

RMC150/151 DATASHEET

Two, Four, Six, and Eight Axis Motion Controllers

The RMC150/151 delivers high-performance motion control to hydraulic, electric servo, and pneumatic industrial applications. With powerful control modes—including dual-loop position-pressure algorithms—and connectivity to many transducer types, the RMC provides optimum control for a wide range of motion applications.

As Delta's most advanced motion controller, the RMC150/151 CPU module comes standard with Ethernet, supporting protocols such as EtherNet/IP, PROFINET, and Modbus/TCP, and is designed to integrate easily with your favorite PLCs, PCs and HMIs.

Equipped with excellent graphing features and easy-to-use wizards, the RMCTools software handles setup, programming, tuning and diagnostics for both the RMC150 and RMC70 series controllers.

Flexible Multi-axis Capability

Modules can be "mixed and matched" to support up to 8 control axes for tightly synchronized motion, and additional reference axes up to a total of 16 control, reference or virtual axes.

Feedback Types

- ▲ **Magnetostrictive Linear Displacement Transducer (MDT)**
RS-422 Start/Stop and PWM signals
- ▲ **Synchronous Serial Interface (SSI)**
Linear and single- or multi-turn rotary
- ▲ **Analog**
±10 V and 4-20 mA
- ▲ **Quadrature Encoder**
5 V differential only (RS-422)
- ▲ **Resolver**
Wide range of frequencies and ratios

Communications

- ▲ **Ethernet** (10/100 Mbps), built-in on CPU.
 - ▲ EtherNet/IP
 - ▲ PROFINET
 - ▲ Modbus/TCP
 - ▲ CSP (Allen-Bradley)
 - ▲ FINS (Omron)
 - ▲ Procedure Exist (Mitsubishi Q-series)
- ▲ **USB Port**
For use with the RMCTools software.
- ▲ **PROFIBUS-DP**



Industrial Applications

- ▲ Forest products
- ▲ Testing
- ▲ Metals
- ▲ Energy / Oil and gas
- ▲ Automotive
- ▲ Aerospace
- ▲ Plastics and rubber
- ▲ Entertainment
- ▲ Food processing
- ▲ Mining
- ▲ Petrochemical
- ▲ Textile

More application notes at deltamotion.com/applications.



Features

Axes

- ▲ Up to 8 control axes, including dual-loop position-pressure axes.

Controlled Quantities

- ▲ Position, velocity, acceleration, pressure, force, torque

Dual-Loop Control

- ▲ Position–pressure, position–force, velocity–pressure, velocity–force, position–torque, velocity–torque
- ▲ Seamless transition from position/velocity to pressure/force
- ▲ Position/velocity with pressure/force limit
- ▲ Cascade Loop

Motion Features

- ▲ Point-to-point motion
- ▲ Gearing
- ▲ Curves (Cams, Splines)
- ▲ Sinusoidal
- ▲ PID or I-PD
- ▲ Active Damping
- ▲ Full parameter set supports high performance motion control

Setup and Programming

- ▲ Command-based—for easy program development and maintenance
- ▲ Flexible User Programs—advanced step sequencer with user-named variables and mathematical expressions

- ▲ Extensive, context-sensitive Help

Tuning and Diagnostics

- ▲ Tuning Wizards
- ▲ Powerful motion graphing for optimizing motion
- ▲ Event Log shows real-time activity

All RMC motion controllers are backed by a company legacy of more than 25 years of excellent product support. Responsive 24/7 customer service is just a telephone call away.

DELTA

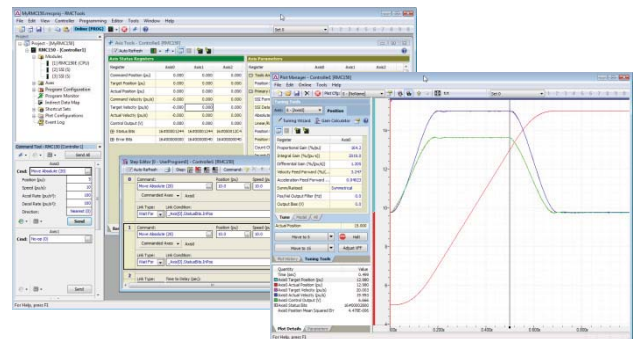


RMCTools Software

RMCTools is a powerful motion control software package for setting up, tuning, troubleshooting, programming, and controlling all features of Delta's multi-axis RMC150/151 controllers from a PC. RMCTools also supports the RMC70 controllers.

Delta's intuitive and easy-to-use RMCTools software features flexible User Programs with extensive commands and the ability to embed mathematical expressions. Setup and tuning wizards reduce startup times, and the graphical diagnostics tools speed troubleshooting of the entire motion system. Extensive, context-sensitive help is included in RMCTools, giving you the information you need at your fingertips.

RMCTools is included on a CD with all RMC150/151 controllers and is also available for download from www.deltamotion.com.



PC Requirements:

- ▲ Operating System*: Windows® XP/Vista/7
- ▲ Processor: Minimum OS requirement
- ▲ Memory: Minimum OS requirement
- ▲ Hard Disk Space: 20MB

*Windows XP requires Service Pack 2 or newer. RMCTools versions 3.37.0 (May 2010) and older support Windows® 2000.

Communication Software

RMCLink ActiveX Control and .NET Assembly

RMCLink enables full monitoring and control of RMC150/151 motion controllers via Ethernet communications from custom applications on Windows®-based PCs. RMCLink supports numerous languages, such as Visual Basic, C++, C#, VBScript, VBA (Microsoft Excel®), LabVIEW™.

RMCLink comes with fully-functioning sample projects to help you get up and running quickly. The help includes detailed walk-throughs and numerous code snippets.

RMCLink, with extensive examples, is available for download from www.deltamotion.com.

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Instrument Driver for Use with 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.

LabVIEW is a trademark of National Instruments. Neither Delta, nor any software programs or other goods or services offered by Delta, are affiliated with, endorsed by, or sponsored by National Instruments.

RMCTools Features

Delta's powerful RMCTools software makes setup, tuning, and troubleshooting motion systems easier than ever.

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 RMC, 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 Shortcut Command Sets to quickly issue commands to speed the tuning process.
- ▲ **User Programs**
Easily create programs to issue sequences of commands.
- ▲ **PreScan Table**
Use wizards to set up immediate response to internal conditions or external events (discrete I/O, etc.)
- ▲ **Mathematical Expressions**
Expressions provide flexible programming capability for advanced calculations and machine control sequences.



Part Numbers

Backplane sizes are 3, 4, 5, and 6 slots. Modules can be mixed and matched according to the table below.

Controller CPU. The CPU is always in slot 1 (second slot from left). Details

RMC150E Motion Control CPU (Includes Ethernet, RMCTools Software)	p. 4
RMC151E RMC150E with Dual-Loop Pressure/Force Control Option*	p. 4

Slots 2-5 Modules. Select 1-4 modules. $n = 1 - 4$.

Mn Magnetostrictive Displacement Transducer (MDT) for Start/Stop or PWM signals: two inputs, two ± 10 V outputs	p. 6
Sn Synchronous Serial Interface (SSI) for linear and single- or multi-turn rotary: two inputs, two ± 10 V outputs	p. 7
Qn Quadrature for 5V differential encoder signals: two inputs, two ± 10 V outputs	p. 8
Rn Resolver: two inputs, two ± 10 V outputs	p. 9
Hn Analog:, four 16-bit ± 10 V or 4-20 mA inputs, two ± 10 V outputs.....	p. 10
An Analog:, four 12-bit ± 10 V or 4-20 mA inputs.....	p. 11
Gn Analog: two 16-bit ± 10 V inputs, two ± 10 V outputs.....	see note on p. 10
Dn Discrete I/O: 8 discrete outputs, 18 discrete inputs, 24 VDC.....	p. 12
Un Universal reference: two 16-bit ± 10 V or 4-20 mA inputs, six discrete I/O, two high speed quadrature or SSI channels	p. 13
SO_n SSI input/output (specialty): one SSI input, one SSI output, two ± 10 V outputs.....	p. 16
BL_n Blank slot cover, allows for future expansion	

Slot 0 Modules

DI/O Discrete I/O module, 8 discrete outputs, 18 discrete inputs, 24 VDC.....	p. 12
UI/O Universal reference: two 16-bit ± 10 V or 4-20 mA inputs, six discrete I/O, two high speed quadrature or SSI channels	p. 13
PROFI PROFIBUS-DP communication.....	p. 15
Blank Blank slot cover - no part number designation needed for blank cover in slot 0	

Options

HZ Hazardous location designation Class I, Division 2, Groups A, B, C, D (not available for all modules)	p. 17
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RMC150E-M2-H1-DI/O-HZ

(Multiple options possible)

* The Dual-Loop Pressure/Force Control Option is required only for dual-loop control, such as position-pressure, position-force, velocity-pressure, or velocity-force. It is not required for pressure-only control or force-only control. The Dual-Loop option also enables advanced control algorithms with two inputs per axis such as Active Damping or Acceleration control using pressure or accelerometer feedback.

Accessories and More

Voltage-to-Current Converters	p. 17
Cable Assemblies	p. 18
Terminal Blocks	p. 18
Mounting Dimensions	p. 19

Online Configuration Tool

Create your own RMC150 controller and request a quote!
Go to Delta's website at www.deltamotion.com and choose **Request a Quote Online**.



Example Part Numbers

RMC150E-S2-Q2

4 axes with SSI feedback, 4 axes with quadrature feedback and a blank cover on the left-most slot

RMC151E-H4-PROFI

8 axes with analog feedback (8 drive outputs and 16 analog inputs) and a PROFIBUS module, 8 axes dual-loop enabled

RMC150E-M2-Q1-D1-DI/O

4 axes with MDT feedback, 2 axes with quadrature feedback, 2 discrete I/O modules, one of which is in slot 0.



RMC150E and RMC151E CPUs

2-8 Axes Controllers

The RMC150E and RMC151E CPUs are capable of controlling up to 8 control axes plus additional reference axes. These CPUs provide an on-board Ethernet port, a USB port for connection to the RMCTools software, two 24 VDC discrete outputs, and two 12-24 VDC discrete inputs.

RMC150E - 8 Axes

Control 8 axes, built-in Ethernet, USB monitor port, 2 discrete inputs, 2 discrete outputs.

RMC151E – 8 Axes with Dual-Loop

RMC150E with dual-loop. Dual-loop is the ability to control two quantities—such as position and pressure—on the same axis. Notice that controlling only pressure or only force on an axis does not require the RMC151E.



RMC150E/RMC151E CPU Specifications

Motion Control	
Control loop times	250 μ s, 500 μ s, 1 ms, 2 ms, or 4 ms
USB Monitor Port (for setup, programming and maintenance only)	
Connector	USB "B" Receptacle
Data Rate	Full-speed (12 Mbps)
Discrete Inputs (2)	
Input type	12-24 VDC inputs; polarity independent
Logic polarity	True "High"
Isolation	500 VAC
Input "High" range	7 to 26.4 VDC, 3 mA maximum
Input "Low" range	0 to 3.5 VDC, <1 mA
Maximum propagation delay	160 μ s
Discrete Outputs (2)	
Output type	Solid State Relays (SSR)
Isolation	500 VAC
Rated voltage	max \pm 30 V (DC or peak AC voltage)
Maximum current	\pm 75 mA (\pm 50 mA for Class I Div 2)
Maximum propagation delay	1.5 ms
Logic 1 (True, On)	Low impedance (50 Ω maximum)
Logic 0 (False, Off)	High impedance (<1 μ A leakage current at 250 V)
Power	
Voltage	+24 VDC \pm 15%
Current	3 slots Typical 290 mA, max 375 mA 4 slots Typical 385 mA, max 500 mA 5 slots Typical 485 mA, max 625 mA 6 slots Typical 585 mA, max 750 mA
DC-DC converter isolation	500 VAC
Mechanical	
Mounting	Symmetrical DIN 3 or panel-mount
Dimensions (see pg. 19 for drawings)	3 slots 4.12 x 5.95 x 4.75 in (WxHxD) (10.5 x 15.0 x 12.1 cm) width increases by 1.0 in for each slot 6 slots 7.12 x 5.95 x 4.75 in (WxHxD) (18.1 x 15.0 x 12.1 cm)
Weight	3 slots 2 lb (0.9 kg) max 6 slots 3 lb (1.4 kg) max



RMC150E/RMC151E CPU Specifications (continued)

Environment

Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17


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

Ethernet Configuration

Configuration parameters	IP address, subnet mask, gateway address, enable/disable auto-negotiation
Configuration methods	BOOTP, DHCP, or static

Ethernet Protocol Support

Application protocols (Call Delta for availability of other protocols)	EtherNet/IP, Modbus/TCP, PROFINET, CSP (DF1 over Ethernet), Omron FINS, Procedure Exist (Mitsubishi Q-series)	
Framing protocol	Ethernet II	
Internet protocol	IP (includes ICMP, ARP, and Address Collision Detection)	
Transport protocols	TCP, UDP	

Pin-out

Discrete I/O Connector

+In 0	General-purpose input 0
-In 0	
+In 1	General-purpose input 1
-In 1	
+Out 0	General-purpose output 0
-Out 0	
+Out 1	General-purpose output 1
-Out 1	

Power connector

+24 V	Power for entire controller
24 Cmn	Power common
Case	Protective earth ground

Ordering Information

The CPU part number is the first part of the entire controller part number. Specify RMC150E, or RMC151E for the dual-loop option.
For example, **RMC150E-M2**: RMC150 motion controller with 4 axes of MDT position control.



MDT Module

Two Axes, Magnetostrictive Linear Displacement Transducers

The two-axis MDT module interfaces to magnetostrictive linear displacement transducers (MDTs) with Start/Stop or Pulse Width Modulated (PWM) outputs. These absolute-position transducers are especially well suited for hydraulic applications because of their non-contact design, robustness, modularity, and resistance to contaminants.

Magnetostrictive linear displacement transducers with the SSI interface provide higher resolution than Start/Stop or PWM outputs and are supported by the RMC SSI module.

Features:

- Two axes of MDT feedback per module
- Up to 0.001 in (25.4 μm) resolution using Start/Stop
- Up to 0.0001 in (2.54 μm) resolution using PWM transducers with multiple recirculations
- Supports internal transducer recirculations
- Transducer length up to 398 in (10.1 m) (4 ms loop time)
- Differential (recommended) or single-ended interface
- Two isolated, ± 10 V, 12-bit drive outputs per module
- Current output up to ± 200 mA with VC2124 converter option

MDT Specifications

Start/Stop and PWM Interface

Axes	Two per module
Return inputs	Two RS-422 differential
Interrogation outputs	Two RS-422 differential (External interrogation required)
ESD protection	15 kV Electrostatic Discharge (ESD) protection
Resolution	0.001 in (25.4 μm) Start/Stop, 0.0001 in (2.54 μm) PWM
Count rate	120 MHz

Drive Interface

Outputs	Two ± 10 V, 5 mA maximum, 12-bit DAC
Isolation	500 VAC
Current Output Accessory	VC2124 voltage-to-current converter output range is adjustable from ± 10 mA to ± 200 mA in 10 mA steps

Environment

Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17



MDT Pin-out

MDT 0 Connector

+Int 0	+ Interrogation
-Int 0	- Interrogation
MDT Cmn	Transducer Common
+Ret 0	+ Return
-Ret 0	- Return
Case	Chassis Ground (shield)

MDT 1 Connector

+Int 1	+ Interrogation
-Int 1	- Interrogation
MDT Cmn	Transducer Common
+Ret 1	+ Return
-Ret 1	- Return
Case	Chassis Ground (shield)

Drive Connector

Drv 0	± 10 V Drive Output
Drv Cmn	Drive Common
Drv 1	± 10 V Drive Output
Case	Chassis Ground (shield)

MDT Ordering Information

To specify an MDT interface module, insert **-Mn** into the part number, where **n** indicates the number of modules. Up to four MDT modules can be ordered in a single RMC unit. The MDT module can be used in slots 2-5. Refer to the SSI module for Magnetostrictive LDTs with a Synchronous Serial Interface (SSI) output.

For example, **RMC150E-M2-A1**: 4 axes of MDT position control and 4 analog inputs.



SSI Module

Two Axes, Synchronous Serial Interface

The two-axis SSI module interfaces to transducers with the Synchronous Serial Interface (SSI) output. Many types of transducers are available with SSI, including magnetostrictive linear displacement transducers, absolute encoders, and laser measuring devices.

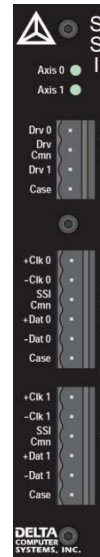
SSI has a number of advantages over other interfaces:

- Higher noise immunity
- Absolute positions
- Available on a wide variety of transducers
- Many SSI devices offer higher precision.

For example, magnetostrictive LDTs offer higher resolutions with SSI interface than for other interface types, such as Start/Stop, PWM, voltage, or current.

Features:

- Two axes of SSI feedback per module
- Binary or gray code
- 8 to 31 data bits
- Differential RS-422 SSI interface
- Two isolated, ± 10 V, 12-bit drive outputs per module
- Current output up to ± 200 mA with VC2124 converter option



SSI Specifications

SSI Interface

Axes	Two per module
Data inputs	Two RS-422 differential, 150 Ω input impedance
Clock outputs	Two RS-422 differential
Clock frequency	User-selectable 230 kHz or 921 kHz
Cable type	Twisted pair, shielded, low capacitance communication cable
Cable length maximum	Transducer dependent (approx. 300-600 ft)
ESD protection	15 kV Electrostatic Discharge (ESD) protection
Resolution	Transducer dependent (up to 2 μ m or approximately 0.00008 in for magnetostrictive LDTs)
Count encoding	Binary or Gray Code
Data bits	8 to 31 bits

Drive Interface

Outputs	Two ± 10 V, 5 mA maximum, 12-bit DAC
Isolation	500 VAC
Current Output Accessory	VC2124 voltage-to-current converter output range is adjustable from ± 10 mA to ± 200 mA in 10mA steps

Environment

Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17

SSI Pin-out

SSI 0 Connector

+Clk 0	+ Clock Output
-Clk 0	- Clock Output
SSI Cmn	Transducer Common
+Dat 0	+ Data Input
-Dat 0	- Data Input
Case	Chassis Ground (shield)

SSI 1 Connector

+Clk 1	+ Clock Output
-Clk 1	- Clock Output
SSI Cmn	Transducer Common
+Dat 1	+ Data Input
-Dat 1	- Data Input
Case	Chassis Ground (shield)

Drive Connector

Drv 0	± 10 V Drive Output
Drv Cmn	Drive Common
Drv 1	± 10 V Drive Output
Case	Chassis Ground (shield)

SSI Ordering Information

To specify an SSI interface module, insert **-Sn** into the part number, where **n** indicates the number of modules. Up to four SSI modules can be ordered in a single RMC unit. The SSI module can be used in slots 2-5.

For example, **RMC150E-S3-A1**: 6 axes of SSI position control and 4 analog inputs.



Quadrature Module

Two Axes, 5 V differential (RS-422) A, B, and Z

The two-axis Quadrature module interfaces to linear and rotary transducers and encoders with 5 V differential (RS-422) A, B, and Z outputs. Many types of transducers and encoders are available with quadrature outputs.

In addition to A, B, and Z (index) inputs, each axis includes a high-speed homing input, a drive enable output, a drive fault input, and two high-speed inputs for limit switches or high-speed position latching.

Features:

- Two axes of quadrature feedback per module
- 4,000,000 counts per second
- High-speed inputs: home, position latch, travel limits
- Digital noise filters on all inputs
- All discrete inputs are isolated
- Drive fault inputs, Drive enable outputs
- Two isolated, ± 10 V, 14-bit drive outputs per module
- Current output to ± 200 mA with VC2124 converter option

Quadrature Specifications

Inputs and Outputs

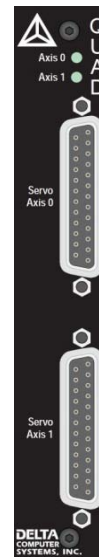
Axes	Two per module
Inputs	Two 5 V differential (RS-422), 215 Ω input impedance, A, B and Z
ESD Protection	15 kV Electrostatic Discharge (ESD) Protection
Maximum Encoder Frequency	4,000,000 counts/s
Fault Inputs, Home Inputs, and high-speed Limit or Registration Inputs	Input "High" range: 3.2 to 26.4 VDC, 3.5 mA min., 10 mA max. Input "Low" range: 0 to 2 VDC, < 1 mA Max input voltage: 26.4 V, 500 VAC isolation, compatible with most limit switches, TTL, and CMOS outputs
Home input response time	50 μ s
Index (Z) input response time	125 ns
Drive Enable output	Solid State relay, 50 Ω , 30 V, 75 mA (50 mA for Class I, Div 2), 1.5 ms, 500 VAC isolation

Drive Interface

Outputs	Two ± 10 V, 5 mA maximum, 14-bit DAC
Isolation	500 VAC
Current Output Accessory	VC2124 voltage-to-current converter output range is adjustable from ± 10 mA to ± 200 mA in 10mA steps

Environment

Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17



Quadrature Pin-out

Pin	Function
1	A-
2	A+
3	B-
4	B+
5	No connection
6	Registration X / Neg Limit -
7	Registration X / Neg Limit +
8	Registration Y / Pos Limit -

Pin	Function
9	Registration Y / Pos Limit +
10	No connection
11	No connection
12	± 10 V Drive Output
13	Drive Output Common
14	Z- Index from encoder
15	Z+ Index from encoder
16	Encoder Common

Pin	Function
17	No connection
18	Home Input -
19	Home Input +
20	Fault Input -
21	Fault Input +
22	No connection
23	No connection
24	Enable Output
25	Enable Output

Quadrature Ordering Information

To specify a Quadrature module, insert **-Q n** into the part number, where **n** indicates the number of modules. Up to four Quadrature modules can be ordered in a single RMC unit. The Quadrature module can be used in slots 2-5.

For example, **RMC150E-Q2-A1**: 4 axes of quadrature position control and 4 analog inputs.



Resolver Module

Two Axes, Resolvers 800 Hz to 5 kHz, ratios 0.42 to 1.41

The two-axis Resolver module interfaces to resolvers. These single-turn absolute-position transducers are well-suited for hazardous and harsh environments due to the simplicity and robustness of the transducer construction.

Features:

- Two axes of resolver feedback per module
- 14 or 16 bit resolution
- Reference frequency from 800 Hz to 5 kHz
- Resolver Transformation Ratios from 0.42 to 1.41
- Custom frequency and transformation ratios options available – contact Delta
- Two isolated, ± 10 V, 14-bit drive outputs per module
- Current output up to ± 200 mA with VC2124 converter option

Resolver Specifications

Inputs

Axes	Two per module
Reference Frequency	800 Hz to 5 kHz
Reference Output Voltage	1.41 to 4.8 V RMS
Reference Output Current	28 mA max.
Resolver Transformation Ratio (SINMAX/Reference)	0.42 to 1.41
Resolution	14 or 16 bits
Maximum Speed	3000 RPM at 14 bits and 600 RPM at 16 bits
Maximum Acceleration	1200 RPS per second at 14 bits, 60 RPS per second at 16 bits
Accuracy	4 Minutes +1 LSB

Drive Interface

Outputs	Two ± 10 V, 5 mA maximum, 14-bit DAC
Isolation	500 VAC
Current Output Accessory	VC2124 voltage-to-current converter output range is adjustable from ± 10 mA to ± 200 mA in 10 mA steps

Environment

Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17



Resolver Pin-out

Resolver 0 Connector

R1 0	Reference Output +
Ref In 0	Reference In (normally not used)
R3 0	Reference Output -
S1 0	Sine Input +
S3 0	Sine Input -
S2 0	Cosine Input +
S4 0	Cosine Input -
Case	Chassis ground (shield)

Resolver 1 Connector

R1 1	Reference Output +
Ref In 1	Reference In (normally not used)
R3 1	Reference Output -
S1 1	Sine Input +
S3 1	Sine Input -
S2 1	Cosine Input +
S4 1	Cosine Input -
Case	Chassis ground (shield)

Drive Connector

Drv 0	± 10 V Drive Output
Drv Cmn	Drive Common
Drv 1	± 10 V Drive Output
Case	Chassis Ground (shield)

Resolver Ordering Information

To specify a Resolver module, insert **-Rn** into the part number, where **n** indicates the number of modules. Up to four Resolver modules can be ordered in a single RMC unit. The Resolver module can be used in slots 2-5.

For example, **RMC150E-R2**: 4 axes of resolver position control.



Analog (H) Module

Two Axes, Four Voltage or Current Inputs

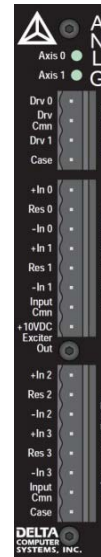
The two-axis H module interfaces to ± 10 V, ± 5 V, and 4-20 mA transducers. This module includes two drive outputs and four 16-bit inputs for controlling position, velocity, pressure, or force. The four inputs provide flexibility in your system, and can be used for such things as reference inputs (e.g. a joystick input), connecting to two pressure transducers to control the resultant force on a hydraulic cylinder, or for dual-loop position-pressure or position-force control (requires the RMC151E CPU).

Features:

- Four isolated 16-bit inputs
- 8 times oversampling
- ± 10 V, ± 5 V, and 4-20 mA input ranges
- +10 V exciter output
- Two isolated, ± 10 V, 12-bit drive outputs per module
- Current output up to ± 200 mA with VC2124 converter option

Analog Specifications

Inputs	
Inputs	Four 16-bit differential
Isolation	500 VAC
Oversampling	8 times per control loop
Offset drift with temperature	0.2 LSB/ $^{\circ}$ C typical (± 10 V range)
Gain drift with temperature	20 ppm/ $^{\circ}$ C typical (± 10 V range)
Non-linearity	12 LSB (counts) typical (± 10 V range)
Exciter output	10 VDC \pm 2%, 8 mA (for use with potentiometers only)
Drive Interface	
Outputs	Two ± 10 V, 5 mA maximum, 12-bit DAC
Isolation	500 VAC
Current Output Accessory	VC2124 voltage-to-current converter output range is adjustable from ± 10 mA to ± 200 mA in 10mA steps
Environment	
Operating temperature	+32 to +140 $^{\circ}$ F (0 to +60 $^{\circ}$ C)
Storage temperature	-40 to +185 $^{\circ}$ F (-40 to +85 $^{\circ}$ C)
Agency compliance	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17



Note: Analog (G) Module

The Analog (G) module has two ± 10 V inputs and two ± 10 V drive outputs.

Delta recommends using the H module instead of the G module. The similarly-priced H module has four analog inputs instead of two and supports 4-20 mA feedback.

For detailed specifications on the G module, refer to the RMC100 datasheets at www.deltamotion.com/downloads.

Analog Pin-out

Inputs 0&1 Connector	
+In 0	Differential analog input 0+
Res 0	Connect to +In 0 for 4-20 mA
-In 0	Differential analog input 0-
+In 1	Differential analog input 1+
Res 1	Connect to +In 1 for 4-20 mA
-In 1	Differential analog input 1-
Input Cmn	Analog common (Isolated)
+10 VDC	+10 VDC output for use with
Exciter Out	potentiometers only

Inputs 2&3 Connector	
+In 2	Differential analog input 2+
Res 2	Connect to +In 2 for 4-20 mA
-In 2	Differential analog input 2-
+In 3	Differential analog input 3+
Res 3	Connect to +In 3 for 4-20 mA
-In 3	Differential analog input 3-
Input Cmn	Analog common (Isolated)
Case	Chassis Ground (shield)

Drive Connector	
Drv 0	± 10 V Drive Output
Drv Cmn	Drive Common
Drv 1	± 10 V Drive Output
Case	Chassis Ground (shield)

Analog Ordering Information

To specify an H module, insert **-Hn** into the part number, where **n** indicates the number of modules. Up to four H modules can be ordered in a single RMC unit. The H module can be used in slots 2-5.

For example, **RMC150E-H2-DI/O**: Two H modules and one discrete I/O module.



Analog (A) Module

Four Voltage or Current Inputs

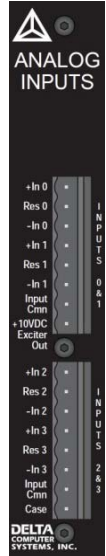
The A module provides four 12-bit analog inputs, individually configurable as ± 10 V, ± 5 V, or 4-20 mA. The inputs provide flexibility in designing your system, and are typically used in the following applications:

- Dual-loop position-pressure or position-force control. The A module is typically used to provide the analog inputs for the pressure transducers or force load cells.
- Reference inputs, such as joystick inputs.

Differential force input from two pressure transducers on a hydraulic cylinder.

Features:

- Four isolated 12-bit inputs
- 8 times oversampling
- ± 10 V, ± 5 V, and 4-20 mA input ranges
- +10 V exciter output



Analog Specifications

Inputs	
Inputs	Four 12-bit differential
Isolation	500 VAC
Oversampling	8 times
Input ranges	± 10 V, ± 5 V, 4-20 mA (each input independently configurable)
Input impedance	1 M Ω
Input filter slew rate	25 V/ms
Oversampling	8 times per control loop
Offset drift with temperature	0.01 LSB/ $^{\circ}$ C typical (± 10 V range)
Gain drift with temperature	20 ppm/ $^{\circ}$ C typical (± 10 V range)
Non-linearity	1 LSB (count) typical (± 10 V range)
Exciter output	10 VDC \pm 2%, 8 mA (for use with potentiometers only)
Environment	
Operating temperature	+32 to +140 $^{\circ}$ F (0 to +60 $^{\circ}$ C)
Storage temperature	-40 to +185 $^{\circ}$ F (-40 to +85 $^{\circ}$ C)
Agency compliance	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17

Analog Pin-out

Inputs 0&1 Connector	
+In 0	Differential analog input 0+
Res 0	Connect to +In 0 for 4-20 mA
-In 0	Differential analog input 0-
+In 1	Differential analog input 1+
Res 1	Connect to +In 1 for 4-20 mA
-In 1	Differential analog input 1-
Input Cmn	Analog common (Isolated)
+10 VDC	+10 VDC output for use with potentiometers only
Exciter Out	

Inputs 2&3 Connector	
+In 2	Differential analog input 2+
Res 2	Connect to +In 2 for 4-20 mA
-In 2	Differential analog input 2-
+In 3	Differential analog input 3+
Res 3	Connect to +In 3 for 4-20 mA
-In 3	Differential analog input 3-
Input Cmn	Analog common (Isolated)
Case	Chassis Ground (shield)

Analog Ordering Information

To specify an A module, insert **-An** into the part number, where **n** indicates the number of modules. Up to four A modules can be ordered in a single RMC unit (four is rare, as the RMC would have no drive outputs for control). The A module can be used in slots 2-5.

For example, **RMC150E-M2-A1-DI/O**: 4 axes of MDT position control, 4 analog inputs, and one discrete I/O module.



Discrete I/O Module

18 Discrete Inputs, 8 Discrete Outputs

The Discrete I/O module provides 8 discrete outputs and 18 discrete inputs, supporting 5 V to 24 V signal levels.

The discrete I/O can be used for many tasks, for example, starting motion sequences, providing interlocks, starting external events, simple communications, and more.

Discrete I/O Specifications

Discrete Inputs

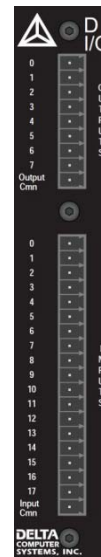
Inputs	18, compatible with signal levels from 5V to 24V
Input Characteristics	5-24 VDC, sinking (requires sourcing driver)
Logic Polarity	True high
Isolation	500 VAC
Input "High" Range	3 to 26.4 VDC 3.2 mA minimum, 10 mA maximum
Input "Low" Range	0 to 2 VDC < 1 mA
Filtering	Inputs 0-15: 500 μ s Inputs 16-17: 250 μ s
Maximum Propagation Delay	100 μ s + filtering

Outputs

Outputs	8, Solid State Relay
Logic polarity	True On
Isolation	500 VAC
Maximum voltage	± 30 V (DC or peak AC voltage rating of SSR)
Maximum current	± 75 mA (± 50 mA for Class I, Div 2)
Maximum propagation delay	1.5 ms
Logic 1 (True, On)	Low impedance (50 Ω maximum)
Logic 0 (False, Off)	High impedance (<1 μ A 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	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17



Discrete I/O Pin-out

Discrete Outputs

0-7	General Outputs 0-7
Output Cmn	Common (high or low side)

Discrete Inputs

0-17	General Inputs 0-17
Input Cmn	Common (must be low side)

Discrete I/O Ordering Information

The part number depends on the slot in which the Discrete I/O module is installed. The Discrete I/O module for slot 0 is not interchangeable with the Discrete I/O module for slots 2-5.

Slot 0: Append **-DI/O** to the part number.

Slots 2-5: Insert **-Dn** to the part number, where **n** indicates the number of modules.

For example, **RMC150E-M2-D1-DI/O**: 4 axes of MDT position control and 2 discrete I/O modules, one of which is in slot 0.



Universal I/O Module

2 Analog Inputs, 6 Discrete I/O, 2 Quadrature/SSI Channels

The Universal Input/Output module provides two analog inputs, six discrete inputs/outputs, and two high-speed channels that can be configured for quadrature inputs, SSI inputs, or even inter-controller communications for synchronizing axes between RMCs.

Analog Input Features:

- Two 16-bit analog inputs, ± 10 V or 4-20 mA

Discrete I/O Features:

- Six I/O, individually configurable as input or output
- Inputs: 12 to 24 VDC, sinking or sourcing
- Outputs: Solid state relay, 75 mA
- Inputs 0 and 1 can be used as high-speed registration inputs in conjunction with the quadrature inputs.

High-Speed Channel Features

Each of the two RS-422 channels is independently configurable as Quadrature or SSI.

Quadrature Channels

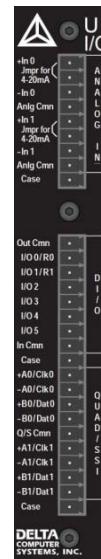
Each high-speed channel can be configured as quadrature.

- A and B quadrature inputs
- Requires 5 V differential (RS-422) signals
- Discrete inputs 0 and 1 can be used as high-speed registration or homing inputs in conjunction with quadrature inputs 0 and 1, respectively.

SSI Channels

Each high-speed channel can be configured to do the following SSI tasks:

- **Receive SSI Input from a Transducer**
This is a standard SSI input for obtaining data from an SSI transducer or encoder.
- **Send Data Out Via SSI (Slave)**
The SSI channel behaves as a transducer or encoder and will return data to the requesting master.
- **Synchronize Multiple RMCs to One Transducer**
The SSI channel can monitor the data that another RMC is receiving from an SSI device. This makes it possible to synchronize multiple RMCs to one SSI transducer.
- **Communicate between RMCs**
The SSI channels can exchange data between RMCs every loop time of the controller, providing the ability to tightly synchronize axes between RMCs.



Specifications

See next page.

Universal I/O Pin-out

Analog In Connector		DI/O Connector		Quad/SSI Connector	
+In 0	Differential analog input 0+	Out Cmn	Common to one side of all outputs	+A0/Clk0	Channel 0: A Input, Clock Output, or Clock Input
Jmpr for 4-20 mA	Connect to +In0 for 4-20 mA	I/O 0/RO	Input or Output	-A0/Clk0	
-In 0	Differential analog input 0-	I/O 1/R1	Input or Output	+B0/Dat0	Channel 0: B Input, Data Input, or Data Output
Input Cmn	Analog common (Isolated)	I/O 2	Input or Output	-B0/Dat0	
+In 1	Differential analog input 1+	I/O 3	Input or Output	Q/S Cmn	Quad/SSI Common
Jmpr for 4-20 mA	Connect to +In0 for 4-20 mA	I/O 4	Input or Output	+A1/Clk1	Channel 1: A Input, Clock Output, or Clock Input
-In 1	Differential analog input 1-	I/O 5	Input or Output	-A1/Clk1	
Input Cmn	Analog common (Isolated)	In Cmn	Common to one side of all inputs	+B1/Dat1	Channel 1: B Input, Data Input, or Data Output
Case	Chassis Ground (shield)	Case	Chassis Ground (shield)	-B1/Dat1	
				Case	Chassis Ground (shield)

Universal I/O Ordering Information

The part number depends on the slot in which the Universal I/O module is installed. The Universal I/O module for slot 0 is not interchangeable with the Universal I/O module for slots 2-5.

Slot 0: Append **-UI/O** to the part number.

Slots 2-5: Insert **-Un** to the part number, where *n* indicates the number of modules.

For example, **RMC150E-M2-UI/O**: 4 axes of MDT position control and one Universal I/O module in slot 0.



Universal I/O Specifications

Analog Inputs

Inputs	Two 16-bit differential inputs
Isolation	500 VAC
Overvoltage protection	±40 V
Input ranges	±10 V and 4-20 mA (each input independently configurable)
Input impedance	5 MΩ
Input filter frequency	1.2 kHz
Input filter slew rate	25 V/ms
Sampling rate	60 kHz
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

Discrete I/O – General

Discrete I/O points	6; each is individually configurable as input or output
---------------------	---

Isolation	500 VAC
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Discrete I/O – Inputs

Input characteristics	12-24 VDC, sinking or sourcing
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Logic polarity	True “high”
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Input “high” range	7 to 26.4 VDC (polarity independent), 3mA maximum
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Input “low” range	0 to 3.5 VDC (polarity independent), <1 mA
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Maximum propagation delay	160 μs + filtering
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Filtering	50 μs (value stable for 7 samples @ 8 μs interval)
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Registration	Inputs 0 and 1 can be used as high-speed registration inputs in conjunction with the quadrature inputs. For this use, filtering can be set to 100ns (max propagation delay is still 160 μs).
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Discrete I/O – Outputs

Output characteristics	Solid State Relay
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Logic polarity	True On
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Maximum voltage	±30 V (DC or peak AC rating of SSR)
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Maximum current	±75 mA
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Maximum propagation delay	1.5 ms
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Logic 1 (True, On)	Low impedance (25 Ω typ, 50 Ω max)
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Logic 0 (False, Off)	High impedance (<1 μA at 250 V)
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Environment

Operating temperature	+32 to +140°F (0 to +60°C)
-----------------------	----------------------------

Storage temperature	-40 to +185°F (-40 to +85°C)
---------------------	------------------------------

Agency compliance	Contact Delta
-------------------	---------------

High-Speed Channels

Channels	2, independently configurable
Transducer types	MDT with SSI output, single- or multi-turn absolute SSI encoders, quadrature encoders.

Note: Linear MDTs with SSI output should be of the synchronized type. Non-synchronized is not well-suited for motion control.

Modes	Quadrature input – ±A and ±B inputs SSI Standard input – for interfacing to transducers and encoders
-------	---

SSI Monitor input – for monitoring SSI communication on another device

SSI Slave output – emulates a transducer

SSI Master output – for sending data to another controller

Input type (Data/Clock/Quad)	RS-422 (5 V differential) (Single-ended encoders not supported due to low noise immunity)
------------------------------	--

Output type (Clock/Data)	RS-422 (5 V differential)
--------------------------	---------------------------

Clock frequency	250 kHz, 500 kHz, or 971 kHz, user-selectable
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Resolution	Transducer dependent (typically down to 2μm or approximately 0.00008” for MDTs)
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SSI count encoding	Binary or Gray code
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SSI count data length	8 to 32 bits
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Termination	215 Ω – user-selectable on all inputs
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Registration	Discrete inputs 0 and 1 can be used as high-speed registration for channels 0 and 1 respectively.
--------------	---

Registration response time	160 μs
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Max encoder frequency	8,000,000 quadrature counts per second
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Maximum cable length	1000 ft (Low capacitance, shielded, twisted pair computer communication cable)
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Electrostatic discharge (ESD) protection	15 kV (human body model)
--	--------------------------

Isolation	500 VAC
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PROFIBUS Module

PROFIBUS-DP Communications

The RMC150 PROFIBUS-DP module supports data rates up to 12 Mbaud, which permits high-speed transfer of any data to and from the RMC, including position commands, parameters, and status information.

The RMC's PROFIBUS interface gives the flexibility of several modes, including I/O Modes with in/out data of 4, 8, 16, or 32 registers. Select the mode that best fits your application and PROFIBUS master's capabilities.

With the PROFIBUS module installed, the RMC150/151 supports simultaneous Ethernet and PROFIBUS communications.



PROFIBUS Specifications

PROFIBUS-DP Interface	
Data Rate	9.6 kbaud up to 12 Mbaud
Isolation	2500 VAC
Product Identifier Number	0x0AC6
Features Supported	Sync Mode, Freeze Mode, Auto-baud rate detect
Valid Station Addresses	0-126 (set by software or Set Slave Address function)
Connector	Standard PROFIBUS-DP DB-9 (use termination in cable connectors as per PROFIBUS specification)
Environment	
Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17

PROFIBUS Ordering Information

To specify a PROFIBUS interface module, append **-PROFI** to the part number. The PROFIBUS module can only be used in slot 0.

For example, **RMC150E-M2-PROFI**: 4 axes of MDT position control and PROFIBUS communications.



SO Module

SSI Input/Output

The SSI Input/Output module allows for synchronizing multiple RMCs to a single SSI position transducer, such as gearing multiple axes to a feed chain.

The SO module's two $\pm 10V$ drive outputs and SSI input can be used for machine control. The SSI output retransmits the position data received from the SSI input as though it were itself an SSI transducer.

This allows the SSI output on one SO module to be fed into an SSI input on another RMC's SSI or SO module. Both RMCs will see the same SSI position data, although the retransmission incurs one loop time of delay in the position data on the second RMC. Many RMCs can be chained together in this way, with an additional delay introduced for each retransmission.

Note: Consider using the Universal I/O module instead, as it supports the same SSI output retransmission functionality as the SO module. However, there are some cases when the SO module may be more cost-effective, since it also provides drive outputs.

Features:

- One SSI input
- One SSI output which retransmits the SSI input data.
- Supports SSI devices with Binary or Gray Code data from 8 to 31 bits in length
- Differential RS-422 SSI interface
- Two isolated, $\pm 10 V$, 12-bit drive outputs per module
- Current output up to ± 200 mA with VC2124 converter option.



SO Specifications

SSI Interface

Data and Clock inputs	RS-422 differential, 150 Ω input impedance
Data and Clock outputs	RS-422 differential
Clock frequency	User-selectable 230 kHz or 921 kHz
Cable type	Twisted pair, shielded, low capacitance communication cable
Cable length maximum	Transducer dependent (approx. 300-600 ft)
ESD protection	15 kV Electrostatic Discharge (ESD) protection
Resolution	Transducer dependent (up to 2 μ m or approximately 0.00008 in for magnetostrictive LDTs)
Count encoding	Binary or Gray Code
Data bits	8 to 31 bits

Drive Interface

Outputs	Two $\pm 10 V$, 5 mA maximum, 12-bit DAC
Isolation	500 VAC
Current Output Accessory	VC2124 voltage-to-current converter output range is adjustable from ± 10 mA to ± 200 mA in 10mA steps

Environment

Operating temperature	+32 to +140°F (0 to +60°C)
Storage temperature	-40 to +185°F (-40 to +85°C)
Agency compliance	CE, UL, CUL. Optional: Class I, Division 2, see pg. 17



SO Pin-out

SSI 0 Connector

+Clk 0	+ Clock Output
-Clk 0	- Clock Output
SSI Cmn	Transducer Common
+Dat 0	+ Data Input
-Dat 0	- Data Input
Case	Chassis Ground (shield)

SSI 1 Connector

+Dat 1	+ Data Output
-Dat 1	- Data Output
SSI Cmn	Transducer Common
+Clk 1	+ Clock Input
-Clk 1	- Clock Input
Case	Chassis Ground (shield)

Drive Connector

Drv 0	$\pm 10 V$ Drive Output
Drv Cmn	Drive Common
Drv 1	$\pm 10 V$ Drive Output
Case	Chassis Ground (shield)

SO Ordering Information

To specify an SO interface module, insert **-SO n** into the part number, where **n** indicates the number of modules. Up to four SO modules can be ordered in a single RMC unit. The SO module can be used in slots 2-5.

For example, **RMC150E-S1-SO-A1**: 3 axes of SSI position control, one SSI output, and 4 analog inputs.



Class I Division 2 Compliance

Hazardous location designation Class I, Division 2, Groups A, B, C, D is available for the RMC150E. Class I Division 2 compliance is not available for the G and UI/O modules.

- Products marked "Class I Division 2, Group A, B, C, D" are suitable for use in Class I Division 2, Groups A, B, C, and D hazardous locations and nonhazardous locations only.
- **WARNING—EXPLOSION HAZARD—DO NOT DISCONNECT EQUIPMENT WHILE THE CIRCUIT IS LIVE OR UNLESS THE AREA IS KNOWN TO BE FREE OF IGNITABLE CONCENTRATIONS.**
- **WARNING—EXPLOSION HAZARD—SUBSTITUTION OF ANY COMPONENT MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.**
- Maximum surrounding air temperature of 60° C.
- The RMC150E USB port is intended for configuration, programming, and troubleshooting purposes only. It should not be connected during normal operation.
- Wire gauge, screw clamp torque and wire type requirements are listed in the RMC Startup Guide and RMCTools help.

Class I Division 2 Ordering Information

To specify Class I, Division 2, append "-HZ" to the entire RMC part number. Class I Division 2 compliance is not available for RMC configurations with the G and UI/O modules.

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	24V DC
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.



Cable Assemblies

Delta 's provides cable assemblies for certain products. The table below lists the available cables:

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



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/downloads.

Terminal Blocks

All RMCs ship with connectors. Connectors are also available for order individually from Delta. The table below lists the available connectors. These parts are also available from connector manufacturers Amphenol Pcd or WECO using these part numbers.

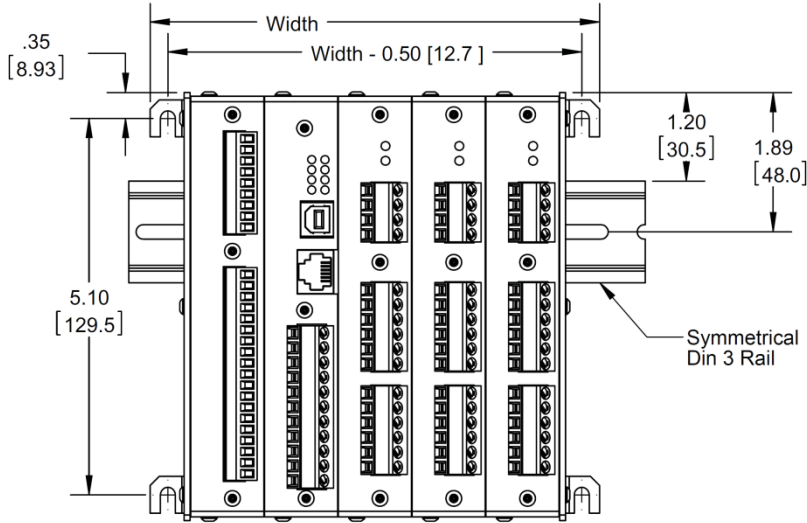
Connector Part No	Connector Description	For Modules
10.808.304 (WECO)	RMC100/150 4-pin Terminal Block	M, S, H, G, R
10.808.306 (WECO)	RMC100/150 6-pin Terminal Block	M, S
10.808.308 (WECO)	RMC100/150 8-pin Terminal Block	H, A, G, R
10.808.311 (WECO)	RMC100/150 11-pin Terminal Block	RMC150/151E
ELVP09100 (Amphenol Pcd)	RMC100/150 9-pin Terminal Block	DI/O, UI/O
ELVP19100 (Amphenol Pcd)	RMC100/150 19-pin Terminal Block	DI/O, UI/O





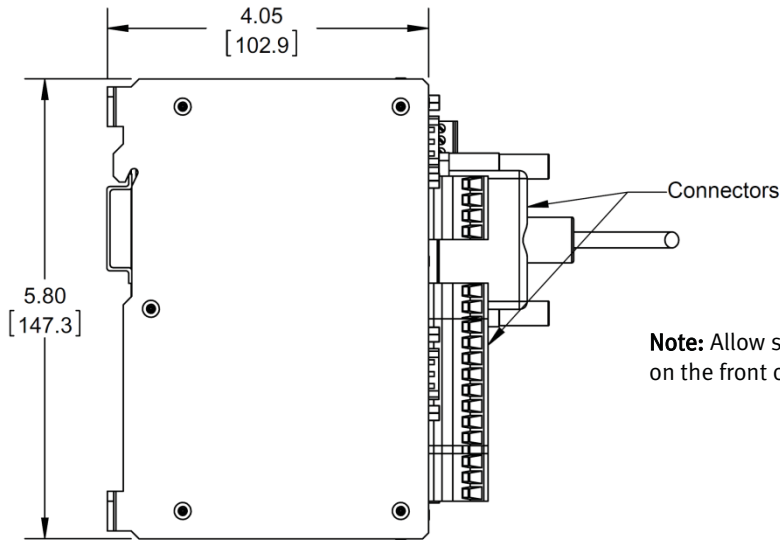
Mounting Dimensions

The width of the RMC depends on the number of slots in the backplane.
 CAD drawings of the RMC are available at www.deltamotion.com/downloads.
 Units are in inches [mm].



Chassis Front View

Slots	Width
3	4.12 in [105 mm]
4	5.12 in [103 mm]
5	6.12 in [155 mm]
6	7.12 in [181 mm]



Chassis Side View

Note: Allow space for the connectors on the front of the RMC.



The RMC Family of Motion Control



Connect. Control. Optimize.

Printed in USA
January 2011

DELTA

RMC70 Series

One- and Two-Axis Motion Controllers

D A T A S H E E T



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.

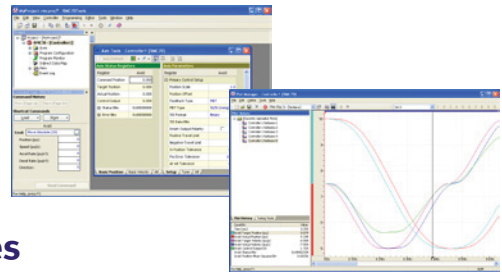
With powerful control modes—including dual-loop position-pressure algorithms—and multiple feedback types, the RMC70 Series provides optimum control to a wide range of hydraulic, electric, and pneumatic position and position–pressure/force applications.

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 25 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

RMCTools Software
Setup, Programming,
Tuning and Diagnostics

USB,
Ethernet,
Serial
(RS-232)

Ethernet
Serial RS-232/485
PROFIBUS-DP

**HMIs, PLCs, and PCs
via protocols:**

- EtherNet/IP
- PROFINET
- Modbus/TCP
- DF1
- Modbus/RTU and more...

Actuators & Motors
Hydraulic & Pneumatic
Valves
Electric Motor Amplifiers
and Drives

**Position & Pressure
Feedback**
Magnetostrictive,
Potentiometer, and
Pressure Transducers
Quadrature and
SSI Encoders



±10 V Analog

Analog, SSI,
Quadrature,
MDT (PWM and
Start/Stop)

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

DELTA
COMPUTER SYSTEMS

Motion Control...and More.
deltamotion.com

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** = 1/2-axis quadrature reference input (5 V differential) p.15

Accessories and More

- Mounting Dimensions p. 18
- Voltage-to-Current Converters..... 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 ships on a CD with all RMC70 motion controllers and is available for download from Delta's website at www.deltamotion.com.

PC Requirements:

- ▲ Operating System: Windows® XP/Vista/7*
- ▲ Processor: Minimum OS Requirement
- ▲ Memory: Minimum OS Requirement
- ▲ Hard Disk Space: 20 MB

*Windows XP requires Service Pack 2 or newer.
RMCTools versions 3.37.0 (May 2010) and older support Windows® 2000.

RMCLink

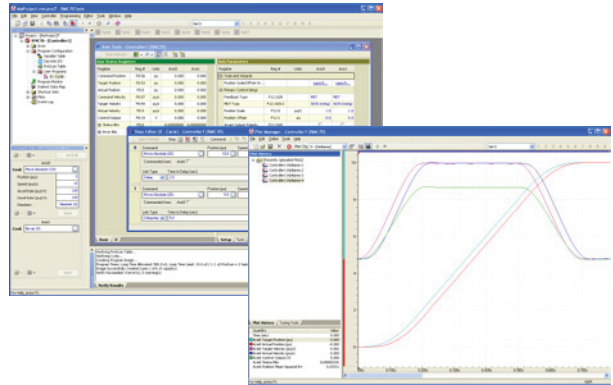
The RMCLink ActiveX Control and .NET Assembly enables full serial RS-232 or Ethernet communications from Windows-based PCs to the RMC70. RMCLink supports many languages, such as Visual Basic, C++, C#, VBScript, VBA (Microsoft® Excel, etc.).

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 Delta's website at 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.

▲ PreScan Table

Use wizards to set up immediate response to internal conditions or external events (discrete I/O, 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
 - ▲ Move Velocity
 - ▲ Rotary motion with support for incremental and absolute
- ▲ **Velocity Control**
 - ▲ Velocity control with position feedback
 - ▲ Velocity control with velocity feedback
- ▲ **Pressure and Force Control**
 - ▲ Linear or S-curve Ramps
 - ▲ Gearing
 - ▲ Cyclic Sinusoidal Profile
 - ▲ Splines
 - ▲ Cams
- ▲ **Force Control**
Load cell or differential force.
- ▲ **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 and vice versa. Ramp the Control Output smoothly between two values, or ramp the Control Output down as the position approaches the final position, for hard-to-control systems.
- ▲ **Quick Move**
Move in open loop and stop in closed loop for fast, smooth motion with accurate stops.

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.
- ▲ **PreScan Table**
Cyclic task for immediate response to internal conditions or external 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

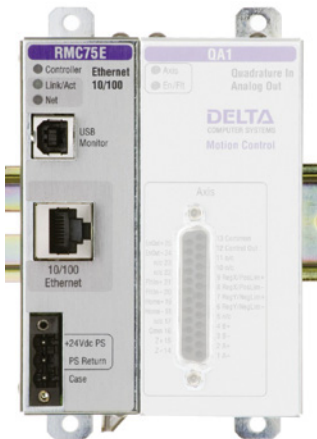
- ▲ **Plots**
Plot any register in the RMC70, up to 16 registers per plot, sampled down to the control loop resolution.
- ▲ **Event Log**
Speeds troubleshooting by recording events such as parameter changes, commands, errors, and communications.

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 0.5 to 4 ms

Power

Voltage +24 VDC \pm 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)

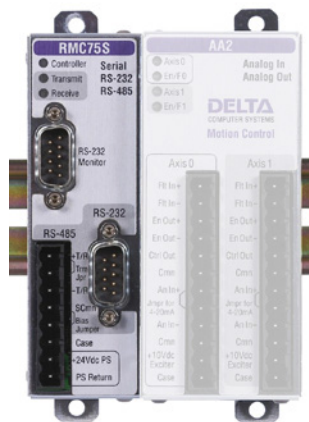
Weight – Base module Up to 0 lb 12 oz (0.4 kg)
with 4 Expansion modules Up to 2 lb 0oz (0.9 kg)

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)

Delta plans to expand the RMC70 Ethernet protocol offerings. Call Delta for the target release date of specific protocols.

RMC75P – PROFIBUS-DP Communication

PROFIBUS is a vendor-independent, open fieldbus standard for a wide range of applications in manufacturing and factory automation. This high-speed fieldbus was 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 spanning up to 14 km.

The RMC75P module supports data rates up to 12 Mbaud, permitting high-speed on-the-fly downloads of positions, parameters, and commands to the RMC70 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.

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.

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	48k Ω (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 1.5 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 transducers. 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.

AAx 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 5M Ω

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/ $^{\circ}$ C typical

Gain drift with temperature 20 ppm/ $^{\circ}$ C typical

Non-linearity 12 LSB (counts) typical

Exciter Output 10 VDC $\pm 2\%$, 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.

MAx 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 μ m 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 μ s

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 1/2-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.

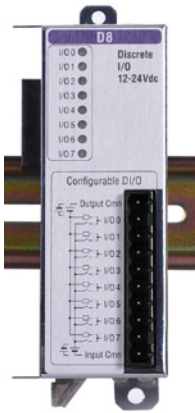
A2 Specifications

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 M Ω
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/ $^{\circ}$ C typical
Gain drift with temperature	20 ppm/ $^{\circ}$ C typical
Non-linearity	12 LSB (counts) typical over full 16-bit range
Exciter Output	10 VDC $\pm 2\%$, 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 M Ω
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/ $^{\circ}$ C typical
Gain drift with temperature	20 ppm/ $^{\circ}$ 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 μ sec

Outputs

Output type	Solid State Relay (SSR)
Isolation	500 VAC
Rated voltage	12-24 V, max \pm 30 V (DC or peak AC voltage)
Maximum current	\pm 75 mA
Maximum propagation delay	1.5 ms
Logic 1 (True, On)	Low impedance (50 Ω maximum)
Logic 0 (False, Off)	High impedance (<1 μ A 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 k Ω 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 μ sec

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.

MAxAxis 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.

AAxAxis 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.

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Wiring *continued*

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

QAx 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

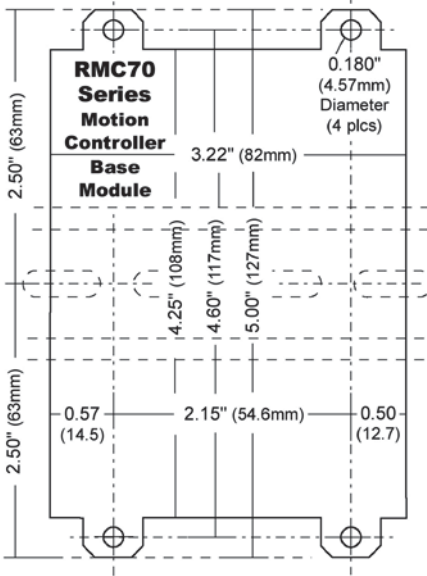
Exp70-Q1 Expansion Module

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

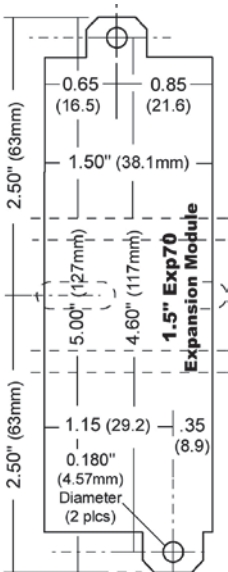
* Use either both jumpers or no jumpers.

RMC70 Series Dimensions

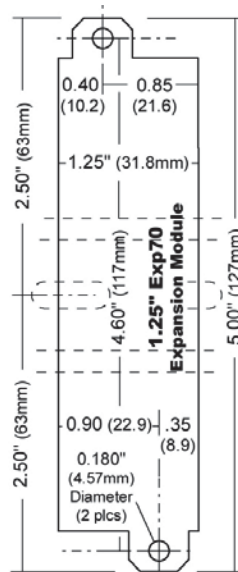
RMC70 Base Module Series Mounting Dimensions



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.

Cable Assemblies

Delta 's provides cable assemblies for certain products. The table below lists the available cables:

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



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/downloads.

Terminal Blocks

All RMCs ship with connectors. Connectors are also available for order individually from Delta. The table below lists the available connectors. These parts are also available from connector manufacturers Amphenol Pcd or WECO using these part numbers.

Connector Part No	Connector Description	For Modules
ELFT03260E	RMC70 3-pin Terminal Block	RMC75E, RMC75P
ELFT08260	RMC70 8-pin Terminal Block	RMC75S, AP2
ELFT10260	RMC70 10-pin Terminal Block	A2, D8
ELFT12260	RMC70 12-pin Terminal Block	AA, MA



The RMC Family of Motion Control



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