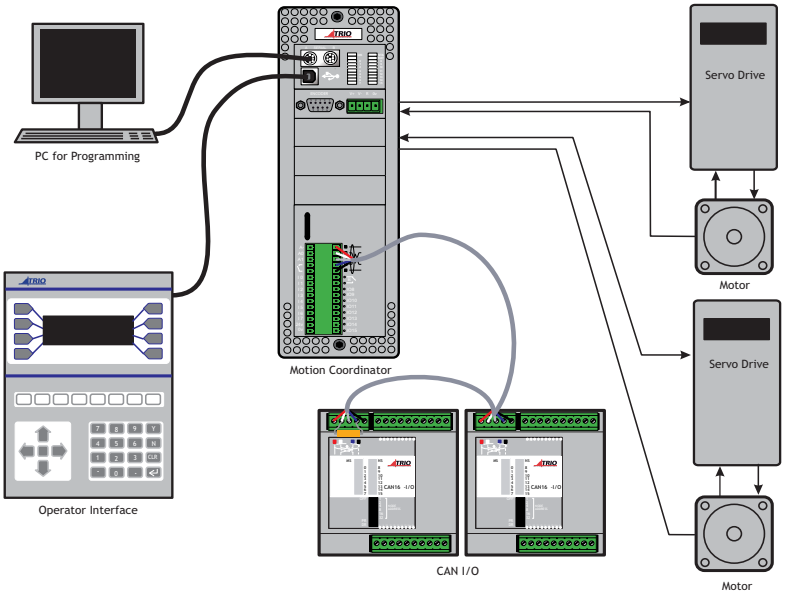
CHAPTER

1

INTRODUCTION

Trio Motion Technology's range of *Motion* Coordinator products are designed to enable the control of industrial machines with a minimum of external components. The products may be combined to build a control system capable of driving a multi-axis machine and its auxiliary equipment. The *Motion* Coordinator system described in this manual allows you to control up to 24 servo or stepper motors, Digital I/O and additional equipment such as keypads and displays from a single master. Up to fifteen masters can be networked together using the Trio fibre optic network allowing up to 360 axes of control. The controller is programmed using the *Trio* BASIC programming language. This may be used to build stand-alone programs or commands can be sent from an external computer.

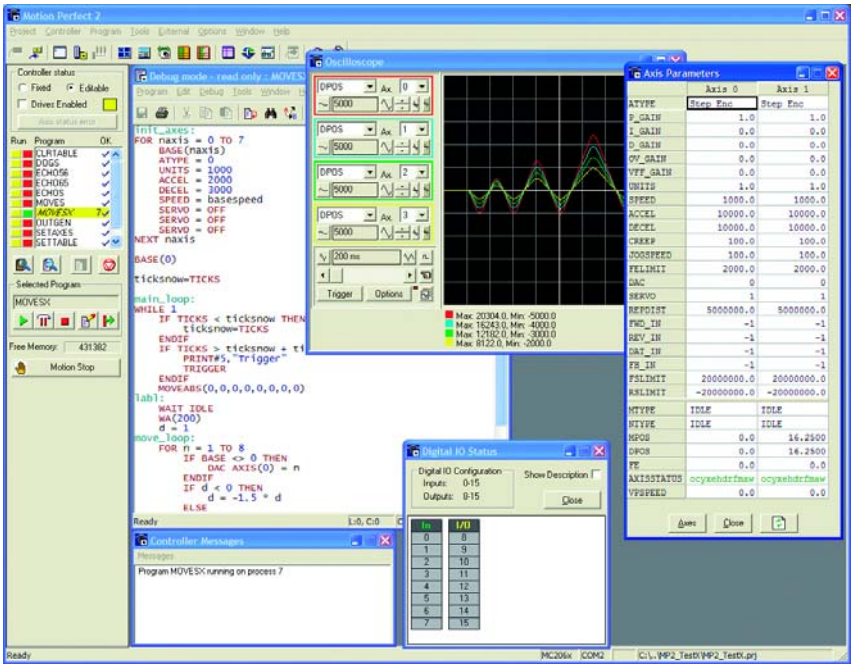


Typical System Configuration

The *Motion* Coordinator system is modular, allowing the user to tailor the controller to their specific needs, but also allowing the flexibility to incorporate new modules if needs should change.

Setup and Programming

To program the *Motion* Coordinator a PC is connected via an RS-232, USB serial or Ethernet link. The dedicated *Motion* Perfect program is normally used to provide a wide range of programming facilities, on a PC running Microsoft Windows 2000, XP or Vista 32bit versions.



Motion **Perfect 2**

Once connected to the *Motion* Coordinator, the user has direct access to *Trio* BASIC, which provides an easy, rapid way to develop control programs. All the standard program constructs are provided; variables, loops, input/output, maths and conditions. Extensions to this basic instruction set exist to permit a wide variety of motion control facilities, such as single axis moves, synchronized multi axis moves and unsynchronised multi axis moves as well as the control of the digital I/O.

The *Motion* Coordinator range described in this manual currently consists of the MC302X, MC206X, Euro 205x, Euro209 and MC224. The MC464 is not covered here, but will be described separately. These controllers feature multi-tasking BASIC. Multiple *Trio* BASIC programs can be constructed and run simultaneously to make programming complex applications much easier.

Products

The range of Trio *Motion* Coordinator products covered by this manual:

Motion Coordinator Master Controllers

Product Code	Name	Description
P192	**MC302X**	Compact, low cost DIN-rail mounting module features 1 1/2 servo or 2 stepper axes. 4 Opto-isolated Inputs and 4 Opto-isolated I/O channels are built in user serial support RS232/ RS485. Multi-tasking *Trio* BASIC. I/O CANbus expansion.
P136	**MC206X**	Low cost, high performance DIN-rail mounting controller for 1-8 axes with additional daughter board. 8 Opto-isolated Inputs and 8 Opto-isolated Input/Output channels,1 Opto-isolated analogue input, USB and memory stick socket are built in. Multi-tasking *Trio* BASIC. I/O CANbus expansion.
P151	**Euro 205x**	For OEM applications, Trio offer a 3U Eurocard format controller featuring 4 onboard axes plus the option for a further axis via a standard Trio daughter board. 16 Opto-isolated Inputs and 8 Opto-isolated Output channels are built in. Multi-tasking *Trio* BASIC. I/O CANbus expansion.
P159	**Euro 209**	For OEM applications, Trio offer a 3U Eurocard format controller featuring 8 onboard axes plus the option for a further axis via a standard Trio daughter board. 16 Opto-isolated Inputs and 8 Opto-isolated Output channels are built in. Multi-tasking *Trio* BASIC. I/O CANbus expansion. *Motion* Perfect programming via Ethernet ports.
P170	**MC224**	Flexible high performance master controller for 1-24 axes. 8 Opto-isolated Inputs and 8 Opto-isolated Input/Output channels, 2 Opto-isolated analogue inputs, USB and memory stick socket are built in. Multi-tasking *Trio* BASIC. I/O CANbus expansion.

Daughter Boards

The Daughter Board concept is a one of the key features which give the *Motion* Coordinator system enormous flexibility in its configuration.

The Daughter Boards provide the interface to many types of Servo or Stepper Axes, plus a number of advanced communications options as well.

There are 19 types of daughter boards currently available:

Product Code:	Name	Description
P200 / P201	**Servo Encoder**	**+/- 10v Output, Differential Encoder Input plus Hardware Registration Input** The Servo Encoder daughter board provides the interface to a DC or Brushless servo motor fitted with an encoder or encoder emulation.
P210	**Servo Resolver**	**+/- 10v Output, Resolver Input plus Hardware Registration Input** The Servo Resolver daughter board provides the interface to a DC or Brushless servo motor fitted with a resolver. The resolver port provides absolute position feedback within one motor turn.
P220	**Reference Encoder**	**Differential Encoder Input plus Hardware Registration Input** The Encoder daughter board provides an encoder input without any servo feedback facility for measurement, registration and synchronization functions on conveyors, drums, flying shears, etc.
P225	**Analog Inputs**	**8 x 0 to 10 Volt Analogue Inputs** The Analog Inputs daughter board has 8 x 16 bit inputs for use as general analog input channels or as feedback for up to 8 axes. When used for feedback, the A to D is synchronised to the SERVO_PERIOD.

Product Code:	Name	Description
P230	**Stepper**	**Open-collector Step, Direction, Boost and Enable outputs** The Stepper daughter board generates pulses to drive an external stepper motor amplifier. Single step, half step and micro-stepping drives can be used with the board.
P240	**Stepper Encoder**	**Open-collector Step, Direction, Boost and Enable outputs plus Differential Encoder Input.** The Stepper Encoder daughter board with position verification has all the features of the simpler stepper daughter board. Position verification is added to a stepper axis by providing encoder feedback to check the position of the motor.
P242	**Hardware Pswitch**	**Differential Encoder Input plus Hardware Position Switch Outputs** The Hardware PSWITCH daughter board allows 4 open-collector outputs to be switched ON and OFF at programmed positions. This function is similar to the PWITCH command which is implemented in the system software and allows outputs to be switched ON and OFF over defined position sectors. The Hardware PSWITCH daughter board performs the position comparison in electronic hardware on the daughter board. This allows the pulses generated to be very accurately timed.
P260	**Analogue Output**	**+/- 10v Output with direct DAC control** The Analogue Output daughter board provides a 12 bit +/-10v voltage output for driving inverters and other devices. The board is a simplified servo daughter board and the connections are similar.
P270	**SSI Absolute Servo**	**+/- 10v Output, Differential Encoder Input plus Hardware Registration Input** The SSI daughter board provides the interface to a DC or Brushless servo motor fitted axis with an absolute encoder using the Synchronous Serial Interface (SSI).

Product Code:	Name	Description
P280	**Differential Stepper**	**Differential Line Driver outputs for Step, Direction, Boost and Enable, plus Hardware Registration Input** The Differential Stepper daughter board is a stepper daughter board with the output signals provided as differential 5 volt signals on a 15 way 'D' connector. The daughter board does not feature an encoder port for position verification, but does have a registration input to allow for capture of the number of step pulses when a registration signals arrives.
P290 / P293	**CAN**	**Digital Link to CANBus drives** The CAN daughter board provides synchronous control of up to four axes using the CanOpen protocol. Alternatively, it can be set up as a DeviceNet slave node, or may use the can directly from Trio Basic.
P291	**SERCOS**	**Digital Link to SERCOS drives** The SERCOS daughter board provids digital control to appropriate servo drives via a Fibre Optic loop. Up to 8 axes can be connected to each P291, which allows the MC224 to control up to 24 axes.
P292	**SLM**	**Digital Link to SLM drives** The SLM daughter board is aimed at providing digital control channels for servo drives utilising the SLM protocol.
P295	**USB Interface**	**Universal Serial bus interface for high-speed PC communications** The USB daughter board provides a high speed interface between the Euro205x and Euro 209 and a host PC fitted with a USB port. Support for this high speed interface is included in Trio's *Motion*Perfect 2 application and software libraries allow developers to support the interface within their own programs.

Product Code:	Name	Description
P296	**Ethernet**	**10 base-T Ethernet interface for TCP/IP networks** The Ethernet daughter board provides a very high speed interface between the *Motion* Coordinator and a host PC fitted with an Ethernet port. Support for Ethernet is included in Trio's MotionPerfect 2 application and software libraries allow developers to support the interface within their own programs. In addition to this, support for Modbus TCP is included on the board..
P297	**Profibus**	**Profibus Fieldbus Interface** With the Profibus Daughter Board and appropriate software on the *Motion* Coordinator, it is possible to connect to external devices using the Profibus protocol.
P298	**Ethernet IP**	**Ethernet IP interface** Adds 1 channel of Ethernet IP server for connection to PLC's and other devices supporting Ethernet Common Industries Protocol (CIP).

Custom Daughter Boards

Trio can produce custom daughter boards for specific customer applications where required.

I/O Expansion options

Prod. Code	Name	Description
P316	**CAN 16 IO**	DIN Rail mounted 24v I/O expander module provides 16 opto-isolated channels each of which may be used as an Input or an Output.
P325	**CAN Analog Inputs**	DIN Rail mounted +/- 10v Analog Input module provides 8 opto-isolated channels.
P301	**Axis Expander**	Expansion module provides housing for up to 4 additional axis daughter boards. Up to 3 connect to the MC224 and MC224.

P316 - CAN-16 I/O

P325 - CAN-8 Analog Inputs

MC224 and the P301 Axis Expander

Operator Interfaces

Name	Name	Description
P502	Mini-Membrane Keypad	Compact operator keypad/display
P503	Membrane Keypad	High performance general purpose operator key-pad/display

System Building

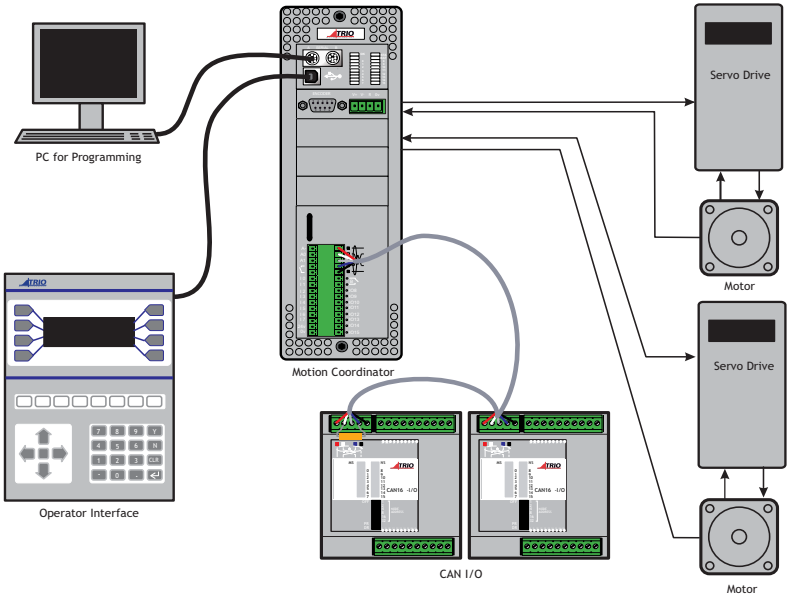
The modules and boards may be mixed within the system rules:

1) Every system must start with one *Motion* Coordinator master unit as this contains the processor and logic power supply for the system.

2) The MC224 master unit can house up to 4 daughter boards. The Euro 205x, Euro 209 and MC206X will accept a single daughter board. These can be of any type.

3) The MC224 can have up to 3 axis expander modules added to house up to 16 daughter boards. 4 being housed in the Master and 4 in each of the axis expanders.

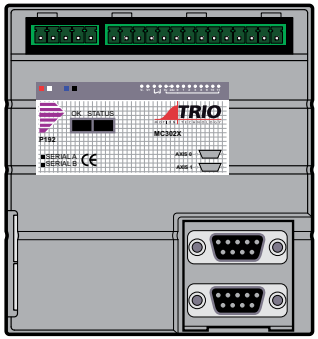
4) Up to 16 CAN-16 I/O and 4 CAN Analog Input modules can be connected to any *Motion* Coordinator.



Typical System Configuration

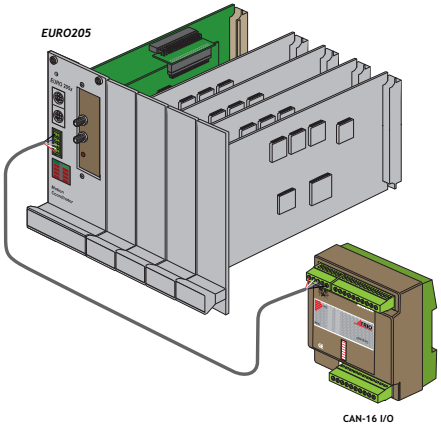
System Examples

Example 1 Simplest Possible System - Single MC302X



- 1½ Axis Servo (Servo + reference encoder) or 2 Axis Stepper
- 8 Channels of 24v I/O on board
  - 4 Inputs
  - 4 I/O

Example 2 Euro205x, 5 Axis Rack mounted System



The Euro 205x controller provides a compact rack-mounted controller ideal for volume OEM applications.

The four internal axes are configured as stepper axes and connected via the backplane to third party stepper drives.

An optional P200 Servo Daughter Board provides a fifth axis connected to a servo drive.

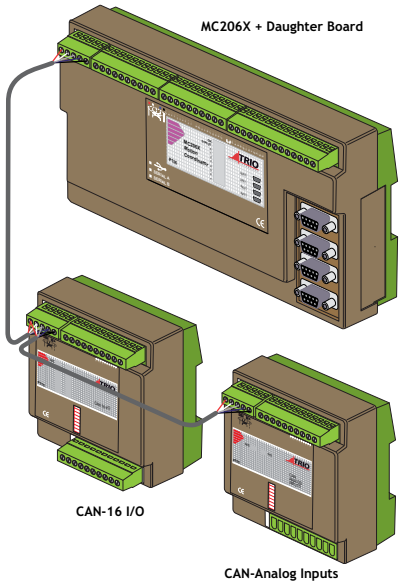
- 5 servo axes
- 40 Channels of 24v I/O
  - 16 in + 8 out on Euro205x, plus
  - 16 I/O on CAN-16 I/O expander

Example 3 MC206X - 5½ Axis Servo System

Utilising the four internal axis as servo axes, an optional servo daughter board and the reference encoder input to provide a total of 5 servo axes plus the reference (master) encoder.

The MC206X has 16 channels of 24v I/O as standard, this is expanded up to 32 channels with the addition of a CAN-16 I/O module. 8 Analog Inputs (+/- 10v) are provided by the CAN Analog Inputs module.

- 5 servo / stepper axes
- 32 Channels of 24v I/O
  - 8 in + 8 I/O on MC206, plus
  - 16 I/O on CAN-16 I/O expander
- 8 Analogue Input Channels

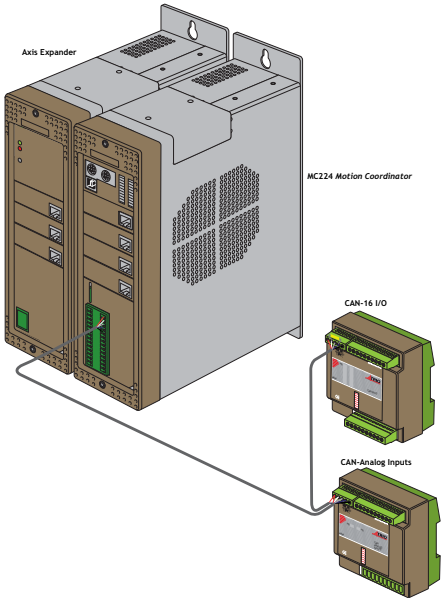


Example 4 MC224 - 7 Axis System

The system comprises an MC224 Master with and additional three axes in the optional Axis Expander module. The axes can be any combination of servo and stepper drives determined by the daughter boards used.

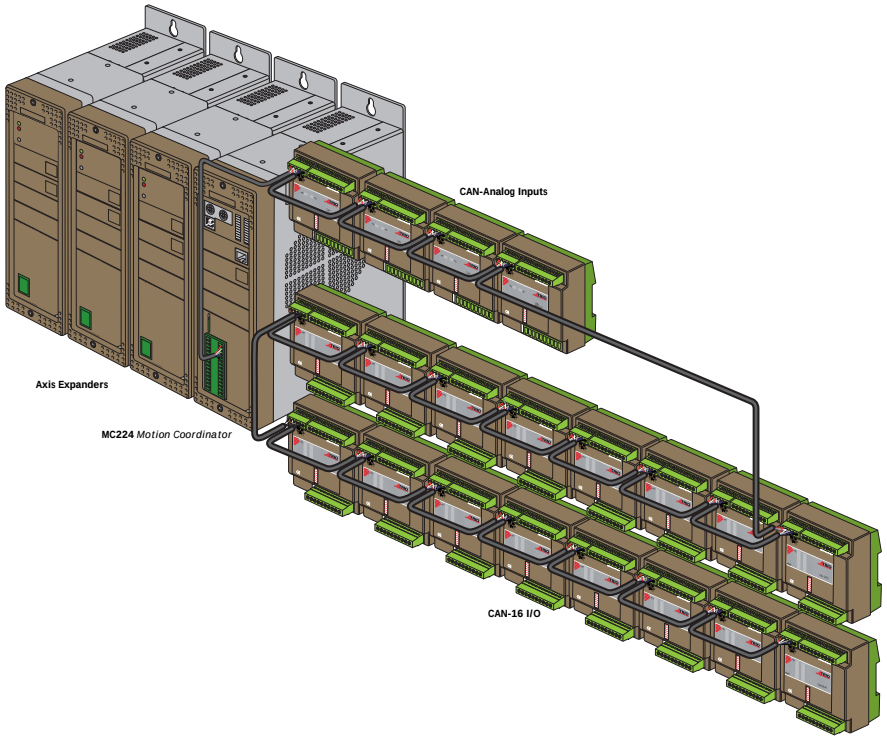
The MC224 has 16 channels of 24v Digital I/O as standard, this is expanded up to 32 with the addition of a CAN-16 I/O module. 8 Analog Inputs (+/- 10v) are provided by the CAN Analog Inputs module.

- 7 axes
  - 4 on MC2224 Master, plus
  - 3 on Axis Expander
- 32 Channels of 24v I/O
  - 8 in + 8 I/O on MC204, plus - 16 I/O on CAN-16 I/O expander
- 8 Analogue Input Channels



Example 5 MC224 - 16 axis system with maximum I/O expansion

The example system illustrated below shows an MC224 controller with the maximum possible I/O expansion. Applications for a system of this complexity might include collating or packaging machinery where there are multiple operations performed on a product and many I/O are used for sensors etc.



- 16 Axes (Any type)
- 272 Channels of 24v I/O
  - 8 in + 8 I/O on MC224, plus
  - 256 I/O (16 * 16) on the 16 CAN-16 I/O modules
- 32 Analogue Input Channels (8 per module)

Features and Typical Applications

Trio BASIC contains accurate motion control functions for the generation of complex movements of various types, including:

- Linear interpolation of up to 24 axes
- Circular and helical interpolation
- Variable speed and acceleration profiles
- Electronic gearboxes
- Electronic cam profiles

The operator interface may be achieved by any combination of the following:

- Dedicated host computer (connected via USB, Ethernet or RS-232 serial port)
- Membrane Keypad with Vacuum Fluorescent Display
- Dedicated Operator Panel using the'Modbus' serial protocol.
- Switches / Thumbwheels
- Status lamps

The system is able to control a wide range of mechanisms and equipment including:

- Brushless servo motors
- Stepper motors
- Brushed DC servo motors
- Hydraulic servo valves
- Hydraulic proportional valves
- Pneumatic/hydraulic solenoids
- Relays/contactors

Typical applications:

- Cut to length
- Flying shears
- Glue laying
- Web control
- Tension control
- Pick & Place
- Coil winding
- Laser guidance
- Electronic assembly
- Printing
- Collating
- Packaging
- Automotive welding
- Spark erosion
- Drilling
- Milling
- YOUR application

The Trio Motion Technology Website

The Trio website contains up to the minute news, information and support for the *Motion* Coordinator product range.

Website Features

- Latest News
- Product Information
- Manuals
- Support Software
- System Software Updates
- Technical Support
- User's Forum
- Application Examples
- Employment Opportunities

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