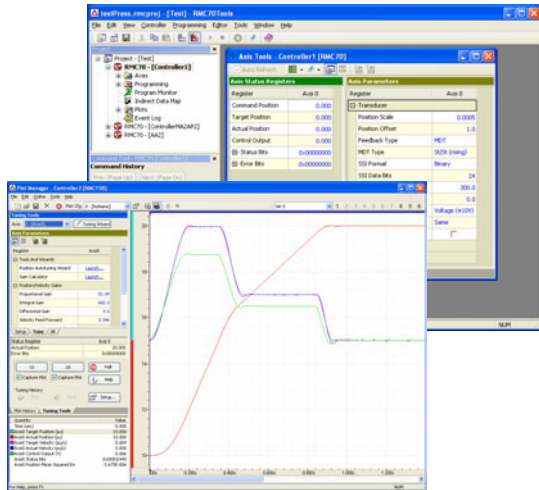


# RMC70 Motion Controller Startup Guide



**DELTA**  
COMPUTER SYSTEMS

*Motion Control and More*



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## RMC70 Overview

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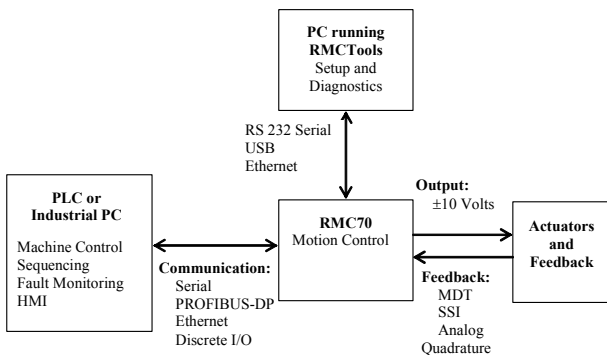
The RMC70 series offers the best combination of ease-of-use, price and performance for one- or two-axis systems. The RMC70 gives smooth, precise, synchronized control of hydraulic, electric, and pneumatic axes, improving part quality and machine life.

The RMC75 is the first in the series. Typically used in conjunction with a machine control PLC, the RMC75 boosts throughput by allowing time-critical sequences to be off-loaded into its User Programs.

Multiple communications choices support popular protocols such as RS-232 DF1 and Modbus/RTU, PROFIBUS, Ethernet/IP and Modbus/TCP and easy systems integration by mirroring PLC register addressing.

The RMC70 base module consists of the CPU, communications, and one or two axes of motion control. Up to four expansion modules can be added in the field for additional capabilities.

Delta's RMCTools software speeds development with a wealth of setup, tuning and diagnostics features.



**Figure 1.** Typical RMC70 and RMCTools installation.

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## How to Use this Guide

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Use this guide to help you get your system up and running. For best results, follow this guide step-by-step.

### Using the Help

This guide will refer you to the extensive RMCTools help for information you will need when setting up your system. To access the help, click the **Help** menu in RMCTools and select **Help Topics**.

### Obtaining a User Manual

The information contained in the RMC70 help is also available in the following formats:

- As a Portable Document Format (PDF) file on the CD included with the RMC70 controller or available as a free download from Delta's web site at [deltamotion.com](http://deltamotion.com).
- A printed manual can be purchased from Delta. Contact Delta by telephone at 360-254-8688 or email at [sales@deltamotion.com](mailto:sales@deltamotion.com).

## **Saving Configuration Settings**

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Throughout the startup procedure, make sure you save the configuration changes you make or they may be lost! Configuration settings should be saved in the RMCTools software *and* in Flash memory in the RMC70.

In this Startup Guide, whenever you are prompted to change parameters in RMCTools, remember to save the settings using this procedure:

- a) Save the settings in the RMC70 to Flash memory:
  - In RMCTools, on the **Controller** menu, click **Update Flash**.

***Note:** If you do not update Flash memory, your changes to the RMC70 **will** be lost when power is removed!*

- b) Save the Project file in RMCTools:
  - On the **File** menu, click **Save**.

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# Step 1: Mount the RMC70

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## Mounting Options:

- Symmetrical DIN 3
- Panel-mount – See Appendix B for mounting hole dimensions

## Orientation:

The RMC should be mounted upright on a vertical surface, such that the ventilation holes are on top and bottom.

## Clearance above and below:

The amount of clearance required depends on the maximum ambient temperature:

<u>Ambient Temperature</u>	<u>Clearance</u>
122 - 140°F (50 - 60°C)	3 in (7.6 cm)
86 - 122°F (30 - 50°C)	2 in (5.1 cm)
Less than 86°F (30°C)	1 in (2.5 cm)

## Grounding

Make sure to properly ground the RMC70. If mounted on a DIN rail, the RMC70 will conduct to the DIN rail. The RMC70 shell is electrically connected its Case pins.

## **Step 2: Add Expansion Modules**

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If your RMC70 is to have any expansion modules, and they are not yet installed on the RMC70, add them now. Follow the instructions included with each expansion module to attach it to the RMC70 and wire it.

***Note:***

*Make sure power is removed from the RMC70 before adding expansion modules!*

Expansion modules can be added in any order. A maximum of 4 expansion modules may be added. The RMC70 will not recognize more than 4 expansion modules total. In addition, the RMC70 will not support more than 2 Q1 modules.

***Note:***

*Do not add more than 4 expansion modules! Adding more than 4 expansion modules may burden the RMC70 circuitry!*

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## Step 3: Apply Power

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The RMC70 requires a +24V power supply.

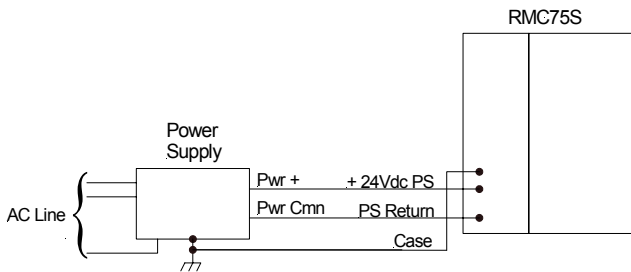
### Power Supply Requirements

- **Voltage:** +24VDC ( 21.6 – 26.4VDC)
- **Current rating:** Minimum 500 mA

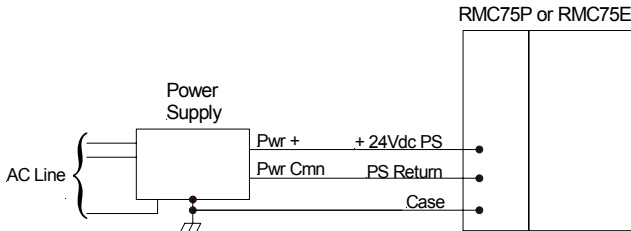
### Connect Power

- a) Connect 24VDC to the RMC70 according to the diagram of your controller type:

#### RMC75S



#### RMC75P, RMC75E



## Step 4: Install RMCTools

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### PC Requirements

- **Processor:** Intel Pentium or AMD equivalent, 200 MHz or higher.
- **Operating System:** Microsoft Windows Vista, Windows XP, Windows 2000, Windows Me, Windows 98, or Windows NT 4.0.

*Note: The USB driver used to connect to the RMC75E module is not supported on Windows NT.*

*Note: Windows NT 4.0 requires SP6 and IE 4.0 or later.*

- **RAM:** 64MB
- **Hard Disk Space:** 20MB of available hard disk space
- **Display:** 1024x768 VGA display with 16-bit color or better
- **Accessories:** Mouse or pointing device

### Installation

You can install RMC70 Tools from the CD that shipped with the RMC, or by downloading it from Delta's download page at [www.deltamotion.com/downloads/](http://www.deltamotion.com/downloads/).

#### To install from the CD:

- a) Insert the CD and wait for the splash screen to appear. Click **Install RMCTools**. Follow the instructions for installation.  
If the splash screen does not automatically open, run the autorun.exe file.

---

**To install by downloading:**

- a) Go to Delta's download website at <http://www.deltamotion.com/downloads/>
- b) Locate the **rmctoolsse.exe** file, click it and save it to your computer.
- c) Run **rmctoolsse.exe** and follow the instructions.

## **Start RMCTools**

To start RMCTools, click the **Start** menu, click **Programs** and then **RMCTools**.

***Note:** It is also possible to run RMCTools directly from the CD without installing it on your PC. To do this, insert the RMC70 CD, wait for the splash screen to appear, and click **Run RMCTools from CD**.*

## Step 5: Connect RMC70 to PC

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The method of connecting your PC to the RMC70 series controller depends on which RMC70 controller you have.

### Connecting to RMC75S or RMC75P

To connect the RMC75S or RMC75P to your PC, you need a Null-modem, DB-9, female-to-female cable. If you make your own cable, pins 2 and 3 must be crossed over, and pin 5 must be straight-through.

- a) Plug the cable into the RMC75 port labeled **RS-232 Monitor**.
- b) On the PC, plug the cable into a serial port. Note which serial port it is. You will need to know this later.

### Connecting to RMC75E

You can connect to the RMC75E via USB or Ethernet.

#### Via USB

Connecting to the RMC75E via USB requires a standard A to B USB cable. This is the same USB cable that is used for many PC peripherals, such as printers, scanners, etc. This cable is readily available at any store that sells electronics.

- a) Connect the USB cable to the PC and to the RMC75 port labeled **USB Monitor**. After a few seconds (you may need to wait a bit), a window will open indicating that new hardware was found and the USB driver is being installed. After the window closes, continue to the next step.

#### Via Ethernet

Make sure both the RMC75E and the PC are connected to the same Ethernet network.

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## Step 6: Start a new RMC70 Project

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### Start a new project:

- a) In RMCTools, in the Startup dialog, choose **Create a New Project** and click **OK**. If the Startup dialog is not open, click on the **File** menu, choose **New** and then **Project**.
- b) In the New Project Wizard, enter the project name, the path where you want to save the project, and the author's name.
- c) Ensure that the **Start the New Controller Wizard** box is checked.
- d) Click **Finish**.
- e) In the New Controller Wizard, enter a Controller Name, select **Automatically Detect the Controller Information**, and click **Next**.
- f) **RMC75E:**  
Click **USB** or **Ethernet** and click **Next**. Wait a few seconds while RMCTools finds the RMC75s connected to the PC via USB or Ethernet. Click the desired RMC75 and click **Next**.

*Note: If your RMC75 does not appear, click **Help** for instructions on how to fix the problem.*

#### **RMC75S or RMC75P:**

Select the serial port you are using to communicate to the RMC70 and click **Next**. Ensure that the serial port is set to the same port that you connected the serial cable to earlier.

- g) RMCTools will connect to the RMC75. The wizard will show the part number of the controller that it has connected to. Click **Finish** to add it to the project.

## Project Pane

The Project pane should now be visible in RMCTools, as shown in Figure 2. If it is not visible, open it as follows: on the **View** menu, click **Project**.

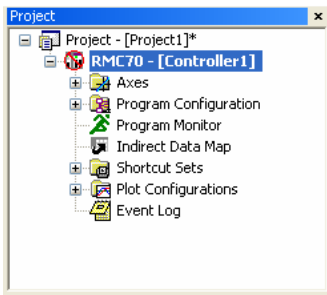


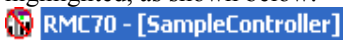
Figure 2: Project Pane


## Go Online

In order to view the data in the controller, RMCTools must be *online*, or communicating, with the controller. In the Project pane, the RMC70 icon has a red circle with a bar through it when the controller is offline, as shown in Figure 2.

### To go online:

- a) In the Project pane, click the controller, so that it is highlighted, as shown below.




- b) Click the **Go Online** button  on the toolbar. If RMCTools successfully goes online with the controller, the red circle around the RMC70 icon in the Project pane will disappear, as shown below.



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**To go offline:**

- a) In the Project pane, click the controller.
- b) Click the **Go Offline** button  on the toolbar. A red circle will appear over around the RMC70 icon in the Project pane.

## Define the Axes

The user has full flexibility in defining the internal RMC70 axes by assigning them to the hardware. A few examples of axes definitions:

- An axis is defined as a position control axis and uses the Axis 0 connector Control Output and the Axis 0 feedback.
- An axis is defined as a reference axis and uses the analog input from an A2 expansion module.
- An axis is defined as a Control Output Only axis and uses the Axis 1 connector Control Output.
- An axis is defined as a position-force axis and uses the Axis 0 connector Control Output, the Axis 0 connector feedback, and the two analog inputs an AP2 expansion module.

You should view the axis definitions to ensure they are what you want.

***Note:** If you need any pressure or force control, or have reference axes, you will probably need to change the default axis definitions.*

**To view the axis definitions:**

- a) In the Project pane, click the controller.

- c) On the **Controller** menu, click **View/Edit Axis Definitions**.
- d) The box displays the RMC70 axes, along with a description of each. To see which hardware is assigned to which axis, click the axis in the box. The image below shows which hardware is assigned to the axis.



**To change the axis definitions:**

- a) In the View/Edit Axis Definitions dialog, click **New** to add an axis, click **Change** to edit an axis, and click **Remove** to remove an axis. For more details, click the **Help** button.

## **PROGRAM mode and RUN mode**

When the RMC70 starts up, it is in PROGRAM mode and the axes are not enabled. In order to issue motion commands to an axis (other than the Direct Output command), the axis must be enabled.

In order to run User Programs or the PreScan Table, the controller must also be in RUN mode. The RUN Mode (98) command enables all the axes and puts the RMC70 in RUN mode.

- a) On the RMCTools toolbar, click the **Go Online** button .
- b) On the toolbar, click the **RUN Mode** button .

***Note:** The RMC can perform motion control in both RUN mode and PROGRAM mode. RUN mode is required only for the User Programs and the PreScan table.*

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## Step 7: Connect an Actuator

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Now will connect and verify an actuator, such as a hydraulic valve or a motor.

**Tip:** The **Event Log** is your best trouble-shooting tool. If you run into problems or the RMC70 reports errors, use the **Event Log** to find out what happened or didn't happen. For details, see the Event Log topic in the RMCTools help.

**Tip:** The RMC70 can simulate an axis. You can learn how to move and tune an axis without being connected to a real system. See the **Simulate Mode** topic in the RMCTools help for more details.


### Wire the Actuator



- a) **Important:** Turn off power to the RMC70, the feedback device, and the actuator before connecting any wires!
- b) Wire each actuator to the RMC according to the instructions in **Appendix A: Wiring**.
- c) After wiring, re-apply power to the RMC70, the feedback device, and the actuator.

### Test Actuator Motion


**Note:** Read this section completely before executing any commands on the RMC70.

To test the actuator, you will supply a Control Output voltage from the RMC70 to the actuator. Before doing this, make sure that the axis may safely move in either direction!

**Note:** Verify that **Simulate Mode** is NOT checked in the **Simulate** section on the **All** tab of the **Axes Parameters** pane in the Axis Tools. If you make changes to the **Axes Parameters**, you must click the Download button  or press **Ctrl+D** to apply the changes to the RMC70.

- a) In RMCTools, go online with the controller (see the **Go Online** section on page 12).
- b) Click the **Axis Tools** button  on the toolbar.
- c) In the **Axis Status Registers** pane, look at the **Control Output** register on the **Basic** tab. It should be 0.
- d) If the Command Tool is not visible in RMCTools, open it as follows: On the **View** menu, click **Command Tool**.
- e) In the Command Tool, in the axis the actuator is connected to, click the **Cmd** box.
- f) In the **Cmd** box, enter the Direct Output (9) command. This can be done in three ways:
  - Type “D” and then choose the Direct Output (9) command.
  - Type “9” and then choose the Direct Output (9) command.
  - In the **Cmd** box, click the ellipsis button . Expand **Motion Commands**, expand **Open Loop**, and double-click **Direct Output**.
- g) In the **Output** box, enter “0.1”.
- h) In the **Ramp Rate** box, enter “100”.

When you issue the command in a later step, these values will cause the Control Output voltage to change to 0.1 V at a rate of 100 V/sec.

***Caution:** Use the Direct Output command with extreme caution! It disables the safety features of the RMC!*
- i) In the next step, you will issue the Direct Output command. If the motion causes problems, be prepared to quickly stop the axis by clicking the **Fault Controller** button (  ) on the toolbar.

- 
- j) In the Command Tool, click **Send Command**, or press Alt+S.
- k) The Control Output (in the **Axis Status Registers** pane) should be “0.1”. If you measured the Control Output with a voltmeter, it should measure roughly 0.1 V.
- l) Observe the system and note whether the system is moving forward or backward.

One of two things could have happened at this point:

- **The actuator moved.**  
In this case, go to step m.
- **The actuator did not move.**  
In this case check the output voltage, check that the actuator is enabled, verify that the axes are initialized, verify the Simulate bit is not set (on the **All** tab of the **Axis Parameters** pane, under the **Simulate** section), and repeat the process above with a larger Output. Some systems may require much more than 0.1 volt to move.

- m) Now stop the axis:  
In the Command tool, enter “0” in the **Output** box and click **Send Command**, or press Alt+S, to turn the **Control Output** voltage off.
- n) Now you will verify that the axis moves in the opposite direction also:  
In the Command tool, enter “-0.1” (or a higher value if that is required to move the axis) in the **Output** box and click **Send Command**, or press Alt+S. The **Control Output** in the **Axis Status Registers** pane should reflect the value you entered and the axis should move in the opposite direction.

## Step 8: Connect Feedback Device


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Now that you have connected a working actuator, you will connect and verify a feedback device, such as an MDT (Magnetostrictive Displacement Transducer), SSI encoder, or an analog transducer.

### Wire the Transducer

- a) **Important:** Turn off power to the RMC70 and the feedback device before connecting any wires!
- b) Wire each feedback device to the RMC according to the instructions in **Appendix A: Wiring**.
- c) After wiring, re-apply power to the RMC70 and the feedback device.

### Go Online and Configure Feedback

- a) In RMCTools, go online with the controller (see the **Go Online** section on page 12).
- b) In the **Project** pane, click the **RMC** controller.
- c) On the RMCTools toolbar, click the **Axis Tools** button .


- 
- d) In the **Axis Parameters** pane, on the **Setup** tab, you will configure certain parameters depending on the type of input you are using.

Refer to the procedure for your module:

<b>Module</b>	<b>Transducer Type</b>	<b>Page:</b>
MA1 or MA2	MDT	19
	SSI	20
AA1 or AA2	Analog	20
QA1 or QA2	Quadrature	21
AP2 or A2	Analog volts or current	21
Q1	Quadrature	21

## Configure MA Axis Module Feedback – MDT

The procedure below should be followed for each MDT-input axis tied to the MA module.


- a) In the **Axis Parameters** pane, on the **Setup** tab, in the **Feedback Type** register, select **MDT**.
- b) In the **MDT Type** register, select the type of MDT transducer you have. This information should be available on the MDT datasheet. The options are:
  - Start/Stop Rising Edge
  - Start/Stop Falling Edge
  - Pulse-Width Modulated
- c) To apply the changes to the RMC70, click the **Download** button  or press Ctrl+D.
- d) Continue to the **Verify Feedback** section on page 22.

## Configure MA Axis Module Feedback – SSI

The procedure below should be followed for each SSI-input axis tied to the MA module.


- a) In the **Axis Parameters** pane, on the **Setup** tab, in the **Feedback Type** register, select **SSI**.
- b) From the information in your SSI data sheet, enter the correct value for each of these registers:
  - **SSI Format** - Binary or Gray
  - **SSI Data bits** (e.g. 24)
  - **Absolute/Incremental**
  - **Linear/Rotary**

*Note: For help on any of these parameters, click the cell and press F1.*

- c) To apply the changes to the RMC70, click the **Download** button  or press Ctrl+D.
- d) Continue to the **Verify Feedback** section on page 22.


## Configure AA Axis Module Feedback

The procedure below should be followed for each axis tied to the AA module.

- a) In the **Axis Parameters** pane, on the **Setup** tab, in the **Input Type** register, select **Voltage** or **Current**.
- b) To apply the changes to the RMC70, click the **Download** button  or press Ctrl+D.
- c) Continue to the **Verify Feedback** section on page 22.

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## Configure A2 or AP2 Module Feedback


- a) In the **Axis Parameters** pane, on the **Setup** tab, under the **Secondary Control Setup**, in the **Input Type** register, select **Voltage** or **Current**.
- b) If the axis is a dual-loop axis, make sure to configure the secondary input under the **Secondary Control Setup** section. Set the **Input Type** register to **Voltage** or **Current**. If the secondary input is dual-input (differential), both inputs must be of identical types and are specified by only one Input Type parameter.
- c) To apply the changes to the RMC70, click the **Download** button  or press Ctrl+D.
- d) Continue to the **Verify Feedback** section on page 22.

## Configure QA or Q1 Module Feedback

The QA and Q1 module do not require any configuration to read the encoder. Simply wire the encoder to the inputs.

- a) Continue to the **Verify Feedback** section on page 22.

## Verify Feedback

- a) Click the **Axis Tools** button  on the toolbar. In the **Axis Status Registers** pane, on the **All** tab, expand the **Feedback** section. Look at the **Counts** register (if you are using analog feedback, look at the **Volts** or **Current** register). It may be changing slightly.  
If you are verifying pressure or force feedback on a position-pressure/force axis, look at the **Volts** or **Current** in the **Pressure/Force Feedback** section.
- b) Move the axis (as you learned in the **Connect an Actuator** section) and look for a corresponding change in the **Counts** (or **Volts** or **Current**) register. If it does not change properly, recheck the wiring, verify that the parameters on the **Setup** tab in the **Axis Parameters** pane are correct, and check for changing **Counts** (or **Volts** or **Current**) again. When it is working correctly, proceed to the next step.
- c) Determine which direction you want the **Actual Position** to be increasing as the axis moves. For example, you may want the **Actual Position** to increase as the hydraulic cylinder extends. The actual value of the **Actual Position** is not important here, only the direction of increase or decrease.
- d) If you changed any parameters, on the **Controller** menu, click **Update Flash**. This stores your changes in the RMC70 even in the event of a power outage. Press Ctrl+S to save the project file.

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## Step 9: Setting the Scale and Offset

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The Scale and Offset parameters convert the Counts or Volts or Current from the transducer into meaningful measurement units. RMCTools provides Scale/Offset wizards to help you calculate these parameters.

Before starting, determine approximately what the positions should be at either end of travel. This will help you verify later that you performed the Scaling and Offset procedure correctly.

To set the Scale and Offset:

- a) Open Axis Tools by clicking the **Axis Tools** button  on the toolbar. In the **Axes Parameters** pane, select the **Setup** tab. Expand the **Tools and Wizards** section. Click **Launch** in the axis for which you wish to set the Scale and Offset.
- b) In the wizard, follow the directions. For help, press the **Help** button.
- c) When you have completed the wizard, you must download the parameter changes to the RMC70. To do this, in Axis Tools, click the download button  or press Ctrl+D to apply the changes to the controller.
- d) On the **Controller** menu, click **Update Flash**. This stores your changes in the RMC70 even in the event of a power outage.
- e) Press Ctrl+S to save the project.


***Tip:** If the wizard does not work for your system, you can manually determine the Scale and Offset parameters. See the **Scaling** topic in the RMCTools help for details.*

## Step 10: Set the Output Polarity

---

After setting the Scale and Offset parameters, you must set the polarity of the Control Output.

It is essential that the Actual Position (or Pressure, Force, or Velocity) *increases* when a *positive* output voltage is specified with Direct Output command. If this condition is not met, you will not be able to control the axis in closed loop.

- a) In the Command Tool, choose the Direct Output (9) command. In the **Output** box, enter a positive value that is large enough to move the axis. In the **Ramp Rate** box, enter “100”.
- b) Click **Send Command**.
- c) Observe the **Actual Position** register on the **Basic** tab of the **Axis Status Registers** pane and note whether it is increasing or decreasing:
  - If the **Actual Position** is *increasing*, the Control Output polarity is correct. Proceed to step 11.
  - If the **Actual Position** is *decreasing*, you must change the Output Polarity:
    - i. In the **Axis Parameters** pane, on the **Setup** tab, expand the **Primary Control Setup** section.
    - ii. Set the Invert Output Polarity parameter to the opposite of its current state by double-clicking it.
    - iii. To apply the changes to the RMC70, click the **Download** button  or press Ctrl+D.
    - iv. Remember to Update Flash and save the project.

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## Step 11: Tuning

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In order to control an axis in closed-loop control, it must first be tuned. Refer to the RMCTools help for the tuning procedure:

- a) In RMCTools, on the **Tools** menu, click **Plot Manager**. In the Plot Manager, in the Plot History pane, click the **Tuning Tools** tab. During the tuning process, you will set all the Gain and Feed Forward registers in the Axis Parameters section of the Tuning Tools pane.
- b) Read the appropriate topics describing how to tune an axis:
  - i. Press F1 to open the RMCTools help.
  - ii. Click the **Index** tab, type “tuning” and double-click **about**. The Tuning Overview topic will open.
  - iii. Read the entire Tuning Overview topic. Autotuning is the easiest and fastest way to tune your system. Click the autotuning link to learn how to autotune your system. If you instead wish to tune your system manually, click one of the Manual Tuning Procedure links for precise directions on how to tune the system. For most applications, the [Tuning a Hydraulic Position Axis or Motor in Velocity Mode](#) procedure is the correct one.
- c) After tuning, on the **Controller** menu, click **Update Flash**. This stores your changes in the RMC70 even in the event of a power outage.
- d) Press Ctrl+S to save the project.

## Continuing the Motion Application

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After setting up and tuning the RMC70, it is ready to be programmed and integrated into the rest of your application. The RMC70 has numerous features to assist you. The major components are listed here to guide you when continuing your motion application.

### Event Log

The Event Log is your best trouble-shooting tool. The Event Log reports nearly all the activity on the RMC70, including communications, commands, errors, and configuration. For details, see the **Event Log** topic in the RMCTools help.

Whenever you have difficulties, the Event Log should be one of the first places to look!

### Communications

The RMC70 is typically used in conjunction with a PLC or other host controller. The basic purpose of communications is to issue commands to the RMC70 and read status information. Available RMC70 communications types include PROFIBUS-DP, and RS-232/485 Serial.

See the **Communications** section of the RMCTools help for more detailed information.

### Discrete I/O

Discrete I/O augments the communications of the RMC70. Discrete I/O is often faster than the communications, and is therefore well-suited for starting a sequence in the RMC70 at a specific time. Up to 32 discrete I/O can be added to the RMC70. Each I/O point is individually configurable in software as inputs or outputs. See the **Discrete I/O** topic in the RMCTools help for details.

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Some example uses of discrete I/O:

- General input and output.
- Affect flow of User Programs.
- Start or Stop User Programs.

## Commands

The RMC70 has a rich set of pre-programmed commands that perform anything from simple moves to complex motion to system control. For a list of all the RMC70 commands, see the **Command List** topic in the RMCTools help.

## User Programs

A User Program carries out a sequence of commands on the RMC70. This allows the RMC70 to respond to events within its control-loop time rather than the scan rate of a PLC or other host controller. It also reduces the PLC programming required.

A User Program consists of multiple steps linked together in sequences. Each step can issue any RMC70 command to one or several axes. The link types allow branching and looping, waiting for conditions and many other features. Simple and complex mathematical operations are also possible in the user program.

A User Program runs on a *task*. Each task can run one user program at a time. The RMC70 has four tasks. Therefore, an RMC70 controller may run up to four User Programs simultaneously.

For details on creating and running User Programs, see the **User Programs** topic in the help.

## Variables

Variables help make the User Programs very flexible and easy to maintain. Variables can be used to effortlessly change

programs and easily modify User Program parameters via a PLC. Variables can also be used to store data.

For details on using variables, see the **Variables** topic in the help.

## PreScan Table

Use the PreScan Table starts or stops User Programs based on conditions defined by the user. The PreScan evaluates all the conditions in the PreScan table every loop time. When a condition becomes true, the corresponding User Programs are started or stopped.

Some example uses of the PreScan Table are:

- Start a User Program when a discrete input turns on.
- Automatically start a User Program when the RMC70 starts up.
- When an error condition occurs, automatically start a User Program to handle it.

See the **PreScan Table** topic in the RMCTools help for details.

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## Diagnostic Tools

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This section describes diagnostic tools of RMCTools that will aid you in monitoring and troubleshooting your system.


### Event Log

The Event Log Monitor displays all events that have occurred in the controller, such as issued commands, changed parameters and errors. The Event Log Monitor is an important aid in troubleshooting.

The Event Log can help you:

- Determine if a command was successfully issued. The entire command, with parameters, is displayed.
- Find out which, if any, error occurred.
- See where a command was issued from, for example, from a PLC, from a User Program or from the Command Tool.

#### To open the Event Log:

- In the Project Pane, expand the controller, and double-click **Event Log** .

***Note:** Do not underestimate the usefulness of the Event Log! When you don't know what happened, or why something did not happen, look at the Event Log.*

### Plots

The RMC70 provides very flexible plotting capabilities. Virtually any register in the RMC70 can be plotted, and multiple registers may be plotted simultaneously. You can easily capture events with the plot trigger. For details on using plots, see the **Plots** topics in the help.

## Status Registers

Status Registers provide information on the status of each axis. The RMC70 has numerous Status registers to provide monitoring and troubleshooting capabilities for nearly every aspect of the controller.

To maximize the troubleshooting benefit of the status registers, include them in plots.

## Status Bits

The Status bits status register is a collection of bits that provide a summary of the state of the axis.

## Error Bits

The Error bits status register is a collection of bits that indicate the errors on an axis.

Error bits are important to the safety features of the RMC70. If an error bit turns on, a halt will occur if the Auto Stops are configured to do so. By default, the Auto Stops are set to cause an Open Loop Halt and Disable Drive. You can configure the Auto Stops to specify which type of halt, if any, should occur for each error bit. See the **AutoStop** topic in the help for more details.

Error bits are latched. Any motion command will clear the errors for which the underlying error condition has gone away.

## Appendix A: Wiring

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This appendix describes how to wire the RMC70. Use the table below to find the wiring diagram you need. For expansion module wiring, consult the wiring diagram you received with it, or use the RMC70 Tools help. For communications wiring, consult the RMCTools help.

	<b>Page</b>
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<b>MA Axis Module</b>	
Control Output, Enable Output, Fault Input .....	34
MDT Transducer .....	35
SSI Transducer .....	36
<b>AA Axis Module</b>	
Control Output, Enable Output, Fault Input .....	34
Voltage Feedback Transducer .....	38
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<b>QA Axis Module</b>	
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## General Wiring Information

For CE compliance and to minimize electrical interference:

- Use twisted pairs for all wiring where possible.
- Use shielded cables for all wiring.
- Keep RMC wiring separate from AC mains or conductors carrying high currents, especially high frequency switching power such as conductors between servo drives and motors or amplifiers and proportional valves.

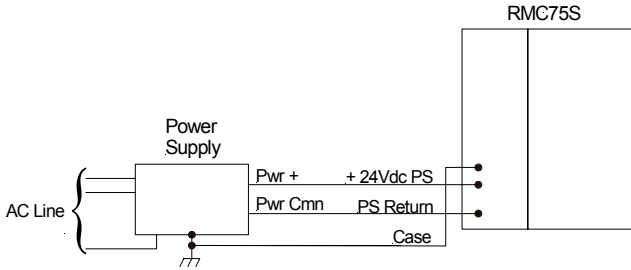
For UL and C-UL compliance:

- Power supply must be Class 2.
- All RMC70 inputs and outputs must be connected to Class 2 circuits only.

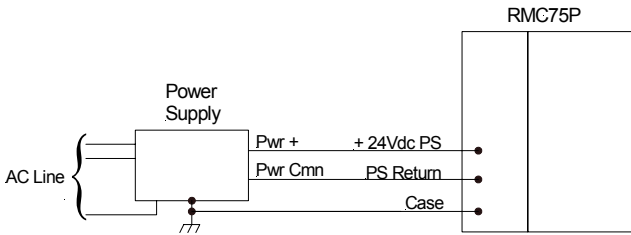
## Wiring Power

Connect + 24V DC to the RMC70 according to the following diagrams:

### RMC75S



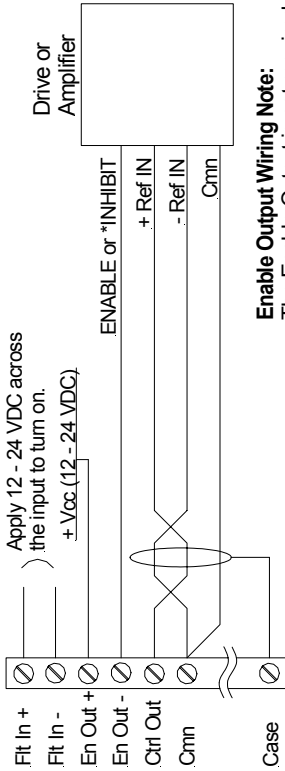
### RMC75P



## Wiring for all Axis Modules

### Control Output, Enable Output, and Fault Input

#### RMC70 MA, AA, and QA modules 12-Pin Connector



#### Enable Output Wiring Note:

The Enable Output is not required. It is often wired to the enable input of the drive or amplifier. It is a Solid State Relay (SSR) rated for a maximum 100 mA and 30 V. Both the + and - connection must be connected. It may be connected in a sourcing or sinking configuration. The polarity is unimportant. The behavior of the Enable Output can be set with the RMC70Tools software.

#### Control Output Wiring Note:

The Ctrl Output is +/- 10 V 16-bit analog.

#### General Wiring Note:

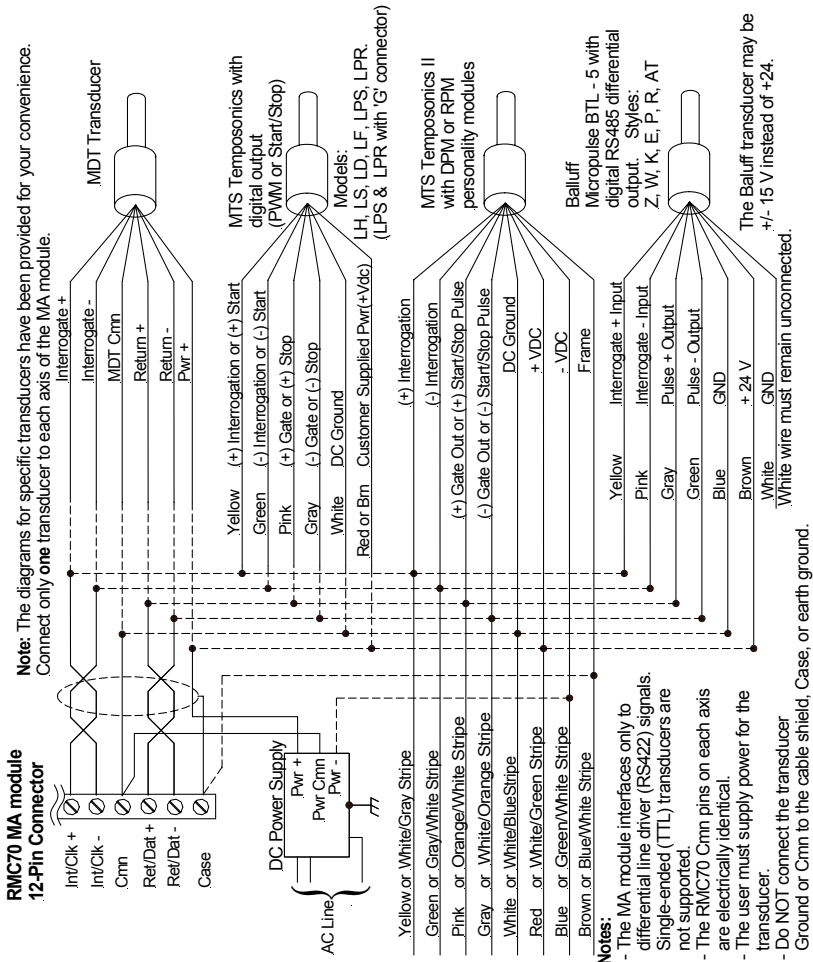
Each axis has two electrically identical Cmn pins.

#### Fault Input Wiring Note:

The Fault Input is not required. It is often wired to the fault output of the drive or amplifier. The Fault Input is compatible with signal levels from 12 to 24 V. Both the + and - pins must be connected. It draws 2.7 mA max and turns on when the voltage across the input is greater than 6 V. The polarity is unimportant.

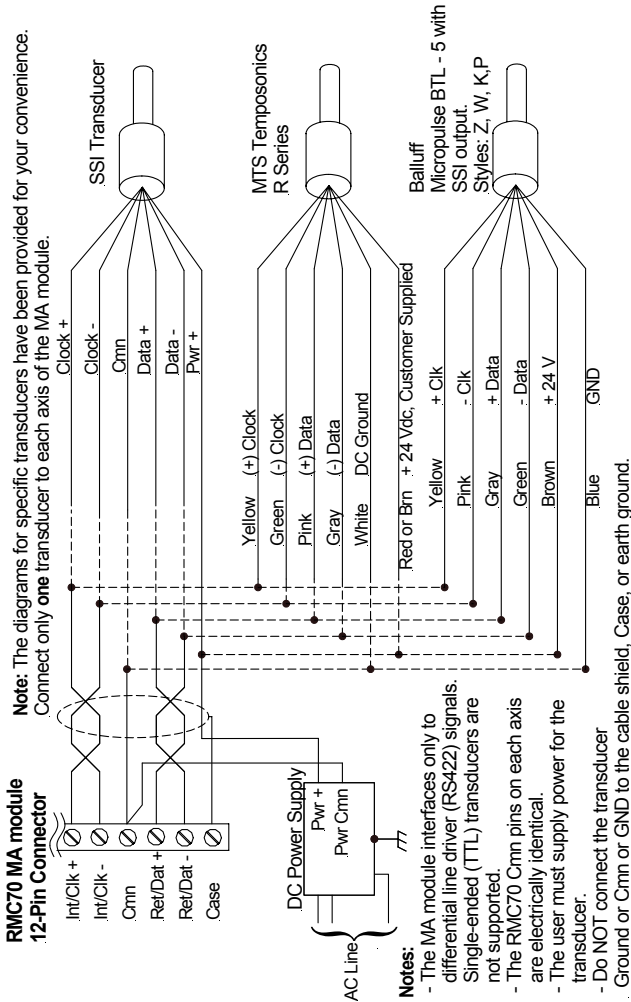
# MA Module MDT Transducer Wiring

See page 37 for the MA module pin-out description.



## MA Module SSI Transducer Wiring

See page 37 for the MA module pin-out description.



## MA Module Pin-out

Pin	Function	
<b>Flt In +</b>	Fault Input	
<b>Flt In -</b>	Fault Input	
<b>En Out +</b>	Enable Output	
<b>En Out -</b>	Enable Output	
<b>Ctrl Out</b>	Control Output, +/- 10 V 16-bit Analog	
<b>Cmn</b>	Common	
	<b>MDT Transducer</b>	<b>SSI Transducer</b>
<b>Int/Clk +</b>	+ Interrogation	+ Clock
<b>Int/Clk -</b>	- Interrogation	- Clock
<b>Ret/Dat +</b>	+ Return	+ Data
<b>Ret/Dat -</b>	- Return	- Data
<b>Cmn</b>	Common	
<b>Case</b>	RMC70Chassis	

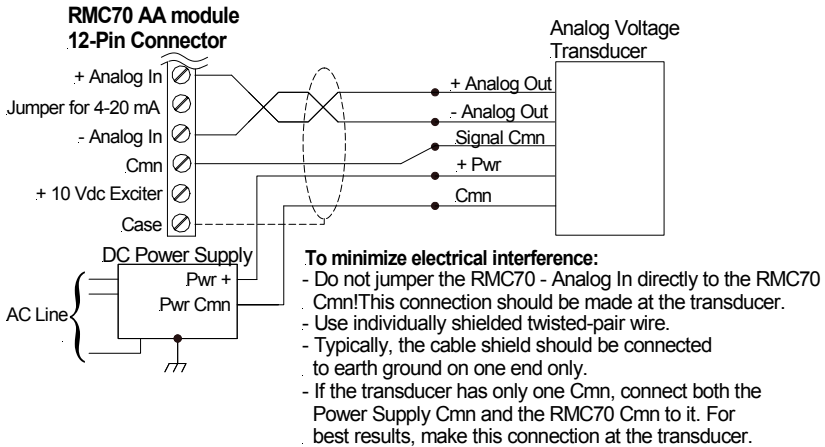
*Note: The two Cmn pins are electrically the same.*

*Note: The user must supply power for the transducer.*

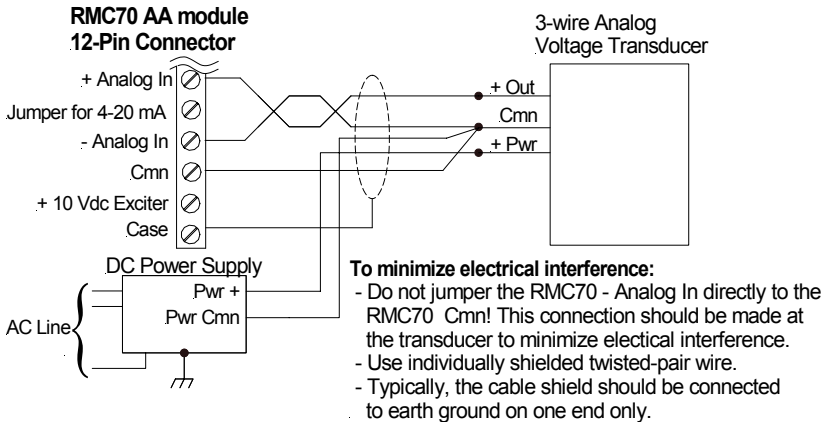
## AA Module Voltage Transducer Wiring

See page 40 for the AA module pin-out description.

### Voltage Transducer, 4- or 5-Wire

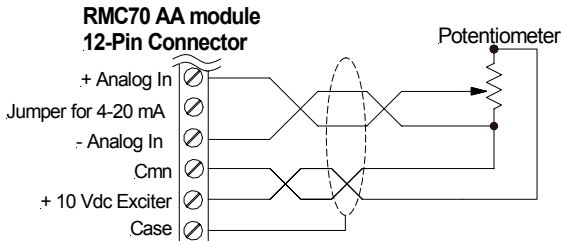


### Voltage Transducer, 3-Wire



## AA Module Potentiometer with Exciter Pin

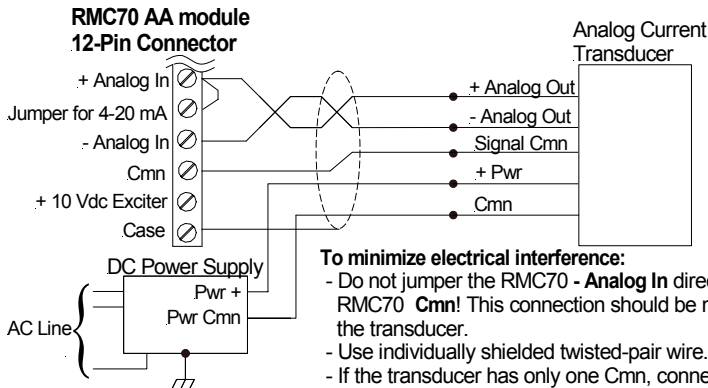
*Note: When using a potentiometer, use the Exciter pin to increase the accuracy of the analog to digital conversion.*



### To minimize electrical interference:

- Do not jumper the RMC70 - **Analog In** directly to the RMC70 **Cmn**. This connection should be made at the transducer.
- Use individually shielded twisted-pair wire.
- Typically, the cable shield should be connected to earth ground on one end only.

## AA Module Current Transducer Wiring



### To minimize electrical interference:

- Do not jumper the RMC70 - **Analog In** directly to the RMC70 **Cmn**! This connection should be made at the transducer.
- Use individually shielded twisted-pair wire.
- If the transducer has only one **Cmn**, connect both the Power Supply **Cmn** and the RMC70 **Cmn** to it. For best results, make this connection at the transducer.
- If the transducer has no - **Analog Out** pin (only a **Cmn**), connect the Power Supply **Cmn**, the RMC70 **Cmn**, and the RMC70 - **Analog In** to it. For best results, make this connection at the transducer. Observe the first Note.

## AA Module Pin-out

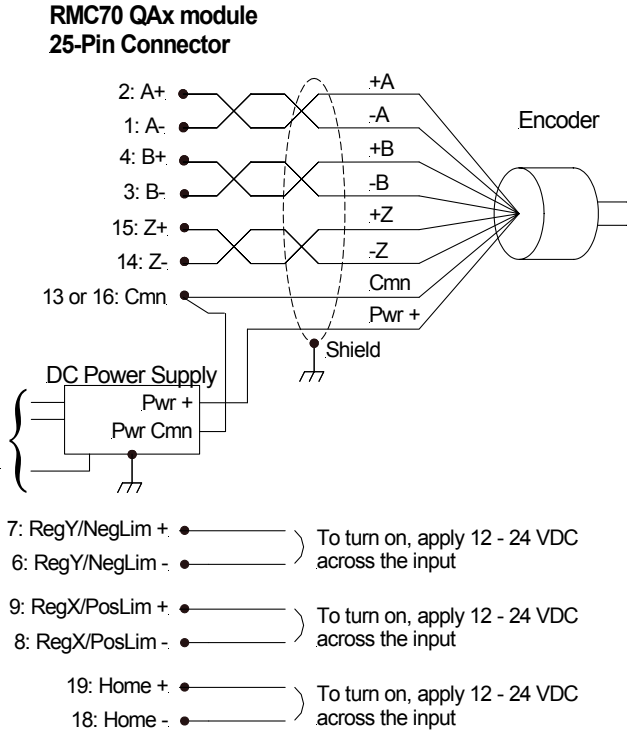
<b>Pin</b>	<b>Function</b>
<b>Flt In +</b>	Fault Input
<b>Flt In -</b>	Fault Input
<b>En Out +</b>	Enable Output
<b>En Out -</b>	Enable Output
<b>Ctrl Out</b>	Control Output, +/- 10 V 16-bit Analog
<b>Cmn</b>	Common
<b>Analog In +</b>	Signal +
<b>Jumper for 4-20 mA</b>	Jumper for Current Transducer
<b>Analog In -</b>	Signal -
<b>Cmn</b>	Common
<b>+ 10 V DC Exciter</b>	10 Volt source for potentiometer
<b>Case</b>	RMC70Chassis

*Note: The two Cmn pins are electrically the same.*

*Note: The user must supply power for the transducer.*

## QA Module Wiring

See page 42 for the QA module pin-out description.



**Notes:**

- The A,B, and Z inputs accept only differential line driver (RS-422) signals. Single-ended (TTL) transducers are not supported.
- The user must supply power for the transducer.
- The Reg/Lim and Home inputs are compatible with signal levels from 12 to 24 V. They draw 2.7 mA max and turn on when the voltage across the input is greater than 6 V. The polarity is unimportant.

## QA Module Pin-out

Pin	QA1 Label	QA2 Label	Function
1	A-	A-	A- from encoder
2	A+	A+	A+ from encoder
3	B-	B-	B- from encoder
4	B+	B+	B+ from encoder
5	n/c	n/c	No connection
6	Reg Y/NegLim-	RY/NL-	Registration Y or Negative Limit
7	Reg Y/NegLim+	RY/NL+	
8	Reg X/PosLim-	RX/PL-	Registration X or Positive Limit
9	Reg X/PosLim+	RX/PL+	
10	n/c	n/c	No connection
11	n/c	n/c	No connection
12	Control Out	CtrlOut	Control Output
13	Cmn	Cmn	Common
14	Z-	Z-	Index pulse from encoder
15	Z+	Z+	
16	Cmn	Cmn	Common
17	n/c	n/c	No connection
18	Home-	Home-	Home Input
19	Home+	Home+	
20	FltIn-	FltIn-	Fault Input
21	FltIn+	FltIn+	
22	n/c	n/c	No connection
23	n/c	n/c	No connection
24	EnOut-	EnOut-	Enable Output
25	EnOut+	Enout+	

**Note:** The two Cmn pins are electrically the same.

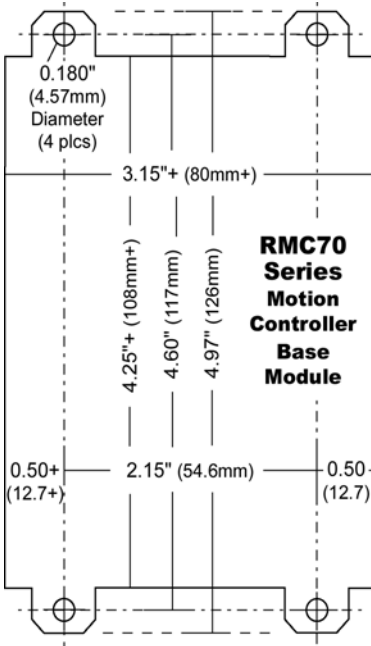
**Note:** The user must supply power for the transducer.

## Appendix B: Mounting Dimensions

This sections contains mounting hole dimensions for the RMC70 series motion controller and expansion modules. Up to four expansion modules may be added to the right side of the RMC70 base module.

### Base Module

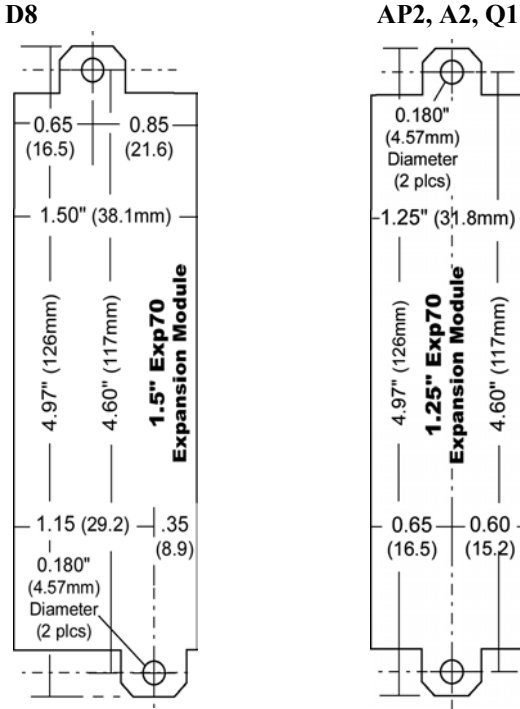
RMC75S, RMC75P, RMC75E



*Note: Drawing is not 1:1 scale.*

## Expansion Modules

Notice that there are two different expansion module widths.



*Note: Drawings are not 1:1 scale.*