DCX-PCI300

Modular Multi-Axis Motion Control System

Introduction and Installation Guide

Revision 1.2d

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Document Revision history

Revision	Date	Description
1.0 Pre	3/12/2001	Preliminary release
	4/6/2001	Added preliminary pinouts for –H (high density) MC3XX modules
	5/2/2001	Edited controller and MCAPI installation descriptions
	5/13/2001	BF3XX-H pinouts and high density connectors module mapping
	5/14/2001	BF320 pinouts
1.0	5/22/2001	Initial release
1.1	7/26/2001	Added Motion Integrator support
1.2	1/15/2002	Added Dual Axis Motion Control Modules (DCX-MC302-H, DCX-MC362-H) Emphasized high density connections throughout document
	1/15/2002	Added Windows XP as a supported operating system
	1/16/2002	Changed module opto isolated inputs to 5 volt (from 12V – 24V)
	1/17/2002	Added MCAPI Status Panel utility
1.2c	8/16/2002	Edited -H/-R typos on pages 8 and 13 Updated ribbon cable connector manufacturer part number
	7/3/2003	Fixed typo (MC360-R Aux. Encoder Power J3-10) Edited MC360-R wiring example
1.2d	12/19/2003	Added J5 connector label to DCX-PCI300 motherboard drawing

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Prologue

The documentation set for the DCX-PCI300 is divided into four volumes. The titles of each of the individual volumes are:

DCX-PCI300 Introduction and Installation Guide
DCX-PCI300 User's Manual
Motion Control Application Programming Interface (MCAPI) Reference Manual
Motion Control Command Language (MCCL) Reference Manual

Al four volumes of the documentation set are available on PMC's **MotionCD**. In addition to PDF versions of the DCX-PCI300 documentation set the **MotionCD** includes:

- Tutorials (PowerPoint presentations)
  An Introduction to PMC Motion Control
  Installing a PMC Motion Controller (Does not Address PCI bus controllers)
  Introduction to Motion Control Programming with the Motion Control API
  Servo Systems Primer
  DCX Servo Tuning

- PMC AppNOTES – detailed descriptions of specific motion control applications

- PMC TechNOTES – one page technical support documents

- PMC Product catalogs and brochures

Chapter

1

Introduction

Motion controller - a device that uses a digital processor to coordinate the movement of mechanical systems.

The DCX-PCI300 is an Intel compatible PC computer based servo motor, stepper motor, and I/O controller.

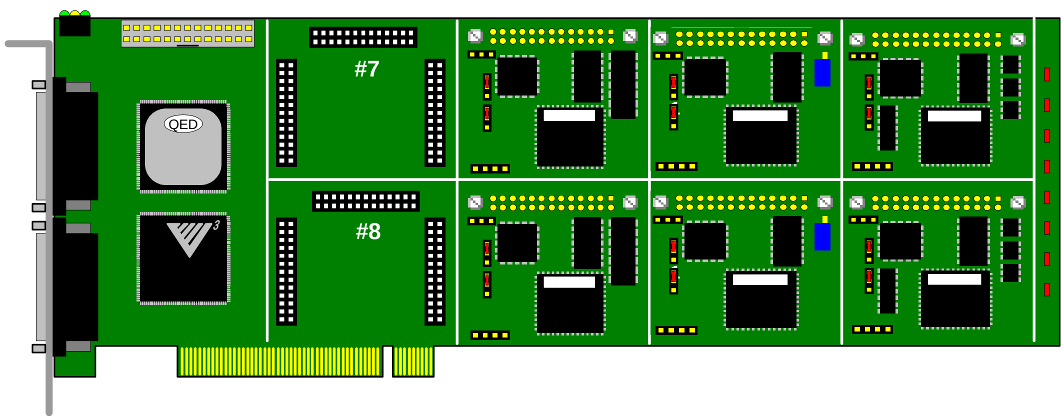


Figure 1: The high density connector version (DCX-PCI300-H) of the DCX-PCI300 Motion Controller

In Windows XP/2000/Me/98 systems the DCX-PCI 300 is a true PCI ‘plug and play’ card. When the PC is turned on, the DCX-PCI300 is *dynamically addressed* into the memory map of the PC. The PC communicates with the motion controller via dual ported memory on the DCX-PCI300. The PC can issue commands (move a motor, change the velocity, etc.) to the controller, and retrieve data from the controller (report to position of an axis, report the state of a digital input, etc.) without interrupting the basic operations of the controller.

But a hardware based motion control card provides only one half of the overall motion control solution. State of the art motion control systems typically require sophisticated multi-threaded application programs and eye catching operator interfaces. PMC’s **Motion Control Application Programming Interface** (**MCAPI**) provides the machine designer with device drivers and a powerful function library for Windows XP/2000/NT/Me/98 based applications.

Figure 2: PMC's Windows Motion Control Panel

```
MCEnableAxis( HCTRLR hCtlr, Word xAxis, short int bState );
MCMoveRelative( HCTRLR hCtlr, Word xAxis, double Distance );
MCIsStopped( HCTRLR hCtlr, Word xAxis, double Timeout );
```

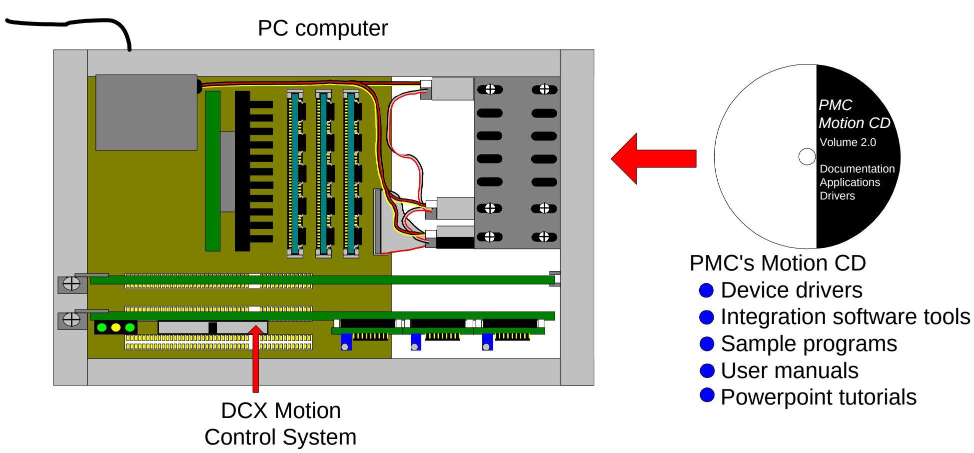
Figure 3: Function Library examples

The MCAPI supports today's popular programming environments including:

- C/C++
- Visual Basic
- Delphi
- LabVIEW

The DCX-PCI300 Motion Controller can be installed in most any Windows PC computer. It executes motion functions independent of the host, so other than the minimum requirements for the selected operating environment (XP/2000/NT/ME/98), the DCX-PCI300 **does not require or use any additional PC resources** (CPU speed, PC memory, hard disk space, etc...).

All documentation, tutorials, and software (drivers, function library, diagnostics and utilities) are available on PMC's **MotionCD**.



The Modular DCX System

The modular architecture of the DCX system allows the user to '**mix and match**' DCX components to meet the **specific requirements of each application**. The DCX system controls the motion of any combination of servos and stepper motors simultaneously. In addition the DCX modular system supports expandable digital I/O and analog I/O.

The term **DCX** refers to a system consisting of from 1 to 9 circuit boards assembled together to form a motion control assembly. The platform of a DCX system is the DCX-PCI300 "motherboard". It is a 'full' size (approximately 4" x 12.25") PCI peripheral card. It communicates with the PC host via the PCI bus. On board dual ported memory is used to pass motion commands and report data between the DCX controller and the PC. The on board CPU (**192MHz MIPS**) allows the DCX to operate autonomously from the PC, freeing the host to process critical events while the DCX handles all motion control. But please note - the DCX-PCI300 motherboard is the processing / communication / synchronizing engine of the DCX system, but on its own it provides no actual motion control.

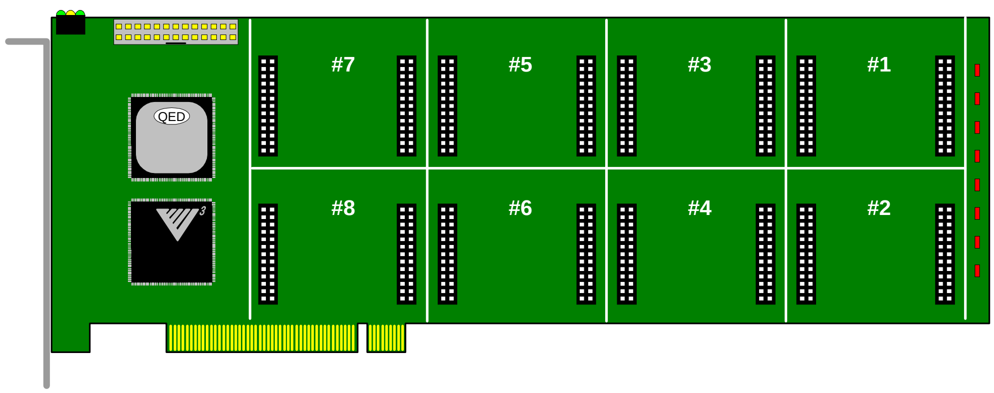


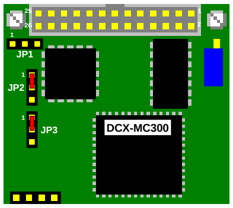
Figure 4: The ribbon cable connector version of the DCX-PCI300 Motion Control Motherboard

To complete the DCX Modular Motion Control System, on to the DCX-PCI300 motherboard the user installs as many as eight, 2 inch square "daughter boards" known as "DCX modules" . DCX motion control modules provide:

- The motion control command output - +/- 10V(single or dual) or Step/Dir / CW/CCW (single or dual)
- PID filter with velocity, acceleration and deceleration feed forward (servo's modules only)
- On board commutation (sine commutation servo only)
- Buffering and monitoring of axis I/O (+/- Limits, Home, Amp/Driver enable)
- Encoder interface and decode

The DCX-PCI300 motherboard currently supports five DCX modules, three for motion control and two for general purpose I/O. A key feature of the DCX system is its ability to sense which DCX modules are present. This results in easy system configuration; simply install whatever modules the application calls for. The logic on the motherboard will adjust its' operation accordingly.

DCX Motion Control Modules

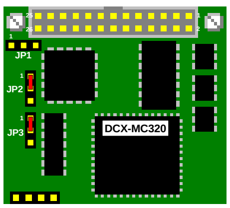


DCX-MC300 Servo Motor Control Module
DCX-MC300-H (for high density cabling)
DCX-MC300-R (for ribbon cable connections)

Supported motor type: DC Brushless, Brush, Hydraulic Servo Valves, Pneumatic Servo Valves

Command output: **+/- 10 volt, 16 bit analog for use with servo amplifier**

I/O
Inputs (opto isolated)- Encoder Coarse Home, Limit +, and Limit -, Amplifier Fault
Output (opto isolated) – Amplifier Enable
Feedback: Quadrature Incremental Encoder Interface, 10 MHz
Primary - Quadrature Incremental Encoder, 10MHz, Single ended (A, B, Z) or
Differential (A+, A-, B+, B-, Z+, Z-)
Auxiliary - Quadrature Incremental Encoder, 10 MHz, Single ended (A, B, Z+, Z-)

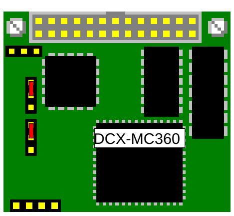


DCX-MC320 AC Brushless Servo Motor Control Module with on-board Sine Commutation
DCX-MC320-H (for high density cabling)
DCX-MC320-R (for ribbon cable connections)

Supported motor type: Brushless AC Servo, Linear Motor

Command output: dual **+/- 10 volt, 16 bit analog for use with servo amplifier**

I/O
Inputs (opto isolated) - Encoder Coarse Home, Limit +, and Limit -, Amplifier Fault
Output (opto isolated) – Amplifier Enable
Feedback:
Primary - Quadrature Incremental Encoder, 10 MHz, Single ended (A, B, Z) or
Differential (A+, A-, B+, B-, Z+, Z-)
Auxiliary – Hall Effect Sensors (A, B, C)



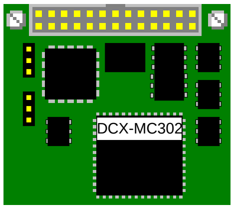
DCX-MC360 Stepper Motor Control Module
DCX-MC300-H (for high density cabling)
DCX-MC300-R (for ribbon cable connections)

Supported motor type: Open loop stepper, Closed loop stepper, Step/Dir controlled servo

Command output: **Step/Direction or CW/CCW (software programmable), open collector drivers (+5 to +30 volts @ 125 ma)**

I/O
Inputs (opto isolated)- Home, Limit +, and Limit -, Null
Outputs (open collector driver) – Drive Enable, Half/Full step, Full/Half current
Feedback (optional):
Quadrature Incremental Encoder, 10MHz, Single ended (A, B, Z) or
Differential (A+, A-, B+, B-, Z+, Z-)

DCX Motion Control Modules (continued)

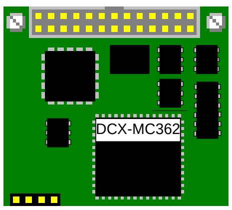


DCX-MC302-H Dual Servo Motor Control Module

Supported motor type: DC Brushless, Brush, Hydraulic Servo Valves, Pneumatic Servo Valves

Command output: Dual **+/- 10 volt, 16 bit analog for use with servo amplifier**

I/O
Inputs (opto isolated)- Dual Encoder Coarse Home, Dual Limit +, Dual Limit -, Dual Amp. Fault
Output (opto isolated) – Dual Amplifier Enable
Feedback: Dual Quadrature Incremental Encoder Interface, 10 MHz
Single ended (A, B, Z) or Differential (A+, A-, B+, B-, Z+, Z-)



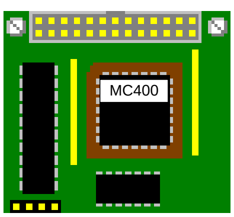
DCX-MC362-H Dual Stepper Motor Control Module

Supported motor type: Open loop stepper or Step/Dir controlled servo

Command output: Dual **Step/Direction or CW/CCW (software programmable), open collector drivers (+5 to +30 volts @ 125 ma)**

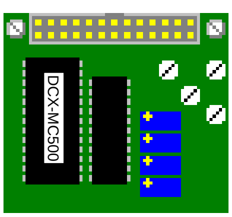
I/O
Inputs (opto isolated)- Dual Home, Dual Limit +, Dual Limit -, Dual Drive Fault
Outputs (open collector driver) – Dual Drive Enable, Dual Full/Half current

DCX General Purpose I/O Modules



DCX-MC400 - 16 Channel Digital I/O Expansion module
DCX-MC400-H (for high density cabling)
DCX-MC400-R (for ribbon cable connections)

Each channel is individually programmable as either an input or output
TTL level (0 – 5 volt, 2 ma sink/source)



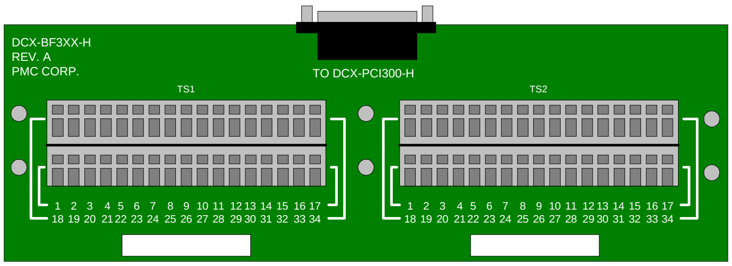
DCX-MC500 – 4 Channel Analog I/O Expansion module
MC500-H – 4 input channels & 4 output channels (high density cabling)
MC510-H – 4 input channels only (high density cabling)
MC520-H – 4 output channels only (high density cabling)

MC500-R – 4 input channels & 4 output channels (ribbon cable connections)
MC510-H – 4 input channels only (ribbon cable connections)
MC520-H – 4 output channels only (ribbon cable connections)

Inputs – 4 channels, 0 – 5 volts, 12 bit
Outputs – 4 channels, 0 – 5 volts and/or –10 - +10 volts, 12 bit

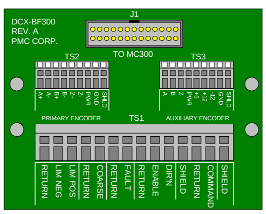
DCX Motion Control Breakout Assemblies

High Density Connection Breakouts

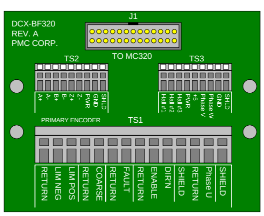


DCX-BF3XX-H – DIN Rail mounted breakout assembly for all -H DCX Modules. Each unit DCX-BF3XX-H breakouts out all signals for 2 DCX module locations.

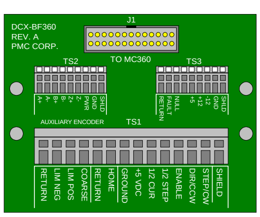
Ribbon Cable Connection Breakouts



DCX-BF300-R – DIN Rail mounted breakout assembly for DCX Servo Motor Control Module (DCX-MC300-R).



DCX-BF320-R – DIN Rail mounted breakout assembly for DCX AC Brushless Servo Motor Control Module (DCX-MC320-R).



DCX-BF360-R – DIN Rail mounted breakout assembly for DCX Stepper Motor Control Module (DCX-MC360-R).

DCX-PCI300 Offers Two Connection Options

For years the traditional method of connecting a PC based motion controller to the 'outside world' (amplifier/driver, sensors, switches, encoders, etc.) has been to use ribbon cables. Besides the fact that the component and labor costs of ribbon cables are very low, the tooling costs are even less. Who doesn't have a small vice in their workshop?

But in today's world of 'smaller, faster, better, and cheaper' the connection requirements placed upon the PC based motion controller have increased due to:

- Increasing demands for maximum reliability
- Tighter packaging requirements
- Government standards compliance

For these reasons the DCX-PCI300 motion controller is available with two different connection solutions:

- High density connections using VHDCI Ultra SCSI cables
- Ribbon cable connections with 26 conductor cables

High Density connector version – DCX-PCI300-H
The DCX-PCI300-H motion controller uses high density shielded connectors (AMP P/N 787962-2) that mate with 'off the shelf' cables used by **RAID** (**R**edundant **A**rray of **I**ndependent **D**isks) network servers. The connector is known as **VHDCI 0.8mm** (sometimes called **SCSI V** or **Ultra SCSI**). The module I/O signals are routed from the J3 connector on the DCX modules, through the DCX motherboard, to the VHDCI connectors. Appending a **-H** to the end of the part number identifies the high density connector version of the DCX-PCI300 motion controller.

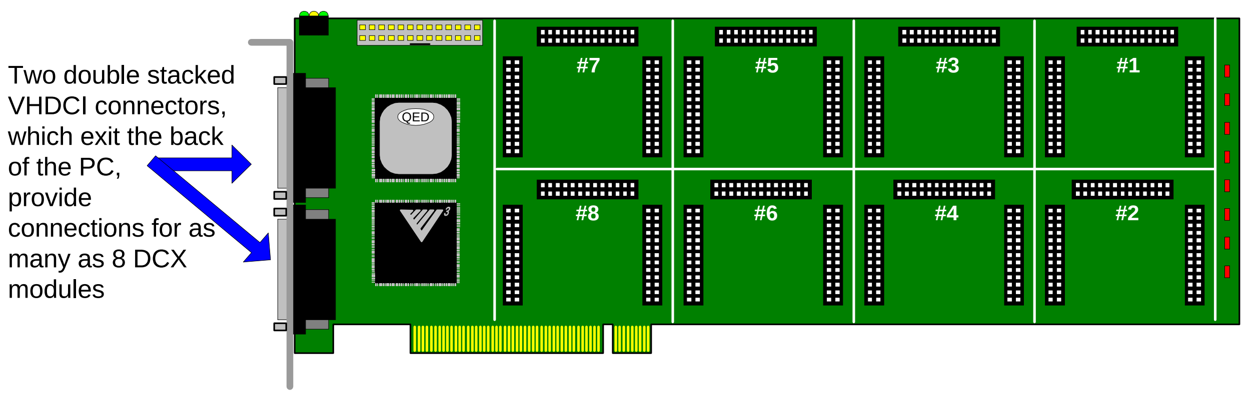
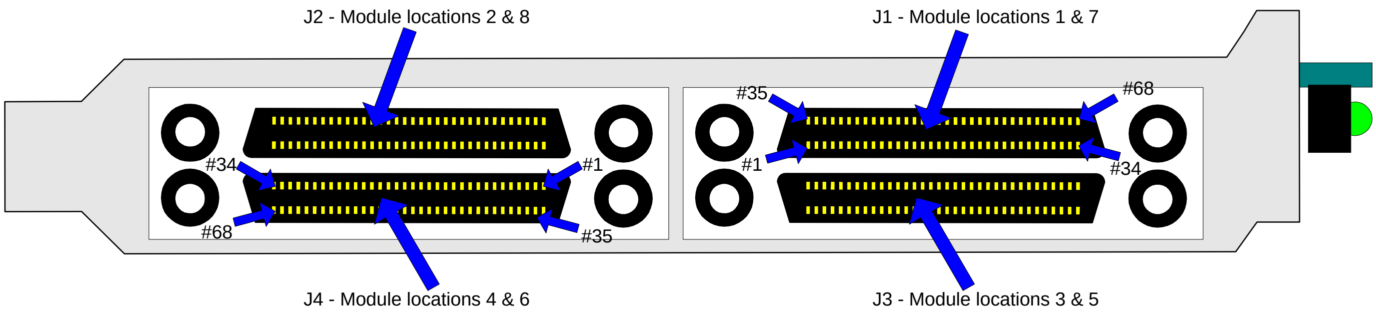


Figure 5: High density connector version of the DCX-PCI300 (DCX-PCI300-H)

Following the SCSI specification, the VHDCI connector has 68 contacts, and the shielded mating cable twists conductors 1 & 64, 2 & 63 and so on. The DCX-PCI300-H uses two double stacked VHDCI connectors, resulting in a total of four 68 pin connectors (272 contacts)

All I/O signals from the J3 connector of the DCX modules are routed through the PCI300-H printed circuit board to the 4 VHDCI connectors. As with the PCI300-H motherboard, to specify a high density connector version of a DCX module, append a **-H** to the end of the module part number. The pinout for the VHDCI connectors is available in chapter 6 **Connectors, Jumpers, and Schematics**.



VHDCI connectors as viewed from the back of the computer
(component side down)

Figure 6: VHDCI connectors as viewed from the back of the PC computer

High density accessories
The PCI300-H is designed to be used by OEM machine builders who would build their own cables and signal breakouts. First time users and low volume OEM's can purchase all necessary accessories for completing DCX-PCI300-H motion control system.

- 6 foot long high density cable (P/N **DCX-PCICBL-H**). Each of the four 68 pin connectors on the DCX-PCI300-H provides I/O connections for 2 axes. To route all signals for eight / fifteen axes requires four high density cables.
- High density cable signal breakout (P/N **DCX-BF3XX-H**) works with all –H DCX modules

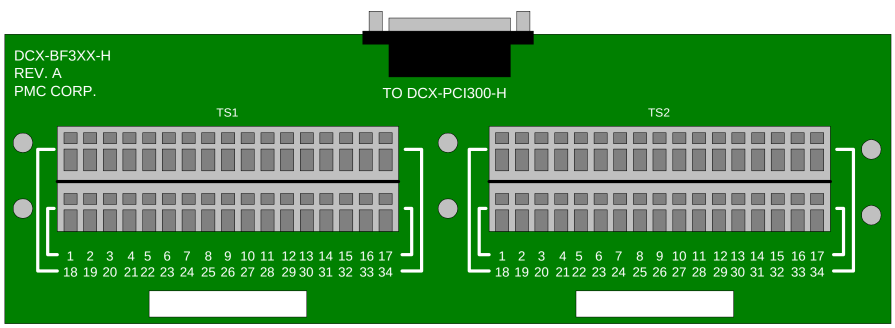


Figure 7: The DCX-BF3XX-H breakout is compatible with all -H versions of DCX modules. One DCX-BF3XX-H provides clamp type connections for two DCX modules

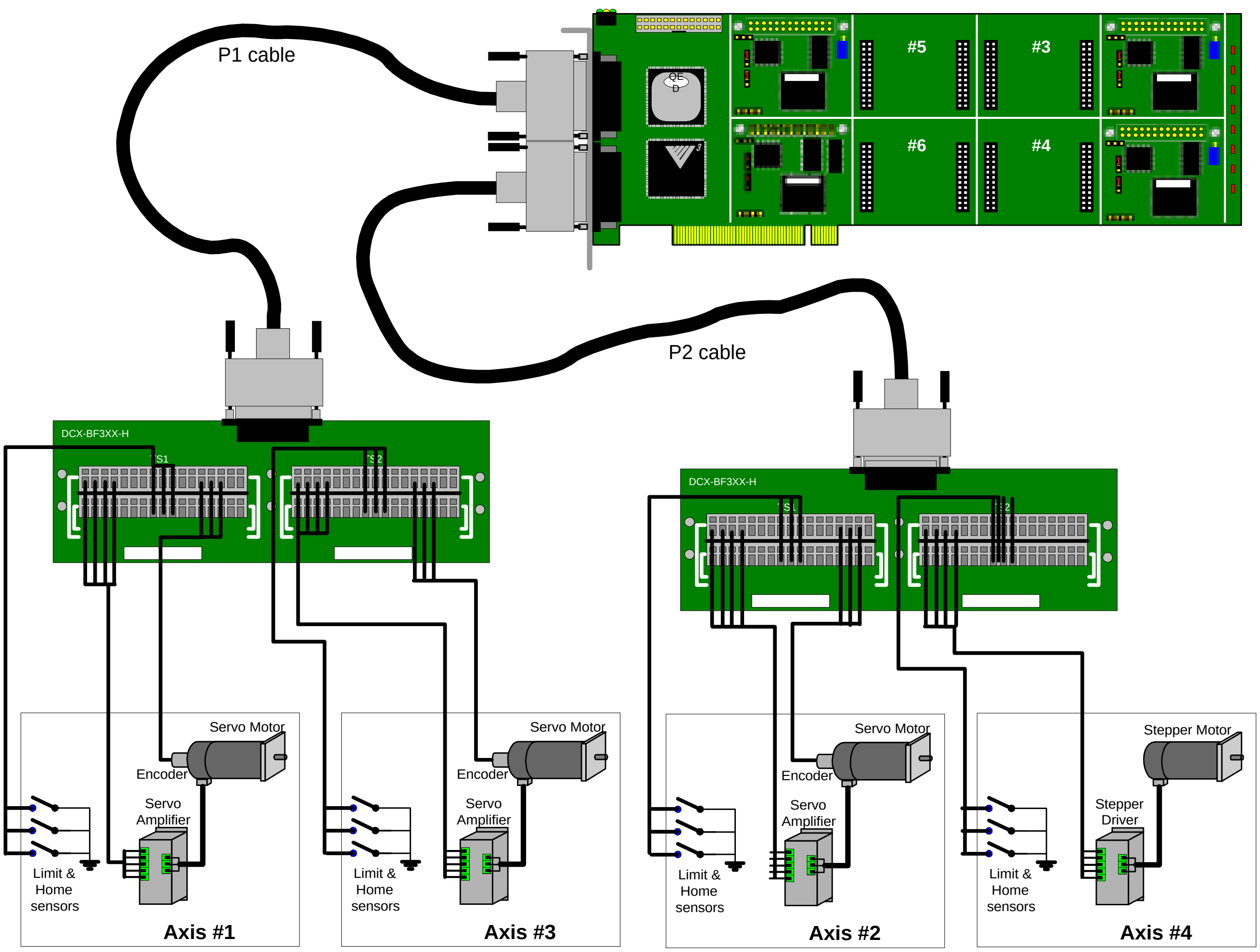
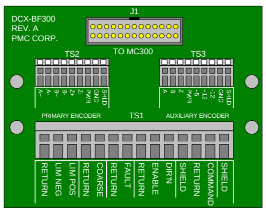


Figure 8: Typical connections for a 4 axis DCX-PCI300-H system (modules in locations 1, 2, 7, & 8)

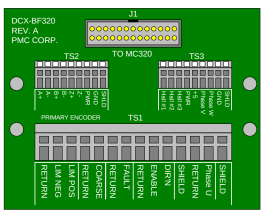
Ribbon cable version – DCX-PCI300-R
The **–R** version of the DCX-PCI300 allows the user to connect to the outside world with simple 26 conductor ribbon cables. Each **–R** DCX module has a 26 pin shrouded and polarized header into which the ribbon cable connector is inserted. From here the machine designer has two options:

- Option #1 – the other end of the ribbon cable can be directly connected to the 'outside world'
- Option #2 – an externally mounted breakout card can be used to transition from the light duty 28AWG. ribbon cable conductors to a more rugged wire type. For this option PMC does offer breakout assemblies (DCX-BF300-R, DCX-BF320-R, and DCX-BF360-R) or the user can design his/her own.

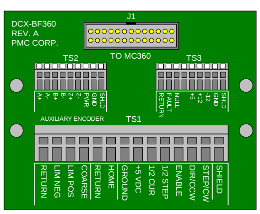
DCX Motion Control Breakout Assemblies



DCX-BF300-R – DIN Rail mounted breakout assembly for DCX Servo Motor Control Module (DCX-MC300-R).



DCX-BF320-R – DIN Rail mounted breakout assembly for DCX AC Brushless Servo Motor Control Module (DCX-MC320-R).



DCX-BF360-R – DIN Rail mounted breakout assembly for DCX Stepper Motor Control Module (DCX-MC360-R).

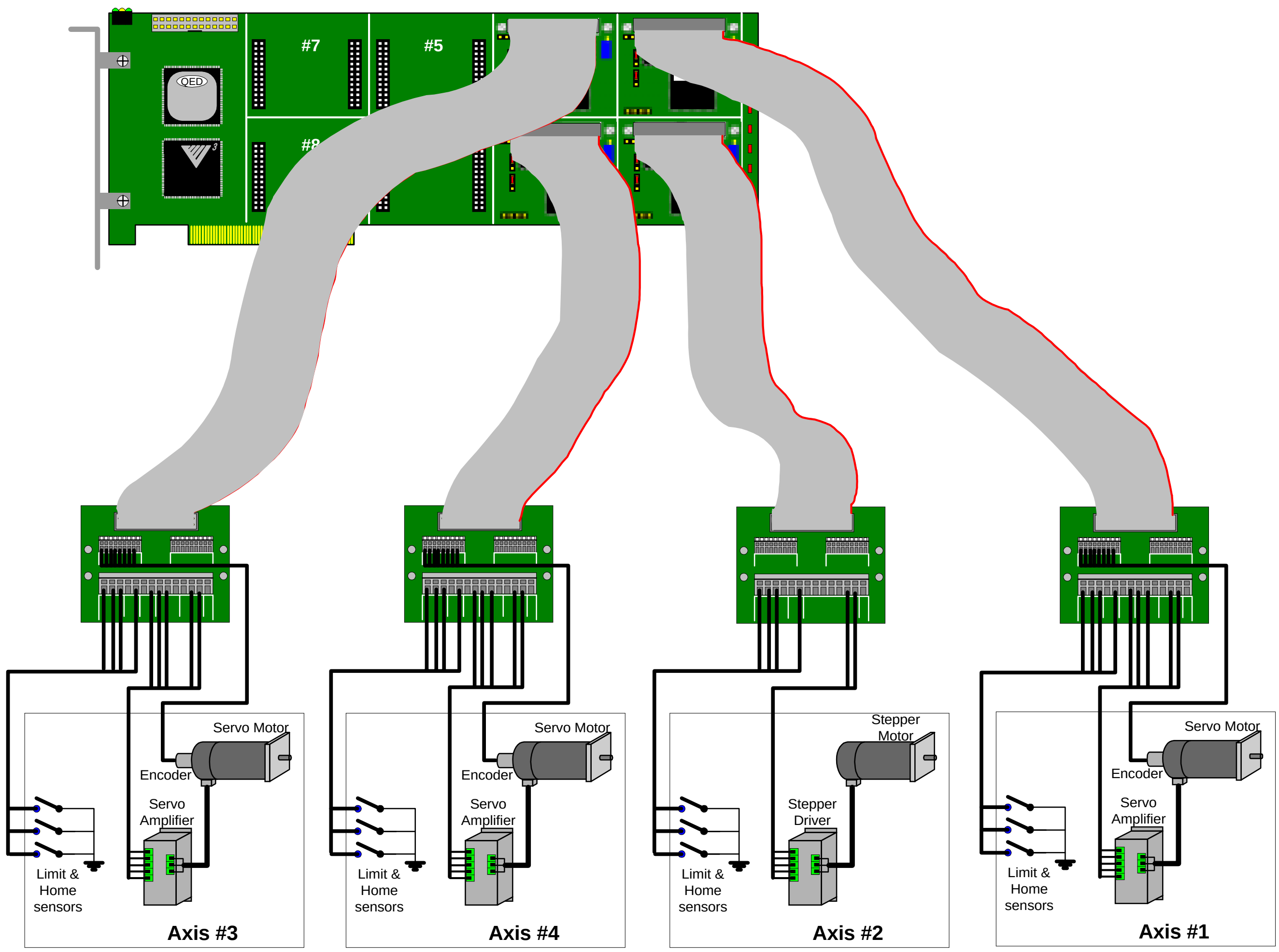


Figure 9:Typical connections for a 4 axis DCX-PCI300-R-system connected via ribbon cable and PMC BF300-R breakout assemblies

Chapter Contents

- DCX Motion Control System Installation
- Installing the DCX-PCI300 Motion Control Motherboard
- Installing the DCX Software (MCAPI)

Chapter

2

Controller and Software Installation

The DCX-PCI300 is installed in a PCI slot of a PC computer or the passive back plane of an industrial computer. Power (+5V, +12V, and –12V), Ground reference, and communication (Address, Data, and Read/Write control signals) is supplied via the PCI edge connector. The DCX-PCI300 motion controller supports Windows XP/2000/NT/ME/98 operating systems, **the DCX-PCI300 does not support Windows 95 or 3.X**. .

DCX Motion Control System Installation

The basic steps for a **new** installation of the DCX-PCI300 motion controller for PC based applications are as follows:

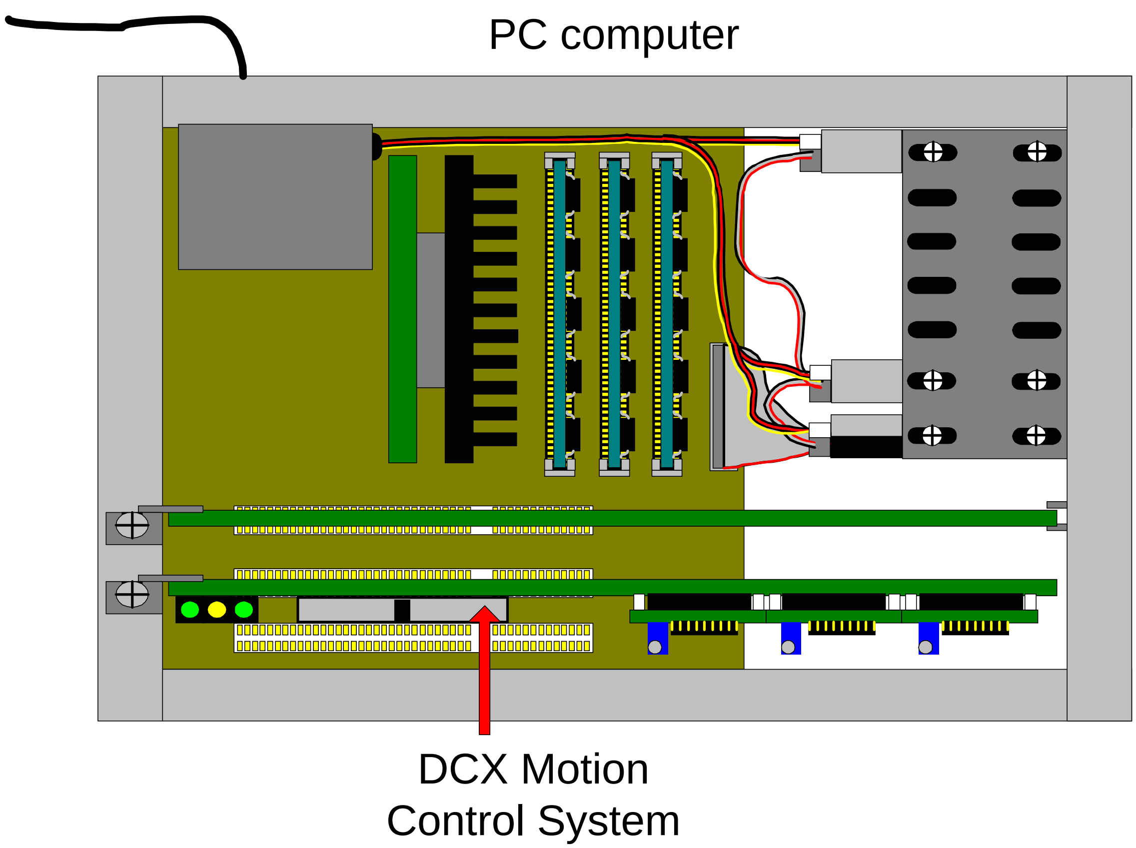
- Install DCX motion control and/or I/O expansion modules onto the DCX-PCI300 motherboard
- With PC power turned off, install the DCX controller into an available PCI slot
- Turn on the computer, during the loading of Windows (except for NT4) the operating system should recognize that a new PCI card has been installed
- Use the Windows New Hardware Wizard to select the DCX-PCI300 device driver
- Install the PMC's motion control software (MCAPI) from the **MotionCD** or from PMC's web site **www.pmccorp.com**
- Restart the computer to complete the installation
- The DCX motion control system is now ready for testing

Installing the DCX-PCI300 Motion Control Motherboard

The DCX-PCI300 is 'Plug and Play' (Windows XP/2000/98/Me) compatible, there are no jumpers or switches to be configured. The DCX can be installed in any of the PC's available PCI slots. The DCX modules and cabling may interfere with a card installed in the slot next to the DCX, so it is recommended that the slot next to the DCX be left open. Make sure to attach the bracket of the DCX to the back panel of the PC.

> Make sure that the PC computer power is turned off before installing the DCX-PCI300 motion controller.

For new installations, to verify communication between the PC, MCAPI, and the DCX it is recommended that the DCX-PCI300 motherboard first be installed without any DCX modules.



Installing the motion controller in a Plug & Play system (Windows XP/2000/98/Me)

> The following section describes the basic steps for installing the DCX-PCI300 motion controller into plug and play PC computers. For step by step installation procedures please refer to the MCAPI readme file
> :\MotionCD\Windows\MCAPI\Readme.txt

After installing the DCX-PCI300, power up the PC. The operating will detect a new PCI device, and will launch the **Windows Found new Hardware Wizard**.

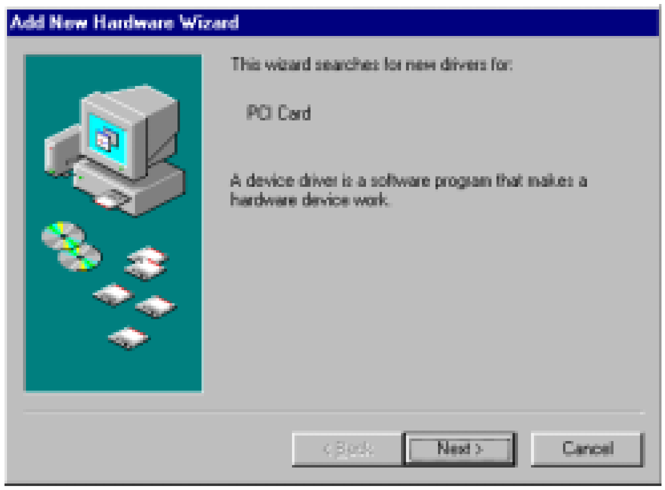


Figure 10: Windows New Hardware Wizard

Figure 11: Select Search for the best driver for your device

Figure 12: Select Specify a location. Insert the Motion CD into the CD-ROM drive. Browse to :\MotionCD\WIndows\MCAPI\Current\Win2000 or:\MotionCD\WIndows\MCAPI\Current\Win98. Select the *.inf file

Figure 13: Select Next to install the device driver

Figure 14: Select finish to complete the DCX-PCI300 device driver installation

To complete the installation of a DCX-PCI300 motion controller you must install PMC's motion control software, the Motion Control API (MCAPI). Please proceed to the section titled, **Installing the DCX Software (MCAPI)**

Installing the motion controller in a Windows NT system
There are no jumpers or switches to be configured prior to installing the DCX-PCI300 in a Windows NT PC. The DCX can be installed in any of the PC's available PCI slots. The DCX modules and cabling may interfere with a card installed in the slot next to the DCX, so It is recommended that the slot next to the DCX be left open . Make sure to attach the bracket of the DCX to the back panel of the PC.

Make sure that the PC computer power is turned off before installing the DCX-PCI300 motion controller.

For new installations, to verify communication between the PC, MCAPI, and the DCX it is recommended that the DCX-PCI300 motherboard first be installed without any DCX modules. After installing the DCX-PCI300, turn on the PC and log on to the Windows NT system as the **system administrator**.

To install PMC's motion control software, the MCAPI, the user must be logged on as the system administrator.

For assistance with installing the MCAPI please refer to the section titled **Installing the DCX Software (MCAPI)**.

Windows NT is **not a 'plug & play' operating system**. the user must configure the MCAPI device driver for the type and quantity of DCX-PCI300 controllers installed in the computer. The next few pages describe the steps required to configure the MCAPI.

Launch PMC's **New Controller Wizard** by selecting the Motion Control icon from the Windows Control Panel or from the Windows **Start** menu (Motion Control\Motion Control API\MCAPI Setup).

Figure 15:For NT systems launch Motion Control from the Windows Control Panel

Do not attempt to setup the Motion Control API without a DCX-PCI300 motion controller installed in the PC. The last step of the **New Controller Wizard** verifies communication between the DCX controller and the PC.

Figure 16:PMC's New Controller Wizard

Controller ID

Each PMC motion controller installed in your PC requires an individual Controller ID number. The MCAPI supports controller ID's between 0 and 15, supporting applications with as many as 16 DCX controllers in a single computer. Typically the Controller ID is set to zero (ID=0). If more than one DCX controller is to be installed usually the DCX-PCI300 upon which the primary axes reside is set to ID0.

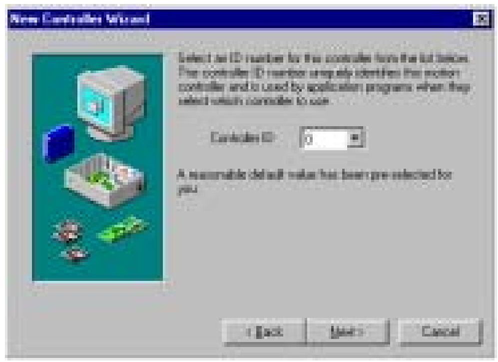


Figure 17: Setting the Controller ID

Controller Type

The MCAPI supports mixing and matching various PMC controllers (DCX-PCI300, DCX-PC100, and DC2-PC) within a single PC. A list of PMC controllers that are supported by the MCAPI will be displayed. Select the DCX-PCI300.

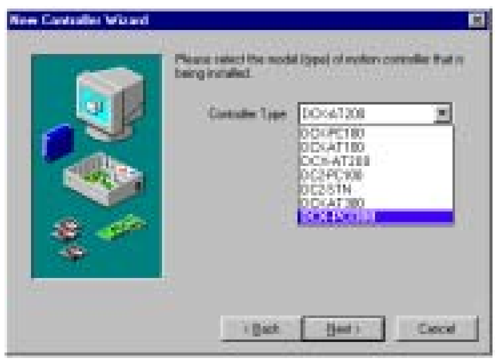
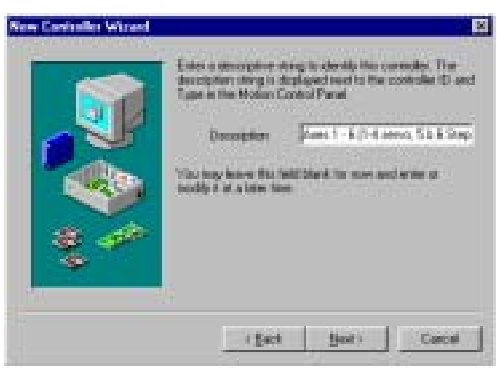


Figure 18: Selecting the Controller Type

Description

Allows the user to enter comments about the controller. An example of a completed General setup of a DCX-PCI300 follows:



Communications Interface

A list of supported controller interfaces will be displayed. Select the PC-Bus.

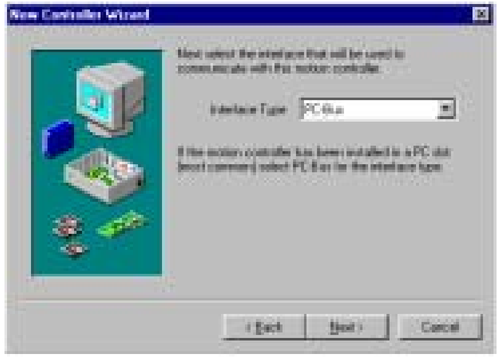
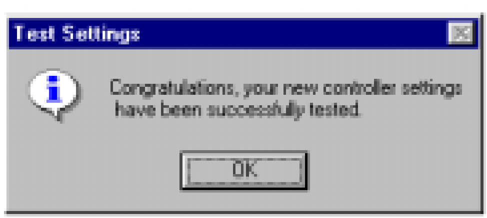


Figure 19: Selecting the communication Interface

Testing the Installation

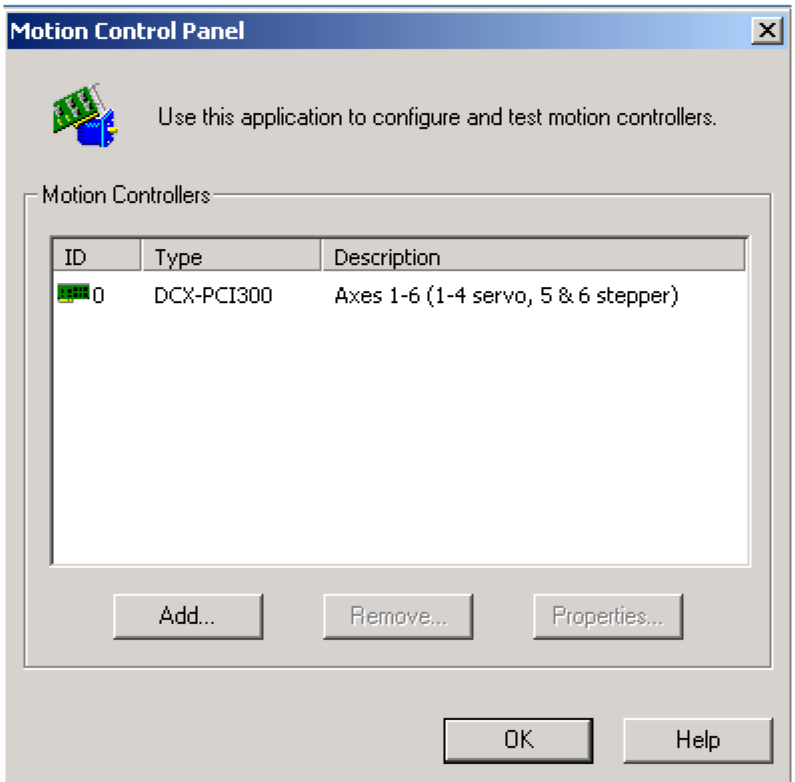
The final step of the New Controller Wizard is to test the communication between the Motion Control API and the DCX motion controller.

A successful controller communication test will result in the following displays:



If the test fails and the New Controller Wizard is unable to verify communication between the controller and the Motion Control API refer to the troubleshooting guide in the **DCX-PCI300 User's Manual**.

To complete the New Controller Wizard select OK. If you need to configure another controller select Add.



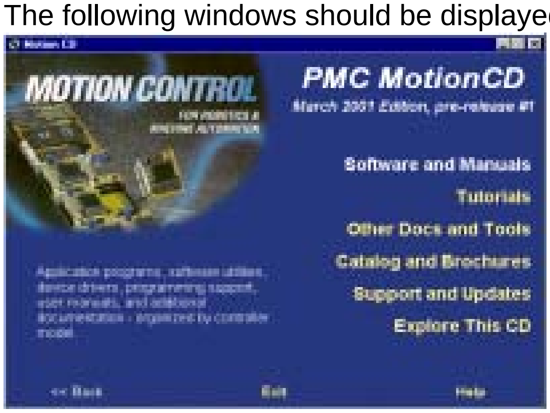
Installing the DCX Software (MCAPI)

DCX controllers ship with PMC's MotionCD, which includes the Motion Control API software. For the **most recent version** of the MCAPI please check the support page of PMC's website **www.pmccorp.com**

Installation from PMC's Motion CD
To install the Motion Control API software which includes: device drivers, function library, controller setup utilities, communication utilities, and program samples, place the PMC Motion CD into the PC computer CD drive. If the Motion CD does not auto start, browse the CD and select the file STARTUP.EXE.

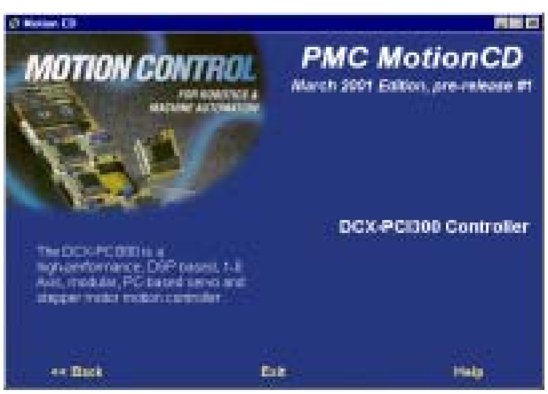
Due to Windows Plug and Play issues, the MCAPI should not be installed 'on top of' previous installations. Please refer to **Removing the Motion Control API later** in this chapter.

The following windows should be displayed:

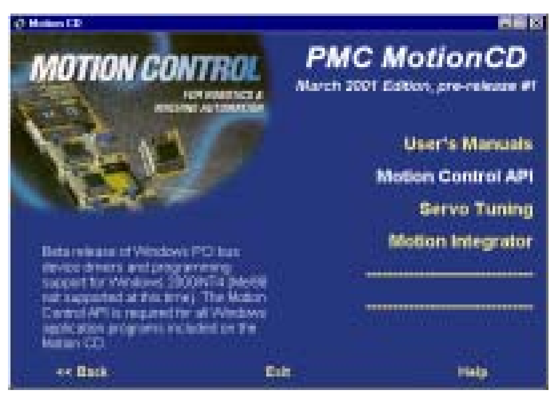


Step #1 - Select "Software and Manuals"

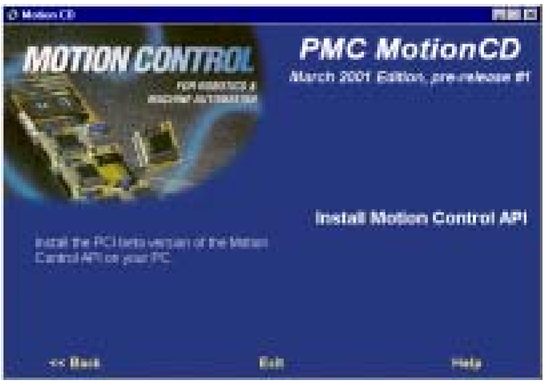
Step #2 - Select "PCI Bus Controllers"



Step 3) Select "DCX-PCI300 Controller"



Step #4) Choose Motion Control API

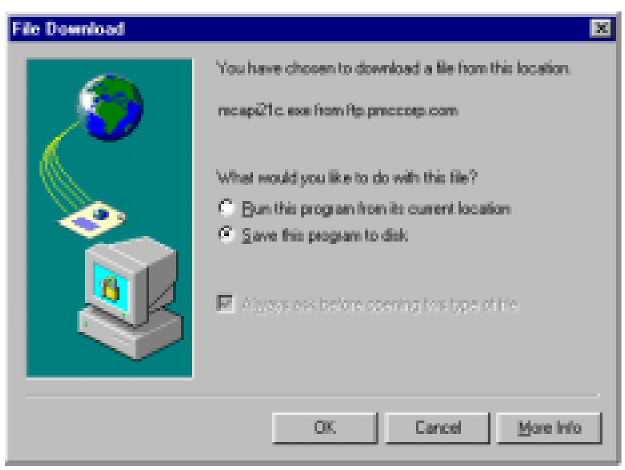


Step 5) Install Motion Control API

Step #6) Follow the on screen instructions

Downloading the Most Recent release of the Motion Control API from PMC's web site
Due to the dated nature of a CD, it is recommended that the user check PMC's web (**www.pmccorp.com**) site for the most recent release of the MCAPI. Go to the support page and select the link to the Motion Control API page.

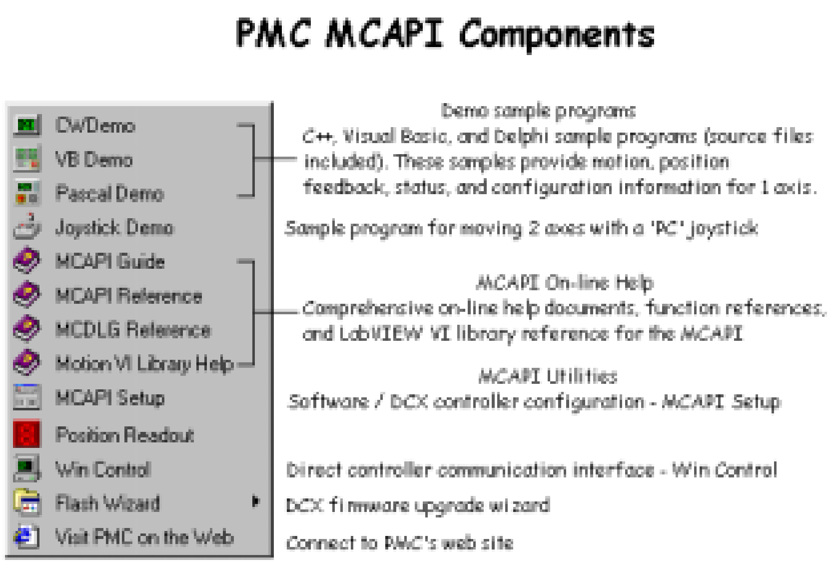
Selecting the Motion Control API will begin the file download of this self extracting zip file. As shown in the following graphic, it is recommended that the file be saved to disk.



The installation of the MCAPI will begin upon launching the downloaded file. Follow the on screen instructions.

Motion Control API Components

Upon successful installation of PMC's Motion Control API, the Motion Control Panel will be available from the Windows Control Panel and the following components will be available from the Windows **Start** menu. For additional information on individual MCAPI components please refer to the **Software** and **Utilities** section of the **Programming, Software, and Utilities** chapter of this manual.



Reporting Software and Firmware Versions

From the Motion Control panel you can view the installed versions of the Motion Control API and the on-board firmware of the DCX-PCI300 controller. To report the software and firmware versions select **Properties** and then **Info**. The MCAPI will query the DCX controller for its firmware version. If the Motion Control Panel is unable to acquire this information the version will be reported as unknown.

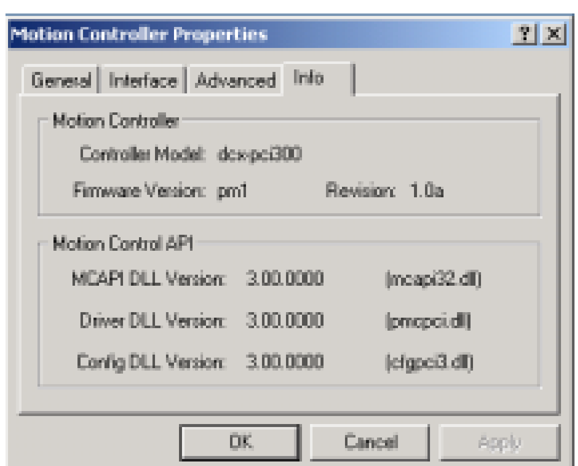


Figure 20: Checking firmware and MCAPI version

Removing the Motion Control API
Prior to uninstalling the MCAPI you **must remove all configured motion controllers** from the **Windows Motion Control Panel**. From the Windows Control panel launch Motion Control.

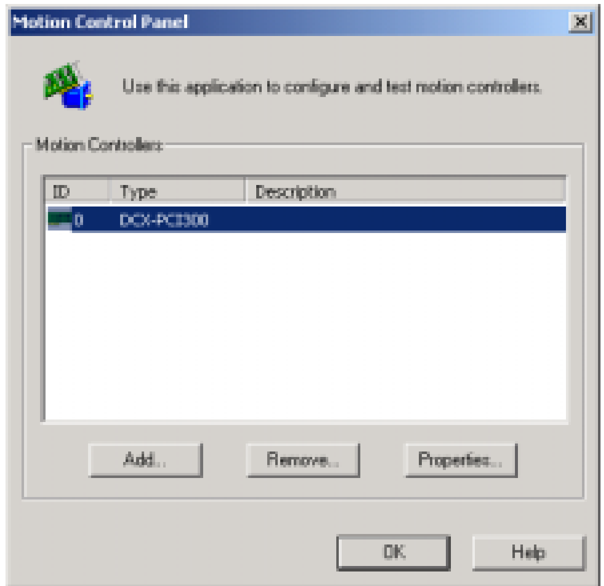


Figure 21: Select the controller and then click Remove

To remove the MCAPI , launch the Add/Remove Programs applet in the Windows Control Panel. After the Uninstall Shield has removed the MCAPI you will need to restart the computer to remove active .dll's.

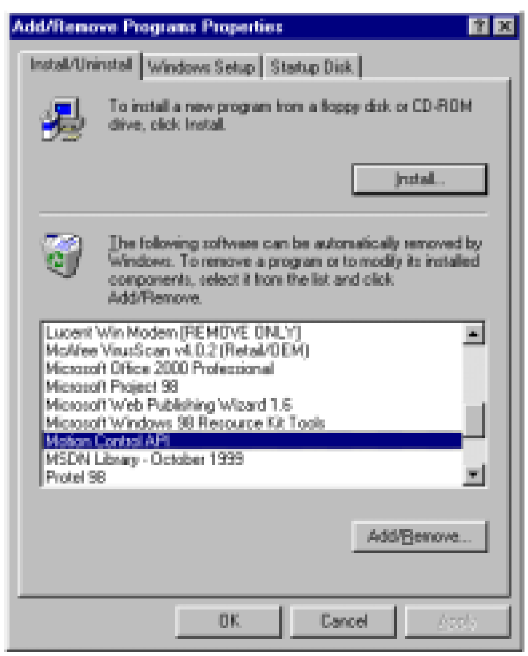


Figure 22: Windows Add/Remove programs

Chapter Contents

- Installing DCX Modules onto the DCX-PCI300 Motion Control Motherboard
- DCX-MC300 – Servo Motor (+/- 10V output) Module Installation
- DCX-MC302 – Dual Axis Servo Motor (+/- 10V output) Module Installation
- DCX-MC320 – Brushless Servo Commutation Module Installation
- DCX-MC360 – Stepper Motor Module Installation
- DCX-MC362 – Dual Axis Stepper Motor Module Installation
- DCX-MC400 – Digital I/O Expansion Module Installation
- DCX-MC500 – Analog I/O Expansion Module Installation

Chapter 3

Installing and Wiring DCX Modules

The basic steps for competing the installation of the DCX-PCI300 motion controller are:

- Install and wire DCX servo and/or stepper motion control modules
- Install and wire digital and/or analog I/O modules
- If servo's are being used verify servo operation (refer to **DCX Servo Basics** section in the **Motion Control** chapter of the **DCX-PCI300 User Manual**)
- If steppers are being used verify stepper operation (refer to **DCX Stepper Basics** section in the **Motion Control** chapter of the **DCX-PCI300 User Manual**)
- If general purpose I/O (analog or digital) is being used Verify I/O operation (refer to **DCX General Purpose I/O** chapter of the **DCX-PCI300 User Manual**)

Connections – High Density versus Ribbon Cable

The DCX-PCI300 motion control system offers the user two connection options:

- The –H version (DCX-PCI300-H, DCX-MC300-H, etc...): high density connections via Ultra SCSI 68 pin connectors
- The –R version (DCX-PCI300-R, DCX-MC300-R, etc...): Dual row shrouded header- 26 pin, 0.1 inch spacing for use with standard ribbon cables

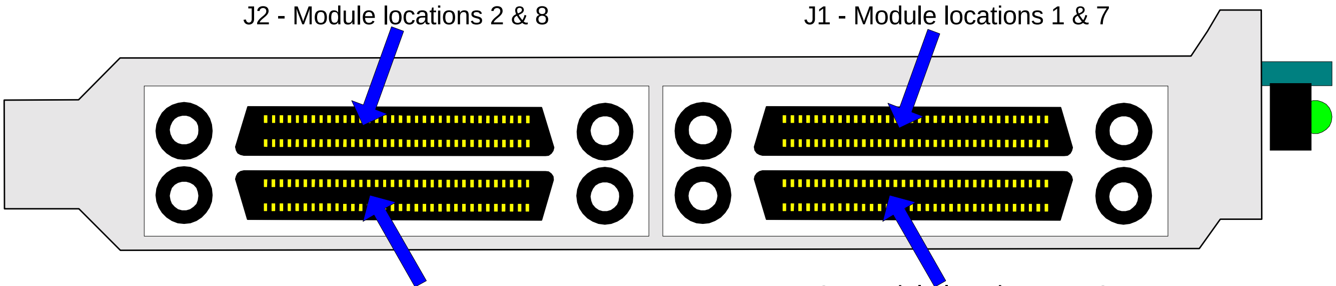
Similarities (-H vs. –R)

- **100% functional compatibility** - The high density (-H) and ribbon cable (-R) DCX modules are 100% functionally compatible. Once a system is properly wired, any application program that works with a –R DCX module will work exactly the same when a –H module is used.

Differences

- **Pinout –** The –R version uses a 26 pin header shrouded (13 pins X 2 rows), the –H version uses 34 pins of a 68 pin connector

- **For the most efficient use of cabling the -H modules would typically be installed in different locations than –R modules –** The DCX module I/O signals are routed through the DCX-PCI300-H motherboard to the four high density connectors. To maintain maximum signal integrity motherboard module locations connect to the high density connectors as follows:



VHDCI connectors as viewed from the back of the computer
(component side down)

DCX-PCI300-H Module location	High Density connector #	Interconnect cable #
1	J1	P1
7	J1	P1
5	J3	P3
3	J3	P3
6	J4	P4
4	J4	P4
2	J2	P2
8	J2	P2

As demonstrated by the graphic and table, one high density connector provides the I/O signals for **2 axes,** where as the –R modules require one cable per installed axis. Lets look at a typical four axis application. When connecting to the external system components via ribbon cable (R version), the four motion control modules would typically be installed in locations 1, 2, 3, and four. The system connections would look like this:

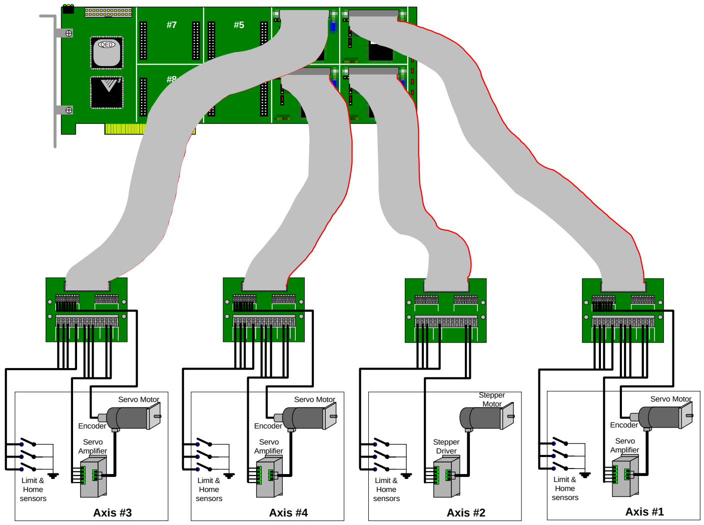


Figure 23: Typical 4 axis -R system, modules in locations 1 - 4

When configuring the same four axis system using high density connectors, installing modules in locations 1, 2, 3, and 4 would require the use of **four high density cables**. The most efficient cabling solution is to install the four DCX modules into locations 1, 2, 7, and 8.

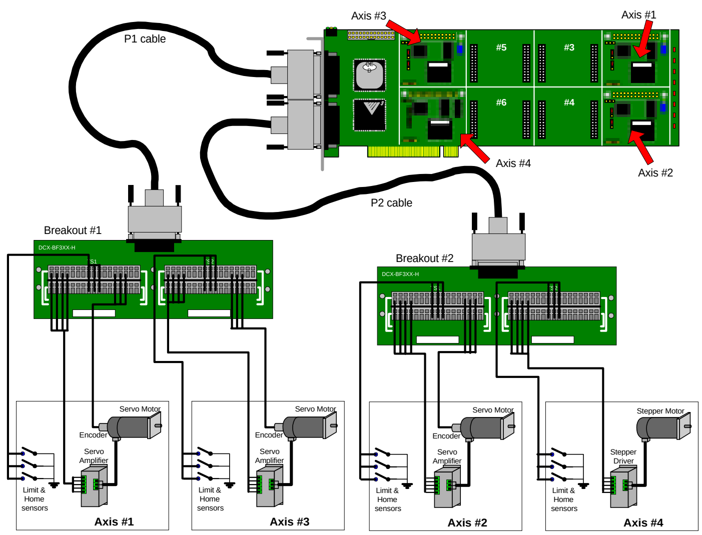
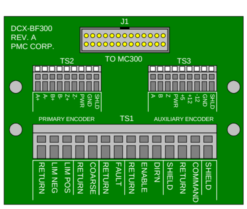
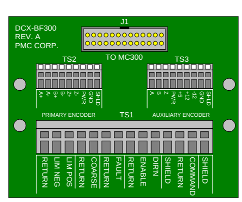
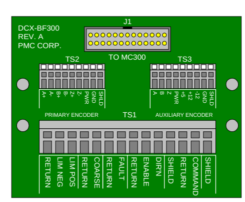


Figure 24: Typical four axis -H system, modules in locations 1, 2, 7, & 8

- **Different breakout assemblies** – For systems connected with ribbon cable, PMC offers three different DIN rail mounted breakout assemblies (DCX-BF300-R, DCX-BF320-R, DCX-BF360-R) that provide convenient connection points.







It is assumed that most OEM's using the DCX-PCI300-H controller will build breakout assemblies specific to the packaging requirements of the application. Detailed PCB layout drawings for the single or dual 0.8mm Ultra SCSI connectors can be found on the MotionCD (browse to \PCI300/Manuals\Intro&Install\). For initial system evaluations and low volume applications, PMC offers the DCX-BF3XX-H breakout assembly. This DIN rail mounted, two axis/module general purpose breakout can be used with all five DCX –H modules.

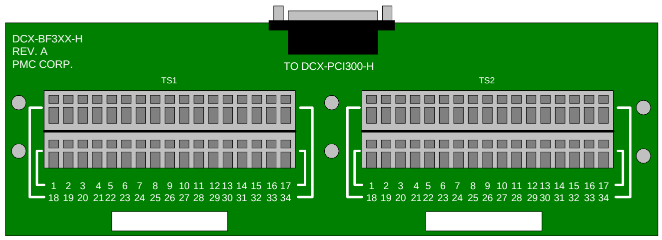


Figure 25: DCX-BF3XX-H breakout

For specific connector pinout information please refer to:

Module type	Mechanical connection	Page #
DCX-MC300-H	Directly to the high density connector	92
DCX-MC300-H	To the DCX-BF3XX breakout	147
DCX-MC300-R	Directly to the module – no breakout	93
DCX-MC300-R	To the DCX-BF300 breakout	151
DCX-MC302-H	Directly to the high density connector	101
DCX-MC302-H	To the DCX-BF3XX breakout	149
DCX-MC320-H	Directly to the high density connector	109
DCX-MC320-H	To the DCX-BF3XX breakout	147
DCX-MC320-R	Directly to the module – no breakout	110
DCX-MC320-R	To the DCX-BF320 breakout	154
DCX-MC360-H	Directly to the high density connector	119
DCX-MC360-H	To the DCX-BF3XX breakout	147
DCX-MC360-R	Directly to the module – no breakout	120
DCX-MC360-R	To the DCX-BF360 breakout	157
DCX-MC362-H	Directly to the high density connector	128
DCX-MC362-H	To the DCX-BF3XX breakout	149
DCX-MC400-H	Directly to the high density connector	134
DCX-MC400-H	To the DCX-BF3XX breakout	147
DCX-MC400-R	Directly to the module – no breakout	135
DCX-MC500-R	Directly to the module – no breakout	137
DCX-MC500-H	Directly to the high density connector	138
DCX-MC500-H	To the DCX-BF3XX breakout	147

Installing DCX Modules onto the DCX-PCI300 Motion Control Motherboard

DCX Modules can be placed in any open module position (1 – 8) on the DCX motherboard. Each time PC power is applied, the DCX motherboard allocates axis numbers based on the physical location in which the DCX motion control modules are installed. The DCX motion control module installed in the lowest motherboard module location will be defined as axis #1, the motion control module in the next lowest module location will be defined as axis #2.

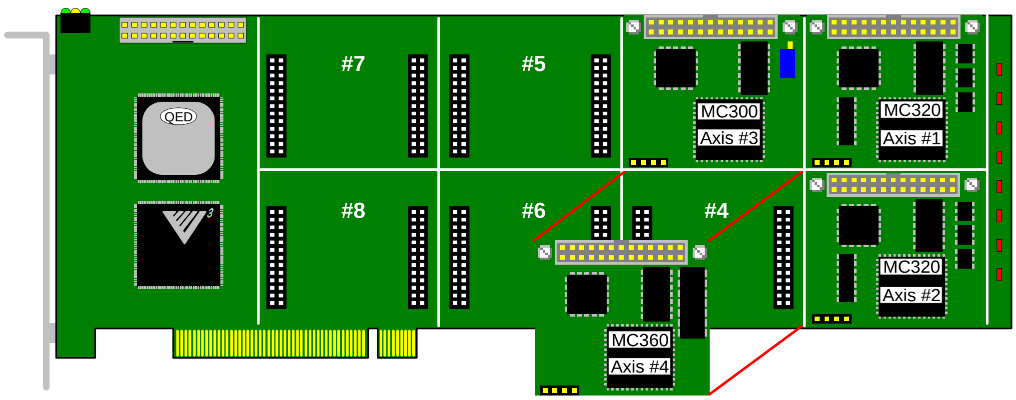


Figure 26: Allocating axis numbers to DCX motion control modules

In the example in figure 25 DCX modules are installed in module locations 1, 2, 3, and 4 and the axis numbers are allocated in that same order. In the example depicted in figure 26 DCX modules are installed in module locations 1, 3, 5, and 7.

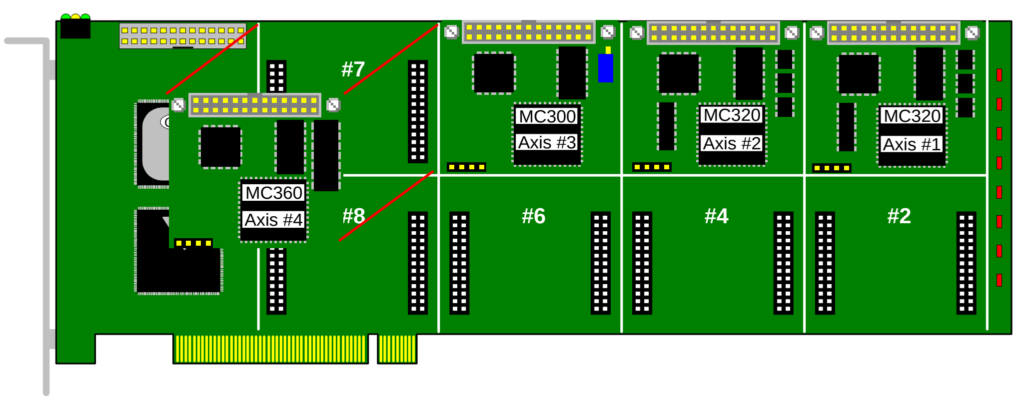


Figure 27: Allocating axis numbers to DCX motion control modules

Axis allocation examples (figures 7 & 8)

Motherboard module location	***Figure 25 Module type***	***Figure 25 axis #***	***Figure 26 module type***	***Figure 26 axis #***
Location #1	DCX-MC320	1	DCX-MC320	1
Location #2	DCX-MC320	2		
Location #3	DCX-MC300	3	DCX-MC320	2
Location #4	DCX-MC360	4		
Location #5			DCX-MC300	3
Location #6				
Location #7			DCX-MC360	4
Location #8				

If a group of motors will be used to perform multi-axis contouring (interpolated lines and/or arcs), one axis of the group should be assigned to axis 1. This will be the controlling axis for the group. Other groups of axes on the controller can also perform contouring motion, but will be limited in the number of motion segments that can be stored on the board. For additional information on multi-axis contouring please see the description of **Contouring Motion (arcs and lines)** in the **Motion Control** chapter of the **DCX-PCI 300 User's Manual**.

To install DCX modules, lay the DCX-PCI300 motherboard on a flat static free surface, component side up. Place each DCX module in the desired position, aligning the connectors and mounting holes with their respective mates on the DCX motherboard. When you are satisfied that the module is properly aligned, carefully press the module into the DCX. The header pins of the module should seat completely into the mating connectors on the DCX motherboard. Two nylon mounting screws are supplied with each DCX module. These should be installed from the backside of the motherboard, into the standoffs on the modules. Repeat this process for installing modules on the DCX until all modules are in place.

Next the DCX should be re-installed in the PC chassis and interfacing cables connected.

> For first time installations - after installing the DCX modules, it is **strongly recommended** that communication between the DCX controller and the PC be verified **before connecting** the cabling to the external motion components

Refer to the following sections in this chapter for specific wiring and jumper information for the types of modules that are being used. After connecting the DCX to the external motion components, turn on power to the PC and use the **Motion Integrator** program to verify the operation of the system.

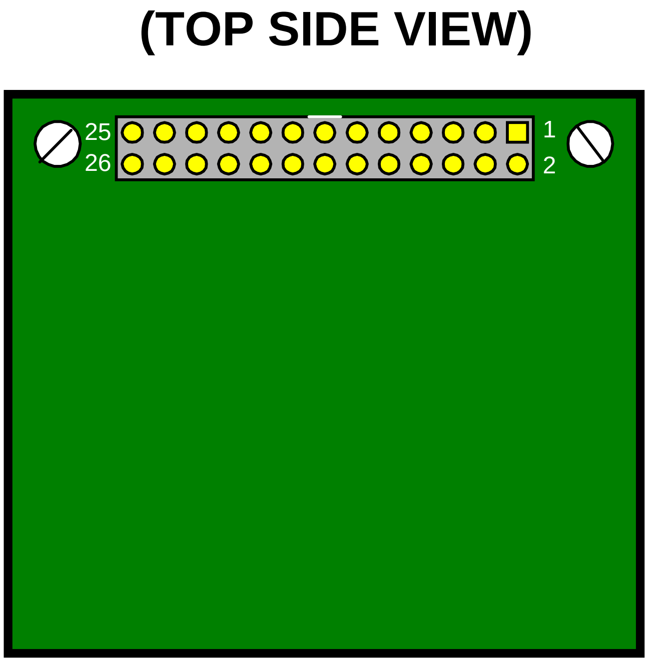


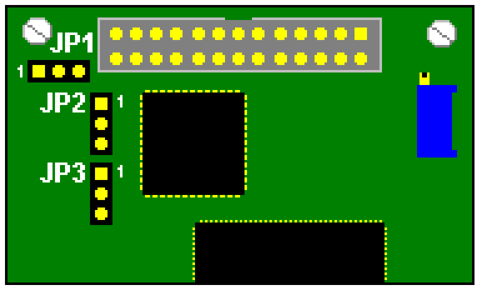
Figure 28: DCX module J3 connector pin numbering

All ribbon cable versions of the DCX modules (-R suffix) provide a 26 pin, shrouded, center polarized header for I/O connections. The pins of this connector are numbered from 1 to 26. The diagram above shows the location of pins 1, 2, 25 and 26. The other 22 pins are numbered and located respectively.

For pin numbering and pinout for High Density versions of DCX modules please refer to the Connectors, Jumpers, and Schematics section of this manual.

DCX-MC300 – Servo Motor Module Installation

Installation of a DCX-MC300 Servo Motor Control Module includes setting three jumpers (JP1, JP2, and JP3). These jumpers are used to configure the module for the type of incremental encoder that will be used. These jumpers are configured by installing shorting blocks on the pins of the jumpers, or leaving them open. Note that the pins of the three jumpers are numbered sequentially from 1 to 3, with pin 1 being shown as a square.



Jumper JP1 configures the module's encoder phase inputs for 'single ended' (A and B) or 'differential' (A+, A-, B+, and B-) signals. For single ended outputs, install the 3 hole shorting block (supplied with the module) across all 3 pins of jumper JP1. Connect the A and B signals from the encoder to the A+ and B+ inputs of the module. If an encoder with differential phase outputs is to be connected to the module, jumper JP1 should be left open (no shorting block installed).

Jumper JP2 is used to configure the module's encoder index input. Either a single ended or differential index signal can be connected to the module. The table below lists the possible combinations.

MC300 Module Encoder Index Configuration

Signal Name	***Input Type***	***Active Level***	***Jumper JP2***	***J3 connections***
Index +	Single ended	High	1 to 2	Pin 8
Index -	Single ended	Low	2 to 3	Pin 25
Index +/-	Differential	N/A	None	Pins 8(+) & 25(-)

The MC300 provides a user selectable Encoder Power supply by routing +5V or +12V from the PC supply to connector J3 pin 17. The Encoder Power supply can provide up to 500ma of current.

MC300 Encoder Power Selection Jumper

Jumper	***Setting***	***Encoder Power Supply (JP3 pin 17)***
JP3	Pins 1 to 2	+5VDC
JP3	Pins 2 to 3	+12 VDC
JP3	Open	Open

Note: The DCX-MC300 provides the Encoder Power output as a convenience, It is **not required** that it be used to power the encoder. If an external +5 volts or +12 volts supply is used to power the encoder, jumper JP3 **must still be configured** to match the voltage level (+5 volts or +12 volts) of the external supply.

After configuring the jumpers of the module, the servo encoder, amplifier and limit switches can be connected to the module. Wiring diagrams on the next two pages depict typical installations using ribbon cable. The first diagram details direct connection of the MC300 to the external components (servo amplifier, encoder, and sensors). The second diagram details typical connections when a **DCX-BF300 Breakout Assembly** is used.

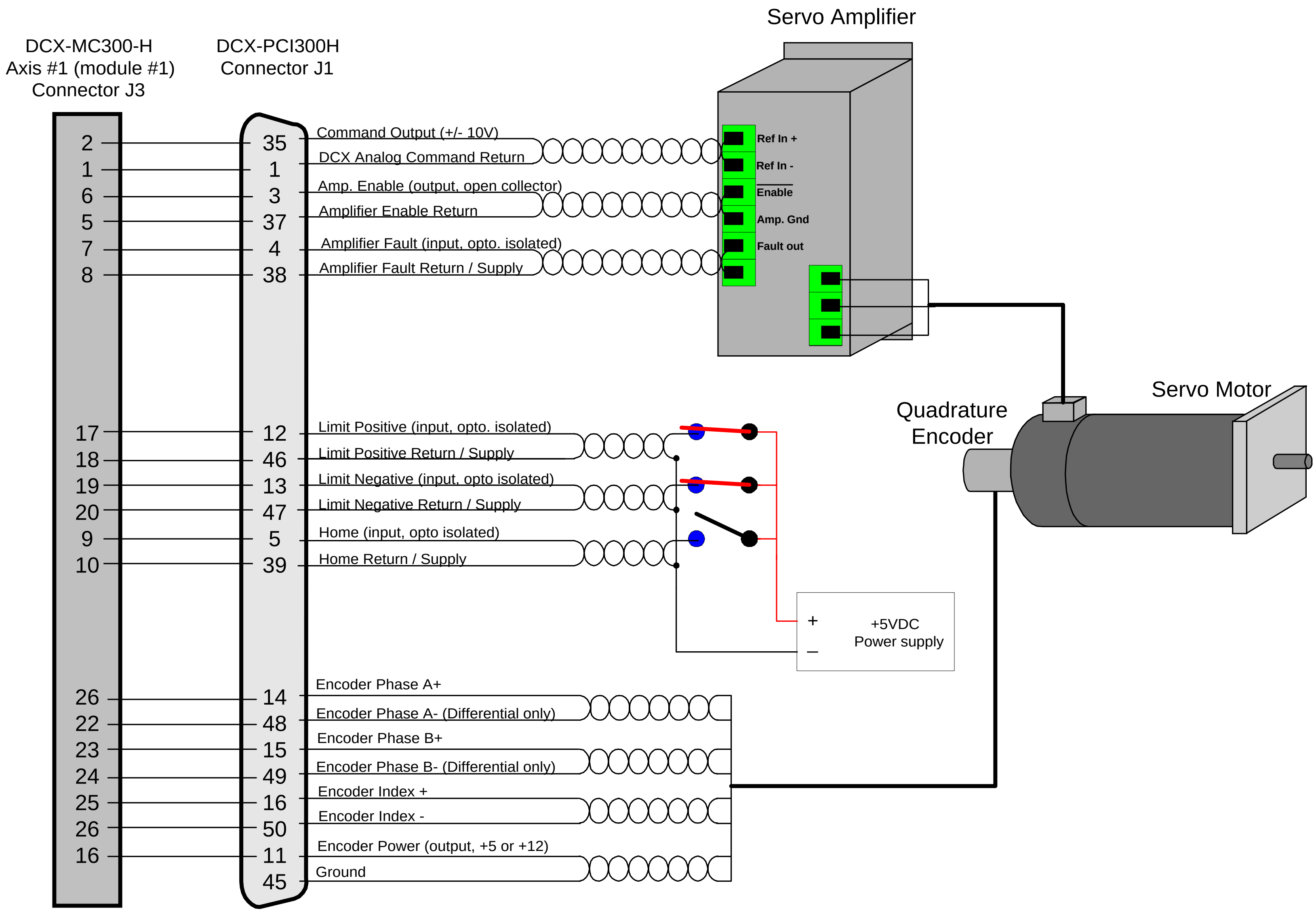


Figure 29: Typical connections for DCX-MC300-H Servo Motor Control Module

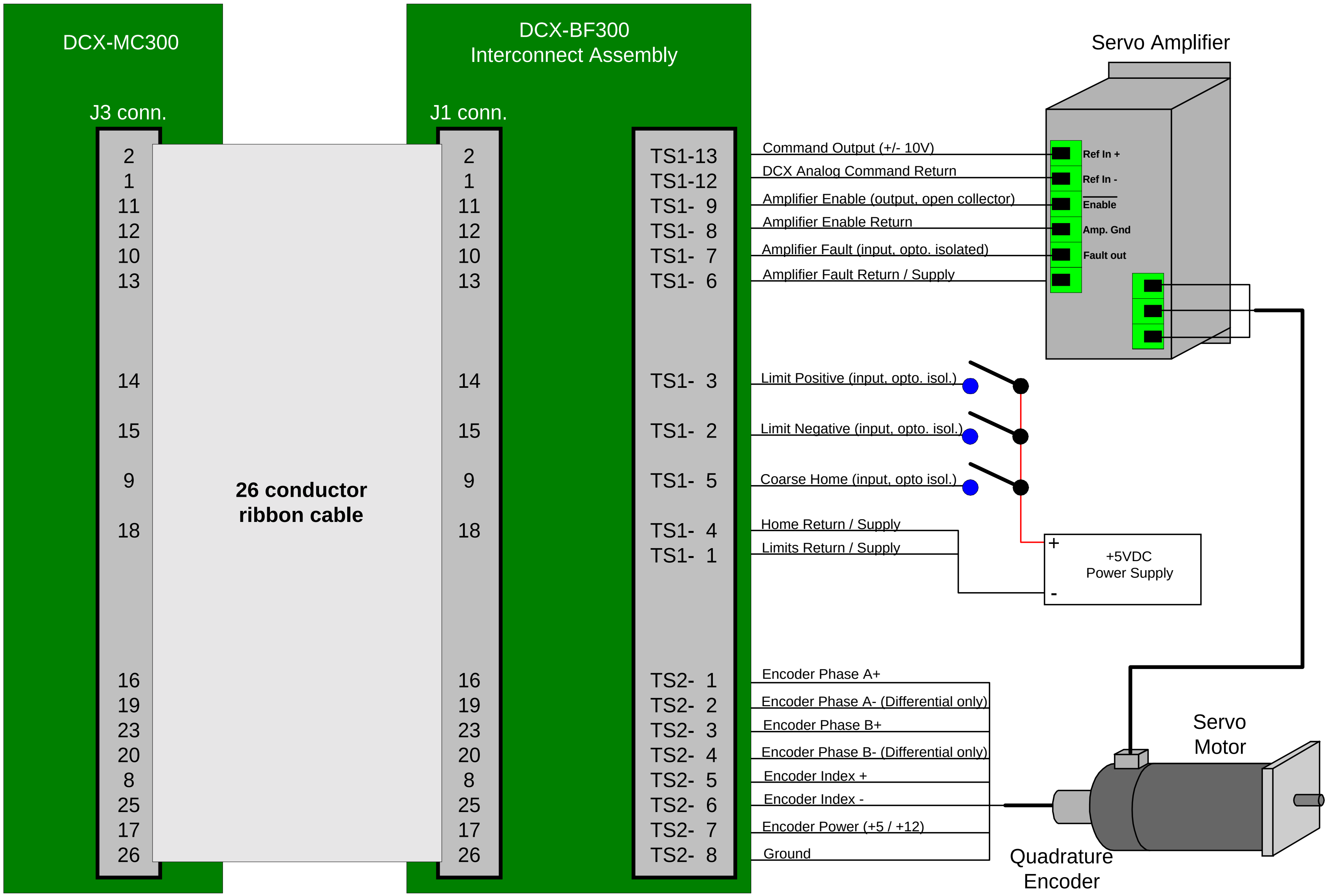


Figure 30: Typical connections for DCX-MC300-R Servo Motor Control Module (and DCX-BF300 breakout)

DCX-MC302 – Dual Axis Servo Motor Module Installation

Installation of a DCX-MC302 Dual Axis Servo Motor Control Module includes:

1) Configuring the encoder inputs
2) Setting the encoder Power voltage level

Configuring the encoder inputs

The DCX-MC302 default configuration supports differential encoder inputs (A+, A-, B+, B-, Z+, & Z-) . If single ended encoders are used inputs channels A-, B-, and Z- must be terminated. To terminate the appropriate unconnected encoder inputs install 0 ohm resistors R1 – R3 for axis #1 and 0 ohm resistors R4 – R6 for axis #2.

DCX-MC302 Single Ended Encoder Termination Circuit

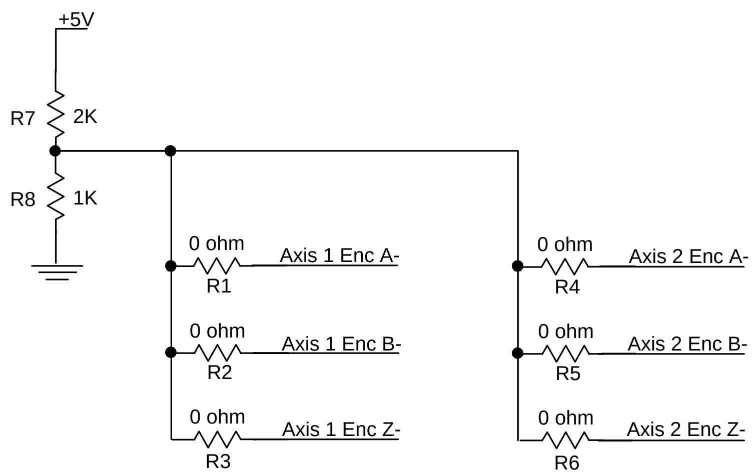
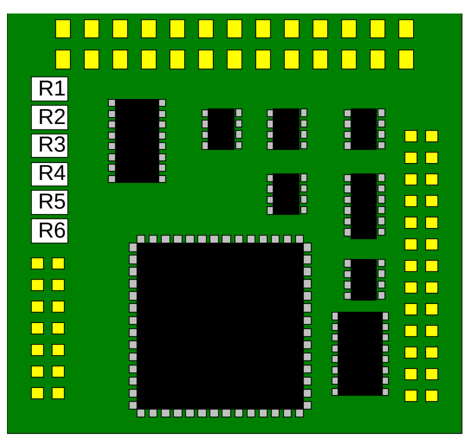


Figure 31: DCX-MC302 single ended encoder terminations



DCX-MC302 bottom side: For single ended encoders add resistors R1 – R3 (axis 1) and/or R4 – R6 (axis 2)

Configuring encoder Power jumpers

Jumpers JP1 and JP2 are used to configure the Encoder Power Output for each axis. JP1 and JP2 are configured by installing shorting blocks on the pins of the jumpers, or leaving them open. Note that the pins of the three jumpers are numbered sequentially from 1 to 3, with pin 1 being shown as a square.

Note: The DCX-MC302 provides the Encoder Power output as a convenience, It is **not required** that it be used to power the encoder. If an external +5 volts or +12 volts supply is used to power the encoder, remove the shorting blocks from JP1 & JP2.

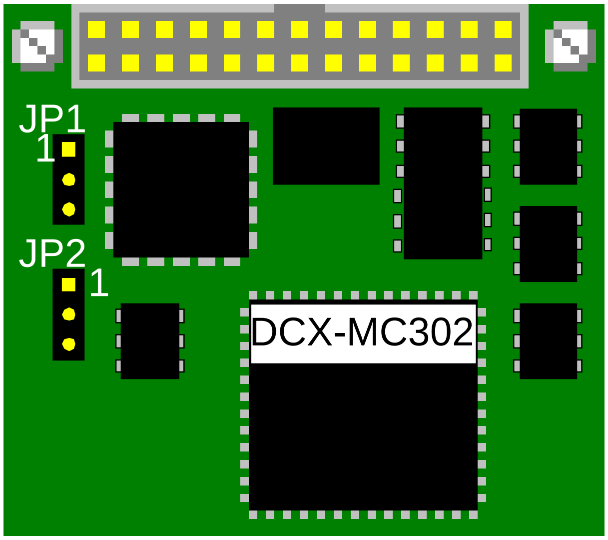


Figure 32: Configure jumpers JP1 & JP2 if an encoder power output is required

DCX-MC302 Encoder Power Selection Jumpers

Jumper	***Setting***	***Encoder Power Supply (JP3 pin 17)***
JP1	Pins 1 to 2	Axis 1 Encoder Power Output (J3 pin 8) = +5VDC
JP1	Pins 2 to 3	Axis 1 Encoder Power Output (J3 pin 8) = +12VDC
JP1	Open	No connect
JP2	Pins 1 to 2	Axis 2 Encoder Power Output (J3 pin 8) = +5VDC
JP2	Pins 2 to 3	Axis 2 Encoder Power Output (J3 pin 8) = +12VDC
JP2	Open	No connect

The wiring diagram on the next page depicts the typical wiring connections.

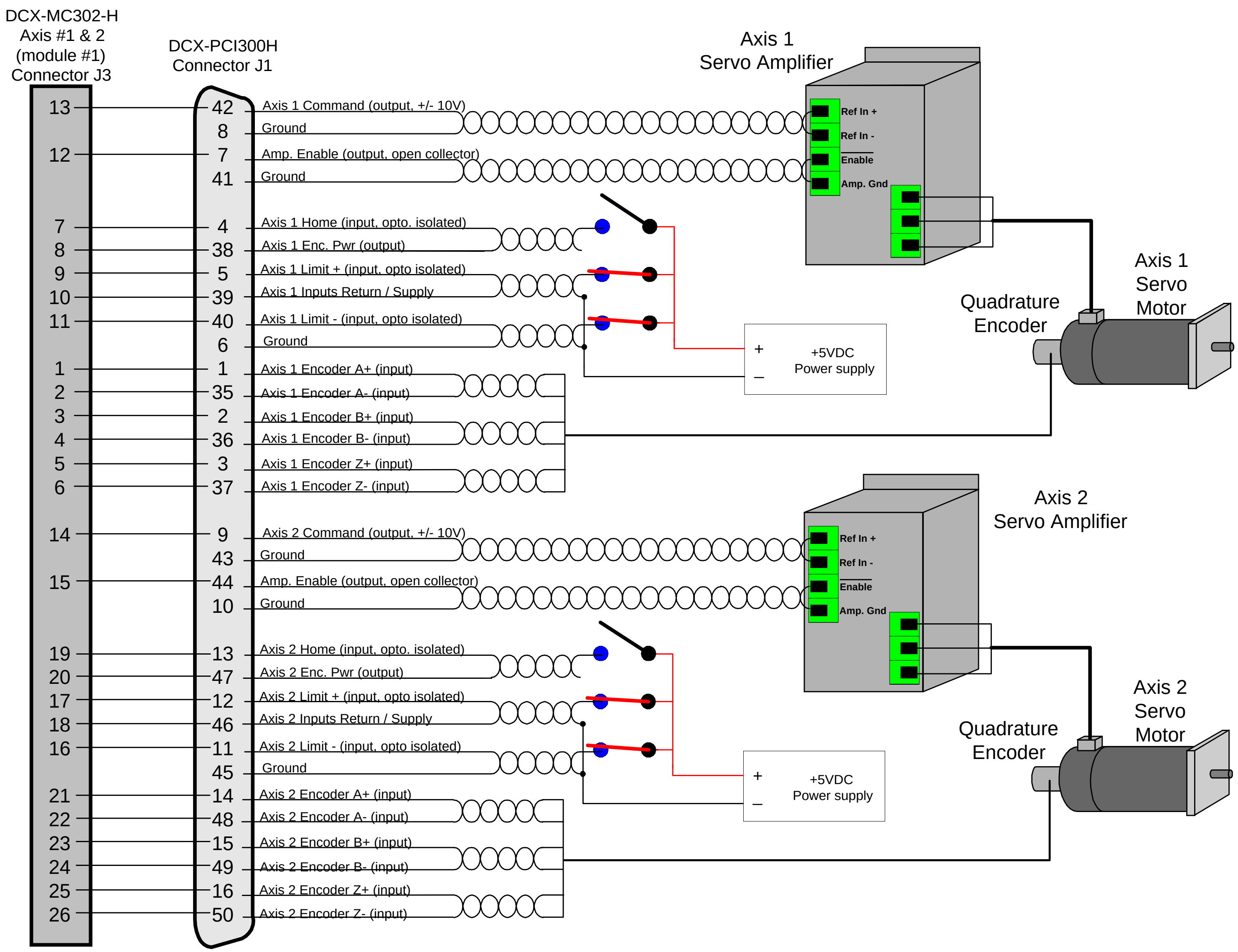
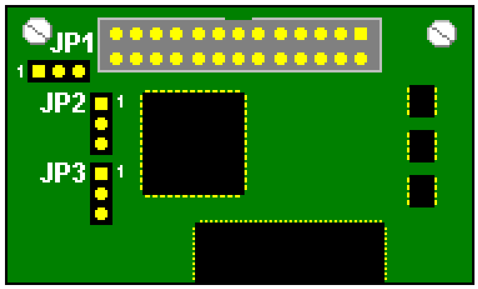


Figure 33: Typical connections for DCX-MC302-H Dual Servo Motor Control Module

DCX-MC320 – Brushless Servo Motor Module Installation

Installation of a DCX-MC320 Servo Motor Control Module includes setting three jumpers (JP1, JP2, and JP3). These jumpers are used to configure the module for the type of incremental encoder that will be used. These jumpers are configured by installing shorting blocks on the pins of the jumpers, or leaving them open. Note that the pins of the three jumpers are numbered sequentially from 1 to 3, with pin 1 being shown as a square.



Jumper JP1 configures the module's encoder phase inputs for 'single ended' (A and B) or 'differential' (A+, A-, B+, and B-) signals. For single ended outputs, install the 3 hole shorting block (supplied with the module) across all 3 pins of jumper JP1. Connect the A and B signals from the encoder to the A+ and B+ inputs of the module. If an encoder with differential phase outputs is to be connected to the module, jumper JP1 should be left open (no shorting block installed).

Jumper JP2 is used to configure the module's encoder index input. Either a single ended or differential index signal can be connected to the module. The table below lists the possible combinations.

Table 2: MC320 Module Encoder Index Configuration

Signal Name	***Input Type***	***Active Level***	***Jumper JP2***	***J3 connections***
Index +	Single ended	High	1 to 2	Pin 8
Index -	Single ended	Low	2 to 3	Pin 25
Index +/-	Differential	N/A	None	Pins 8(+) & 25(-)

The MC320 provides a user selectable Encoder Power supply by routing +5V or +12V from the PC supply to connector J3 pin 17. The Encoder Power supply can provide up to 500ma of current.

MC320 Encoder Power Selection Jumper

Jumper	***Setting***	***Encoder Power Supply (JP3 pin 17)***
JP3	Pins 1 to 2	+5VDC
JP3	Pins 2 to 3	+12 VDC
JP3	Open	Open

Note: The DCX-MC320 provides the Encoder Power output as a convenience, It is **not required** that it be used to power the encoder. If an external +5 volts or +12 volts supply is used to power the encoder, jumper JP3 **must still be configured** to match the voltage level (+5 volts or +12 volts) of the external supply.

After configuring the jumpers of the module, the servo encoder, motor and limit switches can be connected to the module. Wiring diagrams on the next two pages depict typical ribbon cable installations. The first diagram details direct connection of the MC320 to the external components (servo motor, sine drive, encoder, and sensors). The second diagram details typical connections when the **DCX-BF320 Breakout Assembly** is used.

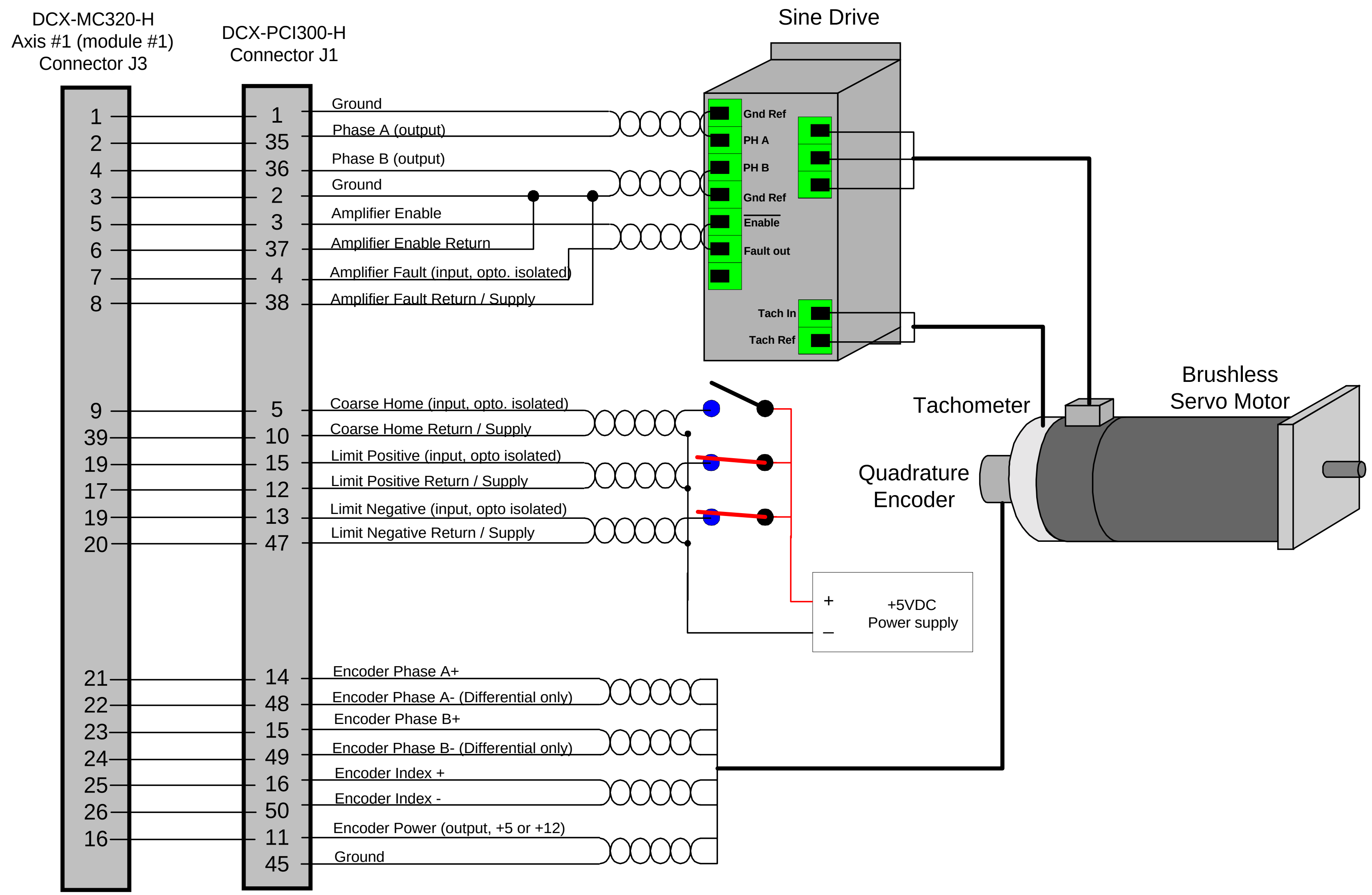


Figure 34: Typical connections for DCX-MC320-H Brushless Servo Motor Control Module

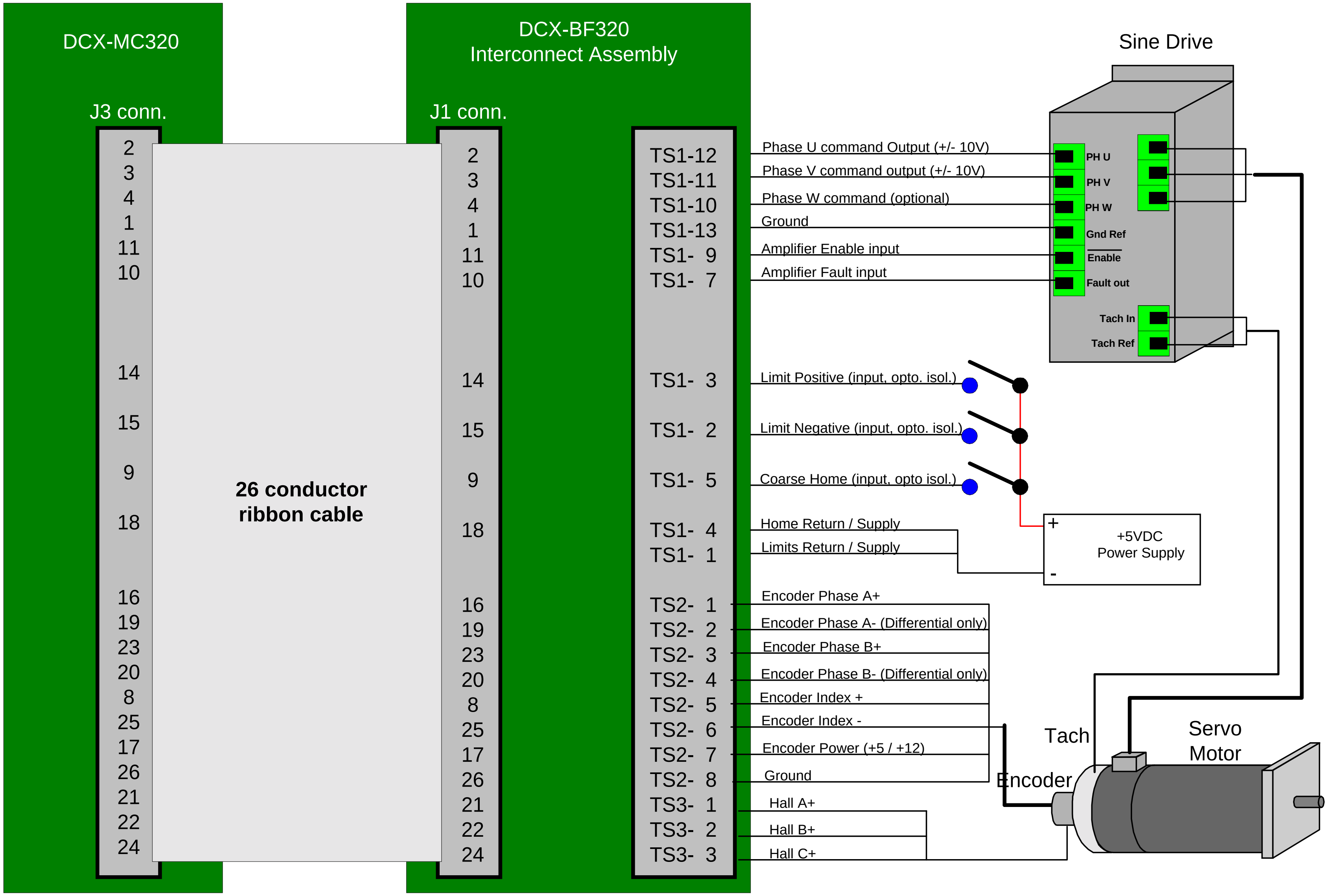
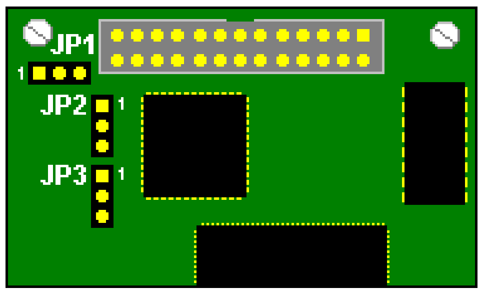


Figure 35: Typical connections for DCX-MC320-R Brushless Servo Motor Control Module (and DCX-BF320 breakout)

DCX-MC360 – Stepper Motor Module Installation

Installation of a DCX-MC360 Stepper Motor Control Module includes setting jumper JP1if an incremental encoder will be used for position feedback.

Jumper JP1 configures the module's encoder phase inputs for 'single ended' (A and B) or 'differential' (A+, A-, B+, and B-) signals. For single ended outputs, a 3 hole shorting block (supplied with the module) should be installed across all 3 pins of jumper JP1. In this case, the A and B signals from the encoder should be connected to the A+ and B+ inputs of the module. If an encoder with differential phase outputs is to be connected to the module, jumper JP1 should be left open (no shorting block installed).



Jumper JP2 is used to configure the module's encoder index input. Either a single ended or differential index signal can be connected to the module. The table below lists the possible combinations.

MC360 Module Encoder Index Configuration

Signal Name	Input Type	Active Level	Jumper JP2	J3 connections
Index +	Single ended	High	1 to 2	Pin 22
Index -	Single ended	Low	2 to 3	Pin 23
Index +/-	Differential	N/A	None	Pins 22(+) & 22(-)

The MC360 provides a user selectable Encoder Power supply by routing +5V or +12V from the PC supply to connector J3 pin 10. The Encoder Power supply can provide up to 500ma of current.

MC360 Encoder Power Selection Jumper

Jumper	Setting	Encoder Power Supply (JP3 pin 10)
JP3	Pins 1 to 2	+5VDC
JP3	Pins 2 to 3	+12 VDC
JP3	Open	Open

Note: The DCX-MC360 provides the Encoder Power output as a convenience, It is **not required** that it be used to power the encoder. If an external +5 volts or +12 volts supply is used to power the encoder, jumper JP3 **must still be configured** to match the voltage level (+5 volts or +12 volts) of the external supply.

After configuring the jumper of the module, the stepper driver, limit switches and optional encoder can be connected to the module. Wiring diagrams on the next two pages depict typical ribbon cable installations. The first diagram details direct connection of the MC360 to the external components (stepper driver, sensors, and optional encoder). The second diagram details typical connections when the **DCX-BF360 Breakout Assembly** is used.

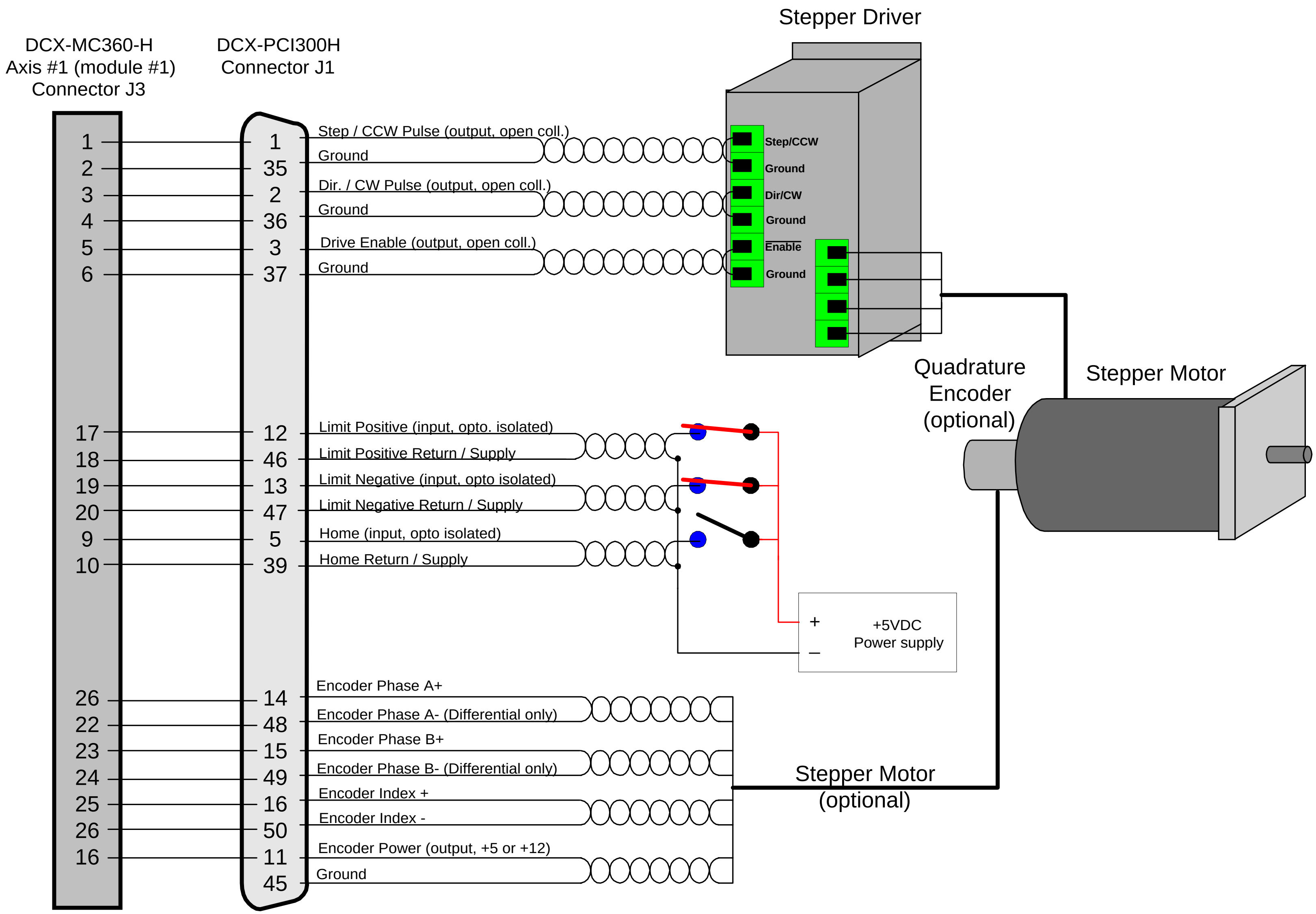


Figure 36: Typical connections for DCX-MC360-H Stepper Motor Control Module

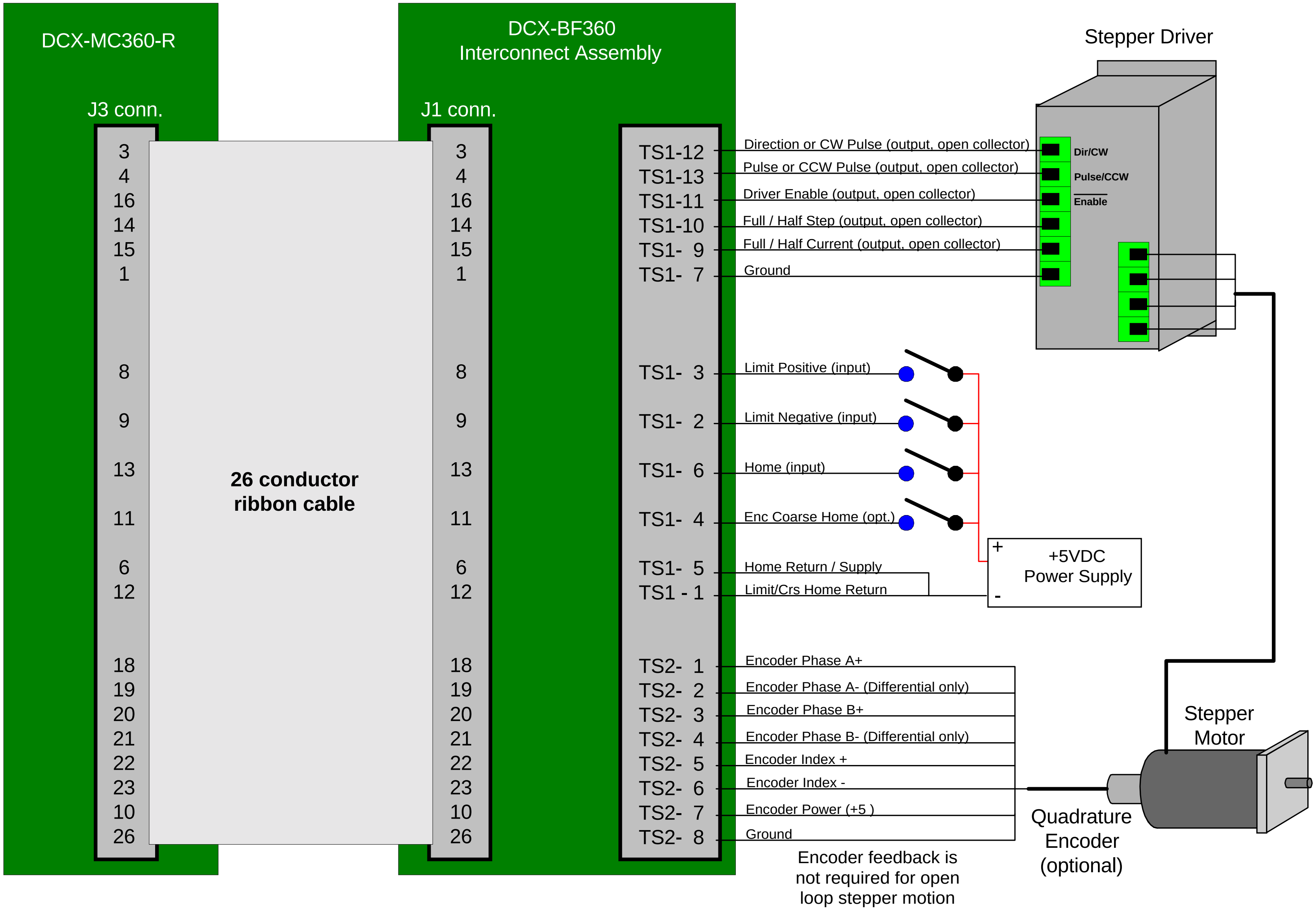


Figure 37: Typical connections for DCX-MC360-R Stepper Motor Control Module (and DCX-BF360 breakout)

DCX-MC362 – Dual Axis Stepper Motor Module Installation

The DCX-MC362 Dual Axis Stepper Motor Control Module has no configuration jumpers. The diagram on the next page depicts the typical wiring connections.

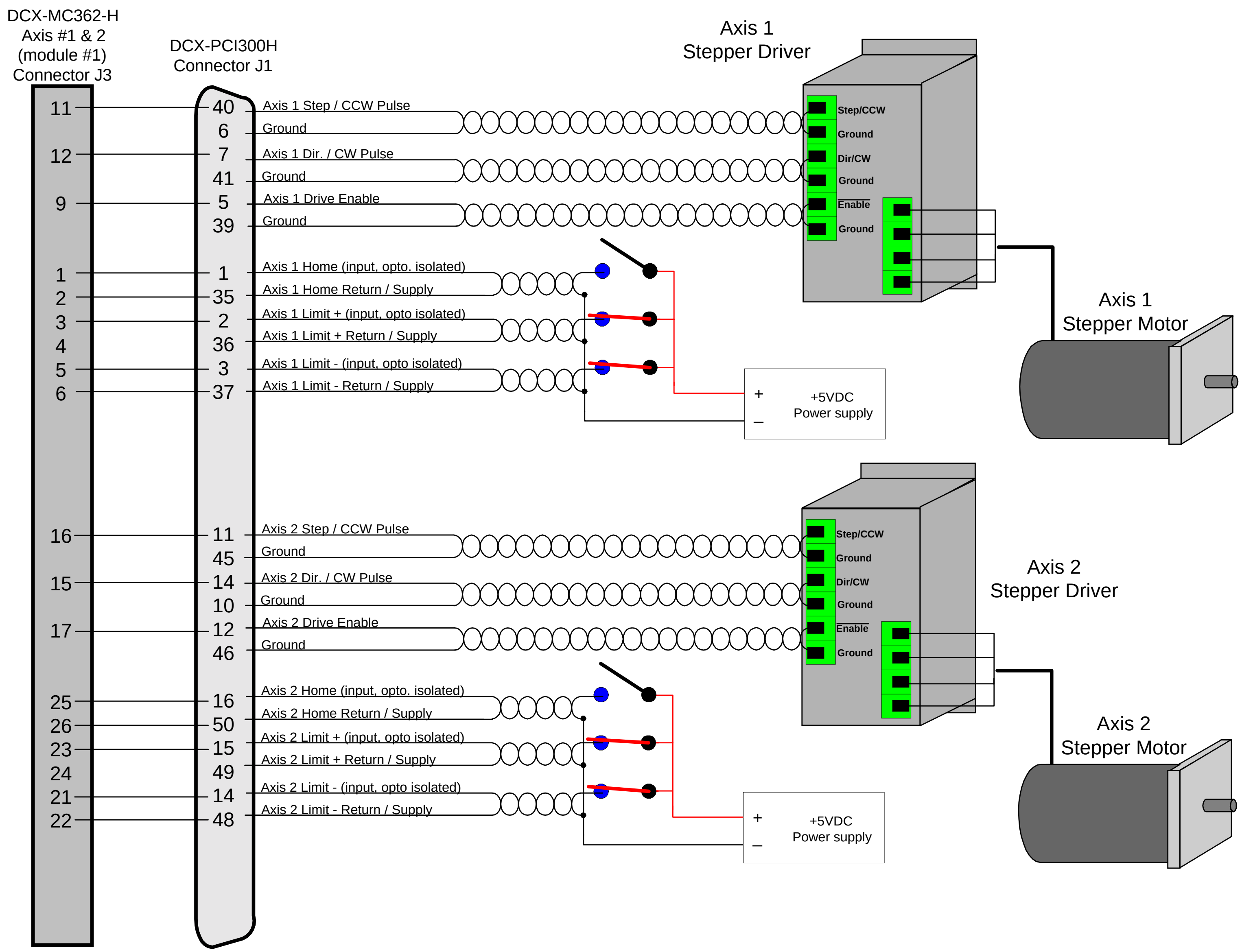


Figure 38: Typical connections for DCX-MC362-H Dual Stepper Motor Control Module

DCX-MC400 – Digital I/O Expansion Module Installation

One or more MC400 digital I/O modules can be installed on the DCX. There are no jumpers on this module to be configured. The module's TTL digital I/O signals can be connected directly to the external circuits if output loading (1ma maximum sink/source) and input voltages (0.0V to +5.0V) are within acceptable limits. Alternatively, PMC's DCX-BFO22 interface board can be used to connect the module's I/O to a relay rack in order to provide optically isolated inputs and outputs.

The DCX-BFO22 interface board provides a convenient means of connecting the MC400's TTL digital I/O channels to a 16 position relay rack available from two manufacturers, Opto22 (P/N PB16H) and Grayhill (P/N 70RCK16-HL). These relay racks accept up to 16 optically isolated input or output modules for interfacing with external electrical systems. Using one of these relay racks and a BFO22, an optically isolated I/O module can be connected to each of the MC400's digital I/O channels.

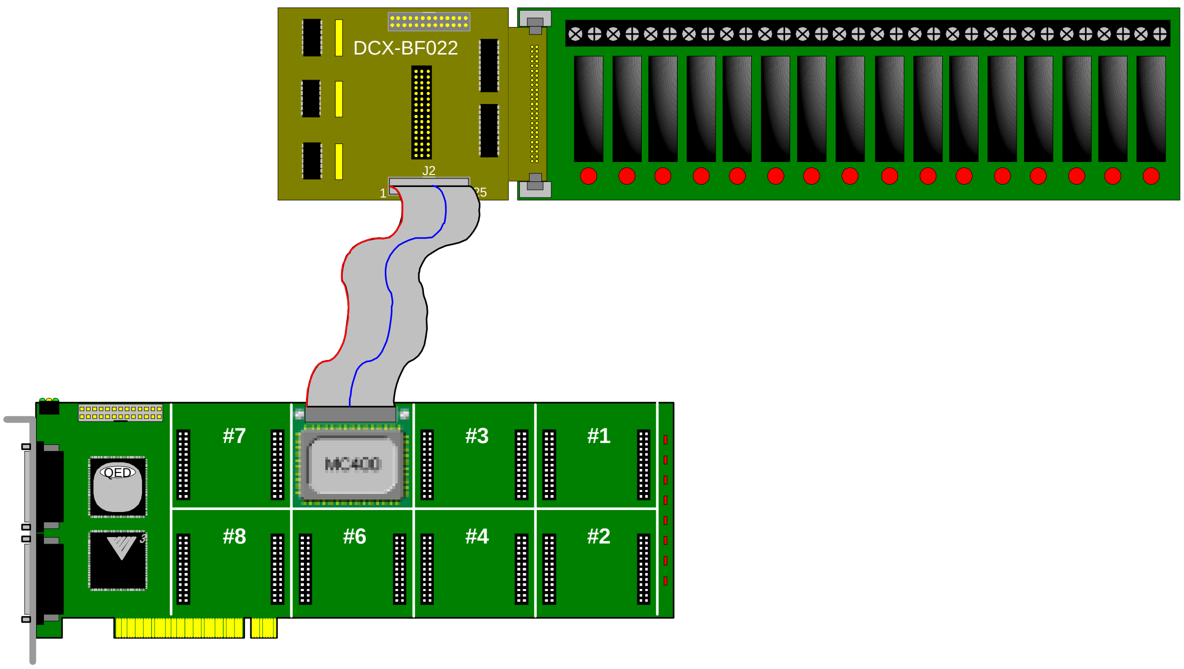


Figure 39: A DCX-BF022 is used to interface DCX digital I/O to an OPTO22 relay rack

As shown above, the BFO22 plugs directly into the relay rack's 50 pin header connector and then connects to the MC400 via a 26 conductor ribbon cable. Note that the relays are numbered sequentially starting from 0, while the DCX digital I/O channels are numbered sequentially starting with 1.

Although the relay rack has screw terminals for connecting a logic supply, it is not necessary to make this connection. By installing a shorting block on jumper JP17 of the BFO22, the 5 volt supply of the DCX will be supplied to the relay rack.

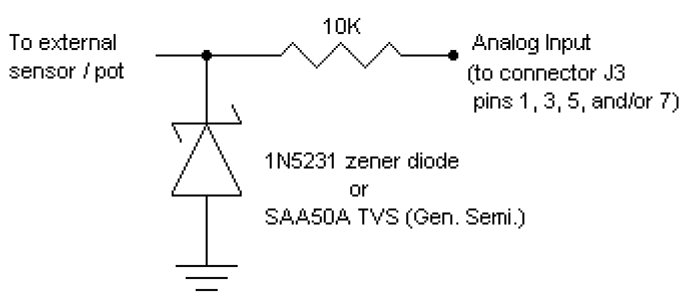
For detailed information on configuring the DCX-BF022, please refer to the schematic and jumper table in the DCX-BF022 Appendix in this user manual.

DCX-MC500 – Analog I/O Expansion Module Installation

One or more MC500 analog I/O modules can be installed in the DCX as described in the first section of this chapter. There are no jumpers on this module to be configured. The module's I/O signals can be connected directly to the user's external circuits as long as output loading is not excessive and input voltages are maintained within the specified limits (see the MC500 appendix).

A voltage level greater than 5.6 volts will damage DCX-MC500 analog input channels. The schematic below is recommended to protect an analog input from damage due to an over voltage condition. This circuit will limit the maximum voltage applied to the A/D converter to 5.6 VDC.

Analog Input Protection Circuit



Chapter Contents

Chapter 4

Programming, Software and Utilities

The DCX motion control system integrates seamlessly into high performance, Windows applications. The **Motion Control Application Programming Interface** (**MCAPI**) provides support for all popular high level languages. Additionally, the board level command set (MCCL) allows the machine designer to execute local ‘macro’ routines independent of the PC host and its application programs.

PMC’s Motion Control API (MCAPI) is a group of Windows components that, taken together, provide a consistent, high level, Applications Programming Interface (API) for PMC's motion controllers. The difficulties of interfacing to new controllers, as well as resolving controller specific details, are handled by the API, leaving the applications programmer free to concentrate on the application program.

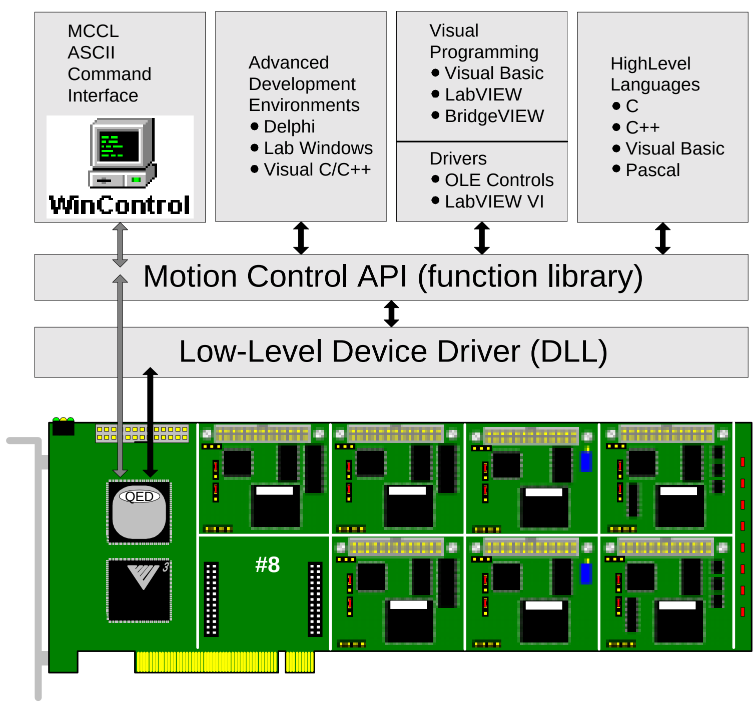


Figure 40: MCAPI and DCX-PCI300 architectural diagram

The API has been constructed with a layered approach. As new versions of Windows operating systems and new PMC motion controllers become available API support is provided by simply replacing one or more of these layers. Because the public API (the part the applications programmer sees) is above these layers, few or no changes to applications programs will be required to support new version of the MCAPI.

The API itself is implemented in three parts. The low level device driver provides communications with the motion controller, in a way that is compatible with the Microsoft Windows operating system. The MCAPI low level driver passes binary MCCL commands (Motion Control Command Language – the instruction set of the DCX motion controller) to the DCX. By placing the operating system specific portions of the API here it will be possible to replace this component in the future to support new operating systems without breaking application programs, which rely on the upper layers of the API.

Sitting above that, and communicating with the driver is the API Dynamic Link Library (DLL). The DLL layer implements the high level motion functions that make up the API. This layer also handles the differences in operation of the various PMC Motion Controllers, making these differences virtually transparent to users of the API.

At the highest level are environment specific drivers and support files. These components support specific features of that particular environment or development system.

Care has been exercised in the construction of the API to ensure it meets with Windows interface guidelines. Consistency with the Windows guidelines makes the API accessible to any application that can use standard Windows components - even those that were developed after the Motion Control API! Please refer to the **Motion Control Application Programming Interface (MCAPI Reference Manual** for additional information on adapting the MCAPI to other development environments.

Controller Interface Types

The DCX controller supports two onboard interfaces, an ASCII (text) based interface and a binary interface. The binary interface is used for high speed command operation, and the ASCII interface is used for interactive text based operation. The high level sample programs (CWDEMO and VBDEMO) use the binary interface, PMC WinControl uses the ASCII interface.

Application programs must indicate which interface they intend to use when they open a handle for a particular controller. A controller may have more than one handle open at a time, but all open handles for a particular controller must specify the same interface (all must be open with the binary interface or all must be open with the ASCII interface). The open mode is specified by setting the second argument of the ***MCOpen( )*** function to either **MC_OPEN_ASCII** or **MC_OPEN_BINARY**.

Note that not all functions are available in the ASCII mode of operation, this mode is intended primarily for use with the ***pmcgetc( )***, ***pmcgets( )***, ***pmcputc( )***, and ***pmcputs( )*** character based functions (these 4 functions are not available in binary mode). This restriction will be eliminated in a future release of the API.

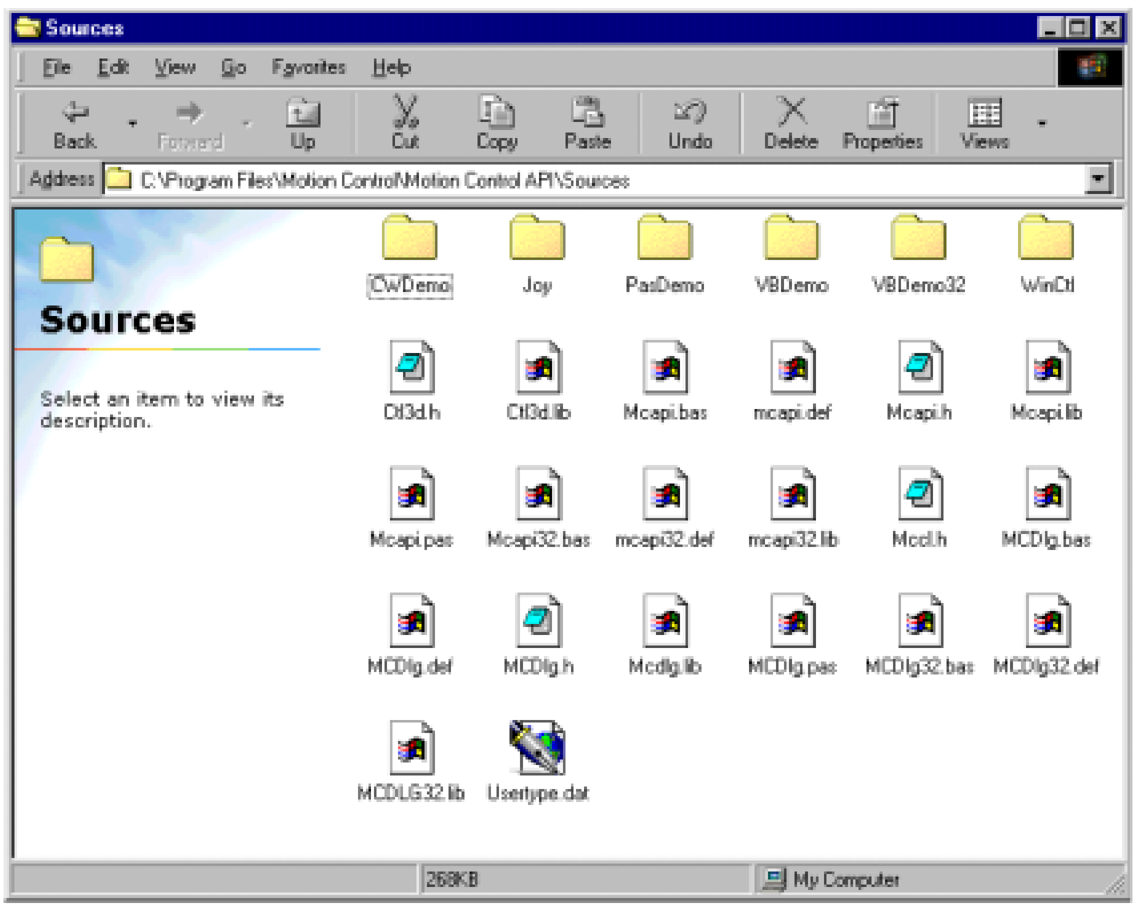
Building Application Programs using Motion Control API

The Motion Control Application Programming Interface (MCAPI) is designed to allow a programmer to quickly develop sophisticated application programs using popular development tools. The MCAPI provides high level function calls for:

- Configuring the controller (servo tuning parameters, velocity and ramping, motion limits, etc.)
- Defining on-board user scaling (encoder/step units, velocity units, dwell time units, user and part zero)
- Commanding motion (Point to Point, Constant velocity, Electronic Gearing, Lines and Arcs, Joystick control)
- Reporting controller data (motor status, position, following error, current settings)
- Monitoring Digital and Analog I/O
- Driver functions (open controller handle, close controller handle, set timeout)

A complete description of all MCAPI functions can be found in the **Motion Control Application Programming Interface (MCAPI) Reference Manual**.

Included with the installation of the MCAPI is the Sources 'folder'. In this folder are complete program sample source files for C++, VisualBasic, and Delphi.



C/C++ Programming

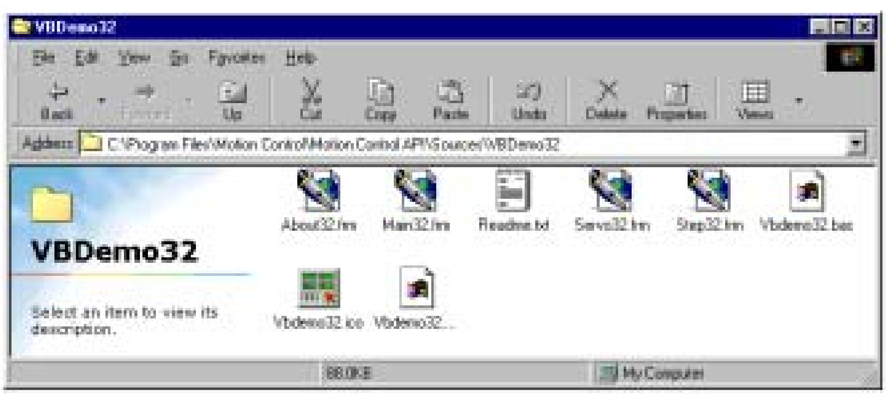
Included with each of the C program samples (CWDemo. Joystick demo, and WinControl) is a read me file (readme.txt) that describes how to build the sample program. The following text was reprinted from the readme.txt file for the CWDemo program sample.

```
Contents
========
- How to build the sample
- LIB file issues
- Contacting technical support

How to build the sample
=======================
To build the samples you will need to create a new project or make file within your C/C++ development
tool. Include the following files in your project:
   CWDemo.c
   CWDemo.def
   CWDemo.rc

For 16-bit development you will also need:
   ..\mcapi.lib
   ..\mcdlg.lib
   ..\ctl3d.lib

For 32-bit development you will also need:
   ..\mcapi32.lib
   ..\mcdlg32.lib

   If your compiler does not define the _WIN32 constant for 32-bit projects you will need to define it at
   the top of the source file (before the header files are included).

LIB File Issues
===============
Library (LIB) files are included with MCAPI for all the DLLs that comprise the user portion of the API
(MCAPI.DLL, MCAPI32.DLL, MCDLG.DLL, and MCDLG32.DLL). These LIB files make it easy to resolve
references to functions in the DLL using static linking (typical of C/C++). Unfortunately,
under WIN32 the format of the LIB files varies from compiler vendor to compiler vendor. If you cannot use
the included LIB files with your compiler you will need to add an IMPORTS section to your projects DEF
file. We have included skeleton DEF files for all of the DLLs for which we also include a LIB file
(MCAPI.DEF, MCAPI32.DEF, MCDLG.DEF, and MCDLG32.DEF).

The 16-bit LIB files were built with Microsoft Visual C/C++ Version 1.52,
and the 32-bit LIB files Microsoft Visual Studio Version 5.
```

Visual Basic Programming

Included with each of the Visual Basic program samples (VBDemo. VBDemo32) is a read me file (readme.txt) that describes how to build the sample program. The following text was reprinted from the readme.txt file for the VBDemo32 program sample.

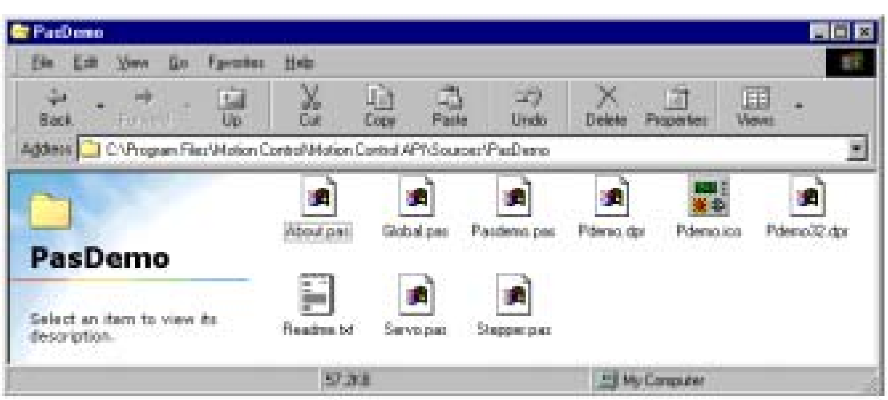
```
Contents
========

- About the sample
- How to build the sample
- Contacting technical support


About the sample
================
This sample demonstrates a simple user interface to one axis of a motion controller. The user may
program moves and interact with the motion in a number of ways (stop it, abort it, etc.). Sample forms
demonstrate how to configure servo or stepper motor axes. A number of the new MCDialog functions
(such as a full-featured, ready-to-run
axis configuration dialog) are also demonstrated.


How to build the sample
=======================
To build the samples you will need to create a new project or use the  Visual Basic project file (created
with Visual Basic v6.0) included with the sample. Include the following files if you create your own project:

    About32.frm
    Main32.frm
    Servo32.frm
    Step32.frm
    VBDemo.bas

    ..\mcapi32.bas
    ..\mcdlg32.bas

Set frmMain as the startup object for the project.
```



Delphi Programming

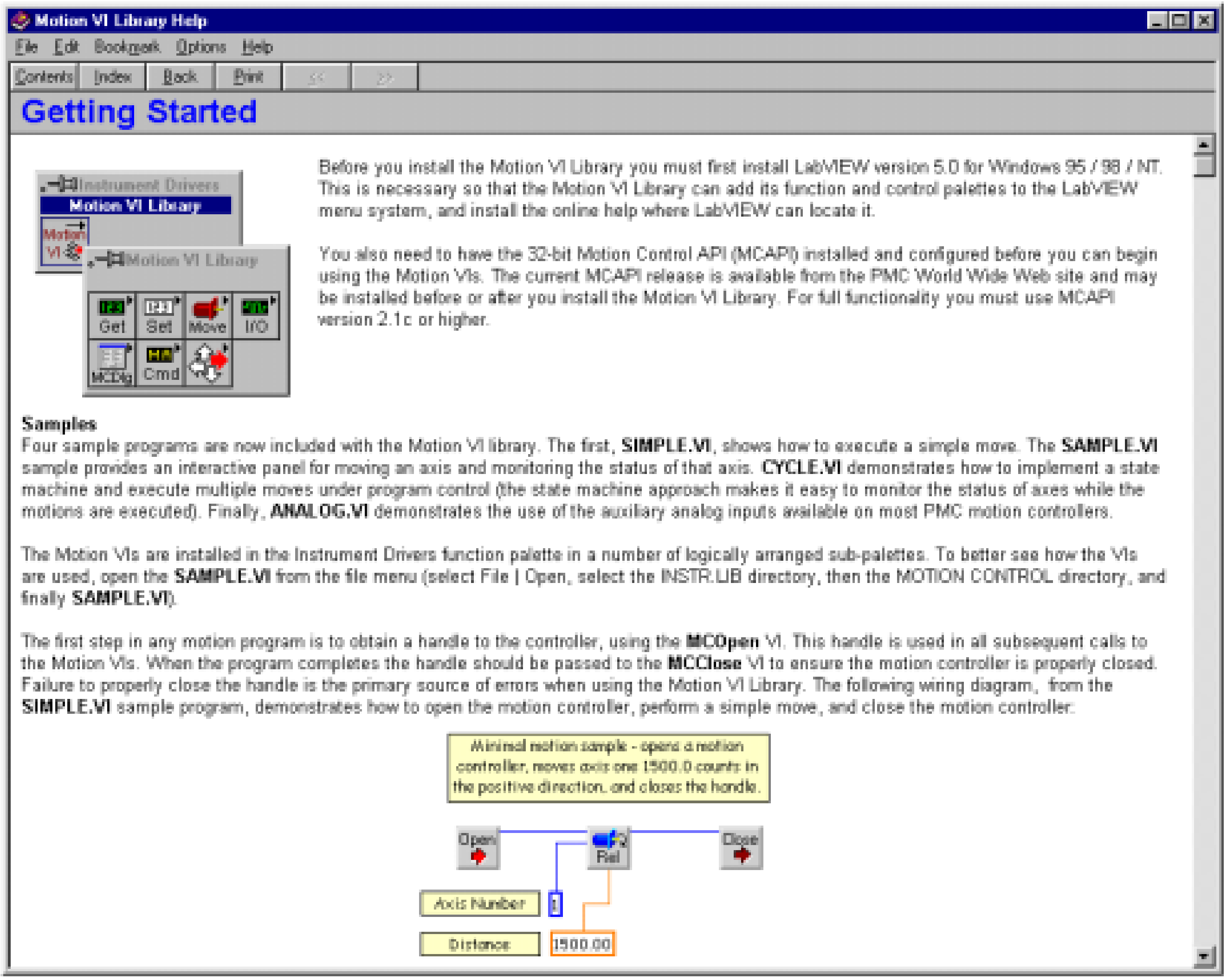
Included with each of the Delphi program sample (PasDemo) is a read me file (readme.txt) that describes how to build the sample program. The following text was reprinted from the readme.txt file for the PasDemo program sample.

```
Contents
========

- About the sample
- How to build the sample
- Contacting technical support


About the sample
================
This sample demonstrates a simple user interface to one axis of a motion controller. The user may
program moves and interact with the motion in a number of ways (stop it, abort it, etc.). Sample forms
demonstrate how to configure servo or stepper motor axes. A number of the new MCDialog functions
(such as a full-featured, ready-to-run
axis configuration dialog) are also demonstrated.


How to build the sample
=======================
To build the samples you will need to create a new project or use the  Delphi project files included with the
sample (Pdemo.dpr for 16-bit, Pdemo32.dpr for 32-bit). Include the following files if you create your
own project:

    About.pas
    Global.pas
    PasDemo.pas
    Servo.pas
    Stepper.pas

For 16-bit projects you will also need:

    ..\mcapi.pas
    ..\mcdlg.pas

For 32-bit projects you will also need:

    ..\mcapi32.pas
    ..\mcdlg32.pas
```



LabVIEW Programming

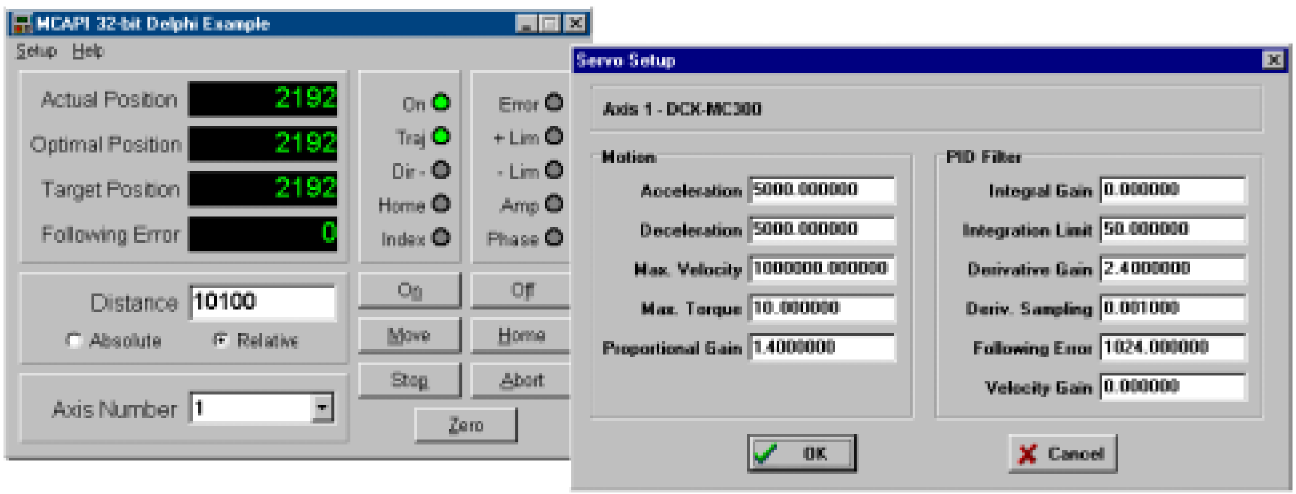
PMC’s LabVIEW Virtual Instrument Library includes an On-Line help with a Getting Started guide.

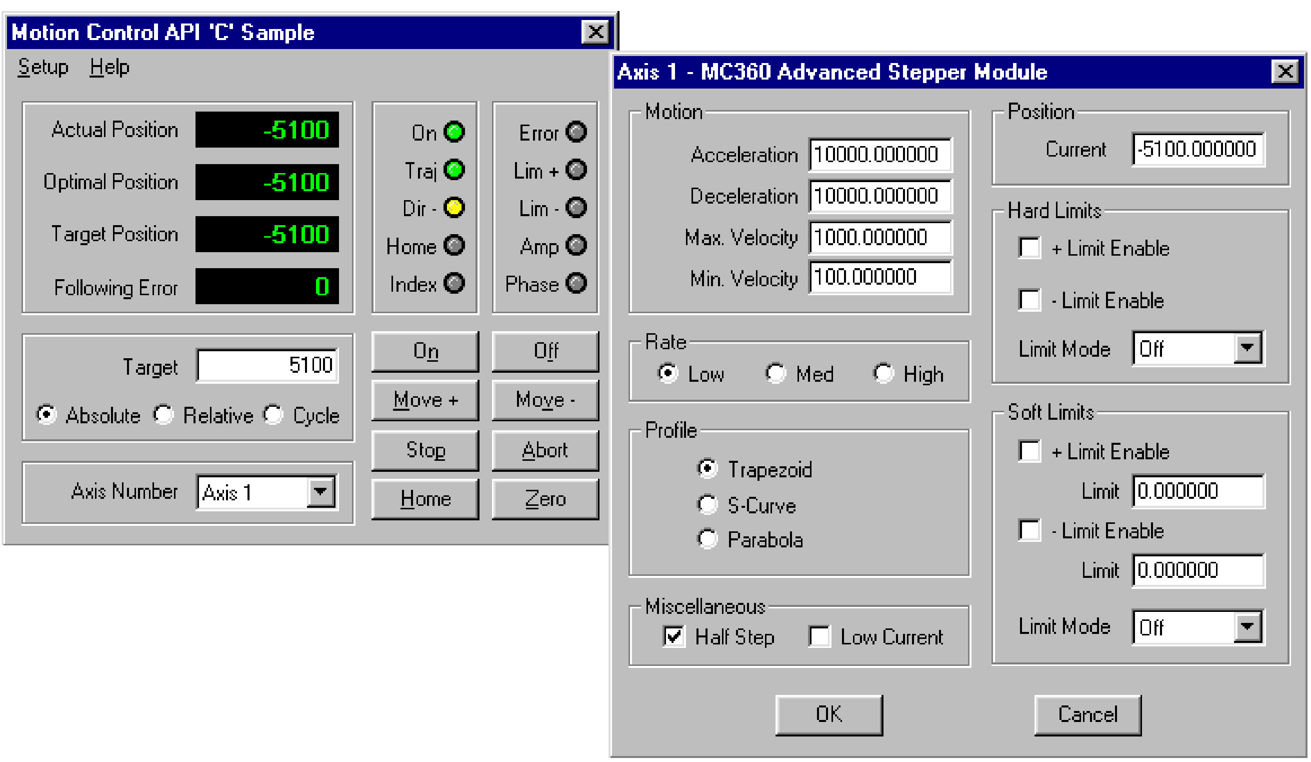


PMC Sample Programs

Sample programs with full source code are supplied with the MCAPI. These C++, Visual Basic, and Delphi sample programs allow the user to:

- Move an axis (servo or stepper)
- Monitor the actual, target, and optimal positions of an axis
- Monitor axis I/O (Limits +/-, Home, Index, an Amplifier Enable)
- Define or change move parameters (Maximum velocity, acceleration/deceleration)
- Define or change the servo PID parameters



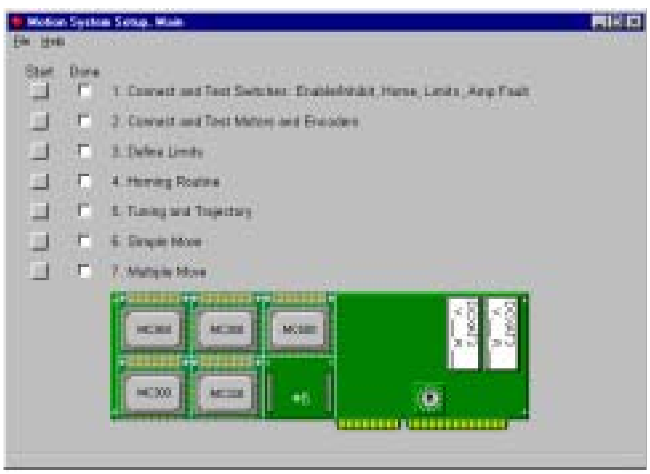


Motion Integrator

PMC's Motion Integrator program is just like having your own 'Systems Integrator' to assist you with every step of the integration process. Motion Integrator is a suite of powerful Windows tools that are used to:

- Configure the DCX motion control system
- Verify the operation of the control system
- Execute and plot the results of single and/or multi-axes moves
- Connect and test I/O
  - Axis I/O (Home, Limits, Enable)
  - General purpose Digital I/O
  - General purpose Analog I/O
- Tune the servo axes
- Diagnose controller failures
- View comprehensive on-line help including detailed wiring diagrams

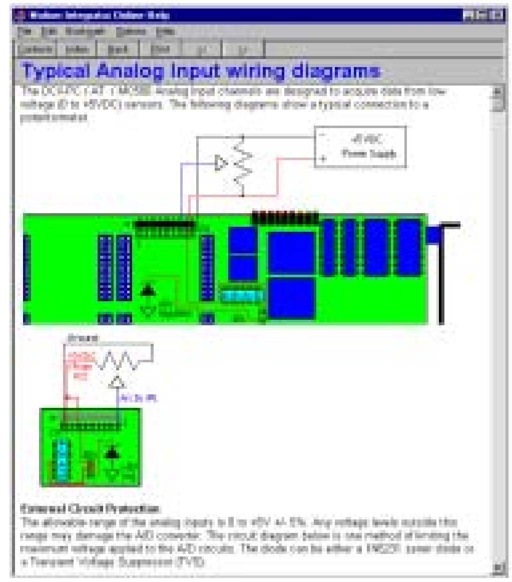
For first time PMC motion control users, Motion Integrator can be run as a series of Windows Wizards



The Motion System Setup program opens with a picture of the DCX controller and a listing of the recommended integration steps

The Axis I/O wizard allows the user to verify the operation of the Limits, Home, and Amp/Drive Enable

Once the systems has been tested and tuned (servo's only) PMC's Motor Mover allows users to: move any or all motors, change velocities on the fly, define cycling routines, monitor position and status



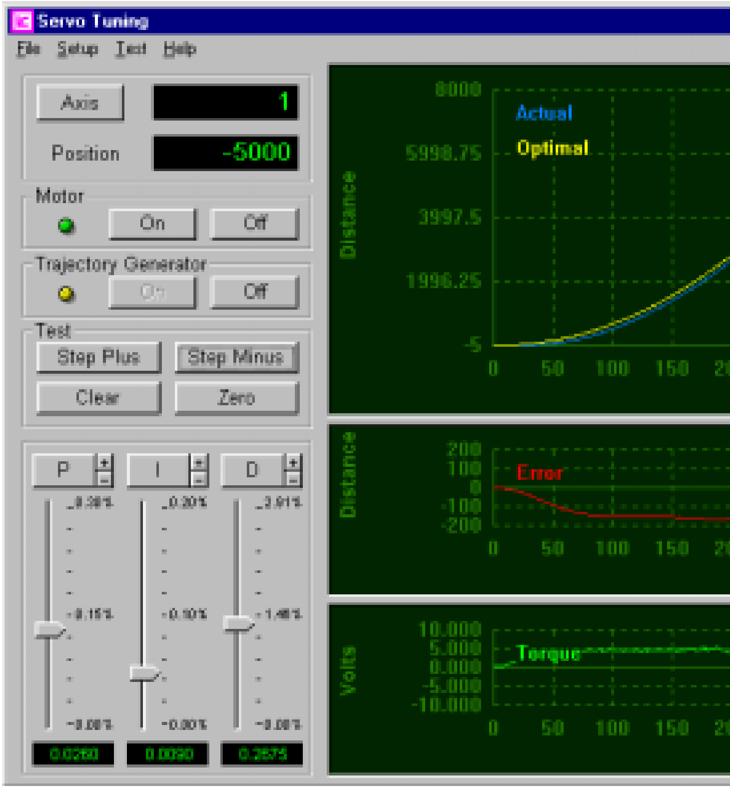
The on-line help provides detailed information, wiring diagrams, and application examples.

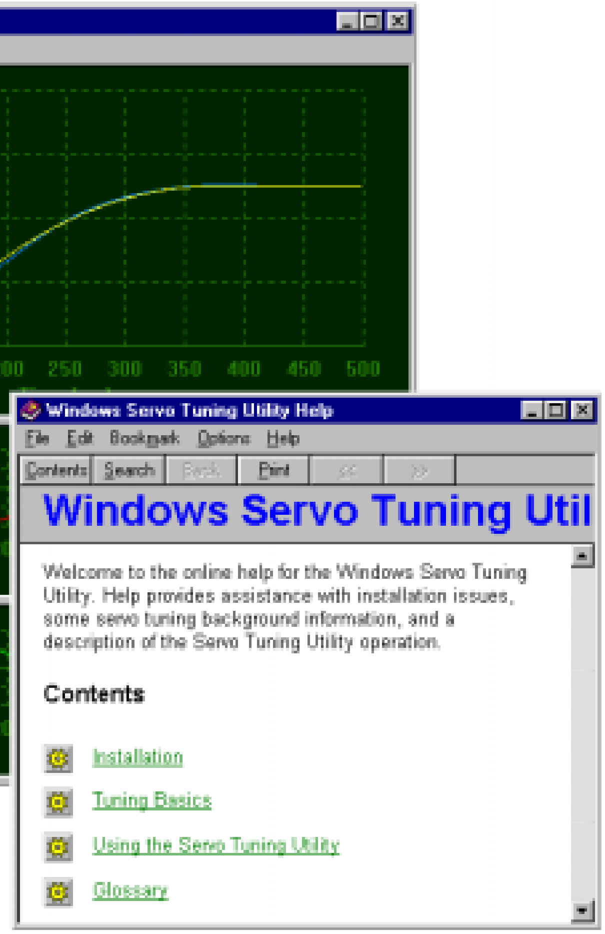
Tuning servo's with Motion Integrator
Motion Integrator provides a powerful and easy to use tool for 'dialing in' the performance of servo systems. From simple current/torque mode amplifiers to sophisticated Digital Drives, Motion Integrator makes tuning a servo is quick and easy.

By disabling the Trajectory generator, the user can execute repeated Gain mode (no ramping - maximum velocity or acceleration/deceleration) step responses to determine the optimal PID filter parameters:

Proportional gain
Derivative gain
Derivative sampling period
Integral gain
Integration Limit

With the Trajectory generator turned on, the user can execute 'real world' moves displaying the calculated position, actual position, following error, and DAC output plots.

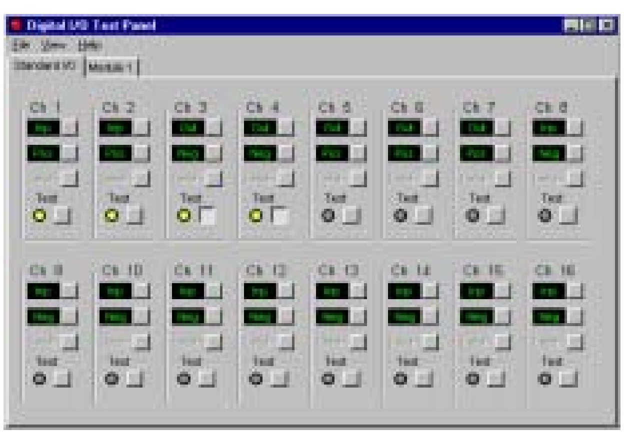




The Servo Tuning Utility includes on-line help assisting with both using the program and explaining the fundamentals of servo tuning. A complete Servo Tuning tutorial is available on the MotionCD

Digital and Analog I/O Test Panels

Motion Integrator Digital I/O, and Analog I/O allow the user to verify the operation of general purpose I/O.

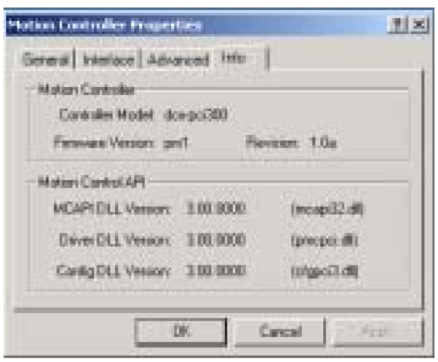


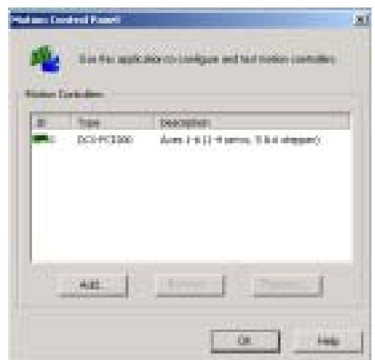
PMC Utilities

A powerful suite of utilities are included with the Motion Control API. These tools allow the user:

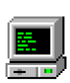
- Query motion control system version information
- Issue native language (MCCL) commands directly to the DCX controller
- Upgrade the firmware of the DCX controller
- Manually position axes with a game port joystick
- Display the Status of an axis

PMC's Motion Control Panel
The Motion Control Panel is used to query the motion control system for firmware and software (MCAPI) version information, and remove a controller. It can be launched either from the Windows **Start** menu or by selecting the Motion Control icon from the Windows Control Panel.

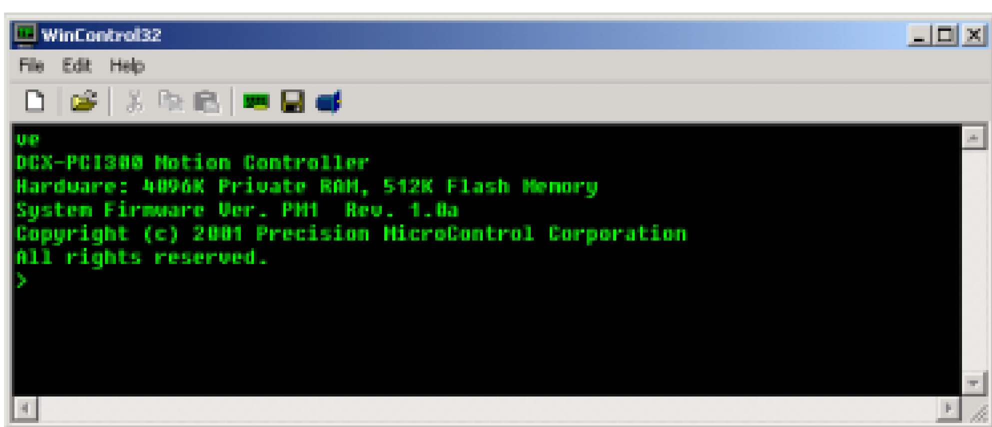




WinControl – MCCL (Motion Control Command Language) command set interface utility
This utility provides the user with a direct communication interface with the DCX-PCI300 in its native language (MCCL). This tool is extremely useful not only during initial controller integration but also as a debug tool during application software development. Two methods of executing MCCL commands are supported: A PC keyboard key stroke is passed directly to the DCX controller, and/or download a MCCL command text file via the **File** – **Open** menu options



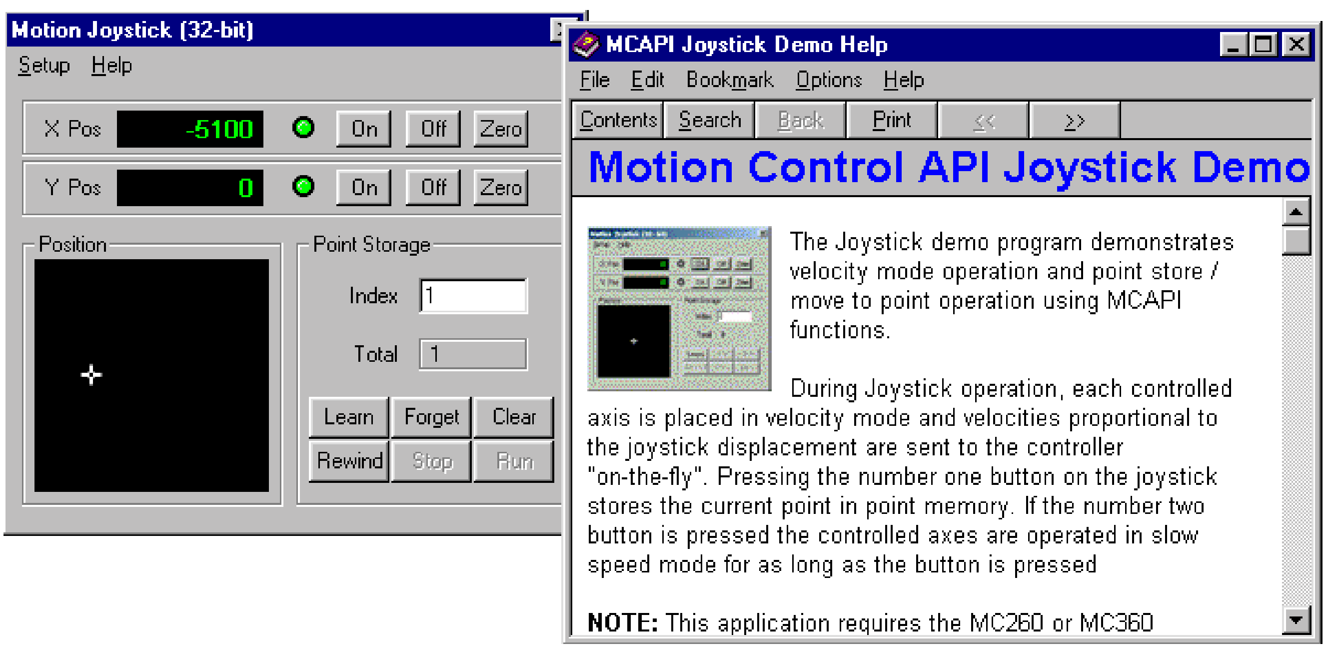
WinControl.exe



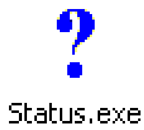
Flash Wizard
To increase CPU efficiency and reduce cost the DCX-PCI300 uses primarily SDRAM. All operational program code (otherwise known as firmware) for the DCX-PCI300 is stored on the hard drive during installation of the MCAPI. When the PC is first powered the MCAPI writes this program code into the on-board SDRAM in a process called Dynamically Loaded Firmware (DLF).

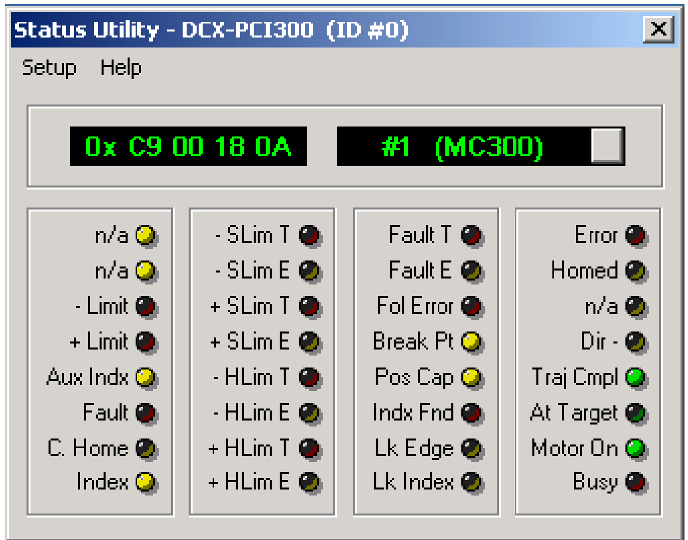
PMC's Flash Wizard is a windows utility that allows the user to easily upgrade the program code from file downloaded from PMC's web site **www.pmccorp.com**.

Joystick Applet
Allows the user to manually position two axes using a joystick connected to the game port of a PC. Full source code for this applet is provided.



Status Panel
Allows the user to monitor the status any or all axes (servo or stepper).





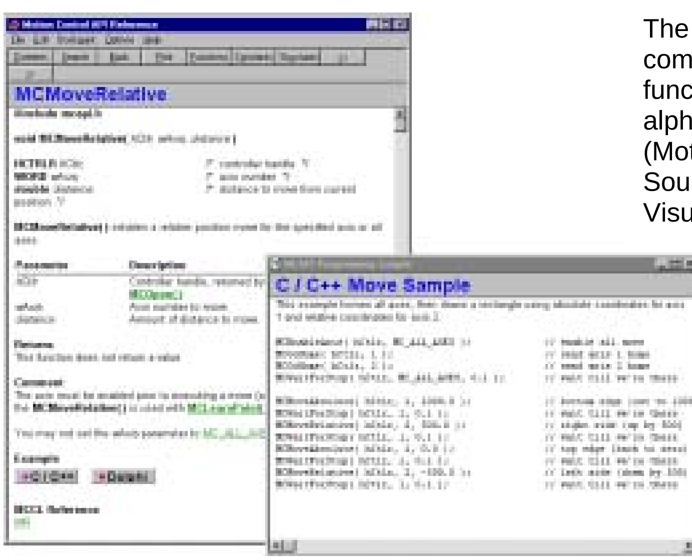
MCAPI On-line Help

Complete and up to date (from PMC website www.pmccorp.com) On-line help for PMC's MCAPI (Motion Control Application Programming Interface). Help documents include; installation and basic usage, complete function call reference and examples, high level dialog descriptions, and LabVIEW VI Library reference.

Mcguide.hlp

The MCAPI Users Guide On-line Help describes the basics of PMC's MCAPI. This should be the '**first stop**' for any questions about the MCAPI.

Mcapi.hlp

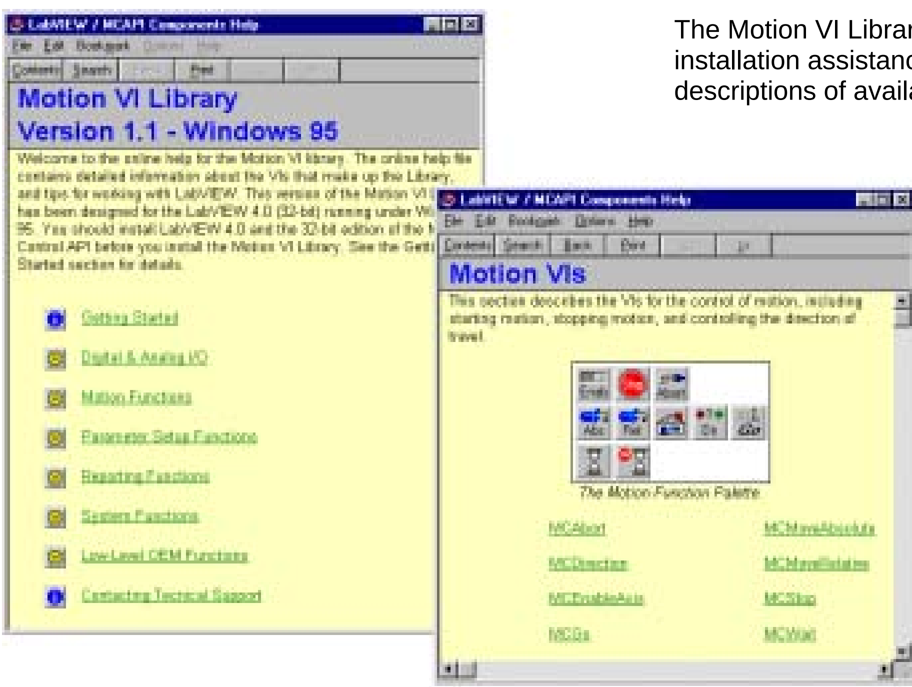


The MCAPI On-line Help provides a complete listing and description of all MCAPI functions. Function calls are grouped both alphabetically and by functional groups (Motion, Setup, Reporting, Gearing, etc...). Source code examples are provided for C++, Visual Basic, and Delphi.

Mcdlg.hlp

The MCAPI Common Dialog On-line Help describes the high level MCAPI Dialog functions. These operations include: Save and Restore axis configurations (PID and Trajectory), Windows Class Position and Status displays, Scaling, and I/O configuration.

Mclv.hlp



The Motion VI Library On-line Help provides installation assistance and detailed descriptions of available VI's.

Chapter Contents

- Motherboard: DCX-PCI300
- DCX-MC300 - +/- 10 Volt Analog Servo Motor Control Module
- DCX-MC302 – Dual +/- 10 Volt Analog Servo Motor Control Module
- DCX-MC320 - Brushless Servo Commutation Control Module
- DCX-MC360 - Stepper Motor Control Module
- DCX-MC362 – Dual Stepper Motor Control Module
- DCX-MC400 - 16 channel Digital I/O Module
- DCX-MC5X0 - Analog I/O Module

Chapter 5

DCX Specifications

Motherboard: DCX-PCI300

Function	15 Axis Motion Controller
Installation	Intel PC compatible computer
Configuration	8 User Installed Modules
Main Processor	QED 5231 200MHz MIPS RISC
Processor Clock	192 MHz
Memory	512k x 8 bit Flash Memory
	1Meg X 32 Synchronous Dynamic Ram
Processor Fault Detection	Watchdog Circuit with Reset Relay
Status LED's	Power, Reset, Run, General Purpose (8)
Standard Communication Interface	PCI Bus 4 Kilobytes dual ported memory in Memory Address Space 'Plug and Play' dynamic addressing
Undedicated Digital I/O Channels	16 TTL (0 – 5 VDC), 1ma max. sink/source with 4.7K ohm pull up to +5V 2 groups (8 inputs, 8 outputs)
Connection options	DCX-PCI300-H - VHDCI Ultra SCSI (SCSI V) DCX-PCI300-R – 26 conductor, dual row, ribbon cable
Required Supply Voltages	+5,+12 and -12 vdc
Form Factor	Full Size PCI card (4.2" x 12.28")
Operating Temperature range	0 degrees C to 60 degrees C
Weight	10 oz + 1.2 oz per module (approx.)

DCX-MC300 - +/- 10 Volt Analog Servo Motor Control Module

Function	Closed Loop Servo Controller with Dual Encoder Inputs
Installation	DCX-PCI300 Motion Control Motherboard
Operating Modes	Position, Velocity, Contouring, Torque, and Gain
Filter Algorithm	PID with Velocity and Acceleration Feed-Forwards
Filter Update Rate	8, 4 or 2 KHz, software selectable
Trajectory Generator	Trapezoidal, Parabolic or S-Curve Independent Acceleration and Deceleration
Command output	Analog Signal (+/- 10 vdc @ 10 ma, 16 bit)
Position Feedback	Incremental Encoder with Index
Position and Velocity Resolution	32 bit
Primary Encoder	
Encoder and Index Inputs	Differential or single ended, -7 to +7 vdc max.
Encoder Count Rate	10,000,000 Quadrature Counts/Sec.
Encoder Supply Voltage	+5 or +12 vdc, jumper selectable
Auxiliary Encoder	
Encoder and Index Inputs	Differential or single ended, -7 to +7 vdc max.
Encoder Count Rate	10,000,000 Quadrature Counts/Sec.
Encoder Supply Voltage	+5 or +12 vdc, jumper selectable
Axis Inputs	Limit+, Limit-, Coarse Home, Amplifier Fault Optically isolated (Motorola MOC256)
Voltage range	+2.5V to +7.5V
Minimum current required	10 ma
Axis Outputs	Amplifier Enable, Direction Optically isolated Open Collector (Motorola MOC223)
Maximum voltage	30V
Maximum current sink	125ma
Connection options	DCX-MC300-H - VHDCI Ultra SCSI (SCSI V) DCX-MC300-R – 26 conductor, dual row, ribbon cable
Operating Temperature range	0 degrees C to 60 degrees C

DCX-MC302 – Dual +/- 10 Volt Servo Motor Control Module

Function	Dual Closed Loop Servo Controller
Installation	DCX-PCI300 Motion Control Motherboard
Operating Modes	Position, Velocity, Contouring, Torque, and Gain
Filter Algorithm	PID with Velocity and Acceleration Feed-Forwards
Filter Update Rate	8, 4 or 2 KHz, software selectable
Trajectory Generator	Trapezoidal, Parabolic or S-Curve Independent Acceleration and Deceleration
Command output	Axis 1 - Analog Signal (+/- 10 vdc @ 10 ma, 16 bit) Axis 2 - Analog Signal (+/- 10 vdc @ 10 ma, 16 bit)
Position Feedback	Incremental Encoder with Index
Position and Velocity Resolution	32 bit
Encoder	
Encoder and Index Inputs	Axis 1 - Differential or single ended, -7 to +7 vdc max. Axis 2 - Differential or single ended, -7 to +7 vdc max.
Encoder Count Rate	10,000,000 Quadrature Counts/Sec.
Encoder Supply Voltage	Axis 1 - +5 or +12 vdc, jumper selectable Axis 2 - +5 or +12 vdc, jumper selectable
Axis Inputs	Axis 1 - Limit+, Limit-, Coarse Home, Amplifier Fault Optically isolated (Seimens ILDC256) Axis 2 - Limit+, Limit-, Coarse Home, Amplifier Fault Optically isolated (Seimens ILDC256)
Voltage range	+2.5V to +7.5V
Minimum current required	10 ma
Axis Outputs	Axis 1 - Amplifier Enable Open Collector (TI 75453B) Axis 2 - Amplifier Enable Open Collector (TI 75453B)
Maximum voltage	30V
Maximum current sink	125ma
Connection options	DCX-MC302-H - VHDCI Ultra SCSI (SCSI V)
Operating Temperature range	0 degrees C to 60 degrees C

DCX-MC320 - Brushless Servo Commutation Control Module

Function	Closed Loop Servo Controller with Dual Encoder Inputs
Installation	DCX-PCI300 Motion Control Motherboard
Operating Modes	Position, Velocity, Contouring, Torque, and Gain
Filter Algorithm	PID with Velocity and Acceleration Feed-Forwards
Filter Update Rate	8, 4 or 2 KHz, software selectable
Trajectory Generator	Trapezoidal, Parabolic or S-Curve Independent Acceleration and Deceleration
Command output	Phase A (+/- 10 vdc @ 10 ma, 16 bit) Phase B (+/- 10 vdc @ 10 ma, 16 bit)
Position Feedback	Incremental Encoder with Index
Position and Velocity Resolution	32 bit
Primary Encoder	
Encoder and Index Inputs	Differential or single ended, -7 to +7 vdc max.
Encoder Count Rate	10,000,000 Quadrature Counts/Sec.
Encoder Supply Voltage	+5 or +12 vdc, jumper selectable
Hall Sensor / Auxiliary Encoder	
Encoder and Index Inputs	Differential or single ended, -7 to +7 vdc max.
Encoder Count Rate	10,000,000 Quadrature Counts/Sec.
Encoder Supply Voltage	+5 or +12 vdc, jumper selectable
Axis Inputs	Limit+, Limit-, Coarse Home, Amplifier Fault Optically isolated (Motorola MOC256)
Voltage range	+2.5V to +7.5V
Minimum current required	10 ma
Axis Outputs	Amplifier Enable, Optically isolated Open Collector (Motorola MOC223)
Maximum voltage	30V
Maximum current sink	125ma
Connection options	DCX-MC320-H - VHDCI Ultra SCSI (SCSI V) DCX-MC320-R – 26 conductor, dual row, ribbon cable
Operating Temperature range	0 degrees C to 60 degrees C

DCX-MC360 - Stepper Motor Control Module

Function	Open or Closed Loop Stepper Controller
Installation	DCX-PCI300 Motion Control Motherboard
Operating Modes	Position, Velocity, and Contouring
Trajectory Generator	Trapezoidal, Parabolic or S-Curve Independent Acceleration and Deceleration
Position Feedback	Incremental Encoder with Index (for closed loop stepper operation or position verification of an open loop stepper)
Position and Velocity Resolution	32 bit
Step Outputs	Pulse/Direction or CW/CCW (software selectable), 50% duty cycle open collector drivers (max. 30V, 125ma current sink)
Step Rates (Software Selectable)	High Speed - 153 Steps/Sec. - 5.0M Steps/Sec. Medium Speed - 20 Steps/Sec. - 625K Steps/Sec. Low Speed - .1 Steps/Sec. – 78K Steps/Sec.
Axis Inputs	Limit+, Limit-, Home, Drive Fault (Optically isolated Motorola MOC256)
Voltage range	+2.5V to +7.5V
Minimum current required	10 ma
Axis Outputs	Drive Enable, Full/Half Current (Open Collector TI 75453B)
Maximum voltage	30V
Maximum current sink	125ma
Connection options	DCX-MC360-H - VHDCI Ultra SCSI (SCSI V) DCX-MC360-R – 26 conductor, dual row, ribbon cable
Operating Temperature range	0 degrees C to 60 degrees C

DCX-MC362 – Dual Stepper Motor Control Module

Function	Dual Open Loop Stepper Controller
Installation	DCX-PCI300 Motion Control Motherboard
Operating Modes	Position, Velocity, and Contouring
Trajectory Generator	Trapezoidal, Parabolic or S-Curve Independent Acceleration and Deceleration
Position Feedback	None
Position and Velocity Resolution	32 bit
Step Outputs	Axis 1 - Pulse/Direction or CW/CCW (software selectable), 50% duty cycle, open collector drivers (max. 30V, 125ma current sink) Axis 2 - Pulse/Direction or CW/CCW (software selectable), 50% duty cycle, open collector drivers (max. 30V, 125ma current sink)
Step Rates (Software Selectable)	High Speed - 153 Steps/Sec. - 5.0M Steps/Sec. Medium Speed - 20 Steps/Sec. - 625K Steps/Sec. Low Speed - .1 Steps/Sec. – 78K Steps/Sec.
Axis Inputs	Axis 1 - Limit+, Limit-, Home, Drive Fault Optically isolated (Motorola MOC256) Axis 2 - Limit+, Limit-, Home, Drive Fault Optically isolated (Motorola MOC256)
Voltage range	+2.5V to +7.5V
Minimum current required	10 ma
Axis Outputs	Axis 1 - Drive Enable, Full/Half Current, Open Collector (TI 75453B) Axis 2 - Drive Enable, Full/Half Current, Open Collector (TI 75453B)
Maximum voltage	30V
Maximum current sink	125ma
Connection options	DCX-MC362-H - VHDCI Ultra SCSI (SCSI V)
Operating Temperature range	0 degrees C to 60 degrees C

DCX-MC400 - 16 channel Digital I/O Module

Function	16 Channel Digital I/O module
Installation	DCX-PCI300 Motion Control Motherboard
Channels	16, individually programmable as input s or outputs
Output low voltage (min)	0.0 volt
Output high voltage (min)	2.4 volt
Current sink	1 ma max
Current source	1 ma max.
Input Low voltage	-0.3V min. to 0.8V max.
Input High voltage	2.0V min. to 5.3V max.
Input termination	4.7K ohm pull up to +5V per channel
Relay rack interface	DCX-BF022
Connection options	DCX-MC400-H - VHDCI Ultra SCSI (SCSI V) DCX-MC400-R – 26 conductor, dual row, ribbon cable
Operating Temperature range	0 degrees C to 60 degrees C

.

DCX-MC5X0 - Analog I/O Module

Function	DCX-MC500 – 4 A/D channels, 4 D/A channels DCX-MC510 – 4 A/D channels DCX-MC520 – 4 D/A channels
Installation	DCX-PCI300 Motion Control Motherboard
Inputs resolution	12 bit
Input voltage range	0.0V to +5.0V
Output resolution	12 bit
Output voltage range	0.0V to +5.0V (@ 5ma), -10V to +10V (@ 5ma)
Output Offset Adjustment	20 turn trim pot
Output Full Scale Adjustment	single turn trim pot
Connection options	DCX-MC5__0-H - VHDCI Ultra SCSI (SCSI V) DCX-MC5__0-R – 26 conductor, dual row, ribbon cable
Operating Temperature range	0 degrees C to 60 degrees C

DCX-MC500 Electrical Specifications

Parameter	Min.	Max	Unit
Input Resolution	12		Bits
Input Conversion Rate		10	KHz
Input Zero Error Using Internal Reference Using External Reference		 +/- 3 +/- 1/2	 LSB LSB
Input Full-Scale Error Using Internal Reference Using External Reference		 +/- 15 +/- 1/2	 LSB LSB
Input Zero Temp. Coefficient		0.5	ppm/C
Input Differential Nonlinearity		+/- 1	LSB
Input Total Unadjusted Error Using Internal Reference Using External Reference		 +/- 15 +/- 1	
Input Voltage Range Using Internal Reference Using External Reference	 0.0 0.0	 5.0 Vref	
Input Capacitance		8	
Input Leakage Current		100	
External Reference Voltage	4.0	6.0	

Parameter	Min.	Max	Unit
Output Resolution	12		Bits
Output Zero Code Error *			LSB
Output Full Scale Error *			LSB
Output Nonlinearity *			LSB
Output Total Unadjusted Error *			LSB
Output Voltage Range	0.0 -10.0	5.0 +10.0	V V

* These values are for 0 to +5.0 volt outputs

Chapter Contents

- DCX-PCI300 Motion Control Motherboard
- DCX-MC300 +/- 10V Servo Motor Control Module
- DCX-MC302 Dual +/- 10 Volt Analog Servo Motor Control Module
- DCX-MC320 Brushless Servo Commutation Control Module
- DCX-MC360 Stepper Motor Control Module
- DCX-MC362 Dual Stepper Motor Control Module
- DCX-MC400 Digital I/O Module
- DCX-MC500/MC510/MC520 Analog I/O Module
- DCX-BF022 Relay Rack Interface
- DCX-BF3XX-H High Density Cable Breakout
- DCX-BF300-R Servo Module Breakout Assembly
- DCX-BF320-R Servo Module Breakout Assembly
- DCX-BF360-R Stepper Module Breakout Assembly

Chapter 6

Connectors, Jumpers, and Schematics

DCX-PCI300 Motion Control Motherboard

Status LED Indicators

LED #	Color	Description
D1	Green	+5 VDC logic supply OK
D2	Yellow	DCX Reset active
D3	Green	Run (processor fault or watchdog tripped if off)
L1	Red	Motor Module #1 initialization error (will blink when reset)
L2	Red	Motor Module #2 initialization error (will blink when reset)
L3	Red	Motor Module #3 initialization error (will blink when reset)
L4	Red	Motor Module #4 initialization error (will blink when reset)
L5	Red	Motor Module #5 initialization error (will blink when reset)
L6	Red	Motor Module #6 initialization error (will blink when reset)
L7	Red	Motor Module #7 initialization error (will blink when reset)
L8	Red	Motor Module #8 initialization error (will blink when reset)

(Refer to diagram at the end of this appendix)

General Purpose I/O (Digital I/O and Analog inputs) Connector J5

Pin #	***Description***
1	+5 VDC
2	RESET RELAY CONTACT #1 *
3	DIGITAL OUTPUT CHANNEL 16
4	RESET RELAY CONTACT #2 *
5	DIGITAL OUTPUT, CHANNEL 15
6	DIGITAL OUTPUT, CHANNEL 14
7	DIGITAL OUTPUT, CHANNEL 13
8	DIGITAL OUTPUT, CHANNEL 12
9	DIGITAL OUTPUT, CHANNEL 11
10	DIGITAL OUTPUT, CHANNEL 10
11	DIGITAL OUTPUT, CHANNEL 09
12	DIGITAL INPUT, CHANNEL 08
13	DIGITAL INPUT, CHANNEL 07
14	DIGITAL INPUT, CHANNEL 06
15	DIGITAL INPUT, CHANNEL 05
16	DIGITAL INPUT, CHANNEL 04
17	DIGITAL INPUT, CHANNEL 03
18	DIGITAL INPUT, CHANNEL 02
19	DIGITAL INPUT, CHANNEL 01
20	NO CONNECT
21	+12 VDC
22	NO CONNECT
23	NO CONNECT
24	GROUND
25	-12 VDC
26	GROUND

Mating Connector:26-pin dual-row IDC female, Circuit Assembly P/N 26IDS2-C-SPT-SR or equivalent

*** -** Reset Relay contacts (normally open). The relay is energized (contacts 1 and 2 connected) when the DCX-PCI300 is held in reset.

Alternative +12 volt supply connector (not supported at this time)

Pin #	***Description***
1	
2	
3	
4	

Mating Connector:___________________________

J31 – +12 volt supply input select

Pins	***Description***
Open	+12 volt supply provided via connector J33
2 to 3	**+12 volt supply provided via PCI bus**

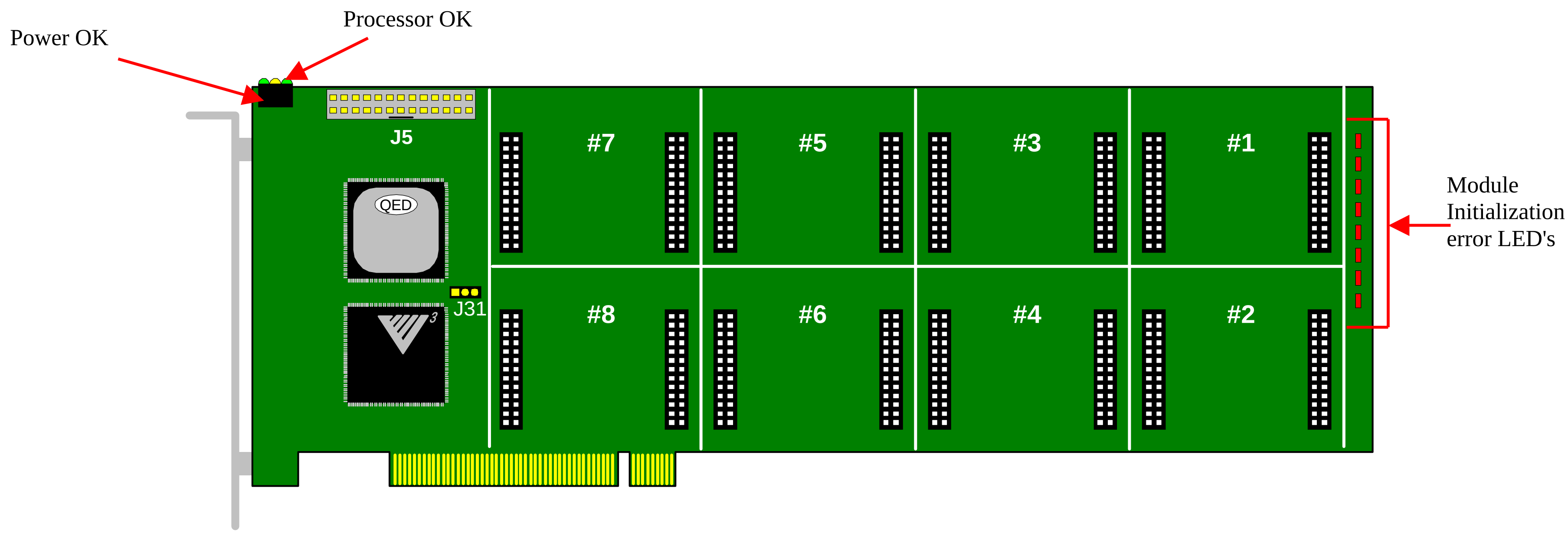
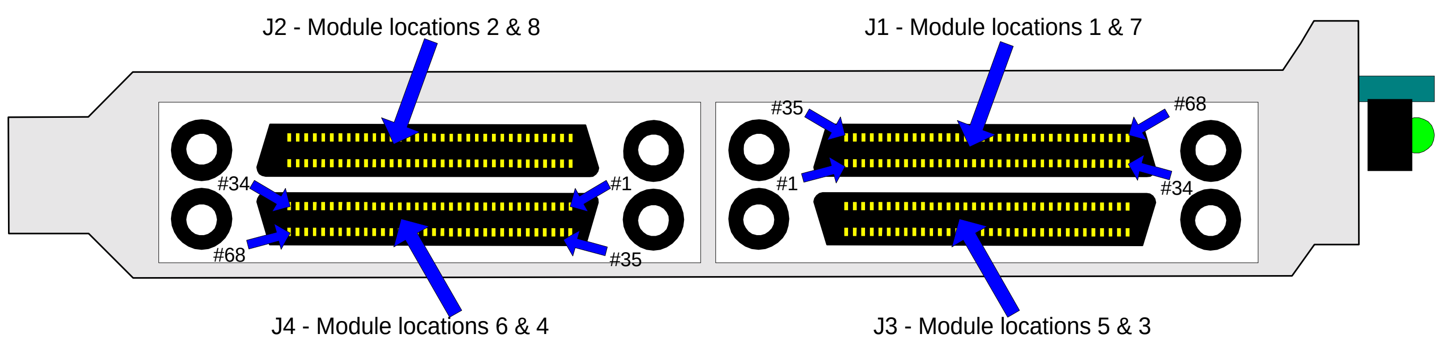


Figure 41: DCX-PCI300-R motherboard (ribbon cable version)



VHDCI connectors as viewed from the back of the computer
(component side down)

Figure 42: DCX-PCI300-H high density connectors pin numbering

DCX-MC300 +/- 10V Servo Motor Control Module

SIGNAL DESCRIPTIONS:

Analog Command Return
connection point: MC300-H J3 - pin 1, MC300-R J3 - pin 1
signal type: ground
notes:
explanation: Provides the signal ground for the modules Analog Command Signal output. This return path is common to the ground plane of the DCX motherboard, but is connected in such a way as to reduce digital noise. Typical servo amplifiers will have a connection for the analog command (or Ref-) return where this signal should be connected.

Analog Command Output
connection point: MC300-H J3 - pin 2, MC300-R J3 - pin 2
signal type: +/- 10V analog, 16 bit
notes: connects to servo amplifier motor command input (Ref+)
explanation: This module output signal is used to control the servo amplifier's output. When connected to the command input of a velocity mode amplifier, the voltage level on this signal should cause the amplifier to drive the servo at a proportional velocity. For current mode amplifiers, the voltage level should cause a proportional current to be supplied to the servo. In its default Bipolar output mode, the module provides an analog signal that is in the range -10 to +10 volts, with 0 volts being the null output level. Positive voltages indicate a desired velocity or current in one direction. Negative voltages indicate velocity or current in the opposite direction. By using the Output Mode command, the output can be changed to Unipolar, where the analog signal range is 0 to +10 volts, and a separate signal is used to indicate the desired direction of velocity or current. The maximum drive current of this signal is +/-10 milliamps.

Compare / Direction Output
connection point: MC300-H J3 - pin 3, MC300-R J3 - pin 7
signal type: Open collector, current sink, 100ma max. current sink, 30V max.
notes: external pull-up required
explanation:
Compare – Used to indicate when a position compare event has occurred. See the description of **Position Compare** in the **Application Solutions chapter**.

Direction - For servo drives requiring a Unipolar output. The velocity or current command input consists of a magnitude signal and a separate direction signal . The magnitude signal is provided by the modules Analog Command Signal (J3 pin 2) previously described, while this signal provides a digital direction command.

This signal is driven by a high current open collector driver and is suitable for direct connection to optically isolated inputs commonly found on a servo amplifier. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them. When the axis is moving in the positive direction the output will be pulled low. When the axis is moving in the negative direction the open collector driver will be turned off and the output will be pulled high.

Coarse Home Input

connection point: MC300-H J3 - pin 9, MC300-R J3 - pin 9
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: Supply/Return using INPRET (J3 pin 18)
explanation: This module input is used to determine the proper zero position of the servo. In servo systems that use rotary encoders with index outputs, an index pulse is generated once per rotation of the encoder. While this signal occurs at a very repeatable angular position on the encoder, it may occur many times within the motion range of the servo. In these cases, a Coarse Home switch connected to this module input can be used to qualify which index pulse is the true zero position of the servo. By setting this switch to be activated near the end of travel of the servo, and using DCX motion commands to position the servo within this region prior to searching for the index pulse, a unique zero position for the servo can be determined. The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W). The minimum current required to turn on the optical isolator is **10ma**. Bi-directional optical isolator wiring examples are provided later in this section.

Amplifier Fault Input

connection point: MC300-H J3 - pin 7, MC300-R J3 - pin 10
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: Supply/Return using AMPFRET (J3 pin 13)
explanation: - This module input is designed to be connected to the servo amplifiers Fault or Error output signal. The state of this signal will appear as a status bit in the servo's status word. The **EnableAmpFault** member of the **MCMotion** structure will enable the module to shut off the axis if the Amplifier Fault input is active. No further servo motion will occur until the fail signal is deactivated and the axis is enabled. The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Amplifier Enable Output

connection point: MC300-H J3 - pin 5, MC300-R J3 - pin 11
signal type: Open collector, current sink, 100ma max. current sink, 30V max.
notes: external pull-up required
explanation: - This module output signal should be connected to the enable input of the servo amplifier. When the DCX is turned on or reset, this signal will immediately go to its' inactive high level. When the ***MCEnableAxis( )*** is called, this signal will go to its' active low level. Anytime there is an error on the respective servo axis, including ***exceeding the following error, a limit switch input activated or the Amplifier Fault input activated***, the Amplifier Enable signal will be deactivated. This signal can also be deactivated by the Motor oFf command.

This signal is driven by a high current open collector driver and is suitable for direct connection to optically isolated inputs commonly found on a servo amplifier. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

Limit Positive and Limit Negative Inputs
connection point: Limit Positive: MC300-H J3 - pin 17, MC300-R J3 - pin 14
Limit Negative: MC300-H J3 - pin 19, MC300-R J3 - pin 15
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: MC300-H Limit Positive Supply/Return J3 pin 18
MC300-H Limit Negative Supply/Return J3 pin 20
MC300-R Limits Supply/Return J3 pin 18
explanation: The limit switch inputs are used to cause the DCX to stop a servo's motion when it reaches the end of travel. If the servo is in position mode, the axis will only be stopped if it is moving in the direction of an activated limit switch. In all other modes, the servo will be stopped regardless of the direction it is moving if either limit switch is activated. There are three modes of stopping (decelerate to a stop, stop immediately, turn off the axis) that can be configured by the ***MCSetLimits( )***. The limit switch inputs can be enabled and disabled by ***MCSetLimits( )***. See the description of **Motion Limits** in the **Motion Control** chapter.

The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Position Capture / Auxiliary Encoder Index +
connection point: MC300-H J3 - pin 15, MC300-R J3 - pin 24
signal type: TTL or Differential driver output (-7V to +7V)
notes:
explanation: -
Position Capture – Used to initiate the capture of position data. See the description of **Position Capture** in the **Application Solutions chapter**.

Auxiliary Encoder Index + - This input signal can be used to define the home position of an auxiliary encoder.

Primary Encoder Inputs (Phase A+, Phase -, Phase B+, Phase B-, Index+, Index-)
connection point: see pin-out table
signal type: TTL or Differential driver output (-7V to +7V)
notes: The encoder power jumper JP3 sets the ‘mid point’ for the differential receiver
explanation: These input signals should be connected to an incremental quadrature encoder for supplying position feedback information for the servo controller. The plus (+) and minus (-) signs refer to the two sides of differential inputs. By setting jumpers JP1 and JP2 appropriately, the plus signal inputs can be configured for single ended inputs.

Auxiliary Encoder Inputs (Phase A, Phase B, Index+, Index-)
connection point: see pin-out table
signal type: TTL or Differential driver output (-7V to +7V)
notes:
explanation: - These input signals can be used for an auxiliary encoder.

Encoder Power Output

connection point: MC300-H J3 - pin 16, MC300-R J3 - pin 17
signal type: +5 VDC PC power supply output or +12 VDC PC power supply output
notes: The encoder power jumper JP3 selects +5VDC or +12VDC (**max. load 250 mA**).
explanation: This module pin provides a convenient supply voltage connection for the encoders. The jumper JP3 located on the module can be used to connect either the +5 or +12 volt supply to the Encoder Power pin. The setting of this jumper also selects the threshold voltage for the module's single ended phase and index encoder inputs. When JP1 is set for +5 volts, the threshold will be 2.5 volts, for +12 volts, the threshold will be +6 volts. The threshold voltage determines at what voltage the input changes between on and off.

SUPPLY CONNECTIONS (+5, +12, -12, GROUND) - These module pins provide access to the DCX supply voltages.

DCX-MC300-H High Density connector signal map

Module #1	Module #2	Module #3	Module #4	Module #5	Module #6	Module #7	Module #8	J3 Pin #	Description
J1 – 1	J2 – 1	J3 - 19	J4 - 19	J3 – 1	J4 – 1	J1 – 19	J2 - 19	1	Analog Command return
J1 – 35	J2 - 35	J3 – 53	J4 – 53	J3 – 35	J4 – 35	J1 – 53	J2 – 53	2	Analog Command output
J1 – 2	J2 – 2	J3 – 20	J4 – 20	J3 – 2	J4 – 2	J1 – 20	J2 – 20	3	Compare / Direction: output
J1 – 36	J2 - 36	J3 – 54	J4 – 54	J3 – 36	J4 – 36	J1 – 54	J2 – 54	4	Compare / Direction return
J1 – 3	J2 – 3	J3 - 21	J4 - 21	J3 – 3	J4 – 3	J1 – 21	J2 - 21	5	Amplifier Enable: output
J1 – 37	J2 - 37	J3 – 55	J4 – 55	J3 – 37	J4 – 37	J1 – 55	J2 – 55	6	Amp Enable return
J1 – 4	J2 – 4	J3 – 22	J4 – 22	J3 – 4	J4 – 4	J1 – 22	J2 – 22	7	Amplifier Fault: input
J1 – 38	J2 - 38	J3 – 56	J4 – 56	J3 – 38	J4 – 38	J1 – 56	J2 – 56	8	Amp Fault opto isolator supply/return
J1 – 5	J2 – 5	J3 – 23	J4 – 23	J3 – 5	J4 – 5	J1 – 23	J2 – 23	9	Coarse Home: input
J1 – 39	J2 - 39	J3 – 57	J4 – 57	J3 – 39	J4 – 39	J1 – 57	J2 – 57	10	Coarse Home return
J1 – 6	J2 – 6	J3 – 24	J4 – 24	J3 – 6	J4 – 6	J1 – 24	J2 – 24		Ground
J1 – 40	J2 - 40	J3 – 58	J4 – 58	J3 – 40	J4 – 40	J1 – 58	J2 – 58	11	Reserved
J1 – 7	J2 – 7	J3 – 25	J4 – 25	J3 – 7	J4 – 7	J1 – 25	J2 – 25	12	Reserved
J1 – 41	J2 - 41	J3 – 59	J4 – 59	J3 – 41	J4 – 41	J1 – 59	J2 – 59		Ground
J1 – 8	J2 – 8	J3 – 26	J4 – 26	J3 – 8	J4 – 8	J1 – 26	J2 – 26		Ground
J1 – 42	J2 - 42	J3 – 60	J4 – 60	J3 – 42	J4 – 42	J1 – 60	J2 – 60	13	Auxiliary Encoder Phase A+: input
J1 – 9	J2 – 9	J3 – 27	J4 – 27	J3 – 9	J4 – 9	J1 – 27	J2 – 27	14	Auxiliary Encoder Phase B+: input
J1 – 43	J2 - 43	J3 – 61	J4 – 61	J3 – 43	J4 – 43	J1 – 61	J2 – 61		Ground
J1 – 10	J2 - 10	J3 – 28	J4 – 28	J3 – 10	J4 – 10	J1 – 28	J2 – 28		Ground
J1 – 44	J2 - 44	J3 – 62	J4 – 62	J3 – 44	J4 – 44	J1 – 62	J2 – 62	15	Position Capture + / Aux. Encoder Index+
J1 – 11	J2 - 11	J3 - 29	J4 - 29	J3 – 11	J4 – 11	J1 – 29	J2 - 29	16	Encoder Power: output (**max. load 250 mA**)
J1 – 45	J2 - 45	J3 – 63	J4 – 63	J3 – 45	J4 – 45	J1 – 63	J2 – 63		Ground
J1 – 12	J2 - 12	J3 – 30	J4 – 30	J3 – 12	J4 – 12	J1 – 30	J2 – 30	17	Limit Positive: input
J1 – 46	J2 - 46	J3 – 64	J4 – 64	J3 – 46	J4 – 46	J1 – 64	J2 – 64	18	Limit Positive opto isolator supply/return
J1 – 13	J2 - 13	J3 – 31	J4 – 31	J3 – 13	J4 – 13	J1 – 31	J2 – 31	19	Limit Negative: input
J1 – 47	J2 - 47	J3 – 65	J4 – 65	J3 – 47	J4 – 47	J1 – 65	J2 – 65	20	Limit Negative opto isolator supply/return
J1 – 14	J2 - 14	J3 – 32	J4 – 32	J3 – 14	J4 – 14	J1 – 32	J2 – 32	21	Primary Encoder Phase A+: input *
J1 – 48	J2 - 48	J3 – 66	J4 – 66	J3 – 48	J4 – 48	J1 – 66	J2 – 66	22	Primary Encoder Phase A-: input
J1 – 15	J2 - 15	J3 – 33	J4 – 33	J3 – 15	J4 – 15	J1 – 33	J2 – 33	23	Primary Encoder Phase B+: input*
J1 – 49	J2 - 49	J3 – 67	J4 – 67	J3 – 49	J4 – 49	J1 – 67	J2 – 67	24	Primary Encoder Phase B-: input
J1 – 16	J2 - 16	J3 – 34	J4 – 34	J3 – 16	J4 – 16	J1 – 34	J2 – 34	25	Primary Encoder Index +:input
J1 – 50	J2 - 50	J3 – 68	J4 – 68	J3 – 50	J4 – 50	J1 – 68	J2 – 68	26	Primary Encoder Index -:input
J1 – 17	J2 – 17			J3 – 17	J4 – 17				Ground
J1 – 51	J2 - 51			J3 – 51	J4 – 51				Ground
J1 – 18	J2 – 18			J3 – 18	J4 – 18				Ground
J1 – 52	J3 – 52			J3 – 52	J4 – 52				Ground

For a more complete signal description please refer to the previous five pages
Mating cable connector components: Amp: 787801-1 (offset connector), 788362-1 (backshell, offset)

DCX-MC300-R Module connector

J3 connector pin-out (Motor command, encoders, and axis I/O)

Pin #	Description
1	Analog Command return (analog ground)
2	Analog Command output (output, +/-10 V)
3	+12 VDC (**250 mA max.**)
4	-12 VDC (**50 mA max.**)
5	Ground
6	+5 VDC (**250 mA max.**)
7	Compare / Direction: output (open collector, 100ma max., 30V max.)
8	Primary Encoder Index +:input (active high)
9	Coarse Home: input (optically isolated, 12V – 24V, 15ma min.)
10	Amplifier Fault: input (optically isolated, 12V – 24V, 15ma min.)
11	Amplifier Enable: output (open collector, 100ma max., 30V max.)
12	Amp Enable & Direction return
13	Amp Fault opto isolator supply/return
14	Limit Positive: input (optically isolated, 12V – 24V, 15ma min.)
15	Limit Negative: input (optically isolated, 12V – 24V, 15ma min.)
16	Primary Encoder Phase A+: input *
17	Encoder Power: output (+5VDC or +12VDC, see jumper JP3) (**max. load 250 mA**)
18	Coarse Home & Limits opto isolator supply/return
19	Primary Encoder Phase A-: input
20	Primary Encoder Phase B-: input
21	Auxiliary Encoder Phase A+: input
22	Auxiliary Encoder Phase B+: input
23	Primary Encoder Phase B+: input*
24	Position Capture + / Auxiliary Encoder Index+: input (active high)
25	Primary Encoder Index-: input (active low)
26	Ground

* Use A+ and B+ for single-ended ENCODER INPUTS

Mating Connector:26-pin dual-row IDC female, Circuit Assembly P/N 26IDS2-C-SPT-SR or equivalent

DCX-MC300 Module Configuration Jumpers - configuration in **bold type** denotes default factory shipping configuration

JP1 – Encoder type (single ended or differential)

Pins	*Description*
1 to 2 to 3	Single ended encoder, A, B, Z (three pin jumper provided)
open	**Differential encoder, A+, A-, B+, B-**

JP2 – Encoder Index Active Level Select)

Pins	*Description*
1 to 2	Single ended Index, Z+ (Active high)
2 to 3	**Single ended Index, Z- (active low)**
open	Differential Index, Z+ and Z-

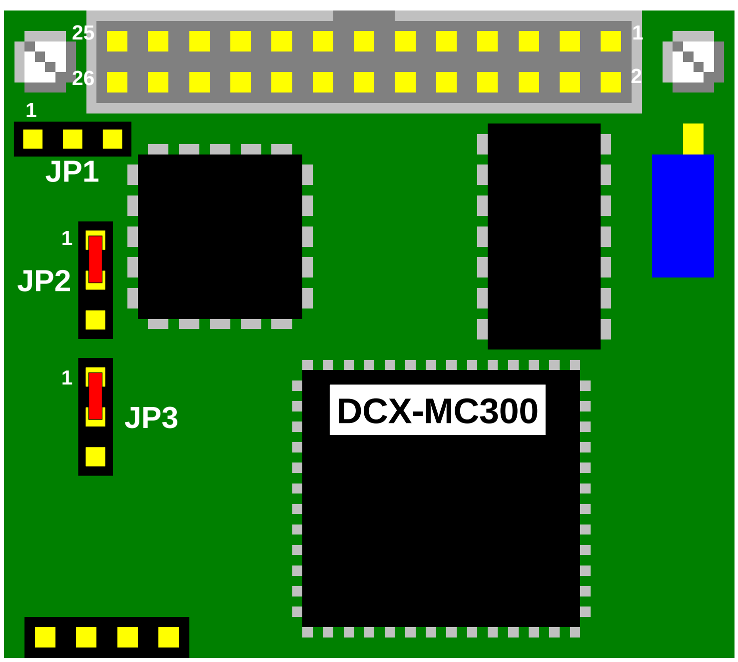
JP3 – Encoder Power Select (+5VDC or +12 VDC)

Pins	*Description*
1 to 2	**+5 VDC encoder supply on J3 pin 16/17** (**250 mA max.**)
2 to 3	+12 VDC encoder supply on J3 pin 16/17 (**250 mA max.**)

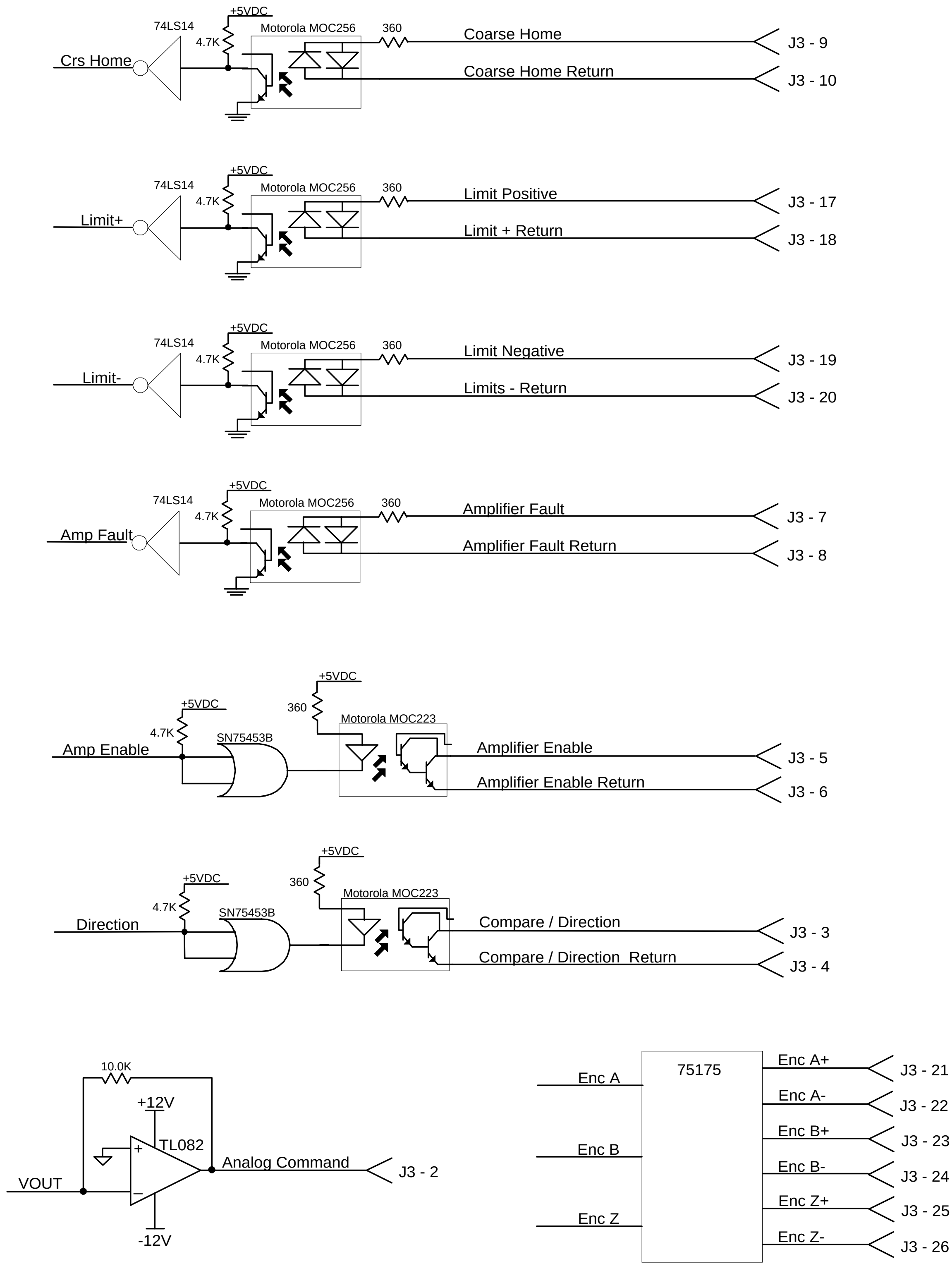
DCX-MC300 Module Output Offset Potentiometer

This multi-turn trimming potentiometer can be used to add an offset to the module's analog output. The range of this adjustment is approximately +/-1.0 volts.

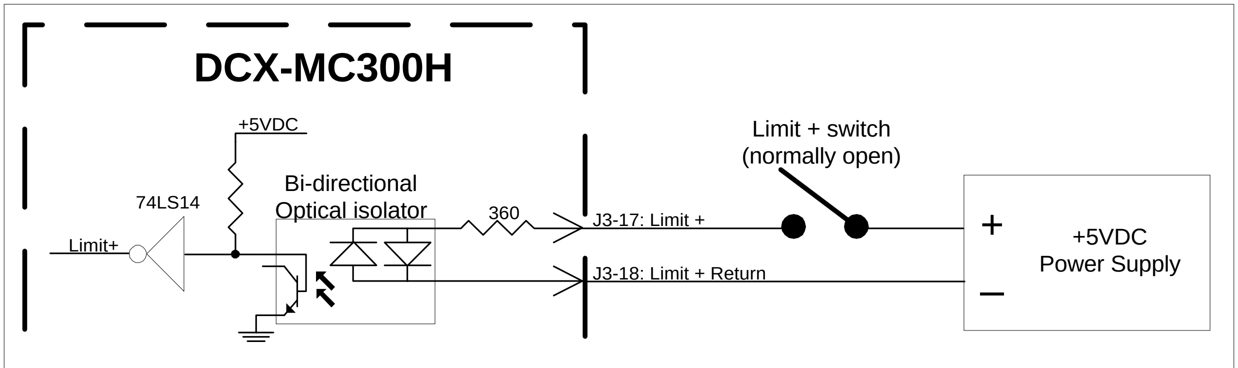
DCX-MC300 Module Layout



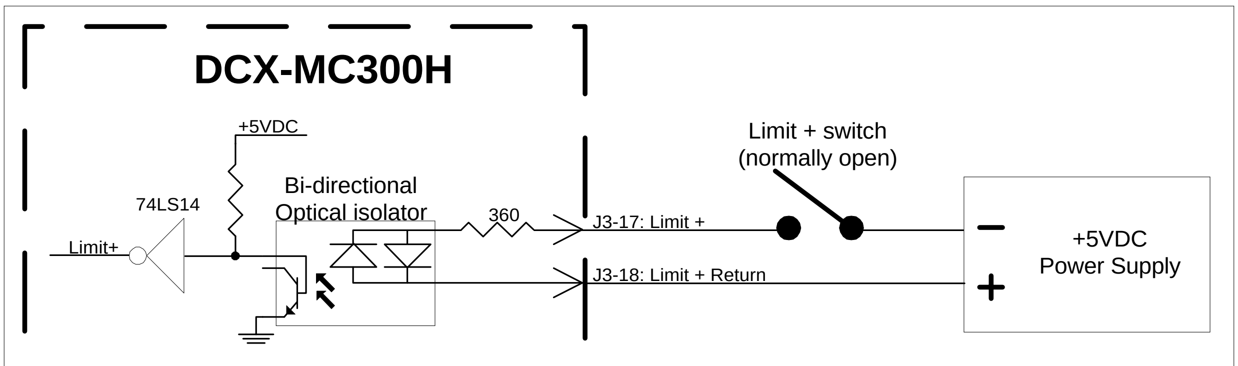
DCX-MC300H Axis I/O Interface Schematic



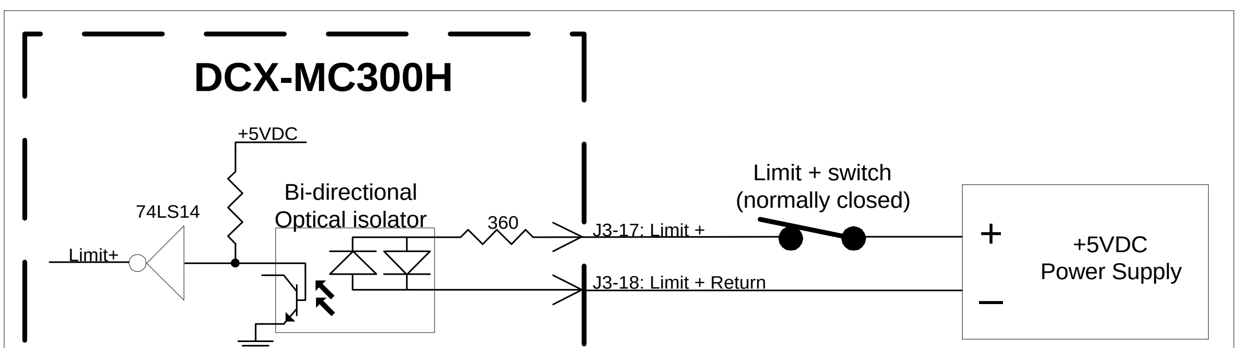
DCX-MC300H Optically Isolated Inputs Wiring Examples



This limit circuit wll indicate that a limit is active if the switch is closed



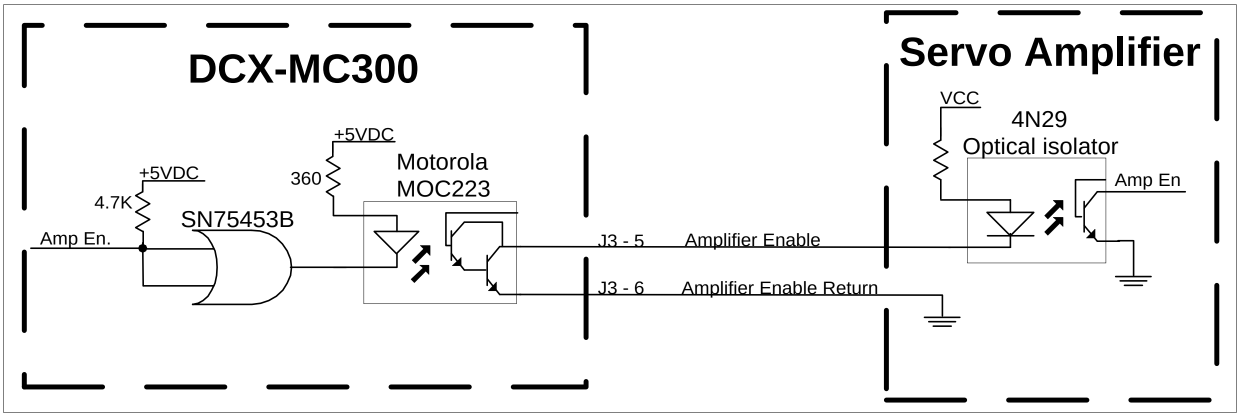
This limit circuit wll indicate that a limit is active if the switch is closed



This limit circuit wll indicate that a limit is active if:
1) The switch is open
2) Any component in the circuit fails (power supply, bi-directional opto isolator, broken wire, etc...

This is not the default configuration of the DCX, issue the **MC_LIMIT_INVERT** parameter of the ***MCSetLimits( )*** function.

DCX-MC300H Open Collector Driver Wiring Examples



DCX-MC302 Dual Axis +/- 10V Servo Motor Control Module

SIGNAL DESCRIPTIONS:

Analog Command Return
connection point: Axis 1: VHDCI connector pin 8 (no connection on module J3 connector)
Axis 2: VHDCI connector pin 43 (no connection on module J3 connector)
signal type: ground
notes:
explanation: Provides the signal ground for the modules Analog Command Signal output. This return path is common to the ground plane of the DCX motherboard, but is connected in such a way as to reduce digital noise. Typical servo amplifiers will have a connection for the analog command (or Ref-) return where this signal should be connected.

Analog Command Output
connection point: Axis 1: J3 - pin 13
Axis 2: J3 – pin 14
signal type: +/- 10V analog, 16 bit
notes: connects to servo amplifier motor command input (Ref+)
explanation: This module output signal is used to control the servo amplifier's output. When connected to the command input of a velocity mode amplifier, the voltage level on this signal should cause the amplifier to drive the servo at a proportional velocity. For current mode amplifiers, the voltage level should cause a proportional current to be supplied to the servo. In its default Bipolar output mode, the module provides an analog signal that is in the range -10 to +10 volts, with 0 volts being the null output level. Positive voltages indicate a desired velocity or current in one direction. Negative voltages indicate velocity or current in the opposite direction. The maximum drive current of this signal is +/-10 milliamps.

Coarse Home Input
connection point: Axis 1: J3 - pin 7
Axis 2: J3 – pin 19
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: Axis 1 Supply/Return: A1Limret (J3 pin 10)
Axis 2 Supply/Return: A2Limret (J3 pin 18)
explanation: This module input is used to determine the proper zero position of the servo. In servo systems that use rotary encoders with index outputs, an index pulse is generated once per rotation of the encoder. While this signal occurs at a very repeatable angular position on the encoder, it may occur many times within the motion range of the servo. In these cases, a Coarse Home switch connected to this module input can be used to qualify which index pulse is the true zero position of the servo. By setting this switch to be activated near the end of travel of the servo, and using DCX motion commands to position the servo within this region prior to searching for the index pulse, a unique zero position for the servo can be determined. The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Amplifier Enable Output
connection point: Axis 1: J3 - pin 12
Axis 2: J3 – pin 15
signal type: Open collector, current sink, 100ma max. current sink, 30V max.
notes: external pull-up required
explanation: - This module output signal should be connected to the enable input of the servo amplifier. When the DCX is turned on or reset, this signal will immediately go to its' inactive high level. When the ***MCEnableAxis( )*** is called, this signal will go to its' active low level. Anytime there is an error on the respective servo axis, including ***exceeding the following error, a limit switch input activated or the Amplifier Fault input activated***, the Amplifier Enable signal will be deactivated. This signal can also be deactivated by the **M**otor o**F**f command.

This signal is driven by a high current open collector driver and is suitable for direct connection to optically isolated inputs commonly found on a servo amplifier. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

Limit Positive and Limit Negative Inputs
connection point: Axis 1 Limit Positive: J3 - pin 9, Axis 2 Limit Positive: J3 - pin 17
Axis 1 Limit Negative: J3 - pin 11, Axis 2 Limit Positive: J3 - pin 16
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: Axis 1 Limits +/- Supply/Return: A1Limret (J3 pin 10)
Axis 2 Limits +/- Supply/Return: A2Limret (J3 pin 18)
explanation: The limit switch inputs are used to cause the DCX to stop a servo's motion when it reaches the end of travel. If the servo is in position mode, the axis will only be stopped if it is moving in the direction of an activated limit switch. In all other modes, the servo will be stopped regardless of the direction it is moving if either limit switch is activated. There are three modes of stopping (decelerate to a stop, stop immediately, turn off the axis) that can be configured by the ***MCSetLimits( )***. The limit switch inputs can be enabled and disabled by ***MCSetLimits( )***. See the description of **Motion Limits** in the **Motion Control** chapter.

The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Encoder Inputs (Phase A+, Phase A-, Phase B+, Phase B-, Index+, Index-)
connection point: see pin-out tables
signal type: TTL or Differential driver output (-7V to +7V)
notes:
explanation: These input signals should be connected to an incremental quadrature encoder for supplying position feedback information for the servo controller. The plus (+) and minus (-) signs refer to the two sides of differential inputs. The default shipping configuration is for using a differential encoder. For a single ended encoder add 0 ohm resistors (Axis 1- R1, R2, R3; Axis 2-R4, R5, R6).

Encoder Power Output
connection point: Axis 1: J3 - pin 8
Axis 2: J3 – pin 20
signal type: +5 VDC PC power supply output or +12 VDC PC power supply output
notes: Axis 1: jumper JP1 selects +5VDC or +12VDC (**max. load 250 mA**)
Axis 2: jumper JP2 selects +5VDC or +12VDC (**max. load 250 mA**)
explanation: This module pin provides a convenient supply voltage connection for the encoders. The jumper can be used to connect either the +5 or +12 volt supply to the Encoder Power pin.

DCX-MC302-H High Density connector signal map

Module #1	Module #2	Module #3	Module #4	Module #5	Module #6	Module #7	Module #8	J3 Pin #	Description
J1 – 1	J2 – 1	J3 - 19	J4 - 19	J3 – 1	J4 – 1	J1 – 19	J2 - 19	1	Axis 1 Encoder Phase A+: input *
J1 – 35	J2 - 35	J3 – 53	J4 – 53	J3 – 35	J4 – 35	J1 – 53	J2 – 53	2	Axis 1 Encoder Phase A-: input
J1 – 2	J2 – 2	J3 – 20	J4 – 20	J3 – 2	J4 – 2	J1 – 20	J2 – 20	3	Axis 1 Encoder Phase B+: input*
J1 – 36	J2 - 36	J3 – 54	J4 – 54	J3 – 36	J4 – 36	J1 – 54	J2 – 54	4	Axis 1 Encoder Phase B-: input
J1 – 3	J2 – 3	J3 - 21	J4 - 21	J3 – 3	J4 – 3	J1 – 21	J2 - 21	5	Axis 1 Encoder Index +:input
J1 – 37	J2 - 37	J3 – 55	J4 – 55	J3 – 37	J4 – 37	J1 – 55	J2 – 55	6	Axis 1 Encoder Index-: input
J1 – 4	J2 – 4	J3 – 22	J4 – 22	J3 – 4	J4 – 4	J1 – 22	J2 – 22	7	Axis 1 Coarse Home: input (optically isolated)
J1 – 38	J2 - 38	J3 – 56	J4 – 56	J3 – 38	J4 – 38	J1 – 56	J2 – 56	8	Axis 1 Encoder Power (+5/+12) (**250 mA max.**)
J1 – 5	J2 – 5	J3 – 23	J4 – 23	J3 – 5	J4 – 5	J1 – 23	J2 – 23	9	Axis 1 Limit Positive: input (optically isolated)
J1 – 39	J2 - 39	J3 – 57	J4 – 57	J3 – 39	J4 – 39	J1 – 57	J2 – 57	10	Axis 1 Coarse Home & Limits supply/return
J1 – 6	J2 – 6	J3 – 24	J4 – 24	J3 – 6	J4 – 6	J1 – 24	J2 – 24		Ground
J1 – 40	J2 - 40	J3 – 58	J4 – 58	J3 – 40	J4 – 40	J1 – 58	J2 – 58	11	Axis 1 Limit Negative: input (optically isolated)
J1 – 7	J2 – 7	J3 – 25	J4 – 25	J3 – 7	J4 – 7	J1 – 25	J2 – 25	12	Axis 1 Amplifier Enable: output (open collector)
J1 – 41	J2 - 41	J3 – 59	J4 – 59	J3 – 41	J4 – 41	J1 – 59	J2 – 59		Ground
J1 – 8	J2 – 8	J3 – 26	J4 – 26	J3 – 8	J4 – 8	J1 – 26	J2 – 26		Ground
J1 – 42	J2 - 42	J3 – 60	J4 – 60	J3 – 42	J4 – 42	J1 – 60	J2 – 60	13	Axis 1 Analog Command output (+/-10 V)
J1 – 9	J2 – 9	J3 – 27	J4 – 27	J3 – 9	J4 – 9	J1 – 27	J2 – 27	14	Axis 2 Analog Command output (+/-10 V)
J1 – 43	J2 - 43	J3 – 61	J4 – 61	J3 – 43	J4 – 43	J1 – 61	J2 – 61		Ground
J1 – 10	J2 - 10	J3 – 28	J4 – 28	J3 – 10	J4 – 10	J1 – 28	J2 – 28		Ground
J1 – 44	J2 - 44	J3 – 62	J4 – 62	J3 – 44	J4 – 44	J1 – 62	J2 – 62	15	Axis 2 Amplifier Enable: output (open collector)
J1 – 11	J2 - 11	J3 - 29	J4 - 29	J3 – 11	J4 – 11	J1 – 29	J2 - 29	16	Axis 2 Limit Negative: input (optically isolated)
J1 – 45	J2 - 45	J3 – 63	J4 – 63	J3 – 45	J4 – 45	J1 – 63	J2 – 63		Ground
J1 – 12	J2 - 12	J3 – 30	J4 – 30	J3 – 12	J4 – 12	J1 – 30	J2 – 30	17	Axis 2 Limit Positive: input (optically isolated)
J1 – 46	J2 - 46	J3 – 64	J4 – 64	J3 – 46	J4 – 46	J1 – 64	J2 – 64	18	Axis 2 Coarse Home & Limits supply/return
J1 – 13	J2 - 13	J3 – 31	J4 – 31	J3 – 13	J4 – 13	J1 – 31	J2 – 31	19	Axis 2 Coarse Home: input (optically isolated)
J1 – 47	J2 - 47	J3 – 65	J4 – 65	J3 – 47	J4 – 47	J1 – 65	J2 – 65	20	Axis 2 Encoder Power (+5/+12) (**250 mA max.**)
J1 – 14	J2 - 14	J3 – 32	J4 – 32	J3 – 14	J4 – 14	J1 – 32	J2 – 32	21	Axis 2 Encoder Phase A+: input *
J1 – 48	J2 - 48	J3 – 66	J4 – 66	J3 – 48	J4 – 48	J1 – 66	J2 – 66	22	Axis 2 Encoder Phase A-: input
J1 – 15	J2 - 15	J3 – 33	J4 – 33	J3 – 15	J4 – 15	J1 – 33	J2 – 33	23	Axis 2 Encoder Phase B+: input*
J1 – 49	J2 - 49	J3 – 67	J4 – 67	J3 – 49	J4 – 49	J1 – 67	J2 – 67	24	Axis 2 Encoder Phase B-: input
J1 – 16	J2 - 16	J3 – 34	J4 – 34	J3 – 16	J4 – 16	J1 – 34	J2 – 34	25	Axis 2 Encoder Index +:input
J1 – 50	J2 - 50	J3 – 68	J4 – 68	J3 – 50	J4 – 50	J1 – 68	J2 – 68	26	Axis 2 Encoder Index-: input
J1 – 17	J2 – 17			J3 – 17	J4 – 17				Ground
J1 – 51	J2 - 51			J3 – 51	J4 – 51				Ground
J1 – 18	J2 – 18			J3 – 18	J4 – 18				Ground
J1 – 52	J3 – 52			J3 – 52	J4 – 52				Ground

For a more complete signal description please refer to the previous five pages
Mating cable connector components: Amp: 787801-1 (offset connector), 788362-1 (backshell, offset)

DCX-MC302 Module Configuration Jumpers - configuration in **bold type** denotes default factory shipping configuration

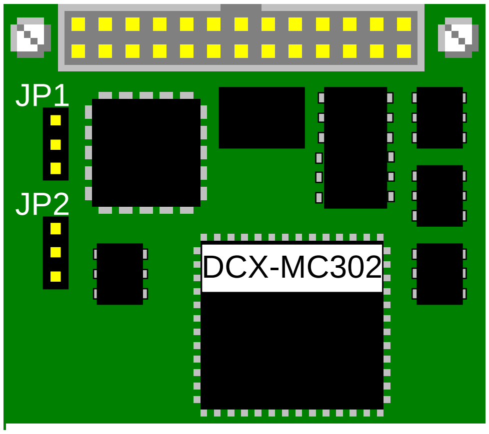
JP1 – Axis 1 Encoder Power Select (+5VDC or +12 VDC)

Pins	*Description*
1 to 2	**+5 VDC encoder supply on J3 pin 8** (**250 mA max.**)
2 to 3	+12 VDC encoder supply on J3 pin 8 (**250 mA max.**)

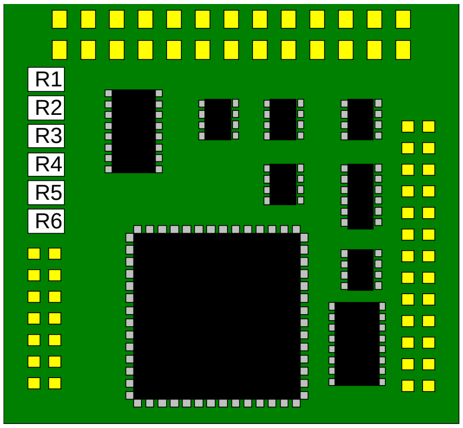
JP2 – Axis 2 Encoder Power Select (+5VDC or +12 VDC)

Pins	*Description*
1 to 2	**+5 VDC encoder supply on J3 pin 20** (**250 mA max.**)
2 to 3	+12 VDC encoder supply on J3 pin 20 (**250 mA max.**)

DCX-MC302 Module Layout

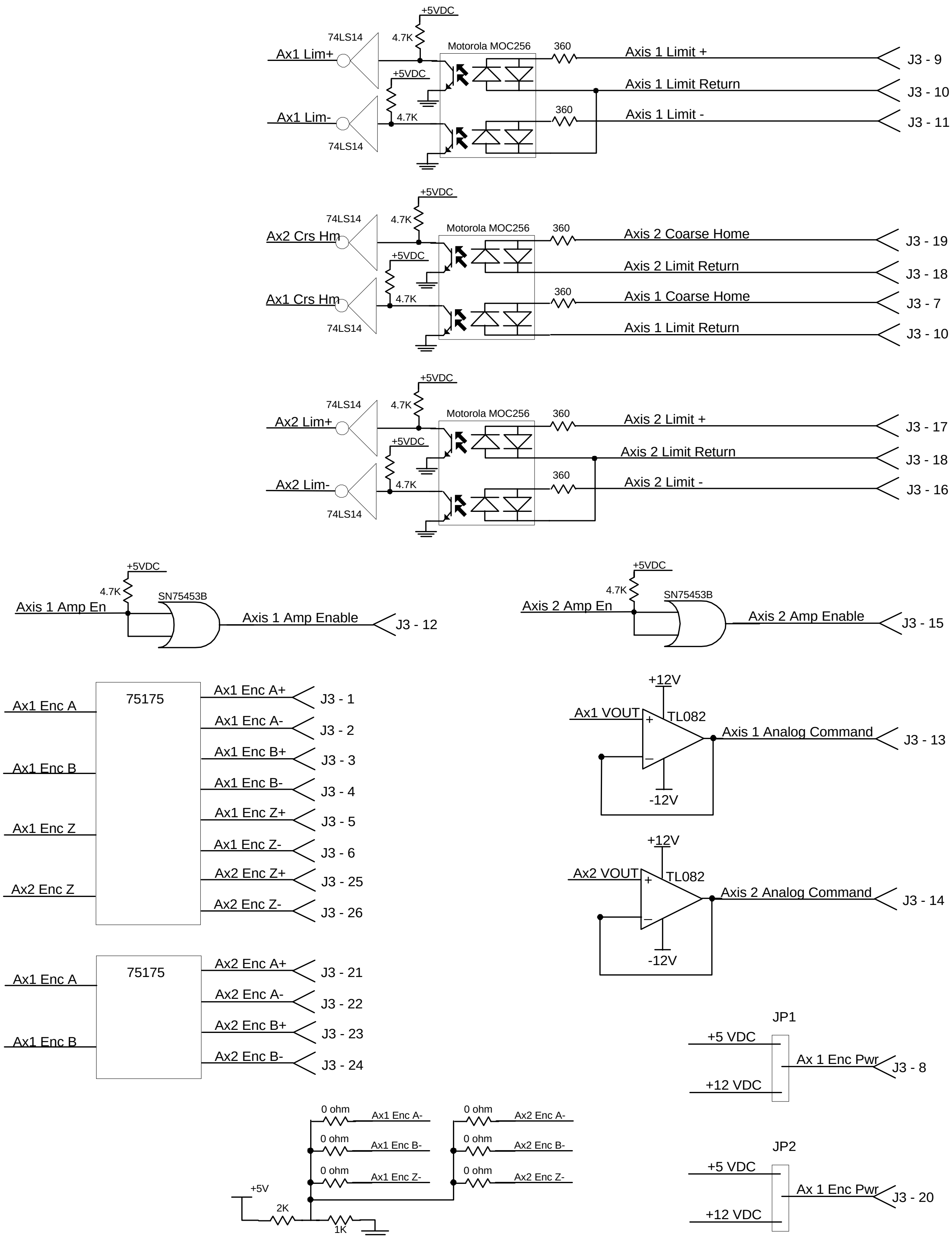


DCX-MC302 top side

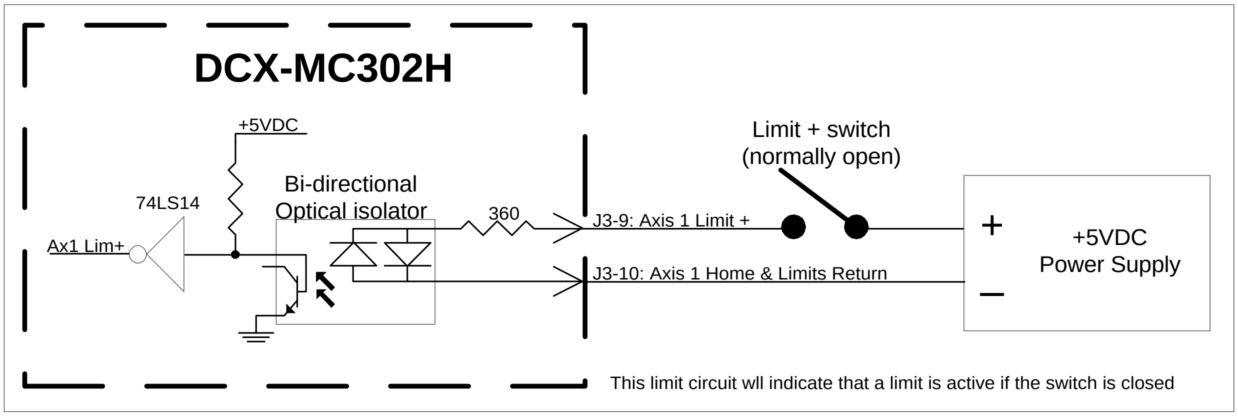


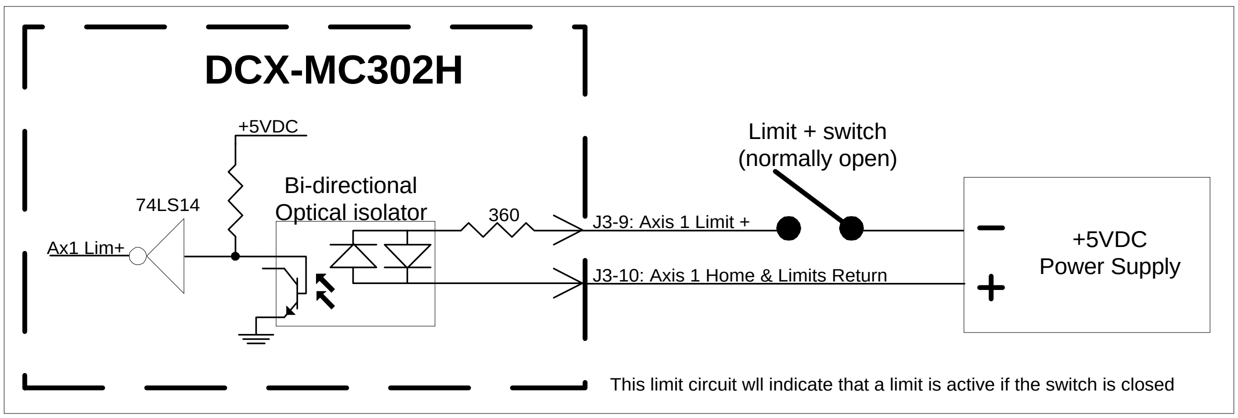
DCX-MC302 bottom side: remove R1 – R6 for differential encoder

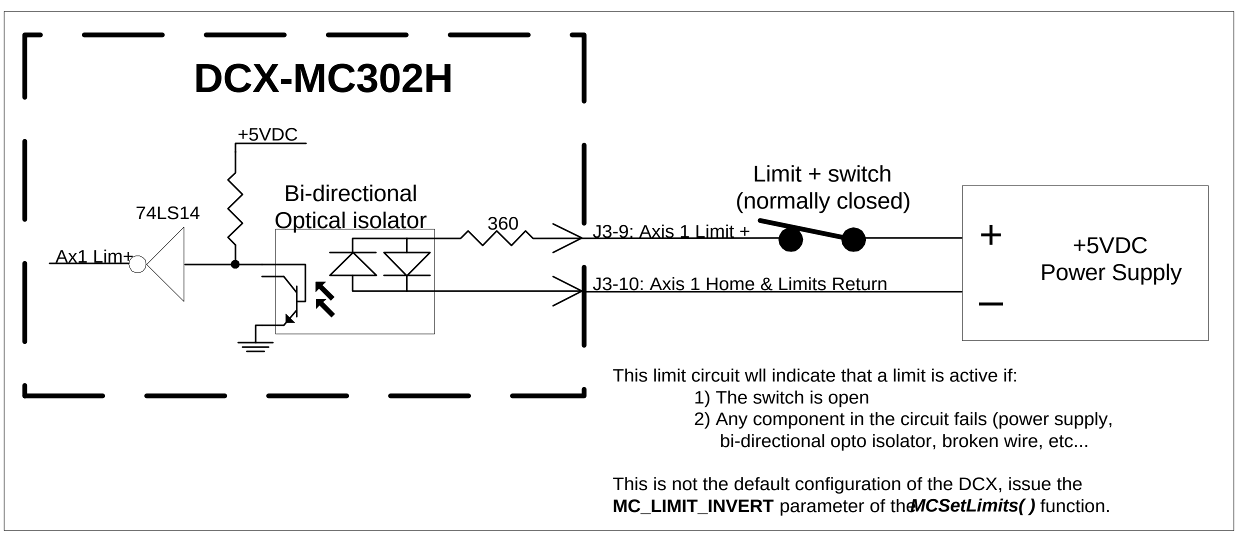
DCX-MC302H Axis I/O Interface Schematic



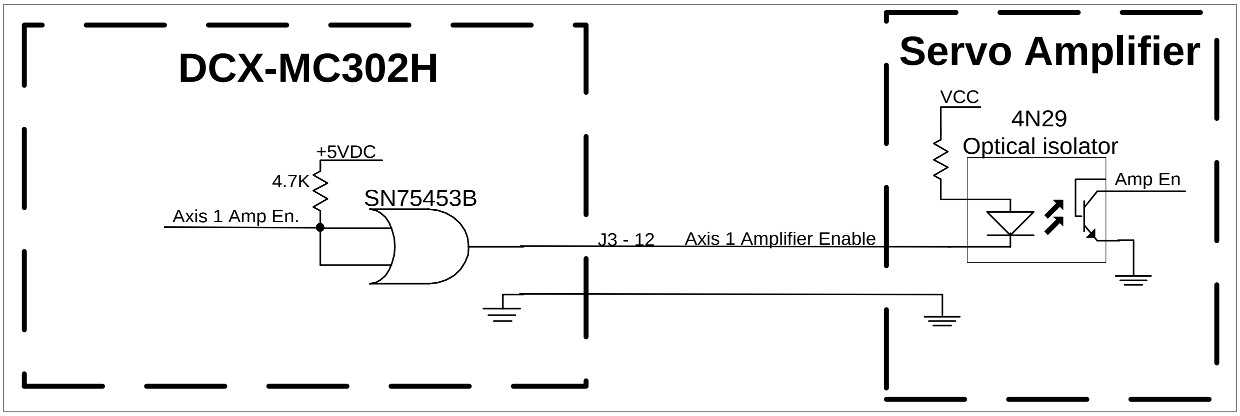
DCX-MC302 Optically Isolated Inputs Wiring Examples







DCX-MC302H Open Collector Driver Wiring Examples



DCX-MC320 Brushless Servo Commutation Control Module

The description of how to set up and operate the MC320 Commutation module was not available when this document was printed.

Please refer to Application Note **AN1004** - **Brushless AC Motor Commutation**. This PDF document is available on PMC's **MotionCD** (Other Docs and Tools/AppNOTES/Explore AppNOTES/AN1004.PDF) or from PMC's web site (www.pmccorp.com)

SIGNAL DESCRIPTIONS:

Analog Command Return
connection point: MC320-H J3 - pin 1 & 3, MC320-R J3 - pin 1
signal type: ground
notes:
explanation: Provides the signal ground for the modules Analog Command Signal output. This return path is common to the ground plane of the DCX motherboard, but is connected in such a way as to reduce digital noise. Typical servo amplifiers will have a connection for the analog command (or Ref-) return where this signal should be connected.

Phase U Torque Command Output
connection point: MC320-H J3 - pin 2, MC320-R J3 - pin 2
signal type: +/- 10V analog, 16 bit
notes: connects to servo amplifier motor command input (Ref+)
explanation: This module output signal is used to control the torque of the U winding of a brushless servo. The maximum drive current of this signal is +/-10 milliamps.

Phase V Torque Command Output
connection point: MC320-H J3 - pin 4, MC320-R J3 - pin 3
signal type: +/- 10V analog, 16 bit
notes: connects to servo amplifier motor command input (Ref+)
explanation: This module output signal is used to control the torque of the V winding of a brushless servo. The maximum drive current of this signal is +/-10 milliamps.

Phase W Torque Command Output
connection point: MC320-H not supported, MC320-R J3 - pin 1J3 - pin 4
signal type: +/- 10V analog, 16 bit
notes: connects to servo amplifier motor command input (Ref+)
explanation: This module output signal is used to control the torque of the W winding of a brushless servo. The maximum drive current of this signal is +/-10 milliamps.

Coarse Home Input
connection point: MC320-H J3 - pin 9, MC320-R J3 - pin 9
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: MC320-H Supply/Return J3 pin 10
MC320-R Supply/Return J3 pin 18
explanation: This module input is used to determine the proper zero position of the servo. In servo systems that use rotary encoders with index outputs, an index pulse is generated once per rotation of the encoder. While this signal occurs at a very repeatable angular position on the encoder, it may occur many times within the motion range of the servo. In these cases, a Coarse Home switch connected to this module input can be used to qualify which index pulse is the true zero position of the servo. By setting this switch to be activated near the end of travel of the servo, and using DCX motion commands to position the servo within this region prior to searching for the index pulse, a unique zero position for the servo can be determined. The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Amplifier Fault Input
connection point: MC320-H J3 - pin 7, MC320-R J3 – pin 10
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: MC320-H Supply/Return J3 pin 8
MC320-R Supply/Return J3 pin 13
explanation: - This module input is designed to be connected to the servo amplifiers Fault or Error output signal. The state of this signal will appear as a status bit in the servo's status word. The **EnableAmpFault** member of the **MCMotion** structure will enable the module to shut off the axis if the Amplifier Fault input is active. No further motion will occur until the fail signal is deactivated and the axis is enabled. The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Amplifier Enable Output
connection point: MC320-H J3 - pin 5, MC320-R J3 – pin 11
signal type: Open collector, current sink, 100ma max. current sink, 30V max.
notes: external pull-up required
explanation: - This module output signal should be connected to the enable input of the servo amplifier. When the DCX is turned on or reset, this signal will immediately go to its' inactive high level. When the ***MCEnableAxis( )*** is called, this signal will go to its' active low level. Anytime there is an error on the respective servo axis, including ***exceeding the following error, a limit switch input activated or the Amplifier Fault input activated***, the Amplifier Enable signal will be deactivated. This signal can also be deactivated by the Motor oFf command.

This signal is driven by a high current open collector driver and is suitable for direct connection to optically isolated inputs commonly found on a servo amplifier. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

Limit Positive and Limit Negative Inputs
connection point: Limit Positive: MC320-H J3 - pin 17, MC320-R J3 - pin 14
Limit Negative: MC320-H J3 - pin 19, MC320-R J3 - pin 15
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: MC320-H Limit Positive Supply/Return J3 pin 18
MC320-H Limit Negative Supply/Return J3 pin 20
MC320-R Limits Supply/Return J3 pin 18
explanation: The limit switch inputs are used to cause the DCX to stop a servo's motion when it reaches the end of travel. If the servo is in position mode, the axis will only be stopped if it is moving in the direction of an activated limit switch. In all other modes, the servo will be stopped regardless of the direction it is moving if either limit switch is activated. There are three modes of stopping (decelerate to a stop, stop immediately, turn off the axis) that can be configured by the ***MCSetLimits( )***. The limit switch inputs can be enabled and disabled by ***MCSetLimits( )***. See the description of **Motion Limits** in the **Motion Control** chapter.

The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Primary Encoder Inputs (Phase A+, Phase -, Phase B+, Phase B-, Index+, Index-)
connection point: see pin-out table
signal type: TTL or Differential driver output (-7V to +7V)
notes: The encoder power jumper JP3 sets the ‘mid point’ for the differential receiver
explanation: These input signals should be connected to an incremental quadrature encoder for supplying position feedback information for the servo controller. The plus (+) and minus (-) signs refer to the two sides of differential inputs. By setting jumpers JP1 and JP2 appropriately, the plus signal inputs can be configured for single ended inputs.

Hall Effect Sensor A, B, and C Inputs
connection point: see pin-out table
signal type: TTL or Differential driver output (-7V to +7V)
notes:
explanation: - These input signals can be used for interfacing to Hall effect sensors.

Encoder Power Output
connection point: MC300-H J3 - pin 16, MC300-R J3 - pin 17
signal type: +5 VDC PC power supply output or +12 VDC PC power supply output
notes: The encoder power jumper JP3 selects +5VDC or +12VDC (**250 mA max.**)
explanation: This module pin provides a convenient supply voltage connection for the encoders. The jumper JP3 located on the module can be used to connect either the +5 or +12 volt supply to the Encoder Power pin. The setting of this jumper also selects the threshold voltage for the module's single ended phase and index encoder inputs. When JP1 is set for +5 volts, the threshold will be 2.5 volts, for +12 volts, the threshold will be +6 volts. The threshold voltage determines at what voltage the input changes between on and off.

SUPPLY CONNECTIONS (+5, GROUND) - These module pins provide access to the DCX supply voltages.

DCX-MC320-H High Density connector signal map

Module #1	Module #2	Module #3	Module #4	Module #5	Module #6	Module #7	Module #8	J3 Pin #	Description
J1 – 1	J2 – 1	J3 - 19	J4 - 19	J3 – 1	J4 – 1	J1 – 19	J2 - 19	1	Ground
J1 – 35	J2 - 35	J3 – 53	J4 – 53	J3 – 35	J4 – 35	J1 – 53	J2 – 53	2	Phase U Torque Command: output
J1 – 2	J2 – 2	J3 – 20	J4 – 20	J3 – 2	J4 – 2	J1 – 20	J2 – 20	3	Ground
J1 – 36	J2 - 36	J3 – 54	J4 – 54	J3 – 36	J4 – 36	J1 – 54	J2 – 54	4	Phase V Torque Command: output
J1 – 3	J2 – 3	J3 - 21	J4 - 21	J3 – 3	J4 – 3	J1 – 21	J2 - 21	5	Amplifier Enable: output
J1 – 37	J2 - 37	J3 – 55	J4 – 55	J3 – 37	J4 – 37	J1 – 55	J2 – 55	6	Amplifier Enable return
J1 – 4	J2 – 4	J3 – 22	J4 – 22	J3 – 4	J4 – 4	J1 – 22	J2 – 22	7	Amplifier Fault: input
J1 – 38	J2 - 38	J3 – 56	J4 – 56	J3 – 38	J4 – 38	J1 – 56	J2 – 56	8	Amplifier Fault return
J1 – 5	J2 – 5	J3 – 23	J4 – 23	J3 – 5	J4 – 5	J1 – 23	J2 – 23	9	Coarse Home: input
J1 – 39	J2 - 39	J3 – 57	J4 – 57	J3 – 39	J4 – 39	J1 – 57	J2 – 57	10	Coarse Home return
J1 – 6	J2 – 6	J3 – 24	J4 – 24	J3 – 6	J4 – 6	J1 – 24	J2 – 24		Ground
J1 – 40	J2 - 40	J3 – 58	J4 – 58	J3 – 40	J4 – 40	J1 – 58	J2 – 58	11	Reserved
J1 – 7	J2 – 7	J3 – 25	J4 – 25	J3 – 7	J4 – 7	J1 – 25	J2 – 25	12	Reserved
J1 – 41	J2 - 41	J3 – 59	J4 – 59	J3 – 41	J4 – 41	J1 – 59	J2 – 59		Ground
J1 – 8	J2 – 8	J3 – 26	J4 – 26	J3 – 8	J4 – 8	J1 – 26	J2 – 26		Ground
J1 – 42	J2 - 42	J3 – 60	J4 – 60	J3 – 42	J4 – 42	J1 – 60	J2 – 60	13	Hall sensor A+ / Aux. Encoder Phase A+
J1 – 9	J2 – 9	J3 – 27	J4 – 27	J3 – 9	J4 – 9	J1 – 27	J2 – 27	14	Hall sensor B+ / Aux. Encoder Phase B+
J1 – 43	J2 - 43	J3 – 61	J4 – 61	J3 – 43	J4 – 43	J1 – 61	J2 – 61		Ground
J1 – 10	J2 - 10	J3 – 28	J4 – 28	J3 – 10	J4 – 10	J1 – 28	J2 – 28		Ground
J1 – 44	J2 - 44	J3 – 62	J4 – 62	J3 – 44	J4 – 44	J1 – 62	J2 – 62	15	Hall Sensor C+
J1 – 11	J2 - 11	J3 - 29	J4 - 29	J3 – 11	J4 – 11	J1 – 29	J2 - 29	16	Encoder Power: output (**max. load 250 mA**)
J1 – 45	J2 - 45	J3 – 63	J4 – 63	J3 – 45	J4 – 45	J1 – 63	J2 – 63		Ground
J1 – 12	J2 - 12	J3 – 30	J4 – 30	J3 – 12	J4 – 12	J1 – 30	J2 – 30	17	Limit Positive: input
J1 – 46	J2 - 46	J3 – 64	J4 – 64	J3 – 46	J4 – 46	J1 – 64	J2 – 64	18	Limit Positive return
J1 – 13	J2 - 13	J3 – 31	J4 – 31	J3 – 13	J4 – 13	J1 – 31	J2 – 31	19	Limit Negative: input
J1 – 47	J2 - 47	J3 – 65	J4 – 65	J3 – 47	J4 – 47	J1 – 65	J2 – 65	20	Limit Negative return
J1 – 14	J2 - 14	J3 – 32	J4 – 32	J3 – 14	J4 – 14	J1 – 32	J2 – 32	21	Primary Encoder Phase A+: input *
J1 – 48	J2 - 48	J3 – 66	J4 – 66	J3 – 48	J4 – 48	J1 – 66	J2 – 66	22	Primary Encoder Phase A-: input
J1 – 15	J2 - 15	J3 – 33	J4 – 33	J3 – 15	J4 – 15	J1 – 33	J2 – 33	23	Primary Encoder Phase B+: input*
J1 – 49	J2 - 49	J3 – 67	J4 – 67	J3 – 49	J4 – 49	J1 – 67	J2 – 67	24	Primary Encoder Phase B-: input
J1 – 16	J2 - 16	J3 – 34	J4 – 34	J3 – 16	J4 – 16	J1 – 34	J2 – 34	25	Primary Encoder Index +:input
J1 – 50	J2 - 50	J3 – 68	J4 – 68	J3 – 50	J4 – 50	J1 – 68	J2 – 68	26	Primary Encoder Index-: input
J1 – 17	J2 – 17			J3 – 17	J4 – 17				Ground
J1 – 51	J2 - 51			J3 – 51	J4 – 51				Ground
J1 – 18	J2 – 18			J3 – 18	J4 – 18				Ground
J1 – 52	J3 – 52			J3 – 52	J4 – 52				Ground

For a more complete signal description please refer to the previous five pages
Mating cable connector components: Amp: 787801-1 (offset connector), 788362-1 (backshell, offset)

DCX-MC320-R Module connector

J3 connector pin-out (Motor command, encoders, and axis I/O)

Pin #	Description
1	Torque Command Return (Ground)
2	Phase U Torque Command: output (10ma max.)
3	Phase V Torque Command: output (10ma max.)
4	Phase W Torque Command: output (10ma max.)
5	Ground
6	+5 VDC (**250 mA max.**)
7	Reserved
8	Primary Encoder Index +:input (active high)
9	Coarse Home: input (optically isolated, 12V – 24V, 15ma min.)
10	Amplifier Fault: input (optically isolated, 12V – 24V, 15ma min.)
11	Amplifier Enable: output (open collector, 100ma max., 30V max.)
12	Amp Enable & Direction return
13	Amp Fault opto isolator supply/return
14	Limit Positive: input (optically isolated, 12V – 24V, 15ma min.)
15	Limit Negative: input (optically isolated, 12V – 24V, 15ma min.)
16	Primary Encoder Phase A+: input *
17	Encoder Power: output (+5VDC or +12VDC, see jumper JP3) (**250 mA max.**)
18	Coarse Home & Limits opto isolator supply/return
19	Primary Encoder Phase A-: input
20	Primary Encoder Phase B-: input
21	Hall sensor A+
22	Hall sensor B+
23	Primary Encoder Phase B+: input*
24	Hall Sensor C+
25	Primary Encoder Index-: input (active low)
26	Ground

* Use A+ and B+ for single-ended Encoder inputs

Mating Connector:26-pin dual-row IDC female, Circuit Assembly P/N 26IDS2-C-SPT-SR or equivalent

DCX-MC320 Module Configuration Jumpers - configuration in **bold type** denotes default factory shipping configuration

JP1 – Encoder type (single ended or differential)

Pins	Description
1 to 2 to 3	Single ended encoder, A, B, Z (three pin jumper provided)
open	**Differential encoder, A+, A-, B+, B-**

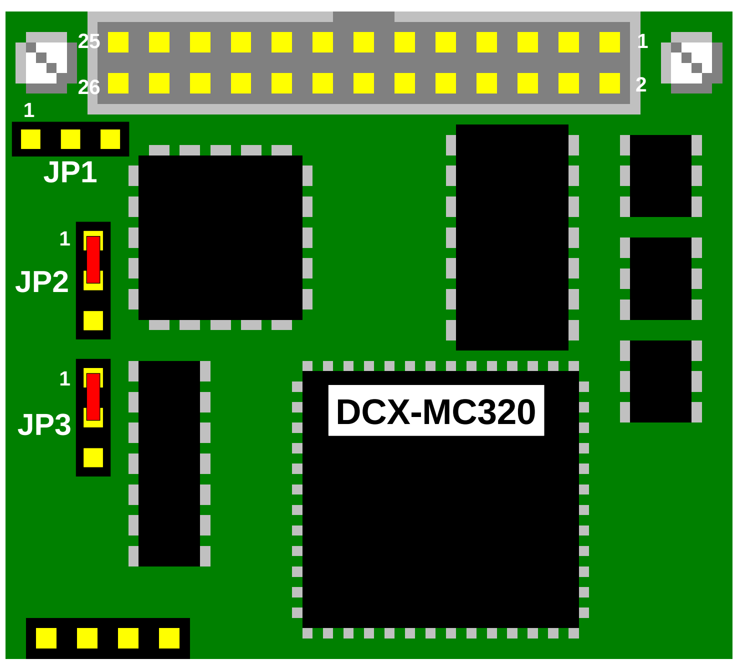
JP2 – Encoder Index Active Level Select)

Pins	Description
1 to 2	Single ended Index, Z+ (Active high)
2 to 3	**Single ended Index, Z- (active low)**
open	Differential Index, Z+ and Z-

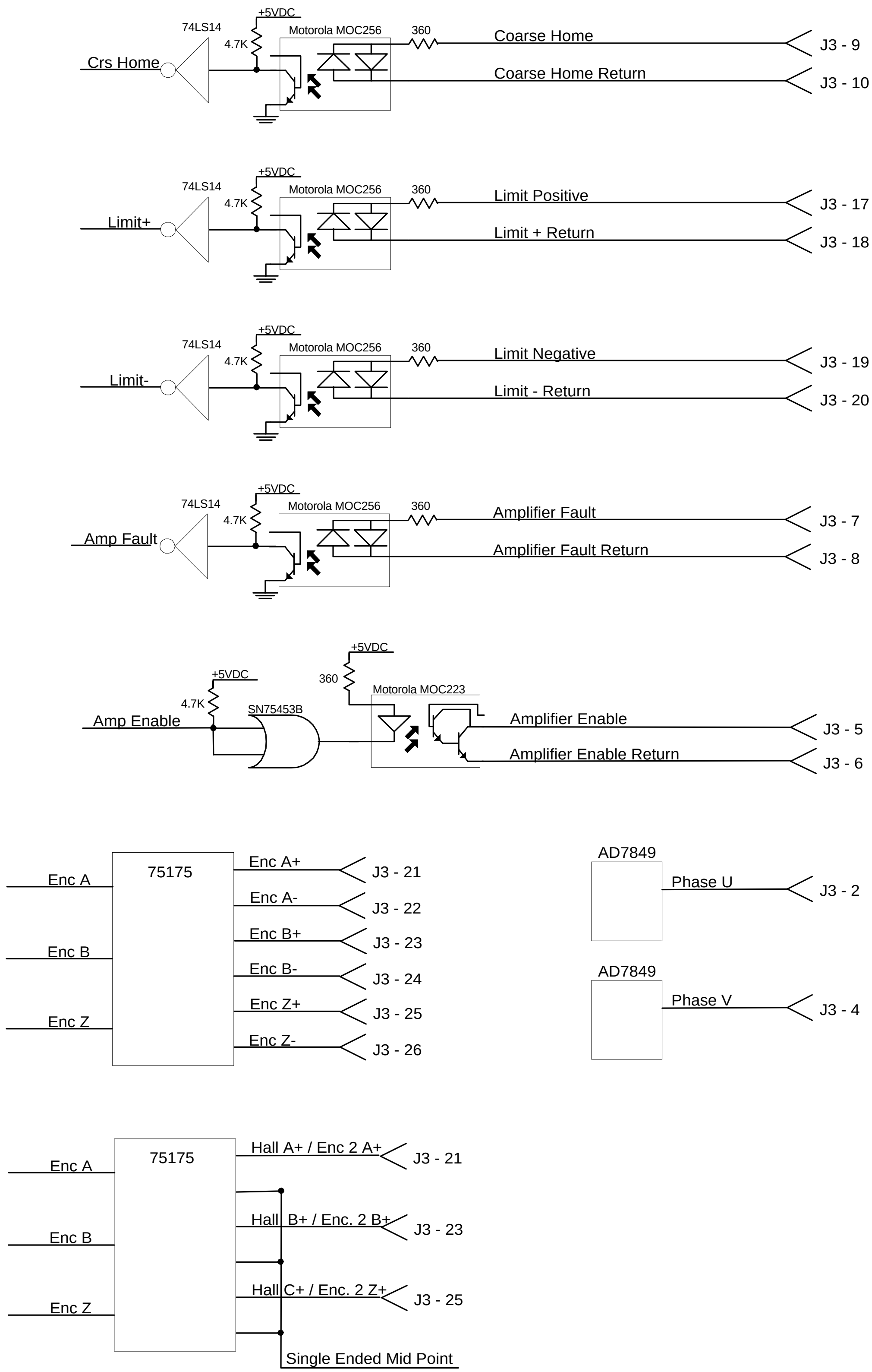
JP3 – Encoder Power Select (+5VDC or +12 VDC)

Pins	Description
1 to 2	**+5 VDC encoder supply on J3 pin 16/17** (**250 mA max.**)
2 to 3	+12 VDC encoder supply on J3 pin 16/17 (**250 mA max.**)

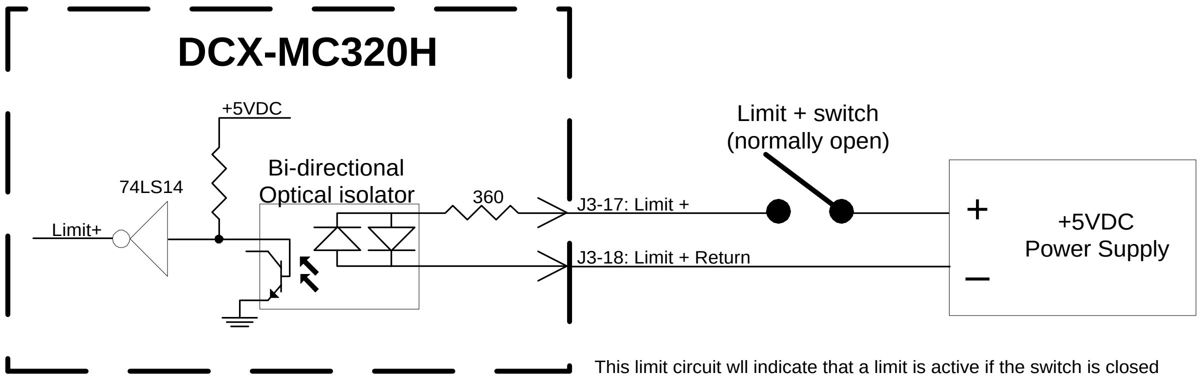
DCX-MC320 Module Layout



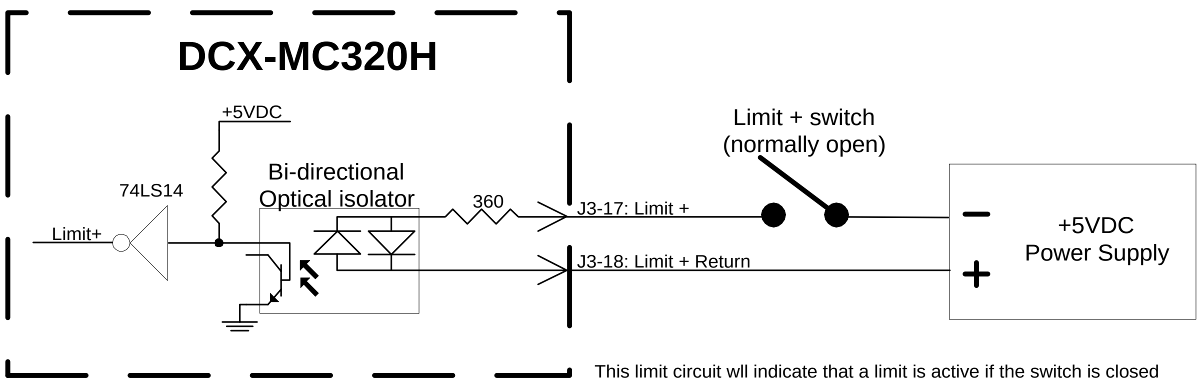
DCX-MC320H Axis I/O Interface Schematic



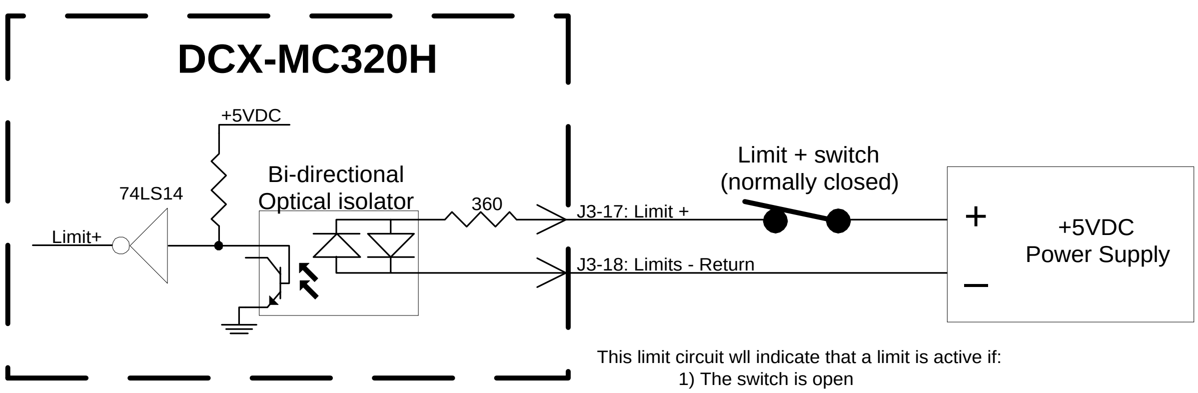
DCX-MC320H Optically Isolated Inputs Wiring Examples



This limit circuit wll indicate that a limit is active if the switch is closed



This limit circuit wll indicate that a limit is active if the switch is closed

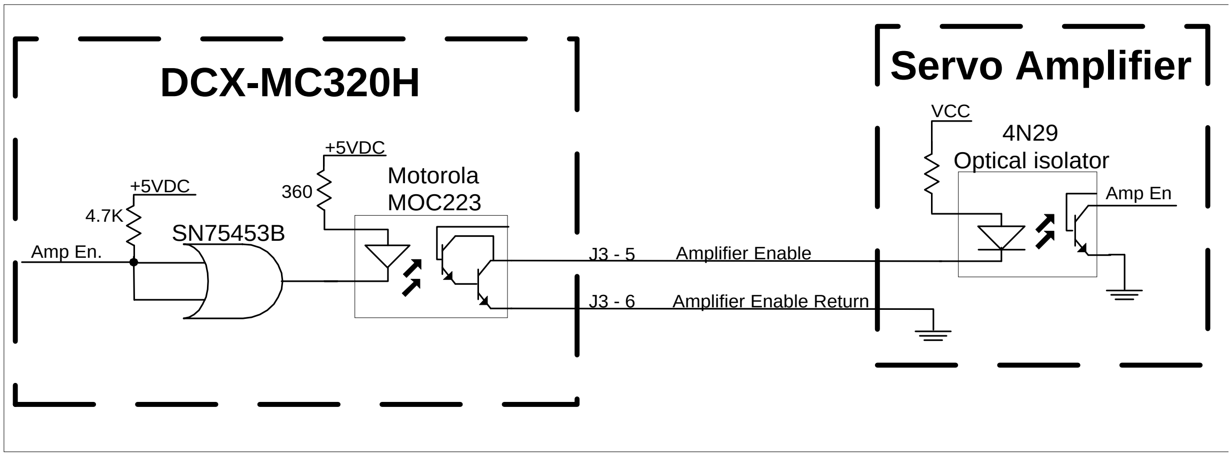


This limit circuit wll indicate that a limit is active if:

1) The switch is open
2) Any component in the circuit fails (power supply, bi-directional opto isolator, broken wire, etc...

This is not the default configuration of the DCX, issue the **MC_LIMIT_INVERT** parameter of the ***MCSetLimits( )*** function.

DCX-MC320H Open Collector Driver Wiring Examples



DCX-MC360 Stepper Motor Control Module

SIGNAL DESCRIPTIONS:

Pulse and Direction Outputs
connection point: Direction / CW: MC360-H J3 - pin 3, MC360-R J3 - pin 3
Pulse / CCW: MC360-H J3 - pin 1, MC360-R J3 - pin 4
signal type: Open collector, current sink, 100ma max. current sink, 30V max.
notes: external pull-up required
explanation: In the control of a stepper motor, the two primary control signals are Pulse and Direction (or CW Pulse and CCW Pulse). These signals are connected to the external stepper motor driver that supplies current to the motor windings. In order for the stepper module to move the motor one step, a pulse is generated on one of these signals.

Both of these signals are driven by high current open collector drivers and are suitable for direct connection to optically isolated inputs commonly found on stepper motor drivers. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

Pulse: The motor driver should advance the motor by one increment for each pulse. The motor may advance a full step, a half step, or a micro step. This is determined by the mode of the stepper motor driver. The Pulse signal is normally high, and is pulled low at the beginning of a step. It stays low for one half the step period (50% duty cycle), and then goes back high. When it is time for the next step, the signal will be pulled low again.

Direction: This signal indicates the direction the motor will move. When the stepper is incrementing the current position (moving positive) this signal will remain high (pulled up). When the stepper is decrementing the current position (moving negative) this signal will be pulled low.

The function ***MCSetModuleOutputMode( )*** is used to change the operation of these signals to CW and CCW Pulse. In this mode, pulses will be generated on the CW Pulse output when the current position is increasing, and on the CCW Pulse output when the current position is decreasing.

Drive Enable Output
connection point: MC360-H J3 - pin 5, MC360-R J3 - pin 16
signal type: Open collector, current sink, 100ma max. current sink, 30V max.
notes: external pull-up required
explanation: This output will be pulled low when an axis is enabled (***MCEnableAxis( )***). It will remain low until: the axis is disabled or an error condition exists (limits tripped).

This signal is driven by a high current open collector driver and is suitable for direct connection to optically isolated inputs commonly found on a servo amplifier. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

Limit Positive and Limit Negative Inputs

connection point: Limit Positive: MC360-H J3 - pin 17, MC320-R J3 - pin 8
Limit Negative: MC360-H J3 - pin 19, MC320-R J3 - pin 9

signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range

notes: MC360-H Limit Positive Supply/Return J3 pin 18
MC360-H Limit Negative Supply/Return J3 pin 20
MC360-R Limits Supply/Return J3 pin 6

explanation: The limit switch inputs are used to cause the DCX to stop a servo's motion when it reaches the end of travel. If the servo is in position mode, the axis will only be stopped if it is moving in the direction of an activated limit switch. In all other modes, the servo will be stopped regardless of the direction it is moving if either limit switch is activated. There are three modes of stopping (decelerate to a stop, stop immediately, turn off the axis) that can be configured by the ***MCSetLimits( )***. The limit switch inputs can be enabled and disabled by ***MCSetLimits( )***. See the description of **Motion Limits** in the **Motion Control** chapter.

The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Home Input

connection point: MC360-H J3 - pin 9, MC360-R J3 - 13

signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range

notes: MC360-H Home Supply/Return J3 pin 10
MC360-R Home Supply/Return J3 pin 12

explanation: This input is used to set the zero position of a stepper motor. It is typically connected to a sensor/switch that is activated at a fixed position in the motor's range of motion. The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Compare / Full/Half Step Output

connection point: MC360-H J3 - pin 13, MC360-R J3 - 14

signal type: Open collector, current sink, 100ma max. current sink, 30V max.

notes: external pull-up required

explanation:

Compare – Used to indicate when a position compare event has occurred. See the description of **Position Compare** in the **Application Solutions chapter**.

Full/Half Step –This signal is used if the stepper driver has a digital input to select between or full/micro (or full/half) step modes. The default condition of this signal is to be inactive (pulled high). Setting the **MC_STEP_FULL** parameter of the **MCMotion** structure will cause the signal to be pulled low.

This signal is driven by a high current open collector driver and is suitable for direct connection to optically isolated inputs commonly found on a servo amplifier. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

Full/Half Current Output
connection point: MC360-H J3 - pin 14, MC360-R J3 - 15
signal type: Open collector, current sink, 100ma max. current sink, 30V max.
notes: external pull-up required
explanation: This signal is used if the stepper driver has a digital input for current control. The default condition of this signal is to be inactive (pulled high). Setting the **MC_CURRENT_FULL** parameter of the **MCMotion** structure will cause the signal to be pulled low.

This signal is driven by a high current open collector driver and is suitable for direct connection to optically isolated inputs commonly found on a servo amplifier. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

Drive Fault Input
connection point: MC360-H J3 - pin 7, MC360-R J3 - 7
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: MC360-H Drive Fault Supply/Return J3 pin 8
MC360-R Drive Fault Supply/Return J3 pin 5
explanation: This module input is designed to be connected to the Fault or Error output signal of a stepper driver. The state of this signal will appear as a status bit in the servo's status word. The **EnableAmpFault** member of the **MCMotion** structure will enable the module to shut off the axis if the Drive Fault input is active. No further motion will occur until the fault signal is deactivated and the axis has been enabled. The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Null Input
connection point: MC360-H J3 - pin 12, MC360-R J3 - 17
signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range
notes: MC360-H Null VHDCI connector pin 41 (no connect on module J3 connector)
MC360-R Null Supply/Return J3 pin 5
explanation: In order to switch from micro stepping to full stepping without the motor shifting position, the motor should be micro stepped to the "Null" Position. This is the position where the output of the amplifier will not change if it is switched between full and micro stepping. If the stepper amplifier provides an output signal that indicates when the motor is at a null position, the DCX can monitor this signal on the Null Position input of the module.

The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Position Capture +/- / Auxiliary Encoder Index +/-
connection point: Position Cap. + / Aux. Enc. Index+: MC360-H J3 - pin 25, MC320-R J3 - pin 22
Position Cap. - / Aux. Enc. Index-: MC360-H J3 - pin 26, MC320-R J3 - pin 23
signal type: TTL or Differential driver output (-7V to +7V)
notes:
explanation: -
Position Capture +/- – Used to initiate the capture of position data. See the description of **Position Capture** in the **Application Solutions chapter**.

Auxiliary Encoder Index +/- - This input signal can be used to define the home position of an auxiliary encoder.

Auxiliary Encoder Coarse Home Input
connection point: MC360-H J3 - pin 15, MC360-R J3 - 11
signal type: Bi-directional optical isolator, 15ma min. 12V – 24V range
notes: MC360-H Coarse Home VHDCI connector pin 10 (no connect on module J3 connector)
MC360-R Null Supply/Return J3 pin 6
explanation: This input is used to 'home' the auxiliary encoder by qualifying the index mark. It is typically connected to a switch that is activated at a fixed position in the motors motion range. See the description of **Homing an Axis** in the **Motion Control** chapter.

The input device is a bi-directional optical isolator. The allowable voltage range for this signal is 12VDC to 24VDC. The minimum current required to turn on the optical isolator is 10ma. Bi-directional optical isolator wiring examples are provided later in this section.

Auxiliary Encoder Inputs (Phase A, Phase B, Index+, Index-)
connection point: see pin-out table
signal type: TTL or Differential driver output (-7V to +7V)
notes:
explanation: - These input signals can be used for an auxiliary encoder.

Auxiliary Encoder Power Output
connection point: MC300-H J3 - pin 16, MC300-R J3 - pin 10
signal type: +5 VDC PC power supply output or +12 VDC PC power supply output
notes: The encoder power jumper JP3 selects +5VDC or +12VDC (**250 mA max.**)
explanation: This module pin provides a convenient supply voltage connection for the auxiliary encoder. The jumper JP3 located on the module can be used to connect either the +5 or +12 volt supply to the Encoder Power pin. The setting of this jumper also selects the threshold voltage for the module's single ended phase and index encoder inputs. When JP1 is set for +5 volts, the threshold will be 2.5 volts, for +12 volts, the threshold will be +6 volts. The threshold voltage determines at what voltage the input changes between on and off.

SUPPLY CONNECTIONS (+5, +12, -12, GROUND) - These module pins provide access to the DCX supply voltages.

DCX-MC360-H High Density connector signal map

Module #1	Module #2	Module #3	Module #4	Module #5	Module #6	Module #7	Module #8	J3 Pin #	Description
J1 – 1	J2 – 1	J3 - 19	J4 - 19	J3 – 1	J4 – 1	J1 – 19	J2 - 19	1	Step or CCW Pulse: output
J1 – 35	J2 - 35	J3 – 53	J4 – 53	J3 – 35	J4 – 35	J1 – 53	J2 – 53	2	Ground
J1 – 2	J2 – 2	J3 – 20	J4 – 20	J3 – 2	J4 – 2	J1 – 20	J2 – 20	3	Direction or CW Pulse: output
J1 – 36	J2 - 36	J3 – 54	J4 – 54	J3 – 36	J4 – 36	J1 – 54	J2 – 54	4	Ground
J1 – 3	J2 – 3	J3 - 21	J4 - 21	J3 – 3	J4 – 3	J1 – 21	J2 - 21	5	Driver Enable: output
J1 – 37	J2 - 37	J3 – 55	J4 – 55	J3 – 37	J4 – 37	J1 – 55	J2 – 55	6	Ground
J1 – 4	J2 – 4	J3 – 22	J4 – 22	J3 – 4	J4 – 4	J1 – 22	J2 – 22	7	Drive Fault: input
J1 – 38	J2 - 38	J3 – 56	J4 – 56	J3 – 38	J4 – 38	J1 – 56	J2 – 56	8	Drive Fault return
J1 – 5	J2 – 5	J3 – 23	J4 – 23	J3 – 5	J4 – 5	J1 – 23	J2 – 23	9	Home: input
J1 – 39	J2 - 39	J3 – 57	J4 – 57	J3 – 39	J4 – 39	J1 – 57	J2 – 57	10	Home return
J1 – 6	J2 – 6	J3 – 24	J4 – 24	J3 – 6	J4 – 6	J1 – 24	J2 – 24		Ground
J1 – 40	J2 - 40	J3 – 58	J4 – 58	J3 – 40	J4 – 40	J1 – 58	J2 – 58	11	Reserved
J1 – 7	J2 – 7	J3 – 25	J4 – 25	J3 – 7	J4 – 7	J1 – 25	J2 – 25	12	Null Position: input
J1 – 41	J2 - 41	J3 – 59	J4 – 59	J3 – 41	J4 – 41	J1 – 59	J2 – 59		Ground
J1 – 8	J2 – 8	J3 – 26	J4 – 26	J3 – 8	J4 – 8	J1 – 26	J2 – 26		Ground
J1 – 42	J2 - 42	J3 – 60	J4 – 60	J3 – 42	J4 – 42	J1 – 60	J2 – 60	13	Compare / Full/Half Step: output
J1 – 9	J2 – 9	J3 – 27	J4 – 27	J3 – 9	J4 – 9	J1 – 27	J2 – 27	14	Full/Half Current: output
J1 – 43	J2 - 43	J3 – 61	J4 – 61	J3 – 43	J4 – 43	J1 – 61	J2 – 61		Ground
J1 – 10	J2 - 10	J3 – 28	J4 – 28	J3 – 10	J4 – 10	J1 – 28	J2 – 28		Ground
J1 – 44	J2 - 44	J3 – 62	J4 – 62	J3 – 44	J4 – 44	J1 – 62	J2 – 62	15	Aux. Encoder Coarse Home: input
J1 – 11	J2 - 11	J3 - 29	J4 - 29	J3 – 11	J4 – 11	J1 – 29	J2 - 29	16	Aux. Enc. Power: output (**max. load 250 mA**)
J1 – 45	J2 - 45	J3 – 63	J4 – 63	J3 – 45	J4 – 45	J1 – 63	J2 – 63		Ground
J1 – 12	J2 - 12	J3 – 30	J4 – 30	J3 – 12	J4 – 12	J1 – 30	J2 – 30	17	Limit Positive: input
J1 – 46	J2 - 46	J3 – 64	J4 – 64	J3 – 46	J4 – 46	J1 – 64	J2 – 64	18	Limit Positive return
J1 – 13	J2 - 13	J3 – 31	J4 – 31	J3 – 13	J4 – 13	J1 – 31	J2 – 31	19	Limit Negative: input
J1 – 47	J2 - 47	J3 – 65	J4 – 65	J3 – 47	J4 – 47	J1 – 65	J2 – 65	20	Limit Negative return
J1 – 14	J2 - 14	J3 – 32	J4 – 32	J3 – 14	J4 – 14	J1 – 32	J2 – 32	21	Auxiliary Encoder Phase A+: input
J1 – 48	J2 - 48	J3 – 66	J4 – 66	J3 – 48	J4 – 48	J1 – 66	J2 – 66	22	Auxiliary Encoder Phase A-: input
J1 – 15	J2 - 15	J3 – 33	J4 – 33	J3 – 15	J4 – 15	J1 – 33	J2 – 33	23	Auxiliary Encoder Phase B+: input
J1 – 49	J2 - 49	J3 – 67	J4 – 67	J3 – 49	J4 – 49	J1 – 67	J2 – 67	24	Auxiliary Encoder Phase B-: input
J1 – 16	J2 - 16	J3 – 34	J4 – 34	J3 – 16	J4 – 16	J1 – 34	J2 – 34	25	Position Capture + / Aux. Encoder Index+: input
J1 – 50	J2 - 50	J3 – 68	J4 – 68	J3 – 50	J4 – 50	J1 – 68	J2 – 68	26	Position Capture - / Aux. Encoder Index-: input
J1 – 17	J2 – 17			J3 – 17	J4 – 17				Ground
J1 – 51	J2 - 51			J3 – 51	J4 – 51				Ground
J1 – 18	J2 – 18			J3 – 18	J4 – 18				Ground
J1 – 52	J3 – 52			J3 – 52	J4 – 52				Ground

For a more complete signal description please refer to the previous five pages
Mating cable connector components: Amp: 787801-1 (offset connector), 788362-1 (backshell, offset)

DCX-MC360-R Module connector

J3 connector pin-out (Motor command, encoders, and axis I/O)

Pin #	Description
1	Ground
2	+5 VDC (**max. load 250 mA**)
3	Direction or CW Pulse: output (open collector, 100ma max., 30V max.) *
4	Pulse or CCW Pulse: output (open collector, 100ma max., 30V max.) *
5	FNRET: Drive Fault and Null opto isolator supply/return
6	LIMCRSRET: Coarse Home & Limits opto isolator supply/return
7	Drive Fault: input (opto isolator, 15ma min. current, 30V max.)
8	Limit Positive: input (opto isolator, 15ma min. current, 30V max.)
9	Limit Negative: input (opto isolator, 15ma min. current, 30V max.)
10	Auxiliary Encoder Power: output (+5VDC or +12VDC, see jumper JP3) (**max. load 250 mA**)
11	Aux. Encoder Coarse Home: input (opto isolator, 15ma min. current, 30V max.)
12	HOMRET: Home opto isolator supply/return
13	Home: input (opto isolator, 15ma min. current, 30V max.)
14	Compare / Full/Half Step: output (open collector, 100ma max., 30V max.)
15	Full/Half Current: output (open collector, 100ma max., 30V max.)
16	Driver Enable: output (open collector, 100ma max., 30V max.)
17	Null Position: input (opto isolator, 15ma min. current, 30V max.)
18	Auxiliary Encoder Phase A+: input
19	Auxiliary Encoder Phase A-: input
20	Auxiliary Encoder Phase B+: input
21	Auxiliary Encoder Phase B-: input
22	Position Capture + / Auxiliary Encoder Index+: input (active high)
23	Position Capture - / Auxiliary Encoder Index-: input (active low)
24	+12 VDC (**max. load 250 mA**)
25	-12 VDC (**max. load 50 mA**)
26	Ground

* These signals default to DIRECTION and PULSE, use ***MCSetModuleOutputMode( )*** to change to CW and CCW PULSE.

Mating Connector:26-pin dual-row IDC female, Circuit Assembly P/N 26IDS2-C-SPT-SR or equivalent

DCX-MC360 Module Configuration Jumpers - configuration in **bold type** denotes default factory shipping configuration

JP1 – Encoder type (single ended or differential)

Pins	Description
1 to 2 to 3	Single ended encoder, A, B, Z (three pin jumper provided)
open	**Differential encoder, A+, A-, B+, B-**

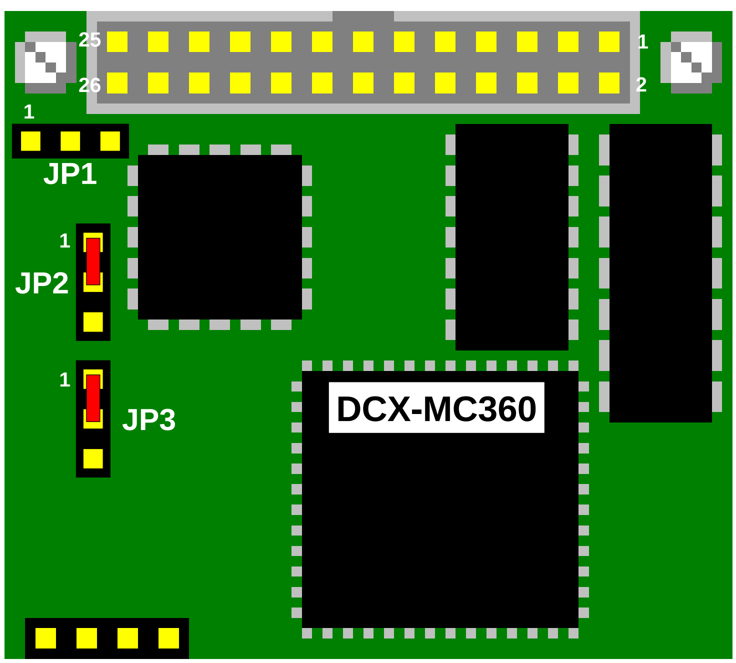
JP2 – Auxiliary Encoder Index Active Level Select

Pins	Description
1 to 2	**Single ended Index, Z+ (Active high)**
2 to 3	Single ended Index, Z- (active low)
open	Differential Index, Z+ and Z-

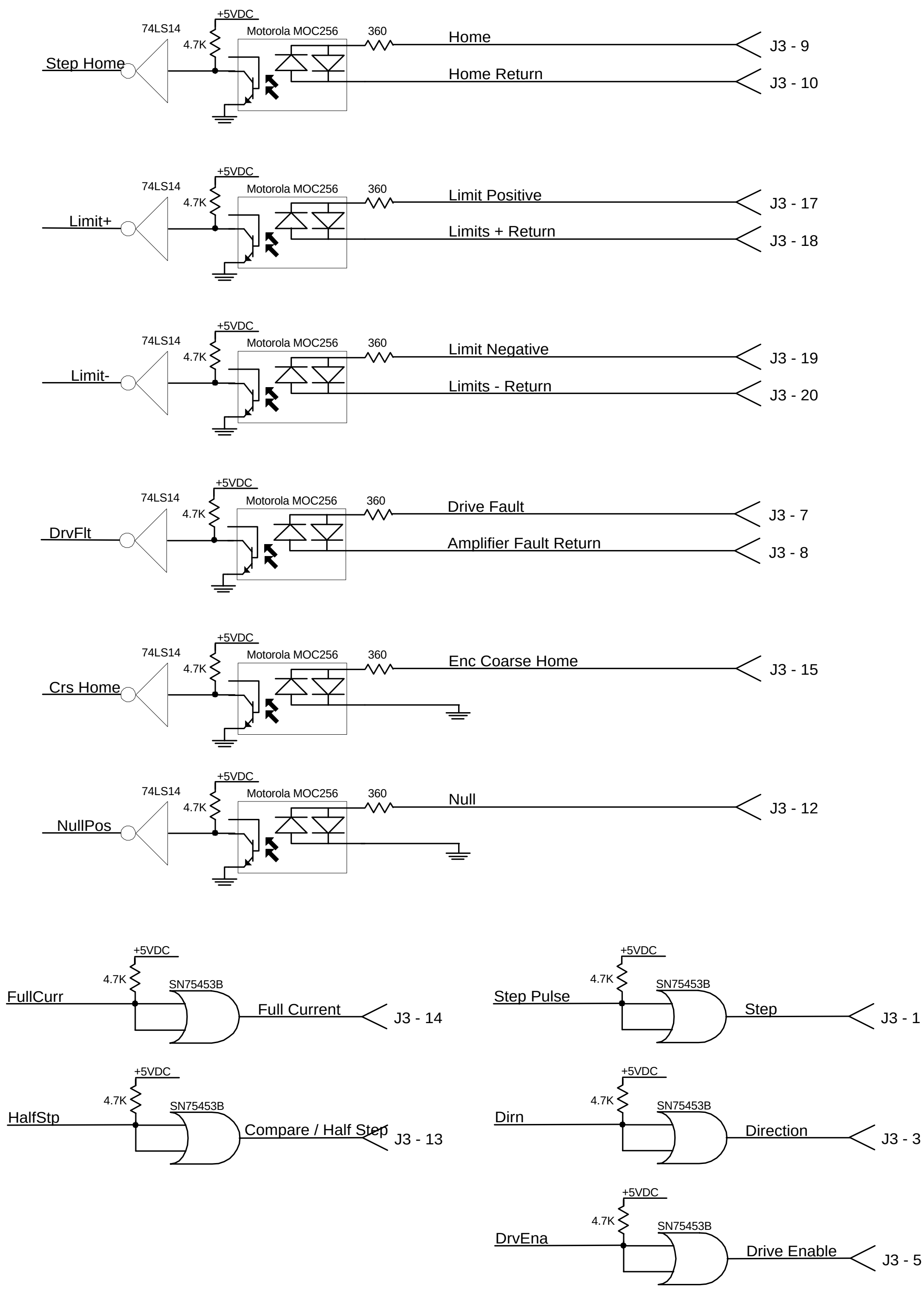
JP3 – Auxiliary Encoder Power Select (+5VDC or +12 VDC)

Pins	Description
1 to 2	**+5 VDC encoder supply on J3 pin 16/10** (**max. load 250 mA**)
2 to 3	+12 VDC encoder supply on J3 pin 16/10 (**max. load 250 mA**)

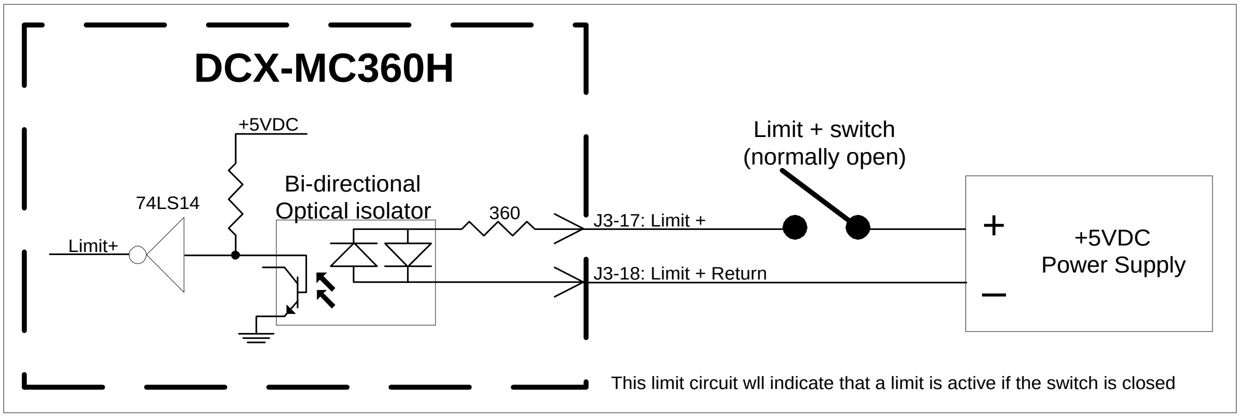
DCX-MC360 Module Layout

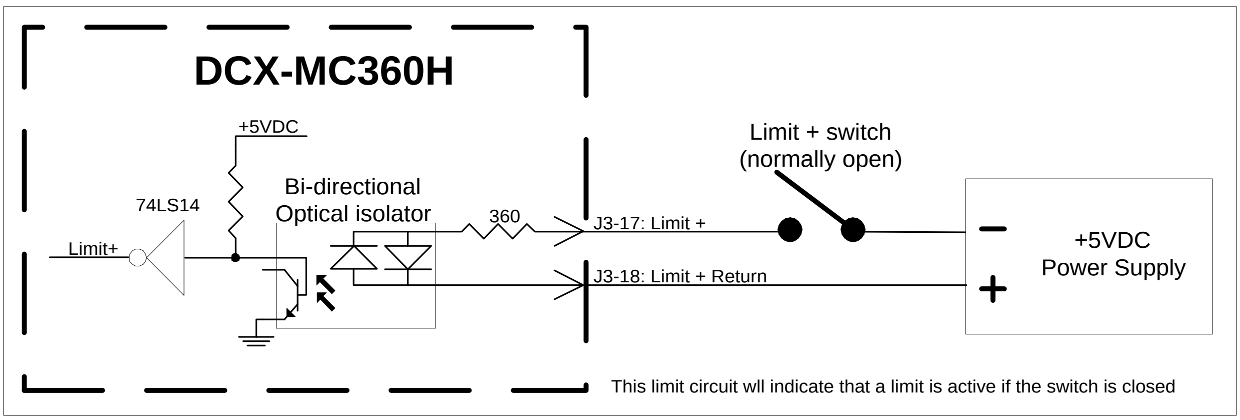


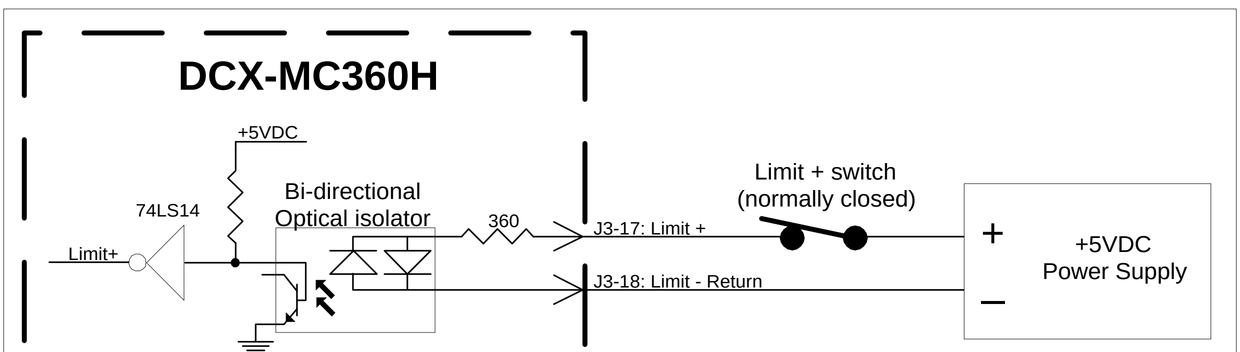
DCX-MC360H Axis I/O Interface Schematic



DCX-MC360H Optically Isolated Inputs Wiring Examples



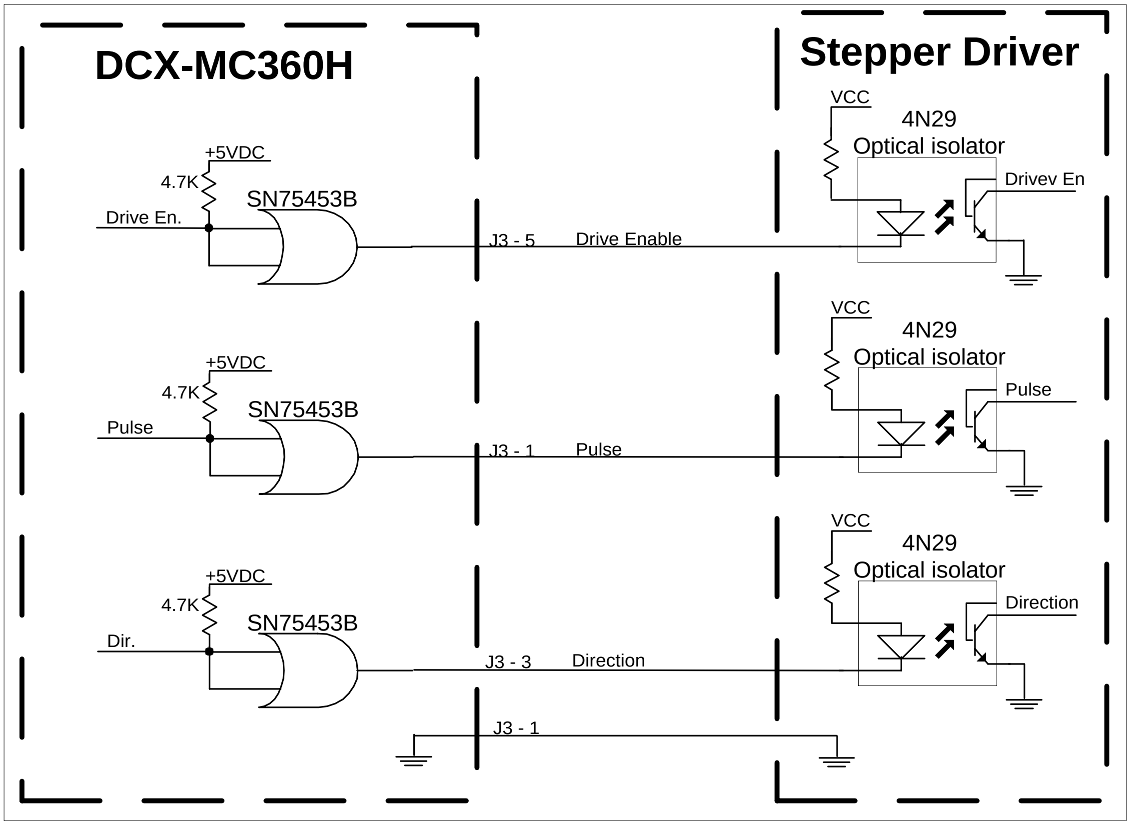




This limit circuit wll indicate that a limit is active if:
1) The switch is open
2) Any component in the circuit fails (power supply, bi-directional opto isolator, broken wire, etc...

This is not the default configuration of the DCX, issue the **MC_LIMIT_INVERT** parameter of the ***MCSetLimits( )*** function.

DCX-MC360H Open Collector Driver Wiring Examples



DCX-MC362 Dual Axis Stepper Motor Control Module

SIGNAL DESCRIPTIONS:

Pulse and Direction Outputs
connection point: Axis 1 Direction/CW – J3 pin 12
Axis 1 Pulse/CCW – J3 pin 11
Axis 2 Direction/CW – J3 pin 15
Axis 2 Pulse/CCW – J3 pin 16
signal type: Open collector, current sink, 100ma max. current sink, 30V max.
notes: external pull-up required
explanation: In the control of a stepper motor, the two primary control signals are Pulse and Direction (or CW Pulse and CCW Pulse). These signals are connected to the external stepper motor driver that supplies current to the motor windings. In order for the stepper module to move the motor one step, a pulse is generated on one of these signals.

Both of these signals are driven by high current open collector drivers and are suitable for direct connection to optically isolated inputs commonly found on stepper motor drivers. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

Pulse: The motor driver should advance the motor by one increment for each pulse. The motor may advance a full step, a half step, or a micro step. This is determined by the mode of the stepper motor driver. The Pulse signal is normally high, and is pulled low at the beginning of a step. It stays low for one half the step period (50% duty cycle), and then goes back high. When it is time for the next step, the signal will be pulled low again.

Direction: This signal indicates the direction the motor will move. When the stepper is incrementing the current position (moving positive) this signal will remain high (pulled up). When the stepper is decrementing the current position (moving negative) this signal will be pulled low.

The function ***MCSetModuleOutputMode( )*** is used to change the operation of these signals to CW and CCW Pulse. In this mode, pulses will be generated on the CW Pulse output when the current position is increasing, and on the CCW Pulse output when the current position is decreasing.

Drive Enable Output
connection point: Axis 1 - J3 pin 9
Axis21 - J3 pin 17
signal type: Open collector, current sink, 100ma max. current sink, 30V max.
notes: external pull-up required
explanation: This output will be pulled low when an axis is enabled (***MCEnableAxis( )***). It will remain low until: the axis is disabled or an error condition exists (limits tripped).

This signal is driven by a high current open collector driver and is suitable for direct connection to optically isolated inputs commonly found on a servo amplifier. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

Limit Positive and Limit Negative Inputs

connection point: Axis 1 Limit Positive – J3 pin 3
Axis 1 Limit Negative – J3 pin 5
Axis 2 Limit Positive – J3 pin 23
Axis 2 Limit Negative – J3 pin 21

signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range

notes: Axis 1 Limit + Supply/Return - J3 pin 4
Axis 1 Limit - Supply/Return - J3 pin 6
Axis 2 Limit + Supply/Return - J3 pin 24
Axis 2 Limit - Supply/Return - J3 pin 22

explanation: The limit switch inputs are used to cause the DCX to stop a servo's motion when it reaches the end of travel. If the servo is in position mode, the axis will only be stopped if it is moving in the direction of an activated limit switch. In all other modes, the servo will be stopped regardless of the direction it is moving if either limit switch is activated. There are three modes of stopping (decelerate to a stop, stop immediately, turn off the axis) that can be configured by the ***MCSetLimits( )***. The limit switch inputs can be enabled and disabled by ***MCSetLimits( )***. See the description of **Motion Limits** in the **Motion Control** chapter.

The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Home Input

connection point: Axis 1 - J3 - pin 1
Axis 2 - J3 - pin 25

signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range

notes: Axis 1 Supply/Return - J3 pin 2
Axis 2 Supply/Return - J3 pin 26

explanation: This input is used to set the zero position of a stepper motor. It is typically connected to a sensor/switch that is activated at a fixed position in the motor’s range of motion. The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Drive Fault Input

connection point: Axis 1 - J3 - pin 7
Axis 2 - J3 - pin 19

signal type: Bi-directional optical isolator, 10ma min. 2.5V – 7.5V range

notes: Axis 1 Supply/Return - J3 pin 8
Axis 2 Supply/Return - J3 pin 19

explanation: This module input is designed to be connected to the Fault or Error output signal of a stepper driver. The state of this signal will appear as a status bit in the servo's status word. The **EnableAmpFault** member of the **MCMotion** structure will enable the module to shut off the axis if the Drive Fault input is active. No further motion will occur until the fault signal is deactivated and the axis has been enabled. The input device is a bi-directional optical isolator. The allowable voltage range for this signal is **2.5 VDC to 7.5 VDC**. For I/O systems operating at higher voltage levels add an external resistor (12 volt I/O = 1.1K, 5%, 1/4W. 24 volt I/O = 4.3K, 5%, 1/4W).

Full/Half Current Output

connection point: Axis 1 - J3 - pin 13
Axis 2 - J3 - pin 14

signal type: Open collector, current sink, 100ma max. current sink, 30V max.

notes: external pull-up required

explanation: This signal is used if the stepper driver has a digital input for current control. The default condition of this signal is to be inactive (pulled high). Setting the **MC_CURRENT_FULL** parameter of the **MCMotion** structure will cause the signal to be pulled low.

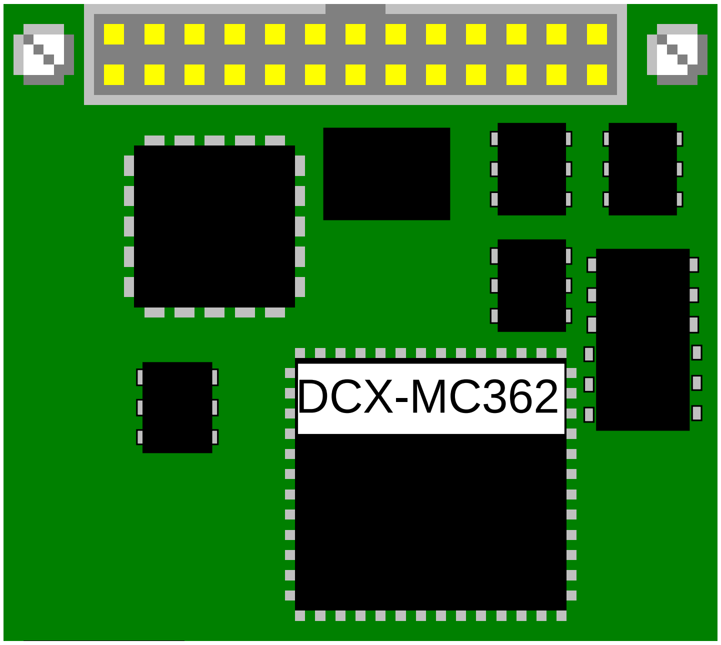
This signal is driven by a high current open collector driver and is suitable for direct connection to optically isolated inputs commonly found on a servo amplifier. Because of the characteristics of open collector drivers, no voltages will be present on these output signals unless pull-up resistors are connected to them.

DCX-MC362-H High Density connector signal map

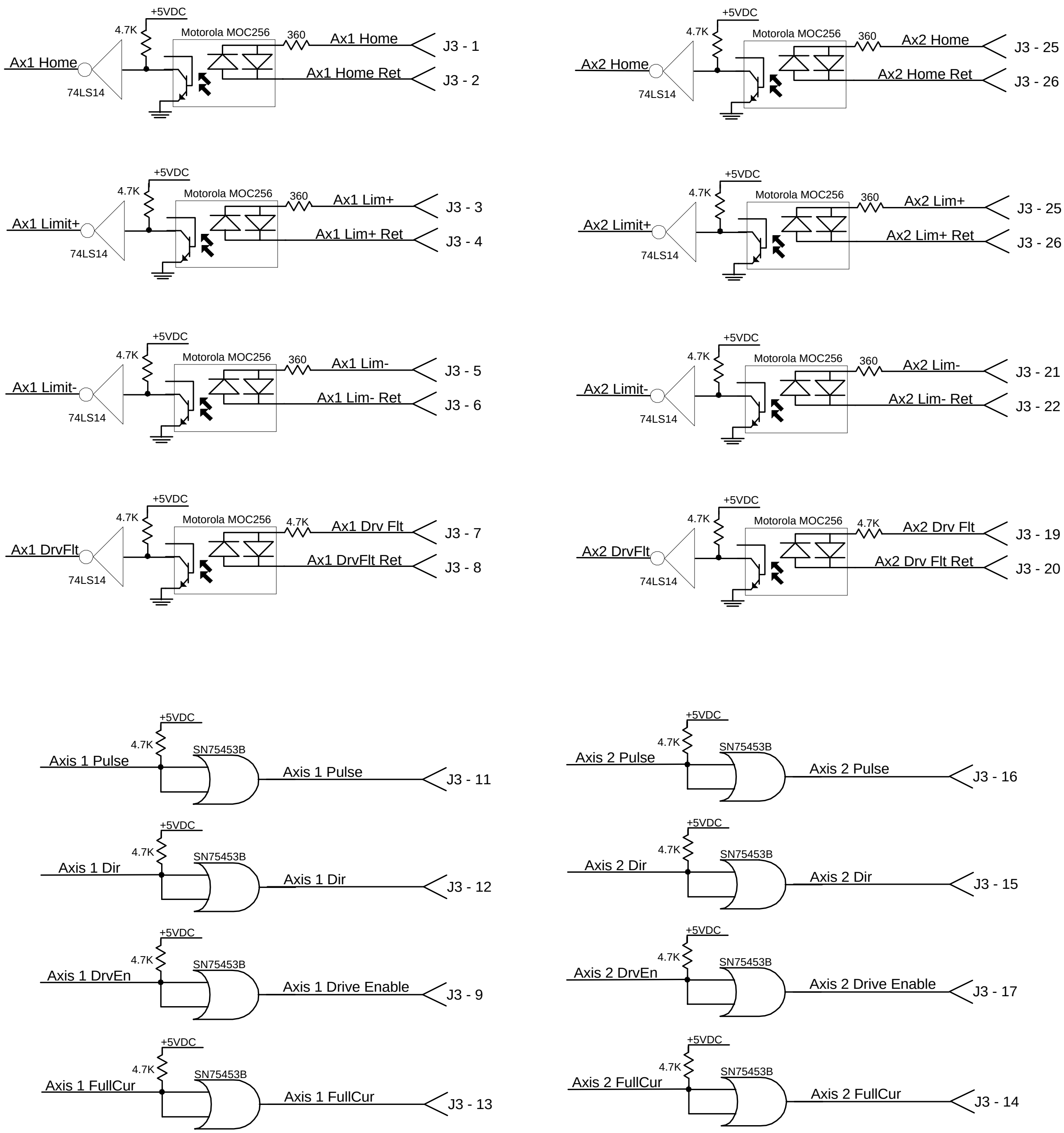
Module #1	Module #2	Module #3	Module #4	Module #5	Module #6	Module #7	Module #8	J3 Pin #	Description
J1 – 1	J2 – 1	J3 - 19	J4 - 19	J3 – 1	J4 – 1	J1 – 19	J2 - 19	1	Axis 1 Home: input (optically isolated)
J1 – 35	J2 - 35	J3 – 53	J4 – 53	J3 – 35	J4 – 35	J1 – 53	J2 – 53	2	Axis 1 Home opto isolator supply/return
J1 – 2	J2 – 2	J3 – 20	J4 – 20	J3 – 2	J4 – 2	J1 – 20	J2 – 20	3	Axis 1 Limit Positive: input (optically isolated)
J1 – 36	J2 - 36	J3 – 54	J4 – 54	J3 – 36	J4 – 36	J1 – 54	J2 – 54	4	Axis 1 Limit Positive opto isolator supply/return
J1 – 3	J2 – 3	J3 - 21	J4 - 21	J3 – 3	J4 – 3	J1 – 21	J2 - 21	5	Axis 1 Limit Negative: input (optically isolated)
J1 – 37	J2 - 37	J3 – 55	J4 – 55	J3 – 37	J4 – 37	J1 – 55	J2 – 55	6	Axis 1 Limit Negative opto isolator supply/return
J1 – 4	J2 – 4	J3 – 22	J4 – 22	J3 – 4	J4 – 4	J1 – 22	J2 – 22	7	Axis 1 Drive Fault: input (optically isolated)
J1 – 38	J2 - 38	J3 – 56	J4 – 56	J3 – 38	J4 – 38	J1 – 56	J2 – 56	8	Axis 1 Drive Fault opto isolator supply/return
J1 – 5	J2 – 5	J3 – 23	J4 – 23	J3 – 5	J4 – 5	J1 – 23	J2 – 23	9	Axis 1 Driver Enable: output (open collector)
J1 – 39	J2 - 39	J3 – 57	J4 – 57	J3 – 39	J4 – 39	J1 – 57	J2 – 57	10	Ground
J1 – 6	J2 – 6	J3 – 24	J4 – 24	J3 – 6	J4 – 6	J1 – 24	J2 – 24		Ground
J1 – 40	J2 - 40	J3 – 58	J4 – 58	J3 – 40	J4 – 40	J1 – 58	J2 – 58	11	Axis 1 Pulse or CCW Pulse: output
J1 – 7	J2 – 7	J3 – 25	J4 – 25	J3 – 7	J4 – 7	J1 – 25	J2 – 25	12	Axis 1 Direction or CW Pulse: output
J1 – 41	J2 - 41	J3 – 59	J4 – 59	J3 – 41	J4 – 41	J1 – 59	J2 – 59		Ground
J1 – 8	J2 – 8	J3 – 26	J4 – 26	J3 – 8	J4 – 8	J1 – 26	J2 – 26		Ground
J1 – 42	J2 - 42	J3 – 60	J4 – 60	J3 – 42	J4 – 42	J1 – 60	J2 – 60	13	Axis 1 Full/Half Current: output
J1 – 9	J2 – 9	J3 – 27	J4 – 27	J3 – 9	J4 – 9	J1 – 27	J2 – 27	14	Axis 2 Full/Half Current: output
J1 – 43	J2 - 43	J3 – 61	J4 – 61	J3 – 43	J4 – 43	J1 – 61	J2 – 61		Ground
J1 – 10	J2 - 10	J3 – 28	J4 – 28	J3 – 10	J4 – 10	J1 – 28	J2 – 28		Ground
J1 – 44	J2 - 44	J3 – 62	J4 – 62	J3 – 44	J4 – 44	J1 – 62	J2 – 62	15	Axis 2 Direction or CW Pulse: output
J1 – 11	J2 - 11	J3 - 29	J4 - 29	J3 – 11	J4 – 11	J1 – 29	J2 - 29	16	Axis 2 Pulse or CCW Pulse: output
J1 – 45	J2 - 45	J3 – 63	J4 – 63	J3 – 45	J4 – 45	J1 – 63	J2 – 63		Ground
J1 – 12	J2 - 12	J3 – 30	J4 – 30	J3 – 12	J4 – 12	J1 – 30	J2 – 30	17	Axis 2 Driver Enable: output
J1 – 46	J2 - 46	J3 – 64	J4 – 64	J3 – 46	J4 – 46	J1 – 64	J2 – 64	18	Ground
J1 – 13	J2 - 13	J3 – 31	J4 – 31	J3 – 13	J4 – 13	J1 – 31	J2 – 31	19	Axis 2 Drive Fault: input (optically isolated)
J1 – 47	J2 - 47	J3 – 65	J4 – 65	J3 – 47	J4 – 47	J1 – 65	J2 – 65	20	Axis 2 Drive Fault opto isolator supply/return
J1 – 14	J2 - 14	J3 – 32	J4 – 32	J3 – 14	J4 – 14	J1 – 32	J2 – 32	21	Axis 2 Limit Negative: input (optically isolated)
J1 – 48	J2 - 48	J3 – 66	J4 – 66	J3 – 48	J4 – 48	J1 – 66	J2 – 66	22	Axis 2 Limit Negative opto isolator supply/return
J1 – 15	J2 - 15	J3 – 33	J4 – 33	J3 – 15	J4 – 15	J1 – 33	J2 – 33	23	Axis 2 Limit Positive: input (optically isolated)
J1 – 49	J2 - 49	J3 – 67	J4 – 67	J3 – 49	J4 – 49	J1 – 67	J2 – 67	24	Axis 2 Limit Positive opto isolator supply/return
J1 – 16	J2 - 16	J3 – 34	J4 – 34	J3 – 16	J4 – 16	J1 – 34	J2 – 34	25	Axis 2 Home: input (optically isolated)
J1 – 50	J2 - 50	J3 – 68	J4 – 68	J3 – 50	J4 – 50	J1 – 68	J2 – 68	26	Axis 2 Home opto isolator supply/return
J1 – 17	J2 – 17			J3 – 17	J4 – 17				Ground
J1 – 51	J2 - 51			J3 – 51	J4 – 51				Ground
J1 – 18	J2 – 18			J3 – 18	J4 – 18				Ground
J1 – 52	J3 – 52			J3 – 52	J4 – 52				Ground

For a more complete signal description please refer to the previous five pages
Mating cable connector components: Amp: 787801-1 (offset connector), 788362-1 (backshell, offset)

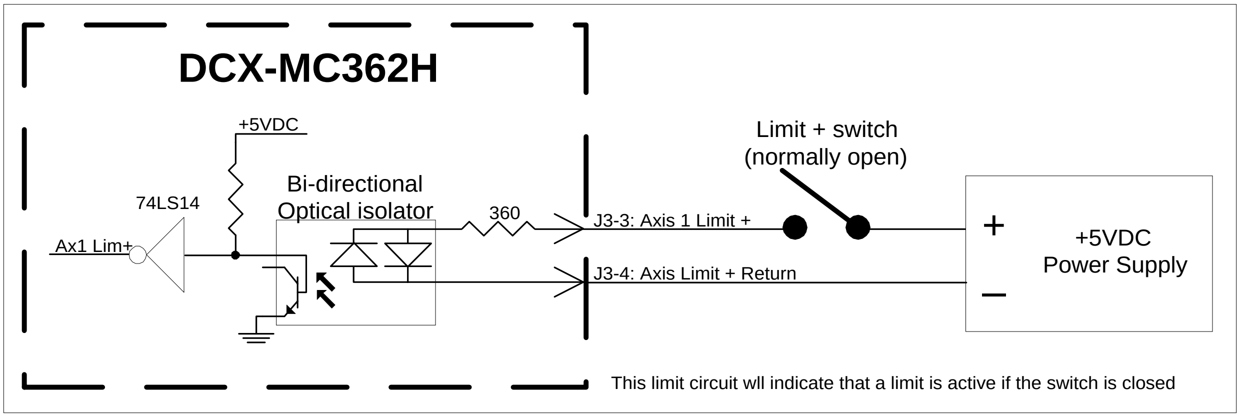
DCX-MC362 Module Layout

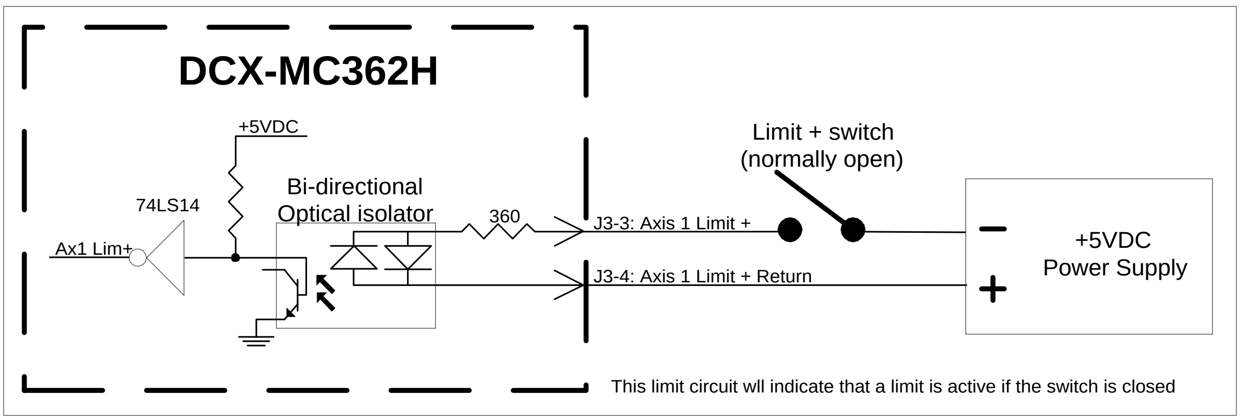


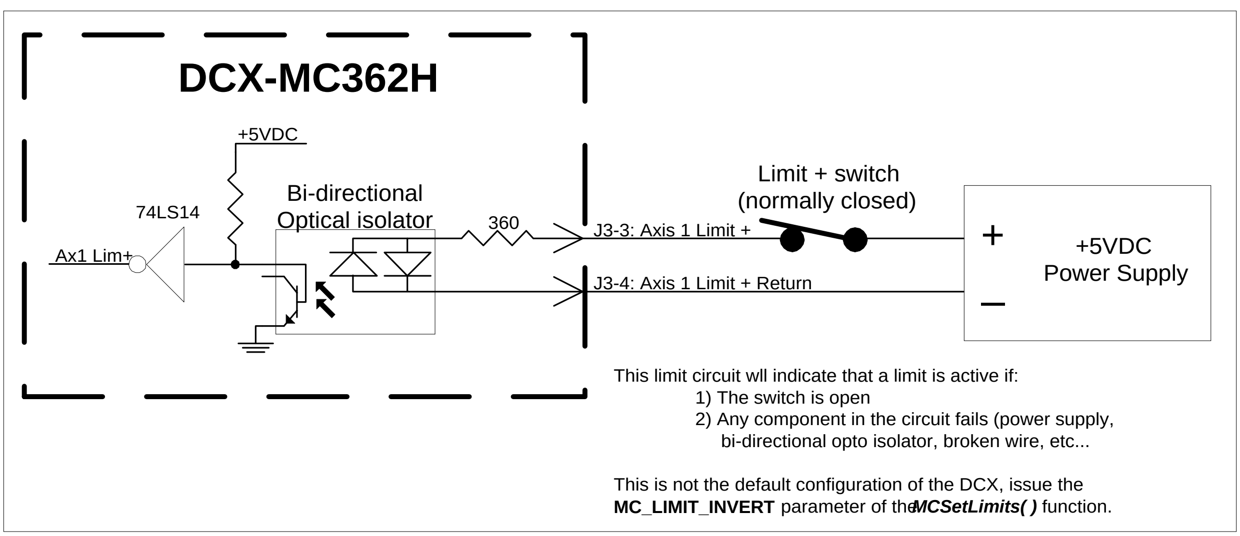
DCX-MC362H Axis I/O Interface Schematic



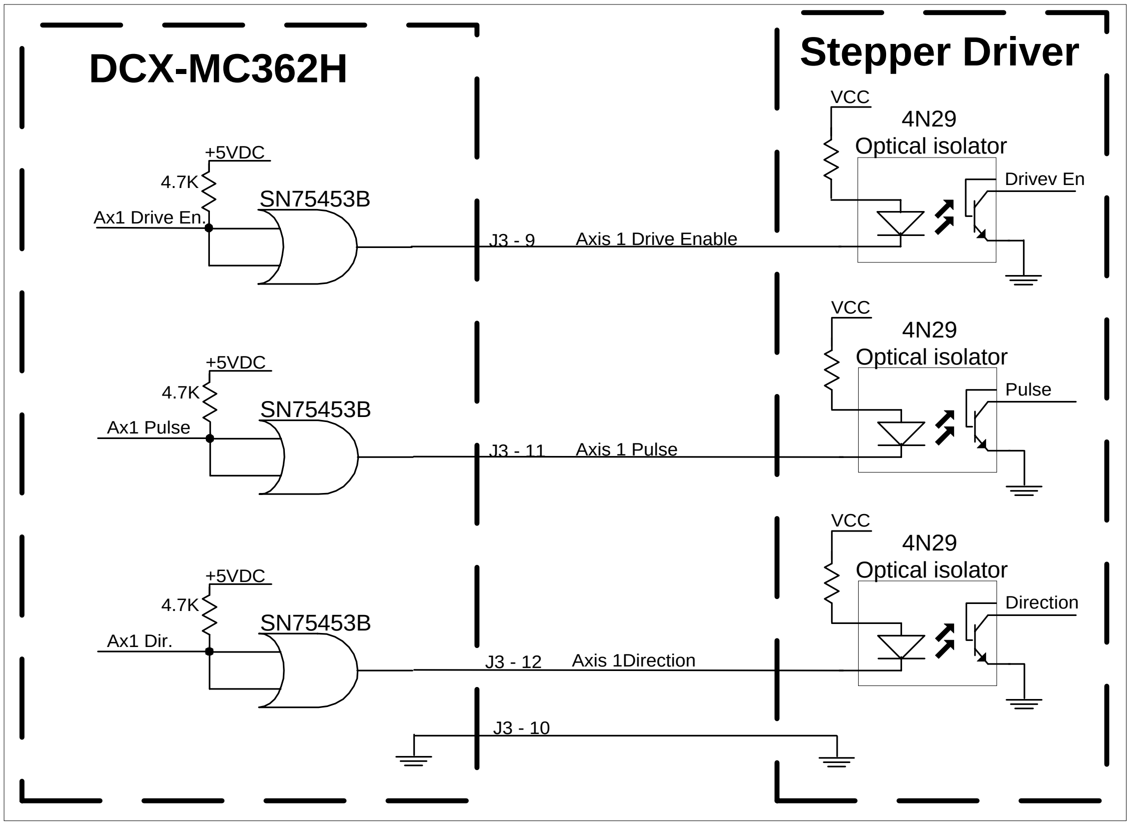
DCX-MC36H Optically Isolated Inputs Wiring Examples







DCX-MC362H Open Collector Driver Wiring Examples



DCX-MC400 Digital I/O Module

DCX-MC400 Electrical Specifications

Parameter	***Min.***	***Max***	***Unit***
Digital Input – High voltage	2.0	5.3	V
Digital Input – Low voltage	-0.3	0.8	V
Digital Output – High voltage	2.4		V (current source 0.25ma)
Digital Output – Low voltage		0.4	V (current source 2.0ma)
Input leakage		+/- 10.0	uA

DCX-MC400-H High Density connector signal map

Module #1	Module #2	Module #3	Module #4	Module #5	Module #6	Module #7	Module #8	J3 Pin #	Description
J1 – 1	J2 – 1	J3 - 19	J4 - 19	J3 – 1	J4 – 1	J1 – 19	J2 - 19	1	Ground
J1 – 35	J2 - 35	J3 – 53	J4 – 53	J3 – 35	J4 – 35	J1 – 53	J2 – 53	2	Digital I/O channel #1
J1 – 2	J2 – 2	J3 – 20	J4 – 20	J3 – 2	J4 – 2	J1 – 20	J2 – 20	3	Ground
J1 – 36	J2 - 36	J3 – 54	J4 – 54	J3 – 36	J4 – 36	J1 – 54	J2 – 54	4	Digital I/O channel #2
J1 – 3	J2 – 3	J3 - 21	J4 - 21	J3 – 3	J4 – 3	J1 – 21	J2 - 21	5	Ground
J1 – 37	J2 - 37	J3 – 55	J4 – 55	J3 – 37	J4 – 37	J1 – 55	J2 – 55	6	Digital I/O channel #3
J1 – 4	J2 – 4	J3 – 22	J4 – 22	J3 – 4	J4 – 4	J1 – 22	J2 – 22	7	Ground
J1 – 38	J2 - 38	J3 – 56	J4 – 56	J3 – 38	J4 – 38	J1 – 56	J2 – 56	8	Digital I/O channel #4
J1 – 5	J2 – 5	J3 – 23	J4 – 23	J3 – 5	J4 – 5	J1 – 23	J2 – 23	9	Ground
J1 – 39	J2 - 39	J3 – 57	J4 – 57	J3 – 39	J4 – 39	J1 – 57	J2 – 57	10	Digital I/O channel #5
J1 – 6	J2 – 6	J3 – 24	J4 – 24	J3 – 6	J4 – 6	J1 – 24	J2 – 24		Ground
J1 – 40	J2 - 40	J3 – 58	J4 – 58	J3 – 40	J4 – 40	J1 – 58	J2 – 58	11	Digital I/O channel #6
J1 – 7	J2 – 7	J3 – 25	J4 – 25	J3 – 7	J4 – 7	J1 – 25	J2 – 25	12	Digital I/O channel #7
J1 – 41	J2 - 41	J3 – 59	J4 – 59	J3 – 41	J4 – 41	J1 – 59	J2 – 59		Ground
J1 – 8	J2 – 8	J3 – 26	J4 – 26	J3 – 8	J4 – 8	J1 – 26	J2 – 26		Ground
J1 – 42	J2 - 42	J3 – 60	J4 – 60	J3 – 42	J4 – 42	J1 – 60	J2 – 60	13	Digital I/O channel #8
J1 – 9	J2 – 9	J3 – 27	J4 – 27	J3 – 9	J4 – 9	J1 – 27	J2 – 27	14	Digital I/O channel #9
J1 – 43	J2 - 43	J3 – 61	J4 – 61	J3 – 43	J4 – 43	J1 – 61	J2 – 61		Ground
J1 – 10	J2 - 10	J3 – 28	J4 – 28	J3 – 10	J4 – 10	J1 – 28	J2 – 28		Ground
J1 – 44	J2 - 44	J3 – 62	J4 – 62	J3 – 44	J4 – 44	J1 – 62	J2 – 62	15	Digital I/O channel #10
J1 – 11	J2 - 11	J3 - 29	J4 - 29	J3 – 11	J4 – 11	J1 – 29	J2 - 29	16	Digital I/O channel #11
J1 – 45	J2 - 45	J3 – 63	J4 – 63	J3 – 45	J4 – 45	J1 – 63	J2 – 63		Ground
J1 – 12	J2 - 12	J3 – 30	J4 – 30	J3 – 12	J4 – 12	J1 – 30	J2 – 30	17	Ground
J1 – 46	J2 - 46	J3 – 64	J4 – 64	J3 – 46	J4 – 46	J1 – 64	J2 – 64	18	Digital I/O channel #12
J1 – 13	J2 - 13	J3 – 31	J4 – 31	J3 – 13	J4 – 13	J1 – 31	J2 – 31	19	Ground
J1 – 47	J2 - 47	J3 – 65	J4 – 65	J3 – 47	J4 – 47	J1 – 65	J2 – 65	20	Digital I/O channel #13
J1 – 14	J2 - 14	J3 – 32	J4 – 32	J3 – 14	J4 – 14	J1 – 32	J2 – 32	21	Ground
J1 – 48	J2 - 48	J3 – 66	J4 – 66	J3 – 48	J4 – 48	J1 – 66	J2 – 66	22	Digital I/O channel #14
J1 – 15	J2 - 15	J3 – 33	J4 – 33	J3 – 15	J4 – 15	J1 – 33	J2 – 33	23	Ground
J1 – 49	J2 - 49	J3 – 67	J4 – 67	J3 – 49	J4 – 49	J1 – 67	J2 – 67	24	Digital I/O channel #15
J1 – 16	J2 - 16	J3 – 34	J4 – 34	J3 – 16	J4 – 16	J1 – 34	J2 – 34	25	Ground
J1 – 50	J2 - 50	J3 – 68	J4 – 68	J3 – 50	J4 – 50	J1 – 68	J2 – 68	26	Digital I/O channel #16
J1 – 17	J2 – 17			J3 – 17	J4 – 17				Ground
J1 – 51	J2 - 51			J3 – 51	J4 – 51				Ground
J1 – 18	J2 – 18			J3 – 18	J4 – 18				Ground
J1 – 52	J3 – 52			J3 – 52	J4 – 52				Ground

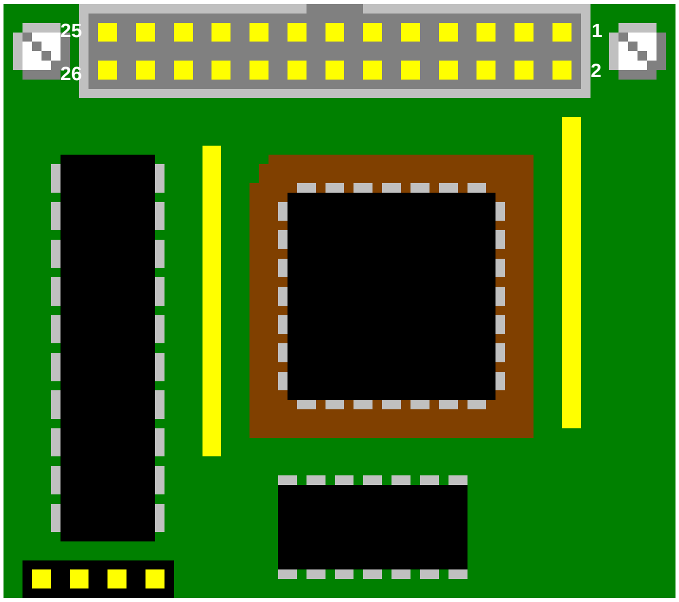
For a more complete signal description please refer to the previous five pages
Mating cable connector components: Amp: 787801-1 (offset connector), 788362-1 (backshell, offset)

DCX-MC400-R connector pin-out

Pin #	Description
1	Digital I/O channel #1
2	Digital I/O channel #2
3	Digital I/O channel #3
4	Digital I/O channel #4
5	Digital I/O channel #5
6	Digital I/O channel #6
7	Digital I/O channel #7
8	Digital I/O channel #8
9	Digital I/O channel #9
10	Digital I/O channel #10
11	Digital I/O channel #11
12	Digital I/O channel #12
13	Digital I/O channel #13
14	Digital I/O channel #14
15	Digital I/O channel #15
16	Digital I/O channel #16
17	Reserved
18	Reserved
19	Reserved
20	+5 VDC
21	Ground
22	Reserved
23	Reserved
24	Reserved
25	Reserved
26	Ground

Mating Connector:26-pin dual-row IDC female, Circuit Assembly P/N 26IDS2-C-SPT-SR or equivalent

DCX-MC400 Module layout



DCX-MC500/510/520 Analog I/O Module

DCX-MC500-H/510-H/520-H High Density connector signal map

Module #1	Module #2	Module #3	Module #4	Module #5	Module #6	Module #7	Module #8	J3 Pin #	Description
J1 – 1	J2 – 1	J3 - 19	J4 - 19	J3 – 1	J4 – 1	J1 – 19	J2 - 19	1	Ground
J1 – 35	J2 - 35	J3 – 53	J4 – 53	J3 – 35	J4 – 35	J1 – 53	J2 – 53	2	Channel 1 Output (-10 to +10 volts)
J1 – 2	J2 – 2	J3 – 20	J4 – 20	J3 – 2	J4 – 2	J1 – 20	J2 – 20	3	Ground
J1 – 36	J2 - 36	J3 – 54	J4 – 54	J3 – 36	J4 – 36	J1 – 54	J2 – 54	4	Channel 2 Output (-10 to +10 volts)
J1 – 3	J2 – 3	J3 - 21	J4 - 21	J3 – 3	J4 – 3	J1 – 21	J2 - 21	5	Ground
J1 – 37	J2 - 37	J3 – 55	J4 – 55	J3 – 37	J4 – 37	J1 – 55	J2 – 55	6	Channel 3 Output (-10 to +10 volts)
J1 – 4	J2 – 4	J3 – 22	J4 – 22	J3 – 4	J4 – 4	J1 – 22	J2 – 22	7	Ground
J1 – 38	J2 - 38	J3 – 56	J4 – 56	J3 – 38	J4 – 38	J1 – 56	J2 – 56	8	Channel 4 Output (-10 to +10 volts)
J1 – 5	J2 – 5	J3 – 23	J4 – 23	J3 – 5	J4 – 5	J1 – 23	J2 – 23	9	Ground
J1 – 39	J2 - 39	J3 – 57	J4 – 57	J3 – 39	J4 – 39	J1 – 57	J2 – 57	10	External A/D reference input (see jumper JP1)
J1 – 6	J2 – 6	J3 – 24	J4 – 24	J3 – 6	J4 – 6	J1 – 24	J2 – 24		Ground
J1 – 40	J2 - 40	J3 – 58	J4 – 58	J3 – 40	J4 – 40	J1 – 58	J2 – 58	11	Channel 1 Output (0 to +5 volts)
J1 – 7	J2 – 7	J3 – 25	J4 – 25	J3 – 7	J4 – 7	J1 – 25	J2 – 25	12	Channel 2 Output (0 to +5 volts)
J1 – 41	J2 - 41	J3 – 59	J4 – 59	J3 – 41	J4 – 41	J1 – 59	J2 – 59		Ground
J1 – 8	J2 – 8	J3 – 26	J4 – 26	J3 – 8	J4 – 8	J1 – 26	J2 – 26		Ground
J1 – 42	J2 - 42	J3 – 60	J4 – 60	J3 – 42	J4 – 42	J1 – 60	J2 – 60	13	Channel 3 Output (0 to +5 volts)
J1 – 9	J2 – 9	J3 – 27	J4 – 27	J3 – 9	J4 – 9	J1 – 27	J2 – 27	14	Channel 4 Output (0 to +5 volts)
J1 – 43	J2 - 43	J3 – 61	J4 – 61	J3 – 43	J4 – 43	J1 – 61	J2 – 61		Ground
J1 – 10	J2 - 10	J3 – 28	J4 – 28	J3 – 10	J4 – 10	J1 – 28	J2 – 28		Ground
J1 – 44	J2 - 44	J3 – 62	J4 – 62	J3 – 44	J4 – 44	J1 – 62	J2 – 62	15	+12 VDC
J1 – 11	J2 - 11	J3 - 29	J4 - 29	J3 – 11	J4 – 11	J1 – 29	J2 - 29	16	-12 VDC
J1 – 45	J2 - 45	J3 – 63	J4 – 63	J3 – 45	J4 – 45	J1 – 63	J2 – 63		Ground
J1 – 12	J2 - 12	J3 – 30	J4 – 30	J3 – 12	J4 – 12	J1 – 30	J2 – 30	17	No connect
J1 – 46	J2 - 46	J3 – 64	J4 – 64	J3 – 46	J4 – 46	J1 – 64	J2 – 64	18	No connect
J1 – 13	J2 - 13	J3 – 31	J4 – 31	J3 – 13	J4 – 13	J1 – 31	J2 – 31	19	Ground
J1 – 47	J2 - 47	J3 – 65	J4 – 65	J3 – 47	J4 – 47	J1 – 65	J2 – 65	20	Channel 1 Input (0 to +5 volts)
J1 – 14	J2 - 14	J3 – 32	J4 – 32	J3 – 14	J4 – 14	J1 – 32	J2 – 32	21	Ground
J1 – 48	J2 - 48	J3 – 66	J4 – 66	J3 – 48	J4 – 48	J1 – 66	J2 – 66	22	Channel 2 Input (0 to +5 volts)
J1 – 15	J2 - 15	J3 – 33	J4 – 33	J3 – 15	J4 – 15	J1 – 33	J2 – 33	23	Ground
J1 – 49	J2 - 49	J3 – 67	J4 – 67	J3 – 49	J4 – 49	J1 – 67	J2 – 67	24	Channel 3 Input (0 to +5 volts)
J1 – 16	J2 - 16	J3 – 34	J4 – 34	J3 – 16	J4 – 16	J1 – 34	J2 – 34	25	Ground
J1 – 50	J2 - 50	J3 – 68	J4 – 68	J3 – 50	J4 – 50	J1 – 68	J2 – 68	26	Channel 4 Input (0 to +5 volts)
J1 – 17	J2 – 17			J3 – 17	J4 – 17				Ground
J1 – 51	J2 - 51			J3 – 51	J4 – 51				Ground
J1 – 18	J2 – 18			J3 – 18	J4 – 18				Ground
J1 – 52	J3 – 52			J3 – 52	J4 – 52				Ground

For a more complete signal description please refer to the previous five pages
Mating cable connector components: Amp: 787801-1 (offset connector), 788362-1 (backshell, offset)

DCX-MC5X0-R connector pin-out

Pin #	*Description*
1	Channel 1 Input (0 to +5 volts)
2	Channel 1 Output (-10 to +10 volts)
3	Channel 2 Input (0 to +5 volts)
4	Channel 2 Output (-10 to +10 volts)
5	Channel 3 Input (0 to +5 volts)
6	Channel 3 Output (-10 to +10 volts)
7	Channel 4 Input (0 to +5 volts)
8	Channel 4 Output (-10 to +10 volts)
9	Reserved
10	Channel 1 Output (0 to +5 volts)
11	Reserved
12	Channel 2 Output (0 to +5 volts)
13	Reserved
14	Channel 3 Output (0 to +5 volts)
15	Reserved
16	Channel 4 Output (0 to +5 volts)
17	Analog Ground
18	External A/D reference input (see jumper JP1)
19	+12 VDC
20	-12 VDC
21	No connect
22	No connect
23	+5 VDC
24	+5 VDC
25	Digital Ground
26	Digital Ground

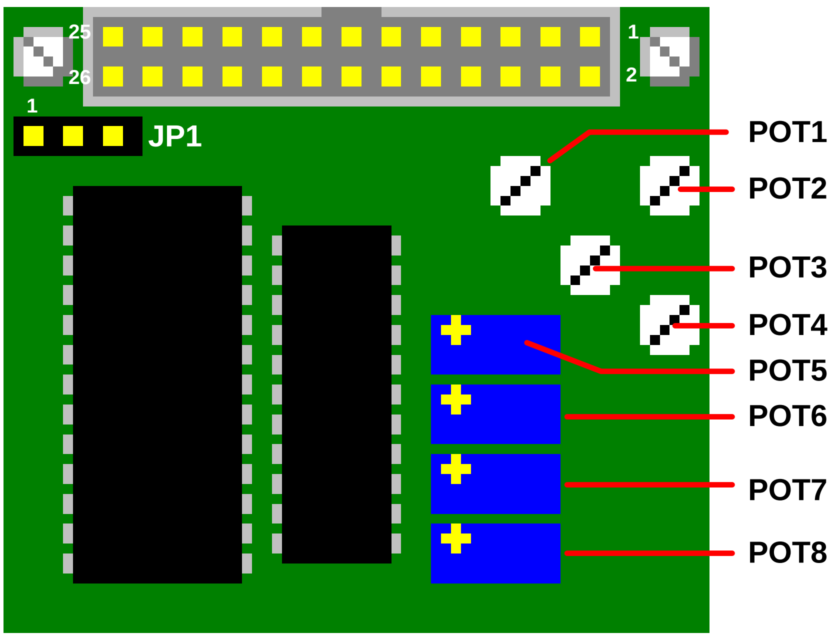
Mating Connector:26-pin dual-row IDC female, Circuit Assembly P/N 26IDS2-C-SPT-SR or equivalent

DCX-MC500/510/520 Module Configuration Jumpers - configuration in **bold type** denotes default factory shipping configuration

JP1 – A/D reference select (external reference or on board +5 VDC reference)

Pins	***Description***
1 to 2	Use external reference (supplied by user on J3 pin 18)
2 to 3	**Use the on board +5 VDC reference**

DCX-MC500 Module layout



DCX-BF022 Relay Rack Interface

J1 connector pin-out - The signals are arranged to interface the DCX-MC400 directly to an OPTO 22 relay rack.

Pin #	Description
1	Digital I/O channel #1
2	Digital I/O channel #2
3	Digital I/O channel #3
4	Digital I/O channel #4
5	Digital I/O channel #5
6	Digital I/O channel #6
7	Digital I/O channel #7
8	Digital I/O channel #8
9	Digital I/O channel #9
10	Digital I/O channel #10
11	Digital I/O channel #11
12	Digital I/O channel #12
13	Digital I/O channel #13
14	Digital I/O channel #14
15	Digital I/O channel #15
16	Digital I/O channel #16
17	No connect
18	No connect
19	No connect
20	+5 VDC
21	Ground
22	No connect
23	No connect
24	No connect
25	No connect
26	Ground

Mating Connector:26-pin dual-row IDC female, Circuit Assembly P/N 26IDS2-C-SPT-SR or equivalent

J2 connector pin-out - The signals are arranged to interface the DCX-PCI300 General Purpose I/O (connector J3) directly to an OPTO 22 relay rack.

Pin #	Description
1	+5 VDC
2	No connect
3	Digital I/O channel #16
4	No connect
5	Digital I/O channel #15
6	Digital I/O channel #14
7	Digital I/O channel #13
8	Digital I/O channel #12
9	Digital I/O channel #11
10	Digital I/O channel #10
11	Digital I/O channel #9
12	Digital I/O channel #8
13	Digital I/O channel #7
14	Digital I/O channel #6
15	Digital I/O channel #5
16	Digital I/O channel #4
17	Digital I/O channel #3
18	Digital I/O channel #2
19	Digital I/O channel #1
20	No connect
21	No connect
22	No connect
23	No connect
24	Ground
25	No connect
26	Ground

Mating Connector:26-pin dual-row IDC female, Circuit Assembly P/N 26IDS2-C-SPT-SR or equivalent

DCX-BF022 Configuration Jumpers - configuration in **bold type** denotes default factory shipping configuration

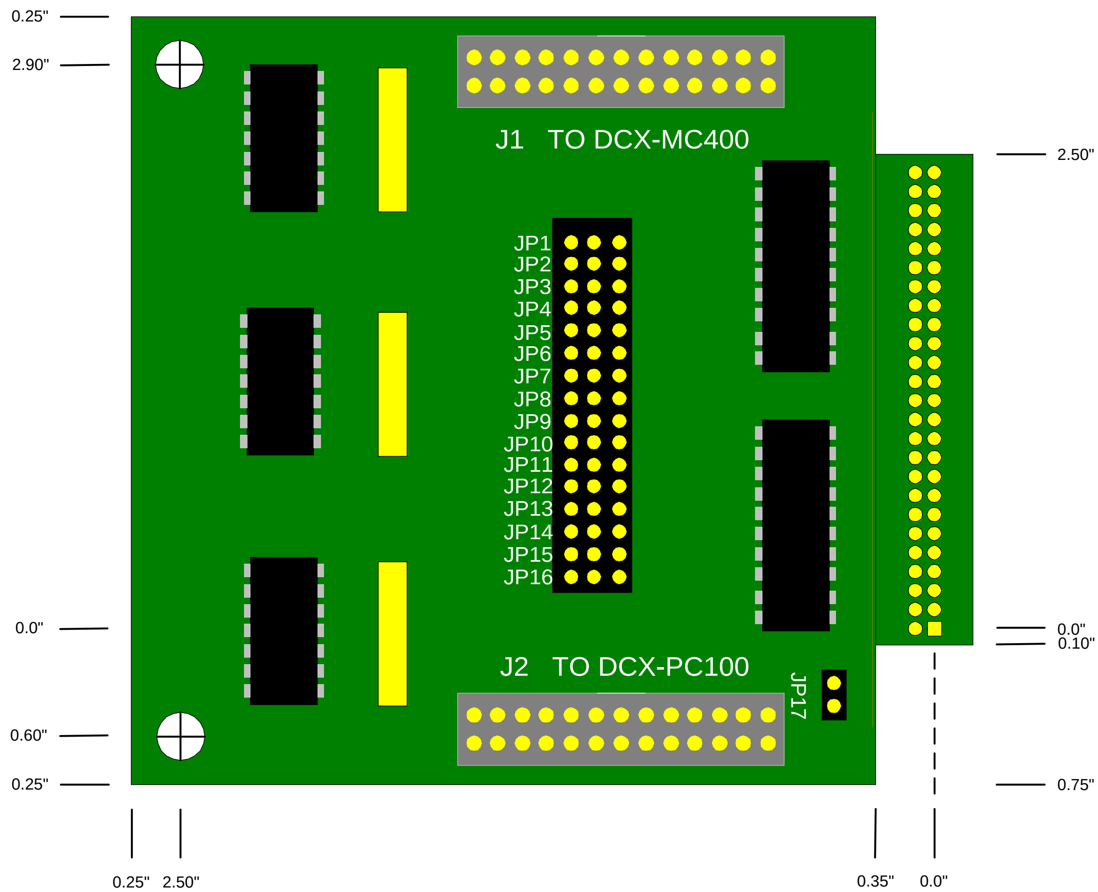
JP1 – JP16 Configure Digital channel as Input or Output

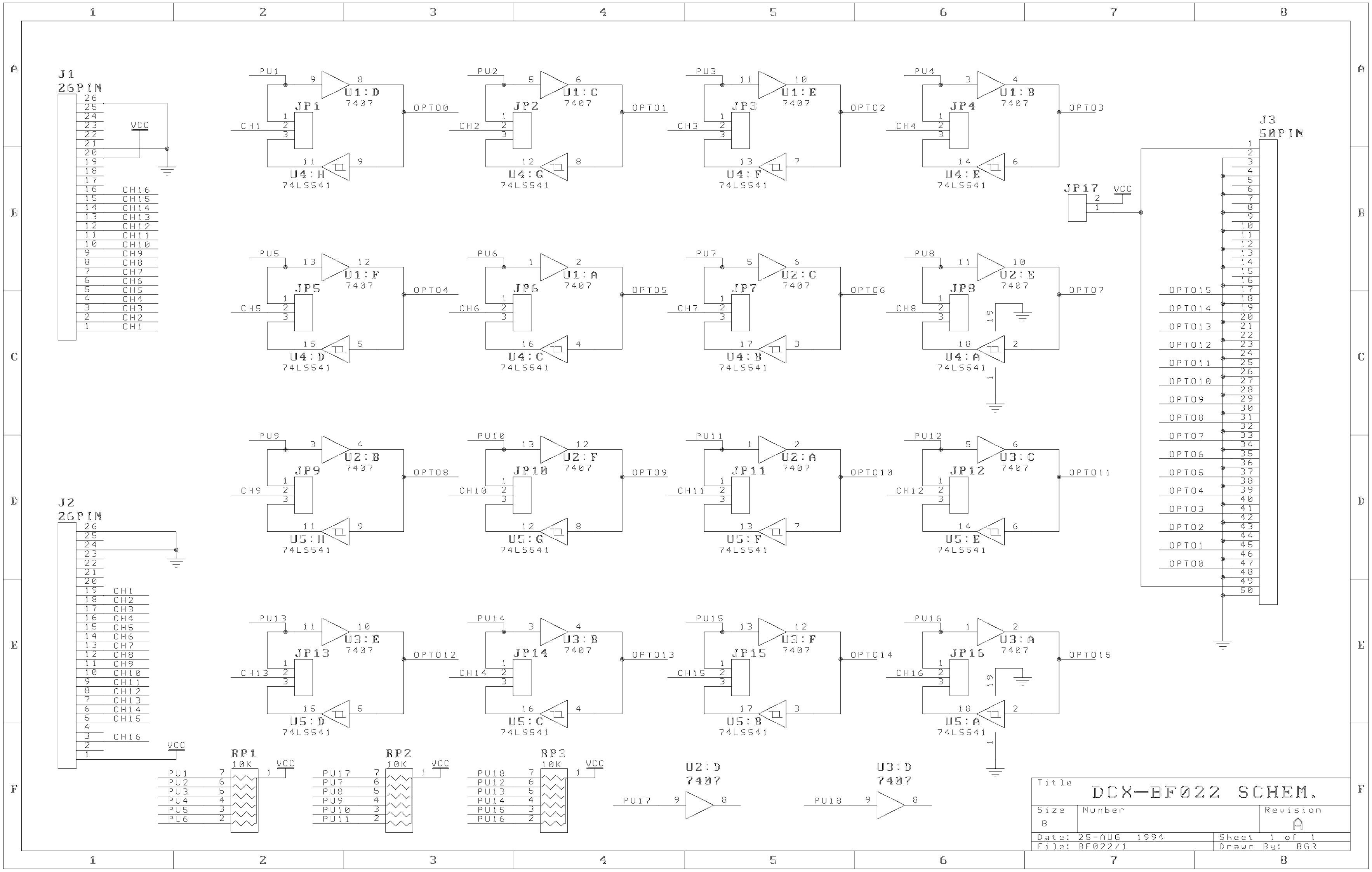
Pins	*Description*
1 to 2	**Configure channel as Output**
2 to 3	Configure channel as an Input

JP17 – Select Relay Rack supply source

Pins	*Description*
1 to 2	**DCX provides +5 VDC Relay Rack supply**
2 to 3	Relay Rack has separate +5 VDC supply

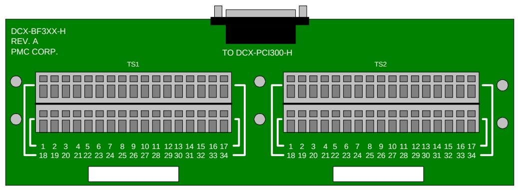
DCX-BF022 Interface layout



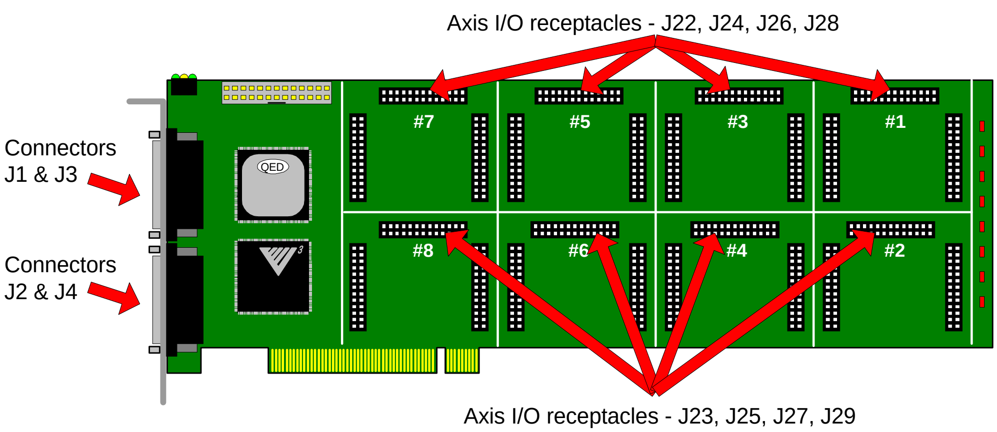

J1
26PIN
J2
26PIN
J3
50PIN
JP1
JP2
JP3
JP4
JP5
JP6
JP7
JP8
JP9
JP10
JP11
JP12
JP13
JP14
JP15
JP16
JP17
VCC
U1:D 7407
U1:C 7407
U1:E 7407
U1:B 7407
U1:F 7407
U1:A 7407
U2:C 7407
U2:E 7407
U2:B 7407
U2:F 7407
U2:A 7407
U3:C 7407
U3:E 7407
U3:B 7407
U3:F 7407
U3:A 7407
U2:D 7407
U3:D 7407
U4:H 74LS541
U4:G 74LS541
U4:F 74LS541
U4:E 74LS541
U4:D 74LS541
U4:C 74LS541
U4:B 74LS541
U4:A 74LS541
U5:H 74LS541
U5:G 74LS541
U5:F 74LS541
U5:E 74LS541
U5:D 74LS541
U5:C 74LS541
U5:B 74LS541
U5:A 74LS541
RP1 10K
RP2 10K
RP3 10K
OPTO0
OPTO1
OPTO2
OPTO3
OPTO4
OPTO5
OPTO6
OPTO7
OPTO8
OPTO9
OPTO10
OPTO11
OPTO12
OPTO13
OPTO14
OPTO15
Title
DCX-BF022 SCHEM.
Size
B
Number
Revision
A
Date: 25-AUG 1994
Sheet 1 of 1
File: BF022/1
Drawn By: BGR

DCX-BF3XX-H High Density Breakout Assembly

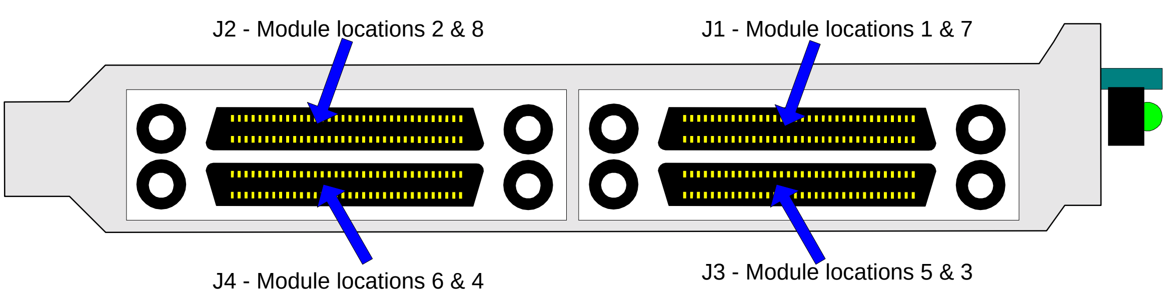
The DCX-BF3XX-H provides easy to use terminal strip contacts for –H DCX modules (MC300-H, MC320-H, MC360-H, MC400-H, MC500-H).



DCX modules can be installed into any one of eight module locations on the DCX-PCI300-H motherboard. The axis I/O signals travel through the inner layers of the DCX-PCI300-H to the high density connectors (J1, J2, J3, and J4).The module, receptacle, and connector locations of a DCX-PCI300-H are shown in the following graphic:



The diagram below details how the DCX-PCI300-H module locations 1 – 8 (receptacles J22 – J29) map into the high density connectors J1 – J4.

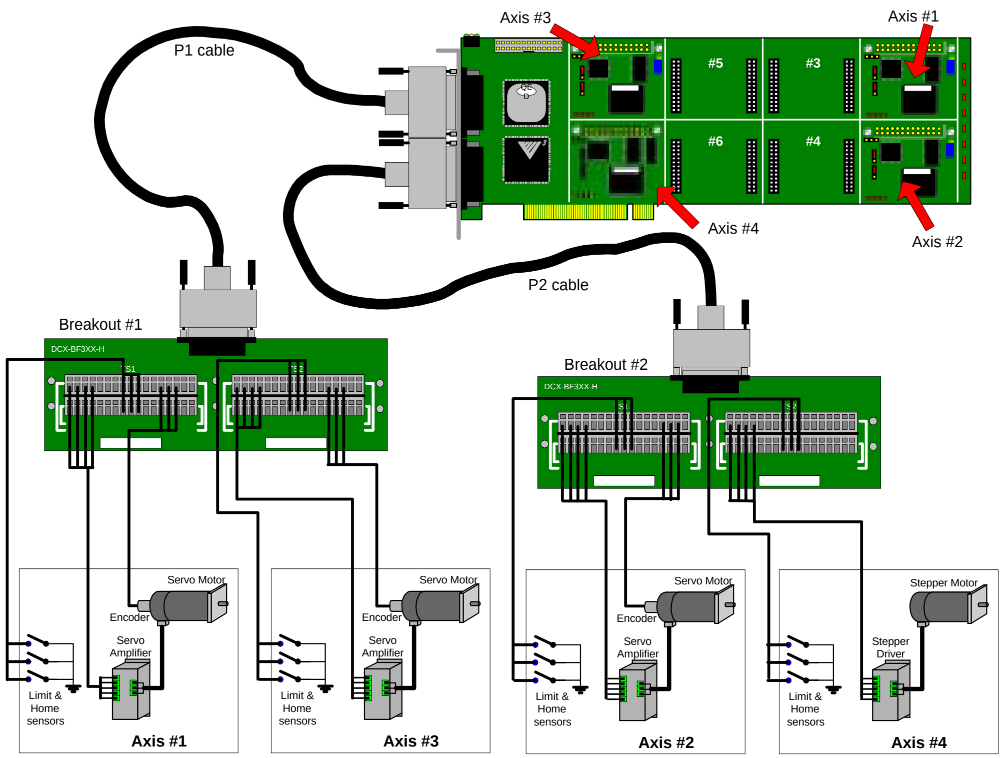


VHDCI connectors as viewed from the back of the computer
(component side down)

Each DCX-BF3XX-H breakout assembly provides contact points for two module locations. The following table details how DCX-PCI300-H motherboard module locations are associated with a DCX-BF3XX-H terminal strip (TS1 or TS2)

DCX-PCI300-H Module location	High Density connector #	Interconnect cable #
1	J1	P1
7	J1	P1
5	J3	P3
3	J3	P3
6	J4	P4
4	J4	P4
2	J2	P2
8	J2	P2

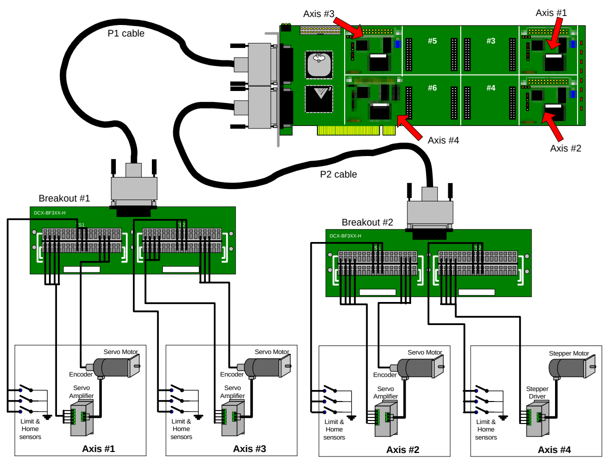
The following diagram details the typical interconnections for a four axis system, three servo's (DCX-MC300-H servo modules in locations 1, 2, & 7) and one stepper (DCX-MC360-H stepper module in location 8). The modules could be installed sequentially into locations #1 - #4, but the system would then require four cables and four DCX-BF3XX-H breakouts instead of two.



DCX-BF3XX-H signals pinout (when using single axis or I/O modules)
The following table details the pinouts –H DCX modules.

BF3XX-H TS1 or TS2	MC300-H	MC320-H	MC360-H	MC400-H	MC500-H
1	Command return	Ground	Step / CCW Pulse	Ground	Ground
18	Command output	Phase U Command	Ground	Digital I/O #1	Output 1 (-10 to +10)
2	Com./Dir. output	Ground	Dir. / CW Pulse	Ground	Ground
19	Com./Dir. return	Phase V Command	Ground	Digital I/O #2	Output 2 (-10 to +10)
3	Amp. Enable output	Amp. Enable output	Driver En. output	Ground	Ground
20	Amp Enable return	Amp. Enable return	Ground	Digital I/O #3	Output 3 (-10 to +10)
4	Amp. Fault input	Amp. Fault: input	Drive Fault: input	Ground	Ground
21	Amp Fault sup./ret.	Amp. Fault return	Drive Fault return	Digital I/O #4	Output 4 (-10 to +10)
5	Coarse Home input	Coarse Home input	Home: input	Ground	Ground
22	Coarse Home ret.	Coarse Home ret.	Home return	Digital I/O #5	External reference
6	Ground	Ground	Ground	Ground	Ground
23	Reserved	Reserved	Reserved	Digital I/O #6	Output 1 (0 to +5)
7	Reserved	Pos. Com. output	Null Position: input	Digital I/O #7	Output 2 (-10 to +10)
24	Ground	Ground	Ground	Ground	Ground
8	Ground	Ground	Ground	Ground	Ground
25	Aux. Enc. A+	Hall A+/Aux Enc A+	Compare / Full/Half Step: output	Digital I/O #8	Output 3 (0 to +5)
9	Aux. Enc. B	Hall B+/Aux Enc B+	Full/Half Current: output	Digital I/O #9	Output 4 (-10 to +10)
26	Ground	Ground	Ground	Ground	Ground
10	Ground	Ground	Ground	Ground	Ground
27	Pos. Capture + / Aux. Enc. Index+	Hall C+/ Pos Cap +	Aux. En Crs Home	Digital I/O #10	+12 VDC
11	Encoder Power	Encoder Power	Aux. Enc. Power	Digital I/O #11	-12 VDC
28	Ground	Ground	Ground	Ground	Ground
12	Limit + input	Limit + input	Limit + input	Ground	
29	Limit + sup./return	Limit + sup./return	Limit + sup/return	Digital I/O #12	
13	Limit Negative input	Limit Negative input	Limit - input	Ground	Ground
30	Limit - supply/return	Limit - supply/return	Limit – sup/return	Digital I/O #13	Input 1 (0 to +5)
14	Prim. Enc. A+	Prim. Enc. A+	Aux. Enc. A+	Ground	Ground
31	Prim. Enc. A-	Prim. Enc. A-	Aux. Enc. A-	Digital I/O #14	Input 2 (0 to +5
15	Prim. Enc. B+	Prim. Enc. B+	Aux. Enc. B+	Ground	Ground
32	Prim. Enc. B-	Prim. Enc. B-	Aux. Enc. B-	Digital I/O #15	Input 3 (0 to +5)
16	Prim. Enc. Index +	Prim. Enc. Index +	Pos. Cap. + / Aux. Enc. Index +	Ground	Ground
33	Prim. Enc. Index -	Prim. Enc. Index -	Pos. Cap. - / Aux. Enc. Index-	Digital I/O #16	Input 4 (0 to +5)
17	Ground	Ground	Ground	Ground	Ground
34	Ground	Ground	Ground	Ground	Ground

Example: DCX-BF3XX-H connections for a four axes system (single axis modules)
Here is an example of the typical connections for a four axes system (3 servo's and one stepper). A larger (more detailed) view of the interconnect drawing can be found earlier in this section.



BF3XX-H #1 – Contacts for axis #1 (a MC300-H installed in module location #1)

TS1	Signal
1	Axis 1 – Analog ret
18	Axis 1 – Command
2	Axis 1 – Comp. / Dir
19	Axis 1 – Com/Dir ret
3	Axis 1 – Amp En
20	Axis 1 – Amp En. ret
4	Axis 1 – Amp Fault
21	Axis 1 – Amp Flt ret
5	Axis 1 – Coarse Hm
22	Axis 1 – Crs Hm ret
6	Ground
23	
7	
24	Ground
8	Ground
25	
9	
26	Ground
10	Ground
27	Axis 1 – Pos Cap
11	Axis 1 – Enc Pwr
28	Ground
12	Axis 1 – Limit +
29	Axis 1 – Limit + ret
13	Axis 1 – Limit -
30	Axis 1 – Limit – ret
14	Axis 1 – Encoder A+
31	Axis 1 – Encoder A+
15	Axis 1 – Encoder B+
32	Axis 1 – Encoder B-
16	Axis 1 – Index +
33	Axis 1 – Index -
17	Ground
34	Ground

BF3XX-H #1 – Contacts for axis #3 (a MC300-H installed in module location #7)

TS2	Signal
1	Axis 3 – Analog ret
18	Axis 3 – Command
2	Axis 3 – Comp. / Dir
19	Axis 3 – Com/Dir ret
3	Axis 3 – Amp En
20	Axis 3 – Amp En. ret
4	Axis 3 – Amp Fault
21	Axis 3 – Amp Flt ret
5	Axis 3 – Coarse Hm
22	Axis 3 – Crs Hm ret
6	Ground
23	
7	
24	Ground
8	Ground
25	
9	
26	Ground
10	Ground
27	Axis 3 – Pos Cap
11	Axis 3 – Enc Pwr
28	Ground
12	Axis 3 – Limit +
29	Axis 3 – Limit + ret
13	Axis 3 – Limit -
30	Axis 3 – Limit – ret
14	Axis 3 – Encoder A+
31	Axis 3 – Encoder A+
15	Axis 3 – Encoder B+
32	Axis 3 – Encoder B-
16	Axis 3 – Index +
33	Axis 3 – Index -
17	Ground
34	Ground

BF3XX-H #2 – Contacts for axis #2 (a MC300-H installed in module location #2)

TS1	Signal
1	Axis 2 – Analog ret
18	Axis 2 – Command
2	Axis 2 – Comp. / Dir
19	Axis 2 – Com/Dir ret
3	Axis 2 – Amp En
20	Axis 2 – Amp En. ret
4	Axis 2 – Amp Fault
21	Axis 2 – Amp Flt ret
5	Axis 2 – Coarse Hm
22	Axis 2 – Crs Hm ret
6	Ground
23	
7	
24	Ground
8	Ground
25	
9	
26	Ground
10	Ground
27	Axis 2 – Pos Cap
11	Axis 2 – Enc Pwr
28	Ground
12	Axis 2 – Limit +
29	Axis 2 – Limit + ret
13	Axis 2 – Limit -
30	Axis 2 – Limit – ret
14	Axis 2 – Encoder A+
31	Axis 2 – Encoder A+
15	Axis 2 – Encoder B+
32	Axis 2 – Encoder B-
16	Axis 2 – Index +
33	Axis 2 – Index -
17	Ground
34	Ground

BF3XX-H #2 – Contacts for axis #4 (a MC360-H installed in module location #8)

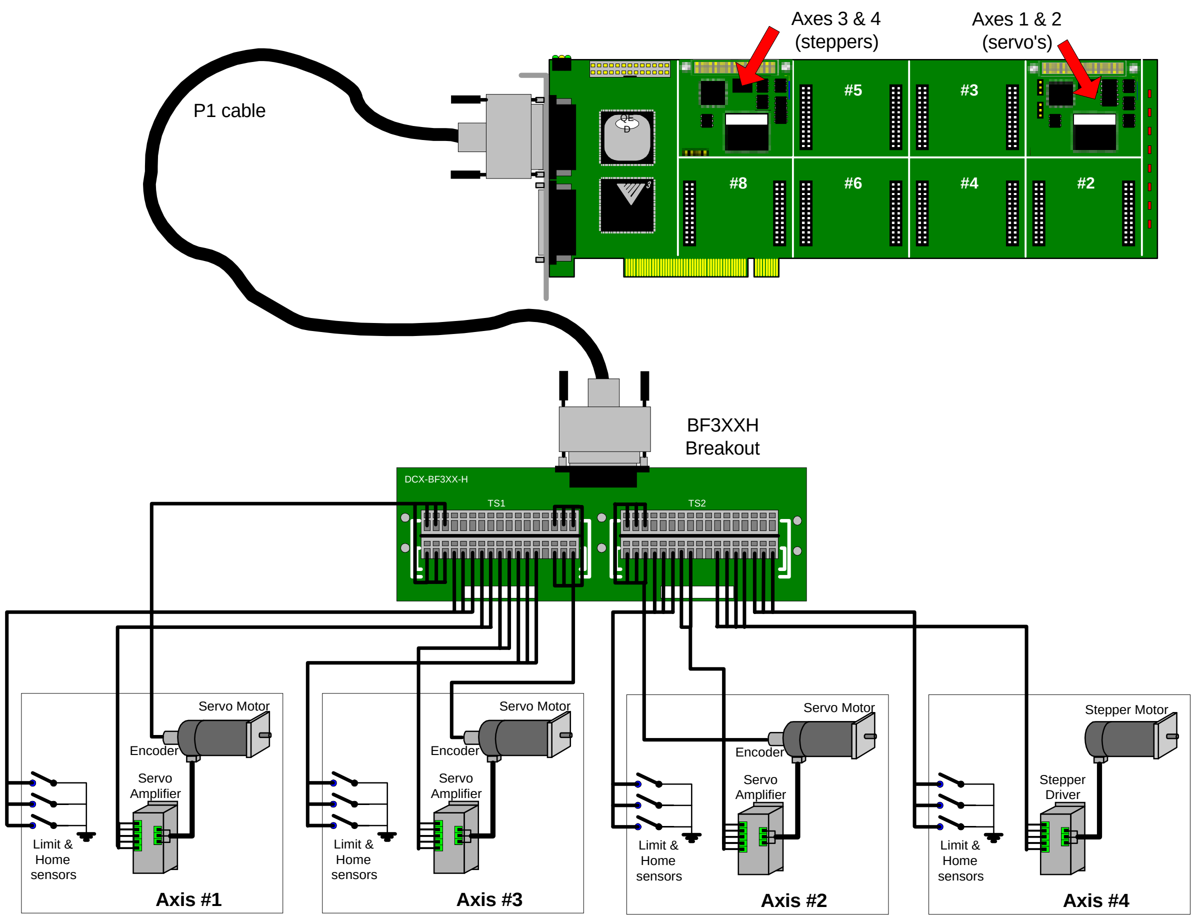
TS2	Signal
1	Axis 4 – Step
18	Axis 4 – Ground
2	Axis 4 – Direction
19	Axis 4 – Ground
3	Axis 4 – Drive En
20	Axis 4 – Ground
4	Axis 4 – Drive Fault
21	Axis 4 – Ground
5	Axis 4 – Home
22	Axis 4 – Home ret
6	Ground
23	
7	
24	Ground
8	Ground
25	
9	Axis 4 – Full/Half cur
26	Ground
10	Ground
27	
11	
28	Ground
12	Axis 4 – Limit +
29	Axis 4 – Limit + ret
13	Axis 4 – Limit -
30	Axis 4 – Limit – ret
14	
31	
15	
32	
16	
33	
17	Ground
34	Ground

DCX-BF3XX-H signals pinout (when using dual axis modules)
The following table details the pinouts of –H Dual Axis DCX modules.

BF3XX-H TS1 or TS2	MC302-H	MC362-H
1	Axis 1 Encoder A+	Axis 1 Home
18	Axis 1 Encoder A-	Axis 1 Home sup/return
2	Axis 1 Encoder B+	Axis 1 Limit +
19	Axis 1 Encoder B-	Axis 1 Limit + sup/return
3	Axis 1 Encoder Index +	Axis 1 Limit -
20	Axis 1 Encoder Index -	Axis 1 Limit - sup/return
4	Axis 1 Coarse Home	Axis 1 Drive Fault
21	Axis 1 Encoder Power	Axis 1 Fault sup/return
5	Axis 1 Limit +	Axis 1 Drive Enable
22	Axis 1 inputs sup./return	Ground
6	Ground	Ground
23	Axis 1 Limit -	Axis 1 Pulse / CCW
7	Axis 1 Amp. Enable	Axis 1 Dir. / CW
24	Ground	Ground
8	Ground	Ground
25	Axis 1 Analog Command	Axis 1 Full Current
9	Axis 2 Analog Command	Axis 2 Full Current
26	Ground	Ground
10	Ground	Ground
27	Axis 2 Amp. Enable	Axis 2 Dir. / CW
11	Axis 2 Limit -	Axis 2 Pulse / CCW
28	Ground	Ground
12	Axis 2 Limit +	Axis 2 Drive Enable
29	Axis 2 inputs sup./return	Ground
13	Axis 2 Coarse Home	Axis 2 Drive Fault
30	Axis 2 Encoder Power	Axis 2 Fault sup/return
14	Axis 2 Encoder A+	Axis 2 Limit -
31	Axis 2 Encoder A-	Axis 2 Limit - sup/return
15	Axis 2 Encoder B+	Axis 2 Limit +
32	Axis 2 Encoder B-	Axis 2 Limit + sup/return
16	Axis 2 Encoder Index +	Axis 2 Home
33	Axis 2 Encoder Index -	Axis 2 Home sup/return
17	Ground	Ground
34	Ground	Ground

Example: DCX-BF3XX-H connections for a four axes system (dual axis modules)

Here is an example of the typical connections for a four axes system (2 servo's and 2 steppers) using dual axis modules. The DCX-MC302 (dual axis servo) is installed in module location #1 and the DCX-MC362 (dual axis stepper) is installed in module location #7.



Axis #1 (module #1)
BF3XX-H TS1 contacts
1-8 & 18–25.

TS1	Signal
1	Axis 1 Encoder A+
18	Axis 1 Encoder A-
2	Axis 1 Encoder B+
19	Axis 1 Encoder B-
3	Axis 1 Index +
20	Axis 1 Index -
4	Axis 1 Coarse Home
21	Axis 1 Encoder Pwr
5	Axis 1 Limit +
22	Axis 1 inputs return
6	Ground
23	Axis 1 Limit -
7	Axis 1 Amp. Enable
24	Ground
8	Ground
25	Axis 1 Command

Axis #2 (module #1)
BF3XX-H TS1 contacts
9-17 & 26-34.

TS2	Signal
9	Axis 2 Command
26	Ground
10	Ground
27	Axis 2 Amp. Enable
11	Axis 2 Limit -
28	Ground
12	Axis 2 Limit +
29	Axis 2 inputs return
13	Axis 2 Coarse Home
30	Axis 2 Encoder Pwr
14	Axis 2 Encoder A+
31	Axis 2 Encoder A-
15	Axis 2 Encoder B+
32	Axis 2 Encoder B-
16	Axis 2 Index +
33	Axis 2 Index -
17	Ground
34	Ground

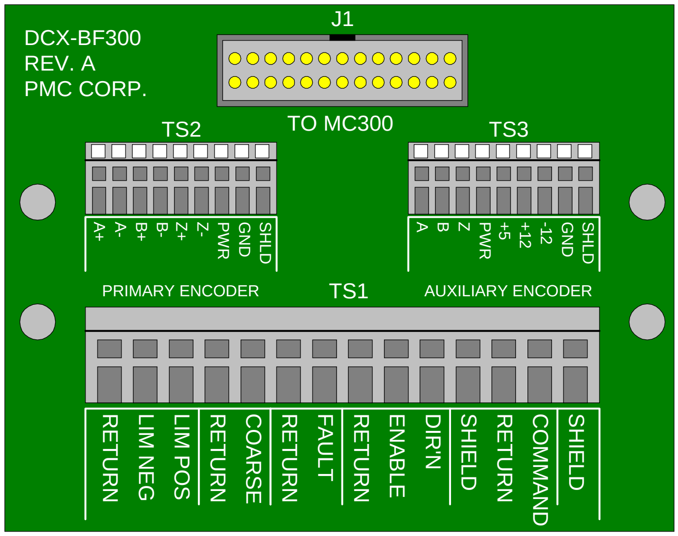
Axis #3 (module 2)
BF3XX-H TS2 contacts
1-8 & 18-25.

TS1	Signal
1	Axis 3 Encoder A+
18	Axis 3 Encoder A-
2	Axis 3 Encoder B+
19	Axis 3 Encoder B-
3	Axis 3 Index +
20	Axis 3 Index -
4	Axis 3 Coarse Home
21	Axis 3 Encoder Pwr
5	Axis 3 Limit +
22	Axis 3 inputs return
6	Ground
23	Axis 3 Limit -
7	Axis 3 Amp. Enable
24	Ground
8	Ground
	Axis 3 Command

Axis #4 (module 2)
BF3XX-H TS2 contacts
9-17 & 26-34.

TS2	Signal
9	Axis 2 Full Current
26	Ground
10	Ground
27	Axis 2 Dir. / CW
11	Axis 2 Pulse / CCW
28	Ground
12	Axis 2 Drive Enable
29	Ground
13	Axis 2 Drive Fault
30	Axis 2 Fault return
14	Axis 2 Limit -
31	Axis 2 Limit - return
15	Axis 2 Limit +
32	Axis 2 Limit + return
16	Axis 2 Home
33	Axis 2 Home return
17	Ground
34	Ground

DCX-BF300-R Servo Module Breakout Assembly



DCX-BF300-R to DCX-MC300-R Connections:

Terminal strip TS1

Pin	Description
1	Crs Home & Limits return
2	Limit -
3	Limit +
4	Crs Home & Limits return
5	Coarse Home
6	Amp Fault supply/return
7	Amplifier Fault
8	Amp Enable/Dir. return
9	Amplifier Enable
10	Direction
11	Shield
12	Analog Ground
13	Analog Command output
14	Shield

Terminal strip TS2

Pin	Description
1	Prim. Encoder Phase A+
2	Prim. Encoder Phase A-
3	Prim. Encoder Phase B+
4	Prim. Encoder Phase B-
5	Prim. Encoder Index+
6	Prim. Encoder Index-
7	Encoder Power
8	Ground
9	Shield

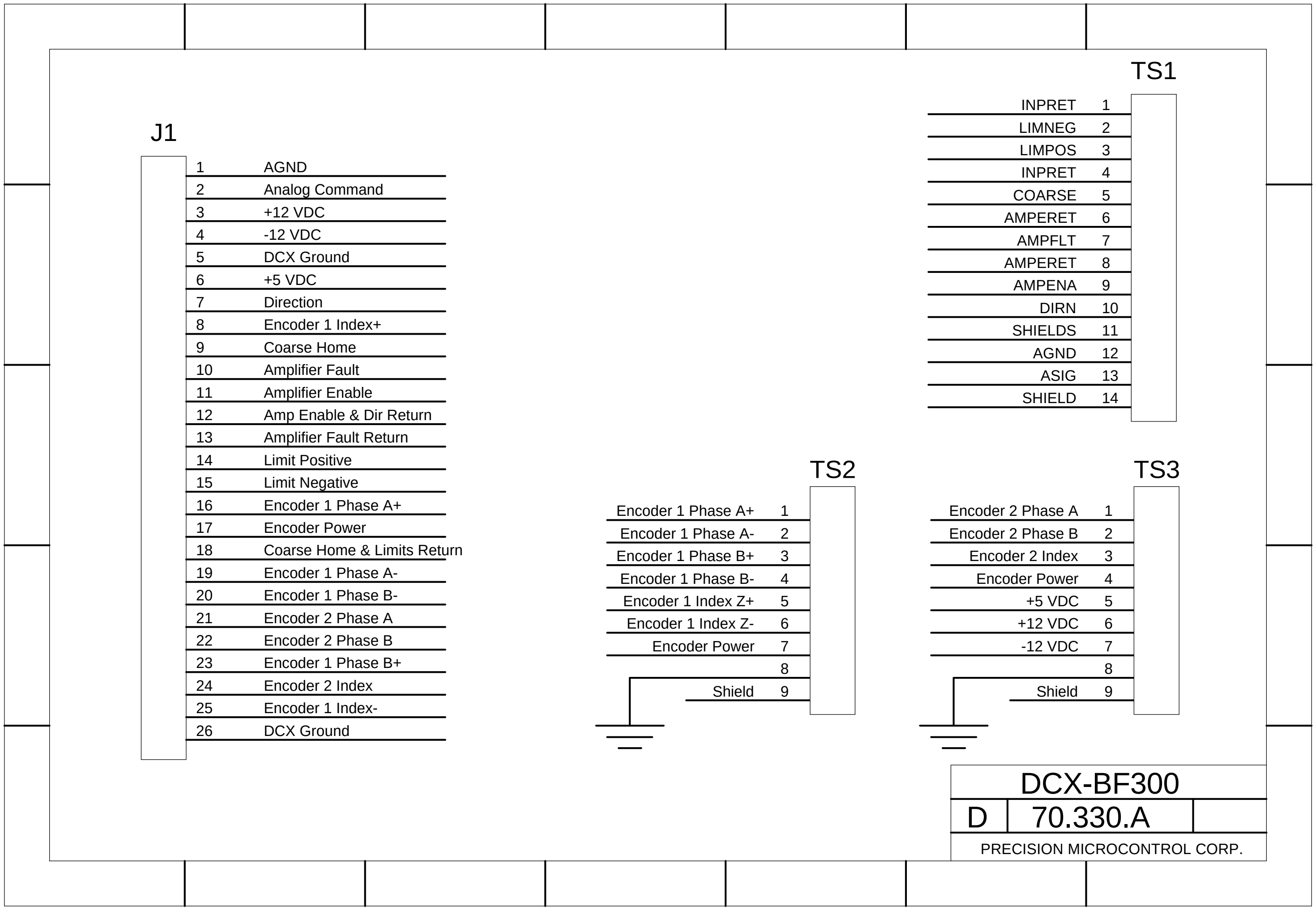
Terminal strip TS3

Pin	Description
1	Aux. Encoder Phase A+
2	Aux. Encoder Phase B+
3	Aux. Encoder Index Z+
4	Encoder Power
5	+5 VDC
6	+12 VDC
7	-12 VDC
8	Ground
9	Shield

DCX-BF300-R to DCX-MC300 Connections (continued):

Connector J1: From MC300

Pin	Description
1	Analog Ground
2	Analog Command output
3	+12 VDC
4	-12 VDC
5	Ground
6	+5 VDC
7	Direction
8	Primary Encoder Index +
9	Coarse Home
10	Amplifier Fault
11	Amplifier Enable
12	Amp Enable/Dir. return
13	Amp Fault supply/return
14	Limit +
15	Limit -
16	Prim. Encoder Phase A+
17	Encoder Power
18	Crs Home & Limits return
19	Prim. Encoder Phase A-
20	Prim. Encoder Phase B-
21	Aux. Encoder Phase A
22	Aux. Encoder Phase B
23	Prim. Encoder Phase B+
24	Aux. Encoder Index+
25	Prim. Encoder Index-
26	Ground


J1
1 AGND
2 Analog Command
3 +12 VDC
4 -12 VDC
5 DCX Ground
6 +5 VDC
7 Direction
8 Encoder 1 Index+
9 Coarse Home
10 Amplifier Fault
11 Amplifier Enable
12 Amp Enable & Dir Return
13 Amplifier Fault Return
14 Limit Positive
15 Limit Negative
16 Encoder 1 Phase A+
17 Encoder Power
18 Coarse Home & Limits Return
19 Encoder 1 Phase A-
20 Encoder 1 Phase B-
21 Encoder 2 Phase A
22 Encoder 2 Phase B
23 Encoder 1 Phase B+
24 Encoder 2 Index
25 Encoder 1 Index-
26 DCX Ground
TS1
INPRET 1
LIMNEG 2
LIMPOS 3
INPRET 4
COARSE 5
AMPERET 6
AMPFLT 7
AMPERET 8
AMPENA 9
DIRN 10
SHIELDS 11
AGND 12
ASIG 13
SHIELD 14
TS2
Encoder 1 Phase A+ 1
Encoder 1 Phase A- 2
Encoder 1 Phase B+ 3
Encoder 1 Phase B- 4
Encoder 1 Index Z+ 5
Encoder 1 Index Z- 6
Encoder Power 7
8
Shield 9
TS3
Encoder 2 Phase A 1
Encoder 2 Phase B 2
Encoder 2 Index 3
Encoder Power 4
+5 VDC 5
+12 VDC 6
-12 VDC 7
8
Shield 9
DCX-BF300
D
70.330.A
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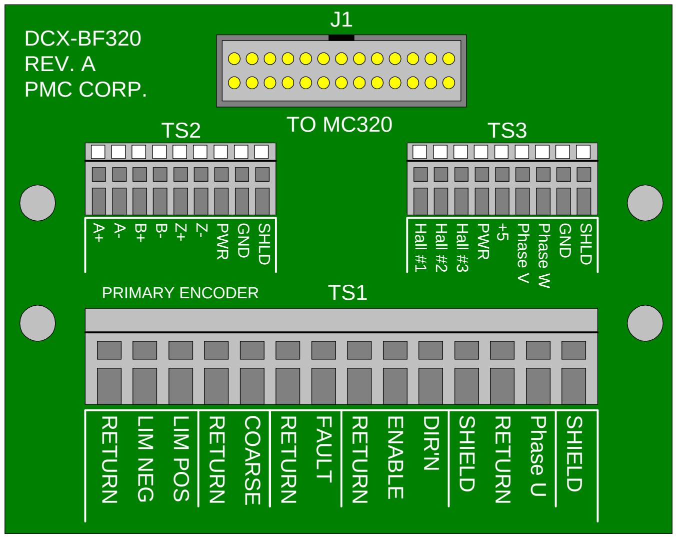
DCX-BF320-R Servo Module Breakout Assembly



DCX-BF320-R to DCX-MC320-R Connections:

Terminal strip TS1

Pin	***Description***
1	Crs Home & Limits return
2	Limit -
3	Limit +
4	Crs Home & Limits return
5	Coarse Home
6	Amp Fault supply/return
7	Amplifier Fault
8	Amp Enable/Dir. return
9	Amplifier Enable
10	Phase W
11	Phase V
12	Phase U
13	Analog Ground
14	Shield

Terminal strip TS2

Pin	***Description***
1	Prim. Encoder Phase A+
2	Prim. Encoder Phase A-
3	Prim. Encoder Phase B+
4	Prim. Encoder Phase B-
5	Prim. Encoder Index+
6	Prim. Encoder Index-
7	Encoder Power
8	Ground
9	Shield

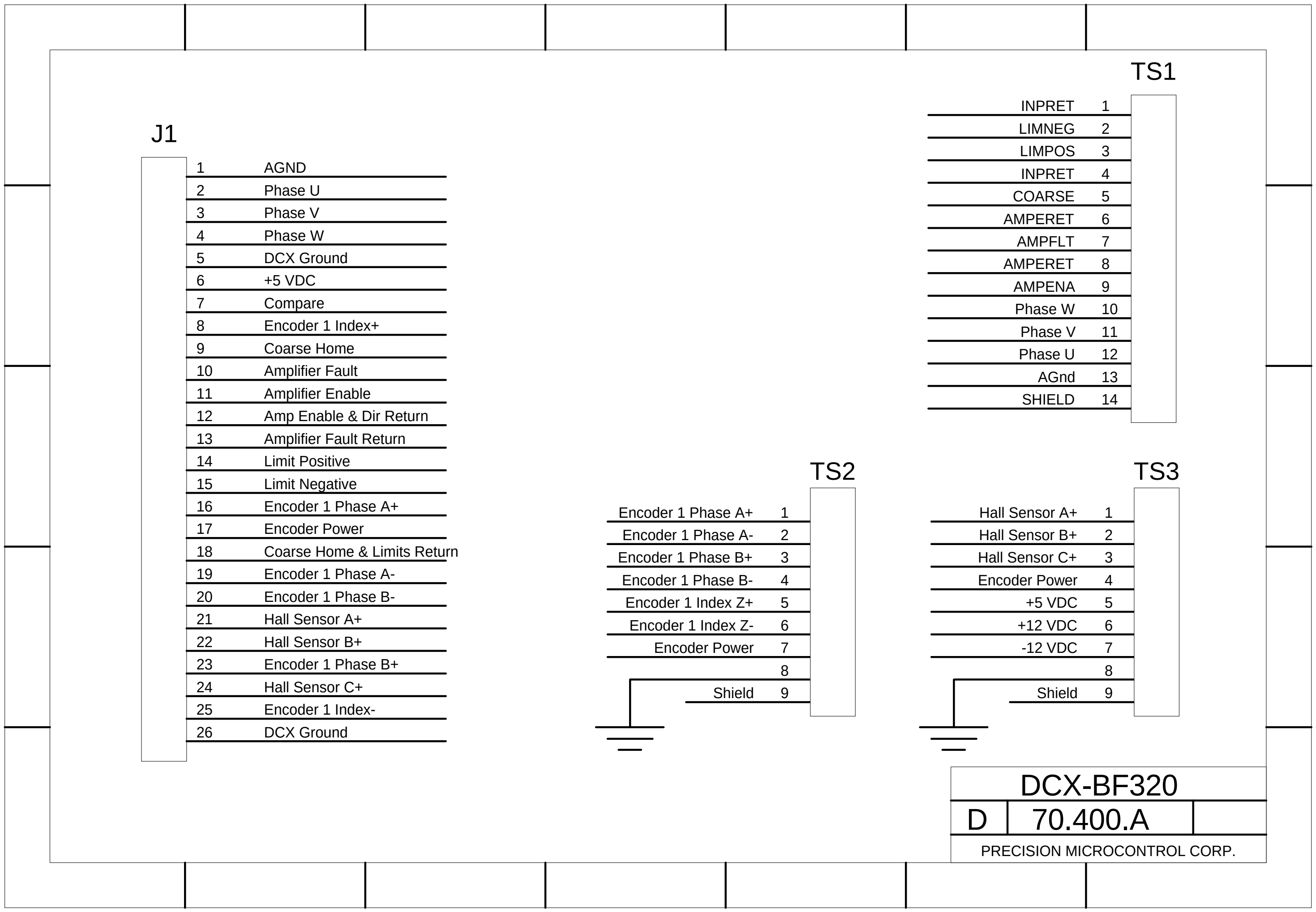
Terminal strip TS3

Pin	***Description***
1	Hall Sensor A+
2	Hall Sensor B+
3	Hall Sensor C+
4	Encoder Power
5	+5 VDC
6	+12 VDC
7	-12 VDC
8	Ground
9	Shield

DCX-BF320-R to DCX-MC320 Connections (continued):

Connector J1: From MC300

Pin	Description
1	Analog Ground
2	Phase U
3	Phase V
4	Phase W
5	Ground
6	+5 VDC
7	Compare
8	Primary Encoder Index +
9	Coarse Home
10	Amplifier Fault
11	Amplifier Enable
12	Amp Enable/Dir. return
13	Amp Fault supply/return
14	Limit +
15	Limit -
16	Prim. Encoder Phase A+
17	Encoder Power
18	Crs Home & Limits return
19	Prim. Encoder Phase A-
20	Prim. Encoder Phase B-
21	Hall Sensor A+
22	Hall Sensor B+
23	Prim. Encoder Phase B+
24	Hall Sensor C+
25	Prim. Encoder Index-
26	Ground


J1
1 AGND
2 Phase U
3 Phase V
4 Phase W
5 DCX Ground
6 +5 VDC
7 Compare
8 Encoder 1 Index+
9 Coarse Home
10 Amplifier Fault
11 Amplifier Enable
12 Amp Enable & Dir Return
13 Amplifier Fault Return
14 Limit Positive
15 Limit Negative
16 Encoder 1 Phase A+
17 Encoder Power
18 Coarse Home & Limits Return
19 Encoder 1 Phase A-
20 Encoder 1 Phase B-
21 Hall Sensor A+
22 Hall Sensor B+
23 Encoder 1 Phase B+
24 Hall Sensor C+
25 Encoder 1 Index-
26 DCX Ground
TS1
INPRET 1
LIMNEG 2
LIMPOS 3
INPRET 4
COARSE 5
AMPERET 6
AMPFLT 7
AMPERET 8
AMPENA 9
Phase W 10
Phase V 11
Phase U 12
AGnd 13
SHIELD 14
TS2
Encoder 1 Phase A+ 1
Encoder 1 Phase A- 2
Encoder 1 Phase B+ 3
Encoder 1 Phase B- 4
Encoder 1 Index Z+ 5
Encoder 1 Index Z- 6
Encoder Power 7
8
Shield 9
TS3
Hall Sensor A+ 1
Hall Sensor B+ 2
Hall Sensor C+ 3
Encoder Power 4
+5 VDC 5
+12 VDC 6
-12 VDC 7
8
Shield 9
DCX-BF320
D
70.400.A
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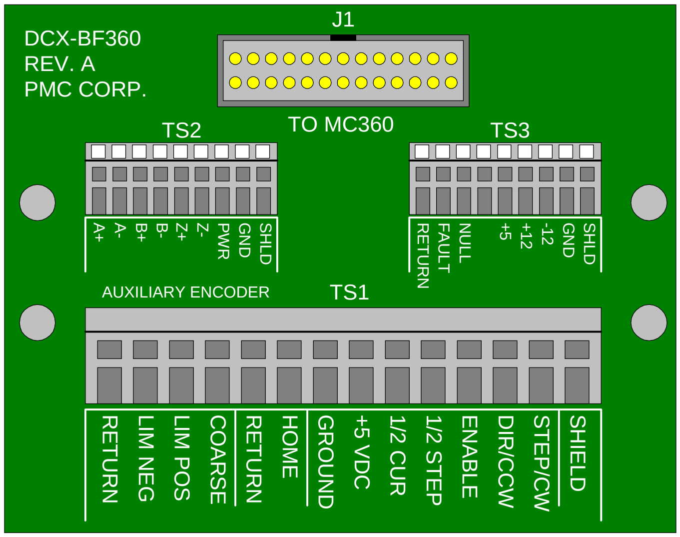
DCX-BF360-R Stepper Module Breakout Assembly



DCX-BF360-R to DCX-MC360-R Connections:

Terminal strip TS1

Pin	Description
1	Crs Home & Limits return
2	Limit -
3	Limit +
4	Aux Encoder Crs Home
5	Home return
6	Home
7	Ground
8	+5 VDC
9	Full/Half Current
10	Full/Half Step
11	Drive Enable
12	Direction
13	Step
14	Shield

Terminal strip TS2

Pin	Description
1	Aux. Encoder Phase A+
2	Aux. Encoder Phase A-
3	Aux. Encoder Phase B+
4	Aux. Encoder Phase B-
5	Aux. Encoder Index+
6	Aux. Encoder Index-
7	Encoder Power
8	Ground
9	Shield

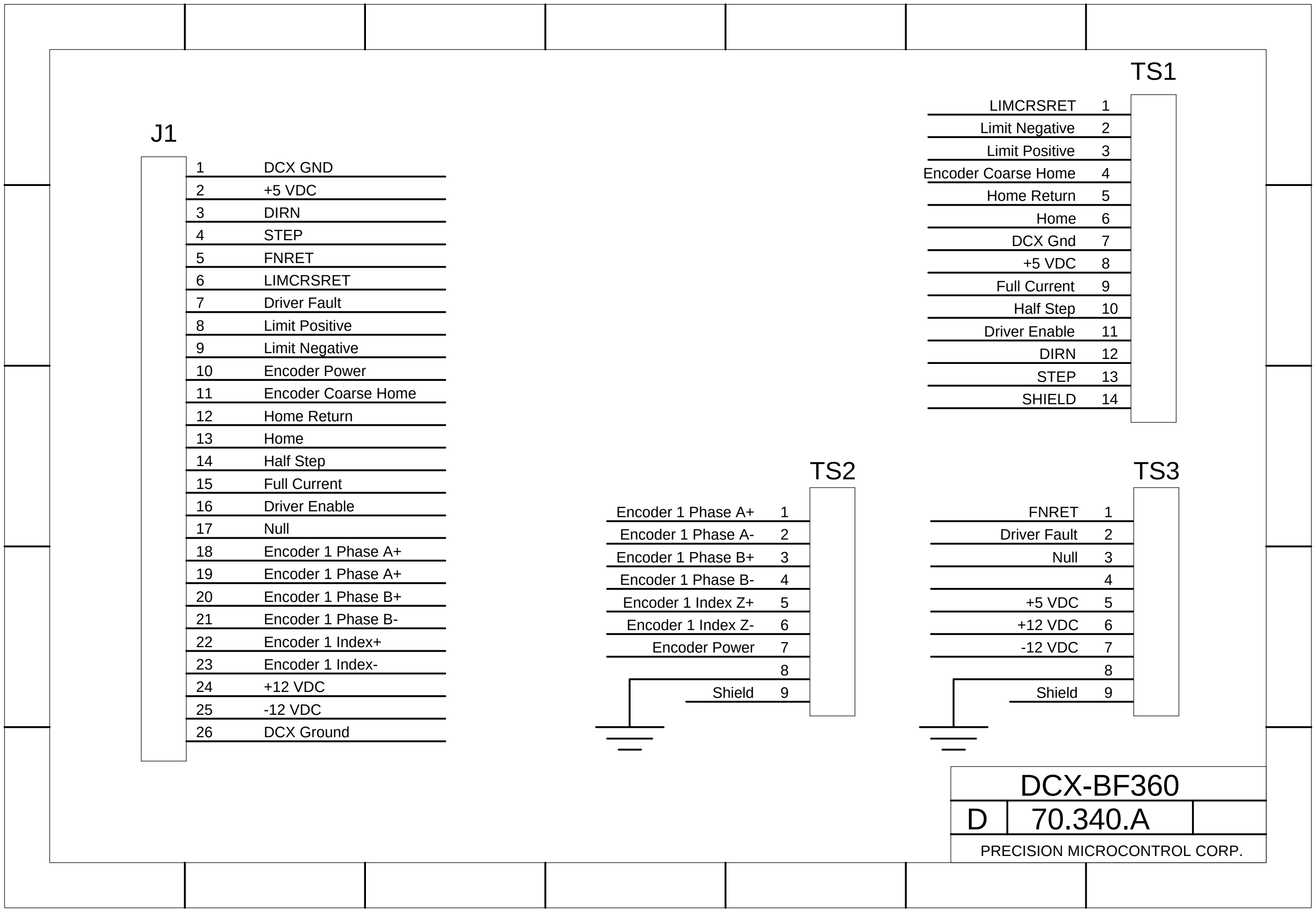
Terminal strip TS3

Pin	Description
1	FNRET
2	Driver Fault
3	Null
4	
5	+5 VDC
6	+12 VDC
7	-12 VDC
8	Ground
9	Shield

DCX-BF300-R to DCX-MC360 Connections (continued):

Connector J1: From MC360

Pin	Description
1	Ground
2	+5 VDC
3	Direction
4	Pulse / CCW Pulse
5	FNRET
6	LIMCRSRET
7	Drive Fault
8	Limit Positive
9	Limit Negative
10	Auxiliary Encoder Power
11	Aux. Enc Coarse Home
12	HOMRET
13	Home
14	Full/Half Step
15	Full/Half Current
16	Driver Enable
17	Null Position
18	Aux Encoder Phase A+
19	Aux Encoder Phase A-
20	Aux Encoder Phase B+
21	Aux Encoder Phase B-
22	Auxiliary Encoder Index+
23	Auxiliary Encoder Index-
24	+12 VDC
25	-12 VDC
26	Ground



J1
1 DCX GND
2 +5 VDC
3 DIRN
4 STEP
5 FNRET
6 LIMCRSRET
7 Driver Fault
8 Limit Positive
9 Limit Negative
10 Encoder Power
11 Encoder Coarse Home
12 Home Return
13 Home
14 Half Step
15 Full Current
16 Driver Enable
17 Null
18 Encoder 1 Phase A+
19 Encoder 1 Phase A+
20 Encoder 1 Phase B+
21 Encoder 1 Phase B-
22 Encoder 1 Index+
23 Encoder 1 Index-
24 +12 VDC
25 -12 VDC
26 DCX Ground
TS1
LIMCRSRET 1
Limit Negative 2
Limit Positive 3
Encoder Coarse Home 4
Home Return 5
Home 6
DCX Gnd 7
+5 VDC 8
Full Current 9
Half Step 10
Driver Enable 11
DIRN 12
STEP 13
SHIELD 14
TS2
Encoder 1 Phase A+ 1
Encoder 1 Phase A- 2
Encoder 1 Phase B+ 3
Encoder 1 Phase B- 4
Encoder 1 Index Z+ 5
Encoder 1 Index Z- 6
Encoder Power 7
8
Shield 9
TS3
FNRET 1
Driver Fault 2
Null 3
4
+5 VDC 5
+12 VDC 6
-12 VDC 7
8
Shield 9
DCX-BF360
D 70.340.A
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Chapter Contents

- Introduction to PDF
- Printing a complete PDF document
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- Paper
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Chapter 7

Printing a PDF Document

Introduction to PDF
PDF stands for Portable Document Format. It is the defacto standard for transporting electronic documents. PDF files are based on the PostScript language imaging model. This enables sharp, color-precise printing on almost all printers.

Printing a complete PDF document
It is **not recommended** that large PDF documents be printed on personal computer printers. The 'wear and tear' incurred by these units, coupled with the difficulties of two sided printing, typically resulting in degraded performance of the printer and a whole lot of wasted paper. PMC recommends that PDF document be printer by a full service print shop that uses digital (computer controlled) copy systems with paper collating/sorting capability.

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While viewing a PDF document with Adobe Reader (or Adobe Acrobat), any page or range of pages can be printed by a personal computer printer by:

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The selection of the paper type to be used for printing a PDF document should be based on the target market for the document. For a user's manual with extensive graphics that is printed on both sides of a page the minimum recommended paper type is 24 pound. A heavier paper stock (26 – 30 pound) will reduce the 'bleed through' inherent with printed graphics. Typically the front and back cover pages are printed on heavy paper stock (50 to 60 pound).

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- Number of pages
- Paper type

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- Language translation.

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