounting bracket screw, for attaching bracket to softMC 3	2

1.3 Technical Specifications

Table 1-2. Technical Specifications

Feature	Specification	
System	CPU	ARM Cortex A9 processor
	Chipset	iMX6
	Memory	512 MB 800 MHz DDR3
	Ethernet Controller	1x GbE
Storage	Micro SD	1 x Micro SD card slot, industrial grade, single level cell (SLC) card, factory-installed softMC firmware
I/Os and Indicators	Ethernet	1 x RJ45 port
	EtherCAT or CAN Bus	1 x RJ45 port
	RS232	Service port (3-pin terminal)
	USB	2x USB for future used
	Display	Status LEDs: orange/green, red
Power	Power Input	18V–28V DC (2-pin terminal block)
	Power Consumption	24V@150mA
Environmental and Mechanical	Mounting	DIN rail or book mount
	Operating Temp.	0°C–45°C
	Storage Temp.	0°C–70°C
	Humidity	10%–90%, non-condensing
	Vibration	1.0 g
	Protection class/Pollution degree	Protection class: IP20, pollution degree: 2 as per IEC 60664-1 Do not use in the following locations: corrosive or flammable gasses, water oil or chemical, dust including iron dust and salts
	Compliance	CE Pending
	Weight	0.2 kg
	Physical Dimensions	32.5 mm x 99.5 mm x 74.3 mm (WxHxD)

1.4 Dimensions

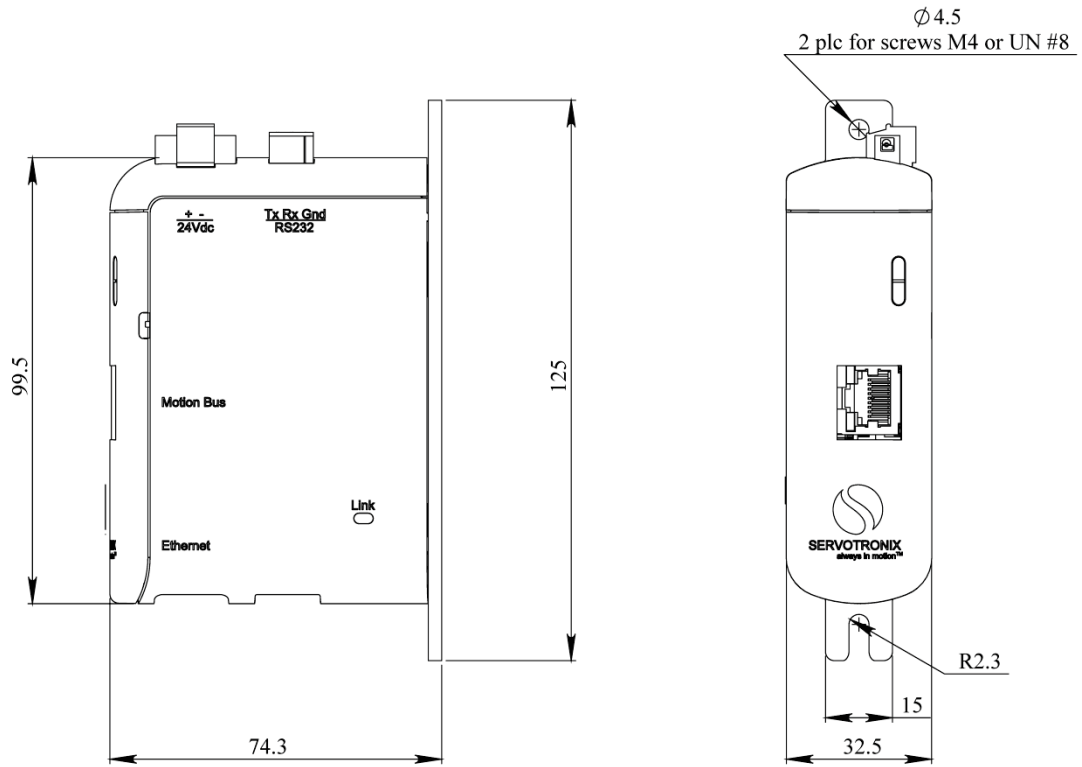


Figure 1-2. softMC 3 Dimensions – Book Mount

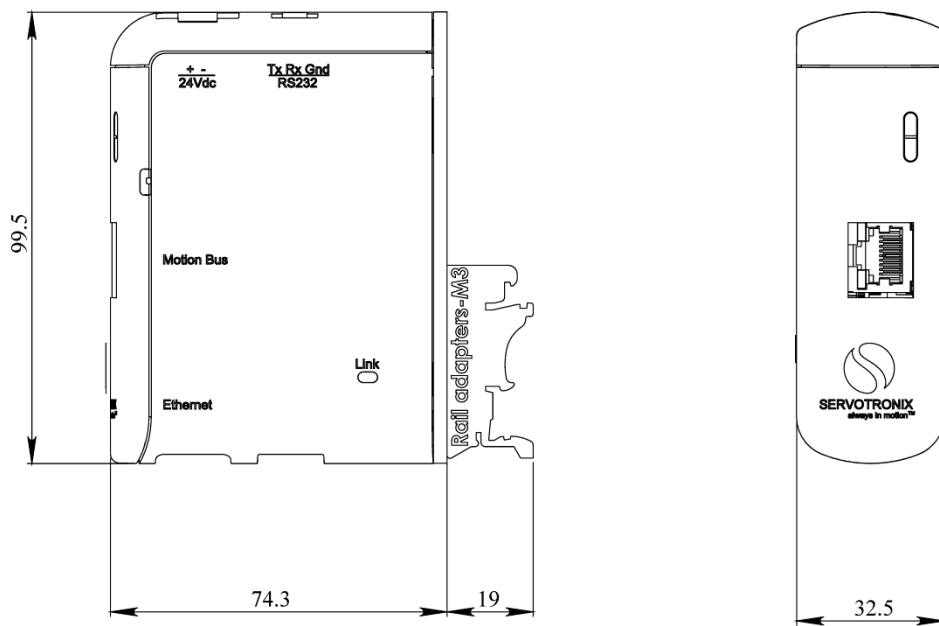


Figure 1-3. softMC 3 Dimensions – DIN Rail Mount

2 Safety

Failure to follow the safety instructions may result in personal injury and/or equipment damage.

2.1 Anti-Static Precautions



Warning.

Failure to take ESD precautions during installation of the softMC 3 may result in permanent damage to the equipment and/or serious injury to the user.

Electrostatic discharge (ESD) can cause serious damage to electronic components, including the softMC 3. Dry climates are especially susceptible to ESD. It is therefore critical that whenever the softMC 3 or any other electrical component is handled, the following anti-static precautions must be strictly followed.

- **Wear an anti-static wristband:** Wearing a simple anti-static wristband can help to prevent ESD from damaging the board.
- **Self-grounding:** Before handling the board, touch any grounded conducting material. During the time the board is handled, frequently touch any conducting materials that are connected to the ground.
- **Use an anti-static pad:** When configuring the softMC 3, place it on an anti-static pad. This reduces the possibility of ESD damaging the softMC 3.

2.2 Installation Precautions

Before beginning the installation, be sure you are aware of the following precautions.

- **Read the installation guide:** This guide provides installation instructions and configuration options for the softMC 3.
- **Disconnect Power:** Power to the softMC 3 must be disconnected during the installation process. Failing to disconnect the power may cause severe injury to the body and/or damage to the system.
- **Qualified Personnel:** The softMC 3 must be installed and operated only by trained and qualified personnel. Maintenance, upgrades, or repairs may only be carried out by qualified personnel.

2.3 General Safety Precautions

Be sure to heed the following safety precautions at all times.

- Do not attempt to open the softMC 3. There are no internal components intended for user access.
- Handle the softMC 3 gently, and avoid dropping or hitting it against hard objects or surfaces.
- Make sure power is turned off and the power cord is disconnected when moving, installing or configuring the system.
- Do not apply voltage levels that exceed the specified voltage range. Doing so may cause an electrical shock and/or fire.
- Do not insert any objects into the ventilation openings, or block the vents in any way.
- Do not use the softMC 3 in a site where the ambient temperature exceeds the rated temperature.
- If considerable amounts of dust, water, or fluids enter the system, turn off the power supply immediately, unplug the power cord, and contact Servotronix technical support: tech.support@servotronix.com

3 Installation Preparation

3.1 Required Computer System

The following computer system and software are required:

- Operating system: Windows XP-SP3, or Windows 7
- LAN connection
- Internet connection (for software download and help)
- ControlStudio, the graphical software interface for configuring and testing the drive. Download from the Servotronix website or contact Servotronix technical support: tech.support@servotronix.com

3.2 IP Address

The softMC 3 factory-defined configuration requires a LAN with DHCP IP address assignment.

Check with the IT manager at your site and make sure the softMC 3 will be able to connect to your site's LAN, and will be able to get an IP address from a DHCP server.

3.3 Required Tools

- A small slotted screwdriver for connecting terminal blocks.
- A Phillips screwdriver for mounting the controller on DIN rails.

3.4 Required Cables

- For **serial** communication: Serial cables
- For **CAN**: Shielded Cat 5e cables and shielded RJ45 connectors.
- For **EtherCAT**: Shielded Cat 5e cables and shielded RJ45 connectors.

Note

System setup requires shielded Cat 5e cables and shielded connectors with latching mechanism. Improper cables and connectors will cause bus fault and/or servo drive errors.

3.5 Interfaces

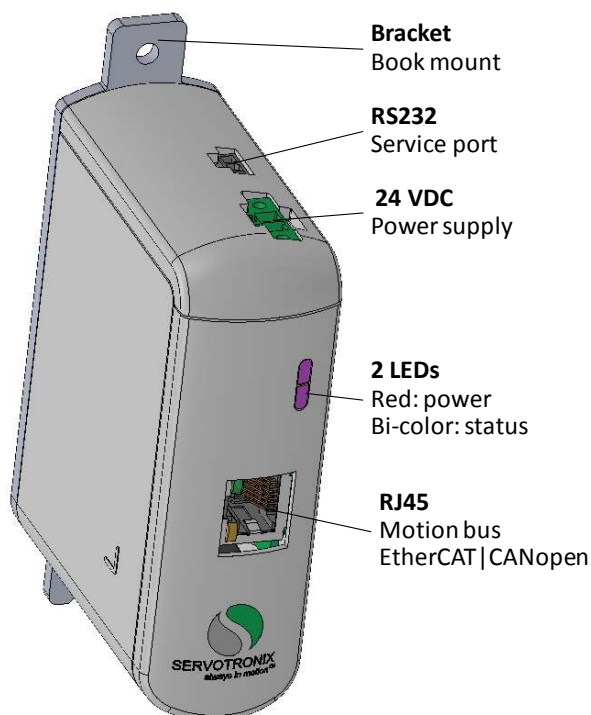


Figure 3-1. Interfaces – Front and Top Panels

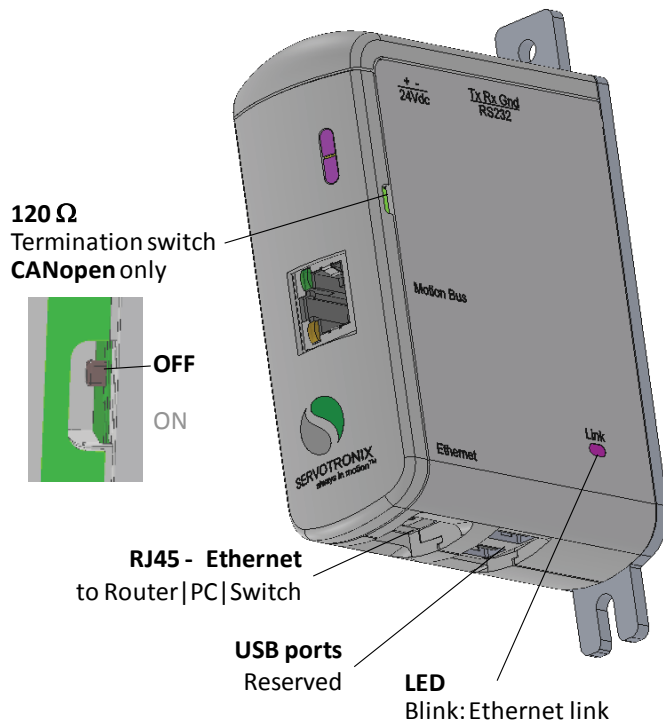


Figure 3-2. Interfaces – Bottom and Side Panels

RS232 Interface

The serial port is a service port. It is required only for setting or modifying the IP address of the softMC 3.

softMC 3 - Micro-Fit			PC - D9 Male		
Pin	Direction	Function	Pin	Direction	Function
1		GND	5		GND
2	In	Rx	3	Out	Tx
3	Out	Tx	2	In	Rx

24 VDC Power

Pin	Pin Label	Signal
1	+	24 VDC
2	-	Return

RJ45 – Motion Bus EtherCAT | CANopen

The motion bus RJ45 port serves as transmitter and receiver for devices operating on a CAN or Ethernet network.

Pin	Signal
1	CAN_H
2	CAN_L
3	CAN_GND

Note: In a **CAN Network**: If the servo drive or I/O device does not have an RJ45 connector, use this table to make your own cable.

RJ45 – Ethernet

The Ethernet RJ45 port serves to connect the softMC 3 to other devices on the system LAN (e.g., switch router, server).

4 Installation Procedure

4.1 DIN Rail Mounting (Optional)

The softMC 3 system can be mounted onto a DIN rail. Attach the supplied DIN rail to the softMC 3 rear panel.

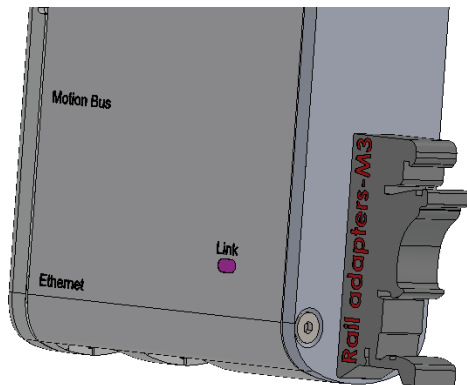


Figure 4-1. DIN Rail Mounting

4.2 Cable Connections

The following cable connections are required, regardless of the type of network or softMC 3. They can be performed in any order.

Do not turn on the softMC 3 until all cable connections are completed.

Refer to the system wiring diagrams in the following sections.

- Connect the softMC 3 **RS232** serial port to the PC serial port using a serial cable. This connection is required only for service, and for setting the IP address of the softMC 3.
- Connect the softMC 3 **Ethernet** port to the site's LAN network (or connect directly to the PC) using a shielded Cat 5e cable.
- Connect the softMC 3 **Motion Bus** port to one or more drives and/or I/O modules. See following sections.
- Connect softMC 3 to **24 VDC** power supply.

Do not yet turn on the softMC 3.

4.3 Connecting softMC 3 and CDHD – CANopen Models

Be sure to use shielded Cat 5e cables and shielded RJ45 connectors.

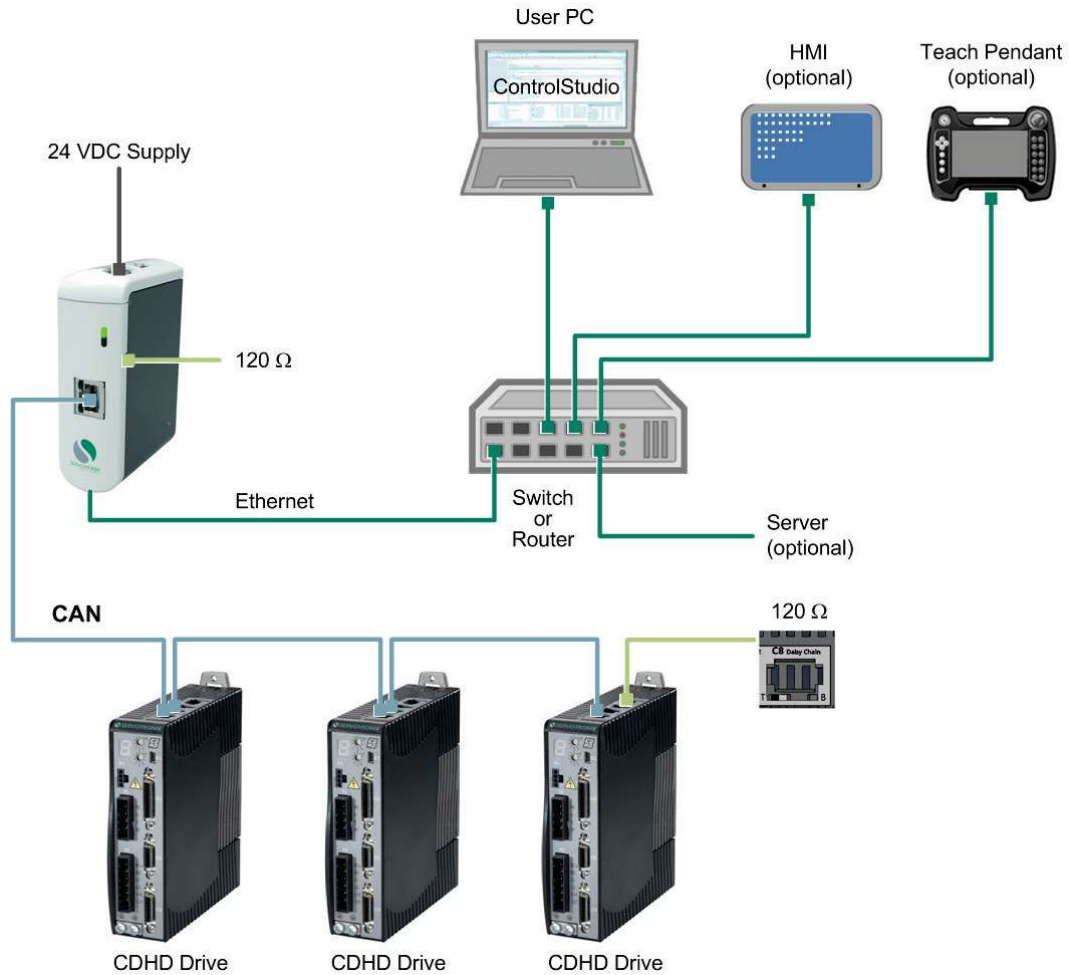


Figure 4-2. Example of Setup with CDHD in a CAN Network

A 120 Ω termination resistor is required at both ends of the CAN bus network between CAN_L and CAN_H. This is the responsibility of the user.

- On the softMC 3, make sure the 120 Ω termination switch is set to ON.
- On the last CDHD in the chain, make sure the 120 Ω termination switch is set away from T.

4.4 Connecting softMC 3 and CDHD – EtherCAT Models

To connect the controller and drives, simply connect RJ45 connectors from drive to drive.

Be sure to use shielded Cat 5e cables and shielded RJ45 connectors.

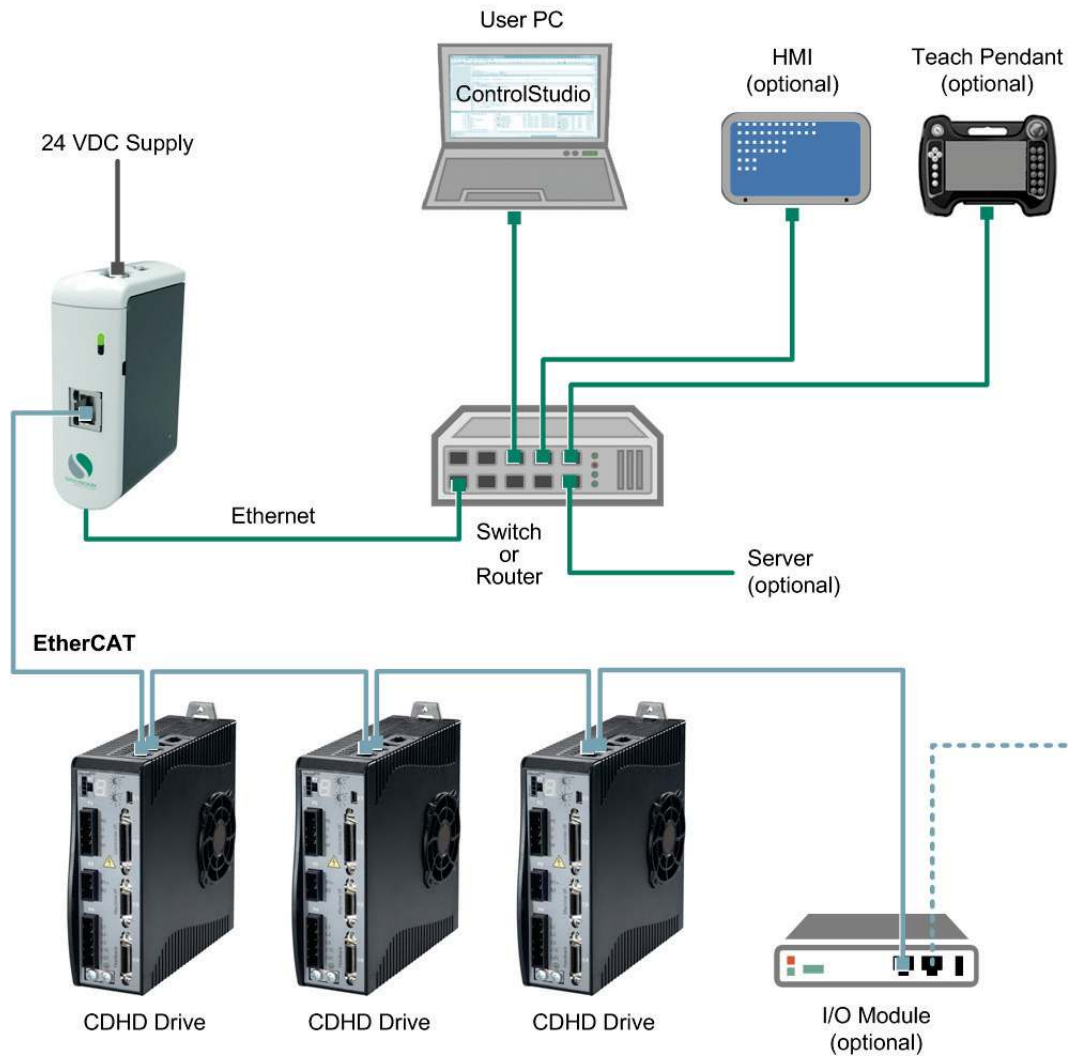


Figure 4-3. Example of Setup with CDHD in EtherCAT Network

4.5 Connecting softMC 3 and stepIM – CANopen Models

Be sure to use shielded Cat 5e cables and shielded RJ45 connectors.

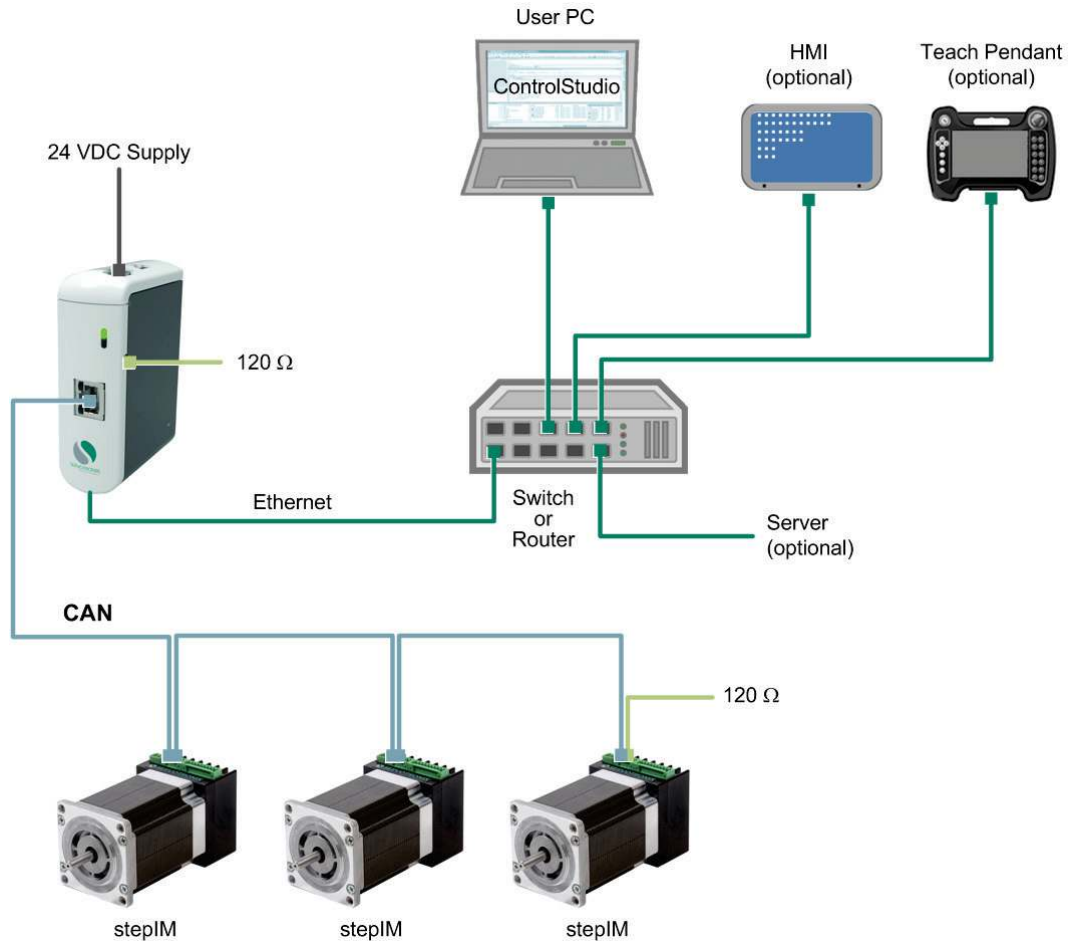


Figure 4-4. Example of Setup with stepIM in CAN Network

A 120 Ω termination resistor is required at both ends of the CAN bus network between CAN_L and CAN_H. This is the responsibility of the user.

- On the softMC 3, make sure the 120 Ω termination switch is set to ON.
- On the last stepIM in the chain, be sure to add a 120 Ω termination resistor, according to the following table and diagram:

Signal	softMC 3 - Pin Motion Bus	stepIM - Pin Phoenix Connector
CAN_H	1	1
CAN_L	2	2
CAN_GND	3	3

Note | The cat 5e cable wiring scheme can be either T568A or T568B.

4.6 ControlStudio Software Installation

ControlStudio software is a development tool for motion applications. It contains a programming editor, data recorder, debugger and monitoring tools.

1. Download the ControlStudio software installation file from the Servotronix website: <http://www.servotronix.com/softMC.html>.
2. Run the ControlStudioSetup.exe file to install ControlStudio on the host computer.

When installation is complete, start ControlStudio from the software icon on your desktop.

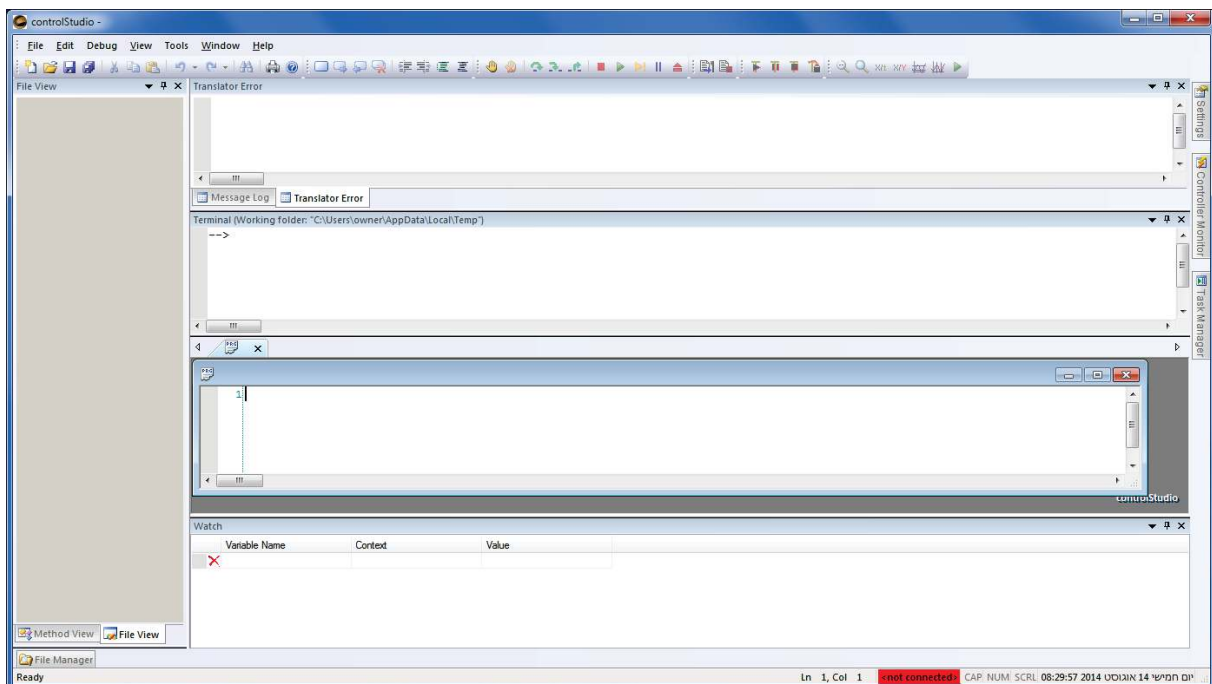


Figure 4-5. ControlStudio

ControlStudio Documentation

Use the ControlStudio **Help** button to access the online software documentation.

The password that allows access to the help files is installed during the ControlStudio software installation.

4.7 Serial Communication

To define the serial communication parameters, use a serial console program, such as **PuTTY**.

Note: The default login for serial console is **mc**. It provides all required permissions for system setup and configuration.

1. Configure the softMC 3 serial port according to the settings shown in the following figures. After setting the parameters, click **Open**.



Figure 4-6.



Figure 4-7.

1. Make sure the serial cable is connected between the softMC 3 RS232 port and the PC.
2. Turn on the softMC 3.

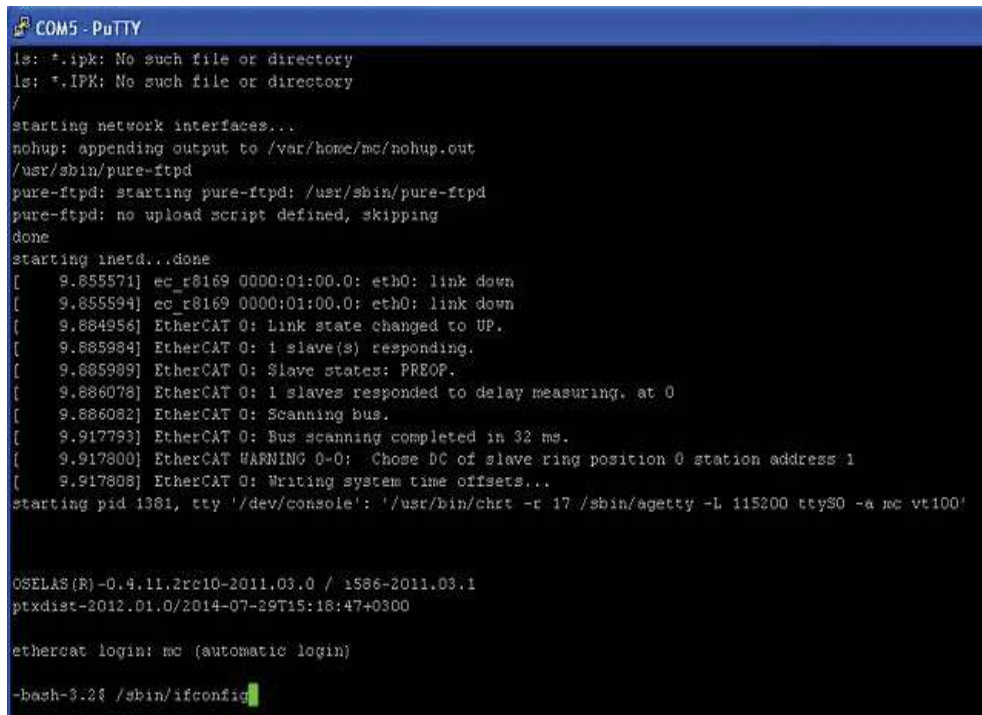
Several seconds after power up, softMC 3 issues a short beep.

After the firmware has loaded, softMC 3 issues a long beep to indicate a successful initialization. Firmware loading may take from 15 seconds to 2 minutes, depending on the speed of the DHCP server.

If initialization fails, softMC 3 issues two long beeps.

3. Watch the serial console screen, and wait for the prompt at the end of the softMC 3 initialization.

Enter the instruction: `/sbin/ifconfig`



```
COM5 - PuTTY
ls: *.ipk: No such file or directory
ls: *.IPK: No such file or directory
/
starting network interfaces...
nohup: appending output to /var/home/mc/nohup.out
/usr/sbin/pure-ftpd
pure-ftpd: starting pure-ftpd: /usr/sbin/pure-ftpd
pure-ftpd: no upload script defined, skipping
done
starting inetd...done
[ 9.855571] ec_r8169 0000:01:00.0: eth0: link down
[ 9.855594] ec_r8169 0000:01:00.0: eth0: link down
[ 9.884956] EtherCAT 0: Link state changed to UP.
[ 9.885984] EtherCAT 0: 1 slave(s) responding.
[ 9.885989] EtherCAT 0: Slave states: PREOP.
[ 9.886078] EtherCAT 0: 1 slaves responded to delay measuring. at 0
[ 9.886082] EtherCAT 0: Scanning bus.
[ 9.917793] EtherCAT 0: Bus scanning completed in 32 ms.
[ 9.917800] EtherCAT WARNING 0-0: Choose DC of slave ring position 0 station address 1
[ 9.917808] EtherCAT 0: Writing system time offsets...
starting pid 1361, tty '/dev/console': '/usr/bin/chrt -r 17 /sbin/agetty -L 115200 ttyS0 -a mc vt100'

OSELAS(R)-0.4.11.2rc10-2011.03.0 / 1586-2011.03.1
ptxdist-2012.01.0/2014-07-29T15:18:47+0300

ethercat login: mc (automatic login)

-bash-3.2$ /sbin/ifconfig
```

Figure 4-8.

The following output is displayed:


```

COM5 - PuTTY

OSELAS(R)-0.4.11.2rc10-2011.03.0 / i586-2011.03.1
ptxdist-2012.01.0/2014-07-29T15:18:47+0300

ethercat login: mc (automatic login)

-bash-3.2$ /sbin/ifconfig
eth0      Link encap:Ethernet  HWaddr 00:18:7D:2C:CB:92
          inet addr:10.4.20.210  Bcast:10.4.20.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MTU:1500  Metric:1
          RX packets:405 errors:0 dropped:0 overruns:0 frame:0
          TX packets:3 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:37644 (36.7 KiB)  TX bytes:318 (318.0 B)
          Interrupt:42 Base address:0x2000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

-bash-3.2$

```

Figure 4-9.

Note that **inet addr** in the section **eth0** will show the current IP address of the softMC 3 that you are using, and not **10.4.20.210** as in these examples.

4.8 IP Address

The IP address of the softMC 3 can be defined in any of three ways.

- DHCP – assigned by DHCP server – *recommended*
- Fixed IP address – assigned by user
- Manual IP address – assigned by ControlStudio

4.8.1 Get an IP Address from a DHCP Server

The softMC 3 is factory-configured to get the IP address from the DHCP server by default.

4.8.2 Manually Assign an IP Address Using ControlStudio

Note: The host PC's IP address must be in the same subnet as the addresses in the ControlStudio IP pool.

1. Start ControlStudio software.

Note the tabs on the right side of the screen:

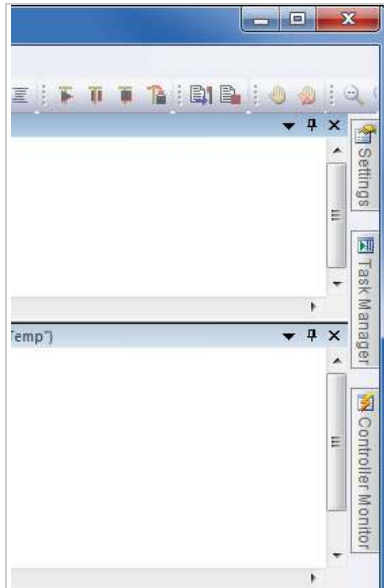


Figure 4-10.

1. Click the **Settings** tab.
In the Settings pane, go to Connector Monitor, and set **TCP/IP connection** to **Automatic IP**.

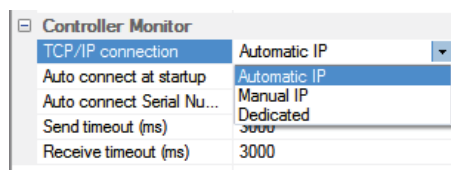


Figure 4-11.

ControlStudio now sends a broadcast over the network, searching for all softMC 3 controllers present on the network. softMC 3 controllers that do not yet have an IP address are assigned an IP address from the IP Pool file.

- Notes:** The **IP Pool** file must contain a list of IP addresses that the network administrator has explicitly excluded from the DHCP range and reserved exclusively for use by softMC 3 controllers.

2. Click the **Controller Monitor** tab.

All softMC 3 controllers that are present on the network are displayed in the list, together with the manual IP address assigned to each of them.

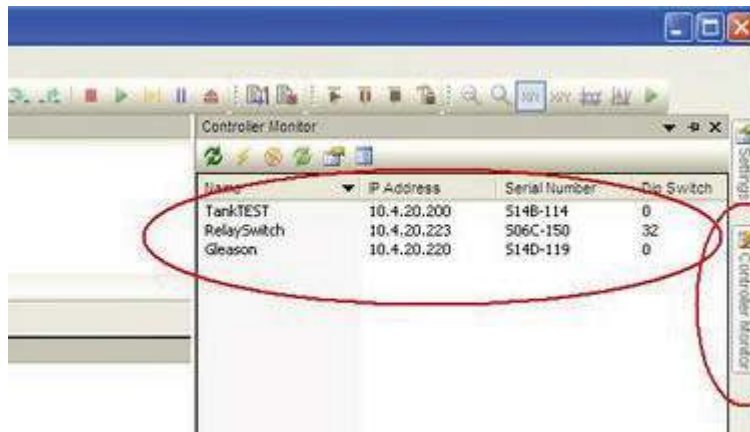


Figure 4-12.

- To connect to a softMC 3 controller, select it from the list and double-click. Once the connection is established, the name and IP of the softMC 3 are displayed in the status bar at the bottom of the screen, highlighted in green.

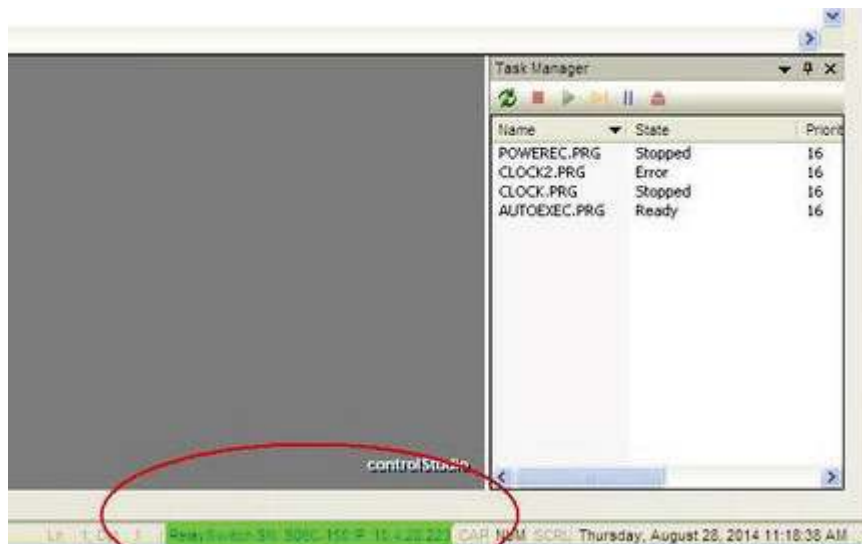


Figure 4-13.

4.8.3 Define a Fixed IP Address

Note: The host PC's IP address and the softMC 3 must be in the same address space.

- Using the text editor over the serial (RS232) connection, create the file FWCONFIG (no extension, upper case):

```
nano/FFS0/FWCONFIG
```

- Enter the following instructions:

```
ipaddressmask aaa.bbb.ccc.ddd:eee.fff.ggg.hhh
sleep 20
ramdisksize=64 mByte
StringPreload=30000
```

Where *aaa.bbb.ccc.ddd:eee.fff.ggg.hhh* holds the permanent IP address and subnet mask that will be assigned to the softMC 3.



```
COM5 - PuTTY
GNU nano 1.3.12      File: /FFSO/FWCONFIG      Modified

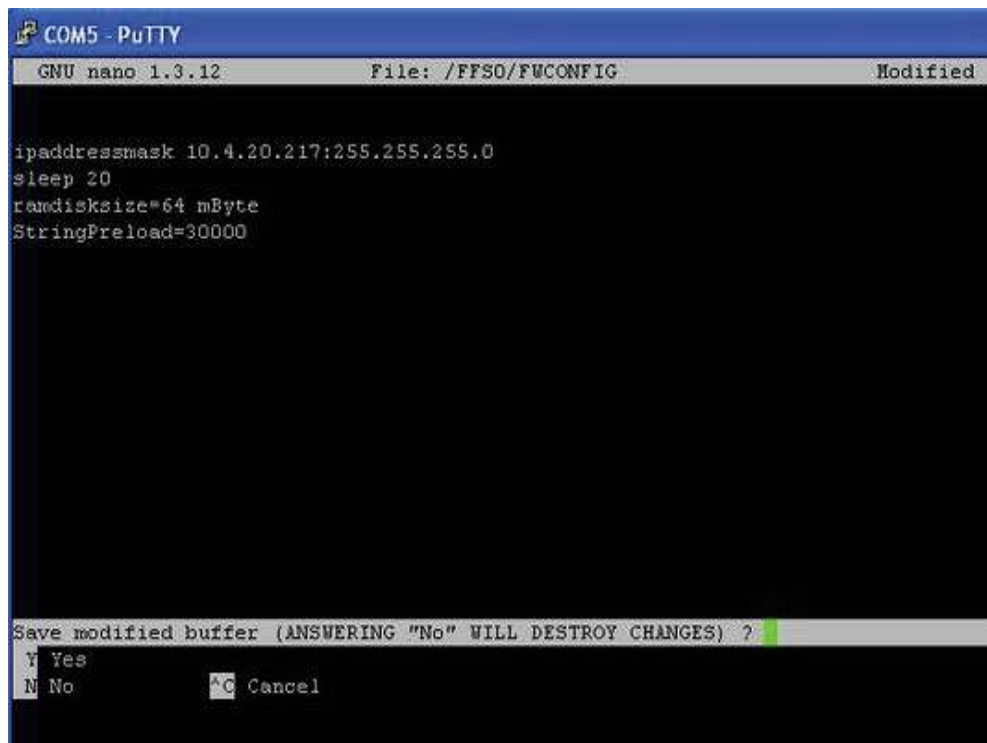
ipaddressmask 10.4.20.217:255.255.255.0
sleep 20
ramdisksize=64 mByte
StringPreload=30000

^G Get Help  ^O WriteOut  ^R Read File  ^V Prev Page  ^K Cut Text   ^C Cur Pos
^X Exit      ^J Justify   ^W Where Is  ^N Next Page  ^U UnCut Text ^T To Spell
```

Figure 4-14.

3. Press <Ctrl>+X

A message will prompt you to save the new file.



```
COM5 - PuTTY
GNU nano 1.3.12      File: /FFSO/FWCONFIG      Modified

ipaddressmask 10.4.20.217:255.255.255.0
sleep 20
ramdisksize=64 mByte
StringPreload=30000

Save modified buffer (ANSWERING "No" WILL DESTROY CHANGES) ?
Y Yes
N No      ^C Cancel
```

Figure 4-15.

4. Click **Y**.

The file is saved, and the prompt returns to the command line.

5. Now reset the softMC 3. It will boot up with the permanent IP address you defined.

A fixed IP address can be changed from the application or in CONFIG.PRG, using the MC-Basic command `SYS.IPADDRESSMASK`.

softMC 3
Multi-Axis Motion Controller
Installation Guide