

Electromechanical Automation Applications Note



Product: Trilogy coils & Positioners
Rev: 1.0
Subject: Wiring and Setup of Trilogy to Compax3

This applications note clarifies the connections with the Trilogy motors and positioners to the Compax3 drives with 6K or ACR controllers or Compax3 drive/controllers (T11, T30 or T40). Trilogy coils and positioners are supplied with flying lead cables typically. The new Connector Box option is also shown that offers pre-wired connectorized cables. Compax3's Servo Manager software allows quick drive configuration using the I-Force and Ripped series coil part numbers.

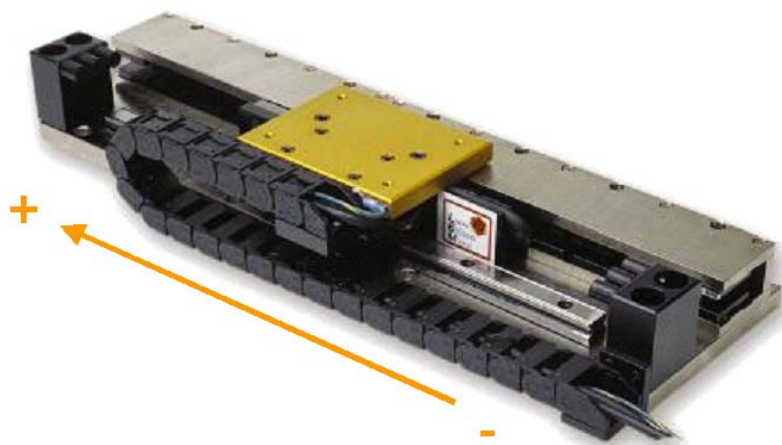
Step 1: Trilogy to Compax3 Wiring

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. The cable part numbers are printed on the cable.

See next page for Trilogy Coil and Positioner to Compax3 Wiring.

Trilogy positioners are now available with connectorized cables for plug & play operation. See Page 11.

Note that the wiring is for the motor moving away from the cable exit as the positive direction. The encoder counts positively as the motor is moving away from the cable exit.



Trilogy Coil and Positioner to Compax3 Wiring

Compax3 Feedback - HD DB15 Male - X13 Connector									
Pin	Encoder		Temperature		Halls		Function		
	LME Magnetic	RGH Optical	Positioners or WD0/1/2/7	WD3/4	All Trilogy Positioners & Coils	except 210 310 410 WD7/C			
4	Brown	Brown					+5V		
15	White	White					Ground		
8	Yellow	Yellow					A/		
7	Green	Green					A		
12	Blue	Blue					B		
11	Red	Red					B/		
13	Black	Pink					C		
14	Orange	Grey					C/		
5			Yellow	Grey			+ Thermo		
10			Orange	Violet			- Thermo		
15					Black	Black	+5V		
3					White	White	Ground		
6					Yellow	Brown	HED C		
9					Blue	Blue	HED B		
					Green	Green	HED A		
Case	Shield				Shield	Shield	Shield		

X12 - Digital I/O - HD DB15 Female		
Pin	HED Head	Function
1	Orange	+24V
1	Red	Home Source Power
1	Grey	+ Limit Source Power
1	Pink	- Limit Source Power
12	Light Blue	- Limit
13	Light Green	+ Limit
14	Brown	Home
15	Violet	Ground

For Compax3 T10 applications, the limits and home sensor are connected to the controller.

NOTES:

Halls C/B/A are reversed at the Compax3, Hall 1/2/3 respectively.

The encoder's A+ and A- are reversed at the Compax3 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.

For C3 pre-conectorized versions, the limits are wired as normally closed (See TC#477 for more information)

Valid for all Trilogy T1D and T1S positioners built after 12/1/2007. Consult factory for T1S and T1D built before 12/1/2007.

Bellows positioners are same as standard positioners. ex. For B3 positioner, see T3 positioner.

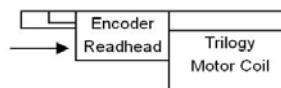
Connect motor cable ground to Compax3 chassis shield using spring-clamp.

Compax3 - Motor Connection - X3 Connector

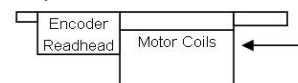
Using Old Color codes			
Pin	T1, T2, T3 Positioners 110 210 310 WD0/1/2/7 coils	T4, TR7, TR10, TR16 Positioners R7, R10, R16 Coils ML50 Coils 110 210 310 WD3/WD4 coils	Function
	1 Red & Blue 2 White & Green 3 Black & Brown 4 Drain wire (Coils) or Green/Yellow (Positioners)	1 Red 2 Brown 3 Orange 4 Drain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

For safety ground for the Ironless linear motors, install a ground wire from Compax3 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 2 White/Yellow & Violet/Yellow 3 Black/Yellow & Brown/Yellow 4 Green/Yellow	1 Red/Yellow 2 Brown/Yellow 3 Orange/Yellow 4 Green/Yellow	1 U 2 V 3 W 4 PE



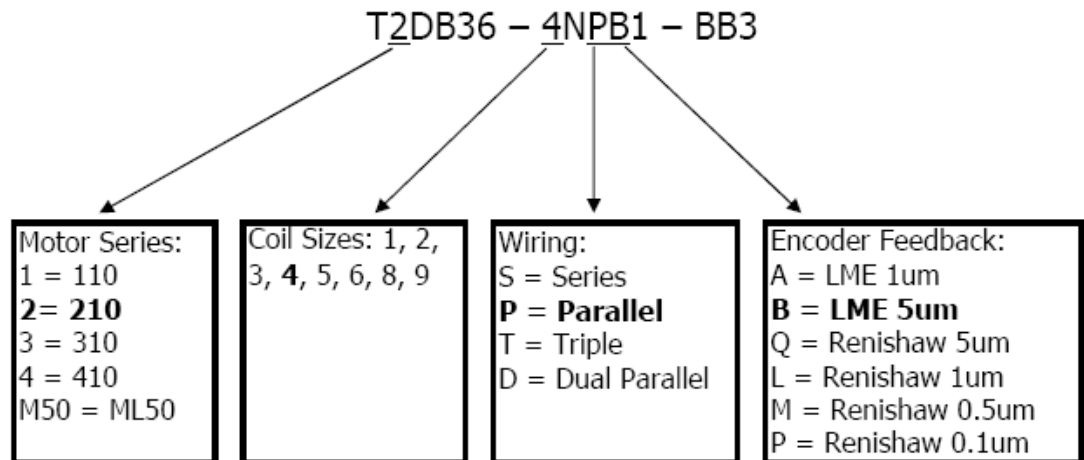
The above connections presumes the motor, readhead and hall cables exit the same direction. For positioners, this is the standard orientation. If the HED is reversed in a custom positioner, consult factory.



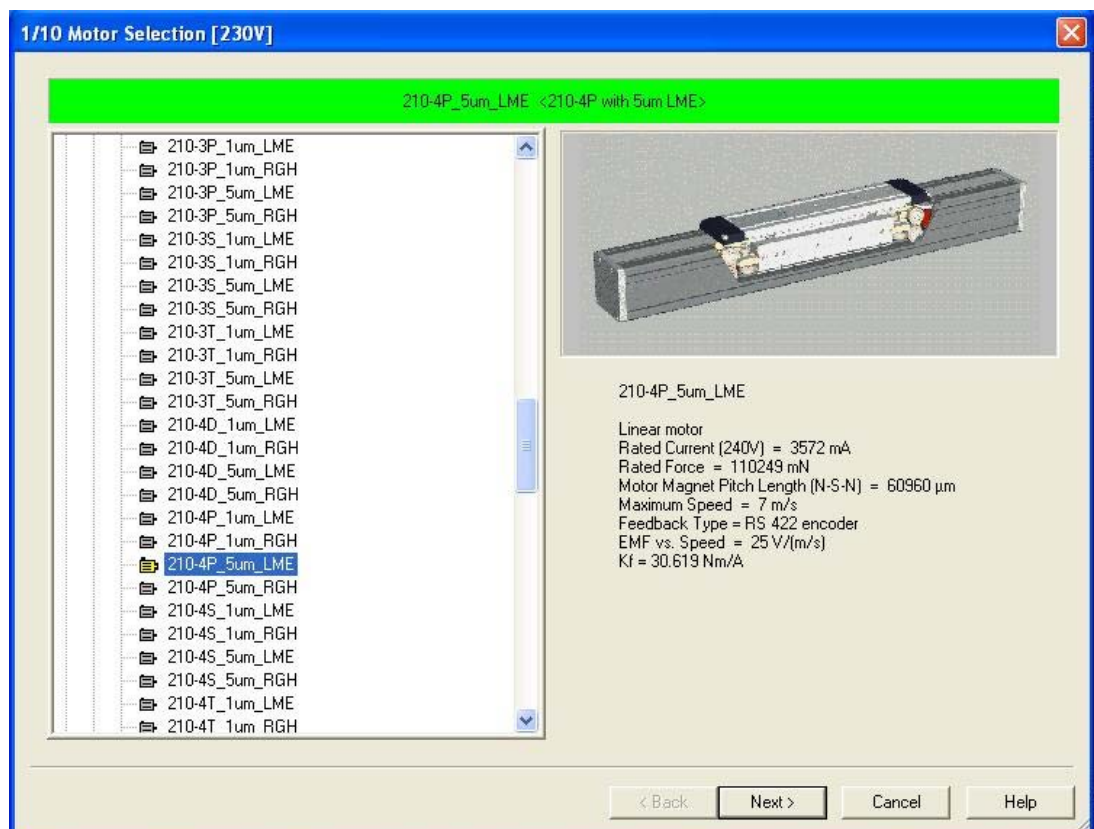
In coil only applications, if the encoder's cable exit faces the opposite way, switch A and A/.

Step 2: Compax3 Drive Configuration

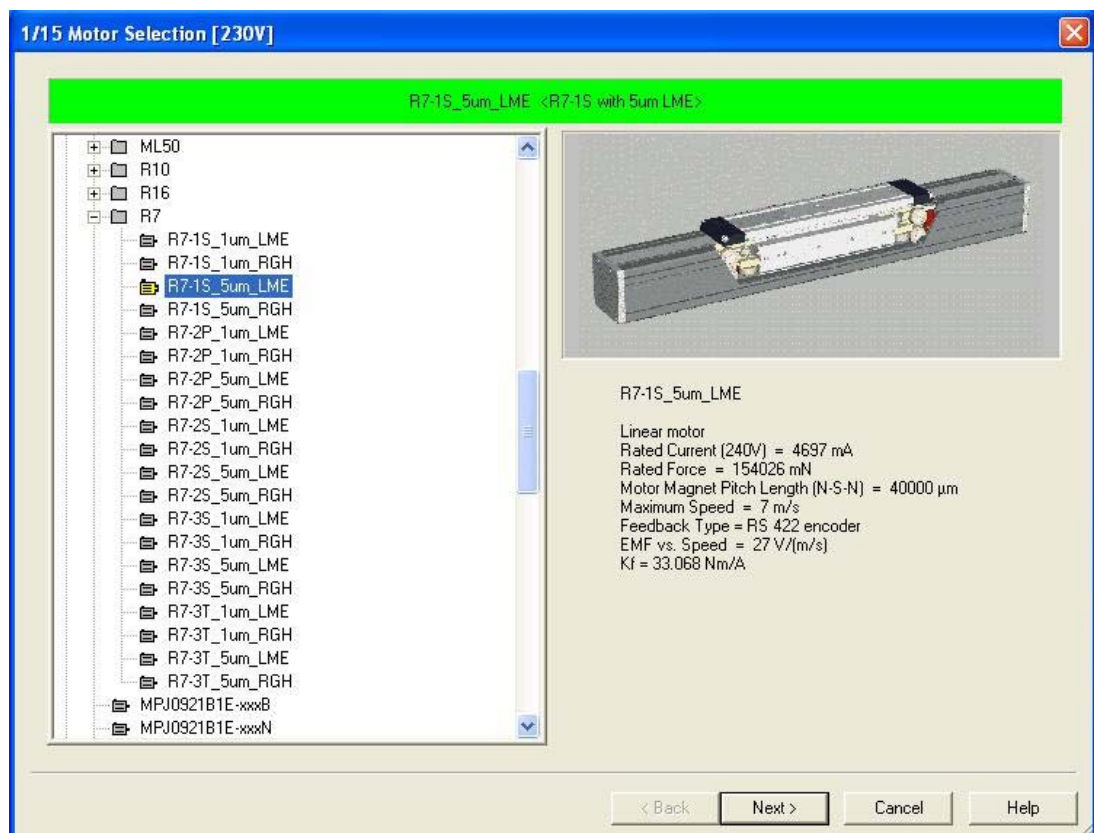
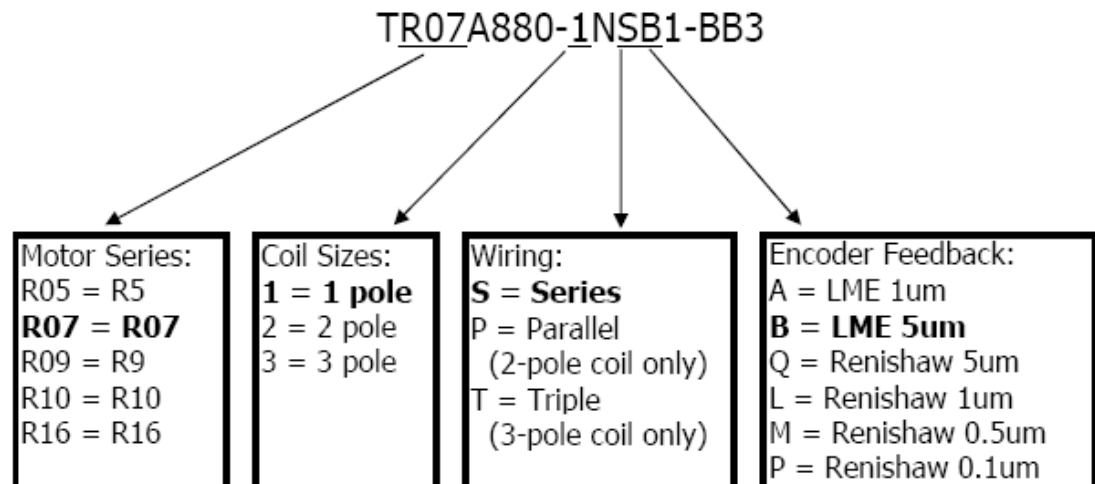
Note that the Trilogy positioner part numbers contain the motor part numbers. Select the motor and encoder feedback in C3 ServoManager. This is an I-Force T2 positioner example:



The Compax3 uses the C3 Servo Manager software for configuring the drive or drive/controller. The Trilogy motors are listed under Parker U.S. Motors and separated by motor series:



Ripped Example:



Note that the Compax3's motor database should be updated. The file is available for download at:

ftp://www.compumotor.com/bbs/FAQ/CPX3_USMOTOR_rev14.zip

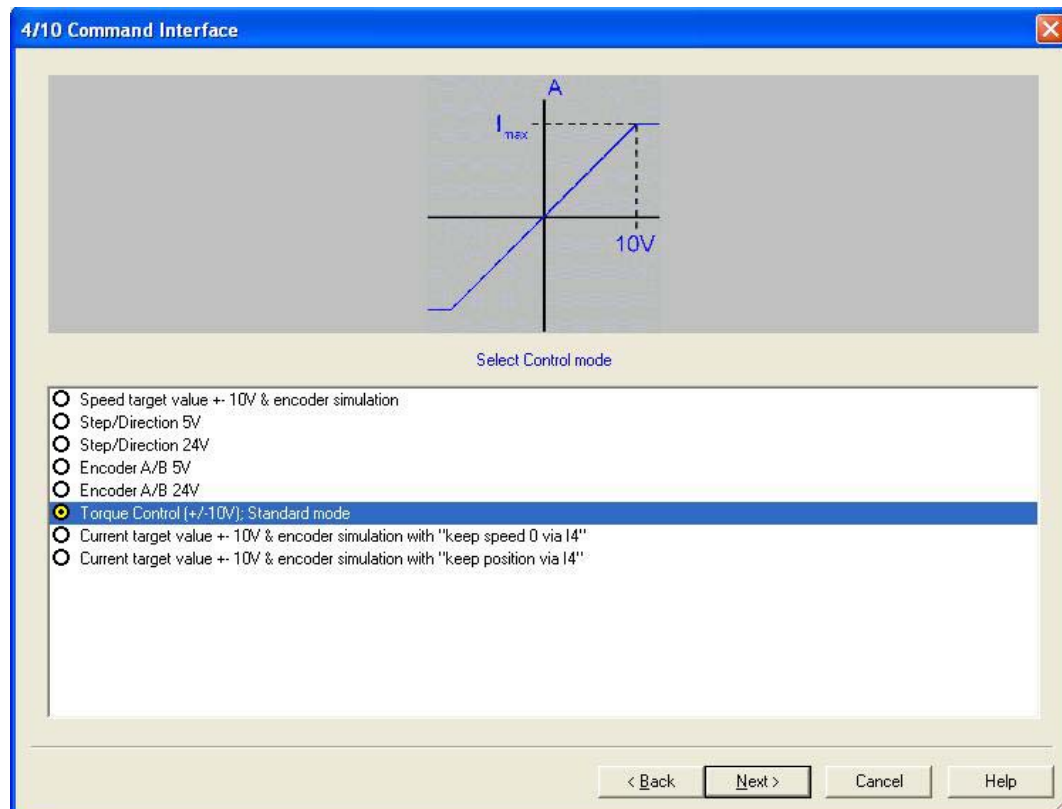
Rename the file as CPX3_USMOTOR.mdb and place the file in the ServoManager's \DB\ subdirectory; you can delete the old file. For the default file location this would be: C:\Program Files\Parker Hannifin\C3MGR2\DB\

For older versions of ServoManager it would be C:\Program Files\Parker\C3MGR2\DB\

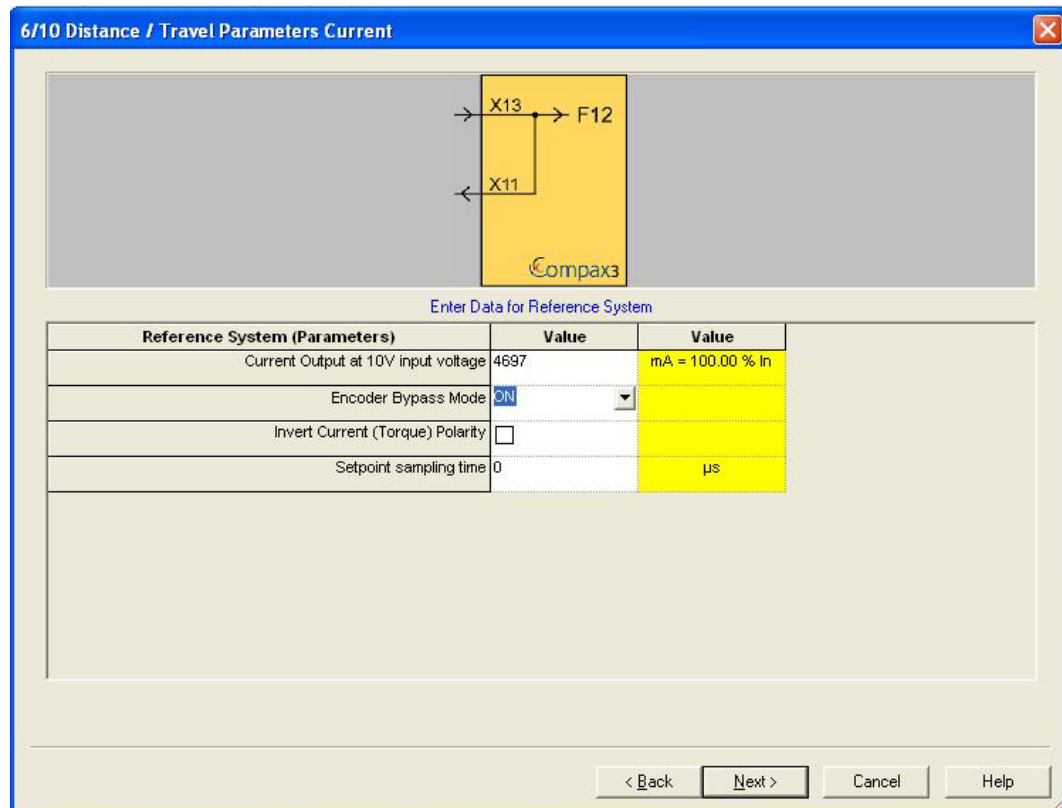
Step 3: Compax3 I10-T10 Base Drive Setup

For the 6K and ACR controllers, configure the C3 as I10T10 with Torque Control (+/-10vdc); Standard Mode.

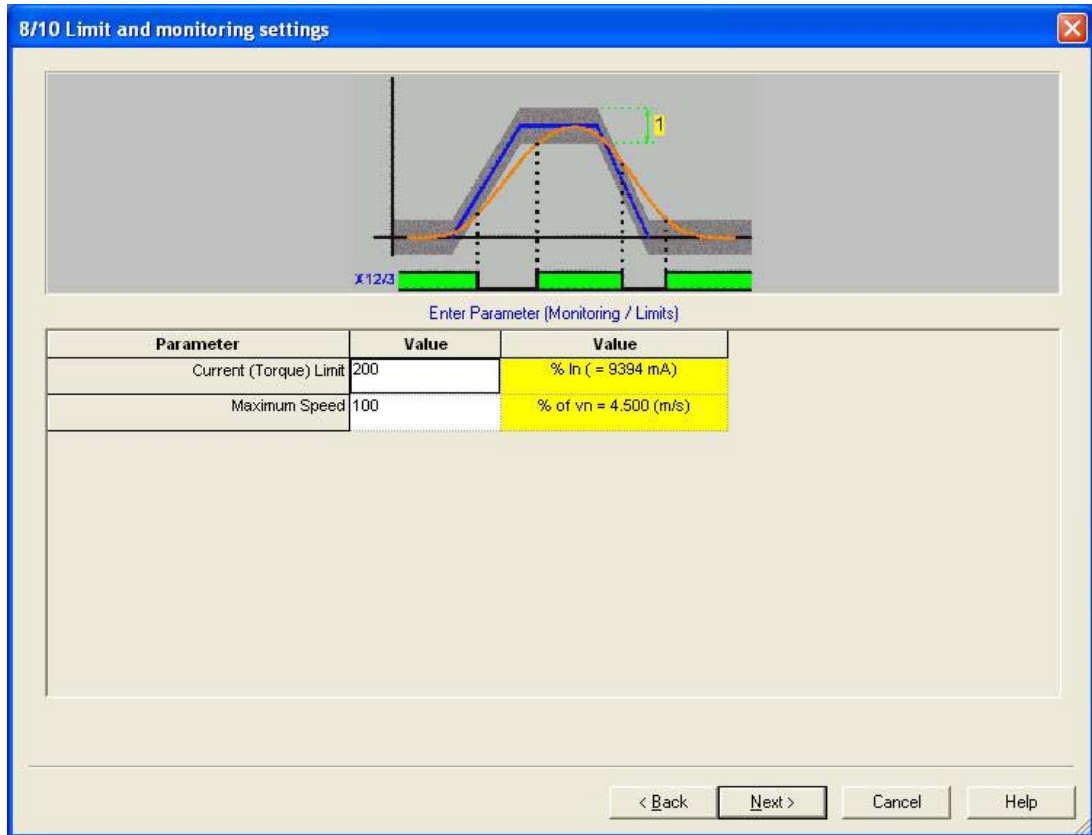
For C3 T11, T30 or T40 go to Step 3b.



In step 6 of 10, set the encoder bypass mode to ON. This configures the x11 encoder outputs for the controller.



In step 8 of 10, the drive's current and maximum speeds can be configured. For the first time setup, it is recommended to limit both these values (typically 20% current limit is sufficient for slow speed jogging). After tuning and basic motion is confirmed, these can be raised to full motor specification and re-downloaded.



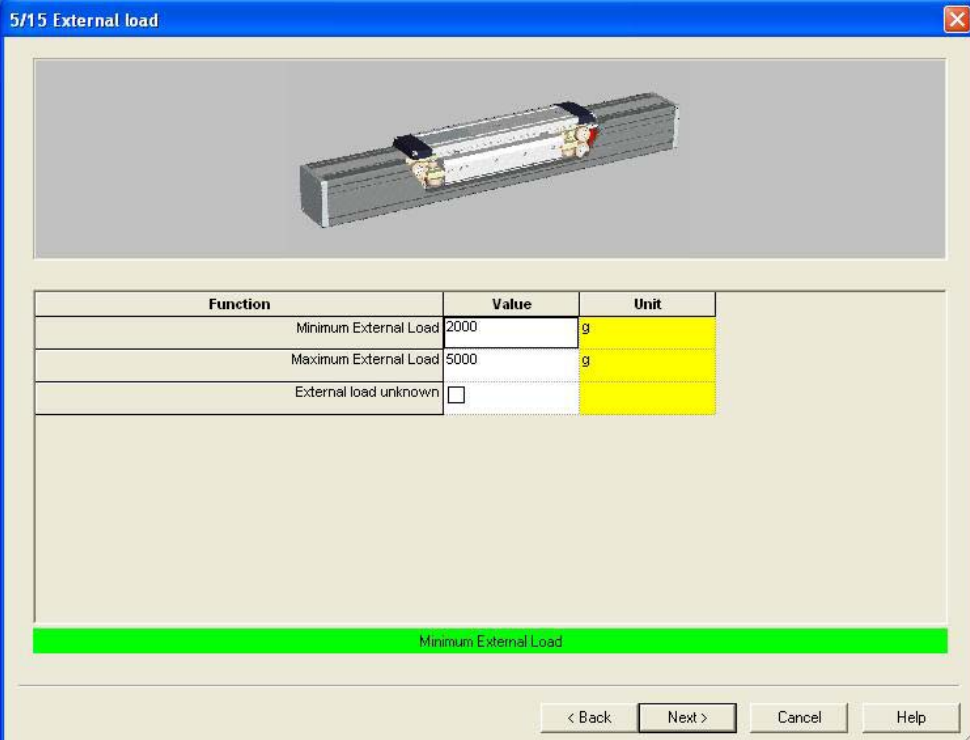
All other defaults in the configuration wizard are valid for basic motion. Download the configuration.

As the limit switches activate close to the positioner hardstops, it is a good idea to use software limits in the controller.

For quick setup notes for the 6K go to step 4a., or for ACR controllers go to step 4b.

Step 3b: Compax3 T11, T30 or T40 Drive/Controller Setup

If using the Compax3 as a drive/controller (T11, T30, or T40), or as an I10T10 in analog velocity or position (step & direction) mode, input the load parameters for the minimum and maximum in step 5. For an unloaded positioner, input the carriage weight. Using the Trilogy catalog, subtract the coil weight (listed on the motor specification pages) from the carriage assembly weight (listed on the positioner specifications). Leaving the default load set to 0 g will result in an unstable position loop; it is important to input a minimal load.



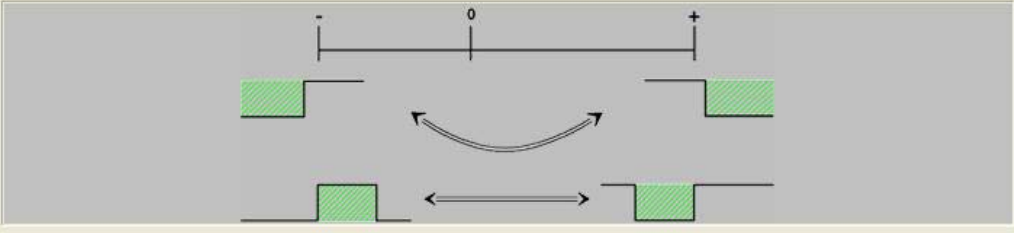
Function	Value	Unit
Minimum External Load	2000	g
Maximum External Load	5000	g
External load unknown	<input type="checkbox"/>	

Minimum External Load

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As the limit switches activate close to the positioner hardstops, enable the software limits in the C3.

8/15 Travel Limit Settings

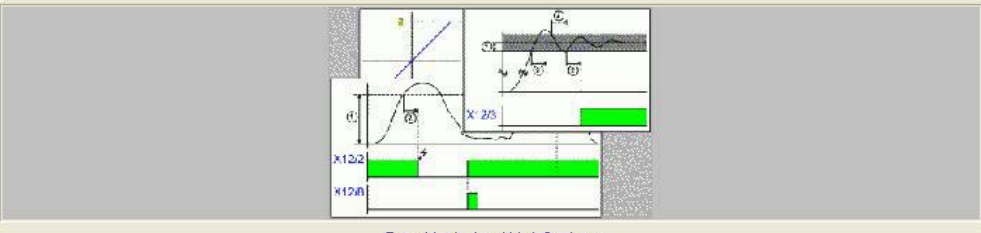


Function	Value	Unit
Error Reaction: Positive SW travel limit (0x7323)	2 - Stop, drive disabled	
Error Reaction: Negative SW travel limit (0x7324)	2 - Stop, drive disabled	
Positive SW travel limit	10000.0	mm
Negative SW travel limit	-10000.0	mm

< Back Next > Cancel Help

In step 10, the drive's current and max speeds can be set. For the first time setup, limit both these values (typically 20% current limit is sufficient for slow speed jogging). After tuning and basic motion is confirmed, these can be raised to full motor specification.

10/15 Monitoring / Limit Settings



Enter Monitoring / Limit Settings

Function	Value	Unit
Current (Torque) Limit	80	% In (= 3757 mA)
In Position Window (+/-)	0.1	mm
In Position Window Time	0	ms
Error Reaction: Tracking Error (0x7320)	2 - Stop, drive disabled	
Following Error (+/-)	1	mm
Following Error Time	0	ms
Maximum Speed	50	% of vn = 2.250 (m/s)
Link "In Position Window" to Target position value	Yes	

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Step 4a: 6K Setup Notes

1. Set the home sensor to normally closed with the LIMLVL command, i.e. LIMLVL001 for axis1.
2. For scaling, using the 5um resolution linear encoder for millimeters, set scaling to 200 counts/mm; for inches, set scaling to 5080 counts/inch. For 1um resolution, set scaling to 1000counts for millimeters; for inches use 25400.
3. ERES should be set to the number of encoder counts per pitch
i.e., For a T2 with 5um encoder, the feedback resolution setting of 12192 encoder counts per electrical pitch. The R7-1 with 5um magnetic would be set to 8000 counts/electrical pitch.

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 cycle length (aka pitch) divided by the post-quadrature resolution. i.e., $60.96\text{mm} / 5\text{um} / \text{post-quad pulse} = 12192 \text{ post-quad pulses} / \text{pitch}$.

4. The encoder polarity should set to 0 for the attached standard wiring (ENCPOL0).
5. Basic tuning gains for 6K control are SGP3, SGV1 for an unloaded positioner at 5um resolution. These can be rather 'soft' but are a good starting point. For the 6K controllers, use Motion Planner's 6K Servo Tuner for tuning (File > 6K Servo Tuner).

The above notes are a short list of command settings for quick setup for experienced 6K users. For full 6K documentation, please see the 6K Series Programmer's Guide, Command Reference and Hardware Installation Guide.

Below chart shows limits and home sensor connections to 6K.

Trilogy	Color Code Trilogy Positioners Ripped & I-Force	6K Connection for Axis 1
Limit Power	Orange	User Supplied +24vdc
Limit Gnd	Purple	any even pin
Home	Brown	19
+Limit	Light Green	23
-Limit	Light Blue	21

Step 4b: ACR Setup Notes

1. In ACR-View, select Motor type Other and Linear
2. Under Feedback, set the encoder counts per millimeter; for 5um set this to 200; for 1um set to 1000.
This can be calculated by $1\text{mm} / (\text{post-quad resolution of the linear encoder})$. Polarity is set to Normal for the attached standard wiring.
3. For the home sensor, change the input type from Normally Open (N.O.) to Normally Closed (N.C.)
4. Basic tuning gains for ACR90x0 control are Proportional gain of .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
5. Note the units for tracking error. Note that the maximum position error is set to 1, whether that is 1mm or 1inch; set appropriately.
6. For the ACR controllers, the ACR-View's Servo Tuner can be used to optimize gains for application-specific loading conditions. See Tuning Trilogy with ACR Controller applications note for step-by-step instructions on tuning.

The above notes are a short list of settings in ACR-View for quick setup for experienced ACR users. For full ACR documentation, please see the ACR user guides and respective hardware installation guide.

Below chart shows limits and home sensor connections to ACR9000

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	

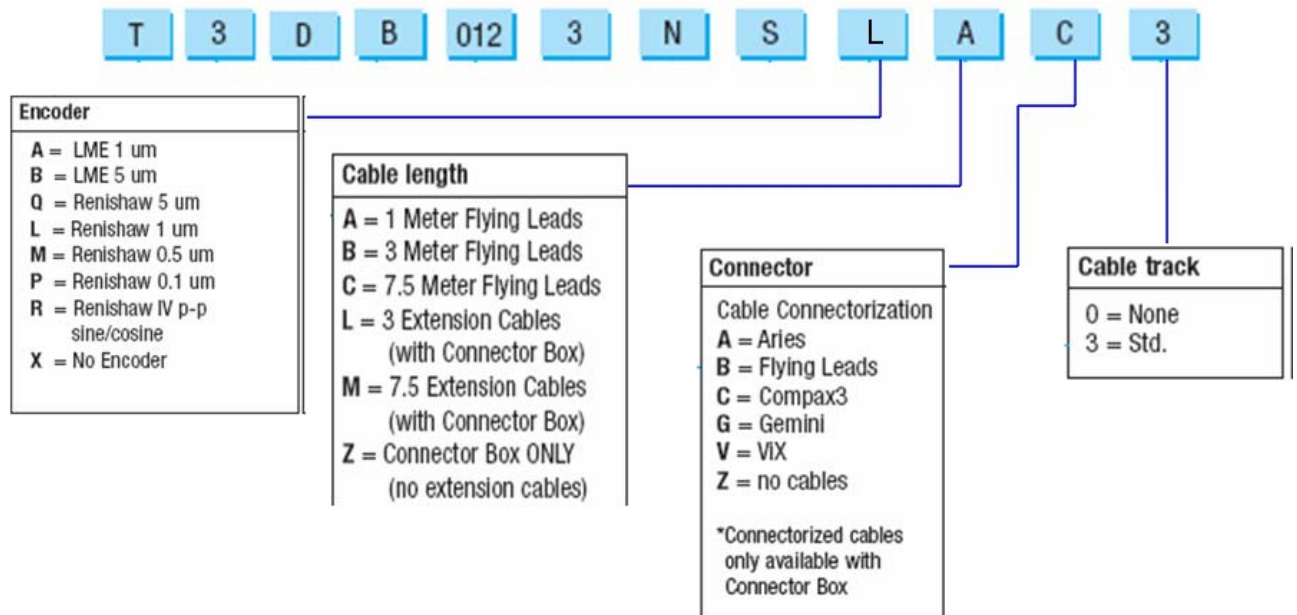
Trilogy Positioner Connector Box Option



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 pre-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.

Order Example:



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)