RMC150E UI/O Simulator

RMC150E UI/O cards can be used as a servo simulator. Each card can simulate two axes. This document outlines the procedure for setting up a UI/O card as a servo simulator.

Axis setup

- 1. In the Axis Definitions create a new Axis
- 2. Select Cascading Outer Loop as the axis type
- 3. Select Single Control Loop, Position feedback
- 4. For the Position Input, select Custom
- 5. Click Finish to create the axis. Not that this axis does not use any hardware inputs or outputs.

Simulator Setup

- 1. Open the Axis Tools
- 2. On the Parameters side, switch to the All tab

Ð	Simulator						
	Simulate Mode						
	Simulator Order	2nd Order	2r				
	System Gain ((pu/s)/V)	3.0					
	Natural Frequency (Hz)	20.0					
	Damping Factor	0.75					
	Pos. Physical Limit (pu)	99.9					
	Neg. Physical Limit (pu)	0.1					
	Output Deadband (V)	0.0					
	Output Null (V)	0.0					
	Weight (lb)	1000.0					
	Maximum Force (lb)	10000.0					
	Maximum Compression (pu)	0.1					
Position/Velocity Control							
⊡- Output							
Setup Tune All							
		Simulator Simulate Mode Simulator Order System Gain ((pu/s)/V) Natural Frequency (Hz) Damping Factor Pos. Physical Limit (pu) Output Deadband (V) Output Null (V) Weight (lb) Maximum Force (lb) Maximum Compression (pu) Image: Voutput Voutput Voutput	Simulator Simulate Mode I Simulator Order 2nd Order System Gain ((pu/s)/V) 3.0 Natural Frequency (Hz) 20.0 Damping Factor 0.075 Pos. Physical Limit (pu) 99.9 Neg. Physical Limit (pu) 0.01 Output Deadband (V) 0.00 Output Null (V) 0.00 Weight (lb) 1000.0 Maximum Force (lb) 10000.0 Maximum Compression (pu) 0.1 E: Position/Velocity Control 0.1				

- 3. Set the System Gain, Natural Frequency, Damping factor and physical limits.
- 4. Click the checkbox to enable simulate mode

Simulator Scaling

1. In the Feedback section of the Axis Parameters, set the position scale.

⊡- Feedback							
	Input Type						
	Custom Feedback Auto-Fault	Disabled	C				
	Position Scale (pu/C)	6.0E-6					
	Position Offset (pu)	0.0					
	Velocity Scale ((pu/s)/V)						

- 2. The maximum number of counts will be the positive physical limit divided by the position scale.
- 3. In this example, 100 / 6e-6 = 16,666,667 which is slightly less than 2^24 , the maximum number of counts for 24 bit SSI.

Set up the SSI Output

- 1. In the Modules section of the Project Tree, right click on the UI/O card and click properties
- 2. Switch to the Quad/SSI tab
- 3. Change the Mode to SSI Output
- 4. Under Output the Contents of the following Register, click Browse
- 5. Select Axes->Outer0->Status->Feedback-Primary->Counts
- 6. Set the SSI Data bits, Binary/Gray code, SSI Clock rate, output mode and termination

[2] UI/O Properties	s	×				
General	Quad/SSI input setup for this module	^				
Quad/SSI Select the operating mode and associated settings for each Quad/SSI channel on this module:						
	Quad/SSI Channel 0					
	Mode: SSI Output	_				
	In this mode, this channel will be configured as an SSI Output and will send the requested data to an external device.					
	Source of Output Data	. =				
	O Automatically retransmit SSI Input 0 to SSI Output 1					
	Output the Contents of the following Register:					
	%MD8.11 Browse Sim0 Counts					
	Settings					
	SSI Data Bits: 24 🛟 SSI Output Mode: Slave 🗸					
	SSI Data Format: Binary 💙 SSI Termination: ±Clock0 🗸					
	SSI Clock Rate: 250 kHz 🗸					
	Quad/SSI Channel 1					
	Mode: SSI Output	_				
	In this mode, this channel will be configured as an SSI Output and will send the requested data to an external device.	~				
	OK Cancel H	lelp				

Create Reference Inputs

- 1. In the Axis Definitions, create a new axis
- 2. Select Reference Axis
- 3. For the Feedback type, select Velocity
- 4. From the Velocity Input drop down, select a UI/O analog input
- 5. Click Finish to create the axis

Create the User Program

- 1. A user program is necessary to get the voltage from the analog inputs to the simulator.
- 2. Import the SimulateSSI program or create a new program with the following step:

B 0 - SimulateSSI × → Step: E K to the Declarations:	🔄 🛛 Command: 🧊 🗙 🆘 🤸 🖉 Condition: 🗞 🗞 🏷 🏷 📳 👺 💂 🗌					
Get the drive voltage from a reference a The command is sent to the Default Axis	SIMULATE SSI					
Declarations: // These variables are only used in this s VAR RefAxisNo : DINT; // Referenc DriveVoltage : REAL; // Drive vol END_VAR	Declarations: // These variables are only used in this step VAR RefAxisNo : DINT; // Reference axis number used for the drive input DriveVoltage : REAL; // Drive voltage to send to the simulator (from the reference axis) END_VAR					
Command: Expression (113)	Expression // Calculate the reference axis number. // This simulator has 8 axes so we add 8 to the simulator axis to get the reference axis RefAxisNo := _CurAxis + 8; // _CurAxis is the default axis number which allows us to run this same program for multiple axes // Get the drive voltage from the reference axis // Limit to +/- 10 V to avoid a command error DriveVoltage := MIN(MAX(_Axis[RefAxisNo].Voltage, -10.0), 10.0);					
Command: Direct Output (9)	Output (V) Ramp Rate (V/s) DriveVoltage 10000.0 >					
Link Type: Jump To Jump V Repeat V						

3. Set the program to run automaticall on all axes by adding it to the program triggers on the FirstScan condition.

💷 0 - SimulateSSI ⊀ Axis Tools 🛛 🚯 Program Triggers 🗙							
+	+ 🗙 🖪 🛛 Time 🛛	Used: 16.2 usec					
	Condition	Task 0	Task 1	Task 2			
	_FirstScan	SimulateSSI	SimulateSSI	SimulateS:			
*							

4. Set the controller to start in Run mode by right clicking on Programming and clicking Properties. On the Run/Program tab, select Start Controller in Run mode.

Programming Prope	erties	×			
General	Select RUN/PROGRAM options				
RUN/PROGRAM	Startup Mode Start controller in RUN RUN/PROGRAM Input				
Halts					
Verify					
Security	One discrete input can optionally be assigned to control RUN/PROGRAM mode.				
	OK Cancel Help				

Download to the Controller

- 1. From the Controller menu, select Download All To Controller
- 2. From the Controller menu, select Update Flash
- 3. Switch the controller into Run mode. The program will now start on all axes.

Monitoring Positions

- 1. To check the Drive input, open the Axis Tools and select the All tab on the Status side
- 2. Expand Feedback.
- 3. The drive input will be the Voltage (V) register on the Reference Axis
- 4. The SSI Output will be the Counts (C) register on the simulator Outer Loop Axis.

🖽 0 - SimulateSSI 🕇 Axis Tools 🗙 🚯 Program Triggers							
	🛛 • 🗶 • 🔂 🖬 🖬 🧃						
Ах	is Status Registers						
Re	gister	Sim0	Drive0				
±۰	Status Bits	16#00000000	16#00000000				
Đ	Error Bits	16#00000000	16#00000000				
Ð	Feedback						
	Actual Position (pu)	0.000					
	Actual Velocity (pu/s)	0.000	0.000				
	Actual Accel (pu/s²)	0.0					
	Voltage (V) S	SI Output	0.000				
	Counts (C)	0.000	Drive Inpu	ıt			
	Raw Counts (raw C)	0	0				
	Custom Counts (C)	0.000					
	Custom - No Transducer						
Đ	Control						
Đ	Output						
Ð	Target						
Ð	Miscellaneous						

5. You can show a graphical view of the simlated axes by selecting Actuator View from the View menu.

SSISimulator.rmcproj* - [SSI Simulator] - RMCTools									
File	Edit	View	Controller	Programming	Plots	s Editor	Tools	Window Help	
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Droie	ct Vie	Project A Output A		Alt+0	Actuator View				
				Alt+1		Accuator			
	Pro	Ver	ify Results	Alt+2				0.0	
l '	= @	Dis	crete I/O Ma	nitor Alt+3					
	-	Fin	d Results	Alt+4				0.0	
		Tas	sk Monitor	Alt+5			-	0.0	
		Cor	mmand Tool	Alt+8					
		Act	uator View			Task Mo	onitor	Actuator View	
		Axi	s Tools	Ctrl+T		💷 0 - S	imulate	SSI 🕇 Axis Too	ls 🗙 🚯 Prog
	-	Eve	ent Log	Ctrl+E			v		
		Sel	Select Columps				7 •		
						Axis St	atus R	egisters	
	T	Pro	perties	Alt+Ente	r	Registe	r		Sim0
			Discrete I	0		⊡- Stat	us Bits		16#00000000