

# ▶ *Trio Motion Technology* ◀

## MC 202 Motion Controller

### Product Overview



### **3.0 Motion Coordinator 202 Description**

#### **3.1 Motion Coordinator 202**

The *Motion Coordinator 202* is a miniature stepper/servo positioner with the built-in ability to control one servo/stepper axis with additional synchronisation encoder, or two stepper axes. The MC202 is designed to provide a compact, low cost, easy to use unit for OEM machine builders. It is designed to be configured and programmed for the application with a Multi-tasking TRIO BASIC using a PC, and then may be set to run "standalone" if an external computer is not required for the final system. The Multi-tasking version of Trio BASIC for the MC202 allows up to 3 BASIC programs to be run simultaneously on the controller using pre-emptive multi-tasking.

The Multi-tasking ability of the MC202 allows parts of a complex application to be developed, tested and run independently, although the tasks can share data and motion control hardware.

The MC202 has 4 built in 24v inputs and 4 built-in bi-directional input/output channels. These may be used for system interaction or may be defined to be used by the controller for end of travel limits, datuming and feedhold functions if required. The MC202 can have up to 256 external Input/Output channels and up to 32 analog input channels connected using DIN rail mounted I/O modules. These units connect to the built-in CAN channel of the MC202

The MC202 has a built in RS-232 port. In addition a further serial channel is available at TTL levels. External adapters are available to allow this serial port to be linked to a full-duplex RS-485 channel or a Trio membrane keypad on a fibre-optic link.

#### **3.2 Axis Configuration**

The MC202 is supplied in a single configuration (Trio product code P165). The programmer can use Axis 0 of the controller as either a servo axis with +/-10volt output and encoder feedback, OR as a stepper control axis using step and direction outputs. Axis 1 of the controller can be used either as an encoder input axis for synchronisation functions, OR as a stepper control axis using step and direction signals. A third axis, Axis 2, is provided in software only for the generation of complex motion profiles using "virtual" axis summing.

#### **3.3 Axis Positioning Functions**

The motion control generation software receives instructions to move an axis or axes from the BASIC language which is running concurrently on the same processor. The motion generation software provides control during operation to ensure smooth, co-ordinated movements, velocity profiled as specified by the controlling program. Linear interpolation may be performed in as many axes as the controller provides, and circular or helical interpolation in any two orthogonal axes. Each axis may run independently or they may be linked in any combination using interpolation, CAM profile or the electronic gearbox facilities.

Consecutive movements may be merged to produce continuous path motion and the user may program the motion using programmable units of measurement (e.g. mm, inches, revs etc.). The module may also be programmed to control only the axis speed. The positioner checks the status of end of travel limit switches which can be used to cancel moves in progress and alter program execution.

### 3.4 Summary of Features *Motion Coordinator - MC202*

Size	90 mm x 90 mm x 30mm Overall
Weight	200 g
Operating Temp.	0 - 45 degrees C
Control Inputs	Forward Limit, Reverse Limit, Datum Input, Feedhold Input.
Communication Ports	1 RS232 Channel: 9600 baud. + 1 TTL serial Channel 9600 or 38400 baud 1 CAN channel built on to motherboard
Position Resolution	32 bit position count
Interpolation modes	Linear 1-3 axes, circular, helical, CAM Profiles, speed control, electronic gearboxes.
Programming	Multi-tasking TRIO BASIC system, maximum 4 tasks.
Speed Resolution	32 bits. Speed may be changed at any time. Moves may be merged.
Servo Cycle	1ms
Memory	64 Kbytes flash user program memory.
Power Input	150mA at 24 V d.c. (+/-10%)
Amplifier Enable Output	NO relay contact rated 24Vdc @ 0.5A..
+/-10volt DAC Output	16 bit resolution, single channel on axis 0 only
Encoder Inputs	2 axes, Differential 5v inputs, 6Mhz maximum edge rate * (MC202 can generate 200mA at 5v for encoder power supplies)
Stepper Outputs	2 axes, 500khz maximum step rate *
Digital Inputs	4 Opto-isolated 24v inputs, 2 may be used for high speed registration
Digital I/O	4 Opto-isolated bi-directional 24v 250 mA Outputs/Inputs

\* Each axis can use EITHER encoder input OR stepper output.

### 3.5 Connections to *MOTION COORDINATOR MC202*

The Motion Coordinator MC202 has 3 disconnect terminals, and an 8 way mini-DIN serial connector.

#### 3.5.1. 5 Way Disconnect:

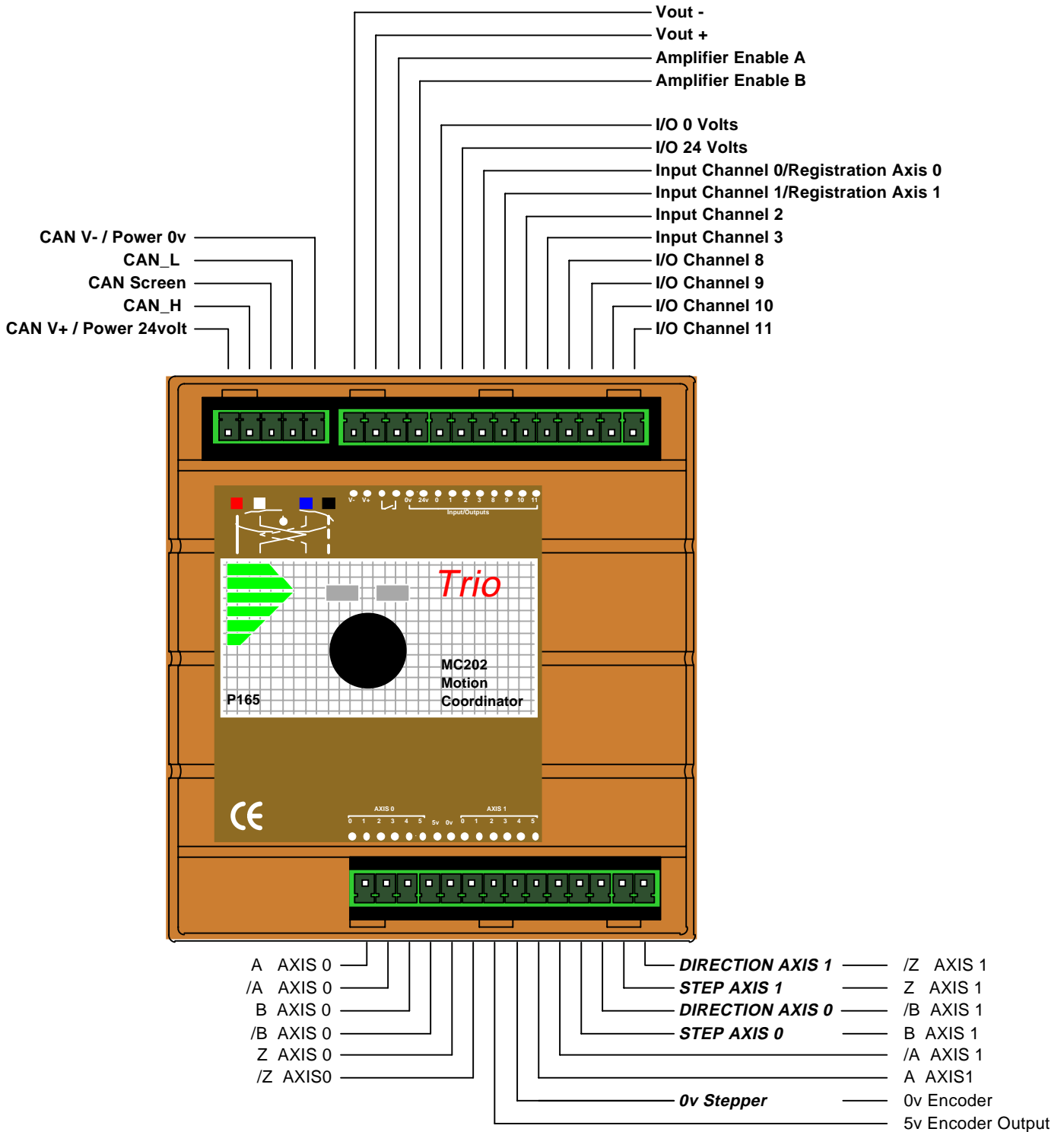
This is a 5 way 3.81mm pitch connector. The connector is used both to provide the 24 volt power to the MC202 and provide connections for I/O expansion via Trio's P315 and P325 CAN I/O expanders. **24 volts must be provided as this powers the unit.** This 24 volt input is internally isolated from the I/O 24 volts and the +/-10v voltage outputs. The CAN connections are optional, although the CAN Screen should be connected to Earth in all cases.

#### 3.5.2. Top 14 Way Disconnect:

This is a 14 way 3.81 pitch connector. The connector provides for the +/-10volt analog output, the enable relay contacts, and the I/O connections.

##### 3.5.2.1 Analog Output

This feature when required is used to drive an servo drive or inverter connected to axis 0. The +/-10 volt analog output is isolated from the power input and the I/O modules of the MC202 and is powered via an internal DC-DC converter. The pair of connections should be connected by a screened cable to the drive input.



This feature is used to interlock the MC202 with a servo OR stepper drive and should be used in all cases. The connections are internally connected to a pair of normally open relay contacts which close when the drive is enabled.

### 3.5.2.3 I/O Power Inputs

The I/O 0 Volts and I/O 24 Volts are used to power the 24 volt inputs and outputs. The I/O connections are isolated from the module power inputs. The I/O 0 Volts connection must be made if any Inputs or outputs are used. The I/O 24 Volts is only required to power outputs and may be omitted if none are used. The I/O channels 8 to 11 are bi-directional and can be used either as an input or an output. They are numbered from 8 to 11 for greater compatibility with other Trio Motion Coordinators. The inputs channels 0 to 3 are not bi-directional. Inputs 0 and input 1 can be used as registration inputs for axes 0 and 1 for use with the REGIST command.

### **3.5.3. Bottom 14 Way Disconnect:**

This is a 14 way 3.81 pitch connector. The connector provides for 2 axes of 5v differential encoder inputs, 2 axes of step and direction encoder inputs and a 5 volt output for powering external encoder only.

#### 3.5.3.1 Axis 0 Encoder Inputs:

6 pins are used to provide dedicated encoder inputs for Axis 0. If axis 0 is used as a stepper axis these connections are not required. The inputs are 5 volt differential encoder inputs. The inputs must be connected to the encoder via a screened cable.

#### 3.5.3.2 Encoder Power Supply:

2 pins provide a low power output at 5v (200mA maximum). This supply is provided for driving one or two encoders (if current consumption permits). The power supplies should be included within the encoder screened cable.

#### 3.5.3.3 Stepper Outputs / Axis 1 Encoder Inputs:

6 pins are used to provide encoder inputs for Axis 1. Alternatively 4 of the pins can be used as step and direction open-collector outputs for axes 0 and 1. The inputs are 5 volt differential encoder inputs. Whatever the use of the pins they must be connected to the stepper amplifier or encoder using screened cable.

### 3.5.4 Serial Port Connections

Trio supply ready made cables for connecting between a PC and the *Motion Coordinator* (product code P350).

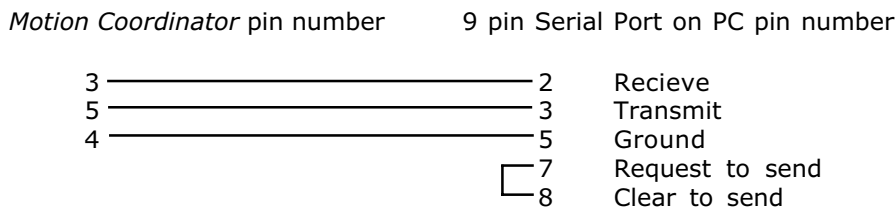
**Serial Port:**

1	-	Internal 5v	- Do not connect
2	-	Internal 0v	- Do not connect
3	-	RS232 Transmit	
4	-	Ground	
5	-	RS232 Receive	
6	-	Internal 5v	- Do not connect
7	-	Externally buffered output	- Do not connect
8	-	Externally buffered input	- Do not connect

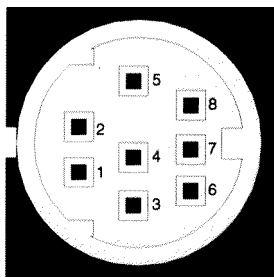
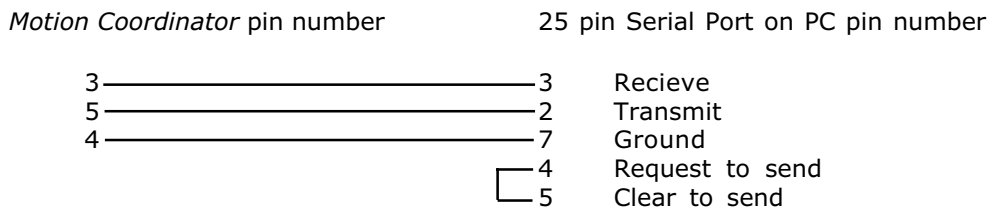
Pins 1, 2, 6, 7, and 8 are designed for the connection of an external fibre-optic adapter. There is no hardware handshake on the serial ports. An XON\XOFF protocol is used.

Trio recommend the use of their pre-made serial cables. If cables need to be made to connect to a PC serial port the following connections are required:

**Motion Coordinator to "AT" style PC with 9 pin serial port:**



**Motion Coordinator to "XT" style PC with 25 pin serial port:**

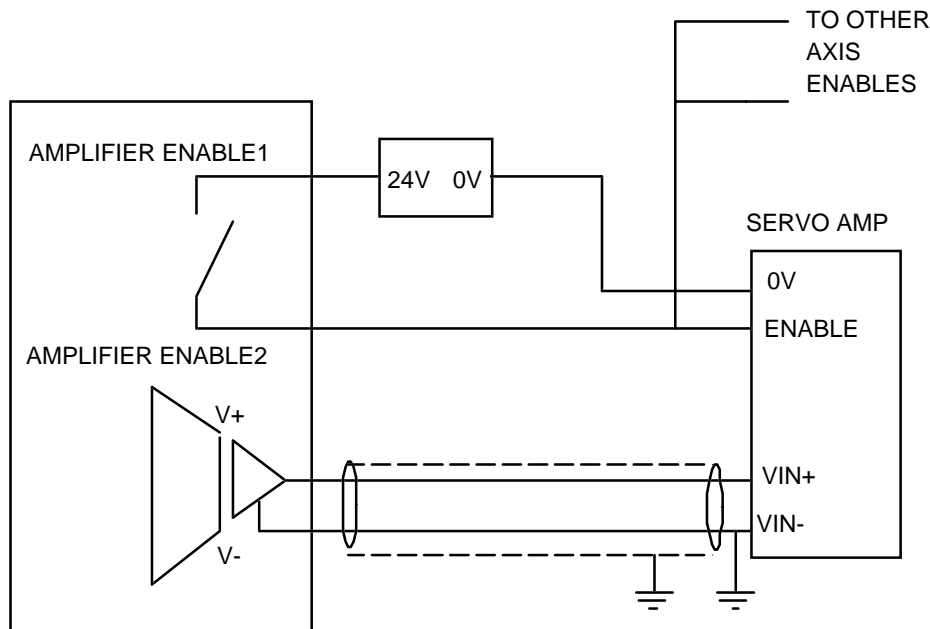


### 3.6.1 Amplifier Enable (Watchdog) Relay Output

An internal relay contact is used to enable external amplifiers when the controller has powered up correctly and the system and application software is ready. The amplifier enable is a single pole relay with a set of normally open contacts. The enable relay contact will be open circuit if there is no power on the controller OR a following error exists on a servo axis OR the user program sets it open with the WDOG=OFF command.

The amplifier enable relay may, for example, be incorporated within a holdup circuit or chain that must be intact before a 3-phase power input is made live.

**ALL STEPPER AND SERVO AMPLIFIERS MUST BE INHIBITED WHEN THE AMPLIFIER ENABLE OUTPUT IS OPEN CIRCUIT**



The ENABLE circuit is similar on a STEPPER Amplifier

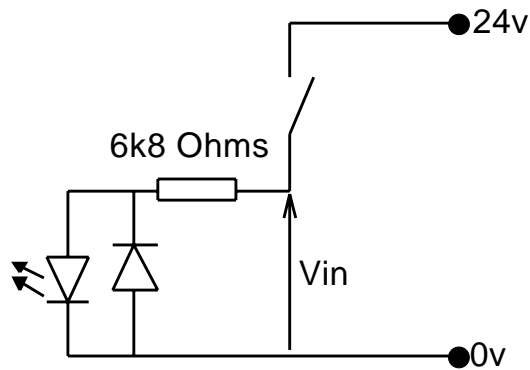
Connection of Watchdog and Velocity Output to Servo Amp

### 3.6.2 Enabling Stepper Motor Amplifiers

The watchdog relay contact can be used to enable both stepper and servo motor amplifiers.

### 3.6.3 24v Input Channels

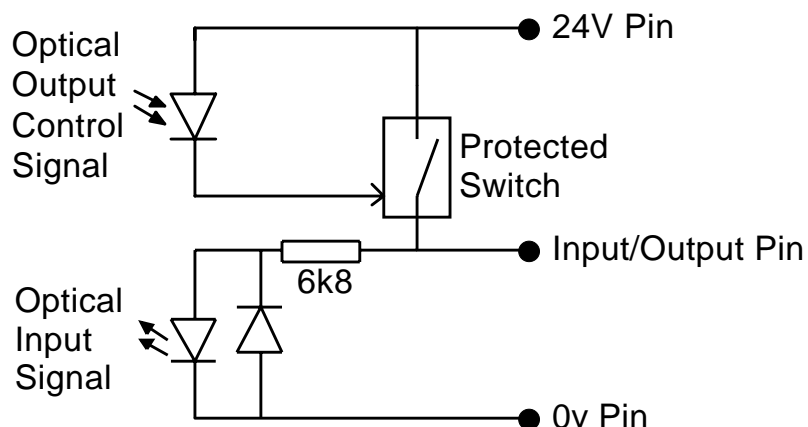
The MC202 MOTION COORDINATOR has 4 24v Input channels built-in. A Further 256 Inputs may be added by the addition of CAN-16I/O modules (P315).



### 3.6.5 24v Input/Output Channels

Input/output channels 8..11 are bi-directional. The inputs have a protected 24v sourcing output connected to the same pin. If the output is unused it may be used as an input in the program. The input circuitry is the same as on the dedicated inputs. The output circuit has electronic over-current protection and thermal protection which shuts the output down when the current exceeds 250mA.

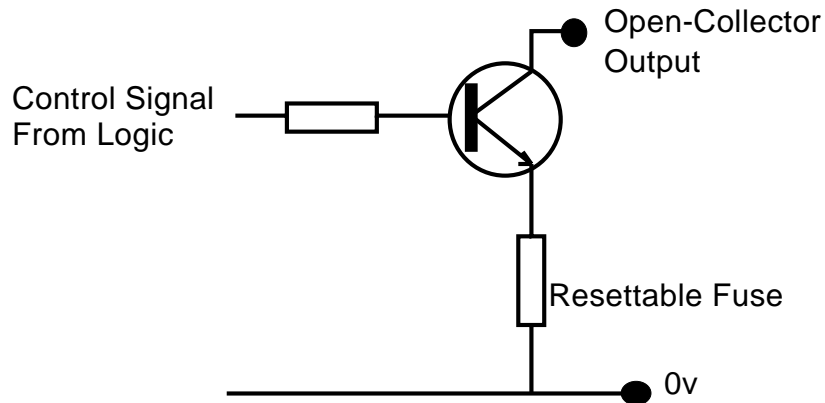
A further 256 Outputs may be added by the addition of CAN-16I/O modules (P315).



### 3.6.6 Open Collector Stepper Driver Outputs

The STEP, DIR signals use open-collector outputs. These outputs are NOT opto-isolated from the processor logic. The open-collector outputs may be pulled up to any voltage in the range 5v..24v as required but a current limiting resistor MUST be provided externally to the MC202 to limit the current in the output channel. Normally this current limiting resistor is built-in to the stepper amplifier circuit.

The open-collector outputs are protected by a resettable fuse. These fuse links will go high impedance if a total of more than 200mA is passed through the group of open-collector outputs. If any outputs are overloaded it is necessary to remove the power from the circuit to reset the fuse.



### 3.6.7 Differential Encoder Inputs

The encoder inputs on the MC202 are designed to be directly connected to 5 volt differential output encoders. The input circuit uses a differential receiver without a load resistor, if a load resistor is required this will need to be fitted externally.