Electromechanical Automation Applications Note

Product: Trilogy coils & Positioners
Rev: 1.0
Subject: Wiring and Setup of Trilogy to AriesEPL with ACR9040 or AriesCE

This applications note clarifies the connections with the Trilogy motors and positioners to the Aries-EPL with ACR9040 or AriesCE drive/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.

1. Trilogy to AriesEPL or Aries-Controller 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 19.

See the next page for Trilogy Coil and Positioner to Aries Wiring. These connections apply to AriesEPL drive and Aries-Controller. In addition, limit and home sensor connections to Aries-Controller or AriesEPL:

Trilogy	Color Code Trilogy Positioners Ripped & I-Force	AriesPE or AriesCE Connections	User Supplied Connections
Limit Power	Orange		+24vdc
Limit Gnd	Purple		24vdc Common
		1,2,3	+24vdc Pullup
Home	Brown	16	
+Limit	Light Green	14	
-Limit	Light Blue	15	

Aries Thermal Model Protection and Power Installation

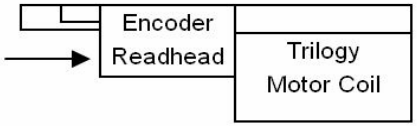
The Aries drive uses a thermal model of the motor to estimate the coil temperature rise and is much faster than a thermal switch. If the internal thermal model is to be relied on to protect the motor, do not power off or reset the amplifier during use. During an e-stop or jam, keep the amplifier alive 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.

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

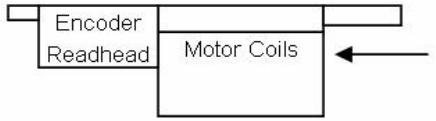
Using Old Color codes

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



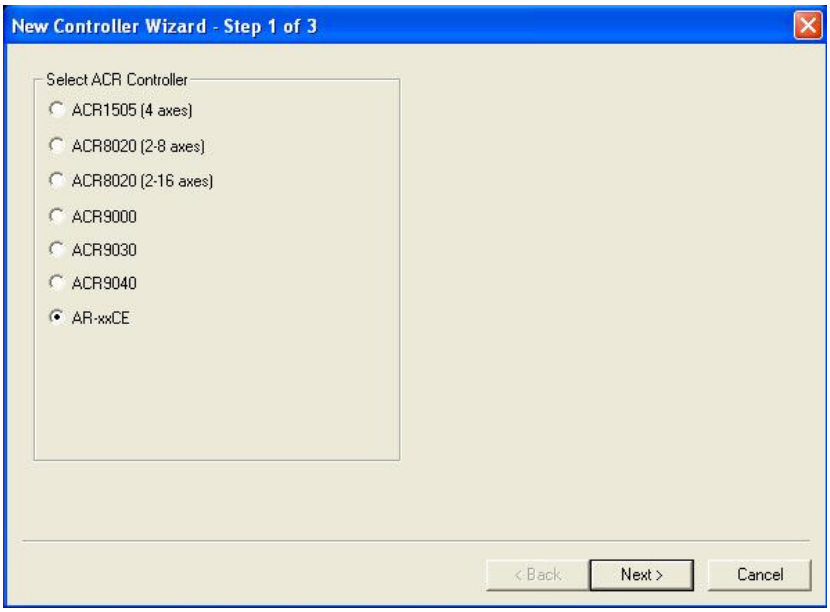
In coil only applications, if the encoder's cable exit faces opposite the opposite way, switch A and A/.

2. AriesCE or Aries-EPL with ACR9040 Software Setup

Step 1. ACR-View > Create New Project

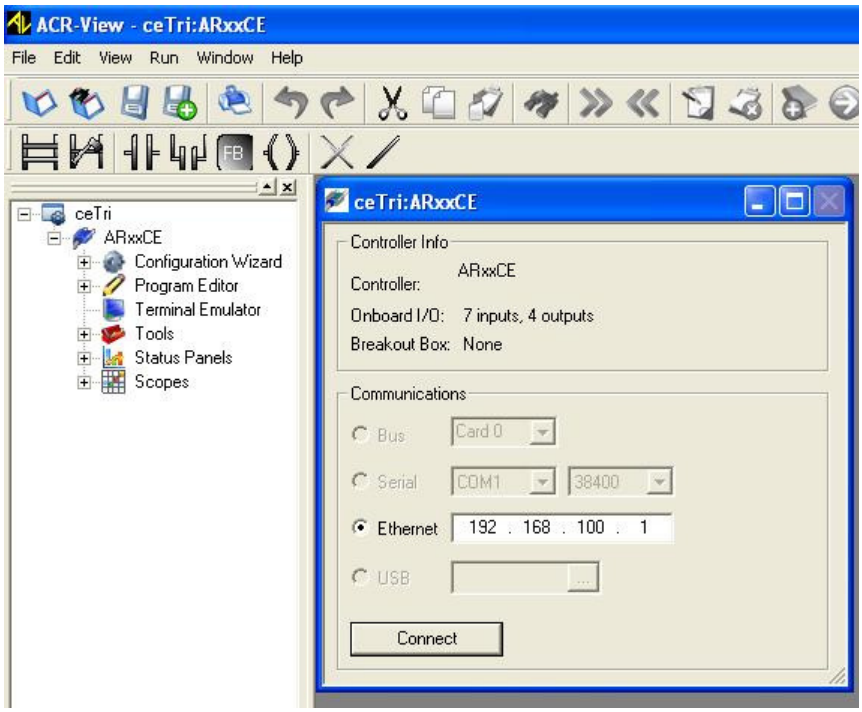
ACR-View's Configuration Wizard allows quick controller and drive configuration, simple tuning and jogging, before starting to program in the program editor.

Step 2. Select Controller



Step 3. Name Controller

Step 4. Connect to Controller



Note by default the ACR9030 and ACR9040's default IP address is 192.168.10.40

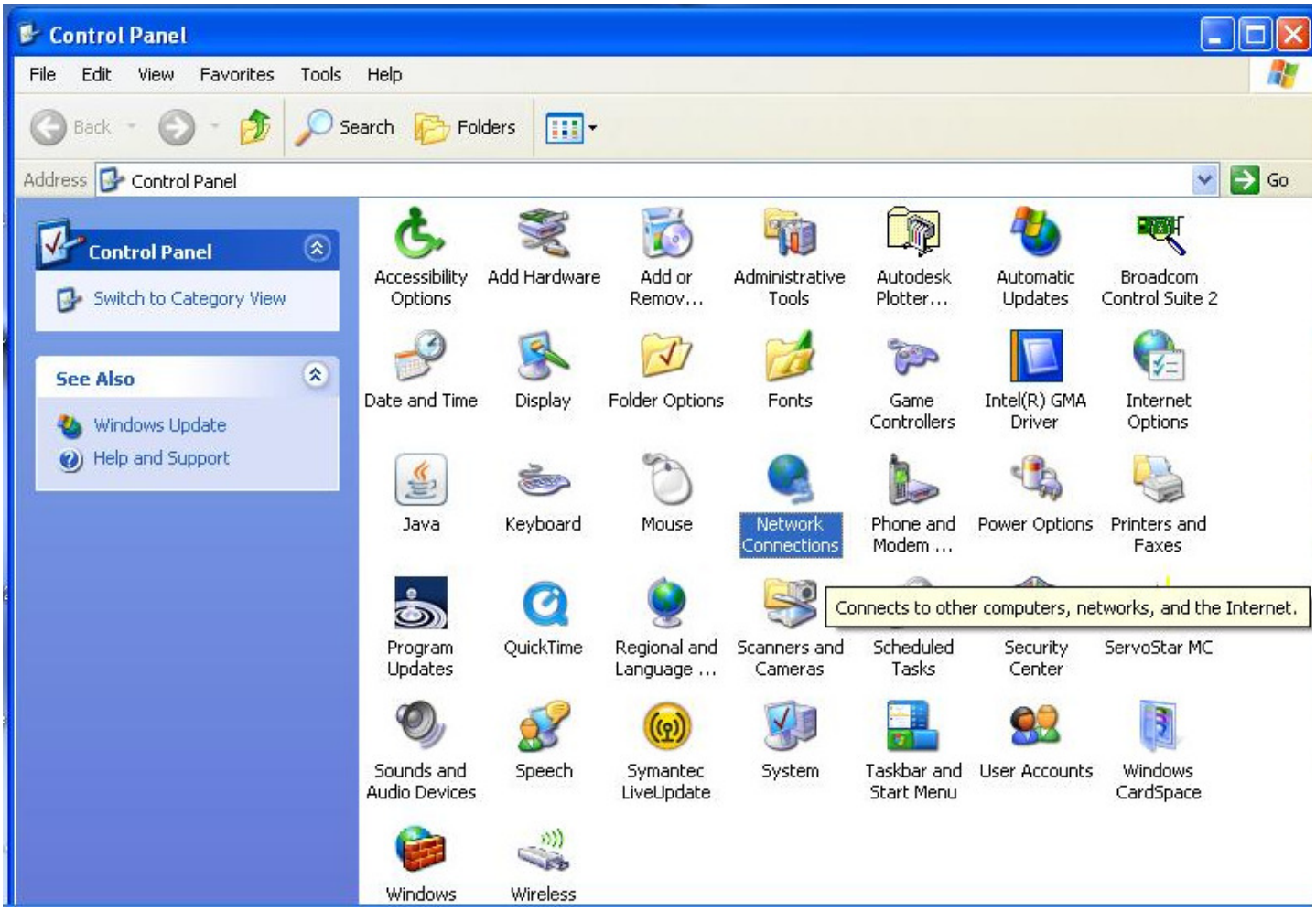
The AriesCE's default IP address is 192.168.100.x, where x is set based on the dial switches.

i.e., 192.168.100.1 if the AriesCE's address switches are set to 0 for the x10 and 1for x1

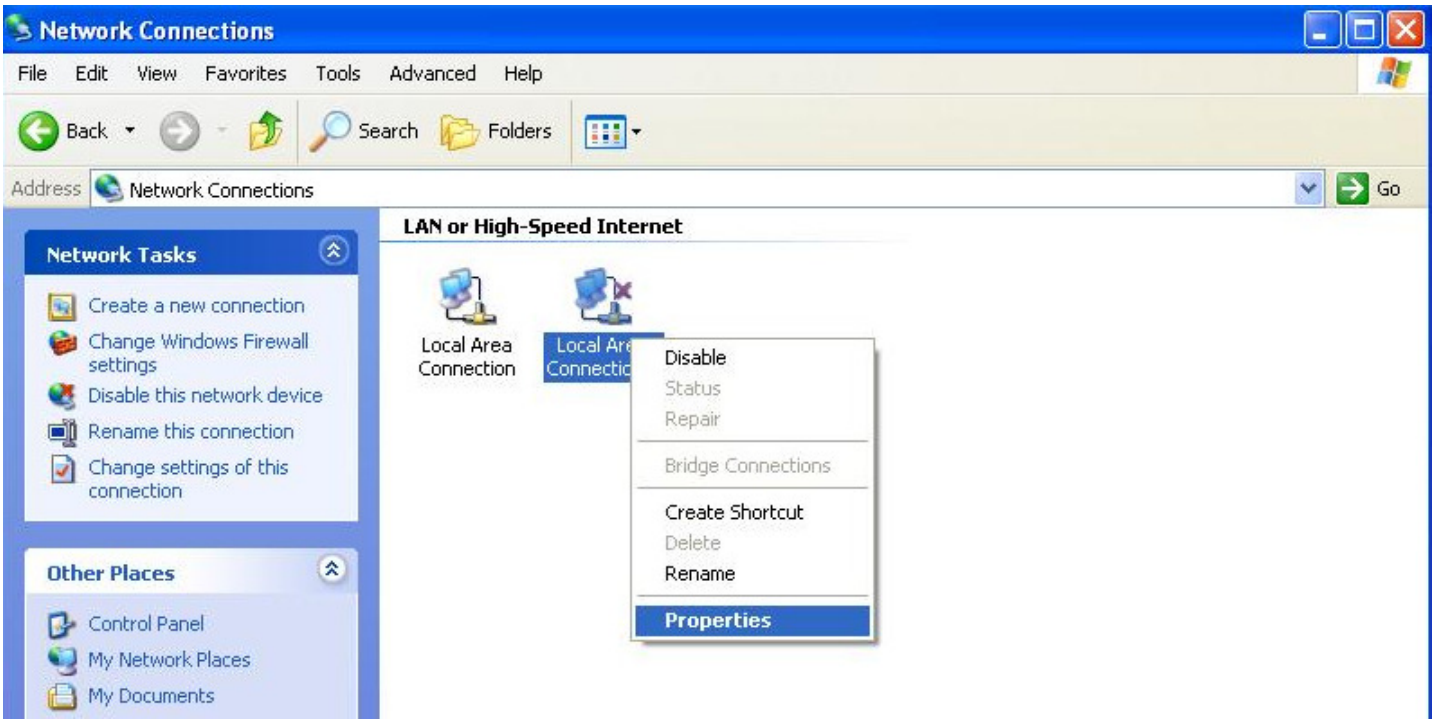
Step 5a. Set your PC's IP address

Note your PC's IP address is set in Windows Control Panel:

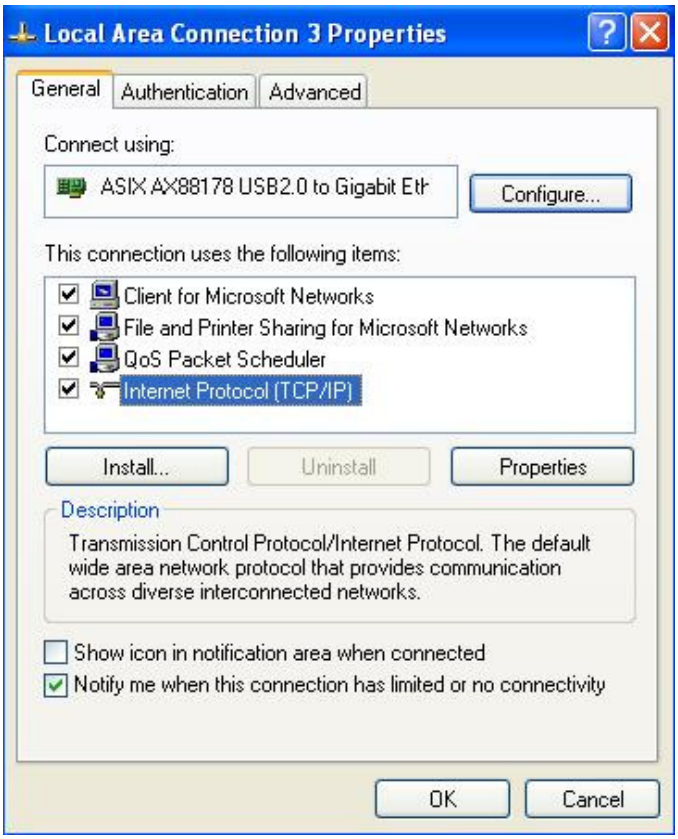
Step 5b. Go to Network Connections



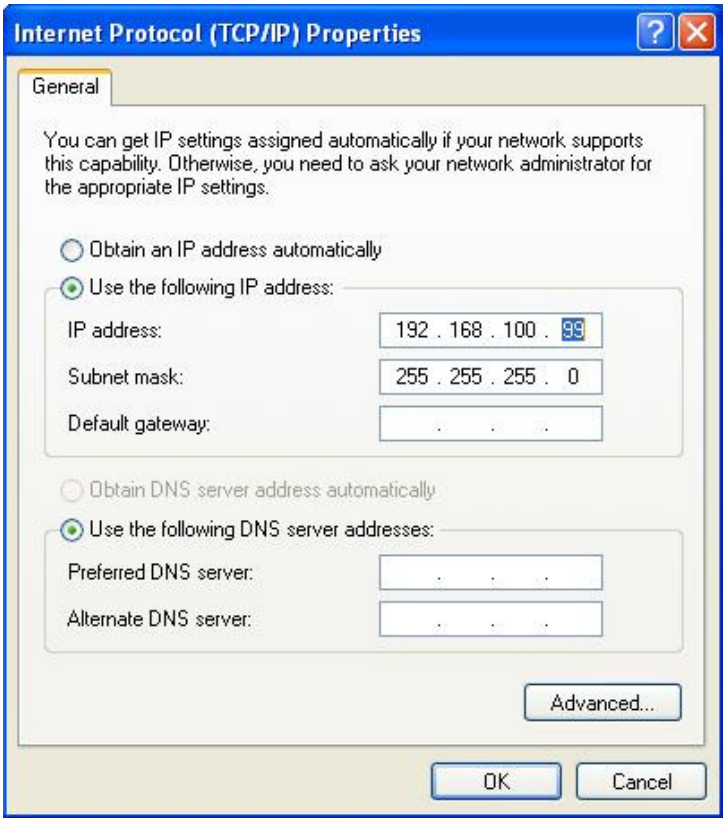
Step 5c. Right-click on your local area connection being used to connect to the controller and select Properties:



Step 5d. Select Internet Protocol (TCP/IP):

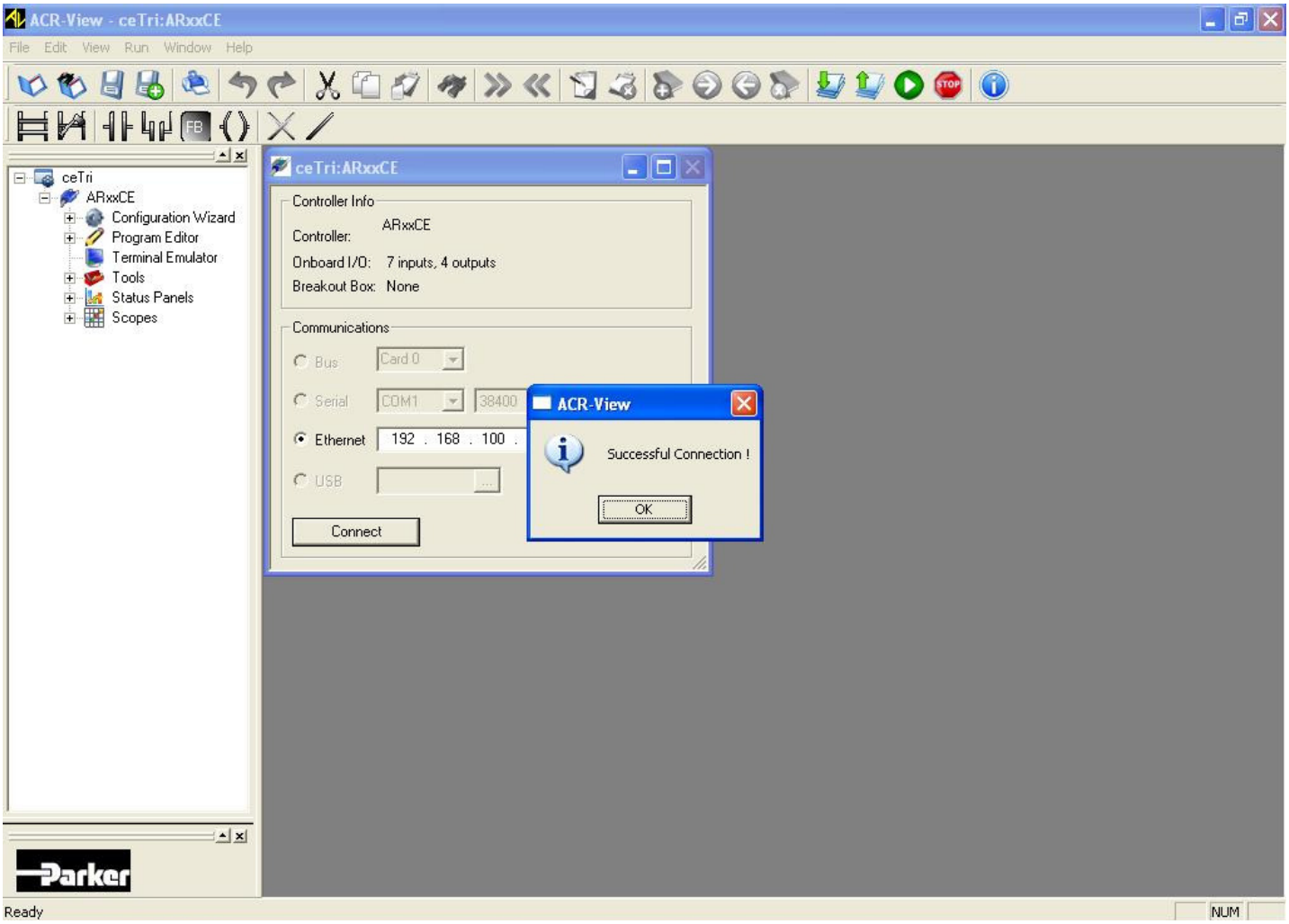


Step 5e. Set your PC's IP address and subnet. Your PC's IP needs to have the same first 3 octects and the last octect needs to be different than the controller's. The subnet mask should be set to 255.255.255.0



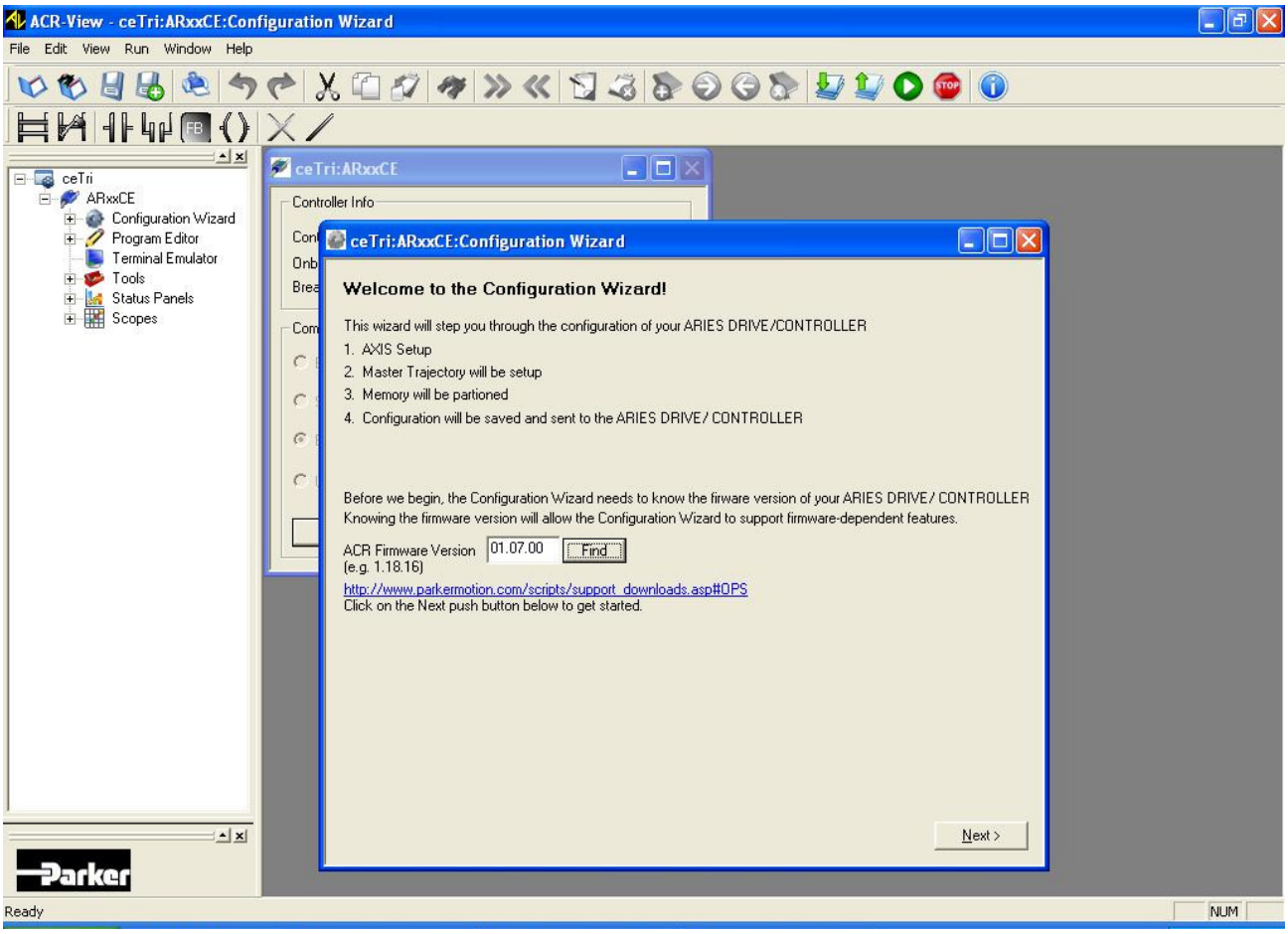
Step 5f. To connect, disable Cisco Security Agent (Red Flag icon on Windows Taskbar)

Step 6. In ACR-View, Connect

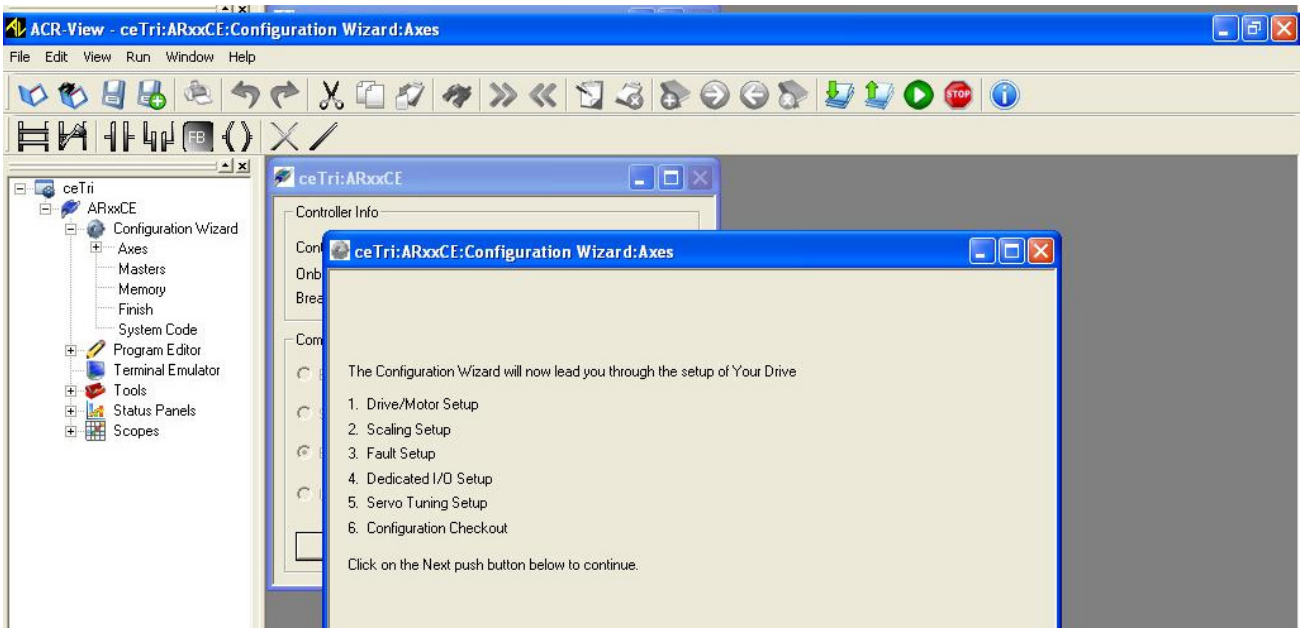


Step 7. Launch Configuration Wizard

The Configuration Wizard steps users through the axis configuration. In the Project Workspace select Configuration Wizard and Find ACR Firmware Version and click Next.

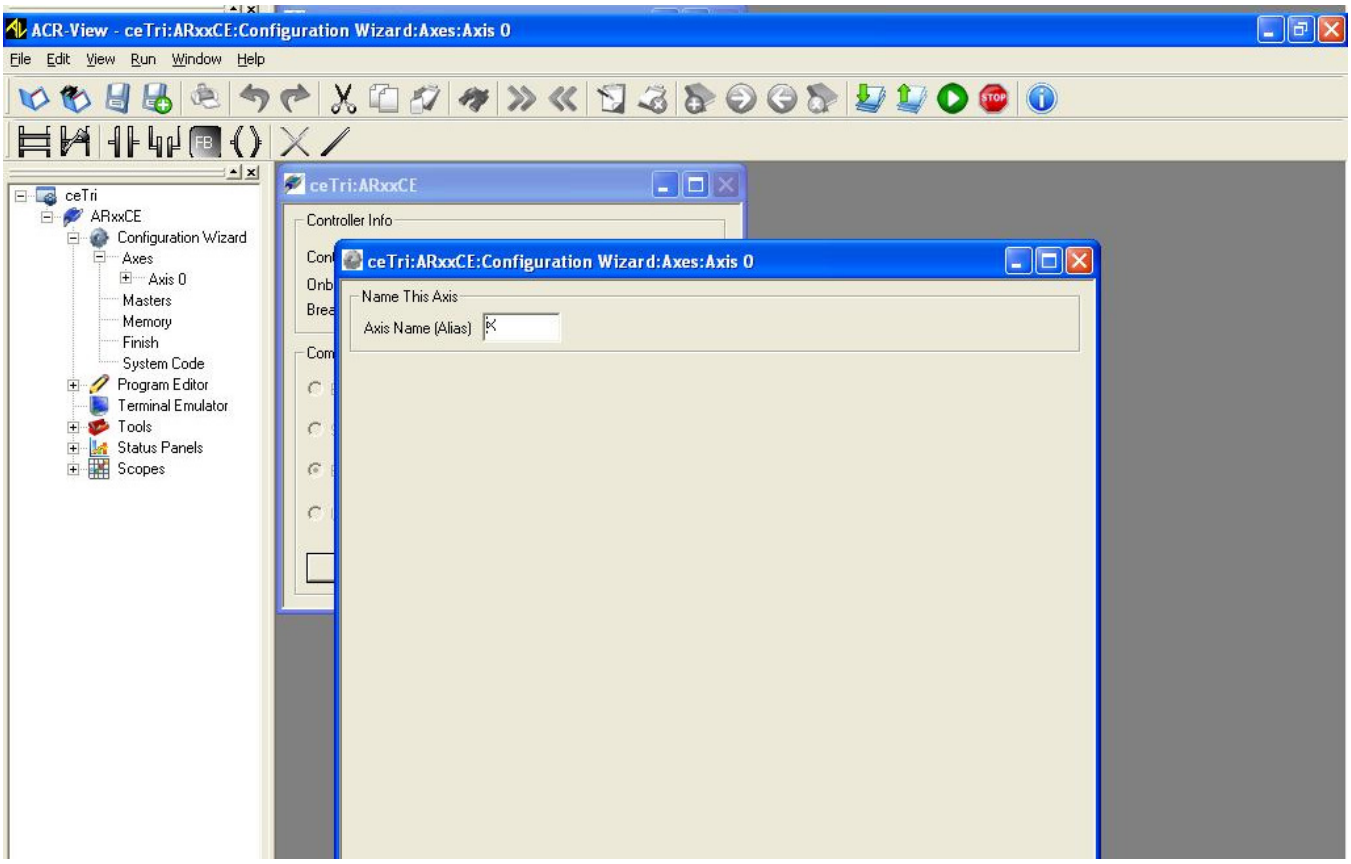


Step 8. Configuration Wizard



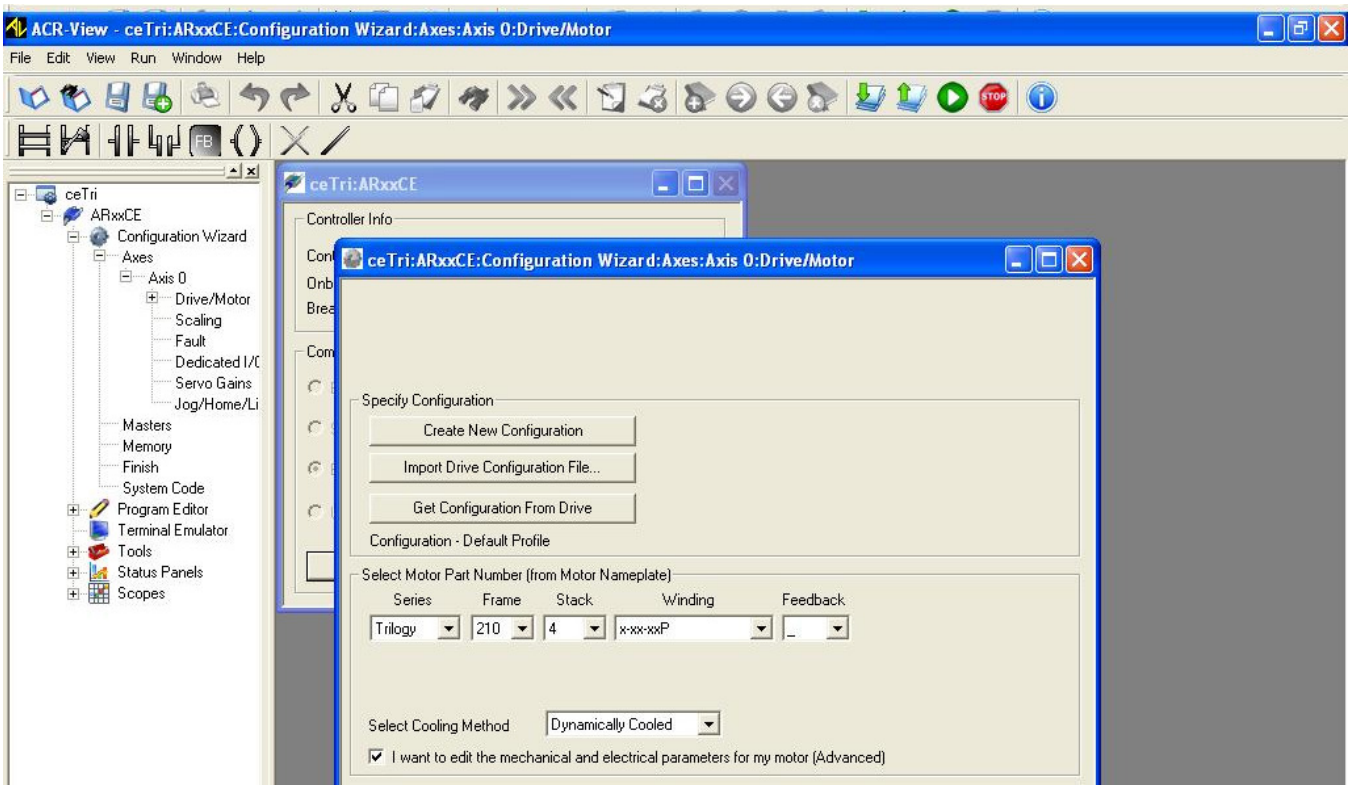
These are the steps for the Configuration Wizard. Select Next.

Step 9. Name Axis

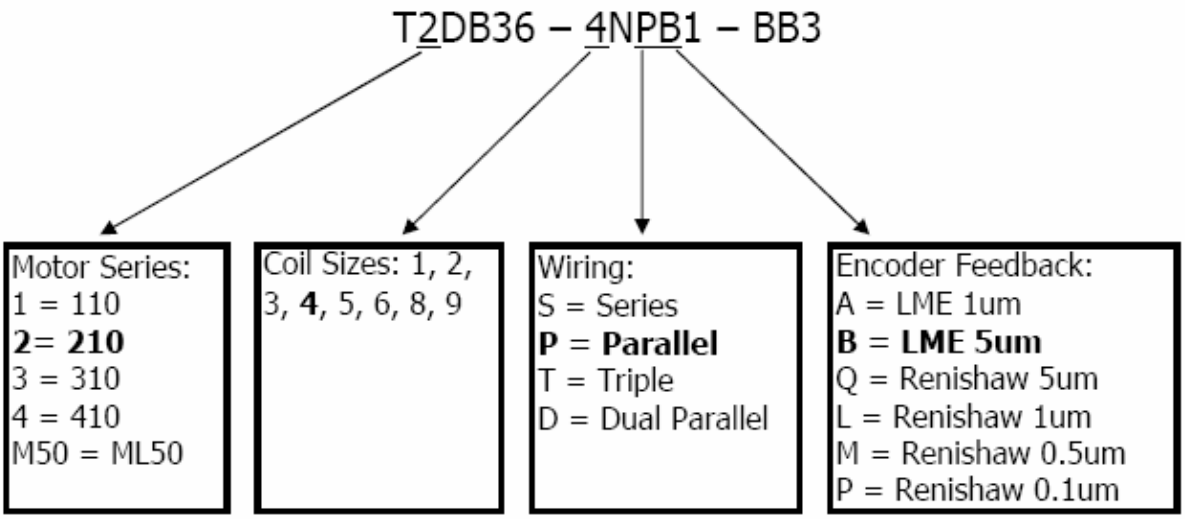


This will be the axis' alias within the local programs.

Step 10a. Select Motor

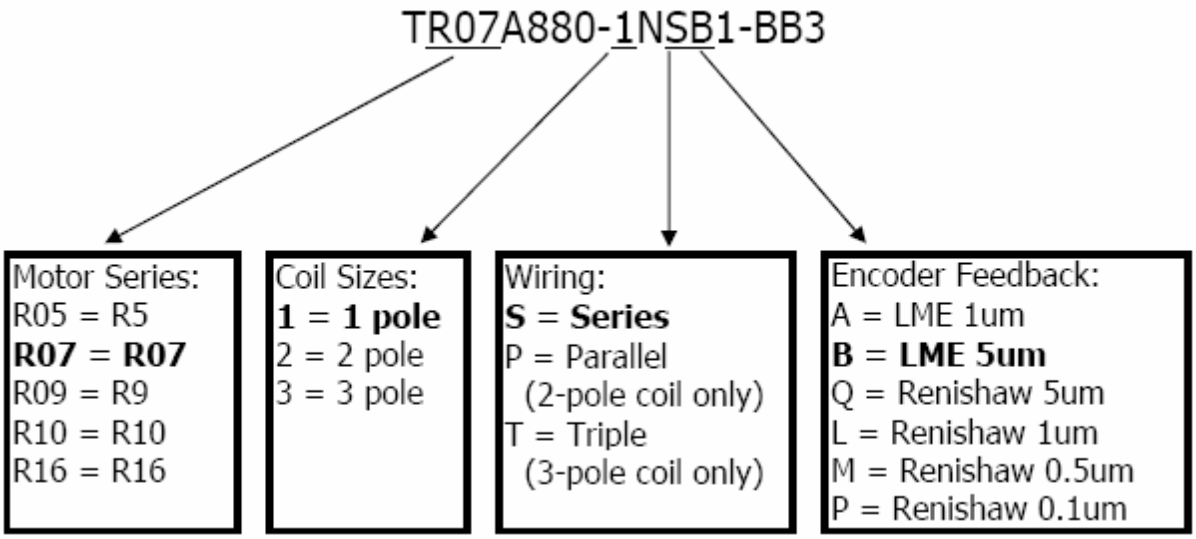


The Trilogy positioner part numbers contain the coil part numbers. Below shows an example of the I-Force T2 positioner part number and the information pertinent for Aries configuration.



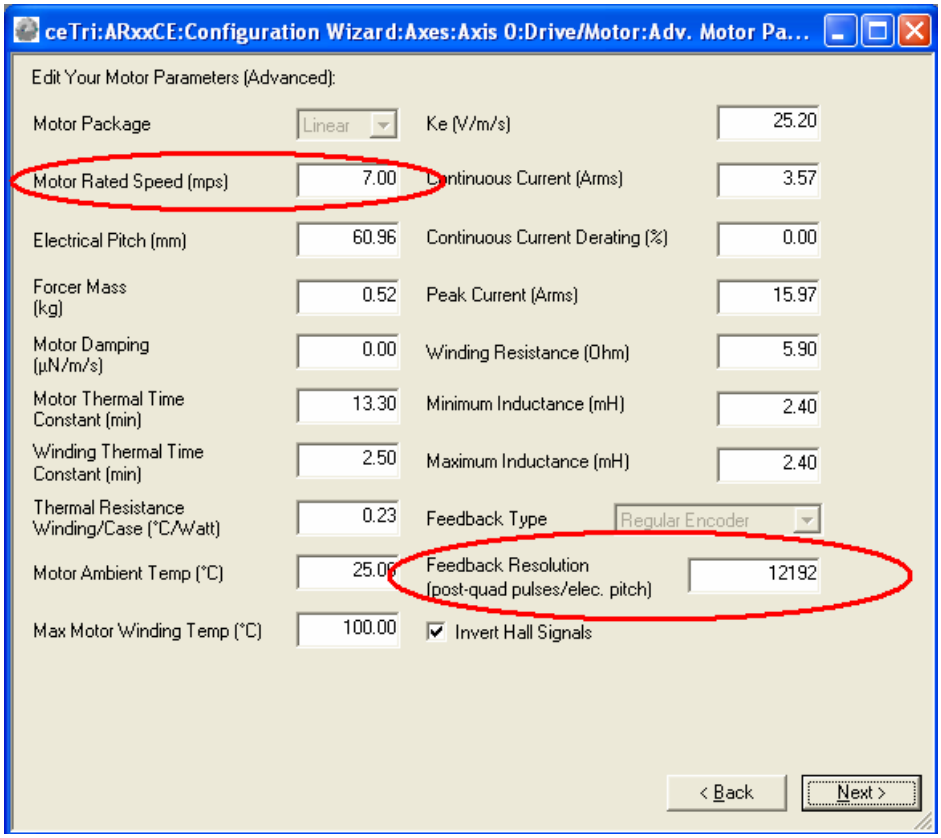
Simple pull-down selections in the ACR-View's Configuration Wizard configure the amplifier based upon the motor part number.

Ripped Example:



Step 10b: 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 in the advanced motor parameters screen in ACR-View. The screen shot below shows the T2 example's feedback resolution setting of 12192 encoder counts per electrical pitch.



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

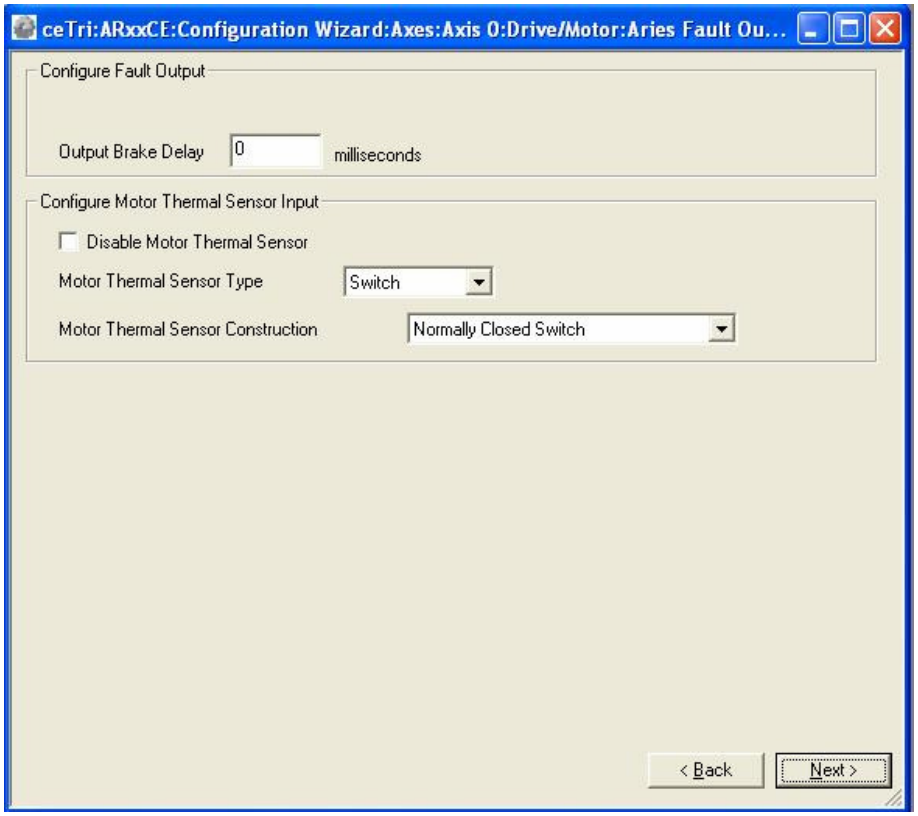
This sets the number of encoder counts (post-quad) over one electrical pitch (two magnet widths on the track). This number can be calculated by the electrical pitch divided by the post-quadrature resolution. i.e., 60.96mm / 5um / post-quad pulse = 12192 post-quad pulses / pitch

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.

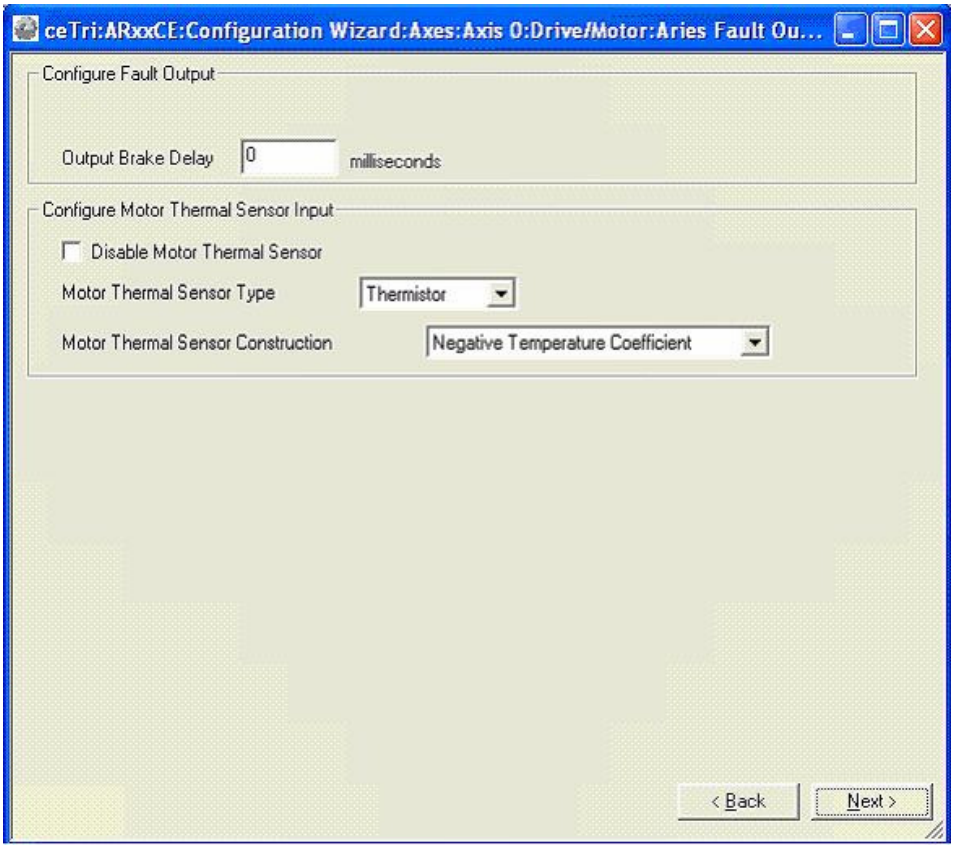
	B 5um LME	A 1um LME	Q 5um Renishaw	L 1um Renishaw	M 0.5um Renishaw	P 0.1um Renishaw
Max Speed (m/s)	7	2.5	5	5	3	0.4

Step 11: Fault Output

The thermal sensor type's default setting of Switch and Normally Closed Switch are correct…

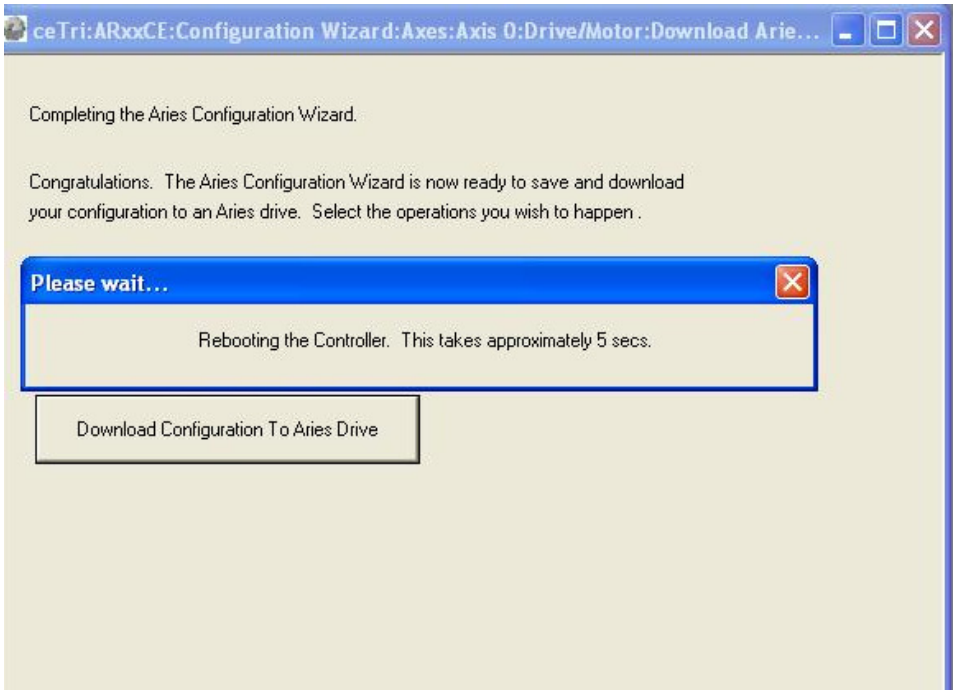


…except for the new WDA, WDB or WDC wiring options set the sensor type to Thermistor, Negative Thermal Coefficient.



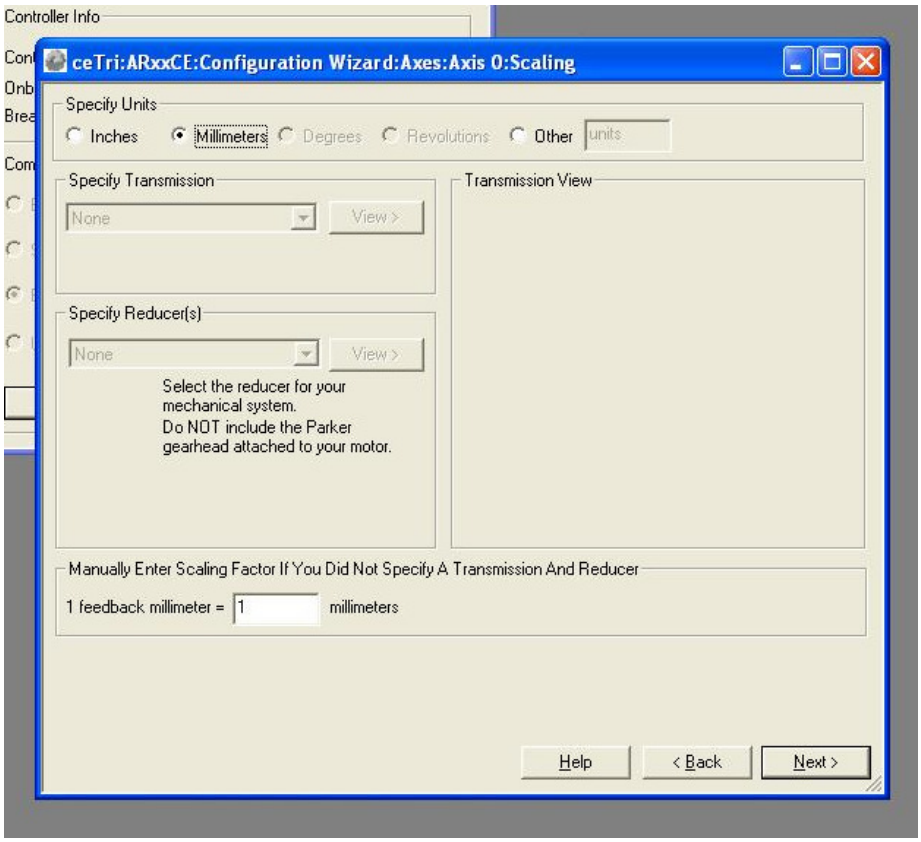
Step 12: Download Aries Configuration

The Aries download screen allows users to save the motor configuration (file type .ast) to the project folder. Download the configuration to the drive at this point. The AriesEPL or AriesCE will reboot.



Step 13: Scaling

Units may be selected as Inches, Millimeters or Other.

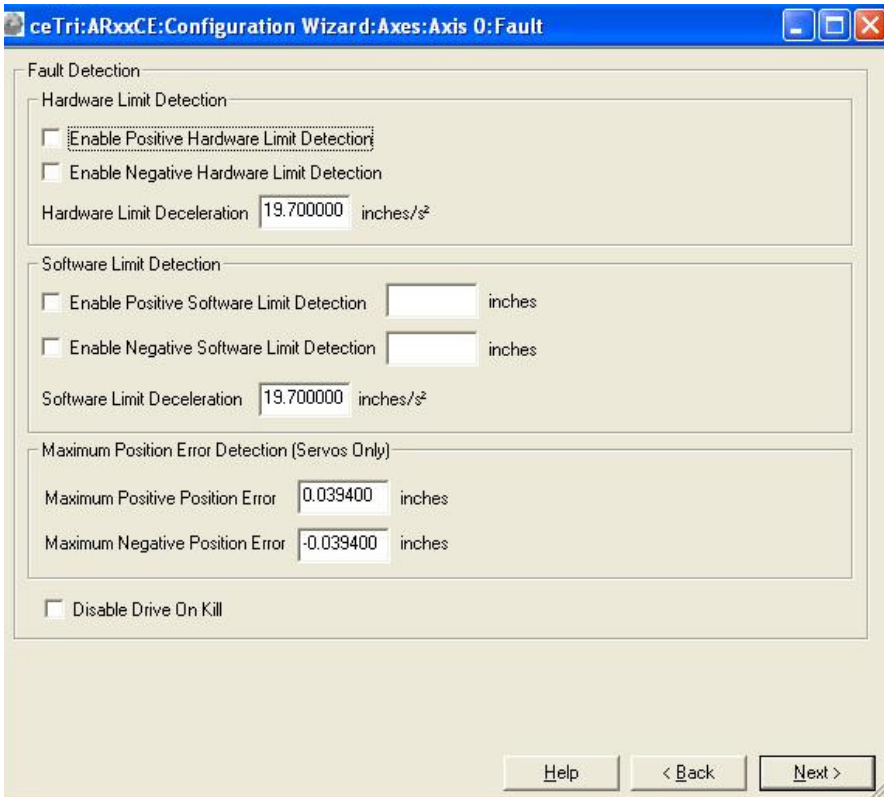


Step 14: Fault

The (controller) Fault screen allows hardware limit switches to be enabled and the deceleration rate when a limit is detected. Software limits can also be enabled. The Maximum Position Error can also be set. For basic setup, set the maximum position errors to 10mm or 0.5 inch. This can be set to a tighter tolerance after tuning. For Trilogy positioners, the hardware limit sensors are very close to the end of travel (~2.54mm or 0.1in). For this reason, enable the software limits. After homing on power-up or reset, the software limits will limit travel and allow longer distance for the motor to decelerate. To approximate the distance during deceleration:

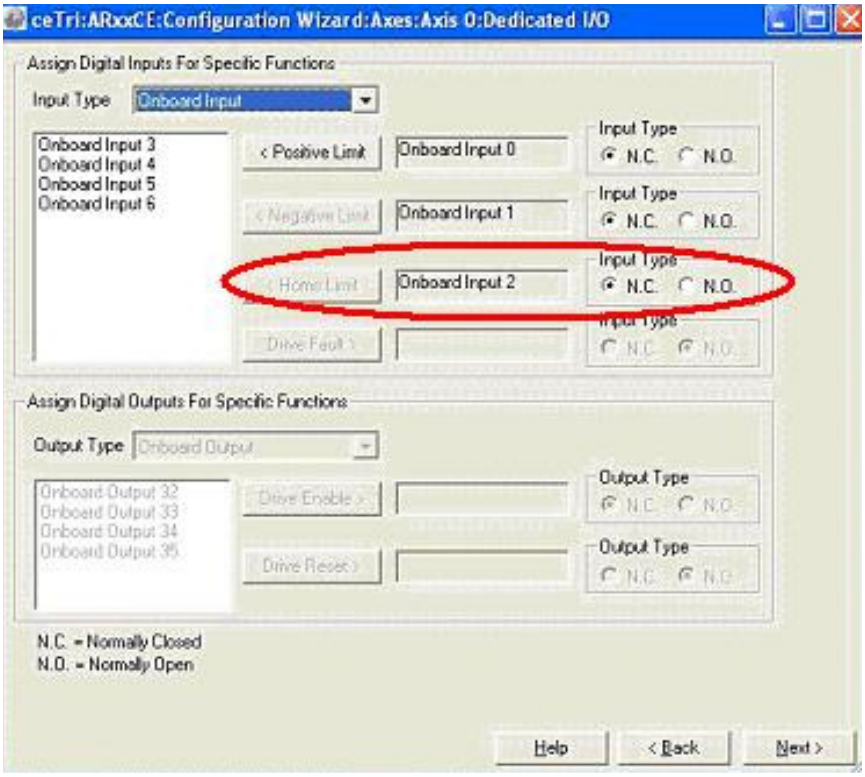
$$D_{decel} = 0.5 (V_{max})^2 * m / F$$

The distance covered during the deceleration is one half of the maximum velocity during operation squared times the total moving mass (include the coil mass) divided by the peak force of the motor.

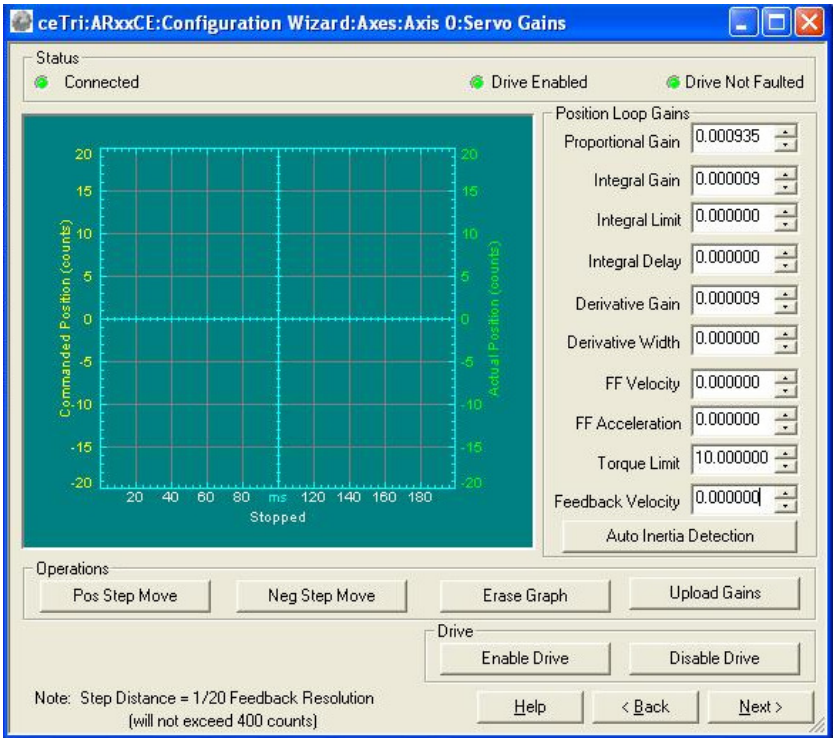


Step 15: Dedicated I/O

Select the on-board input for positive limit. The Negative Limit will be the next input and the home the following. Note for Trilogy positioners, the home sensors are normally closed; change this screen's default from Normally Open (NO) to NC.



Step 16: Servo Gains



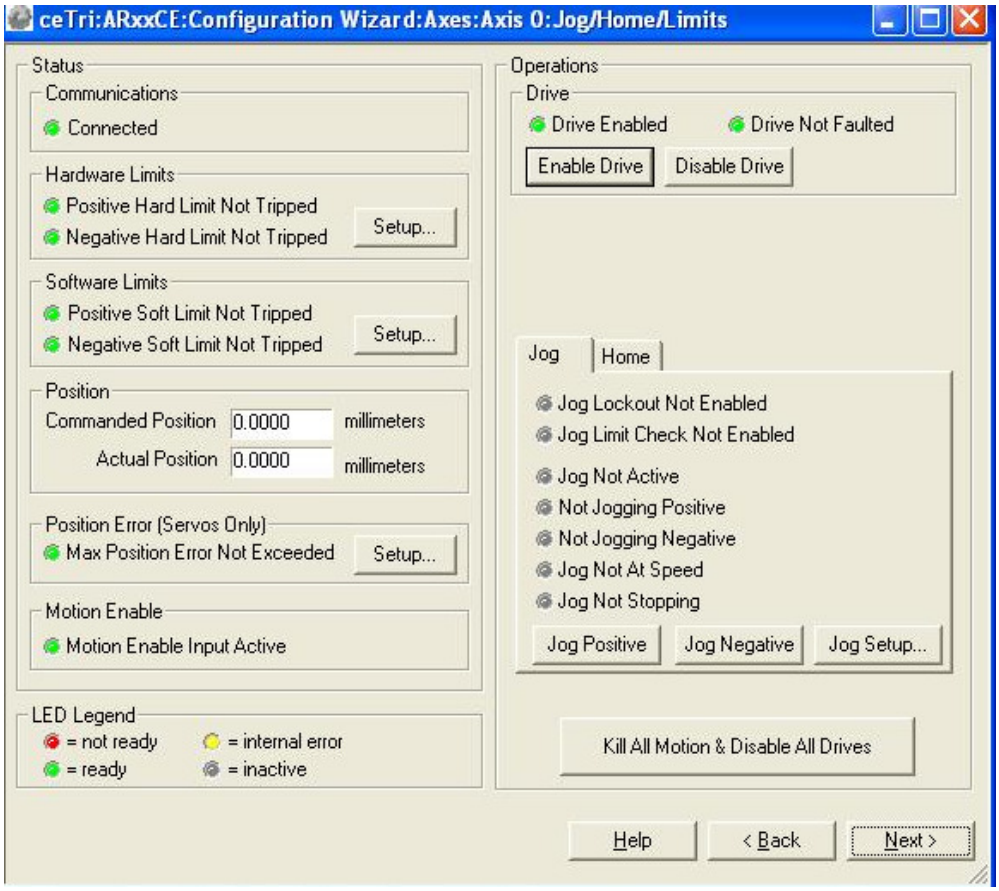
The ServoGains screen has a fixed step distance maximum of 400 encoder counts. As this is a very short move for high resolution linear encoders, it would be recommended to use the ServoTuner (under Tools) for tuning. For now in the

configuration wizard, set the torque limit based on the continuous current for the Trilogy motor. For the ACR9040 or ACR9030, start the EPL Network. Enable the Drive and click Auto Inertia Detection. Scale the proportional gain results by a factor of 10 (presuming ACR-View version 5.5.5). This should be fairly tight motor tuning. Basic tuning gains should be on the order 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 Trilogy to Aries with ACR Applications Note for instructions for using the ServoTuner.

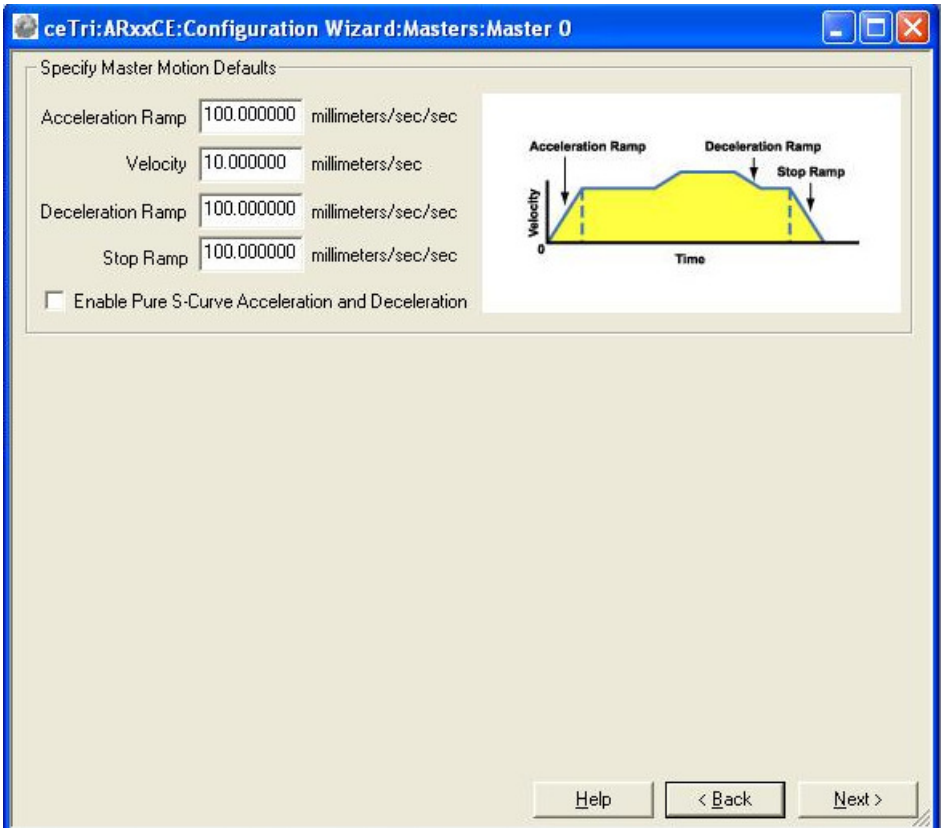
Step 17: Jog/Home/Limits

This screen allows users to enable the drive and do basic jogging and homing. Note for ACR9040 and ACR9030, the EPL Network must be started first before enabling the AriesEPL and jogging.



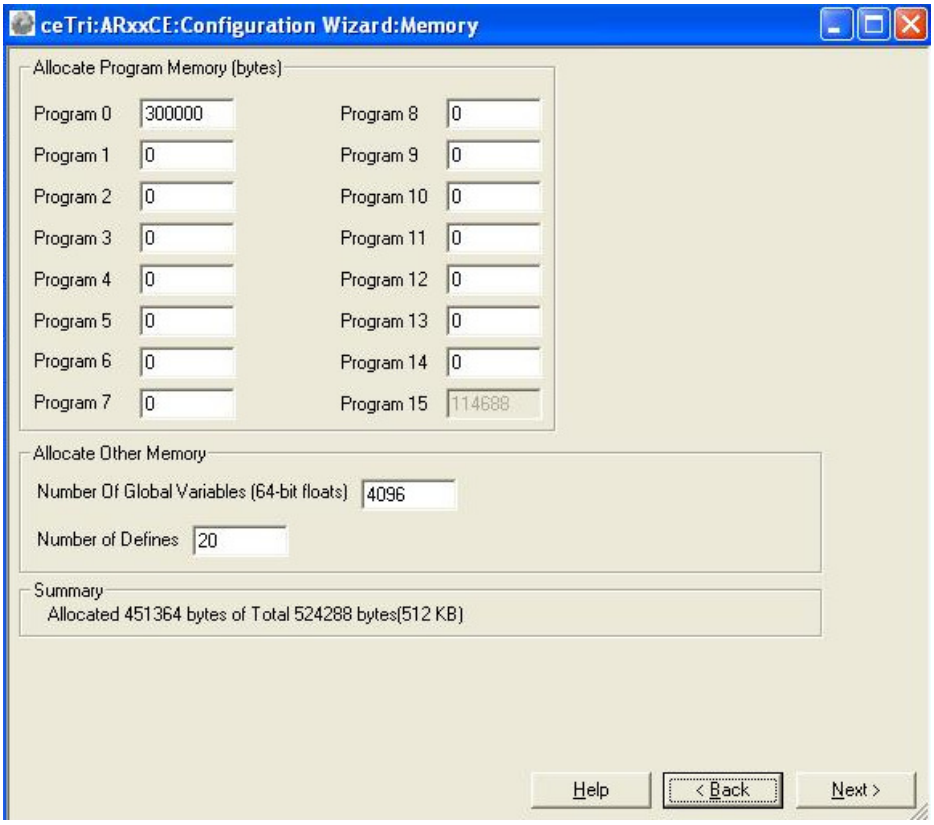
Step 18: Masters

This screen allows users to set the default acceleration, velocity, deceleration and stop ramps.



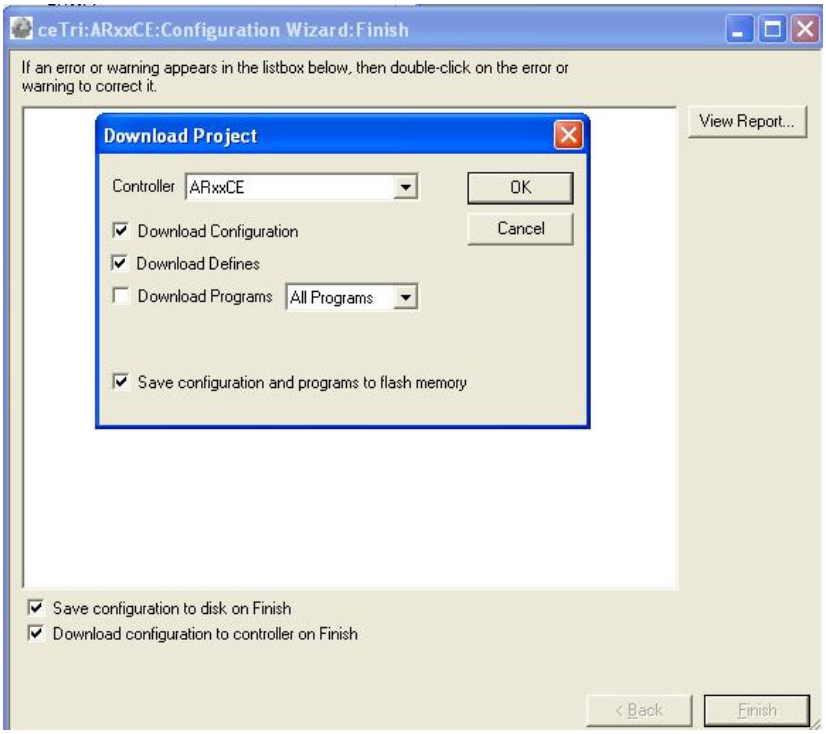
Step 19: Memory

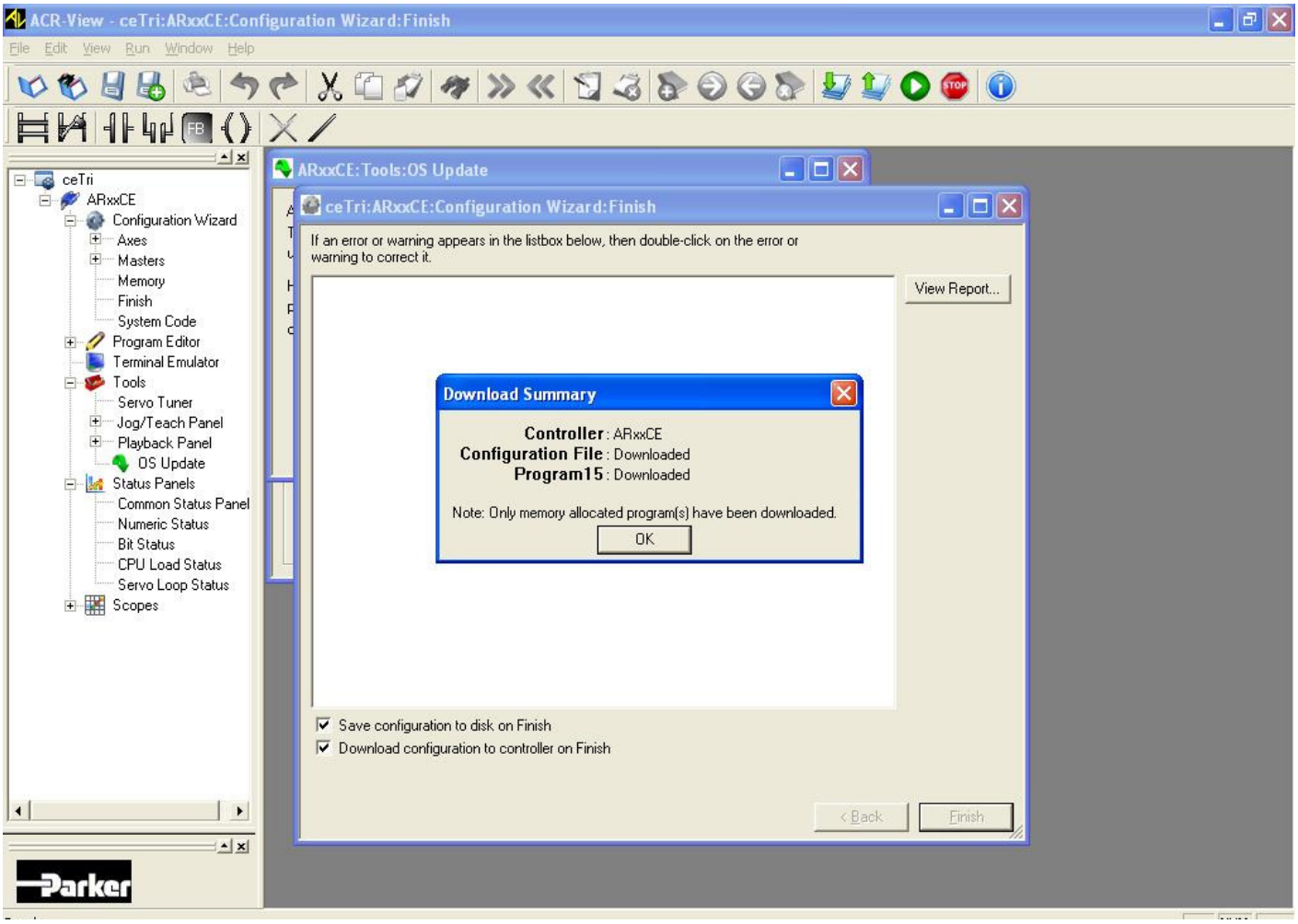
This screen allows users to set the memory allocation for user programs, global variables and variable aliases (defines).



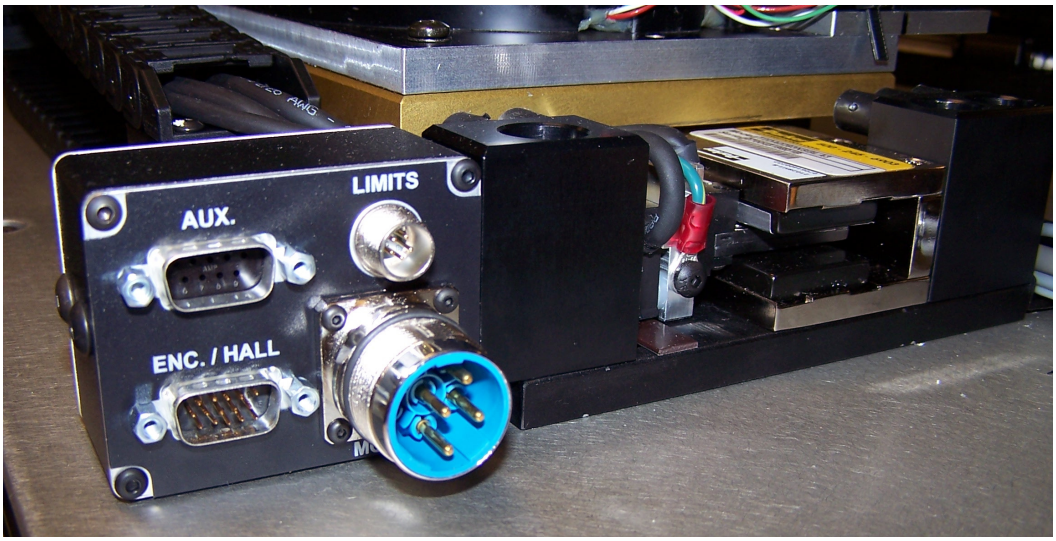
Step 20: Finish

Download project configuration to controller.



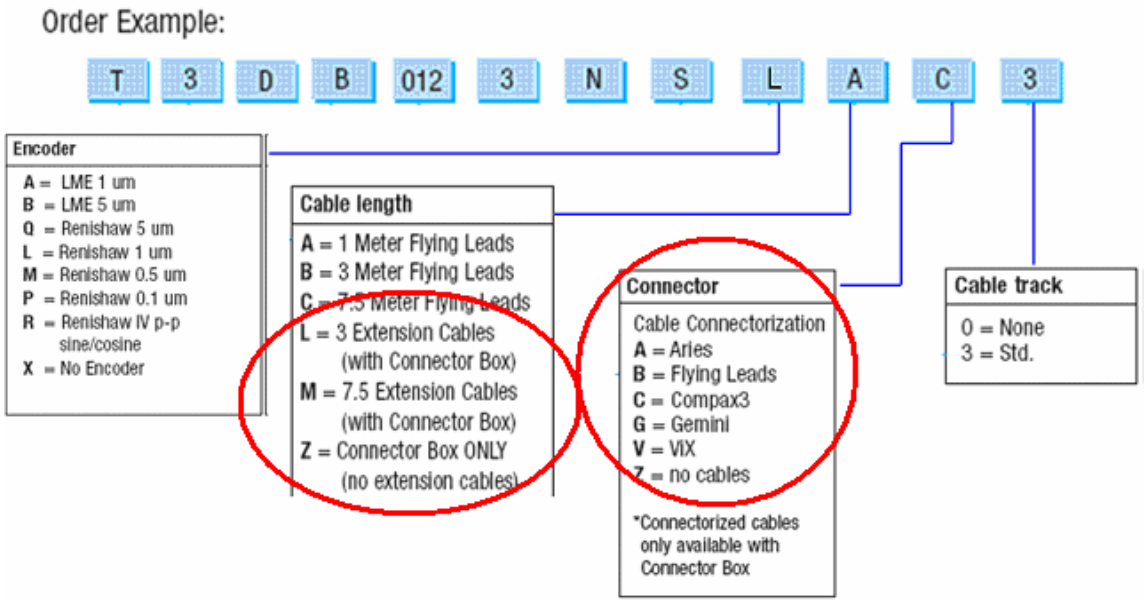


Trilogy Positioner Connector Box Option



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)