32-Axis Motion Controller

The RMC200 is Delta's newest high-performance motion control platform for hydraulic, electric servo, and pneumatic industrial applications up to 32 axes. User-swappable modules provide flexibility and connectivity to many transducer types.

The RMC200's CPU module comes standard with Ethernet, supporting protocols such as EtherNet/IP and Modbus/TCP, and is designed to integrate easily with your favorite PLCs, PCs and HMIs.

Delta's RMCTools software handles setup, programming, tuning and diagnostics for the RMC200, RMC150 and RMC75 controllers. Excellent graphing features and easy-to-use wizards complement its user programs designed specifically for motion sequences.

Flexible Multi-axis Capability

As Delta's largest and most capable motion controller, modules can be "mixed and matched" to support up to 32 axes for tightly synchronized motion.

The initial release in 2016 will support up to 24 control axes, with additional reference axes up to a total of 32 control, reference or virtual axes. With planned larger base modules and I/O modules, up to 32 control axes will be supported.

Industrial Applications

- ▲ Forest products
- ▲ Testing
- ▲ Metals
- ▲ Energy / Petrochemical
- ▲ Automotive
- ▲ Aerospace
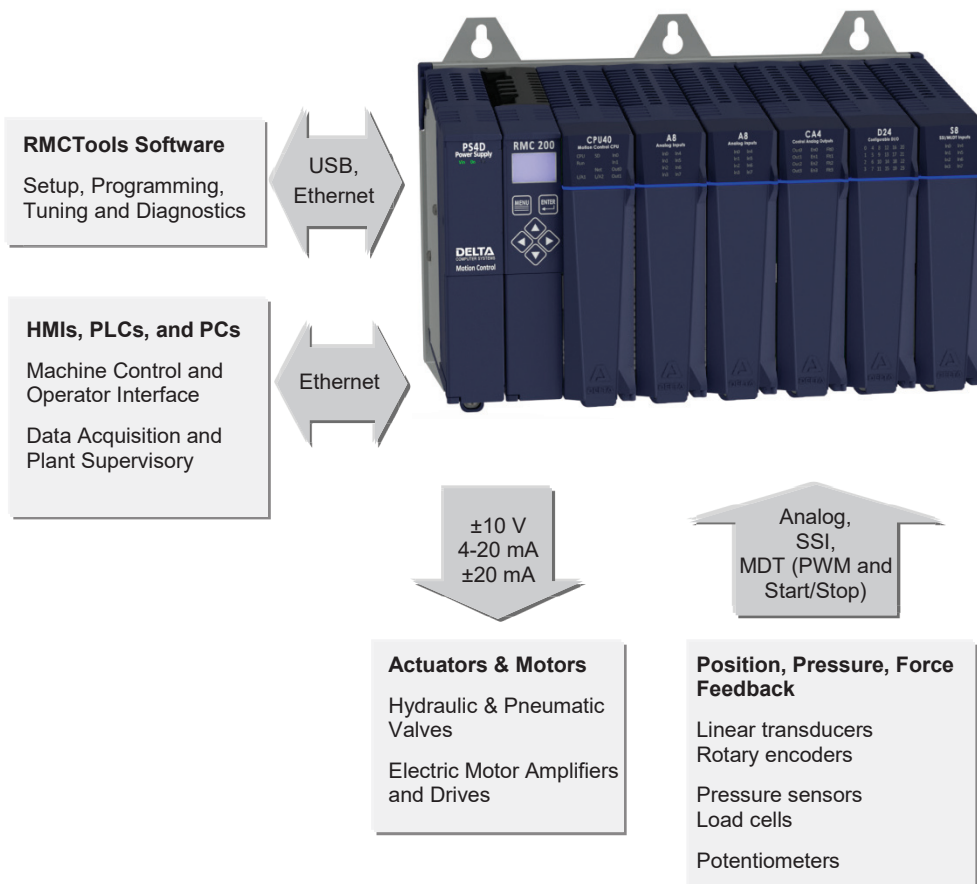- ▲ Plastics and rubber
- ▲ Entertainment
- ▲ Mining

More application notes at deltamotion.com/applications.

Communications

- ▲ **Ethernet** (10/100 Mbps), built-in on CPU. Dual ports (single IP address) supporting star and linear topologies.
  - ▲ EtherNet/IP
  - ▲ Modbus/TCP
  - ▲ CSP (Allen-Bradley)
  - ▲ FINS (Omron)
  - ▲ PROFINET (future)

- ▲ **USB Port**
  For use with RMCTools software and RMCLink ActiveX and .Net assembly.

Feedback Types

- ▲ **Synchronous Serial Interface (SSI)**
  Linear and single- or multi-turn rotary
- ▲ **Magnetostrictive Linear Displacement Transducer (MDT)**
  RS-422 Start/Stop and PWM signals
- ▲ **Analog**
  ±10 V and 4-20 mA
- ▲ **Quadrature Encoder** (future)

RMCTools Software
Setup, Programming, Tuning and Diagnostics

→ USB, Ethernet

HMIs, PLCs, and PCs
Machine Control and Operator Interface

Data Acquisition and Plant Supervisory

→ Ethernet

↓ ±10 V 4-20 mA ±20 mA

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

Actuators & Motors
Hydraulic & Pneumatic Valves

Electric Motor Amplifiers and Drives

Position, Pressure, Force Feedback
Linear transducers
Rotary encoders

Pressure sensors
Load cells

Potentiometers

Ordering Information

A full motion controller requires a base, a power supply, a CPU, a Feature Key with control loops, and I/O modules.

Base
R200-B7	7-slot base (5 I/O module slots)	p. 6
R200-B11	11-slot base (9 I/O module slots)	p. 6

Power Supply
R200-PS4D	24 Vdc-input, 35 W output power supply module	p. 7

CPU
R200-CPU40	RMC200 CPU for up to 32 axes, with dual Ethernet ports, USB, SD card slot, display screen, 2 discrete input, 2 discrete outputs	p. 8

Feature Key
R2-KL*nnn*	**Feature Key:** A removable key mounted in the CPU. Must be ordered with desired number of control loops, with a minimum of four loops.	p. 10

I/O Modules
R200-A8	**Eight analog inputs:** ±10 V or 4-20 mA	p. 11
R200-S8	**Eight SSI or MDT inputs:** Synchronous Serial Interface (SSI) or Magnetostrictive Displacement Transducer (MDT) with Start/Stop or PWM signals	p. 12
R200-CA4	**Four analog outputs:** ±10 V, 4-20 mA, or ±20 mA, with fault inputs and enable outputs	p. 14
R200-D24	**24 Discrete I/O:** 20 configurable I/O, 4 fixed high-speed inputs	p. 16

Options
R2-SC	**Slot Cover:** A cover for empty I/O slots	p. 18

Accessories

Voltage-to-Current Converters .... p. 18
Terminal Blocks .... p. 18

Online Configuration Tool

Create your own RMC200 controller and request a quote!
Go to Delta's website at
www.deltamotion.com and choose
**Request a Quote Online**.

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 RMC200 controllers from a PC. RMCTools also supports the RMC75 and RMC150 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.

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

Supported Operating Systems: Windows® XP SP3/Vista/7/8/10
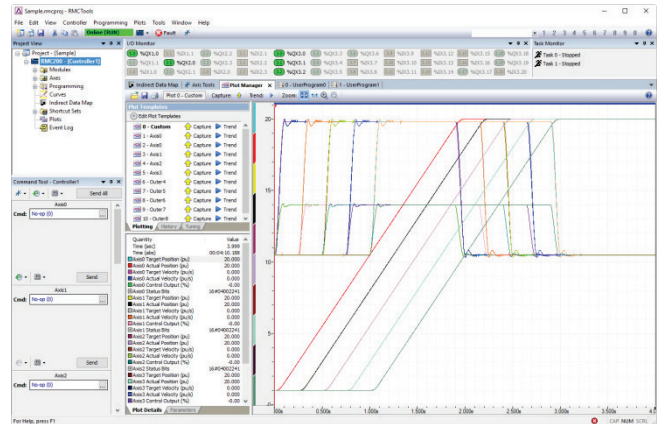
Communication Software

RMCLink ActiveX Control and .NET Assembly

RMCLink enables full monitoring and control of RMC200 motion controllers via Ethernet and USB communications on Windows®-based PCs from custom applications in languages such as Visual Basic, C++, C#, VBScript, VBA (Microsoft Excel®), LabVIEW™, PHP, Jscript, Python, MATLAB®.

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

RMCLink, with extensive examples, is available for download from www.deltamotion.com. RMCLink also supports the RMC75 and RMC150 controllers.

Microsoft, Windows, and Excel are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

For non-Windows applications, such as Linux or embedded C, Delta provides sample C code for communicating with the RMC using Delta's simple DMCP protocol.

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.

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 Tuning.

▲ **Full Parameter Set**
Monitor all axis status registers and modify parameters.

Tuning and Diagnostics

▲ **Plots**
Plot any register in the RMC, up to 32 registers per plot, sampled as finely as the control loop resolution.

▲ **Tuning 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.

Programming

▲ **Commands**
Issue commands directly from RMCTools. Use Shortcut Commands 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.

RMC200 Control Features

The RMC200 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 and 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 and Cams

Position-Pressure and Position-Force Control

- ▲ Transition seamlessly between position or velocity 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 RMC, up to 32 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.

Modular Design

Modules Rock In, Rock Out

The RMC200 modules are designed to be user-installable and removable. The modules rock in and out, rotating around a pivot point. Modules may be installed and removed without being damaged while the RMC200 is powered. The pivot action ensures the electrical pins engage the base pins in a certain order, preventing damage to the module. Note: this is not hot-swapping in the sense of removing modules while equipment is operating.

Materials and Construction

An aluminum base and modules composed of 22 gauge nickel-plated steel sheet metal and UL 94V1 rated PC/ABS plastic provide a long-lasting industrial controller. Indicator LEDs on each module aid troubleshooting, and doors make for a clean appearance. The top of the modules are angled downward to help ensure space for airflow, and to allow the modules to be removed while remaining within the footprint of the base.

Module hold-down Screws

Each module is secured to the base via a captive screw, which extends toward the front of the module for easy screwdriver access.

Unpluggable Terminal Blocks

Wiring connections are made via unpluggable terminal blocks to facilitate the removal of modules in the field. The terminal blocks latch into place and the push-in wire capture style facilitates efficient and reliable wiring. A wire hold-down clip and cable tie points help keep wiring organized.

Pivot point

Screw
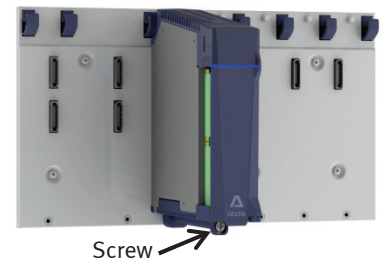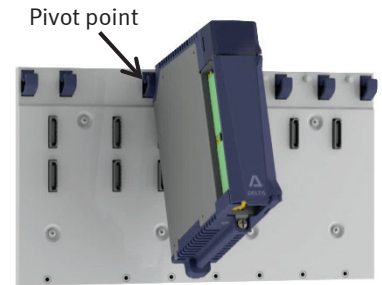
General RMC200 Specifications

Mechanical		
Mounting		Panel-mount
Dimensions with mounting tabs	B7	10.65 x 7.88 x 5.76 in. (WxHxD) (270 x 200 x 146 mm)
	B11	16.15 x 7.88 x 5.76 in. (WxHxD) (410 x 200 x 146 mm)
Environment		
Operating temperature		-4 to +140°F (-20 to +60°C)
Storage temperature		-40 to +185°F (-40 to +85°C)
Humidity		Non-condensing
Agency compliance		Pending: CE, UL, CUL

RMC200

Base Modules

Base modules are available in multiple sizes to accommodate any application.

B7 – 7 Slots (5 I/O module slots)
1 power supply slot, 1 CPU slot, and 5 I/O modules slots. The first I/O slot supports any I/O module or a high-speed communications module (available in a future release).
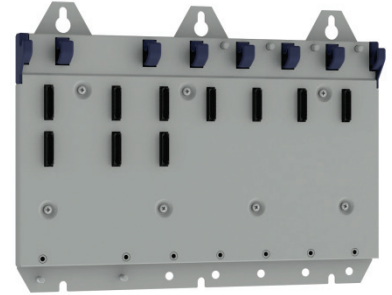
B11 – 11 Slots (9 I/O module slots)
1 power supply slot, 1 CPU slot, and 9 I/O modules slots. The first I/O slot supports any I/O module or a high-speed communications module (available in a future release).

Ordering part numbers:

B7: R200-B7
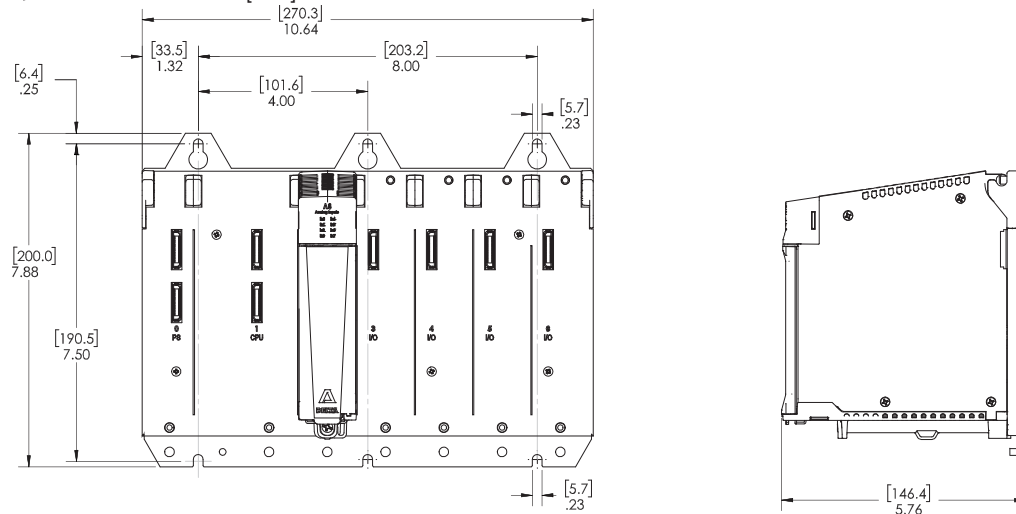
B11: R200-B11

Specifications
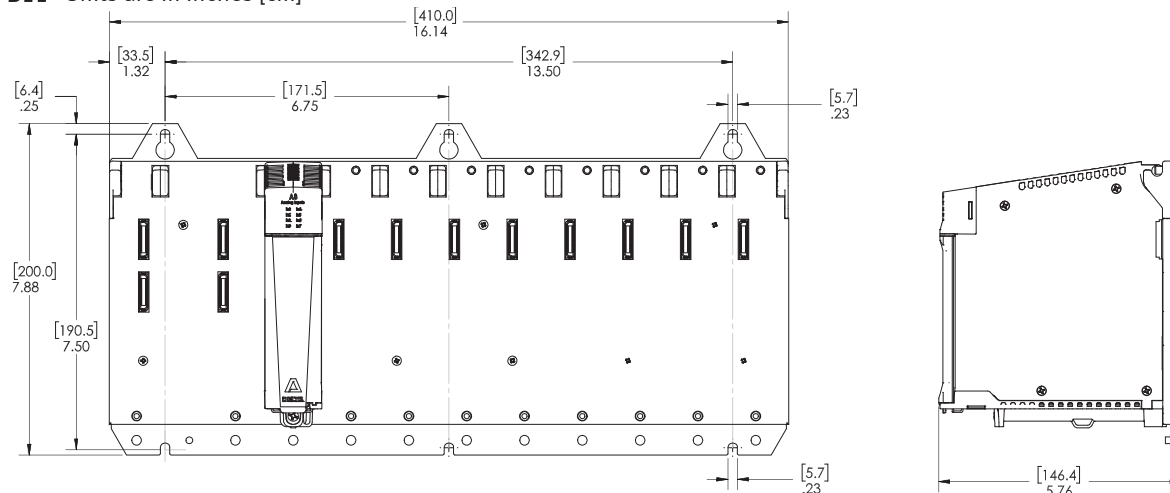
See also General Specifications on page 5.

Mechanical	
Mounting	Panel-mount
Material	Aluminum

Dimensions

B7 Units are in inches [mm]

B11 Units are in inches [cm]

Power Supply Module: PS4D

24 Vdc input, 35 W

The PS4D power supply module powers the B7 and B11 bases and requires a nominal 24 Vdc supply. The PS4D includes status indicator LEDs.

Ordering part number: R200-PS4D

PS4D Specifications

See also General Specifications on page 5.

Power	
Input Voltage	+17 – 36 Vdc
Input Current	2.5 A (max) at full power
Output power	35 Watts
Functional Isolation	500 Vac
LEDs	
Vin	Input voltage level indicator: Green: Normal range (20.4 – 27.4 Vdc) Yellow: Voltage high or low, still operating Flashing Red: Under- or over-voltage, not operating Steady Red: Reverse voltage, not operating
On	Output power indicator: Off: Not providing power to base Green: Providing power to base
Flt	Miscellaneous faults indicator: Flashing Yellow: Power draw high or temperature high, still operating Flashing Red: Power draw high or temperature high, output shut down Flashing Red/Green: Module not plugged into base, output shut down

Shown without door

PS4D Pin-out

The unpluggable terminal block with spring-cage connections accepts stranded wire up to 12 gauge.

Terminal Block	
+24V	24 Volt input power
24Cmn	24 Volt input power common
Case	Electrically connected to the power supply metal and base metal.

Stranded Wire and Ferrule Size	
Conductor cross section	24 – 12 AWG 0.2 – 2.5 mm^2
Conductor cross section, ferrule no plastic sleeve	0.25 – 2.5 mm^2
Conductor cross section, ferrule with plastic sleeve	0.25 – 2.5 mm^2
Stripping Length	10 mm
Ferrule Length	10 – 12 mm

RMC200

CPU Module: CPU40

Dual-core motion controller central processing unit.

The CPU40 is capable of controlling up to 32 axes. The CPU40 includes:

▲ 2 Ethernet ports (single IP address) supporting star and linear topologies.
▲ Supports the following protocols:
  - EtherNet/IP
  - Modbus/TCP
  - CSP (Allen-Bradley)
  - FINS (Omron)
  - PROFINET (future)
  - DMCP (Delta Motion Control Protocol)
▲ High-speed USB 2.0 port (480 Mbps) for communications with RMCTools and RMCLink
▲ Two 12-24 Vdc discrete inputs, individually isolated
▲ Two solid state relay (SSR) discrete outputs, individually isolated
▲ Display screen with navigation buttons
▲ SD card slot (functionality to be added in a future release)
▲ Indicator LEDs
▲ Feature Key slot, accessible from the back of the module

Ordering part number: R200-CPU40

Shown without doors

CPU40 Specifications

See also General Specifications on page 5.

Motion Control	
Control loop times	250 μs, 500 μs, 1 ms, 2 ms, or 4 ms
USB Monitor Port (for setup, programming and maintenance only)	
Connector	USB "B" Receptacle
Data Rate	High-speed (480 Mbps)
Discrete Inputs (2)	
Input type	12-24 Vdc inputs; polarity independent
Logic polarity	True "High"
Functional Isolation	500 VAC, individually isolated
Input "High" range	9 to 26.4 Vdc, 3 mA maximum
Input "Low" range	0 to 5 Vdc, <1 mA
Maximum propagation delay	100 μs Off to On
	750 μs On to Off (open collector drive)
Discrete Outputs (2)	
Output type	Solid State Relays (SSR)
Functional Isolation	500 VAC, individually isolated
Rated voltage	max ±30 V (DC or peak AC voltage)
Maximum current	±75 mA
Maximum propagation delay	1.5 ms
Logic 1 (True, On)	Low impedance (50 Ω maximum)
Logic 0 (False, Off)	High impedance (<1 μA leakage current at 250 V)

CPU40 Specifications (continued)

Ethernet Interface	
Ports	2 ports (single IP address)
Supported Topologies	Star or linear
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)
Connectors	RJ-45 (2)
Cable	CAT5, CAT5e or CAT6, UTP or STP
Ethernet Configuration	
Configuration parameters	IP address, subnet mask, gateway address, enable/disable ports, auto-negotiation
Configuration methods	BOOTP, DHCP, or static
Ethernet Protocol Support	
Application protocols	EtherNet/IP Modbus/TCP CSP (Allen-Bradley) FINS (Omron) PROFINET (future) DMCP (Delta Motion Control Protocol)
Framing protocol	Ethernet II
Internet protocol	IP (includes ICMP, ARP, and Address Collision Detection)
Transport protocols	TCP, UDP
SD Card	
Future	Functionality will be added to the SD card at a future date.

CPU40 Pin-out

The discrete inputs and outputs are individually isolated. Inputs are polarity-independent.

Terminal Block 1 (TB1)	
DIn0+ DIn0-	General-purpose input 0, 12 -24 Vdc
DIn1+ DIn1-	General-purpose input 1, 12 -24 Vdc
DOut0+ DOut0-	General-purpose output 0, Solid State Relay up to 30 Vdc or peak AC
DOut1+ DOut1-	General-purpose output 1, Solid State Relay up to 30 Vdc or peak AC

Terminal Blocks

The unpluggable terminal blocks include spring-cage terminals. Ferrules provide for push-in connections.

Stranded Wire and Ferrule Size	
Conductor cross section	24 – 16 AWG 0.2 – 1.5 mm^2
Conductor cross section, ferrule no plastic sleeve	0.25 – 1.5 mm^2
Conductor cross section, ferrule with plastic sleeve	0.25 – 0.75 mm^2
Stripping Length	10 mm
Ferrule Length	10 – 12 mm

Feature Key

The Feature Key is a rugged, removable and field-upgradable token that is mounted in the CPU. The Feature Key provides the user-specified control features available to the motion controller. Feature Keys are normally ordered together with the CPU module and are ordered together with specified features.

Feature Key Control Features:

Control Loops

The control loops on the feature key define the number of control axes. When purchasing a complete motion controller, four control loops are included at no cost. The number of control loops required per axis are:

- **Single-loop axis: 1 control loop**
  An axis is a single-loop axis if it controls one quantity, such as only position, or only force.

- **Dual-loop axis: 2 control loops**
  An axis that controls two quantities such as position and force.

- **Reference axis: 0 control loops**
  An axis with only an input, and no control output. Also called a half-axis.

- **Virtual axis: 0 control loops**
  A type of reference axis with no input, and no control, but provides virtual motion.

- **Output only axis: 0 control loops**
  An axis with only an analog output.

Ordering part number: R2-KL*nnn*, where *nnn* is the number of loops, with a minimum of four (004).

Feature Key Specifications

Specifications – Apply only to the Feature Key, not the CPU or other modules	
Contact Life	10,000 cycles min.
ESD Protection	15 kV
Read Cycles	Unlimited
Write Cycles	100,000 minimum (writes are performed only when applying new features)
Data Life (Storage) at 35°C	30 years minimum, 50 years typical
Operational Temperature	-40°C to +85°C (-40°F to +185°F)
Storage Temperature	-40°C to +100°C (-40°F to +212°F)

I/O Module: A8

8 Analog Inputs, ±10 V or 4-20 mA

The A8 module provides eight analog inputs for ±10 V or 4-20 mA signals, with 18 bits of resolution. The A8 module includes 10 Vdc exciter outputs intended for use with potentiometers. One LED per channel indicates the state of the respective input.

A8 Specifications

See also General Specifications on page 5.

| Inputs	
Inputs	Eight 18-bit differential
Functional Isolation	500 VAC
Overvoltage protection	±24 V
Input ranges	±10 V, 4-20 mA (each input independently configurable)
Input impedance	Voltage input: 1 MΩ Current input: 250Ω
Input filter slew rate	25 V/ms
Sampling frequency	64 kHz internal sampling. Provides one sample per control loop to CPU.
Sampling filter	250 Hz – 4 kHz, user-selectable internal low-pass sampling filter.
Offset drift with temperature	0.2 LSB/°C typical (±10 V range)
Gain drift with temperature	20 ppm/°C typical (±10 V range)
Non-linearity	12 LSB (counts) typical (±10 V range)
Exciter output	10 Vdc ± 2%, 40 mA max total of all exciter outputs per terminal block

A8 Pin-out

Shown without door

Terminal Block 1 (TB1)

Description		Pin		Description	
Input 0 10V Exciter output	10V Exc	1	2	In0+V	Input 0+ Voltage
Input 0 Common	Cmn	3	4	In0+mA	Input 0+ Current
Input 0 Shield connection	Case	5	6	In0-	Input 0-
Input 1	10V Exc	7	8	In1+V	Input 1
	Cmn	9	10	In1+mA	
	Case	11	12	In1-	
Input 2	10V Exc	13	14	In2+V	Input 2
	Cmn	15	16	In2+mA	
	Case	17	18	In2-	
Input 3	10V Exc	19	20	In3+V	Input 3
	Cmn	21	22	In3+mA	
	Case	23	24	In3-	

Terminal Block 2 (TB2)

Description		Pin		Description	
Input 4	10V Exc	1	2	In4+V	Input 4
	Cmn	3	4	In4+mA	
	Case	5	6	In4-	
Input 5	10V Exc	7	8	In5+V	Input 5
	Cmn	9	10	In5+mA	
	Case	11	12	In5-	
Input 6	10V Exc	13	14	In6+V	Input 6
	Cmn	15	16	In6+mA	
	Case	17	18	In6-	
Input 7	10V Exc	19	20	In7+V	Input 7
	Cmn	21	22	In7+mA	
	Case	23	24	In7-	
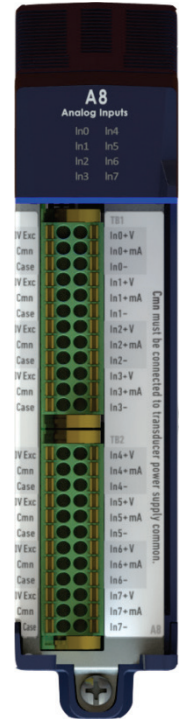
Connection Notes:

When connecting a voltage signal, use the In+V, In-, and Cmn pins. Do not connect In+mA.

When connecting a current signal, use the In+mA, In-, and Cmn pins. Do not connect In+V.

The Cmn pins must be connected to transducer commons.

Inputs 0-7 are isolated as a single group. There is no isolation between inputs.

Exciter outputs are +10 Vdc referenced to Cmn. Maximum current of 40 mA total of all exciter outputs per terminal block.

Terminal Blocks:

The unpluggable terminal blocks include spring-cage terminals. Ferrules provide for push-in connections.

Stranded Wire and Ferrule Size	
Conductor cross section	24 – 16 AWG 0.2 – 1.5 mm^2
Conductor cross section, ferrule no plastic sleeve	0.25 – 1.5 mm^2
Conductor cross section, ferrule with plastic sleeve	0.25 – 0.75 mm^2
Stripping Length	10 mm
Ferrule Length	10 – 12 mm

I/O Module: S8 Module

8 SSI or MDT Inputs

The S8 module provides eight inputs, individually software selectable as SSI, or as magnetostrictive Start/Stop or PWM inputs. The S8 module interfaces with both linear sensors and rotary encoders. One LED per channel indicates the state of the respective input.

S8 Specifications

See also General Specifications on page 5.

SSI Interface	
Data input	RS-422 differential
Clock output	RS-422 differential
Termination	Software selectable data input impedance: 110 Ω or >200 kΩ
Clock frequency	User-selectable, 100 kHz to 2500 kHz
Cable length maximum	Transducer dependent (approx. 3-2100 ft)
Resolution	Transducer dependent (up to 0.5 µm for magnetostrictive LDTs)
Count encoding	Binary or Gray Code
Data bits	8 to 32 bits
Bit masking	High or low bits may be masked
Additional Settings	Selectable overflow modes to conform to various SSI transducers Wire break detection
Start/Stop and PWM Interface	
Transducer interface types	MDT with Start/Stop or PWM (Pulse Width Modulated) feedback
Interrogation output	RS-422 differential (transducer must be configured for external interrogation)
Return input	RS-422 differential
Resolution	0.0005 in. with one recirculation
Count rate	240 MHz
Recirculations	Supports multiple recirculations only for PWM transducers with internal recirculations.
Maximum transducer length	440 in. at 4 ms (loop-time dependent)
Common	
Functional Isolation	500 VAC

Shown without door

RMC200
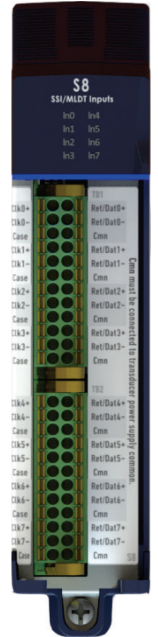
S8 Pin-out

Terminal Block 1 (TB1)

Description		Pin		Description
Input 0 Interrogate+ or Clock+	Int/Clk0+	1	2	Ret/Dat0+	Input 0 Return+ or Data+
Input 0 Interrogate- or Clock-	Int/Clk0-	3	4	Ret/Dat0-	Input 0 Return- or Data-
Input 0 Shield connection	Case	5	6	Cmn	Input 0 Common
Input 1	Int/Clk1+	7	8	Ret/Dat1+	Input 1
Input 1	Int/Clk1-	9	10	Ret/Dat1-	Input 1
Input 1	Case	11	12	Cmn	Input 1
Input 2	Int/Clk2+	13	14	Ret/Dat2+	Input 2
Input 2	Int/Clk2-	15	16	Ret/Dat2-	Input 2
Input 2	Case	17	18	Cmn	Input 2
Input 3	Int/Clk3+	19	20	Ret/Dat3+	Input 3
Input 3	Int/Clk3-	21	22	Ret/Dat3-	Input 3
Input 3	Case	23	24	Cmn	Input 3

Terminal Block 2 (TB2)

Description		Pin		Description
Input 4	Int/Clk4+	1	2	Ret/Dat4+	Input 4
Input 4	Int/Clk4-	3	4	Ret/Dat4-	Input 4
Input 4	Case	5	6	Cmn	Input 4
Input 5	Int/Clk5+	7	8	Ret/Dat5+	Input 5
Input 5	Int/Clk5-	9	10	Ret/Dat5-	Input 5
Input 5	Case	11	12	Cmn	Input 5
Input 6	Int/Clk6+	13	14	Ret/Dat6+	Input 6
Input 6	Int/Clk6-	15	16	Ret/Dat6-	Input 6
Input 6	Case	17	18	Cmn	Input 6
Input 7	Int/Clk7+	19	20	Ret/Dat7+	Input 7
Input 7	Int/Clk7-	21	22	Ret/Dat7-	Input 7
Input 7	Case	23	24	Cmn	Input 7

Stranded Wire and Ferrule Size	
Conductor cross section	24 – 16 AWG 0.2 – 1.5 mm^2
Conductor cross section, ferrule no plastic sleeve	0.25 – 1.5 mm^2
Conductor cross section, ferrule with plastic sleeve	0.25 – 0.75 mm^2
Stripping Length	10 mm
Ferrule Length	10 – 12 mm

Connection Notes:

For SSI:
Int/Clk = Clock, Ret/Dat = Data

For Magnetostrictive Start/Stop or PWM:
Int/Clk = Interrogate, Ret/Dat = Return

The Cmn pins must be connected to transducer commons.

Inputs 0-7 are isolated as a single group. There is no isolation between inputs.

For best noise performance, use shielded, twisted-pair wires and connect Cmn to transducer common with separate wire.

Terminal Blocks:

The unpluggable terminal blocks include spring-cage terminals. Ferrules provide for push-in connections.

I/O Module: CA4 Module

4 Analog Outputs, ±10 V, 4-20 mA, or ±20 mA, with Fault Inputs and Enable Outputs

The CA4 module provides four analog outputs specifically designed for control outputs to valves, amplifiers, or drives. The outputs are individually software selectable as ±10 V, 4-20 mA, or ±20 mA for connection to a wide variety of actuators. The CA4 also supports custom ranges within the ±10 VDC and ±20 mA ranges, such as 0-10 V, 0-5 V, 1-5 V, etc.

Each analog output has an associated 12-24 Vdc Fault Input and a solid state relay Enable Output. The Fault Inputs and Enable Outputs may be dedicated to the respective output, or may be used as general-purpose discrete I/O.

Three LEDs per channel indicate the state of the respective analog output, Enable Output, and Fault Input.
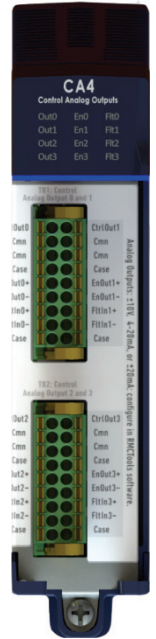
CA4 Specifications

See also General Specifications on page 5.

Shown without door

Analog Outputs	
Range	Voltage mode: ± 10 V @ 15 mA (670 Ω or greater load)
	Current mode: ± 20 mA @ 10 V (500 Ω or lower load)
Tolerance at full output	Voltage mode: ± 5 mV at 10 V
	Current mode: ± 10 μA at 20 mA
Resolution	18 bits
Hardware Output Filter	First-order filter, time constant 100 μsec
Functional Isolation	500 VAC
Overload protection	Continuous short to common
Overvoltage protection	Outputs are protected by clamp diodes
Enable Output	
Output type	Solid State Relay
Logic polarity	User selectable to Active Open or Active Closed
Functional Isolation	500 VAC
Rated voltage	max ±30 V (DC or peak AC voltage)
Maximum current	±75 mA
Maximum propagation delay	1.5 ms
Closed	Low impedance (10 Ω maximum)
Open	High impedance (<1 μA leakage current at 250 V)
Fault Input	
Input characteristics	12-24 Vdc; polarity independent, sinking or sourcing
Logic polarity	User selectable to Active Input "High" or Active Input "Low" (Open when module not powered)
Functional Isolation	500 VAC
Input "High" range	9 to 26.4 Vdc (polarity independent), 3 mA maximum
Input "Low" range	0 to 5 Vdc (polarity independent), <1 mA
Maximum propagation delay	100 μs Off to On 750 μs On to Off (open collector drive)

Continued on next page.

CA4 Pin-out

Terminal Block 1 (TB1)

Description		Pin		Description	
Voltage or current output 0	CtrlOut0	1	2	CtrlOut1	
Output common	Cmn	3	4	Cmn	
Output common	Cmn	5	6	Cmn	
Shield connection	Case	7	8	Case	
Enable Output 0+	EnOut0+	9	10	EnOut1+	Output 1
Enable Output 0-	EnOut0-	11	12	EnOut1-	
Fault Input 0+	FltIn0+	13	14	FltIn1+	
Fault Input 0-	FltIn0-	15	16	FltIn1-	
Shield connection	Case	17	18	Case	

Terminal Block 2 (TB2)

Description		Pin		Description	
	CtrlOut2	1	2	CtrlOut3	
	Cmn	3	4	Cmn	
	Cmn	5	6	Cmn	
	Case	7	8	Case	
Output 2	EnOut2+	9	10	EnOut3+	Output 3
	EnOut2-	11	12	EnOut3-	
	FltIn2+	13	14	FltIn3+	
	FltIn2-	15	16	FltIn3-	
	Case	17	18	Case	

Stranded Wire and Ferrule Size	
Conductor cross section	24 – 16 AWG 0.2 – 1.5 mm^2
Conductor cross section, ferrule no plastic sleeve	0.25 – 1.5 mm^2
Conductor cross section, ferrule with plastic sleeve	0.25 – 0.75 mm^2
Stripping Length	10 mm
Ferrule Length	10 – 12 mm

Connection Notes:

The CtrlOut pin is normally ±10V. May be configured to ±20 mA or 4-20 mA in RMCTools.

Analog outputs 0-3 are isolated as a single group. There is no isolation between outputs.

For best noise performance, use shielded, twisted-pair wires. When connecting to a differential input, connect CtrlOut and Cmn as a twisted pair to the receiver differential inputs, and also run a separate wire from Cmn to the differential input common.

Terminal Blocks:

The unpluggable terminal blocks include spring-cage terminals. Ferrules provide for push-in connections.

I/O Module: D24 Module

24 Discrete I/O

The D24 discrete I/O module contains 20 configurable discrete I/O points for 24 Vdc and 4 high-speed discrete inputs for either 5 or 24 Vdc signals.

The four high-speed inputs of the D24 module support general-purpose input functionality. Specific high-speed functions are planned for a future field-upgradable update.

20 general-purpose discrete I/O points:

▲ 24 Vdc signals
▲ Individually software-configurable as an input or output (solid state relay).
▲ Arranged in 3 isolated groups of 8, 8, and 4 I/O points.

4 high-speed inputs:

▲ 5 or 24 Vdc signals (separate pin for 5 or 12-24 Vdc connection)
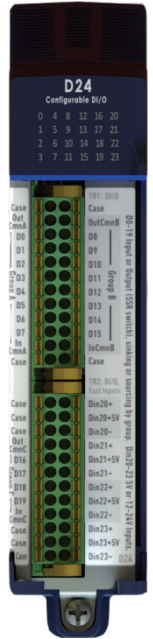
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D24 Specifications

See also General Specifications on page 5.

General Purpose Inputs	
Input Characteristics	12-24 Vdc; polarity independent, sinking or sourcing
Logic polarity	True High
Functional Isolation	500 VAC
Input "High" range	9 to 26.4 Vdc (polarity independent), 3 mA maximum
Input "Low" range	0 to 5 Vdc (polarity independent), <1 mA
Maximum propagation delay	100 µsec
High-Speed Inputs	
Input Characteristics	5 or 12-24 Vdc (separate pins for 5 or 12-24 Vdc)
Logic polarity	True High
Functional Isolation	500 VAC
Input "High" range	5 Vdc input: 3.5 to 5.5 Vdc, 7.5 mA max 12-24 Vdc input: 9 to 26.4 Vdc, 7 mA max
Input "Low" range	5 Vdc input: 0 to 1.7 Vdc, <1 mA 12-24 Vdc input: 0 to 5 Vdc, <1 mA
Maximum propagation delay	Off to On: 5 Vdc input: 0.3 µs 12-12 Vdc input: 0.3 µs On to Off: 5 Vdc input: 0.3 µs, (1.2 µs, open collector drive, 5V) 12-12 Vdc input: 0.5 µs, (11 µs, open collector drive, 24V)
Maximum input frequency	5 Vdc input: 1,000 kHz, (400 kHz, open collector drive, 5V) 12-24 Vdc input: 500 kHz, (25 kHz, open collector drive, 24V)
General Purpose Outputs	
Outputs	Solid State Relay
Functional Isolation	500 VAC
Maximum voltage	max ±30 V (DC or peak AC voltage)
Maximum current	±75 mA
Maximum propagation delay	1.5 ms
Logic 1 (True, On)	Low impedance (50 Ω maximum)
Logic 0 (False, Off)	High impedance (<1 µA leakage current at 250 V)

Continued on next page.

D24 Pin-out

Terminal Block 1 (TB1)

Description		Pin			Description
Shield connection	Case	1	2	Case	Shield connection
Common for group A outputs	OutCmnA	3	4	OutCmnB	Common for group B outputs
DI/O point 0	D0	5	6	D8	DI/O point 8
DI/O point 1	D1	7	8	D9	DI/O point 9
DI/O point 2	D2	9	10	D10	DI/O point 10
DI/O point 3	D3	11	12	D11	DI/O point 11
DI/O point 4	D4	13	14	D12	DI/O point 12
DI/O point 5	D5	15	16	D13	DI/O point 13
DI/O point 6	D6	17	18	D14	DI/O point 14
DI/O point 7	D7	19	20	D15	DI/O point 15
Common for group A inputs	InCmnA	21	22	InCmnB	Common for group B inputs
Shield connection	Case	23	24	Case	Shield connection

Terminal Blocks:

The unpluggable terminal blocks include spring-cage terminals. Ferrules provide for push-in connections.

Stranded Wire and Ferrule Size	
Conductor cross section	24 – 16 AWG 0.2 – 1.5 mm^2
Conductor cross section, ferrule no plastic sleeve	0.25 – 1.5 mm^2
Conductor cross section, ferrule with plastic sleeve	0.25 – 0.75 mm^2
Stripping Length	10 mm
Ferrule Length	10 – 12 mm

Terminal Block 2 (TB2)

Description		Pin			Description
Shield connection	Case	1	2	Din20+	Input 20+ for 12-24 Vdc signals
Shield connection	Case	3	4	Din20+5V	Input 20+ for 5 Vdc signals
Shield connection	Case	5	6	Din20-	Input 20- for all signals
Common for group C outputs	OutCmnC	7	8	Din21+	Input 21
Discrete I/O point 16	D16	9	10	Din21+5V	
Discrete I/O point 17	D17	11	12	Din21-	
Discrete I/O point 18	D18	13	14	Din22+	Input 22
Discrete I/O point 19	D19	15	16	Din22+5V	
Common for group C inputs	InCmnC	17	18	Din22-	
Shield connection	Case	19	20	Din23+	Input 23
Shield connection	Case	21	22	Din23+5V	
Shield connection	Case	23	24	Din23-	

## D24 Configurability and Connection Notes

I/O Points 0-19:

Divided into groups A, B, and C. Each group contains I/O points with a shared output common and input common. Each individual point is configured in the RMCTools software to be an input or an output.

All inputs in a group share the same common, and all outputs in a group share the same common.

Within each group, 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 inputs can be active high or low.

Inputs 20-23:

Inputs only, individually isolated. For 12-24 Vdc inputs, wire to Din+ and Din-. For 5 Vdc inputs, wire to Din+5V and Din-. Do not wire both Din+ and Din+5V on the same input.

Group A
OutCmnA
D0
D1
D2
D3
D4
D5
D6
D7
InCmnA
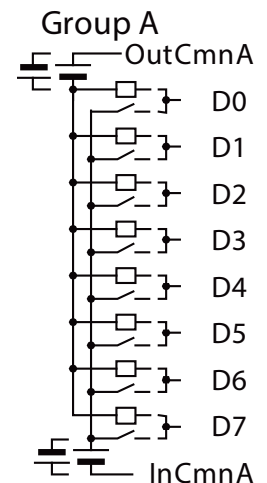
Blank Slot Covers

The blank slot covers protect the base connector from foreign particles. The covers hinge on the top hooks of the base and magnetically attach to the base. In addition, a hole allows the user to supply and install a screw for firm attachment to the base. Recommended screw size is #6-32 x 1/2" or #6-32 x 5/8".

Part number: R2-SC

Voltage-to-Current Converters

Delta's voltage-to-current converters are designed for converting a voltage control output to current for current-controlled servo valves. 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.

Notice that the CA4 analog output module supports up to ±20 mA and does not need a converter for valves rated for ±20 mA or less.

| 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.

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 manufacturer Phoenix using these part numbers.

Phoenix Connector Part No	Delta Part No	Connector Description	For Modules
FKC 2,5/ 3-ST-5,08-LR - 1792520	EPA0078	3-pin Terminal Block	PS4D
FMC 1,5/ 8-ST-3,5-RF – 1952089	EPA0081	8-pin Terminal Block	CPU40
DFMC 1,5/ 9-ST-3,5-LR – 1790551	EPA0079	18-pin Terminal Block	CA4
DFMC 1,5/12-ST-3,5-LR – 1790580	EPA0080	24-pin Terminal Block	A8, S8, D24
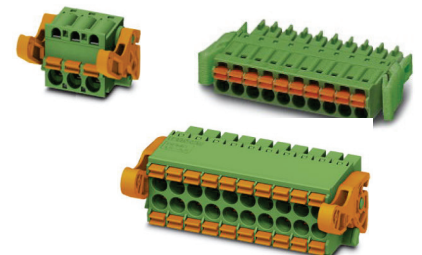
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Connect. Control. Optimize.