Electromechanical Automation Applications Note

Product: Trilogy coils & Positioners
Rev: 1.0
Subject: Wiring and Setup of Trilogy to Aries with ACR9000

This applications note clarifies the connections with the Trilogy motors and positioners to the Aries drives with ACR9000 controller. Trilogy coils and positioners are supplied with flying lead cables typically. The new Connector Box option is shown for Trilogy positioners offering connectorized cables for Aries drives.

1. Trilogy to Aries Wiring

The Trilogy coils have different color codes based upon the wiring option (such as WD3 or WD7 in the part number). The Trilogy I-Force positioners (T1, T2, T3 and T4) use coils with WD2 wiring option, a separate MHED module that includes optical limits/ home sensors and magnetic hall-effect feedback, and the encoder readhead and scale. The Trilogy Ripped positioners (TR05, TR07, TR09, TR10, TR16) use HED connector modules that include both magnetic limits/home and hall-sensors feedback, and encoder readhead and scale.

Trilogy positioners are now available with connectorized cables for plug & play operation. See Page 13.

See next page for wiring connections for Trilogy Coil and Positioners to Aries drives. In addition, limit and home sensor connections to the ACR9000 on-board I/O are:

Trilogy	Color Code Trilogy Positioners Ripped & I-Force	ACR9000 Connection for Axis 1	User Supplied Connections
Limit Power	Orange		+24vdc
Limit Gnd	Purple		24vdc Common
		19, 21, 23	+24vdc Pullup
Home	Brown	20	
+Limit	Light Green	24	
-Limit	Light Blue	22	

Aries Thermal Model Protection and Power Installation

Note that the Aries drive uses a thermal model of the motor to estimate the coil temperature rise and is much faster than a thermal switch. If the internal thermal model is to be relied on to protect the motor, do not power off or reset the amplifier during use. During an e-stop or jam, keep the amplifier alive using the separate C1 & C2 power, and shut off only L1 & L2 power. **Do not reset the amplifier or power off**. Use the enable/disable commands or signals. Repeatedly resetting the drive can thermally damage the motor. If the temperature switch is to be relied on to protect the motor, the peak current should be reduced to twice the continuous current.

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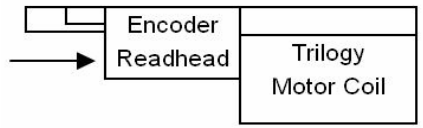
Trilogy Coil and Positioner to Aries Wiring

Aries Motor Feedback Connector - HD DB15 Male

	Encoder		Temperature		Halls		
	LME	RGH	Positioners		All Trilogy	except	
Pin	Magnetic	Optical	or WD0/1/2/7	WD3/4	Positioners & Coils	210 310 410 WD7/C	Function
4	Brown	Brown					+5V
3	White	White					Ground
8	Yellow	Yellow					A/
7	Green	Green					A
12	Blue	Blue					B
11	Red	Red					B/
1	Black	Pink					C
2	Orange	Grey					C/
10			Yellow	Grey			+ Thermo
15			Orange	Violet			- Thermo
5					Black	Black	+5V
6					White	White	Ground
9					Yellow	Brown	HED C
13					Blue	Blue	HED B
14					Green	Green	HED A
Case	Shield				Shield	Shield	Shield

NOTES:
Halls C/B/A are reversed at the Aries, Hall 1/2/3 respectively.
The encoder's A+ and A- are reversed at the Aries drive, A/ and A respectively.
Thermal sensor is not polarity sensitive.
Strip all cables back about 12-inches. Put all wires going into the Feedback connector through one piece of heatshrink
Put all limit/home wires (Orange, Purple, Brown, Lt Green, Lt Blue) through another piece of heatshrink unconnected.
Valid for all Trilogy T1D and T1S positioners built after 12/1/2007. Contact factory for T1S and T1D built before 12/1/2007.
Bellows positioners are same as standard positioners. ex, For B3 positioner, see T3 positioner.
Connect motor cable ground to Aries chassis shield using P-clip.



The above connections presumes the motor, readhead and hall cables exit the same direction.
For positioners, this is the standard orientation. If the HED is reversed in a custom positioner, consult factory.

Aries Motor Connection

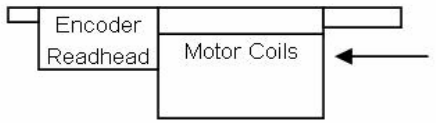
Using Old Color codes

Pin	T1, T2, T3 Positioners 110 210 310 WD0/1/2/7 coils	T4, TR7, TR10, TR16 Positioners R7, R10, R16 Coils ML50 Coils 110 210 310 WD3/WD4 coils	Function
1	Red & Blue	Red	U
2	White & Green	Brown	V
3	Black & Brown	Orange	W
4	Drain wire (Coils)	Drain wire	PE
	or Green/Yellow (Positioners)	Ground wire	

For safety ground for the Ironless linear motors, install a ground wire from Aries ground to the coil bar as per 88-028449-01A installation instructions. New cables include this ground wire in the motor cable and are shown below.

Using New Color codes

Pin	T1, T2, T3 Positioners 110 210 310 WD0/1/2/7/A/C coils	T4, TR7, TR10, TR16 Positioners R7, R10, R16 Coils 410 and ML50 Coils 110 210 310 WD3/4/B coils	Function
1	Red/Yellow & Blue/Yellow	Red/Yellow	U
2	White/Yellow & Violet/Yellow	Brown/Yellow	V
3	Black/Yellow & Brown/Yellow	Orange/Yellow	W
4	Green/Yellow	Green/Yellow	PE



In coil only applications, if the encoder's cable exit faces opposite the opposite way, switch A and A/.

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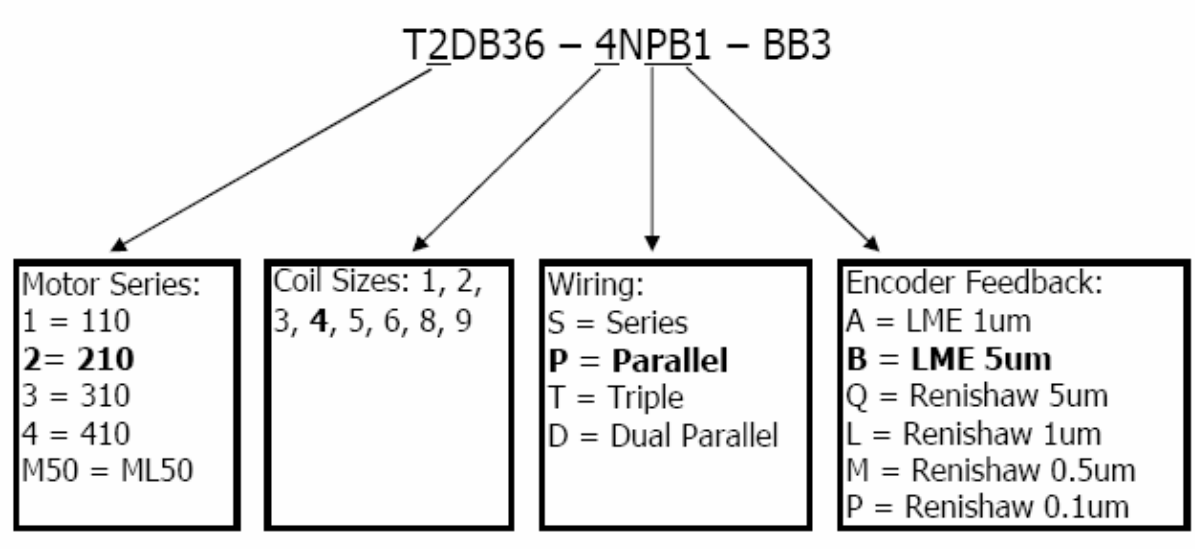
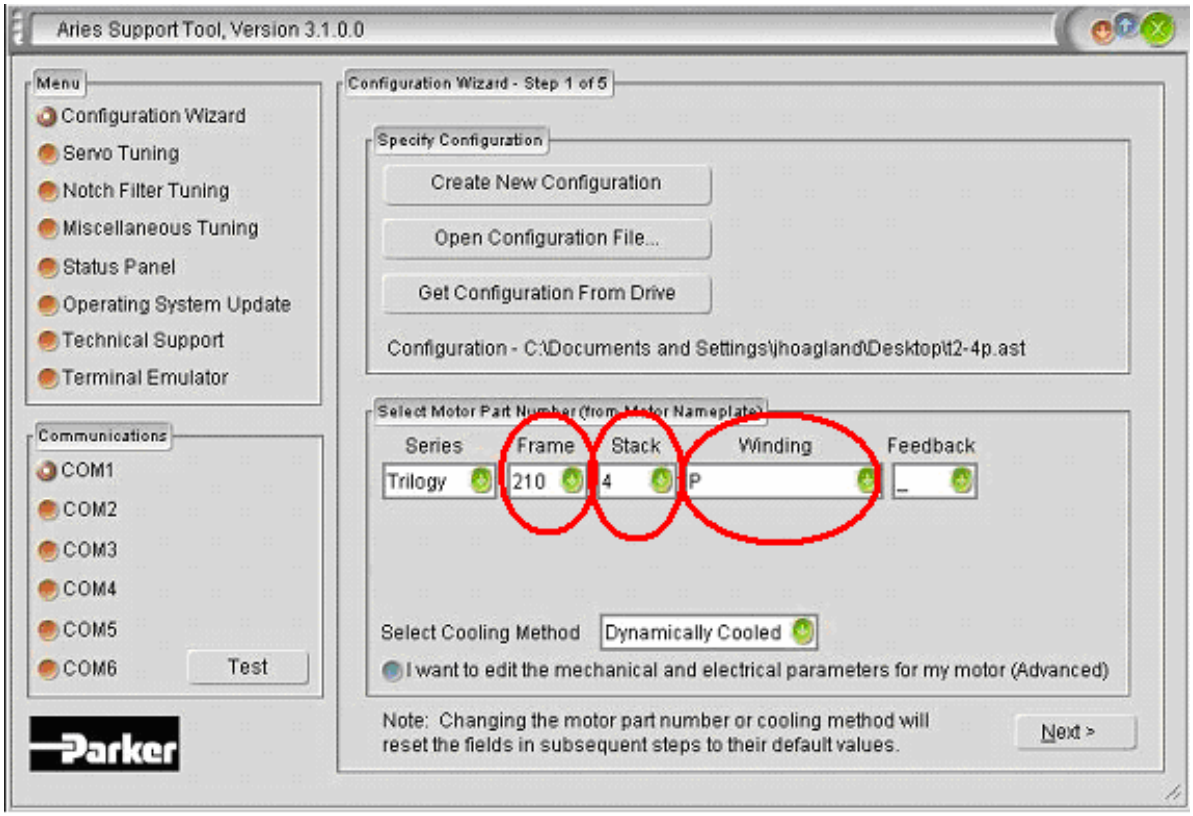
2. Aries (AR-xxAE) Drive Setup

Aries Support Tool's Configuration Wizard allows quick drive configuration using the I-Force and Ripped series coil part numbers. The Trilogy positioner part numbers contain the coil part numbers. Below shows an example of the I-Force T2 positioner part number and the information pertinent for Aries configuration.



Simple pull-down selections in the Aries Support Tool's (AST) Configuration Wizard configure the amplifier.

Step 1: Select Motor Part Number.



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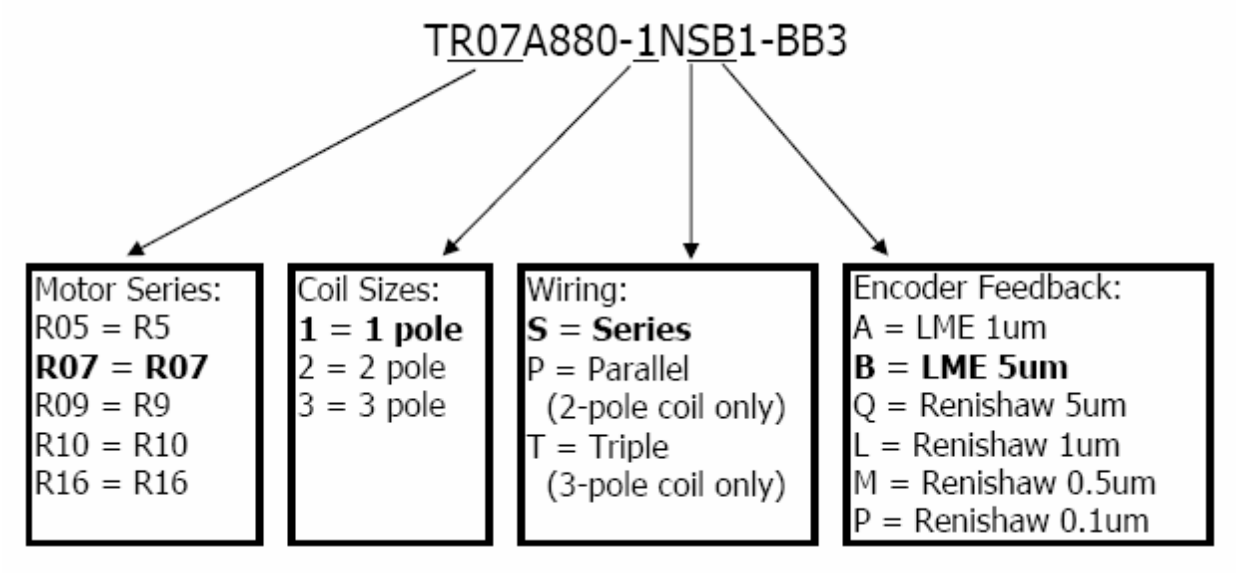
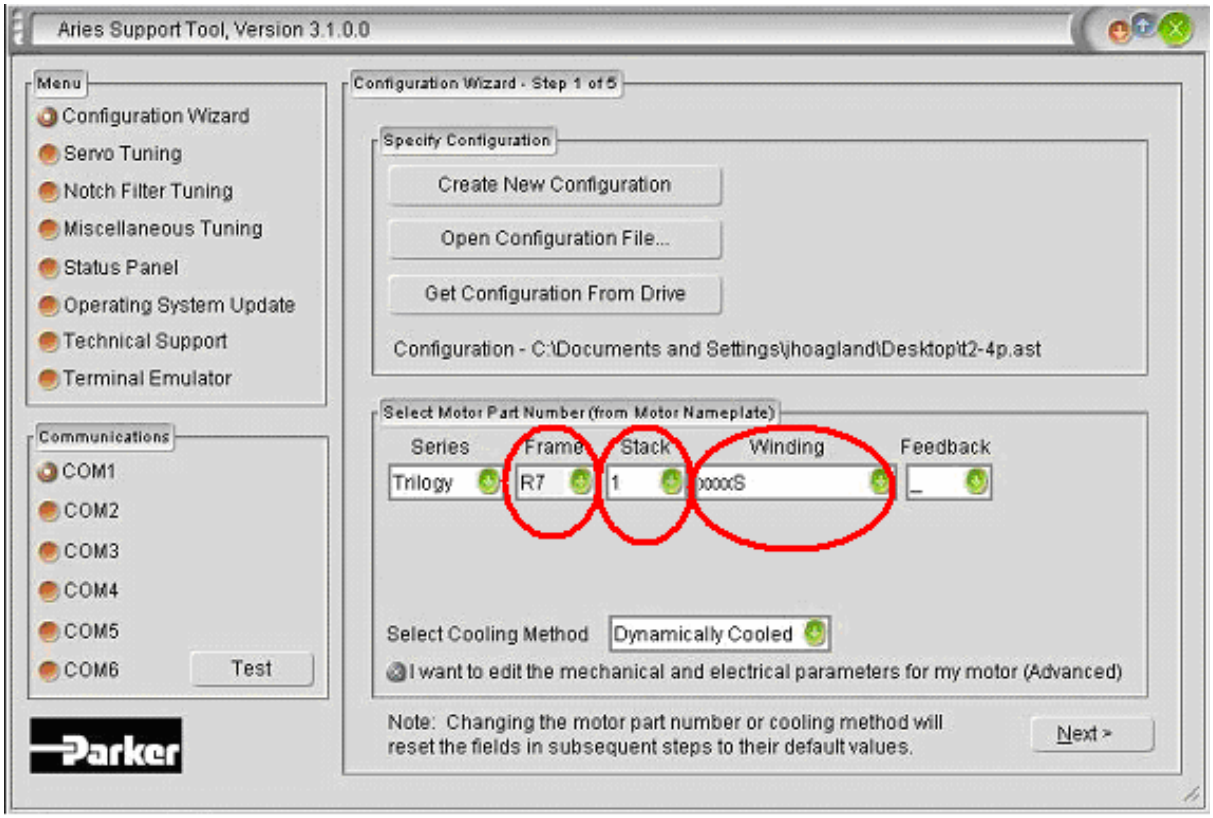
Ripped Example:





Step 2: Setting Feedback Resolution and Motor Rated Speed

The Encoder's Feedback Resolution sets the number of counts over an electrical cycle for the Aries to commutate. This is set in step 2 of the Aries Support Tool. The screen shot below shows the T2 example's feedback resolution setting of 12192 encoder counts per electrical pitch.

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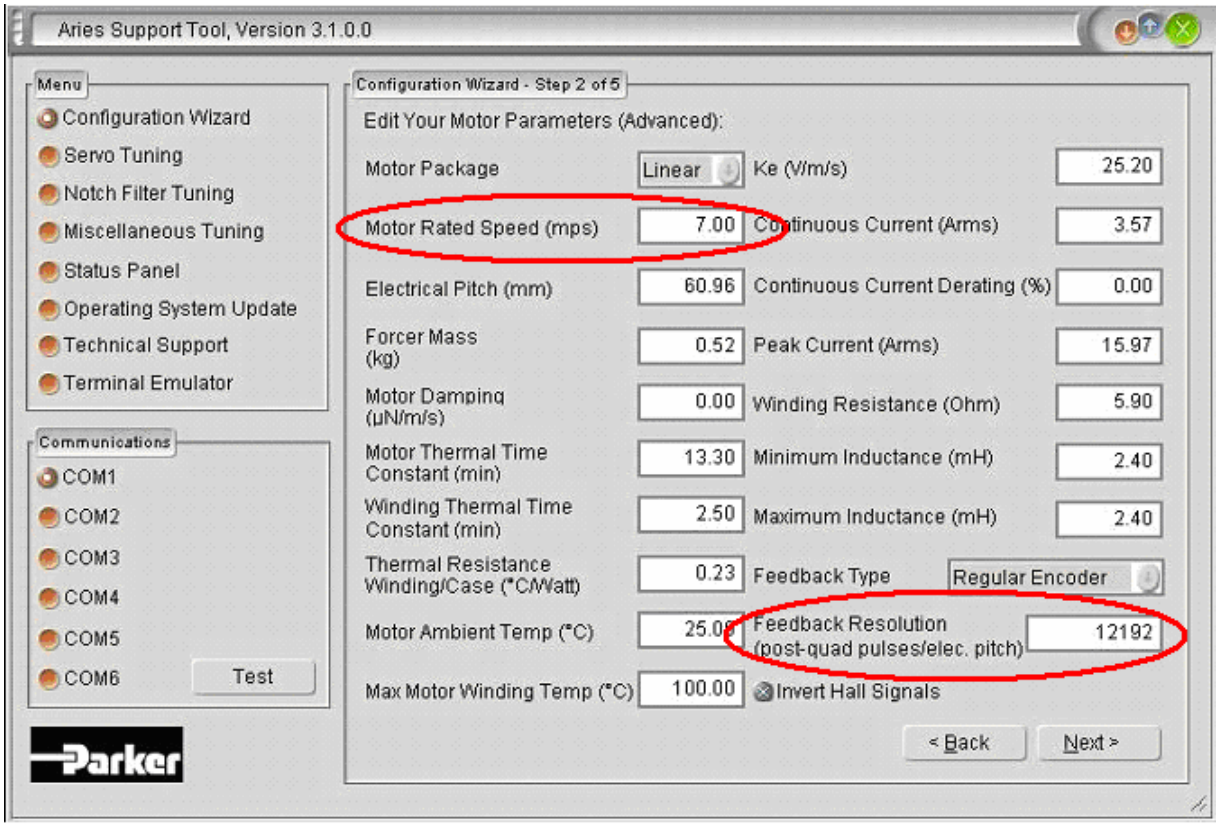

The R7-1 with 5um magnetic would be set to 8000 counts/electrical pitch. Note that the halls are inverted for both I-Force and Ripped series coils for Aries configuration.

Standard resolutions are listed below:

Motor Series	5um	1um	0.5um	0.1um
110 / 210 / 310	12192	60960	121920	609600
410	17068	85340	170680	853400
ML50	12000	60000	120000	600000
R5 / R7 / R9	8000	40000	80000	400000
R10 / R16	12000	60000	120000	600000

This sets the number of encoder counts (post-quad) over one electrical pitch (two magnet widths on the track). This number can be calculated by the electrical pitch divided by the post-quadrature resolution. i.e., 60.96mm / 5um / post-quad pulse = 12192 post-quad pulses / pitch

The motor rated speed can be used to limit maximum speed commanded for higher resolution encoders. Below are the maximum speeds for the standard positioner encoder options.

	B 5um LME	A 1um LME	Q 5um Renishaw	L 1um Renishaw	M 0.5um Renishaw	P 0.1um Renishaw
Max Speed (m/s)	7	2.5	5	5	3	0.4

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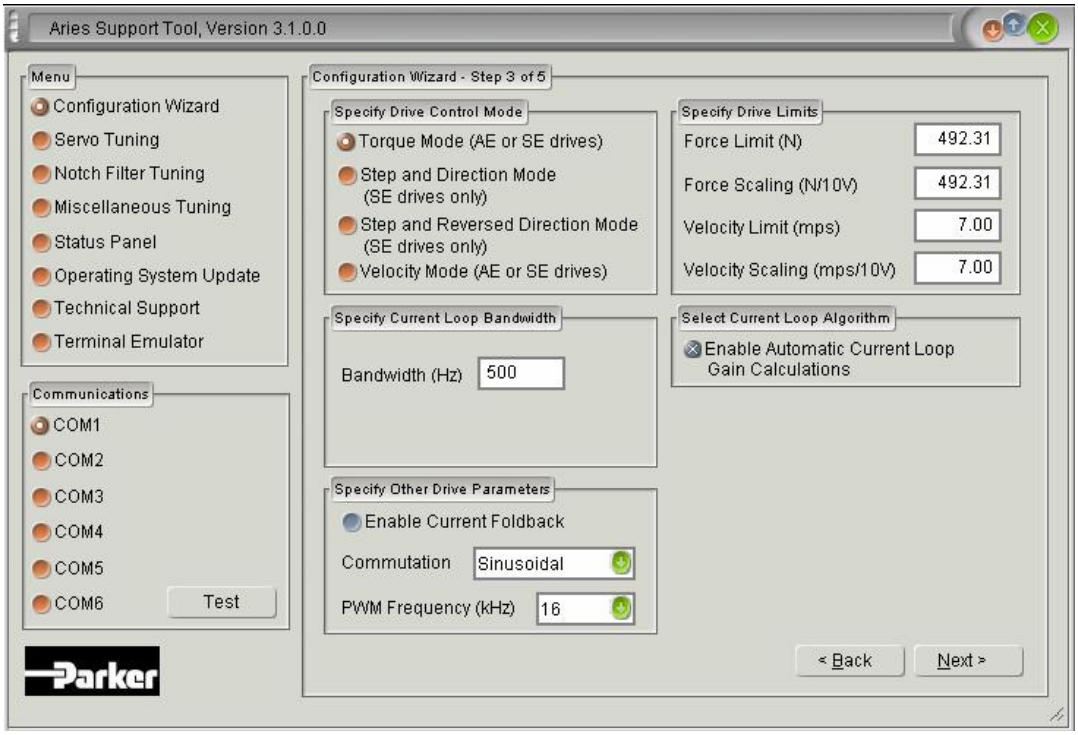
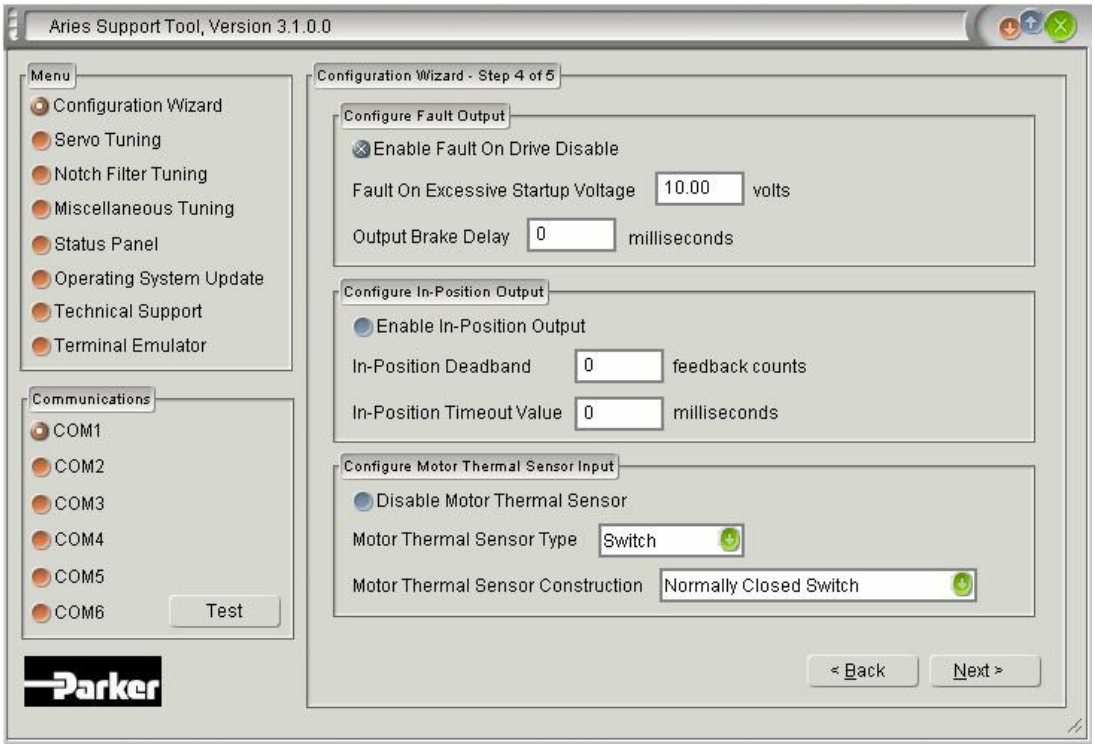
Step 3: Setting Current Bandwidth



When using the Aries with an ACR9000, in step 3 of 5 of the AST's Configuration Wizard set the drive in torque mode. Set the current loop bandwidth to 500Hz. This can be increased in current loop tuning if necessary. As the drive is in torque mode the velocity limit in this screen is not used.

Step 4: Configure inputs and outputs.

The defaults in the configuration wizard shown below are correct for configuring the Aries with the ACR90x0.



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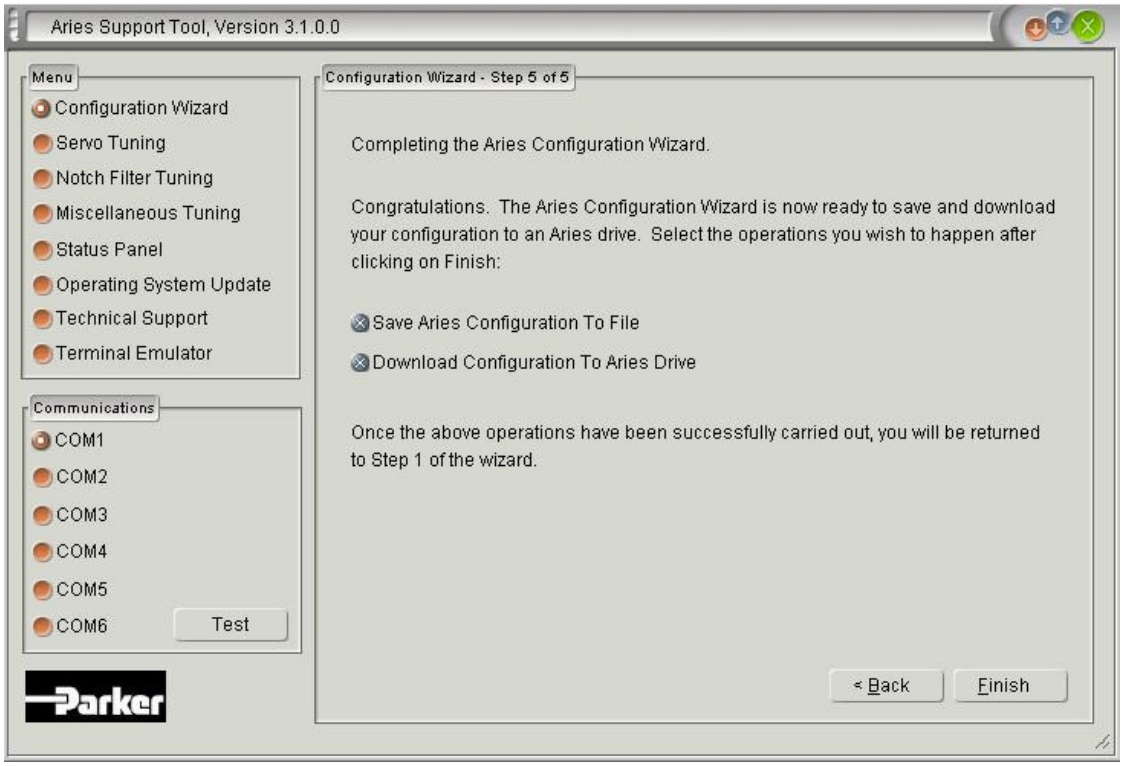
Step 5: Save and Download.

Save configuration and download to the Aries drive.



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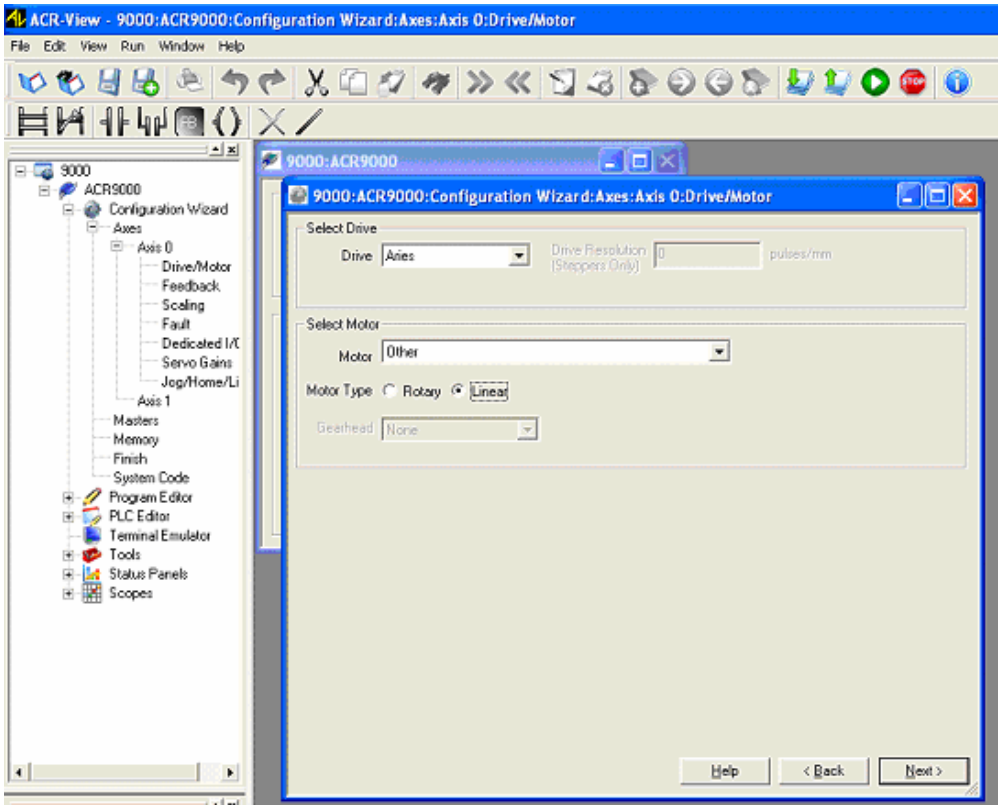
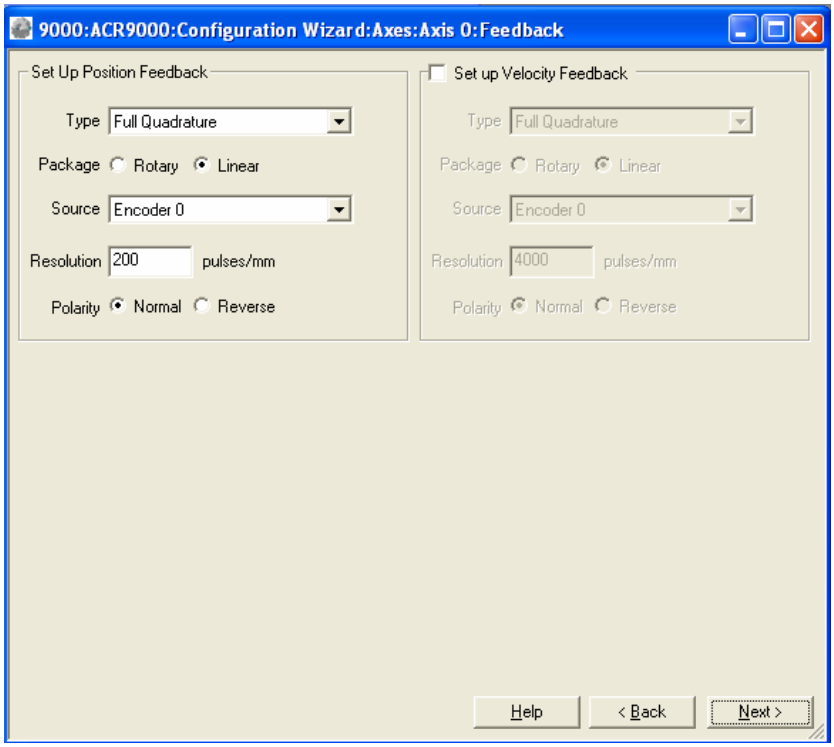
3. ACR9000 Software Setup

Step 1: Drive/Motor

Start ACR-View, starting a new project or opening an existing project. The Configuration Wizard steps through the axis configuration. For configuring a Trilogy coil or positioner with an Aries (AR-xxAE) drive, set the Aries as the drive, Other for the Motor and for Motor Type select Linear.



Step 2: Feedback



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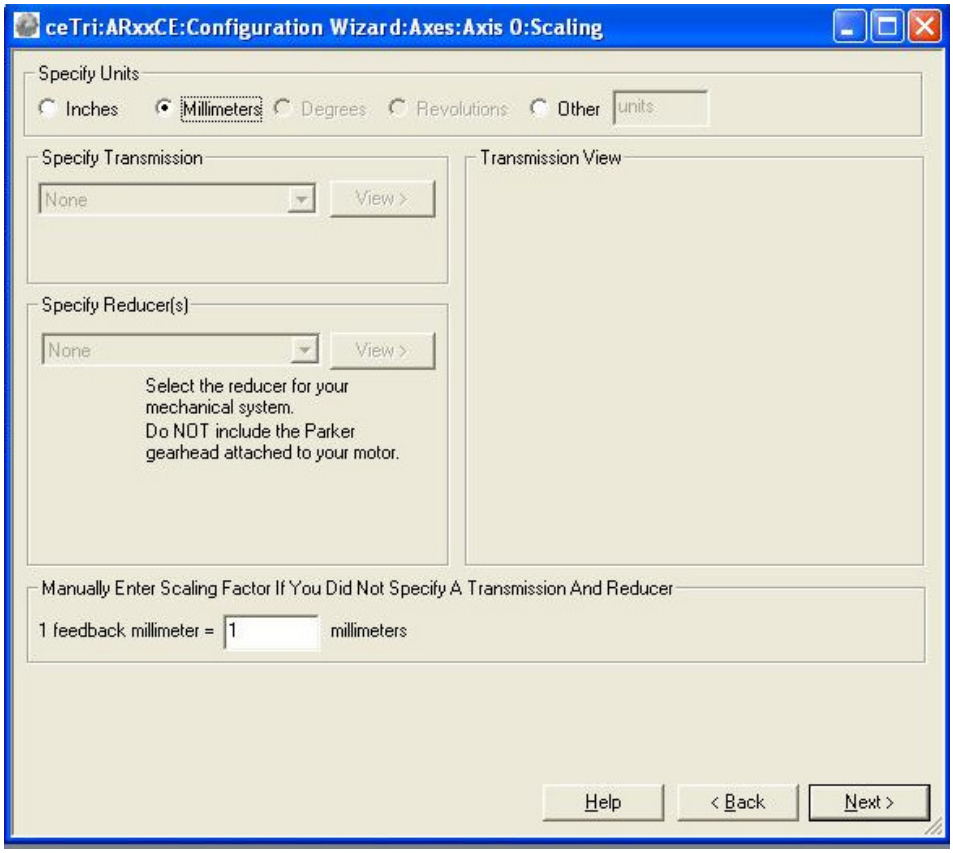
For feedback resolution for the ACR9000, select normal polarity and set the resolution. Standard resolution settings are listed in the following table:

	B 5um LME	A 1um LME	Q 5um Renishaw	L 1um Renishaw	M 0.5um Renishaw	P 0.1um Renishaw
Pulses/mm	200	1000	200	1000	2000	10000

Step 3: Scaling

For Scaling, select millimeters, inches or other. As this is a direct drive linear, the transmission is fixed.



Step 4: Dedicated I/O

For ACR9000, select the first input as the positive limit. The negative limit and home sensor will be the next two inputs. Change the home sensor to normally closed (N.C.)

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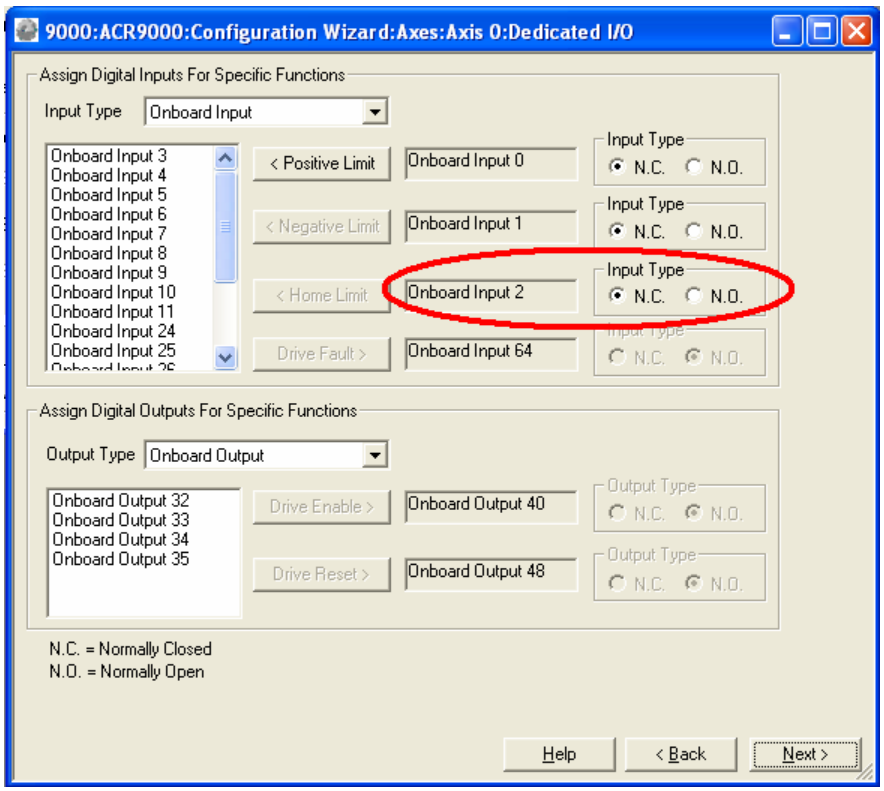
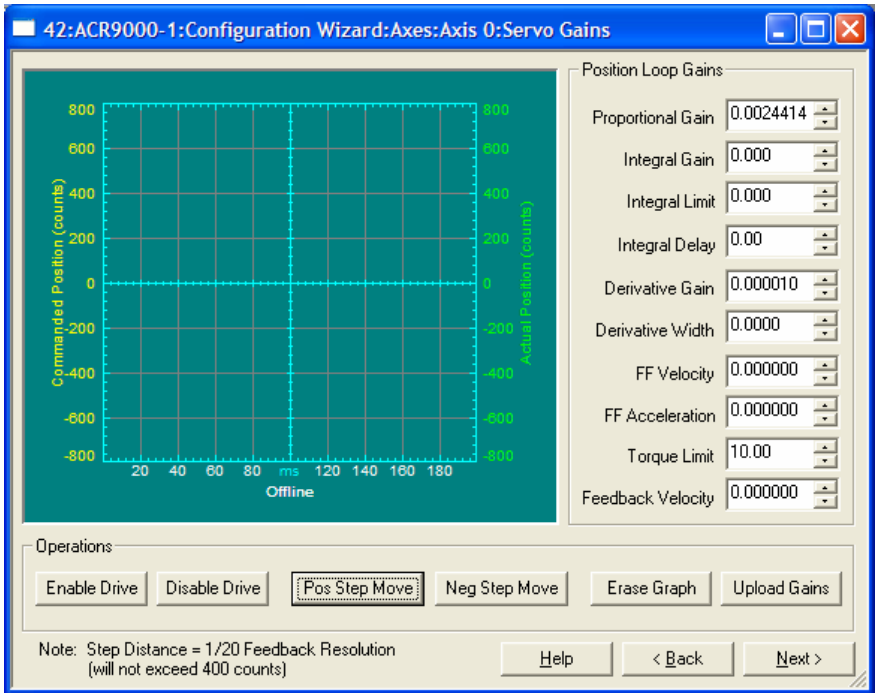


Step 5: Servo Gains



The ServoGains screen has a fixed step distance maximum of 400 encoder counts. As this is a very short move for high resolution linear encoders, it would be recommended to use the ServoTuner (under Tools) for tuning. For now in the configuration wizard, start with basic tuning gains for of proportional gain .0024, derivative gain of .00001 for an unloaded positioner at 5um resolution. For other resolutions, scale proportionally. i.e., if using a 1um resolution encoder, this is 5 times more resolution than the 5um, start with proportional gain of .00048, derivative gain of .000002. See Tuning Trilogy with ACR Controller Applications Note for further details.

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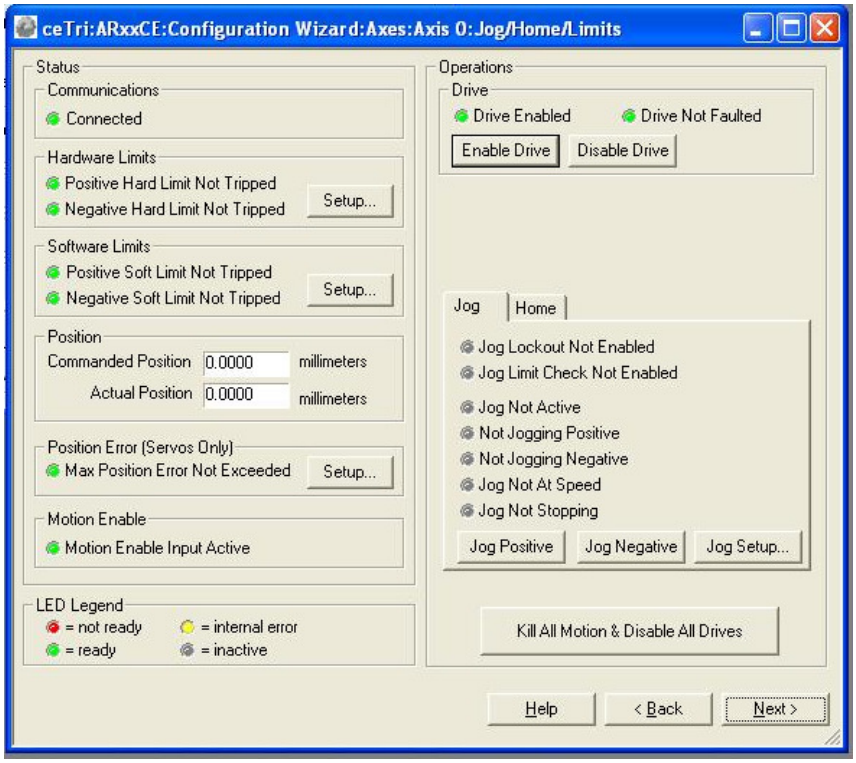
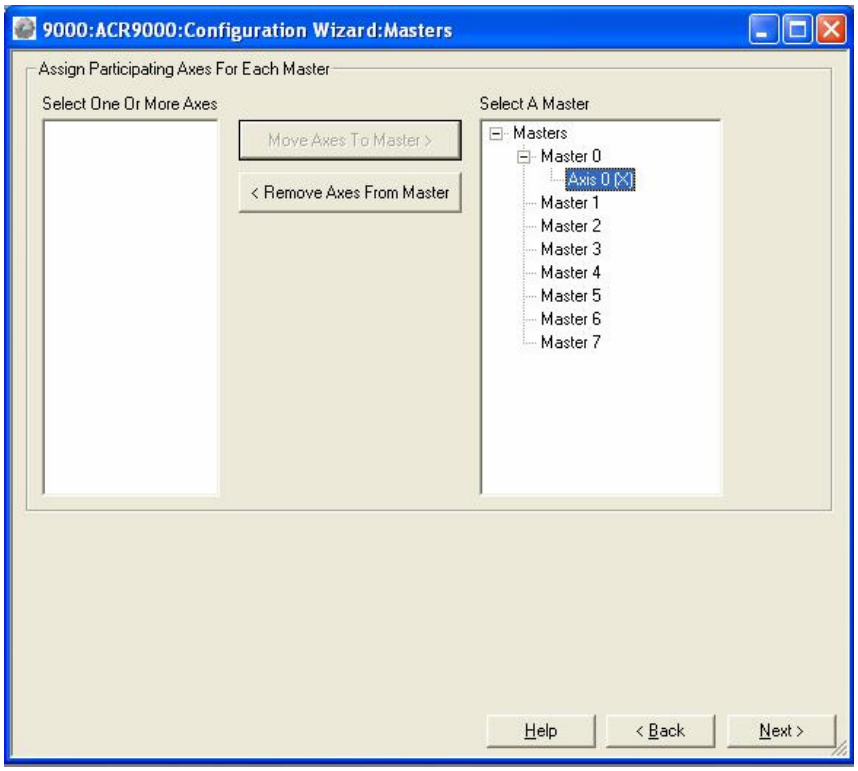
Step 6: Jog/Home/Limits



This screen allows enabling the axis, simple jogging and can verify limit switch functionality. Note that the maximum position error is set to 1, whether that is 1mm or 1inch; set appropriately.

Step 7: Masters



The Masters screen allows the Axis to be attached is the Master, which is the motion trajectory calculator.

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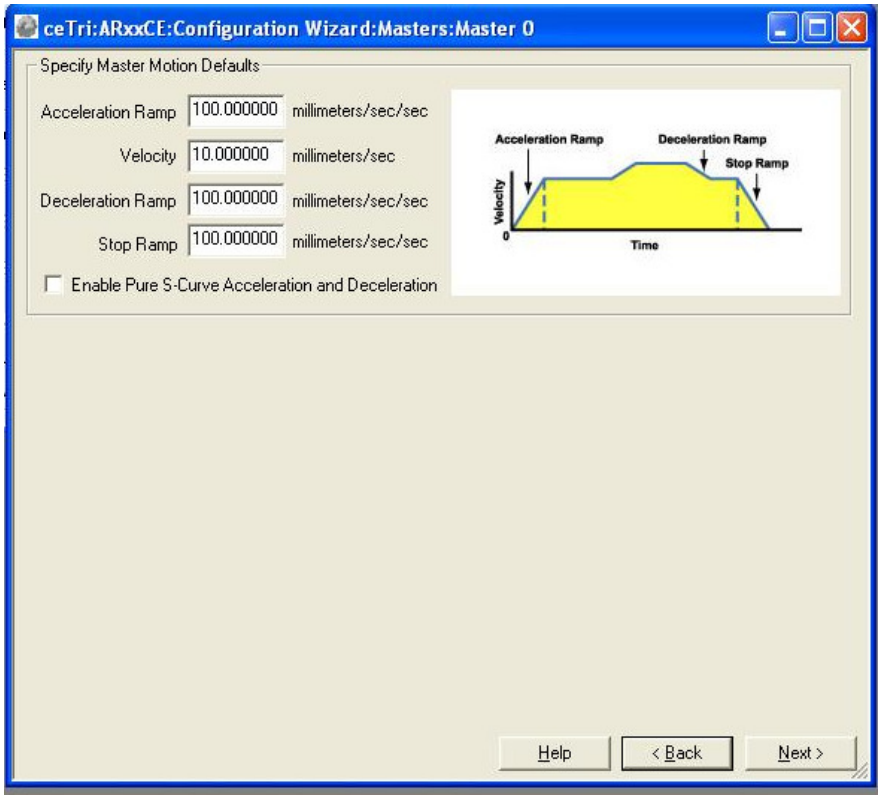
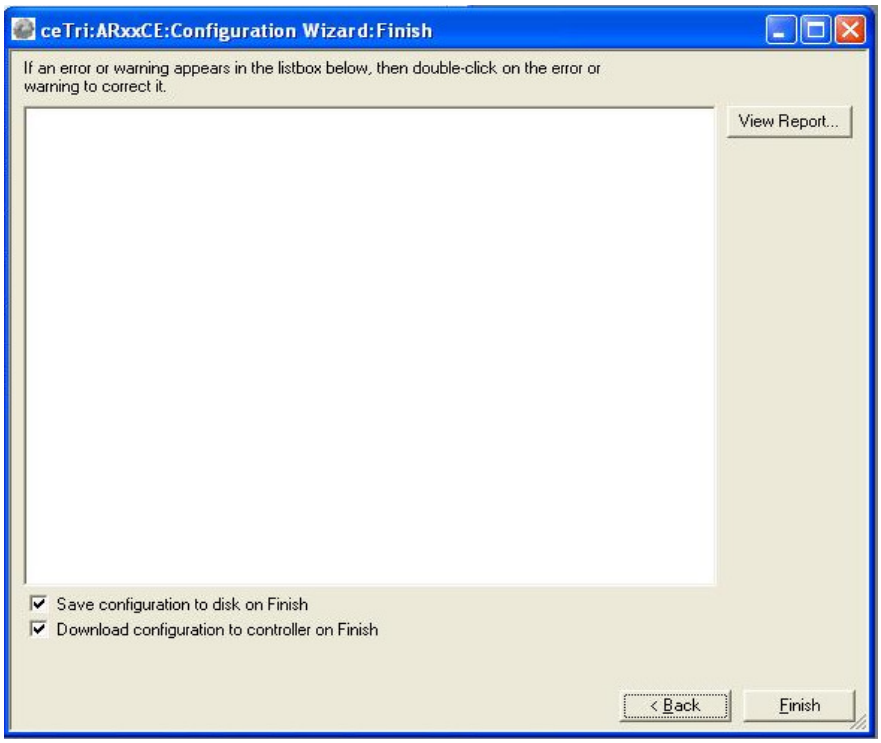
The next Masters screen sets the default acceleration, velocity, deceleration and stop ramps.



Step 8: Finish

Click Finish to save and download the configuration to the ACR9000.



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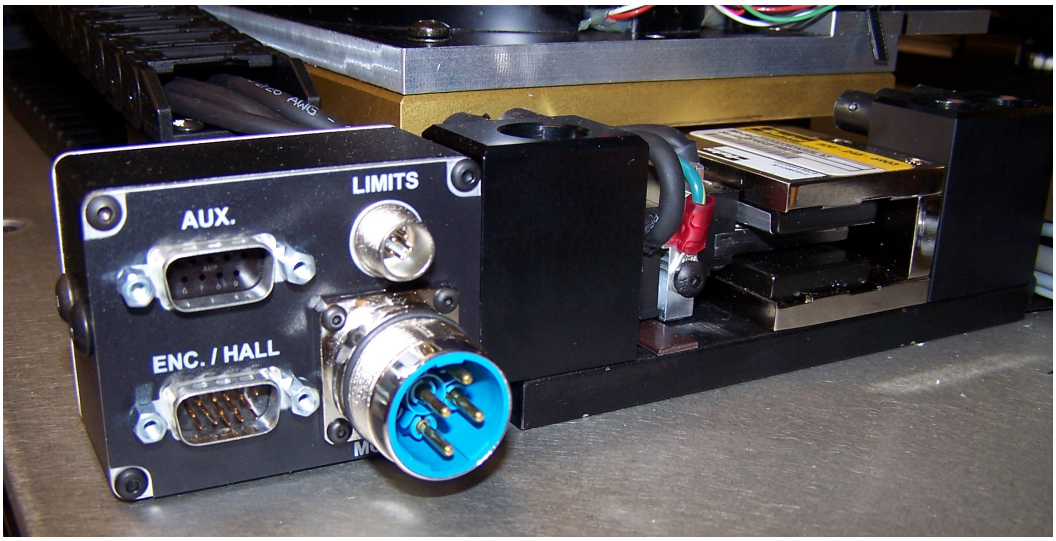
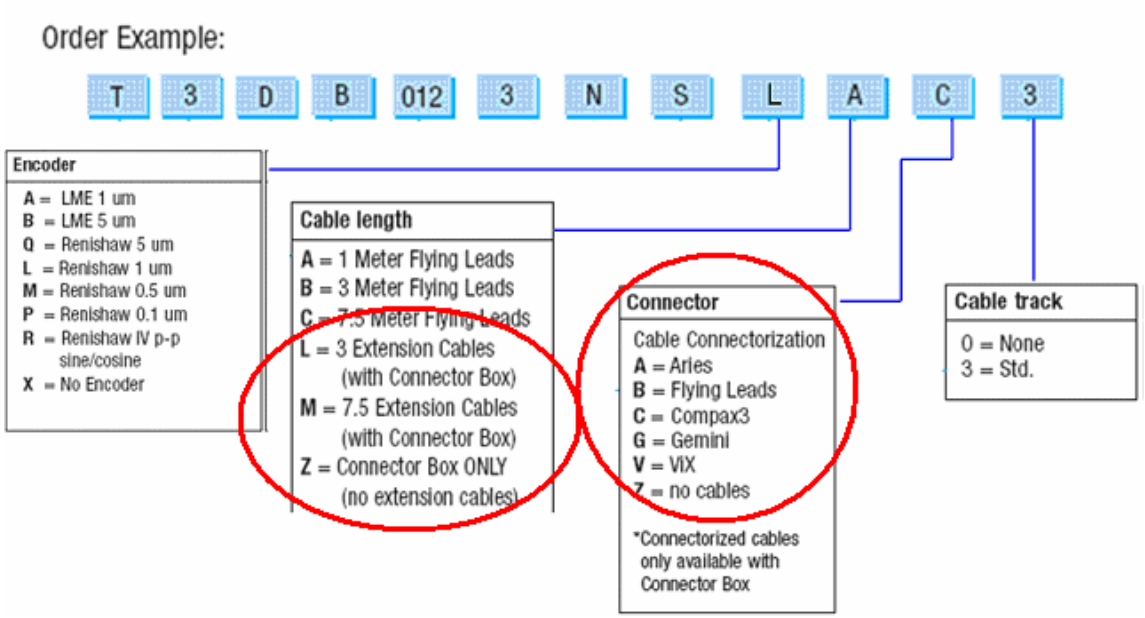
Trilogy Positioner Connector Box Option



Trilogy positioners have a connector box option as a standard option. Daedal LXR users will recognize this as similar to the LXR connector box. This allows users to be able to quickly connect Trilogy positioners to standard Parker drives with connectorized cables. The connector box is available with Flying leads or Parker-drive connectorized cables in 3 or 7.5 meter (10 or 25-foot) for Aries, Compax3, Gemini or ViX servo drive/controllers.

Note that the Connector Box is available on all positioners except parallel and triple wound Ripped Positioners.



If you have any questions, please contact:

- Technical Assistance, Applications Engineering Department (e-mail: emn_support@parker.com or call 800-358-9070 North America, 707-584-7558 International)

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