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RMC70 Series

One- and Two-Axis Motion Controllers

DATASHEET



The RMC70 Base module includes CPU, communications, and one or two motion axes. Up to four Expansion modules can be added (e.g. analog inputs and DI/O).

The RMC70 Series motion controllers offer a valuable combination of performance and ease-of-use for one- and two-axis systems.

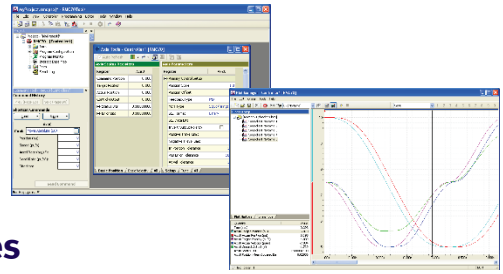
With powerful control modes–including dual-loop position-pressure algorithms–and multiple feedback types, the RMC70 Series provides optimum control to a wide range of hydraulic, electric, and pneumatic position and position–pressure/force applications.

Communications with popular PLCs and HMIs is efficient, with support for numerous protocols, easy-to-use address mapping features, and mirroring of PLC addressing. Time-critical sequences can be offloaded from the PLC into the RMC70's flexible User Programs.

A full set of motion parameters, including acceleration and velocity feed forwards and separate directional gains, delivers smooth, precise motion to boost throughput, improve quality, and extend machine life.

Command-based programming speeds development, and reduces long-term software maintenance. Advanced graphing and diagnostic capabilities can be used to troubleshoot the entire motion system. RMCTools software with informative help is downloadable from deltamotion.com.

The RMC70 Series is backed by a company legacy of more than 30 years of excellent product support. Responsive 24/7 customer service is just a telephone call away.



Features

Setup and Programming

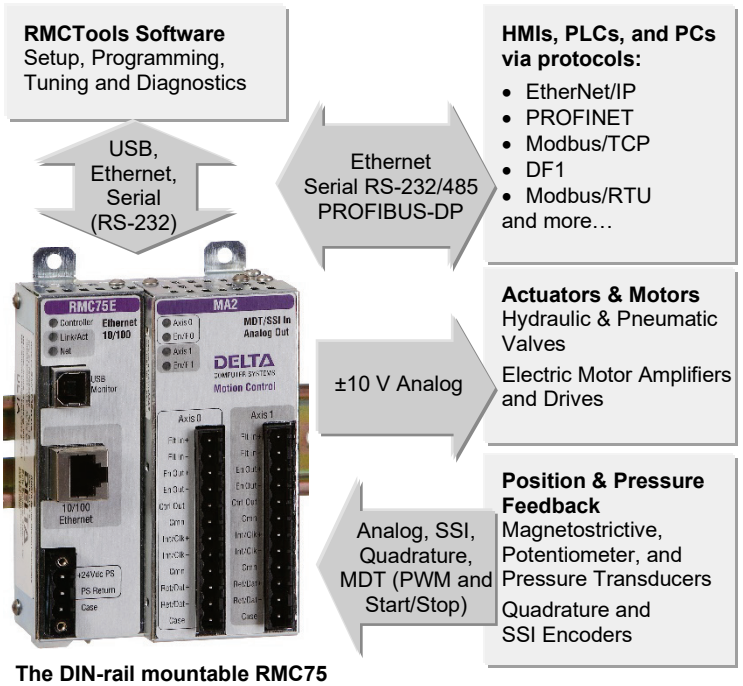
- Command-based—minimal program development and maintenance
- Flexible User Programs—advanced step sequencer with user-named variables and mathematical expressions
- Extensive, context–sensitive online help

Control Algorithms

- Position, velocity, pressure, force, position–pressure, position–force, velocity–pressure, velocity–force, active damping
- Full parameter set supports high performance motion control

Tuning and Diagnostics

- Powerful motion graphing and event logging for optimizing the entire motion system
- Event Log shows real-time activity



The DIN-rail mountable RMC75 Base module is just 3.22" x 5.00"

DELTA COMPUTER SYSTEMS

RMC70 Series Ordering Information

RMC70 Series Part Numbers

RMC70 Base Module

RMC75E-MA1

CPU Module

- **RMC75E** = RMC75 with Ethernet communications and USB monitor port ..... p. 6
- **RMC75P** = RMC75 with PROFIBUS-DP communications and RS-232 monitor port..... p. 6
- **RMC75S** = RMC75 with serial RS-232/485 communications and RS-232 monitor port p.7

Axis Module

- **AA1** = Analog input (±10 V or 4-20 mA), ±10 V analog control output, 1 axis..... p.9
- **AA2** = Analog input (±10 V or 4-20 mA), ±10 V analog control output, 2 axes..... p.9
- **MA1**= Magnetostrictive (Start/Stop, PWM) or SSI input, ±10 V analog control output, 1 axis.. p.10
- **MA2**= Magnetostrictive (Start/Stop, PWM) or SSI input, ±10 V analog control output, 2 axes . p.10
- **QA1** = Quadrature encoder input (5 V differential), ±10 V analog control output, 1 axis..... p.11
- **QA2** = Quadrature encoder input (5 V differential), ±10 V analog control output, 2 axes..... p.11

RMC70 Expansion Modules

EXP70-AP2

Expansion Module

- **A2** = 2 analog reference inputs (±10 V or 4-20 mA) p.13
- **AP2** = 2 analog inputs (±10 V or 4-20 mA) for position-pressure and position-force control.... p.13
- **D8** = 8 discrete I/O, 12-24 VDC, software configurable p.14
- **Q1** = ½–axis quadrature reference input (5 V differential) p.15

Accessories and More

Mounting Dimensions ..... p. 18
Voltage-to-Current Converters..... p. 19
USB-to-Serial Cable..... p. 19
Cable Assemblies ..... p. 19
Terminal Blocks ..... p. 19

Example Part Numbers

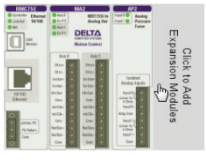
RMC75E-MA2
Ethernet communications with 2 axes of magnetostrictive (Start/Stop or PWM) or SSI feedback.

RMC75P-QA1
PROFIBUS communications with 1 axis of quadrature encoder feedback.

EXP70-D8
8 discrete I/O

Online Configuration Tool

Create your own RMC70 controller and request a quote!
Go to Delta's website at www.deltamotion.com and choose **Request a Quote Online**.



Company Profile

Delta Computer Systems, Inc. manufactures motion controllers, color sensors, and other industrial controls providing high-performance automation solutions to a wide range of industries.

Software

RMCTools

Setup, Tuning, Programming and Diagnostics Software

RMCTools is a powerful motion control software package for setting up, tuning, troubleshooting, programming and controlling all features of Delta's RMC70 and RMC150 motion controller from a PC.

RMCTools communicates with the RMC70 via USB, Ethernet, or serial RS-232. The method of connection depends on the RMC70 CPU module. See the CPU section of the datasheet.

RMCTools is available for download from www.deltamotion.com.

Supported Operating Systems:
Windows® 7/8.1/10

RMCLink

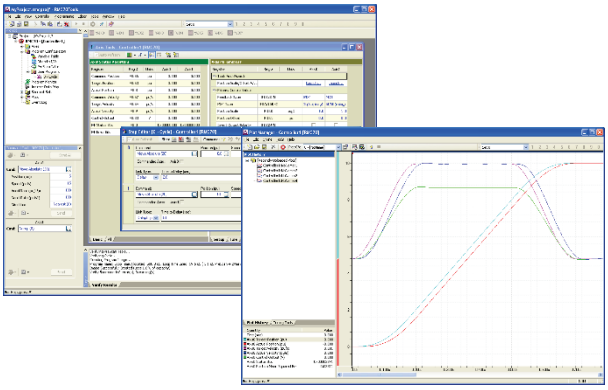
The RMCLink ActiveX Control and .NET Assembly enables full serial RS-232 or Ethernet communications from Windows-based PCs to the RMC70. RMCLink supports many languages, such as Visual Basic, C++, C#, VBScript, VBA (Microsoft® Excel, etc.).

RMCLink comes with sample projects to help you get started quickly. The help includes detailed walk-throughs and code snippets.

RMCLink is available for download from www.deltamotion.com.

Drivers for LabVIEW™

VIs created by Delta for use with LabVIEW™ software provide full-fledged examples including plot uploading and trending. The VIs are available from the Instrument Driver portion of National Instruments' website and from www.deltamotion.com.



RMCTools Features

Setup

- **Wizards**
  Easy-to-use wizards include New Project, New Controller, Scale & Offset, and Autotuning.
- **Full Parameter Set**
  Monitor all axis status registers and modify parameters.

Tuning and Diagnostics

- **Plots**
  Plot any register in the RMC70, up to 16 registers per plot, sampled as fine as the control loop resolution.
- **Autotuning Wizard**
  Quickly and accurately tune your axes, using a slider bar to choose from a range of gains appropriate for your system.
- **Event Log**
  Speed troubleshooting by recording events such as parameter changes, commands, errors, and communications.
- **Program Monitor**
  Monitor User Program execution and variables.

Programming

- **Commands**
  Issue commands directly from RMCTools. Use Command Shortcut Sets to quickly issue commands to speed the tuning process.
- **User Programs**
  Easily create programs to issue sequences of commands.
- **Program Triggers**
  Start user programs automatically based on user-defined events such as discrete inputs, error conditions, etc.
- **Mathematical Expressions**
  Expressions provide flexible programming capability for advanced calculations and machine control sequences.

RMC70 Control Features

The RMC70 provides an extensive set of motion commands and programming capability for quick and easy yet flexible motion control for virtually every motion application.

Control Modes

- **Closed Loop Control**
  Full PID loop control with velocity, acceleration and jerk feed forwards for precise synchronized motion. Directional gain factors support fluid power control.
- **Position Control**
  - Point-to-Point moves
  - S-curves
  - Speed at Position
  - Gearing
  - Cyclic Sinusoidal Motion
  - Splines, Cams
  - Rotary motion (incremental and absolute)
- **Velocity Control**
  - Velocity control with position feedback
  - Velocity control with velocity feedback
- **Pressure and Force Control**
  - Pressure sensor, load cell or differential force
  - Linear or S-curve Ramps
  - Gearing
  - Cyclic Sinusoidal Profile
  - Splines, Cams
- **Position-Pressure and Position-Force Control**
  - Transition seamlessly between position control and pressure or force control.
  - Pressure or Force Limit – limit the pressure or force during a position or velocity move.
- **Active Damping**
  For high-performance control of pneumatics and difficult systems.
- **Open Loop Control**
  Seamless transition from open loop to closed loop. Ramp Control Output between two values, or ramp based on position for hard-to-control systems.
- **Quick Move**
  Move in open loop and stop in closed loop for fast, smooth motion with accurate stops.
- **Valve Linearization**
  For valves with a sharp knee or “kink” in the flow versus command signal diagram.
- **Custom Feedback**
  Control using any calculated value as feedback.
  - Sum, difference, average, etc.
  - Switch feedback on-the-fly
  - Redundant feedback
  - Feedback linearization

High-level Programming

- **User Programs**
  Programs are easy-to-understand sequences of commands. Run multiple programs simultaneously to handle axis commands and machine control functions.
- **Program Triggers**
  Start user programs automatically based on user-defined events such as discrete inputs, error conditions, etc.
- **Variables**
  Recipes and other user parameters can be stored for use by user programs.
- **Mathematical Expressions**
  Expressions provide flexible programming capability for advanced calculations and machine control sequences.

Troubleshooting and Monitoring

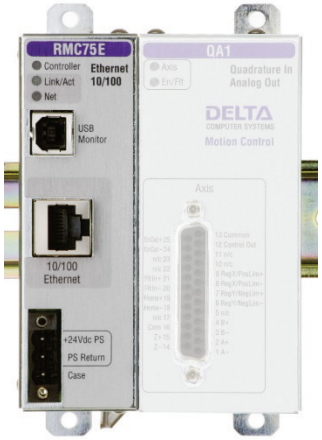
- **Plots**
  Plot any register in the RMC70, up to 16 registers per plot, sampled down to the control loop resolution.
- **Event Log**
  Speeds troubleshooting by recording events such as parameter changes, commands, errors, and communications.

Fault Handling

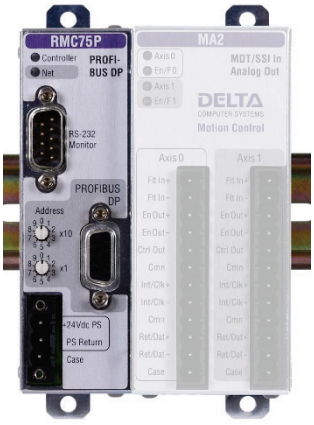
- **Closed Loop stops**
  Ramp speed to zero at specified rate and hold position.
- **Open Loop stops**
  Ramp output voltage to zero at specified rate.
- **Multi-axis (group) stops**
  A fault on one axis halts multiple axes when configured as a group.
- **AutoStops**
  The response of axes to each fault type is easily configurable.

RMC70 Base Module: CPU Choices

The RMC70 CPU portion of the Base module contains the communications and the central processing unit. The initial CPU offering is the RMC75 with support for one or two axes of motion, up to four Expansion modules, and Delta's easy-to-use Step Editor for user programs. The RMC75 CPU modules differ only in the communication type. In addition to the power input and primary communications port, each RMC70 CPU module contains a Monitor Port intended for communication with RMCTools. On the RMC75E, this is a USB port. The RMC75E can also connect to RMCTools via Ethernet. On the RMC75P and RMC75S CPU modules, the Monitor Port is an RS-232 serial port.



RMC75E CPU Module



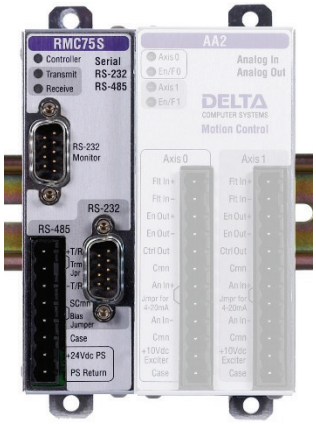
RMC75P CPU Module

Available CPU Modules

Part Number	Primary Communication Type	Monitor Port
RMC75E	Ethernet	USB
RMC75P	PROFIBUS-DP	Serial (RS-232)
RMC75S	Serial (RS-232/485)	Serial (RS-232)

Specifications Common to all Base Modules

Motion Loop Time	
Control loop time	User-selectable: RMC75E: 0.25 to 4 ms RMC75S/P: 0.5 to 4 ms
Power	
Voltage	+24 VDC ±20%
Current – Base module	Typ. 200 mA @ 24 VDC, max 375 mA
with 4 Expansion modules	Typ. 350 mA @ 24 VDC, max 500 mA
DC-DC converter isolation	500 VAC input to controller
Mechanical	
Mounting	Symmetrical DIN 3 or panel-mount
Dimensions – Base module	3.22 x 5.0 x 2.75 in (WxHxD) (8.3 x 12.7 x 6.4 cm)
with 4 Expansion modules	up to 9.22 x 5.0 x 2.75 in, width varies (23.4 x 12.7 x 6.4 cm)
Weight – Base module	Up to 0 lb 12 oz (0.4 kg)
with 4 Expansion modules	Up to 2 lb 0oz (0.9 kg)
Environment	
Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	UL, CUL, CE



RMC75S CPU Module

RMC75E – Ethernet Communication

The RMC75E provides the processing power of the RMC75 series motion controllers and includes Ethernet communications. The RMC75E has a USB Monitor port for convenient connection to a PC running RMCTools (the RMC75S and RMC75P use an RS-232 serial port for the same purpose). The RMC75E can also connect to RMCTools via Ethernet.

The RMC75E supports auto-negotiation for 10/100 Mbps and full/half duplex and also supports auto-crossover detection.

Supported protocols include:

- EtherNet/IP
- PROFINET
- Modbus/TCP
- CSP (DF1 over Ethernet)
- FINS (Omron)
- Procedure Exist (Mitsubishi Q-series)

RMC75P – PROFIBUS-DP Communication

PROFIBUS is a vendor-independent, open fieldbus designed especially for communicating between programmable controllers and distributed I/O such as the RMC70 Series motion controller. Up to 126 nodes can be connected to a single network.

The RMC75P module supports data rates up to 12 Mbaud, permitting high-speed on-the-fly downloads of positions, parameters, and commands to the RMC75 and high-speed uploads of motion profile and status information to the host controller. The RMC75P PROFIBUS-DP interface gives the flexibility of several operating modes. Select the mode that best fits your application and PROFIBUS-DP master's capabilities.

Tip: If your PC does not have a serial port, use the USB-to-serial cable listed on page 19 for setting up the RMC75P.

RMC75E Specifications

Ethernet Interface	
Hardware interface	IEEE 802.3 for 100BASE-T (twisted pair)
Data Rate	10/100 Mbps
Duplex	Full/Half-Duplex
Features	Auto-negotiation, Auto-crossover (MDI/MDI-X)
Connector	RJ-45
Cable	CAT5, CAT5e or CAT6, UTP or STP
Configuration	
Configuration parameters	IP address, subnet mask, gateway address, enable/disable auto-negotiation
Configuration methods	BOOTP or manually using RMCTools
Protocol Support	
Framing protocol	Ethernet II
Internet protocol	IP (includes ICMP, ARP, and Address Collision Detection)
Transport protocols	TCP, UDP
Application protocols	Modbus/TCP, CSP, EtherNet/IP, PROFINET, Omron FINS, Procedure Exist (Mitsubishi Q-series) (Call Delta for availability of other protocols)
USB Monitor Port	
Connector	USB "B" receptacle
Data Rate	Full-speed (12 Mbps)

RMC75P Specifications

PROFIBUS-DP Interface	
Data rate	9.6 kbaud up to 12 Mbaud
Isolation	2500 VAC
Ident. Number	0x07E1
Features supported	Sync mode, freeze mode, auto baud rate detect
Valid station addresses	0-99 (set by rotary switches on faceplate)
Connector	
PROFIBUS-DP connector	Standard PROFIBUS-DP DB-9 (use termination in cable connectors as per PROFIBUS specification)
RS-232 Monitor Port	
Connector	DB-9 Male
Cable	Null modem
Protocol	Allen-Bradley DF1 Full-Duplex, with CRC error detection
Settings	38400 baud, 8 data bits, no parity, 1 stop bit, no handshaking

RMC75S – Serial Communication

The RMC75S combines multiple communication protocols with RS-232 and RS-485 transceiver options to form a versatile and industrial-hardened communication platform. The RS-232 option provides full-duplex point-to-point communications, while RS-485 allows half-duplex multi-drop networking with up to 127 RMC70s.

Due to limited throughput of serial communications, the RMC75S is best suited for applications where time-critical machine control functions related to motion are implemented in the RMC75S using the RMC70 User Programs. The serial communications works well for low-bandwidth monitoring or modifications to the RMC75S parameters or User Program variables. In applications where higher throughput is necessary, consider one of Delta's other RMC70 CPU/Communications choices.

Tip: If your PC does not have a serial port, use the USB-to-serial cable listed on page 19 for setting up the RMC75S.

RMC75S Specifications

Protocol Support	
Allen-Bradley DF1 (full- and half-duplex)	Supported by Allen-Bradley PLCs and other products
Modbus/RTU	Supported by Modicon PLCs and other products
Bidirectional Protocol	Supported by Mitsubishi Q-series
Serial Interface	
Transceivers	RS-232 or RS-485, user selectable
Baud rates	9600, 19200, 38400, 57600, 115200 baud
Protocol options	Data length: 8 bits Parity: none, odd, or even Stop bits: 1 or 2 Flow control: none or hardware (CTS/RTS)
Isolation	500 VAC
Electrostatic Discharge (ESD) protection	15 kV
RS-232 Interface	
Type	Single-ended RS-232
Connector	DB-9
Communication distance	50 ft (12 m)
Network type	Point-to-Point
RS-485 Interface	
Type	Differential RS-485
Connector	Unpluggable Terminal Block
Communication distance	4000 ft (1200 m)
Network type	Point-to-Point or Multi-drop up to 128 nodes
RS-485 input impedance	48 kΩ (1/4 unit load)
Biasing	User selectable
Termination	120 Ω user selectable
RS-232 Monitor Port	
Connector	DB-9 Male
Cable	Null modem
Protocol	Allen-Bradley DF1 Full-Duplex, with CRC error detection
Settings	38400 baud, 8 data bits, no parity, 1 stop bit, no handshaking

RMC70 Base Module: Axis Choices

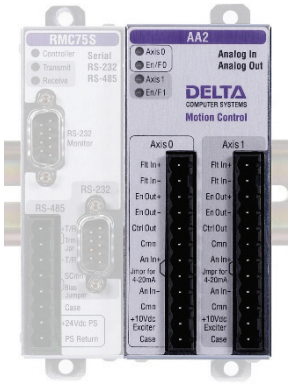
One- and Two-Axis Actuator and Feedback Interfaces

The Axis module portion of the Base module holds the actuator and feedback interfaces of the RMC70 Series motion controller.

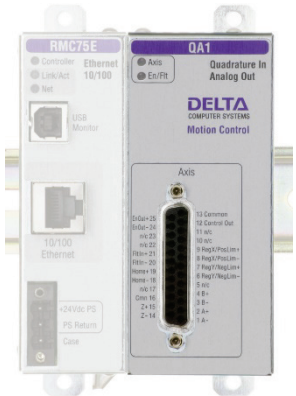
Each factory-installed Axis module is available with one or two control axis interfaces.



MA1 Axis Module



AA2 Axis Module



QA1 Axis Module

Axis Modules	AA1	AA2	MA1	MA2	QA1	QA2
Axes	1	2	1	2	1	2
Feedback Interface*	Analog (16 bits), ±10 V or 4-20 mA		MDT (Start/Stop or PWM), SSI		Quadrature Encoder (A, B, Z) 5 V diff.	
Control Output*	Analog: ±10 V, 5 mA max, 16-bit **					
Fault Input*	Optically-isolated discrete input, 12-24 VDC					
Enable Output*	Optically-isolated SSR output, 12-24 V					

* One per axis

** Use Delta's VC2124 voltage-to-current converter to provide a current output. The VC2124 output range is adjustable from ±10 mA to ±200 mA in 10 mA steps.

Specifications Common to all Axis Modules

General	
Electrostatic Discharge (ESD) protection	15kV
Fault Input	
Input type	12-24 VDC; sinking (sourcing driver)
Logic polarity	User selectable to Active Input "High" or Active Input "Low"
Isolation	500 VAC
Input "High" range	7 to 26.4 VDC (polarity independent), 3 mA maximum
Input "Low" range	0 to 3.5 VDC (polarity independent), <1 mA
Maximum propagation delay	100 µsec
Enable Output	
Output type	Solid State Relay
Logic polarity	User selectable to Active Open or Active Closed
Isolation	500 VAC
Rated voltage	12-24 V, max ±30 V (DC or peak AC voltage)
Maximum current	±75 mA
Maximum propagation delay	2.0 ms
Closed	Low impedance (50 Ω maximum)
Open	High impedance (<1 µA leakage current at 250 V)
Environment	
Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	UL, CUL, CE
Power Requirements	
All Axis modules are powered from the RMC70 controller	The user must supply power to the transducers. Refer to the manufacturer's specifications for the transducer power requirements.

AA1 and AA2

The AA1 and AA2 Axis modules generate analog control outputs and interface to position or pressure feedback transducers with the following characteristics:

- **Voltage:** ±10 V
- **Current:** 4-20 mA

The AA1 and the AA2 modules control one and two axes respectively. Each axis may be independently configured for interface to a voltage-output or current-output transducer. Each axis has an isolated 12-24 VDC discrete Fault Input, and an isolated 12-24 V SSR Enable Output.

AA*x* modules can be used for position or pressure/force control. Position–pressure or position–force control requires the AP2 expansion module.

AA1 and AA2 Specifications

Control Output	
Output	±10 V, 5 mA maximum, 16-bit
Analog Interface	
Inputs	One 16-bit input per axis
Overvoltage protection	±40 V
Input ranges	±10 V and 4-20 mA (each axis independently configured)
Input impedance	5 MΩ
Input filter slew rate	25 V/ms (100 mA/ms)
Oversampling	8 times per control loop
Effective Resolution	19-bit over full ±10 V range (18-bit for 0-10 V and ±5 V, 17 bit for 0-5 V) 16-bit for 4-20 mA
Offset drift with temperature	0.2 LSB/°C typical
Gain drift with temperature	20 ppm/°C typical
Non-linearity	12 LSB (counts) typical
Exciter Output	10 VDC ± 2%, 8 mA maximum
Discrete I/O*	
Fault Input	Optically-isolated discrete input, 12-24 VDC
Enable Output	Optically-isolated SSR output, 12-24 V, max ±30 V (DC or peak AC voltage)

* See Axis Common Specification for details

MA1 and MA2

The MA1 and MA2 Axis modules generate analog control outputs and interface to position feedback transducers with the following characteristics:

- **Magnetostrictive Displacement Transducer (MDT):**
  RS-422 Pulse Width Modulated (PWM) or Start/Stop, with programmable edge response
- **Synchronous Serial Interface (SSI):**
  MDT, or single- or multi-turn absolute encoders with the SSI interface
  Note: Linear MDTs with SSI output should be of the synchronized type. Non-synchronized is not well-suited for motion control.

The MA1 and MA2 Axis modules control one and two axes respectively. Each axis has a 16-bit, ±10 V analog Control Output, an isolated 12-24 VDC discrete Fault Input, and an isolated 12-24 V SSR Enable Output. Each axis may be independently configured for interface to either an MDT or SSI transducer.

MA*x* modules can be used for position control. Position–pressure or position–force control requires the AP2 expansion module.

MA1 and MA2 Specifications

Control Output	
Output	±10 V, 5 mA maximum, 16-bit
MDT Interface	
Transducer types	MDT with Start/Stop or PWM (Pulse Width Modulated) feedback
Return input	RS-422 differential
Interrogation output	RS-422 differential (External interrogation transducers are required for motion control)
Resolution	0.0005” with 1 recirculation
Recirculations	Supports multiple recirculations only for PWM transducers with internal recirculations.
Maximum transducer length	440” at 4ms (loop time dependent)
Count rate	240 MHz
SSI Interface	
Transducer types	MDT, single-turn or multi-turn absolute encoders **Note:** Linear MDTs with SSI output should be of the synchronized type. Non-synchronized is not well-suited for motion control.
Motion Type	Linear or Rotary
Data input	RS-422 differential
Clock output	RS-422 differential
Clock frequency	150 kHz, 250 kHz, or 375 kHz, user-selectable
Resolution	Transducer dependent (typically down to 2 µm or approximately 0.00008” for MDTs)
Count encoding	Binary or Gray Code
Count data length	4 to 32 bits
Discrete I/O*	
Fault Input	Optically-isolated discrete input, 12-24 VDC
Enable Output	Optically-isolated SSR output, 12-24 V, max ±30 V (DC or peak AC voltage)
Cable Requirements	
Maximum SSI cable length	230-1000 ft (70-300 m) dependent on transducer and clock frequency
Cable type	Twisted pair, shielded, low capacitance

* See Axis Common Specification for details

QA1 and QA2

The QA1 and QA2 axis modules, with 5 V differential (RS-422) quadrature inputs and analog ±10 V control outputs, allow cost-effective control of a wide variety of electric drives as well as electric and hydraulic servo motors.

The QA1 and QA2 axis modules generate analog control outputs and interface to quadrature encoders with 5 V differential (RS-422) signals. Additional high-speed inputs allow for homing, registration, or positive and negative limits on a per axis basis.

The QA1 and the QA2 modules control one and two axes respectively. QA*x* modules can be used for position control. Position–pressure or position–force control requires the AP2 Expansion module.

Take advantage of the RMC70's superior tuning and diagnostics by operating drives and amplifiers in their simplest mode, thereby transferring control to the RMC70. Doing this can lower long term maintenance costs by avoiding obsolescence issues common to many smart drives.

Cables

Cables for the QA modules are available for purchase from Delta. See page 19 for details.

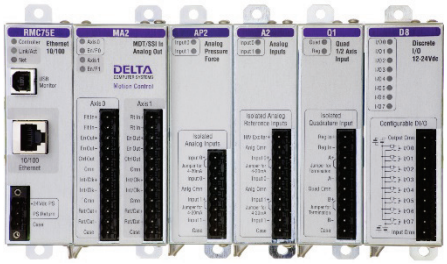
QA1 and QA2 Specifications

Control Output	
Output	±10 V, 5 mA maximum, 16-bit
Quadrature Interface (per Axis)	
Inputs	per axis: 5 V differential (RS-422) receiver for A, B, and Z signals (Single-ended encoders are not supported due to low noise immunity)
Input impedance	215 Ω
Max Encoder Frequency	8,000,000 quadrature counts/second
High-Speed Registration and Home Inputs	
High-Speed Inputs	per axis: 1 Home Input 1 Registration X or Positive Limit Input 1 Registration Y or Negative Limit Input
Input "High" range	7 to 26.4 VDC (polarity independent), 3 mA maximum
Input "Low" range	0 to 3.5 VDC (polarity independent), <1 mA
Response Time	40 μs
General Discrete I/O*	
Fault Input	Optically-isolated discrete input, 12-24 VDC
Enable Output	Optically-isolated SSR output, 12-24 V, max ±30 V (DC or peak AC voltage)

* See Axis Common Specification for details

Exp70 Expansion Modules

For use with RMC70 Series Motion Controllers



Up to four Expansion modules (Exp70) can be added to an RMC70 motion controller to bring additional capabilities to the controller. The Exp70-A2 adds analog reference inputs, and the Exp70-AP2 adds analog inputs intended for use as pressure/force inputs as part of Delta's powerful position–pressure/force control feature. The Exp70-D8 module adds discrete I/O functionality, and the Exp70-Q1 adds a ½–axis quadrature encoder input allowing multiple RMC70s to be electronically geared to a common master axis.

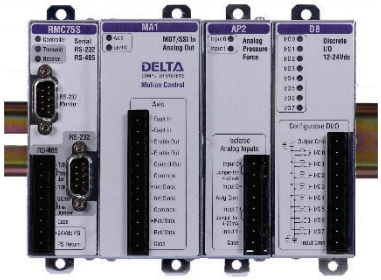
RMC70 Series motion controllers consist of a factory-configured Base module with one or two control axes, plus up to four field-installable Expansion modules. Each Expansion module can be added quickly by simply plugging it into an open expansion connector and securing it with four screws. No backplane is required—the first Expansion module plugs on to the right side of the Base module, and each subsequent Expansion module plugs into the previous Expansion module. Each Exp70 module has its own din-rail locking lever so the entire assembly can be securely mounted. The assembly may also be panel mounted.

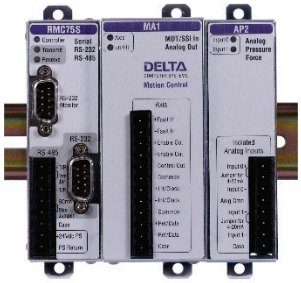
Available Expansion Modules

Order Number	Features
EXP70-A2	Two ±10 V or 4-20 mA differential analog reference inputs. Inputs are 16 bit resolution, and are optically isolated from the controller.
EXP70-AP2	Two ±10 V or 4-20 mA differential analog inputs for use in position–pressure/force control axes. Inputs are 16 bit, and are optically isolated from the controller.
EXP70-D8	Eight discrete I/O individually configurable for any combination of inputs or outputs. Inputs and outputs are 12-24 VDC rated, polarity independent, and optically isolated from controller.
EXP70-Q1	One 5 V differential (RS-422) quadrature encoder input (A and B) with selectable termination. The RMC70 supports up to two Q1 modules.

Specifications Common to Expansion Modules

Mechanical	
Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	UL, CUL, CE
Power Requirements	
All Expansion modules are powered from the RMC70	





Exp70-A2 Expansion Module



The A2 module adds two analog reference inputs for position, velocity, pressure or force (single-input or dual-input differential) feedback. The A2 interfaces to transducers with the following characteristics:

- **Voltage:** ±10 V
- **Current:** 4-20 mA

Each 16-bit input of the A2 can be individually configured to interface to voltage or current output transducers.

The A2 generates a 10 VDC exciter output, which eliminates a precision power source in some potentiometer applications. This low noise reference also provides the accuracy benefits of ratiometric tracking.

Exp70-AP2 Expansion Module



The AP2 module adds two analog inputs for pressure, force (single-input or dual-input differential), or acceleration feedback, and is required for control algorithms using two inputs, such as position–pressure, position–force, velocity–pressure, velocity–force, active damping, and acceleration control.

The AP2 interfaces to transducers with the following characteristics:

- **Voltage:** ±10 V
- **Current:** 4-20 mA

Each 16-bit input of the AP2 can be individually configured to interface to voltage or current output transducers.

The AP2 is required for dual-loop control, such as position–pressure or position–force.

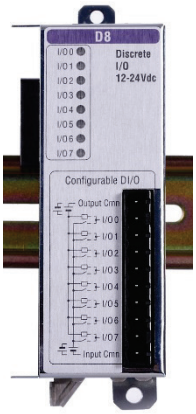
A2 Specifications

Analog Interface	
Inputs	Two 16-bit differential
Isolation	500 VAC
Overvoltage protection	±40 V
Input ranges	±10 V and 4-20 mA (each channel independently configured)
Input impedance	5 MΩ
Input filter slew rate	25 V/ms
Oversampling	8 times per control loop
Effective Resolution	19-bit over full ±10 V range (18-bit for 0-10 V and ±5 V, 17 bit for 0-5 V) 16-bit for 4-20 mA
Offset drift with temperature	0.2 LSB/°C typical
Gain drift with temperature	20 ppm/°C typical
Non-linearity	12 LSB (counts) typical over full 16-bit range
Exciter Output	10 VDC ± 2%, 8 mA

AP2 Specifications

Analog Interface	
Inputs	Two 16-bit differential
Isolation	500 VAC
Overvoltage protection	±40 V
Input ranges	±10 V and 4-20 mA (each channel independently configured)
Input impedance	5 MΩ
Input filter slew rate	25 V/ms
Oversampling	8 times per control loop
Effective Resolution	19-bit over full ±10 V range (18-bit for 0-10V and ±5 V, 17 bit for 0-5 V) 16-bit for 4-20 mA
Offset drift with temperature	0.2 LSB/°C typical
Gain drift with temperature	20 ppm/°C typical
Non-linearity	12 LSB (counts) typical over full 16-bit range

Exp70-D8 Expansion Module



The D8 adds eight discrete inputs or outputs rated for 12-24 VDC. Up to 32 I/O may be added if all four Expansion modules are D8s.

Each I/O can be individually configured in software as an input or output. Inputs and outputs are polarity independent. However, since there is just one input common and one output common, all inputs must be the same polarity, and all outputs must be the same polarity, but inputs need not be the same polarity as outputs. That is, outputs can switch high side or low side, and the inputs can be operated with either polarity signals.

Inputs and outputs are 12-24 VDC rated and optically isolated from the controller. Since all inputs share a common connection, there is no isolation between input points. Likewise, all outputs share a common pin and therefore do not have isolation between outputs.

The D8 can be used for the following purposes:

- Control discrete outputs from User Programs
- Control User Program flow based on discrete I/O state
- Start User Program tasks based on discrete inputs

D8 Specifications

Discrete I/O	
Inputs and Outputs	8; each is individually configurable as an input or output.
Groups	All inputs (up to 8) are in one group, and all outputs (up to 8) are in one group. Each group shares a common pin.
Inputs	
Input type	12-24 VDC; sinking (sourcing driver)
Logic polarity	True “High”
Isolation	500 VAC
Input “High” range	7 to 26.4 VDC (polarity independent), 3 mA maximum
Input “Low” range	0 to 3.5 VDC (polarity independent), <1 mA
Maximum propagation delay	100 µsec
Outputs	
Output type	Solid State Relay (SSR)
Isolation	500 VAC
Rated voltage	12-24 V, max ±30 V (DC or peak AC voltage)
Maximum current	±75 mA
Maximum propagation delay	2.0 ms
Logic 1 (True, On)	Low impedance (50 Ω maximum)
Logic 0 (False, Off)	High impedance (<1 µA leakage current at 250 V)

Exp70-Q1 Expansion Module



The Q1 module adds one 5V differential (RS-422) quadrature encoder reference input for position feedback. Inputs include quadrature A and B, plus one 12-24 VDC high-speed registration input.

The A and B inputs have selectable termination allowing up to 32 Exp70-Q1 modules to be daisy-chained with only the last input terminated. This allows up to 64 slave axes to be electronically geared to one master quadrature signal.

Q1 Specifications

Quadrature Encoder Interface	
Inputs	5 V RS-422 differential receiver Quadrature A, B (Single-ended encoders are not supported due to low noise immunity)
Input Impedance	16 kΩ unterminated 215 Ω terminated (selectable by jumpers)
Max Encoder Frequency	8,000,000 quadrature counts/sec
Daisy-Chaining	Daisy-chain one encoder to a maximum of 32 Q1 modules
High-Speed Registration Input	
Input “High” range	7 to 26.4 VDC (polarity independent), 3mA maximum
Input “Low” range	0 to 3.5 VDC (polarity independent), <1 mA
Reg Input Response Time	40 μsec

RMC70 Series Wiring

Note: For detailed wiring diagrams, see the RMC70 Startup Guide or the RMCTools help.

RMC75E CPU Module

Ethernet (RJ-45)

Twisted pair cable CAT5, CAT5e or CAT6, UTP or STP conforming to IEEE 802.3 for 100BASE-T must be used.

Power Terminal Block

Pin	Label	Function
1	+24Vdc PS	+24 VDC power
2	PS Return	Isolated power common
3	Case	Chassis ground

Monitor Port (USB "B" Connector)

Accepts a standard USB cable to communicate with a PC running RMCTools.

RMC75P CPU Module

PROFIBUS-DP

Standard PROFIBUS-DP cabling must be used.

Power Terminal Block

Pin	Label	Function
1	+24Vdc PS	+24 VDC power
2	PS Return	Isolated power common
3	Case	Chassis ground

Monitor Port

Accepts a null-modem DB-9 female-to-female cable to communicate with a PC running RMCTools.

RMC75S CPU Module

RS-232 (DB-9)

Pin	Function
2	Received data
3	Transmitted data
5	Serial common
7	Request to Send (RTS)
8	Clear to Send (CTS)

RS-485 Terminal Block

Pin	Label	Function
1	+ T/R	Tx/ Rx B (+)
2	Trm Jpr	Jumper to +T/R for termination
3	- T/R	Tx/ Rx A (-)
4	SCmn	Isolated serial common
5	Bias Jumper	Jumper to SCmn for bias
6	Case	Chassis ground

Power (shared connector with RS-485)

Pin	Label	Function
6	Case	Chassis ground
7	+24Vdc PS	+24 VDC power
8	PS Return	Isolated power common

Monitor Port

Accepts a null-modem DB-9 female-to-female cable to communicate with a PC running RMCTools.

MA*x* Axis Module

One connector per axis:

Pin	Label	Function	
1	+ Fault In	Fault Input (12-24 VDC)	
2	- Fault In		
3	+ Enable Out	Enable Output (12-24 VDC)	
4	- Enable Out		
5	Control Out	Control Output (±10 V)	
6	Common		
		MDT	**SSI**
7	+ Int/Clock	+ Interrogate	+ Clock
8	- Int/Clock	- Interrogate	- Clock
9	Common	Common	Common
10	+ Ret/Data	+ Return	+ Data
11	- Ret/Data	- Return	- Data
12	Case	Chassis ground	

Note: Pins 6 and 9 are electrically the same.

AA*x* Axis Module

One connector per axis:

Pin	Label	Function
1	+ Fault In	Fault Input (12-24 VDC)
2	- Fault In	
3	+ Enable Out	Enable Output (12-24 VDC)
4	- Enable Out	
5	Control Out	Control Output (±10 V)
6	Common	
7	+ Anlg In	Analog input (For 4-20 mA, jumper pins 7 and 8)
8	Jmpr for 4-20mA	
9	- Anlg In	
10	Common	Analog common
11	+ 10Vdc Exciter	Exciter output for use with potentiometers
12	Case	Chassis ground

Note: Pins 6 and 10 are electrically the same.

Note: For detailed wiring diagrams, see the RMC70 Startup Guide or the RMCTools help.

QA*x* Axis Module

One connector per axis:

Pin	Label	Function
1	A-	A- from encoder (5 V signal)
2	A+	A+ from encoder (5 V signal)
3	B-	B- from encoder (5 V signal)
4	B+	B+ from encoder (5 V signal)
5	n/c	No connection
6	RegY/NegLim-	Registration Y or Negative Limit (12-24 VDC)
7	RegY/NegLim+	
8	RegX/PosLim-	Registration X or Positive Limit (12-24 VDC)
9	RegX/PosLim+	
10	n/c	No connection
11	n/c	No connection
12	Control Out	Control Output (±10 V)
13	Common	
14	Z-	Index pulse from encoder (5 V signals)
15	Z+	
16	Cmn	Common
17	n/c	No connection
18	Home-	Home Input (12-24 VDC)
19	Home+	
20	- Fault In	Fault Input (12-24 VDC)
21	+ Fault In	
22	n/c	No connection
23	n/c	No connection
24	- Enable Out	Enable Output
25	+ Enable Out	

Note: Pins 13 and 16 are electrically the same.

Exp70-A2 Expansion Module

Pin	Label	Function
1	10V Exciter+	Exciter output for use with potentiometers
2	Anlg Cmn	Isolated analog common
3	Input 0+	Analog input 0 (For 4-20mA, jumper pins 3 and 4)
4	Jumper for 4-20mA	
5	Input 0-	
6	Anlg Cmn	Isolated analog common
7	Input 1+	Analog input 1 (For 4-20mA, jumper pins 7 and 8)
8	Jumper for 4-20mA	
9	Input 1-	
10	Case	Chassis Ground

Note: Pins 2 and 6 are electrically the same.

Exp70-AP2 Expansion Module

Pin	Label	Function
1	Input 0+	Analog input 0 (For 4-20 mA, jumper pins 1 and 2)
2	Jumper for 4-20mA	
3	Input 0-	
4	Anlg Cmn	Isolated analog common
5	Input 1+	Analog input 1 (For 4-20 mA, jumper pins 5 and 6)
6	Jumper for 4-20mA	
7	Input 1-	
8	Case	Chassis ground

Exp70-D8 Expansion Module

Pin	Label	Function
1	Output Cmn	Common to one side of all outputs
2	I/O 0	Input or output 0
3	I/O 1	Input or output 1
4	I/O 2	Input or output 2
5	I/O 3	Input or output 3
6	I/O 4	Input or output 4
7	I/O 5	Input or output 5
8	I/O 6	Input or output 6
9	I/O 7	Input or output 7
10	Input Cmn	Common to one side of all inputs

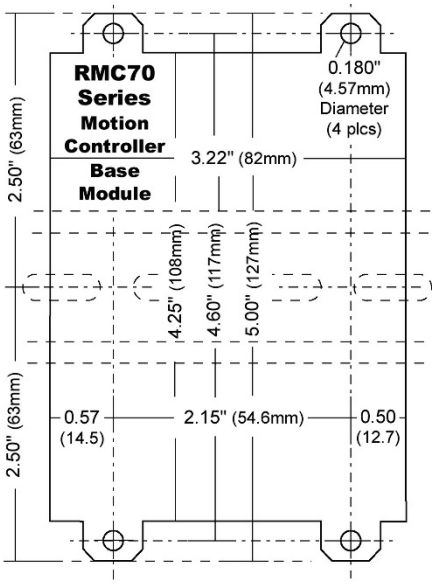
Exp70-Q1 Expansion Module

Pin	Label	Function
1	Reg In+	High-speed registration or home input
2	Reg In-	
3	A+	Encoder A Input (to enable termination, jumper pins 3 and 4*)
4	Jumper for Termination*	
5	A-	
6	Cmn	Common
7	B+	Encoder B Input (to enable termination, jumper pins 7 and 8*)
8	Jumper for Termination*	
9	B-	
10	Case	Chassis ground

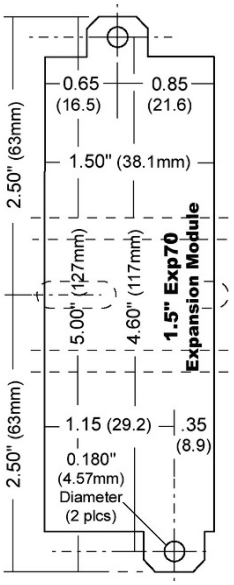
* Use either both jumpers or no jumpers

RMC70 Series Dimensions

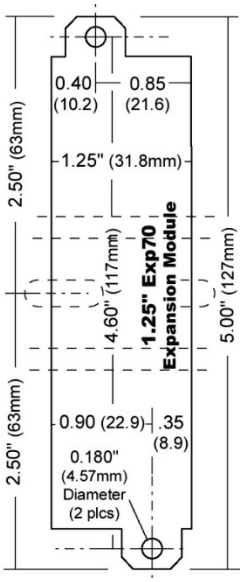
RMC70 Base Module Series Mounting Dimensions



D8 Mounting Dimensions



AP2, A2, Q1 Mounting Dimensions



Drawings are not at 1:1 scale.

Voltage-to-Current Converters

Delta's voltage-to-current converters are designed for converting a voltage drive output to a current drive output in order to control a servo valve. Delta offers several voltage-to-current converters to fit your needs. The maximum output current is adjustable in increments of 10 mA up to the maximum output current range.

Part Number	Description	Output Current Range*	Power Supply
VC2124	2-channel voltage-to-current converter	±100 mA per channel	24 VDC
VC2100	2-channel voltage-to-current converter	±100 mA per channel	±15 VDC
VC2100-HS	2-channel voltage-to-current converter – high speed**	±100 mA per channel	±15 VDC



VC2124



VC2100



VC2100-HS

* Channels can be connected in parallel to provide higher current. For example, two ±100 mA channels connected in parallel will provide ±200 mA.

** Most hydraulic control applications do not require the high-speed converter.

USB-to-Serial Cable for RMC75S and RMC75P

Setting up the RMC75S and RMC75P requires connecting a PC to the RMC's RS-232 serial port. For PCs with no serial port, Delta recommends the Startech ICUSB232FTN USB-to-serial cable. This 5.6 ft cable with built-in converter may be purchased from Delta. Part number: **RMC-CB-USB-SERIAL-01**

Cable Assemblies

Delta 's provides cable assemblies for certain products.

Cable Part No	Length	Cable Description
RMC-CB-QUAD-01-06	6 ft.	
RMC-CB-QUAD-01-10	10 ft.	Cable for QA module. 1 DB25 to 3 individual pig-tailed cables for drive, encoder, and limits.
RMC-CB-QUAD-01-15	15 ft.	
RMC-CB-QUAD-01-20	20 ft.	



Custom lengths are available per request. A drawing of RMC-CB-QUAD-01-xx is available on the Downloads page of Delta's website at www.deltamotion.com/dloads.

Terminal Blocks

All RMCs ship with screw-terminal connectors. Connectors are also available for order individually from Delta as listed below. These parts are also available from connector manufacturer Amphenol Pcd using these part numbers.

Connector Part No	Connector Description	For Modules
ELFT03260E (Amphenol Pcd)	3-pin terminal block with screw terminals	RMC75E, RMC75P
ELFT08260 (Amphenol Pcd)	8-pin terminal block with screw terminals	RMC75S, AP2
ELFT10260 (Amphenol Pcd)	10-pin terminal block with screw terminals	A2, D8
ELFT12260 (Amphenol Pcd)	12-pin terminal block with screw terminals	AA, MA



Spring-clamp terminal blocks are available from connector manufacturer Metz Connect, series ASP046.

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