Electromechanical Automation Applications Note



Product:Trilogy coils & PositionersRev:1.0Subject: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:

	Color Code	AriesPE or	
	Trilogy Positioners	AriesCE	User Supplied
Trilogy	Ripped & I-Force	Connections	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 Pe	edback C	Onnector - HD DB151	viale	
	Enc	oder	Tempera	ture	Ha		
	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					Α/
7	Green	Green					A
12	Blue	Blue					В
11	Red	Red					B/
1	Black	Pink					С
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

Arian Materia Fandhania Onine atau IID DD15 Mala

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				
		T4, TR7, TR10, TR16 Positioners R7, R10, R16 Coils			
	T1, T2, T3 Positioners	ML50 Coils			
Pin	110 210 310 WD0/1/2/7 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					
	T1, T2, T3 Positioners	T4, TR7, TR10, TR16 Positioners R7, R10, R16 Coils 410 and ML50 Coils				
Pin	110 210 310 WD0/1/2/7/A/C 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.

Create New Project	ceTri	OK
	1.000	Cancel
Open Existing Project	1	·

Step 2. Select Controller

v Controller Wizard - Step 1 of 3				
Select ACR Controller				
C ACR1505 (4 axes)				
C ACR8020 (2-8 axes)				
ACR8020 (2-16 axes)				
C ACR9000				
C ACR9030				
C ACR9040				
AR-xxCE				
	< F	Back	Next >	Cancel
			in one z	

Step 3. Name Controller

New Controller Wizard - Step 3 of 3	
Controller Alias	
	< Back Finish Cancel

Step 4. Connect to Controller

ACR-View - ceTri:ARxxCE	
File Edit View Run Window Help	
V V 8 8 8 9	♥ X 1 2 4 ≫ << 1 3 8 6
	×7
	🖉 ceTri: ARxxCE 📃 🗖 💹
ARxxCE ARxxCE Arrow Configuration Wizard Frogram Editor Terminal Emulator Status Panels Scopes	Controller Info Controller: ARxxCE Onboard I/O: 7 inputs, 4 outputs Breakout Box: None Communications Bus Card O Serial COM1 38400 Ethernet 192 . 168 . 100 . 1 Curse

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 1 for 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

Secontrol Panel								
File Edit View Favorites Tools	Help							<i>.</i>
🜀 Back - 🌍 - 🏂 🔎 S	earch 🔀 Fol	ders 🛄 -						
Address 🔂 Control Panel								Go
Control Panel 🛞	Ġ,	Ś	5	1		2		
🥵 Switch to Category View	Options	Add Hardware	Remov	Tools	Plotter	Updates	Control Suite 2	
See Also	P		T	d	So and a second			
Mindows Undate	Date and Time	Display	Folder Options	Fonts	Game Controllers	Intel(R) GMA Driver	Internet Options	
 Windows opdate Windows opdate Windows opdate 			6	-	L.	A		
	S	\$	()					
	Java	Keyboard	Mouse	Network Connections	Phone and Modem	Power Options	Printers and Faxes	
		a						
)	Q	2			er computers, ne	tworks, and the Int	ernet.
	Program Updates	QuickTime	Regional and Language	Scanners and Cameras	Scheduled Tasks	Security Center	ServoStar MC	
	Ø,	2	(m)	3		<u>8</u> 2		
	Sounds and Audio Devices	Speech	Symantec LiveUpdate	System	Taskbar and Start Menu	User Accounts	Windows CardSpace	
	6							
	Windows	Wireless						

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

S Network Connections			
File Edit View Favorites Tools	Advanced Help	and a second second	<u>Ar</u>
🚱 Back 🔹 🕥 - 🏂 🔎 Se	arch 😥 Folders		
Address 🔕 Network Connections			💌 🄁 Go
Network Tasks 🛞	LAN or High-Speed Inter	net	
 Change Windows Firewall settings Disable this network device Rename this connection 	Local Area Local Are Connection Connectic	Disable Status Repair	
Change settings of this connection	_	Bridge Connections Create Shortcut Delete	
Other Places		Rename	
Control Panel My Network Places		Properties	

Eth Configure
soft Networks
Properties
Protocol. The default es communication s.
onnected nited or no connectivity

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

ieneral		
You can get IP settings assigned (this capability. Otherwise, you nee the appropriate IP settings.	automatically if your network supports d to ask your network administrator for	
🔘 Obtain an IP address automa	atically	
• Use the following IP address		
IP address:	192 . 168 . 100 . 😏	
Subnet mask:	255 . 255 . 255 . 0	
Default gateway:	A 42 A	
Obtain DNS server address a	automatically	
O Use the following DNS serve	er addresses:	
Preferred DNS server:		
Alternate DNS server		

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

ACR-View - coTritARvyCE: Configuration Wizard: Aves: Avis 0	
File Edit View Run Window Help	
♥ ♥ 🚽 😓 ⁽ⁿ⁾ ♥ ♥ X 🖆 ∅ / # >> ≪ 🗊 ∅ ♥ ♥ ♥ ♥ ♥ ♥ ♥ ● ● ●	_
Controller Info Controller Info Contro	

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.

ceTri:ARxxCE:Configura	tion Wizard: <i>A</i>	xes:Axis 0:Drive/Motor:Adv. N	lotor Pa 🔳 🗖 🔀
Edit Your Motor Parameters (Adv	anced):		
Motor Package	Linear 💌	Ke (V/m/s)	25.20
Motor Rated Speed (mps)	7.00	Ontinuous Current (Arms)	3.57
Electrical Pitch (mm)	60.96	Continuous Current Derating (%)	0.00
Forcer Mass (kg)	0.52	Peak Current (Arms)	15.97
Motor Damping (μN/m/s)	0.00	Winding Resistance (Ohm)	5.90
Motor Thermal Time Constant (min)	13.30	Minimum Inductance (mH)	2.40
Winding Thermal Time Constant (min)	2.50	Maximum Inductance (mH)	2.40
Thermal Resistance Winding/Case (°C/Watt)	0.23	Feedback Type Regular End	coder 🔽
Motor Ambient Temp (°C)	25.0	Feedback Resolution (post-quad pulses/elec. pitch)	12192
Max Motor Winding Temp (°C)	100.00	🔽 Invert Hall Signals	
			Back

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.

В	Α	Q	L	М	Р
5um	1um	5um	1um	0.5um	0.1um
LME	LME	Renishaw	Renishaw	Renishaw	Renishaw

Step 11: Fault Output

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

ceTri:ARxxCE:Configuration	Wizard:Axes:Axis 0:Drive/Motor:Aries Fault Ou 🔳 🗖 🔀
Configure Fault Output	
Output Brake Delay	milliseconds
Configure Motor Thermal Sensor Input	
🔲 Disable Motor Thermal Sensor	
Motor Thermal Sensor Type	Switch
Motor Thermal Sensor Construction	Normally Closed Switch
1	
	<u> </u>

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

🚰 ceTri:ARxxCE:Con	figuration V	Vizard: Axes: Axis O:Drive/Motor: Aries Fault Ou 🔳 🗖 🔀
Configure Fault Output		
Output Brake Delay	0	milliseconds
Configure Motor Therma	I Sensor Input	
Disable Motor The	ermal Sensor	
Motor Thermal Senso	r Type	Thermistor
Motor Thermal Senso	r Construction	Negative Temperature Coefficient
		< <u>B</u> ack <u>N</u> ext>

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.

Completing the	Aries Configuration	on Wizard.					
Congratulations. Jour configuration	The Aries Conf on to an Aries dri	iguration Wizard ve. Select the o	is now ready to perations you v	o save and downlow vish to happen .	ad		
Please wait.	а÷				X	3	
	Rebooting	the Controller.	This takes appr	oximately 5 secs.			
Download	l Configuration T	o Aries Drive					

Step 13: Scaling

Units may be selected as Inches, Millimeters or Other.

Specify Transmission None View >	Transmission View
Specify Reducer(s)	
Select the reducer for your mechanical system. Do NOT include the Parker gearhead attached to your motor.	
Manually Enter Scaling Factor If You Did Not Spec 1 feedback millimeter = 1 millimeters	ify A Transmission And Reducer

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 =
$$0.5 (Vmax)^2 * m / F$$

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.

ceTri:ARxxCE:Configuration Wizard:Axes:Axis 0:Fault	
□ Hardware Limit Detection	
Enable Positive Hardware Limit Detection Enable Negative Hardware Limit Detection Hardware Limit Deceleration 19.700000 inches/s ²	
Software Limit Detection	
Enable Positive Software Limit Detection inches	
Enable Negative Software Limit Detection inches	
Software Limit Deceleration 19.700000 inches/s²	
Maximum Position Error Detection (Servos Only)	
Maximum Positive Position Error 0.039400 inches	
Maximum Negative Position Error 0.039400 inches	
Disable Drive On Kill	
Help / < Back	Next>

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.

put type unboard in	iput 💌	L		
Dinboard Input 3 Dinboard Input 4	< Positive Limit	Onboard Input 0	- Input Type Input Type Input Type Input Type Input Type Input Type	
Diboard Input 5 Diboard Input 6	 Negative Link 	Onboard Input 1	Input Type	
	Home Lant	Onboard Input 2	- Input Type @ N.C. C N.O.	>
	Drive Feult 5		CNC CNC	
Duput Type Onboard 0 Onboard Output 32 Onboard Output 33	upu 🔶		- Output Type	
Unboard Output 33 Unboard Output 34 Unboard Output 35	Drive Reset.)		Output Type	



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.

tatus	- Operations
Communications	Drive
Connected	Orive Enabled Orive Not Faulted
Hardware Limits Positive Hard Limit Not Tripped Negative Hard Limit Not Tripped Setup	Enable Drive Disable Drive
Software Limits Positive Soft Limit Not Tripped Negative Soft Limit Not Tripped	Jog Home
Position	6 log Lookout Not Enabled
Commanded Position 0.0000 millimeters	Jog Lockout Not Enabled
Actual Position 0.0000 millimeters	G Jog Not Active
Position Error (Servos Only) Max Position Error Not Exceeded	 Not Jogging Positive Not Jogging Negative Jog Not At Speed
Motion Enable	🚳 Jog Not Stopping
Motion Enable Input Active	Jog Positive Jog Negative Jog Setup
ED Legend = not ready = ready = internal error = ready = inactive	Kill All Motion & Disable All Drives

Step 18: Masters

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

Specify Master Motio	n Defaults —					
Acceleration Ramp	100.000000	millimeters/sec/sec				
Velocity	10.000000	millimeters/sec	Acceleratio	on Ramp	Decelera	tion Ramp Stop Ramp
Deceleration Ramp	100.000000	millimeters/sec/sec	elocity			1
Stop Ramp	100.000000	millimeters/sec/sec	3		Time	1
Enable Pure S-0	urve Accelera	ation and Deceleration				

Step 19: Memory

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

🖗 ceTri:AR	xxCE:Conf	iguration Wizard:Mer	nory			
Allocate Pro	gram Memory	(bytes)		1		
Program 0	300000	- Program 8	0			
Program 1	0	– Program 9	0			
Program 2	0	- Program 10	0			
Program 3	0	– Program 11	0			
Program 4	0	- Program 12	0			
Program 5	0	- Program 13	0			
Program 6	0	- Program 14	0			
Program 7	0	- Program 15	114688			
Allocate Oth	er Memory					
Number Of (Global Variabl	les (64-bit floats) 4096	_			
Number of E	efines 20					
Summary-						
Allocated	451364 bytes	of Total 524288 bytes(512	KB)			
				<u>H</u> elp	<u> </u>	<u>N</u> ext>

Step 20: Finish

Download project configuration to controller.

Constant of the second	The Tri: ARxxCE: Configuration Wizard: Finish	
य त	Save configuration to disk on Finish	
	< Back Emish	
ACR-View - cellri:ARxxCE:Configu Elle Edit View Run Window Help	uration Wizard:Finish	
00000000000	▶ 🗶 🖆 🜮 ≫ ≪ 🗊 ⊰ 🏷 ⊖ ⊝ 🏠 🐓 🛇 🞯 🛈	
	</td <td></td>	
La ceTri	ARxxCE:Tools:OS Update	
ARxxCE	e 🖉 ce Tri: ARxxCE: Configuration Wizard: Finish	
Axes Masters	If an error or warning appears in the listbox below, then double-click on the error or warning to correct it.	
Memory Finish	View Report	
System Code		
Terminal Emulator		
Servo Tuner	Download Summary	
	Controller : ARxxCE Configuration File : Downloaded	
Status Panels Common Status Panel	Program15: Downloaded	
Numeric Status Bit Status	Note: Unly memory allocated program(s) have been downloaded.	
CPU Load Status		
	 ✓ Save configuration to disk on Finish ✓ Download configuration to controller on Finish 	
	< Back Einish	

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)