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T E C H N I C A L N O T E

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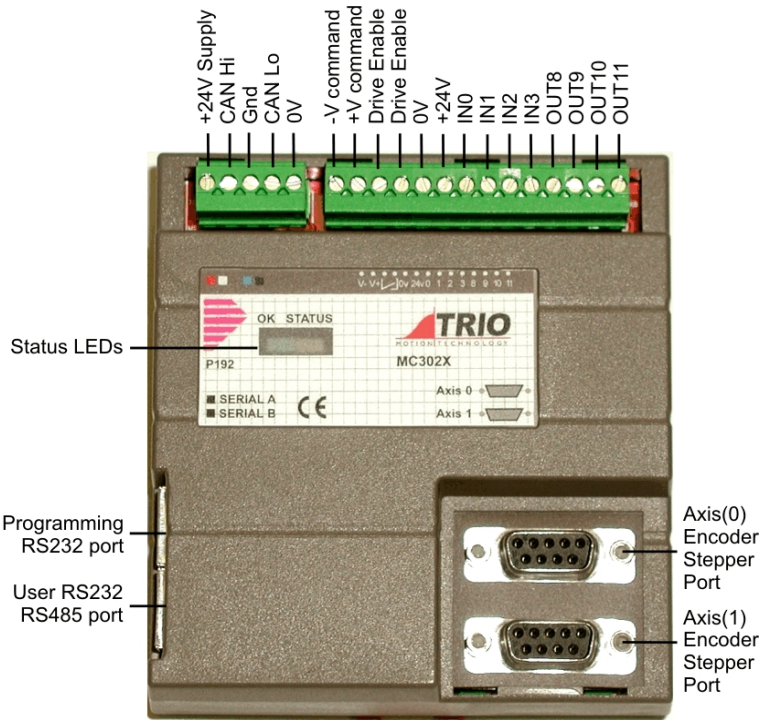
Subject: MC302X Comparison and Connections

The Trio MC302X Motion Coordinator is the latest design based on the ARM processor. It is an update and replacement for the successful MC202 unit. While functionally similar, the MC302X incorporates many improvements and changes over the MC202. The key differences between the two products are listed below. The MC302X is programmed using the standard Trio BASIC language. Please see the User Reference Manual available from the Trio web site www.triomotion.com .

Key differences of the MC302X vs. MC202

	MC302X	MC202
Stepper Freq	2MHz max.	500kHz max.
Stepper Output	Differential Line Driver (high-speed pulse)	Open Collector (squarewave)
Processor	64MHz ARM	40MHz TI DSP
Modes of operation	1 ½ Servo 2 Stepper	1 ½ Servo 2 Stepper
DAC Output	16-bit	12-bit
Max Encoder Frequency	6MHz edge rate	2MHz edge rate
Serial Ports	1 RS232 programming (38400* baud) 1 User Port, RS232 or RS485 (9600, 19200, 38400* baud) *default	1 RS232 programming (9600 baud) 1 TTL Serial (requires P349 adapter)
Input Power	24Vdc @ 40mA	24Vdc @ 100mA
Servo Loop	1ms, 500us, 250us	1ms fixed
Drive Enable relay	Solid state (0.1A)	Dry contact (0.5A)
Simulated Encoder Output capable	Yes	No
Max TABLE size	16000 locations	8000 locations
User Memory	512k byte	128k byte
Stepper Registration	Internal Step/Dir loop-back for registration	Requires external components for loop-back

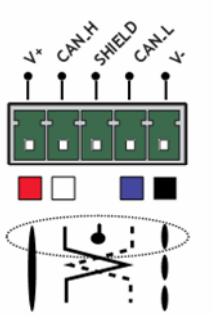
MC302X Connector Layout



Input Power and CANbus

5-Way Connector

This is a 5 way 3.81mm pitch connector. The connector is used both to provide the 24 volt power to the MC302X 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.

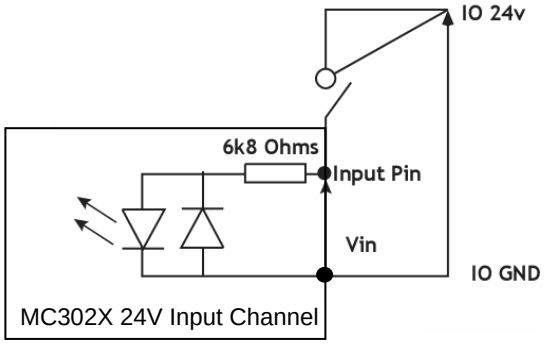


5 Way (CAN) Connector and Power Input

Pin1	V+	24Vdc - Class 2 power supply for main power to controller
Pin2	CAN_H	CANbus connections. Runs the Trio CANbus protocol by default for expanded Trio I/O modules. Can also run CANopen (via BASIC program) and DeviceNET (built-in) protocol.
Pin3	Shield	
Pin4	CAN_L	
Pin5	V-	0 Volt - return for 24V class 2 supply

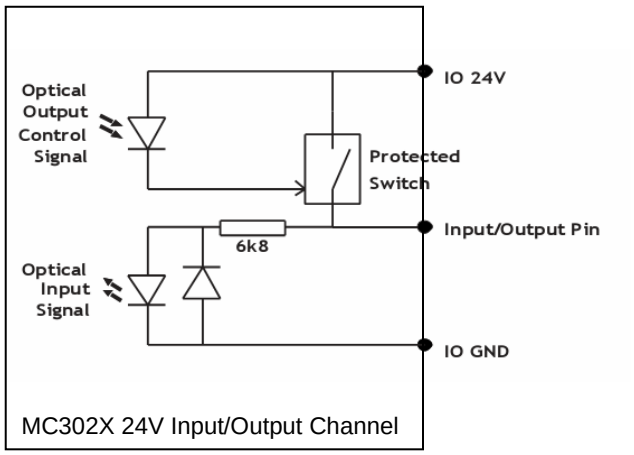
24V Inputs

The MC302X has 4 dedicated 24v Input channels built into the master unit. A further 256 inputs can be provided by the addition of Trio's CAN16 I/O modules. The dedicated input channels are labeled channels 0..3. Inputs 0 and 1 can be used as registration inputs for axes 0 and 1 for use with the REGIST command.



24V Inputs and Outputs

The MC302X has 4 Input/output channels 8..11 that 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. Care should be taken to ensure that the 250mA limit for the output circuit is not exceeded, and that the total load for the group of 8 outputs does not exceed 1 amp.



MC302X 24V Input/Output Channel

14 way Connector

Pin1	Vout+	16-bit single-ended DAC output to servo drive. Can also be a general purpose analog output when Axis 0 is configured as a Stepper axis.
Pin2	Vout-	
Pin3	Amplifier Enable 1	N.O. solid-state drive enable relay output. This output is not polarity sensitive and mimics a physical relay contact up to 100mA max.
Pin4	Amplifier Enable 2	
Pin5	I/O 0 Volts	24Vdc user supplied for outputs. The same power supply connected to the 5 way may be jumped to power the I/O. Use a separate power supply for full isolation.
Pin6	I/O 24 Volts	
Pin7	Input 0 / Registration Axis 0	24Vdc input. Also used as a high-speed Axis 0 encoder position capture. See REGIST command in the Trio programming manual for arming procedure.
Pin8	Input 1 / Registration Axis 1	24Vdc input. Also used as a high-speed Axis 0 encoder position capture. See REGIST command in the Trio programming manual for arming procedure.
Pin9	Input 2	24Vdc input
Pin10	Input 3	24Vdc input
Pin11	I/O Channel 8	24Vdc input or 24Vdc output @ 250mA maximum
Pin12	I/O Channel 9	24Vdc input or 24Vdc output @ 250mA maximum
Pin13	I/O Channel 10	24Vdc input or 24Vdc output @ 250mA maximum
Pin14	I/O Channel 11	24Vdc input or 24Vdc output @ 250mA maximum

Serial Ports

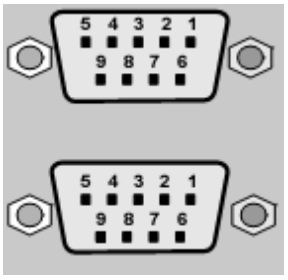
Looking into socket 	1 – 5Vdc output 2 – 0Vdc (signal common) 3 – RS232 Transmit OUT 4 – 0Vdc (signal common) 5 – RS232 Receive IN 6 – 5Vdc output 7 – NC 8 – NC	PORT 0	**PORT A**	- Main programming Port. Supports Modbus[2]. - Supports immediate ASCII commands from host.
	1 – RS485/422 +Data IN 2 – RS485/422 -Data IN	PORT 1[1]	**PORT B**	- User port supports Modbus. - Supports ASCII.
	3 – RS232 Transmit OUT 4 – 0Vdc (signal common) 5 – RS232 Receive IN			- User port supports Modbus. - Supports ASCII.
	6 – 5Vdc output 7 – RS485/422 -Data OUT 8 – RS485/422 +Data OUT			- User port supports Modbus. - Supports ASCII.

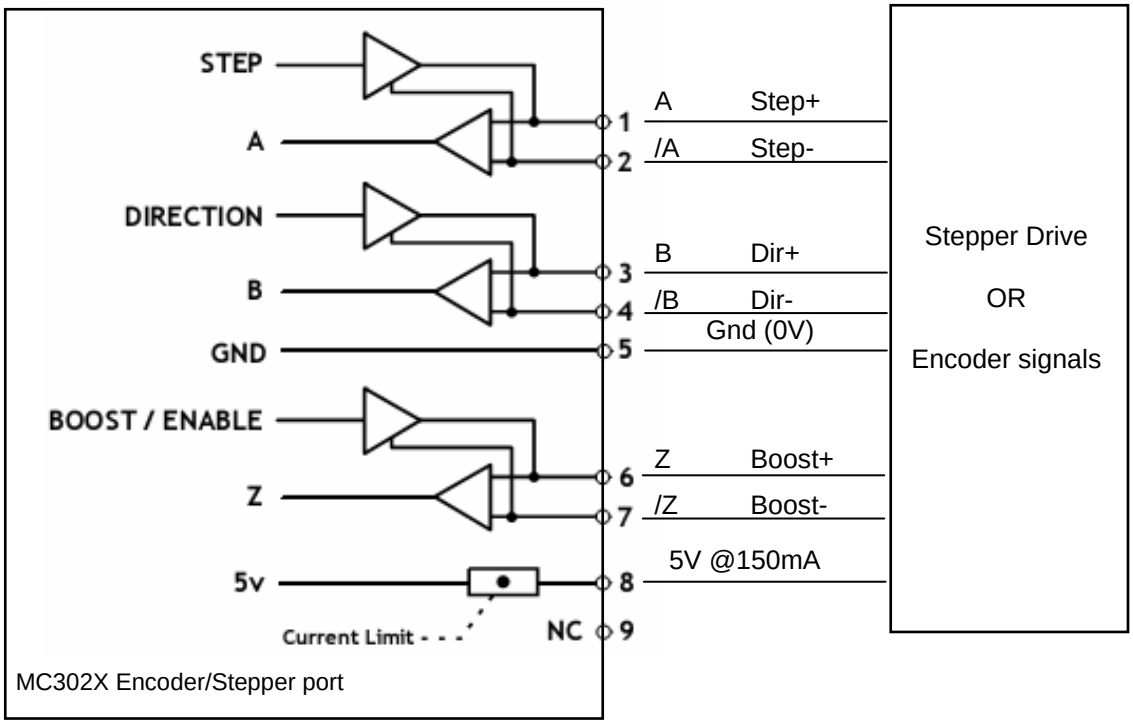
[1] User connects to either RS232 or RS485/422 pins, but not both. Both addressed as PORT1 in programs.

[2] Use care when setting Modbus operation on PORT0. This port is the main programming port for the MC320X via Motion Perfect PC software. If PORT0 is set for Modbus using an auto-start program, it is possible to abort the auto-boot process to get control of the port again. To do so, with the serial lead connected to the MC302X and Motion Perfect PC software running, open the "Channel 0" terminal window utility. Cycle the 24V power to the MC302X. The controller boot up messages will begin to appear in the Channel 0 Terminal window. While the MC302X is booting press the "Q" key several times to quit any autorun programs. Connect to the controller as normal using Motion Perfect PC software.

MC302X Encoder Input/Output and Stepper Output Ports

The MC302X controller is designed to support several combinations of functions from the standard hardware. The two 9-pin d-shell connectors are default set for “Servo”, Axis(0), and “Encoder input”, Axis(1). This is for closed-loop servo operation with encoder follower capability. By setting the parameter ATYPE=1, the ports can set for stepper operation according to the users requirements. If the axis is setup as a servo, the connector will provide the encoder input. If the axis is configured as a stepper, the connector provides differential outputs for step/direction and boost/enable signals. The encoder port also provides a current-limited 5v output capable of powering most encoders. This simplifies wiring and eliminates external power supplies. An additional feature in the MC302X is the ability to output simulated encoder signals, ATYPE=14. This can be used for synchronizing multiple units for gearing.





MC302X Encoder/Stepper port

MC302X Axis Configuration

The two 9-pin D-shell connectors on the MC302X can be configured in multiple control modes as standard firmware features. No additional hardware or software is required. The Trio BASIC parameter ATYPE is used to configure the axes.

Standard Axes Configuration

Axes 0 and 1 can be set for Servo, Stepper, or Encoder operation modes using ATYPE parameter.

Pin	Axis 0			Axis 1	
	Servo *	**Stepper**	**Encoder**	**Encoder ***	**Stepper**
	ATYPE=2	ATYPE=1	ATYPE=3	ATYPE=3	ATYPE=1
1	Enc A	Step +	Enc A	Enc A	Step +
2	Enc /A	Step -	Enc /A	Enc /A	Step -
3	Enc B	Direction +	Enc B	Enc B	Direction +
4	Enc /B	Direction -	Enc /B	Enc /B	Direction -
5	GND	GND	GND	GND	GND
6	Enc Z	Boost +	Enc Z	Enc Z	Boost +
7	Enc /Z	Boost -	Enc /Z	Enc /Z	Boost -
8	5V	5V	5V	5V	5V

* Default configuration

Alternate Axes Configuration

Stepper+Encoder - Axis 0

(2) Stepper Axes and (1) Encoder input - ATPYE=46

Pin	Axis 0	Axis 1
1	Step_0 +	Step_1 +
2	Step_0 -	Step_1 -
3	Direction_0 +	Direction_1 +
4	Direction_0 -	Direction_1 -
5	GND	GND
6	Enc A0	Enc B0
7	Enc /A0	Enc /B0
8	5V	5V

Stepper+Encoder - Axis 1

(1) Stepper Axis and (2) Encoder inputs - ATYPE=46

Pin	Axis 0	Axis 1
1	Enc A0	Enc A1
2	Enc /A0	Enc /A1
3	Enc B0	Enc B1
4	Enc /B0	Enc /B1
5	GND	GND
6	Step_1 +	Direction_1 +
7	Step_1 -	Direction_1 -
8	5V	5V

Stepper with Registration

Internally loops the axis own Step/Dir to its encoder input for registration facilities- ATYPE=4

Pin	Stepper Axis VERIFY=0FF	(Internally mapped)
1	Step + →	Enc A
2	Step - →	Enc /A
3	Direction + →	Enc B
4	Direction - →	Enc /B
5	GND	GND
6	Boost +	Enc Z
7	Boost -	Enc /Z
8	5V	5V

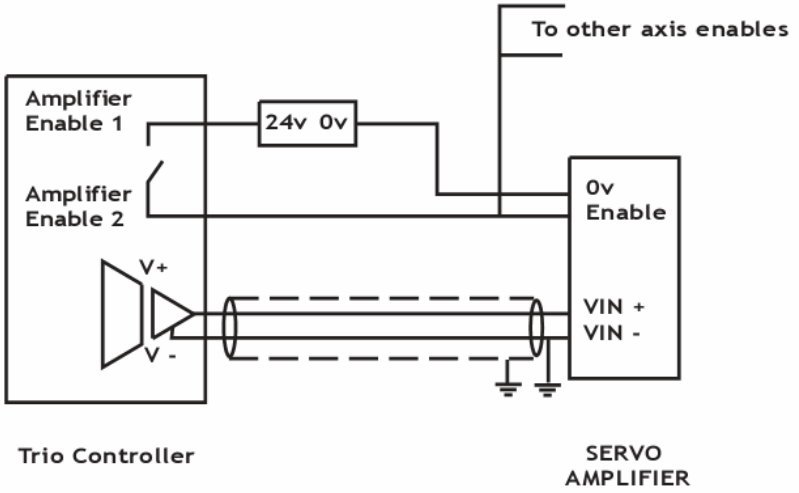
Simulated Encoder Output

Sets an axis to output a simulated quadrature encoder signal - ATYPE=14

Pin	Axis 0 or 1
1	Enc A
2	Enc /A
3	Enc B
4	Enc /B
5	GND
6	NC
7	NC
8	5V

Amplifer Enable (Watchdog) and Analog Command Output

An internal solid-state 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 solid-state relay with bi-directional polarity to mimic 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 hold-up circuit or chain that must be intact before a 3-phase power input is made live.



Amplifier Enable Output

MC302X Feature Summary

Size (mm)	94w x 56d x 105h Overall
Weight	200 g
Operating Temperature	0 - 45 degrees C
Control Inputs	Forward Limit, Reverse Limit, Datum Input, Feedhold Input.
Communication Ports	1 RS232 Channel: 38400 baud (default). 1 RS232 or RS485 serial port, 9600 (default) or 19200 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 3 simultaneous Trio BASIC programs.
Speed Resolution	32 bit. Speed may be changed at any time. Moves may be merged.
Servo Cycle	250us, 500us, 1ms (default)
Memory	512 Kbytes flash user program memory.
Power Input	24V dc, Class 2 transformer or power source. 18 ... 29Vdc at 40mA.
Drive Enable Output	Normally open solid state relay 24Vdc @ 0.1A.
+/-10volt DAC Output	16 bit resolution, single channel on axis 0 only
Encoder Inputs	2 axes, Differential 5v inputs, 6MHz maximum edge rate *(MC302X can generate 150mA at 5v for encoder power supplies)
Stepper Outputs	2 axes. Step & Direction: 5V Differential Line Driver, 2MHz max.
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