AUTOMATIONDIRECT.com

LS ELECTRIC

L7C Series AC Servo Drive
Quick Start Guide

1st Edition, Rev E, February 22nd, 2024

AutomationDirect Foreword

This QuickStart Guide is designed to get an L7C servo system installed and running quickly. This AutomationDirect Guide is a supplement to the LS Electric L7C User Manual. This Guide does not replace the manufacturer's User Manual. For advanced features or options required by your application, you may still need to refer to the User Manual. Download and reference both this QuickStart Guide and the L7C User Manual when commissioning an L7C servo system.

A note on Part Numbers: LS Electric servo parts sold by AutomationDirect have part numbers that end with a "-AD". This suffix signifies special packaging and labeling for AutomationDirect. All the LS servo products with the "-AD" function and behave exactly the same as the standard LS Electric parts. Please note that when reading the LS electric User Manual or using the Drive CM software, the "-AD" will NOT appear in any part numbers.

Example:

AutomationDirect sells a 400W drive with part number L7CA004U-AD. All references to the 400W drive in the LS Electric User Manual and Drive CM software will always show L7CA004U.

Table of Contents

L7C Series Servo System Overview

Warnings and Cautions

***WARNING:** Install both the servo drive and the servo motor before performing any wiring.*

***WARNING:** Before wiring or inspecting, turn off the power, wait **15** minutes, make sure the charge lamp is off, and check the voltage.*

***WARNING:** Ensure this product is correctly grounded. All grounding and circuit protection methods must comply with all local standards/regulations and the national electrical standard (refer to **NFPA 70: National Electrical Code, 202 Ed.**)*

***WARNING:** Do not change the motor or drive wiring while power is on.*

***WARNING:** Only qualified and trained technicians may perform wiring on this product.*

***WARNING:** Do not operate the servo system with wet hands.*

***WARNING:** Do not open the servo drive cover during operation.*

***WARNING:** Do not operate the servo system with the servo drive cover removed.*

***WARNING:** Do not touch the heat sink of the servo drive when it is connected to power and operating This component gets very hot and will scald.*

***CAUTION:** The installation location must be free of vapor and corrosive or flammable gas.*

***CAUTION:** When wiring, do not connect the three-phase power supply to the motor **UVW** connectors. Incorrect wiring may cause damage to the servo drive.*

***CAUTION:** Do not disassemble the servo drive.*

***CAUTION:** Verify the emergency stop can be activated before the servo drive is connected to power and put into operation.*

For additional warnings and precautions, please see pages ***ii*** through ***vi*** of the L7CA User Manual.

Installation

Ambient Installation Conditions

The L7C Servo and AMPC motors should be installed under the environmental conditions detailed below. Exceeding these conditions risks damage to the equipment.

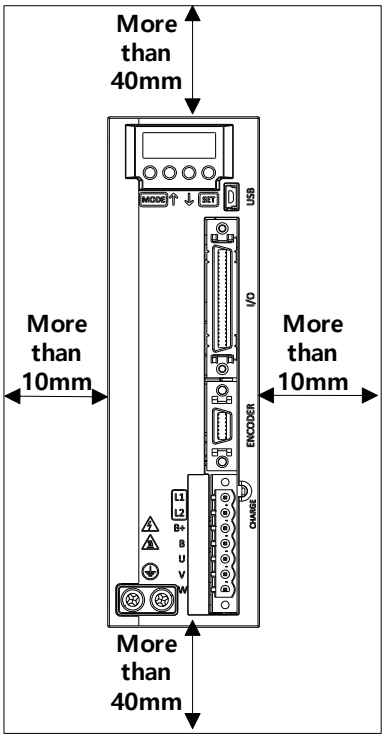
	Condition	Requirement	Notes
Servo Drive	Operating Temperature	0–50°C	Install a cooling fan on the control panel for ventilation and to maintain the temperature within the required range.
	Operating Humidity	80% relative humidity or below	Moisture developed inside the drive due to ice formation or condensation during a prolonged period of inactivity may damage the drive. If the drive has been inactive for a prolonged period remove all moisture before operating the drive.
	External Vibration	Vibration acceleration 4.9 m/s^2 (5G) or lower	Excessive vibration can cause malfunctions and reduces the lifespan of the drive.
	Ambient Conditions	• Do not expose the drive to direct sunlight. • Do not expose the drive to corrosive or combustible gases. • Do not expose the drive to oil or dust. • Ensure that the drive receives sufficient ventilation even if installed in a confined place.	

	Condition	Requirement	Notes
Motor	Operating Temperature	0–40°C	If motor temperature exceeds 40°C, use forced air cooling to keep the motor temperature within spec.
	Operating Humidity	80% relative humidity or below	Do not operate the motors in an environment with steam.
	External Vibration	Vibration acceleration 19.6 m/s^2 (2.5 G) or lower on X and Y axes	Excessive vibrations reduce the lifespan of the motor bearings.

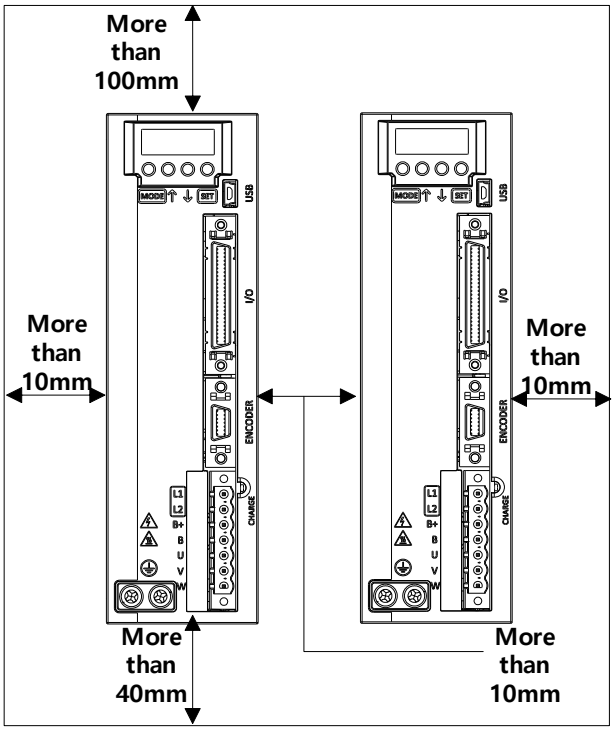
Installation Direction and Space

Comply with the spacing standard below when installing drives with the control panel:

Single Drive



Multiple Drives



Quick Start Instructions

To verify your servo components and motor/drive wiring as quickly as possible, please follow the steps below. These basic instructions will quickly get the motor spinning (verifying that parts and power wiring are correct).

The rest of this quick start guide contains detailed information on how to properly set up your system and configure the drive for your specific application. .

What you'll need:

- *Servo Drive*
- *Servo Motor*
- *Motor Power Cable*
- *Encoder Power Cable*
- *Brake Power Cable (for brake-equipped motors)*
- *Drive CM software (download here) installed on a Windows PC*
- *A USB A to USB mini-B cable (such as SV2-PGM-USB15)*

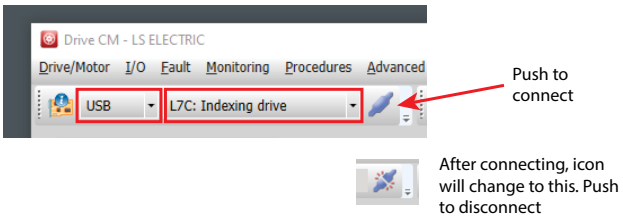
Step 1: Before Powering on the Drive

	Substep	Task
Step 1	A	Ensure Input Power wiring is connected to L1, L2, and Ground. Refer to "Main Power Connection Wiring" on page 14.
	B	Ensure 24VDC power and I/O signals are connected. At the very least, make sure the E-Stop circuit is connected. Refer to "I/O Connection Wiring Diagram with Default Functions" on page 15
	C	Ensure the Motor Encoder cable is connected. Do not simply plug the connector into the motor. Use the captive screws to ensure the connector is secure. Intermittent encoder connection can wreak havoc with the system.
	D	Ensure the Motor Brake cable is connected (if using a brake motor). If practical, wire the brake directly to 24VDC during initial system testing. This eliminates any question of brake wiring functioning properly. Brake testing can be verified after initial drive testing.
	E	Leave the motor power cable disconnected until initial drive setup and testing are complete to prevent unwanted motion. Later, the motor will be wired and tested. Do not connect a load to the motor shaft until testing is completed.

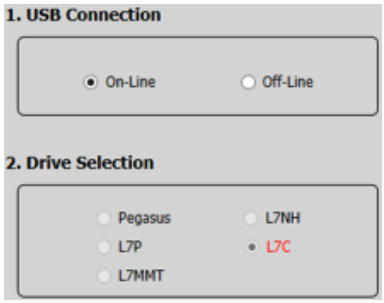
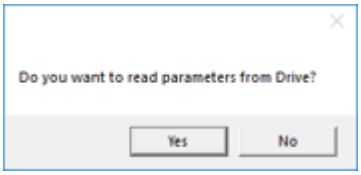
Step 2: Power up the Drive

	Substep	Task
Step 2	A	Turn on 24VDC power to the Drive I/O terminal and brake (if using a brake motor).
	B	Turn on main 230VAC Input power to the Drive Input Terminal at L1 and L2.
	C	The drive LED display will show the drive's status and Warning or Alarm codes if present.

Step 3: Connect the PC to the Drive

	Substep	Task
Step 3	A	Using a standard USB A to USB mini-B cable (such as SV2-PGM-USB15, MOSAIC-CSU, etc.), connect the PC to the Drive.
	B	Start Drive CM software.
	C	Select **L7C: Indexing Drive** and press the **Connect** button. The software should begin to communicate with the drive. A green flashing square should appear in the bottom left corner of the screen indicating comms traffic. 

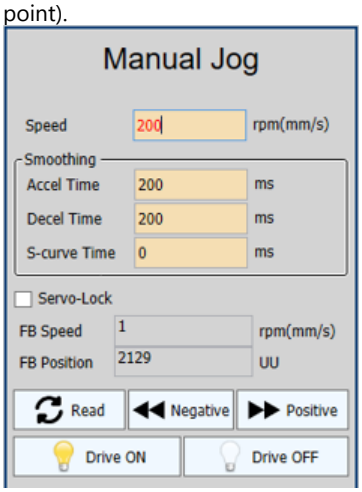
Step 4: Setup Wizard

	Substep	Task
Step 4	A	In the Quick Setup window (left side of screen), click **Setup Wizard**.
	B	In the USB Connection window, choose **On-Line** and click **Yes** to read parameters from the drive.   If the **On-Line** radio button is not available and greyed out, click on **Setup Wizard** again. This should restart the Setup Wizard and enable the button.
	C	Follow the steps in the Setup Wizard to define your application. 1) For initial setup and system testing, allow the Setup Wizard to choose the default selections. After completing this hardware test/verification, you can go through the rest of this guide and refer to the User Manual if you want to customize your configuration. 2) After stepping through the Setup Wizard, select **Write to Drive**. 3) After writing to the drive is complete, make sure to cycle power to the drive. A quick way to power cycle the CPU only is to click the **Software Reset** button in the upper right toolbar. Many settings in the Setup Wizard only take affect after a power cycle.

Step 5: Clear Faults

	Substep	Task
Step 5	A	Restart the drive and establish communications again.
	B	Go to "Fault\Servo Alarm History" and press the **Read** button. Correct any errors that are causing alarms to display on this page. Correction actions and information can be found in the User Manual or by selecting "Fault\Alarm List."
	C	After fixing any issues, click on **Reset Servo Alarm** and verify the alarms have been corrected. 

Step 6: Jog the Motor

	Substep	Task
Step 6	A	Remove power from the drive.
	B	Ensure that there is nothing attached to the motor shaft. Initial motion testing should always be done with the motor uncoupled.
	C	Connect the motor power cable and re-apply power to the drive.
	D	Reconnect the software to the drive (see Step 3C).
	E	Click on the **Jog** icon 
	F	Enter a nominal speed, acceleration, and deceleration (a value of 200 for each setting is a good starting point).  If a value is red, that means the value in the drive is different than the value in the software. Click in that field and press **Enter** to send the updated value to the drive.
	G	Press **Drive ON** to enable the drive from the software. The drive's LED should read **S-.run** (servo is in run mode).
	H	Press **Negative** or **Positive** to jog the motor. Once the motor jogs, you have verified the power wiring, servo drive, motor, and motor cables are connected properly.

Step 7: Set Operating Mode

	Substep	Task
Step 7	A	Determine whether you want to run the system in Internal Index, Velocity, Torque, or High Speed Pulse Input mode.
	B	For Index Mode, see "Index Position Mode" on page 30. For Pulse Mode, see "Pulse Input Position Mode" on page 39. For Velocity Mode, see "Velocity Mode" on page 46. For Torque Mode, see "Torque Mode" on page 54.
	C	Once operating mode is set, system quick setup is complete.

First Time Inspection

Ensure your servo motor and drive match capacity.

L7C Servo Drive

Part Number Explanation

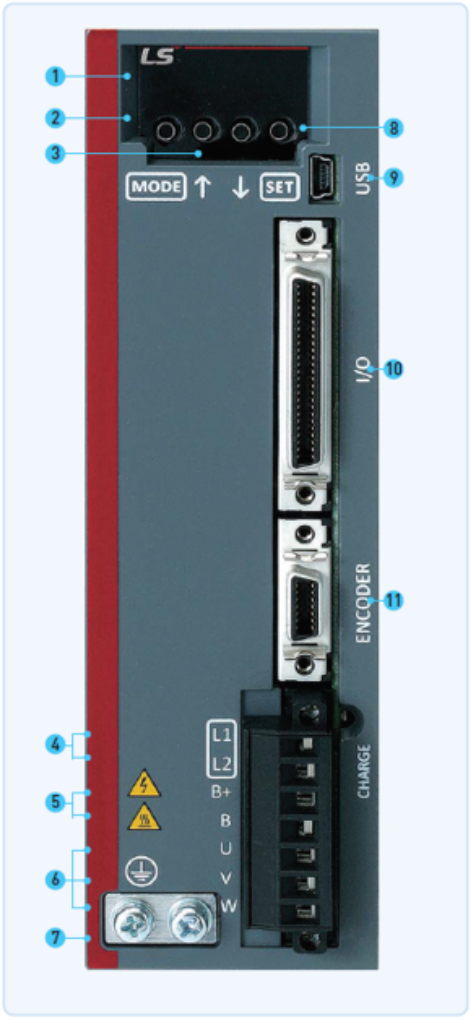
The three digit number in the middle of the drive part number determines the power of the drive. Note that the "-AD" simply represents special packaging for AutomationDirect. These are standard LS Electric Parts.

- *LC7A**004**U-AD*
- *LC7A**010**U-AD*

The value 004 represents a 400W drive. The value 010 represents a 1000W (or 1kW) drive.

Use LC7004U-AD with 100, 200, and 400 W motors.

Use LC7010U-AD with 750 and 1000 W motors.



Servo Drive Components	Location	Description
	1	Display
	2	Mode Switch
	3	Operation Switch (Up/Down)
	4	Main Power Terminal (L1, L2)
	5	External Regenerative Resistor Terminals (B+, B)
	6	Servo Motor Connecting Terminal (U,V,W)
	7	Ground (separate terminals for incoming ground and motor cable ground)
	8	Setup Switch
	9	USB Connector (for software config only)
	10	Control Signal Connector CN1 (I/O)
	11	Encoder Connector CN2 (ENCODER)

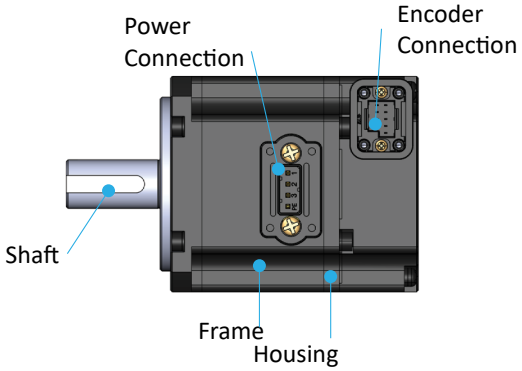
APMC Servo Motor

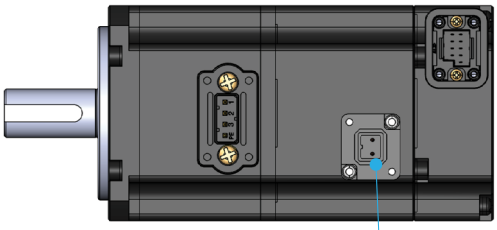
Part Number Explanation

The meaning of the motor part number can be deciphered by looking at several of the digits in the middle. Note that the "-AD" simply represents special packaging for AutomationDirect. These are standard LS Electric Parts.

APMC-F**x**L**yy**AYK**(2)**-AD

- *X = the frame size:*
  - *B = 60mm square (70mm bolt circle)*
  - *C = 80mm square (105mm bolt circle)*
- *YY = power in hundreds of watts*
- *(2) = If present after AYK, represents a motor with built-in brake. No (2) = no brake.*





Basic Inspection

Perform periodic inspections to maintain your equipment, as well as inspections before operation of the servo and motor.

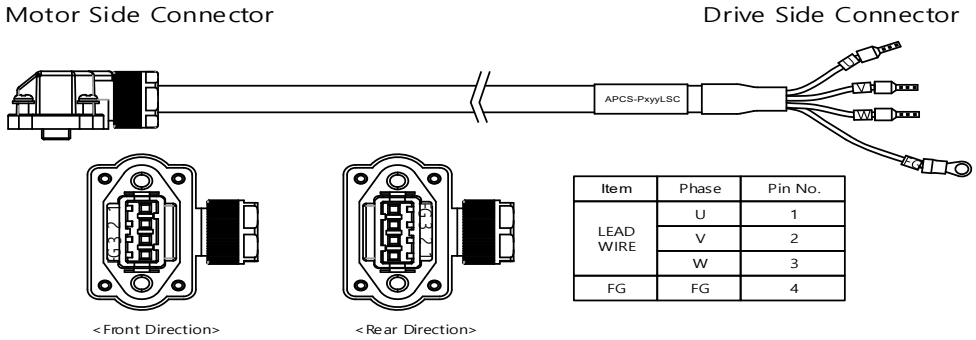
Inspection	*Task*
General Inspection	Periodically check to confirm the screws are securely tightened. This includes the screws in the servo drive, the connection screws between the motor shaft and the machine, and the connection screws between the terminal block and machine.
	Prevent oil, water, metallic particles, and other foreign matter from entering the control box or ventilation equipment. Protect the servo drive from any drill cuttings.
	If the control box is installed in a location where dust or harmful gas are present, ensure the dust or harmful gas cannot enter the control box.
	Make sure to wire encoders and other devices in the proper sequence to avoid sudden unintended acceleration or damage to the motor.
Inspection before operation (power OFF)	To avoid electric shock, connect the ground terminal of the servo drive to the ground terminal of the control box. If wiring must be added or modified, wait at least 10 minutes after disconnecting the servo drive from the power supply or discharge the electricity with a discharge device.
	Isolate the wires at the wiring terminal.
	Make sure the wiring is correct to avoid damage or any abnormal operation.
	Check for and remove any electrically conductive objects, including metal sheet and screws, or flammable objects inside or near the servo drive.
	Make sure the emergency stop switch is OFF.
	To ensure the electromagnetic brake works, make sure the stop and circuit breaker functions are working properly.
	Reduce the electromagnetic interference if there is electromagnetic interference with the peripheral devices.
	Make sure the external voltage level of the servo drive is correct.
Inspection before operation (power ON)	The encoder cable should be protected from excessive stress - make sure the cable is not worn or stretched.
	Contact AutomationDirect if the servo motor vibrates or makes unusual noise during operation.
	Make sure the parameter settings are correct. Different machines have different characteristics. Adjust the parameters according to the characteristics of each machine.
	Reset the parameters when the servo drive is in the Servo OFF status to avoid possible malfunction.
	If there is no contact noise or other abnormal noise when the relay is operating, contact AutomationDirect.
	Contact AutomationDirect if the power indicator or LED display does not function properly.

System Wiring

Pre-made Motor Cables

Motor connections utilize premade cables available in normal flex or robotic flex specifications. Cables are applicable for any L7C drive and motor size 100W–1kW (brake cables are only applicable for brake motors). They are available in lengths of 3m, 5m, 10m, and 20m.

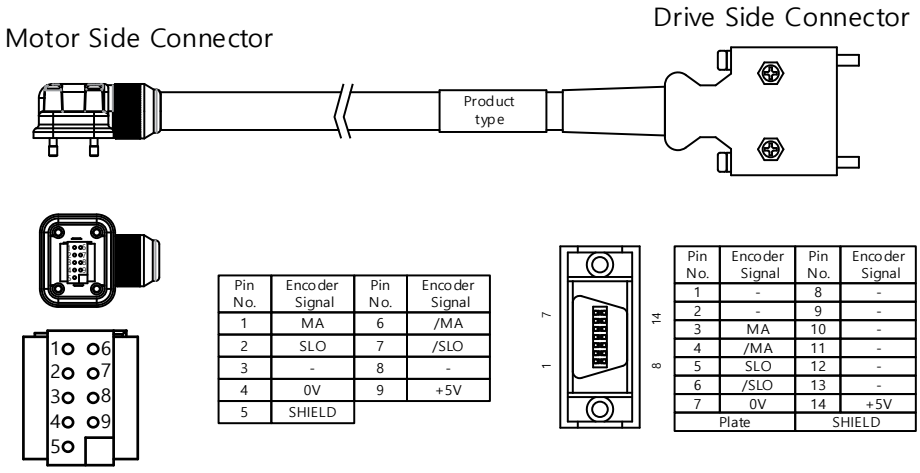
Motor Power Cable



Item	Phase	Pin No.
LEAD WIRE	U	1
	V	2
	W	3
FG	FG	4

Part Number	Flex Rated	Length	Gauge	Description
APCS-PN03LSC-AD	N	3m [9.8 ft]	18AWG	LS Electric power cable, for use with FBL/FCL series motors
APCS-PN05LSC-AD		5m [16.4 ft]		
APCS-PN10LSC-AD		10m [32.8 ft]		
APCS-PN20LSC-AD		20m [65.6 ft]		
APCS-PF03LSC-AD	Y	3m [9.8 ft]		LS Electric flexing power cable, for use with FBL/FCL series motors
APCS-PF05LSC-AD		5m [16.4 ft]		
APCS-PF10LSC-AD		10m [32.8 ft]		
APCS-PF20LSC-AD		20m [65.6 ft]		

Motor Encoder Cable

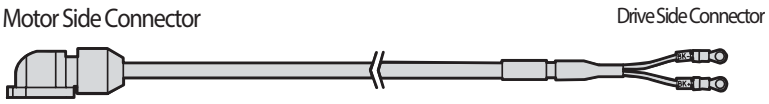


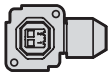
Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	MA	6	/MA
2	SLO	7	/SLO
3	-	8	-
4	0V	9	+5V
5	SHIELD		

Pin No.	Encoder Signal	Pin No.	Encoder Signal
1	-	8	-
2	-	9	-
3	MA	10	-
4	/MA	11	-
5	SLO	12	-
6	/SLO	13	-
7	0V	14	+5V
Plate		SHIELD	

Part Number	Flex Rated	Length	Gauge	Description
APCS-EN03ES-AD	N	3m [9.8 ft]	24AWG	LS Electric encoder feedback cable, for use with FBL/FCL series motors
APCS-EN05ES-AD		5m [16.4 ft]		
APCS-EN10ES-AD		10m [32.8 ft]		
APCS-EN20ES-AD		20m [65.6 ft]		
APCS-EF03ES-AD	Y	3m [9.8 ft]		LS Electric flexing encoder feedback cable, for use with FBL/FCL series motors
APCS-EF05ES-AD		5m [16.4 ft]		
APCS-EF10ES-AD		10m [32.8 ft]		
APCS-EF20ES-AD		20m [65.6 ft]		

Motor Brake Cable

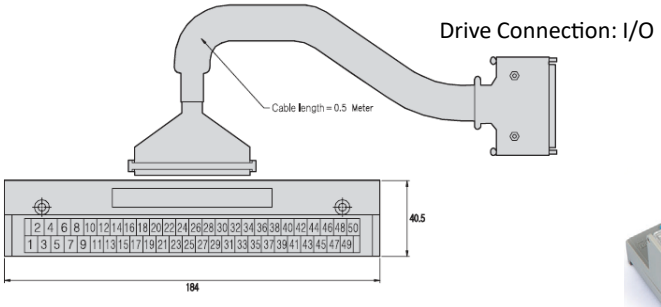


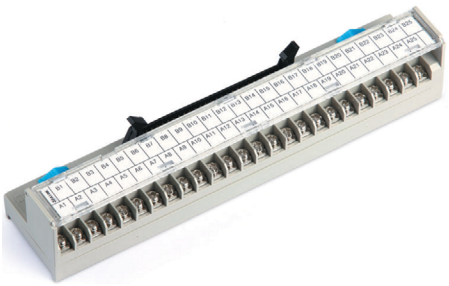


PIN No.	Signal
1	BK +
2	BK -

Part Number	Flex Rated	Length	Gauge	Description
APCS-BN03QS-AD	N	3m [9.8 ft]	18AWG	LS Electric brake cable, for use with FBL/FCL series motors
APCS-BN05QS-AD		5m [16.4 ft]		
APCS-BN10QS-AD		10m [32.8 ft]		
APCS-BN20QS-AD		20m [65.6 ft]		
APCS-BF03QS-AD	Y	3m [9.8 ft]		LS Electric flexing brake cable, for use with FBL/FCL series motors
APCS-BF05QS-AD		5m [16.4 ft]		
APCS-BF10QS-AD		10m [32.8 ft]		
APCS-BF20QS-AD		20m [65.6 ft]		

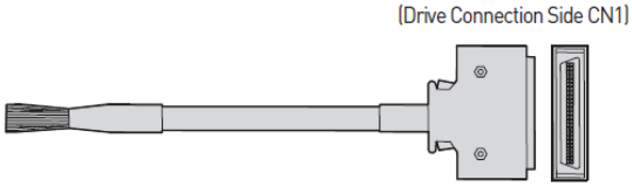
Drive I/O Cables





You can download a printable terminal label at
https://www.automationdirect.com/pn/APC-VSCN1T-AD
See terminal assignments table on the following page.

Part Number	Length	Description
APC-VSCN1T-AD	0.5 m [1.6 ft]	LS Electric CN1 feedthrough terminal block, 50-pole, DIN rail mount
APC-VSCN1T01-AD	1.0 m [3.2 ft]	
APC-VSCN1T02-AD	2.0 m [6.5 ft]	



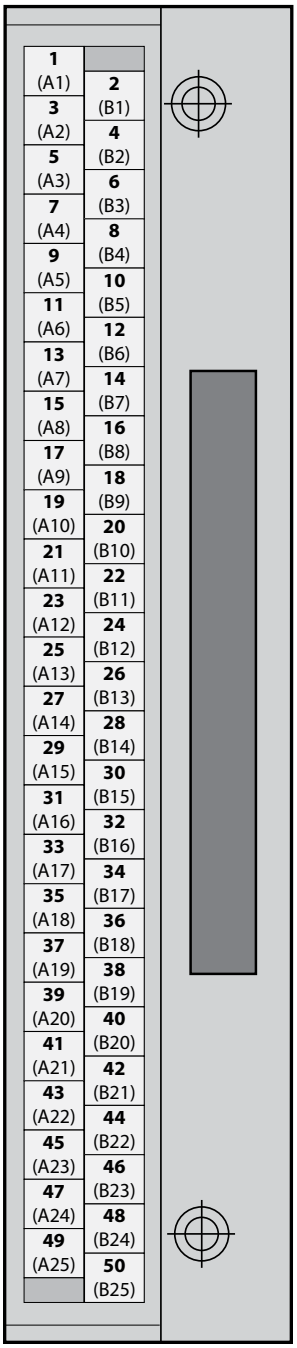
Part Number	Length	Description
APC-CN101A-AD	1.0 m [3.2 ft]	LS Electric CN1 flying lead cable, 50-pin
APC-CN102A-AD	2.0 m [6.5 ft]	
APC-CN103A-AD	3.0 m [9.8 ft]	

Terminal Assignments and Wire Colors

CAUTION: Terminal assignments are different for every LS drive series. Use this terminal assignment chart with L7P series drives ONLY. Using terminal charts from other LS series drives will result in incorrect wiring that will damage your equipment.

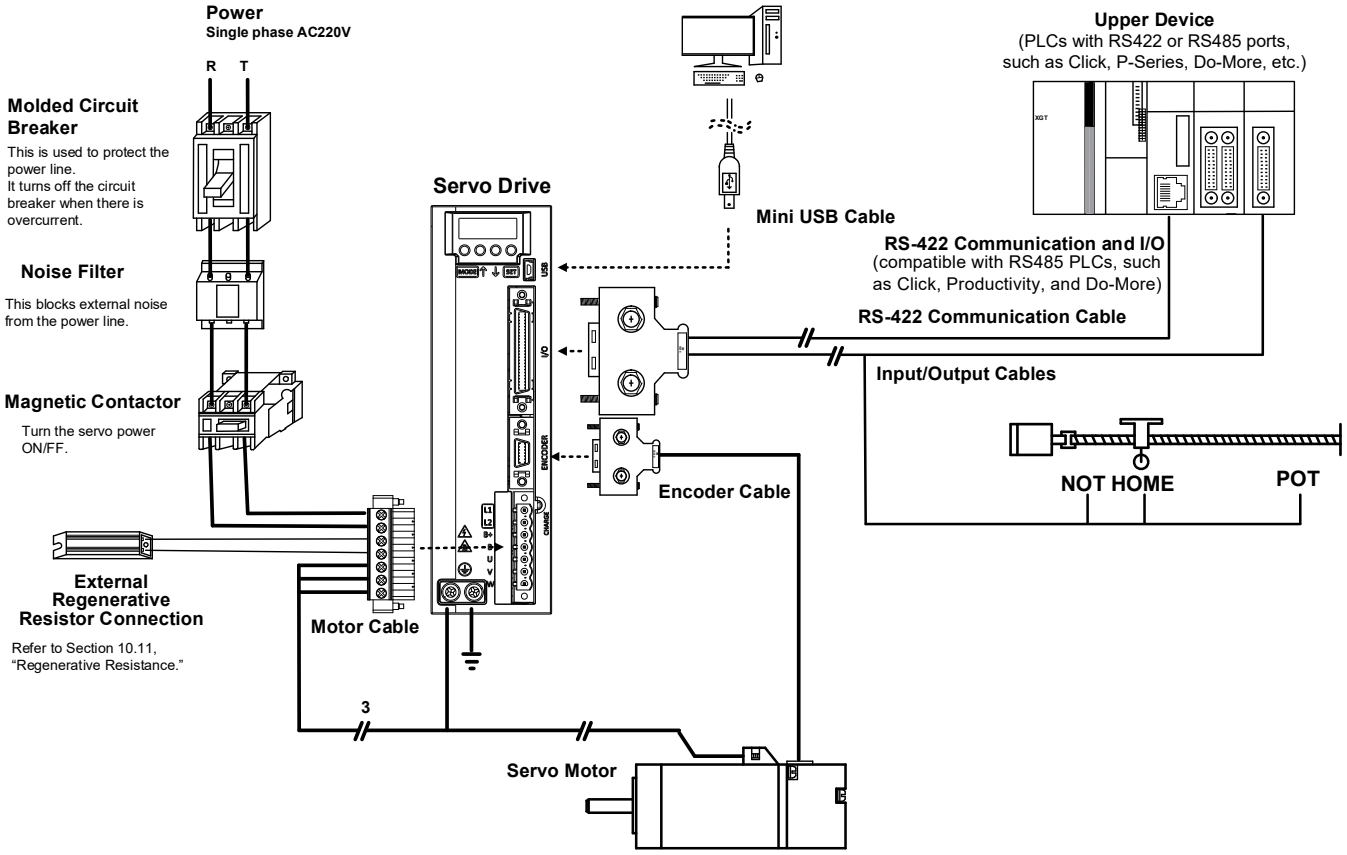
Terminal	Drive I/O Pin/Wire #	Description	APC-CN10xA Flying Lead Cables		
			Wire Color	Stripe Color	Number of Stripes
A1	1	AI-1 (TRQCOM)	Orange	Black	1
B1	2	TXD+	Orange	Red	1
A2	3	TXD-	Orange	Black	2
B2	4	Z0	Orange	Red	2
A3	5	/Z0	Orange	Black	3
B3	6	RXD+	Orange	Red	3
A4	7	RXD-	Orange	Black	4
B4	8	A-GND	Orange	Red	4
A5	9	PF+	Orange	Black	5
B5	10	PF-	Orange	Red	5
A6	11	PR+	Yellow	Black	1
B6	12	PR-	Yellow	Red	1
A7	13	N/C	Yellow	Black	2
B7	14	DO-8	Yellow	Red	2
A8	15	DO-7	Yellow	Black	3
B8	16	DO-6	Yellow	Red	3
A9	17	DI-5	Yellow	Black	4
B9	18	DI-9	Yellow	Red	4
A10	19	DI-8	Yellow	Black	5
B10	20	DI-7	Yellow	Red	5
A11	21	DI-4	Gray	Black	1
B11	22	DI-3	Gray	Red	1
A12	23	DI-2	Gray	Black	2
B12	24	DO-GND24	Gray	Red	2
A13	25	DO-GND24	Gray	Black	3
B13	26	N/C	Gray	Red	3
A14	27	AI-2 (SPDCOM)	Gray	Black	4
B14	28	N/C	Gray	Red	4
A15	29	N/C	Gray	Black	5
B15	30	B0	Gray	Red	5
A16	31	/B0	White	Black	1
B16	32	AO	White	Red	1
A17	33	/AO	White	Black	2
B17	34	+12V	White	Red	2
A18	35	-12V	White	Black	3
B18	36	ENC SG	White	Red	3
A19	37	N/C	White	Black	4
B19	38	DO-1+	White	Red	4
A20	39	DO-1-	White	Black	5
B20	40	DO-2+	White	Red	5
A21	41	DO-2-	Pink	Black	1
B21	42	N/C	Pink	Red	1
A22	43	DO-3	Pink	Black	2
B22	44	DO-4	Pink	Red	2
A23	45	DO-5	Pink	Black	3
B23	46	DI-6	Pink	Red	3
A24	47	DI-1	Pink	Black	4
B24	48	DI-A	Pink	Red	4
A25	49	PULCOM	Pink	Black	5
B25	50	+24v	Pink	Red	5

APC-VSCN1T-AD



General Wiring Overview

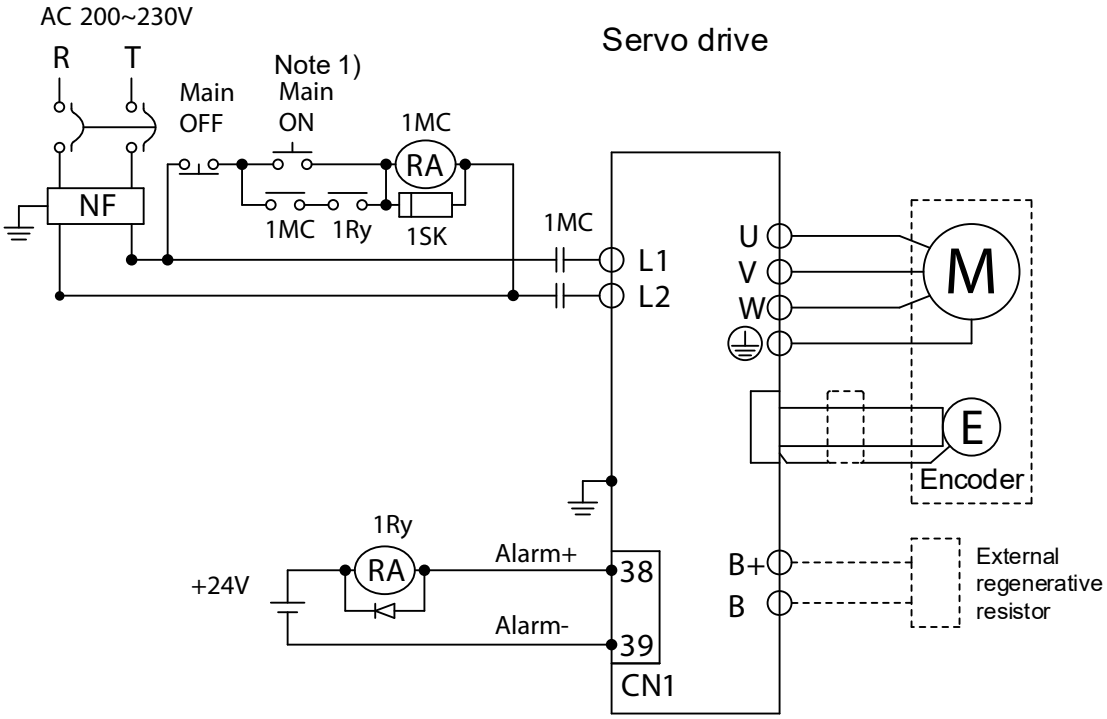
Example System Configuration



NOTE: Do not use APC-VSCN1T(xx)-AD or APC-VPCN1T-AD if using PLC/Drive serial communication. Communication may be poor due to disconnection in cable shields. Build the structure of a single connector holding individual lines of RS-422 communication cables and input/output cables. Make sure to use shielded twisted cables (Twisted Pair Wire) for RS-422 communication cable. AutomationDirect recommends limiting the baud rate to 19.2k for reliable communications.

NOTE: PE between the servo motor and the servo and between the servo and the device must be connected.

Main Power Connection Wiring



NOTE 1: About 1-2 seconds are required from main power supply to alarm signal output. Hold the main power on for 2 seconds until the alarm circuit ("1Ry") will latch main power ON.

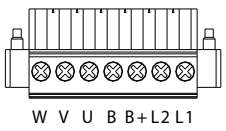
NOTE: If an external regen resistor is required, see APCS-140R50-AD or APCS-300R30-AD regenerative resistors from LS Electric.

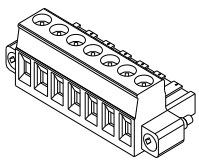
Drive Size	400W	1kW
MCCB (NFB)	5A max	10A max
Fuse	15A max	30A max
Noise Filter (NF)	TB6-B010LBEI	
MC	11A/240V	18A/240V
L1, L2, B+, B, U, V, W **1**	12–16 AWG	
Screw Terminal	Ferrule 16AWG (6mm Strip & Twist)	
Connector	LS Electric p/n = BCP-508F-7 BK Phoenix/AutomationDirect p/n = 5452573	

1 *- Select and use 600V, PVC-insulated wires. To comply with UL (CSA) standards, use UL-certified wires that have a heat resistant temperature of 75°C or above. To comply with other standards, use proper wires that meet the applicable standards. For other special specifications, use wires equivalent or superior to those specified in this section.*

Power Connector Signal Names

Signal Name	Description
L1	Main power input port
L2	
B+	Regenerative resistor connection port
B	
U	Motor U, V, and W signals connection port
V	
W	



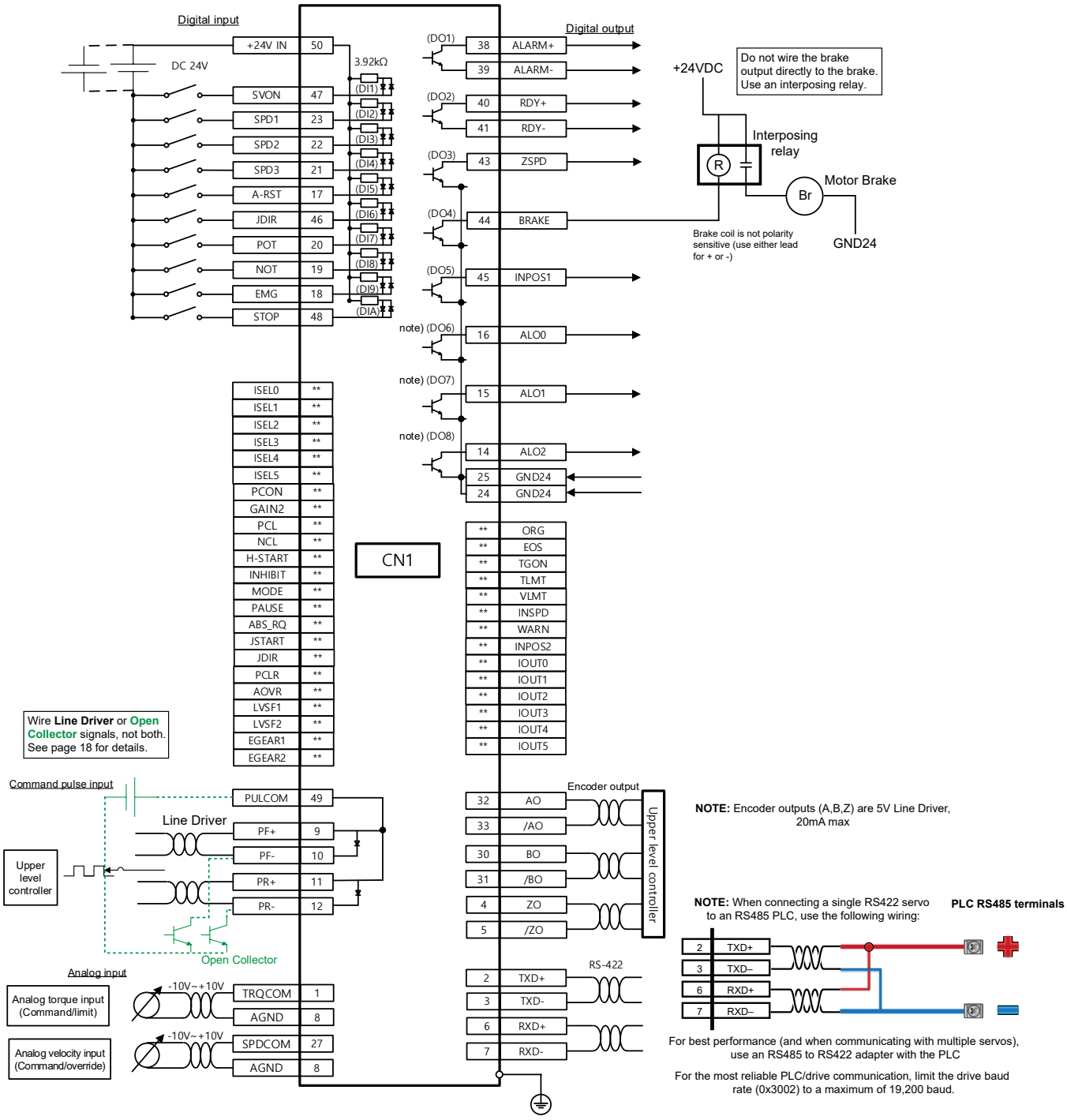


NOTE: Strip all Power Connector wiring 7-10mm. Refer to section 2.4.3 of the User Manual.

I/O Connection Wiring Diagram with Default Functions

I/O Connection wiring diagram is shown below. For a printable terminal label, go to: https://www.automationdirect.com/pn/APC-VSCN1T-AD.

See "Terminal Assignments and Wire Colors" on page 12 for terminal assignments.

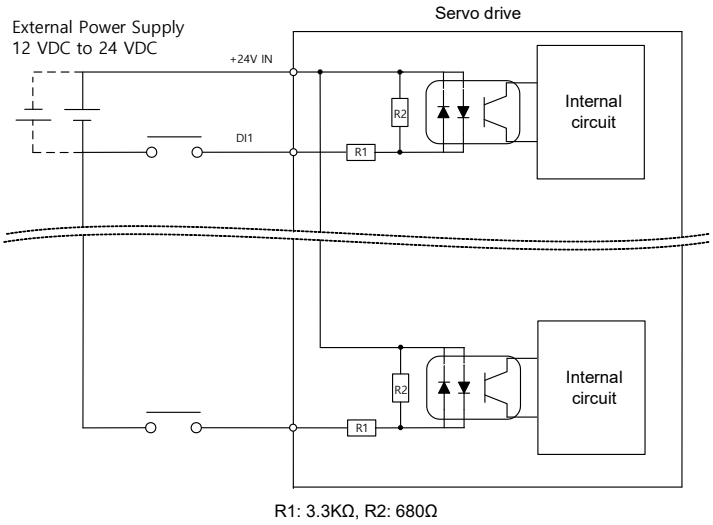


NOTE: Input signals DI1-DIA and output signals DO1-DO5 are factory default signals and can be reconfigured. Note that DO6-DO8 are permanently fixed as status output signals, but all other digital I/O can be reprogrammed.

I/O Wiring Details Digital Inputs/Outputs

Digital Inputs

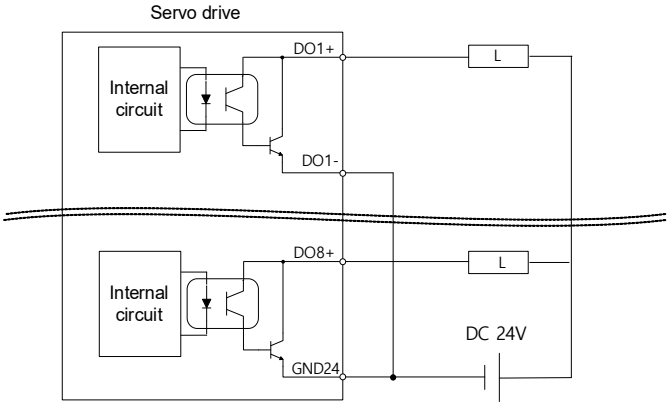
1) You can set the input contact to contact A (normally open) or contact B (normally closed).
2) You can assign each input contact to one of 31 functions.
3) For more information on signal assignment and change of the input contact, refer to the User Manual, section 10.2 “Input/Output Signals Setting.” The Drive CM software makes setting the I/O signals very quick and easy.
4) The rated voltage is 12VDC to 24VDC.



R1: 3.3KΩ, R2: 680Ω

Digital Outputs

1) You can set the output to contact A (normally open) or Contact B (normally closed).
2) You can assign each output contact to one of 19 output functions.
3) For more information on signal assignment and change of the output contact, refer to the User Manual, section 10.2 “Input/Output Signals Setting.” The Drive CM software makes setting the I/O signals very quick and easy.
4) Excessive voltage or overcurrent may damage the device because it uses an internal transistor switch. Be cautious.
5) The rated voltage and current are 24VDC ± 10% and 120mA.



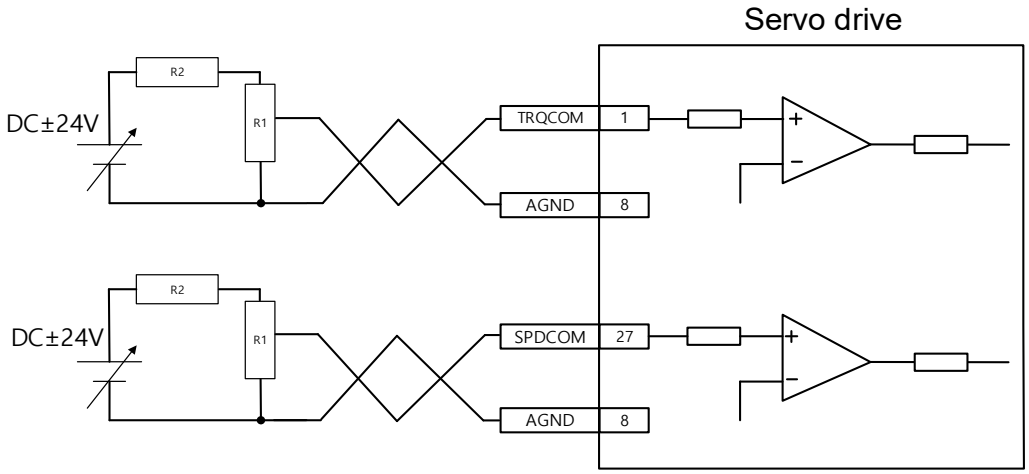
NOTE 1: DO1 and DO2 outputs use separated GND24 terminals, and DO3-DO8 outputs use a common GND24 for DOCOM.

NOTE 2: DO6-DO8 outputs are locked for alarm group outputs. You can assign desired output signals to DO1-DO5 for use.

I/O Wiring and Option Details

Analog

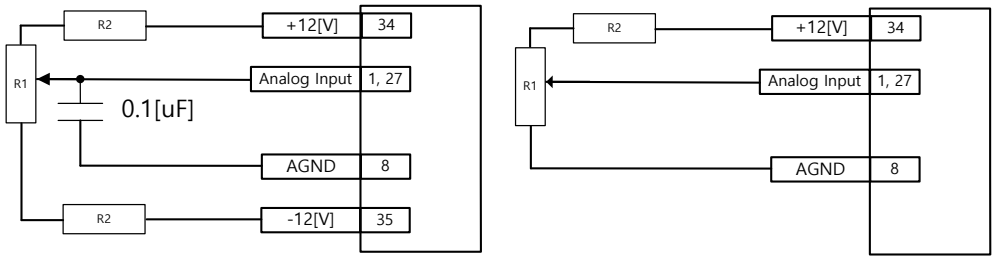
1) For information on how to operate analog input signals, refer to the User Manual, section 4.5 "Analog Velocity Override," section 6.2 "Analog Velocity Command," section 7.2 "Analog Torque Command Scale," and section 10.8 "Torque Limit Function."
2) The range of analog input signals is -10V to 10V.
3) The impedance for input signals is approximately 10KΩ.



4) Example of resistance selection for use of 24V for input voltage:

No.	R1	R2
1	5KΩ	6KΩ
2	10KΩ	12KΩ

5) Examples of using internal +12V and -12V power sources:



6) Example of resistance selection for use of 12V for input voltage:

No.	R1	R2
1	10KΩ	660Ω
2	5KΩ	330Ω
3	2KΩ	132Ω

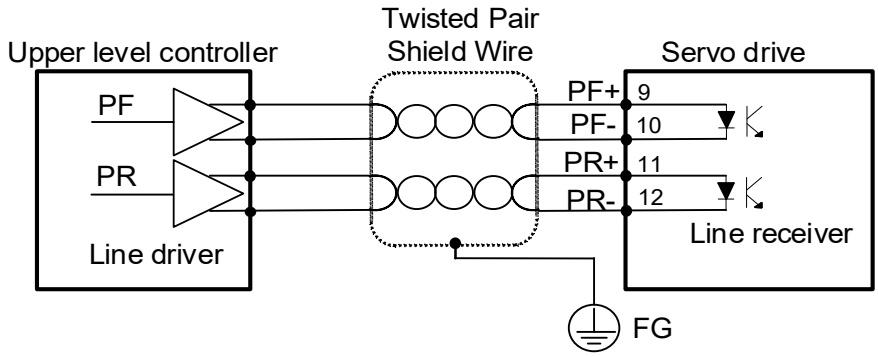
7) Example R1 potentiometers:
   - *GSDA-5K: 5K potentiometer with 0-100% dial*
   - *ECX2300-5K: 5k potentiometer*
   - *ECX2300-10K: 10k potentiometer*

Pulse

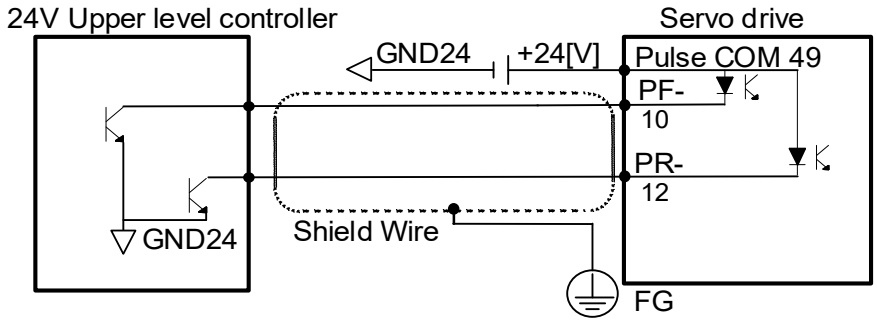
0x3003 = Pulse Input Logic Select.

Determines CW+CCW, Pulse+DIR, A+B, etc.

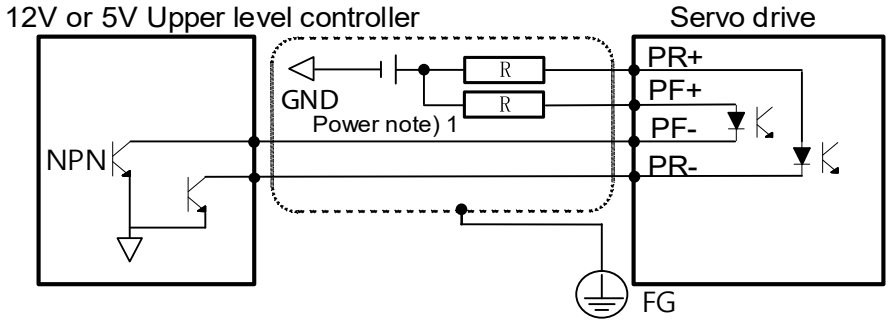
Line Driver (5V) Pulse Input



24V NPN Open Collector Pulse Input (internal dropping resistor on pulse COM (49))



12V or 5V NPN Open Collector Pulse Input (external dropping resistors required)



NOTE: When using 5V power, Resistance R = 100-150 Ω, 1/2 W.
When using 12V power, R = 560-680 Ω, 1/2 W.

Pulse Format

Signal		Pulse/ Direction	CW/ CCW	Quad	L7C Label and Pin #	Productivity PLC HSO Terminals	Productivity PLC AMC Motion
Line Driver	A or A+	Pulse	CCW	B	PF+ 9	1A	STEP+
	/A or A-				PF- 10	/1A	STEP-
	B or B+	Direction	CW	A	PR+ 11	1B	DIR+
	/B or B-				PR- 12	/1B	DIR-
Open Collector	A Voltage Supply	Pulse	CCW	B	**	N/A	N/A
	A Pulse Out				PF- 10	1A SNK*	N/A
	B Voltage Supply	Direction	CW	A	**	N/A	N/A
	B Pulse Out				PR- 12	1B SNK*	N/A

** Must also connect the HSO "COM" logic terminal to power supply common (0V or 24V). See middle diagram on the previous page.*

*** For 24V pulse systems, connect power to Pulse COM (pin 49). See middle diagram on the previous page. For 12V or 5V pulse systems, connect power/resistors to PR+ and PF+ (pins 9, 11). See bottom diagram on the previous page.*

LED Display

The LED status display can contain a variety of information, including the status of the drive's operating state, digital inputs, digital outputs, alarms, and warnings. Please refer to Chapter 10 of the User Manual to see details of using the keypad on the front of the drive to monitor status, change drive parameters, and control certain special functions of the drive (example: you can jog the drive from the keypad).

AutomationDirect recommends skipping Chapter 10 and proceeding straight to using the Drive CM software for maintenance, configuration, commissioning, and debugging.

Alarms

Code	Alarm
AL-10	IPM fault (Overcurrent H/W)
AL-14	IPM fault (Overcurrent S/W)
AL-16	Current Limit exceeded (Overcurrent (H/W))
AL-11	IPM Temperature (IPM Overheat)
AL-15	Current offset abnormality
AL-21	Continuous Overload Abnormality
AL-22	Drive Temperature Overheat 1
AL-23	Regeneration Overload
AL-24	Motor Cable Open
AL-25	Drive Temperature Overheat 2
AL-26	Encoder Temperature (Reserved)
AL-30	Encoder Communication Error
AL-31	Encoder Cable Open
AL-32	Encoder Data Error
AL-38	Encoder Setting Error
AL-33	Motor ID Setting
AL-34	Encoder Z Phase Open
AL-35	Encoder Battery Low Voltage
AL-40	Main Power Input Undervoltage
AL-41	Main Power Input Overvoltage
AL-42	Main Power Input Failure
AL-43	Control Power Failure (reserved)
AL-50	Over Speed Limit
AL-51	POS Excessive Position Error
AL-52	Emergency Stop
AL-53	Excessive Speed Deviation
AL-63	Parameter Checksum Error
AL-71	Factory Setting Error

Warnings

Code	Warning
W01	Main Power Phase Loss
W02	Encoder Battery Low Voltage
W04	Software Position Limit
W08	Dynamic Braking Overcurrent
W10	Operation Overload
W20	Drive-Motor Setup Abnormality
W40	Main Power Undervoltage
W80	Emergency Signal Input Abnormality

Drive CM Software

AutomationDirect Foreword

The LS Electric Drive CM software does not include “Are you sure?” types of warnings. When you make a change in the SW it takes place immediately in the drive, even settings that initiate motion.

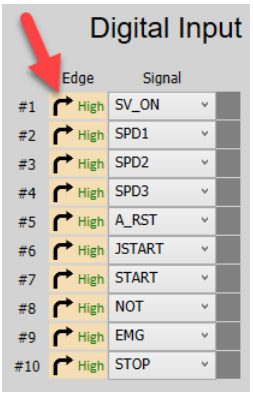
Example 1:

When you go to the JOG screen and press “Enable”, the drive Enables immediately.

Example 2:

When you change a Digital Input from active low to active high, the definition changes immediately by pushing the “Edge” button. In the picture to the right, Input #1 is configured for Servo On. If the input is physically low and you press the Edge button, the input’s definition is changed to active low and the servo will immediately be enabled.

There is nothing wrong with this approach, but it may be more direct than most software packages that are in use today.



Getting Started

Drive CM software provides the fastest and easiest way to set up the LS Electric L7C drive. The following steps show how to get started with the software and a few key features.

Before starting, you will need:

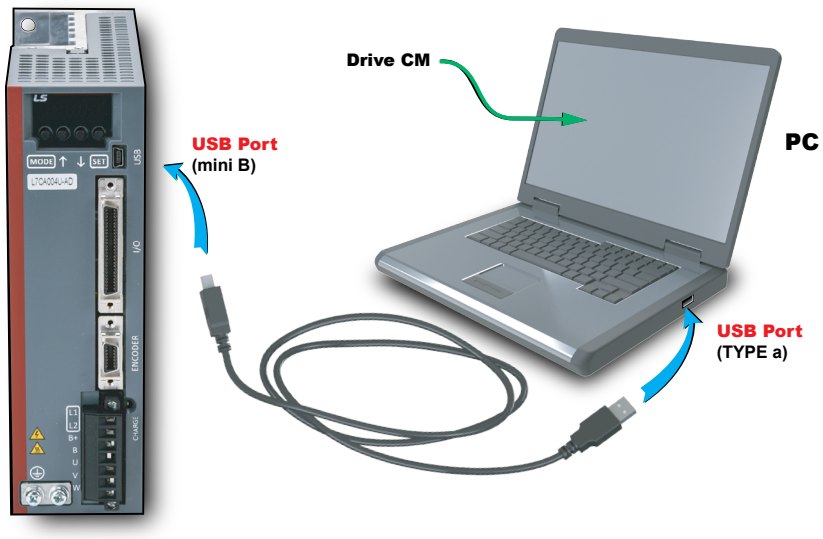
- *PC with Windows 8 or later.*
- *PC USB port*
- *USB Type A to miniB cable (SV2-PGM-USB15 is a good choice due to the dual ferrite filters and opto-isolator included with the cable. This USB cable is helpful when dealing with PC to Drive connectivity issues due to EMI)*

Step 1

Download and install Drive CM Software from the AutomationDirect L7C servo drives support page at https://support.automationdirect.com/products/lselectric.html.

Step 2

Connect the servo drive USB port to the PC USB port using a standard USB-A to USB-mini-B cable. Some cables available from AutomationDirect include:

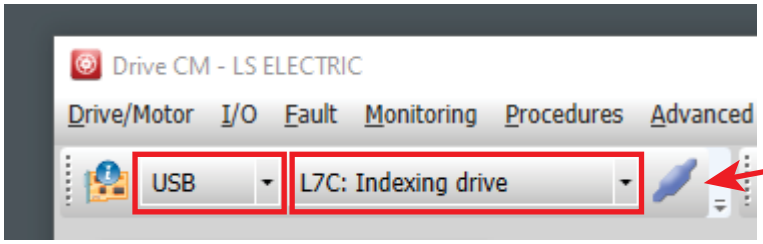


USB-A to USB-mini-B Cables
SV2-PGM-USB15
SV2-PGM-USB30
MOSAIC-CSU

Step 3

Open Drive CM Software and Connect to the drive.

1) Select the USB connection type and L7C drive.
2) Then press the Cable icon to connect and establish communications with the drive.



After connecting, icon will change to this. Push to disconnect

NOTE: The icon does not show the current comms state, it shows what will happen if you push the button.

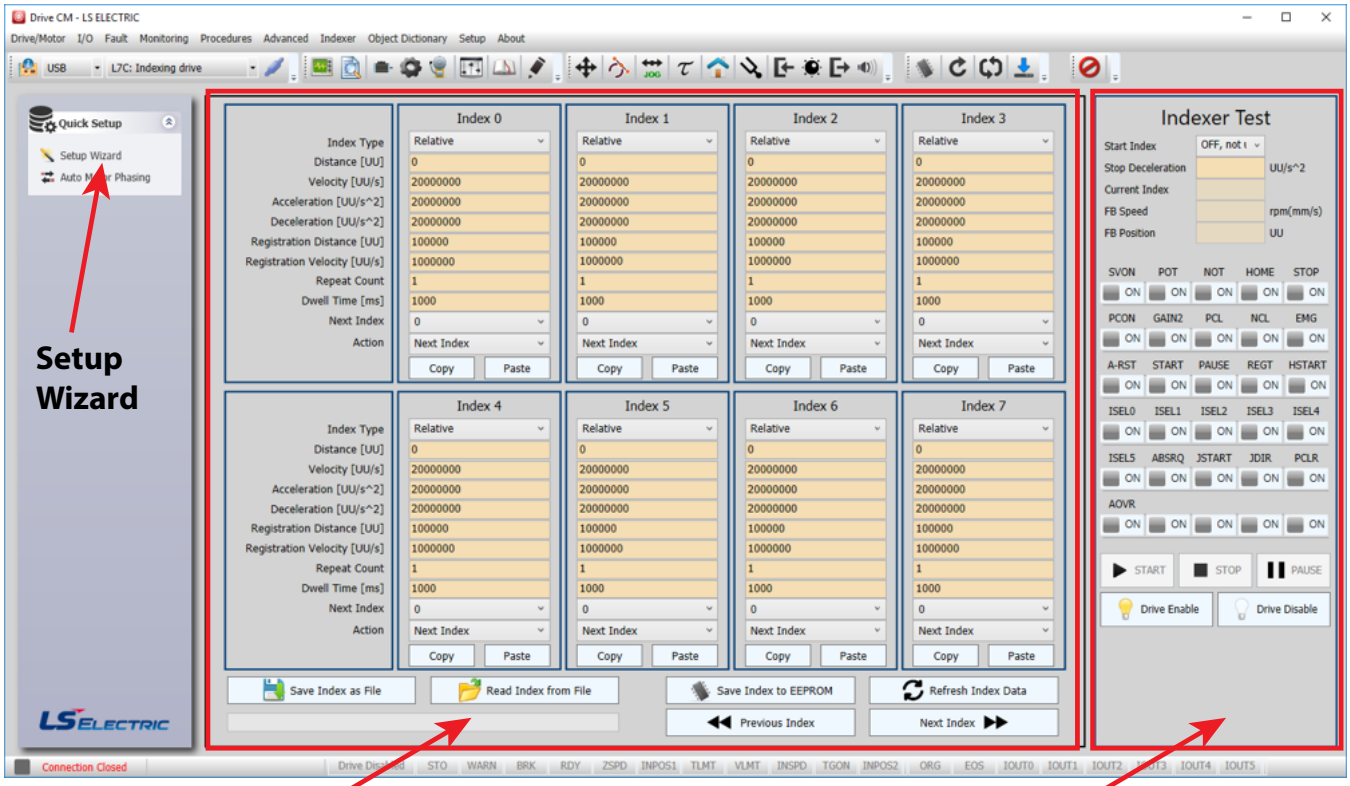
The comms status is displayed at the bottom left corner of the software screen. A green blinking square indicates active communication.

Using the Drive CM Software

There are two main working areas in Drive CM. The Main Window (larger, left) is mostly used for setup and configuration. The Auxiliary Window (smaller, right) has more dynamic operations available. Both areas can be viewed simultaneously for maximum usefulness (ex: select both Index Edit and Indexer Test to define and test Indexes at the same time). The left area is also used to run the Setup Wizard. The Setup Wizard will walk you step-by-step through setting up the basic parameters of the system.

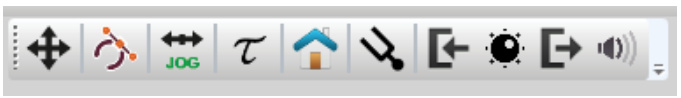
NOTE: If you exit the "Setup Wizard" before completing the process, you will have to restart the wizard from the beginning. The "Setup Wizard" will not update the drive's parameters or the parameters in the object dictionary until they are written to the drive.

NOTE: In the "About" drop down menu you can find the Drive CM software user manual for specifics on each function in the software.



Toolbars

The two main toolbars at the top of the screen control what is displayed in the Main and Auxiliary windows.

Toolbar	Controls
	Main Window
	Auxiliary Window

Toolbar Functions

Icon	Function	Displays In
	Trace/Trigger Monitor (Scope)	Main Window
	Cyclic Monitor (System Data View)	
	Motor Encoder Setup (no configuration needed for auto-identifiable FBL/FCL motors)	
	General Configuration Setup	
	Fault Configuration	
	Controls Loop (Manual Tuning)	
	Object Dictionary (Parameters)	
	Index Edit (configure point-to-point moves/indexes)	
	Indexer Test	Auxiliary Window
	PTP Move	
	Jog Manual	
	Torque Control	
	Homing	
	Tuning	
	Digital Input	
	Analog Input	
	Digital Output	
	Analog Monitor	
	Save to Drive Memory	n/a (Command only)
	Reset Servo Alarm	
	Software Reset for Drive CPU power cycle	
	Firmware Update	
	Emergency STOP	

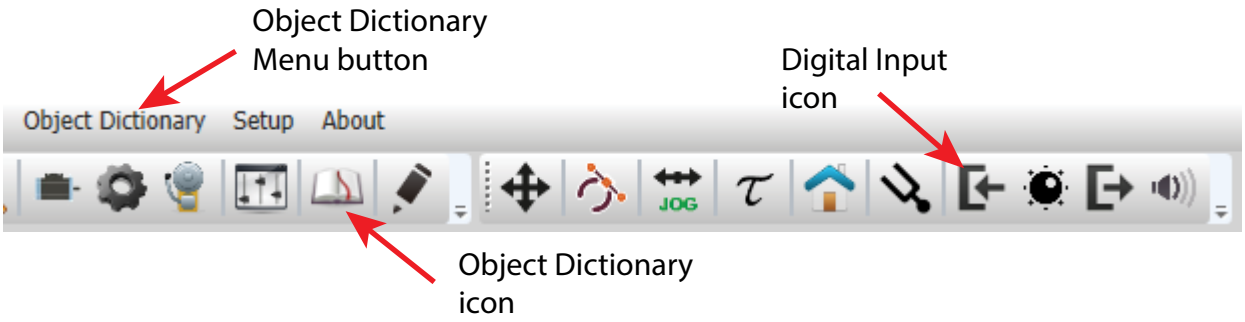
I/O Configuration

Digital Inputs

Use the following parameters to configure Digital Input functionality or use the Digital Input window in Drive CM directly to make changes.

The software provides a very easy way to change the DI functions using the digital input icon (quickest and easiest method for configuration). Alternatively, you can open the parameter object dictionary using the Object Dictionary menu button or the Object Dictionary icon.

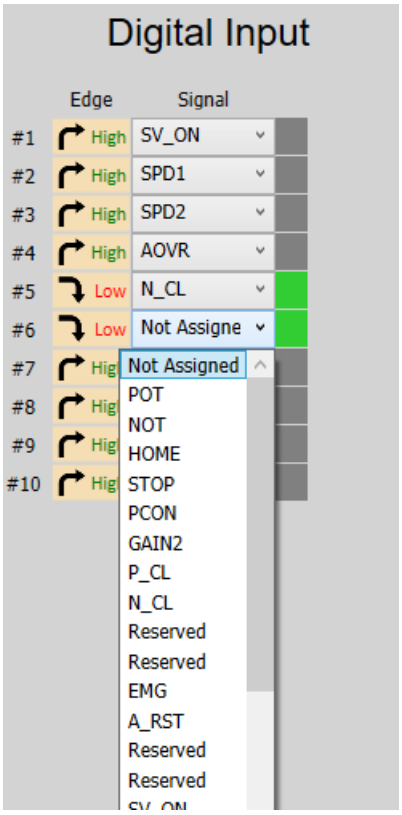
NOTE: When making these changes while the software is connected to the drive the change will take affect immediately, there is no "Are you sure?" warning. Example: Changing an SVON digital input from NO to NC by pressing the "Edge" button will cause the drive to change state immediately.
This feature of immediate changes from NO <-> NC can be used for "forcing" a digital input for testing and troubleshooting your application.



Digital Input Functions

These functions are located under the **I/O** tab.

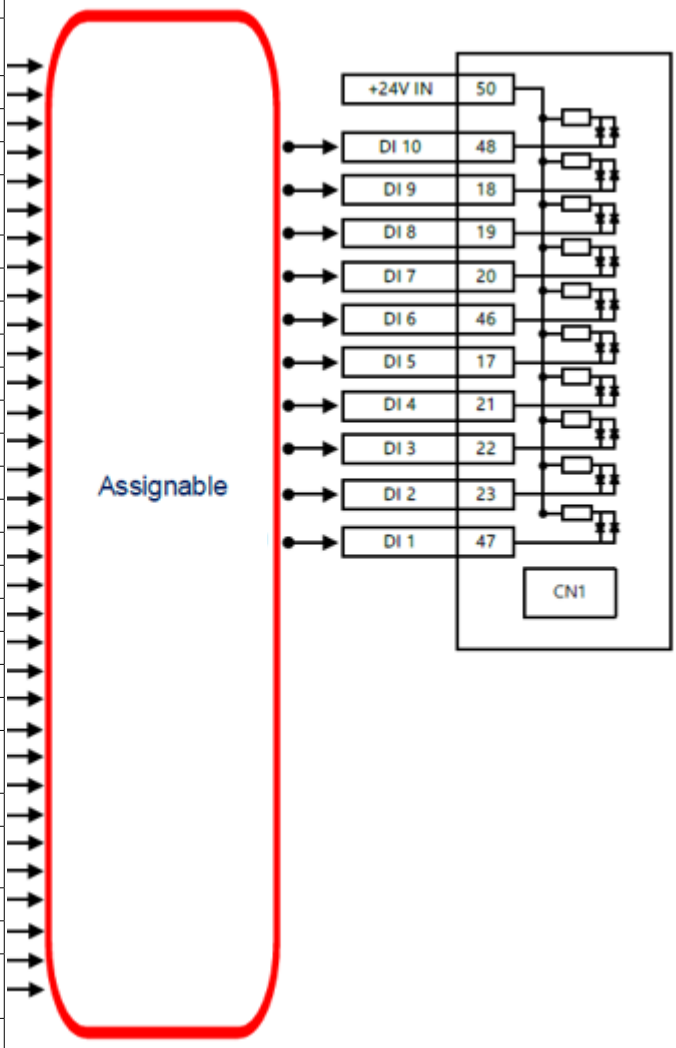
Input	Parameter	Default Function
DI1	0x2200	SVON
DI2	0x2201	SPD1
DI3	0x2202	SPD2
DI4	0x2203	SPD3
DI5	0x2204	A-RST
DI6	0x2205	JDIR
DI7	0x2206	POT
DI8	0x2207	NOT
DI9	0x2208	EMG
DI10	0x2209	STOP



Digital Input Codes

See section 2.5.1 and 10.2 in the user manual for more information about DI codes.

Parameter Setting		Code	Function
NC	NO		
0x8000	0x0000	Not assigned	Input not used
0x8001	0x0001	POT	Prohibit forward rotation (CCW limit)
0x8002	0x0002	NOT	Prohibit reverse rotation (CW limit)
0x8003	0x0003	HOME	Origin sensor
0x8004	0x0004	STOP	Stop servo
0x8005	0x0005	PCON	Operate P control
0x8006	0x0006	GAIN2	Switch between Gain1 and Gain2
0x8007	0x0007	P_CL	Forward torque limit
0x8008	0x0008	N_CL	Reverse torque limit
0x800b	0x000b	EMG	Emergency stop
0x800C	0x000C	A_RST	Reset alarm
0x800F	0x000F	SV_ON	Servo on
0x8010	0x0010	START	Start operation
0x8011	0x0011	PAUSE	Pause index
0x8012	0x0012	REGT	Registration input
0x8013	0x0013	HSTART	Start homing
0x8014	0x0014	ISEL0	Selection position 0
0x8015	0x0015	ISEL1	Selection position 1
0x8016	0x0016	ISEL2	Selection position 2
0x8017	0x0017	ISEL3	Selection position 3
0x8018	0x0018	ISEL4	Selection position 4
0x8019	0x0019	ISEL5	Selection position 5
0x801A	0x001A	ABSRQ	Request absolute position data
0x801b	0x001b	JSTART	Operate jog
0x801C	0x001C	JDIR	Select jog rotation direction
0x801d	0x001d	PCLR	Clear input pulse
0x801E	0x001E	AOVR	Select velocity override
0x8020	0x0020	SPD1/LVSF1	Multi-step speed 1 / Vibration control filter 1
0x8021	0x0021	SPD2/LVSF2	Multi-step speed 2 / Vibration control filter 2
0x8022	0x0022	SPD3	Multi-step speed 3
0x8023	0x0023	MODE	Switch operation mode
0x8024	0x0024	EGEAR1	Electric gear 1
0x8025	0x0025	EGEAR2	Electric gear 2
0x8026	0x0026	ABS_RESET	Absolute position reset

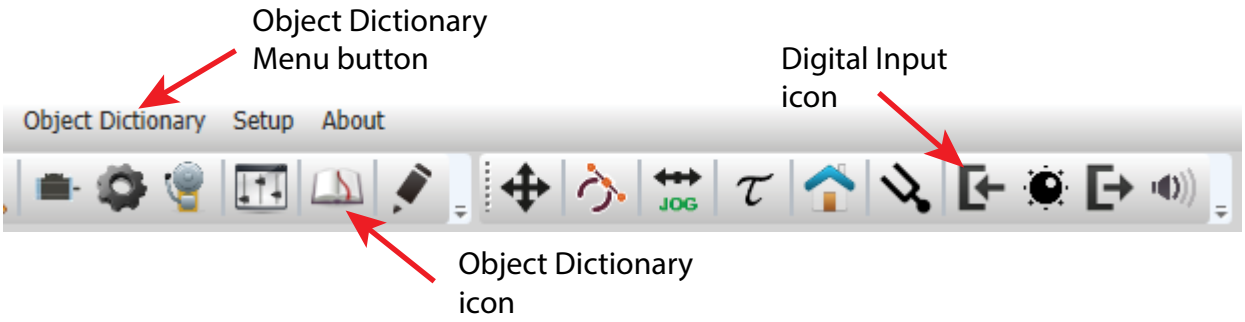


Digital Outputs

Use the following parameters to configure Digital Output functionality or use the Digital Output window in Drive CM directly to make changes. Digital Outputs 1 -5 are configurable. Digital Outputs 6 – 8 not configurable.

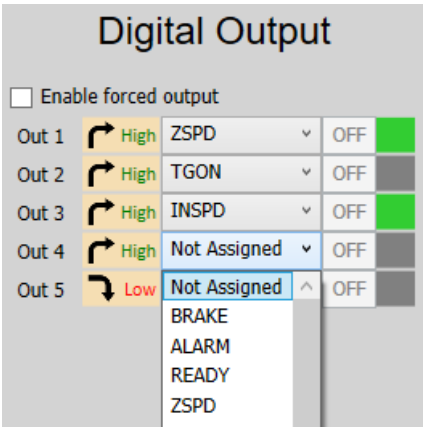
The software provides a very easy way to change the DO functions using the digital output icon (the quickest and easiest method of configuration). Here you can also force the outputs individually by checking the "Enable forced output" check box. Alternatively, you can open the parameter object dictionary using the Object Dictionary menu button or the Object Dictionary icon.

NOTE: When making these changes while the software is connected to the drive the change will take affect immediately, there is no "Are you sure?" warning. Example: Changing an SVON digital input from NO to NC by pressing the "Edge" button will cause the drive to be enabled immediately.



Digital Output Functions

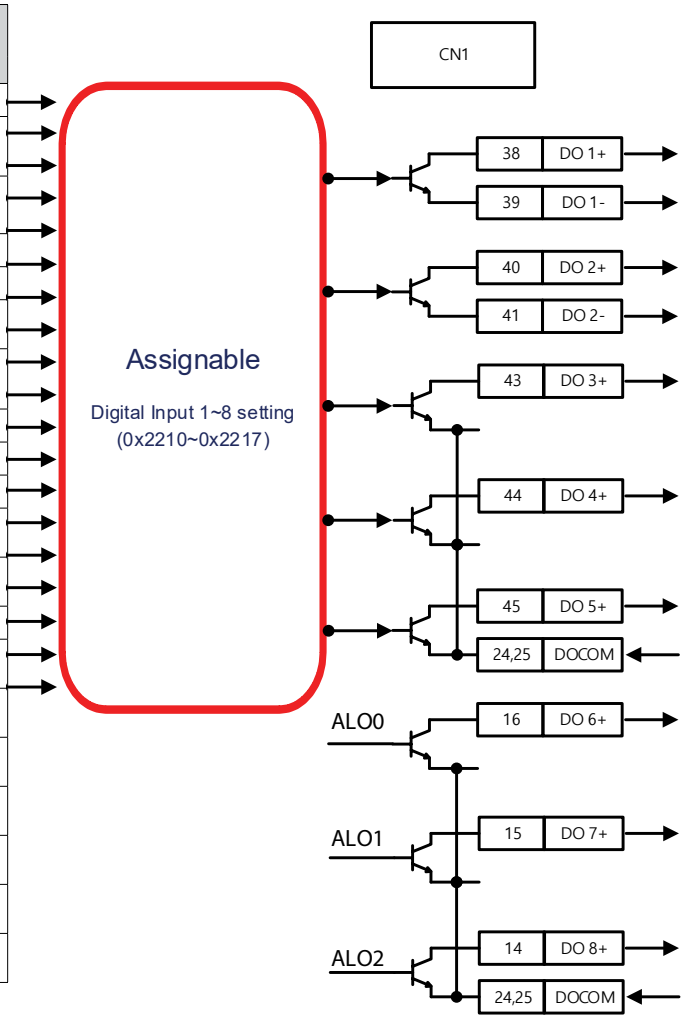
Input	Parameter	Default Function
DO1	0x220A	ALARM
DO2	0x220B	READY
DO3	0x220C	ZSPD
DO4	0x220D	BRAKE
DO5	0x220E	INPOS1
DO6	no config	ALARM 0 (AL-10, hw/w overcurrent)
DO7	no config	ALARM 1 (AL-31, Encoder cable open)
DO8	no config	ALARM 2 (AL-42, Main Power Fail)



Digital Output Codes

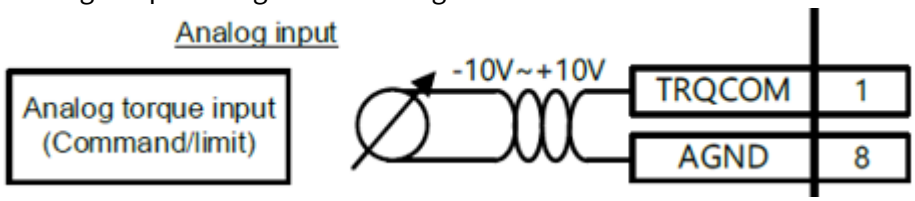
See section 2.5.1 and 10.2 in the user manual for more information about DO codes.

Parameter Setting		Code	Function
NC	NO		
0x8000	0x00	Not assigned	Input not used
0x8001	0x01	BRAKE	Brake- (ON when SVON is off)
0x8002	0x02	ALARM	Servo alarm
0x8003	0x03	RDY	Servo ready
0x8004	0x04	ZSPD	Zero speed reached
0x8005	0x05	INPOS1	Complete position reach 1
0x8006	0x06	TLMT	Limit Torque is enabled
0x8007	0x07	VLMT	Speed Limit is enabled
0x8008	0x08	INSPD	Velocity is reached
0x800b	0x09	WARN	Servo warning
0x800C	0x0A	TGON	Output rotation detection
0x800F	0x0B	INPOS2	Complete position reach 2
0x8010	0x10	ORG	Complete homing
0x8011	0x11	EOS	Complete drive coordinate
0x8012	0x12	IOUT0	Complete drive coordinates 0
0x8013	0x13	IOUT1	Complete drive coordinates 1
0x8014	0x14	IOUT2	Complete drive coordinates 2
0x8015	0x15	IOUT3	Complete drive coordinates 3
0x8016	0x16	IOUT4	Complete drive coordinates 5
0x8017	0x17	IOUT5	Complete drive coordinates 6



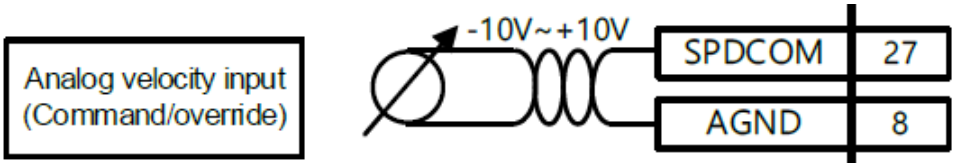
I/O Connection - Analog Torque Input

The L7C drive has an analog -10V -> +10V analog torque signal. This signal can be used as an analog torque command (in Analog Torque Command Mode) or can be used as an analog torque limit in other control modes. Using a FA-DCDC-1 DC-to-DC converter and the ECX2300-10K potentiometer from AutomationDirect is a good option for providing a +10 to -10 volt supply and control signal. See page 54 for Analog Torque configuration settings.



I/O Connection - Analog Velocity Input

The L7C drive has an analog -10V -> +10V analog velocity signal. This signal can be used as an analog velocity command (in Analog Velocity Command Mode) or can be used as an analog velocity override in Index Position mode. Using a FA-DCDC-1 DC-to-DC converter and the ECX2300-10K potentiometer from AutomationDirect is a good option for providing a +10 to -10 volt supply and control signal. See page 46 for Analog Velocity configuration settings.

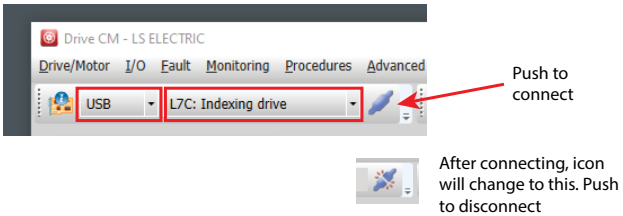
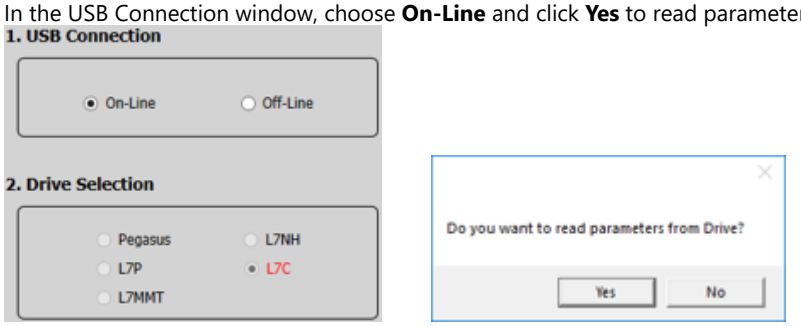


Index Position Mode

Indexing Position Mode using the Setup Wizard for Simple Motion Commissioning

Below is a simple walk through of minimal settings to establish an index application. Other object configuration settings may be required for your specific needs. See the User Manual for details

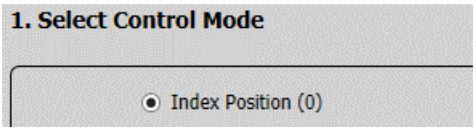
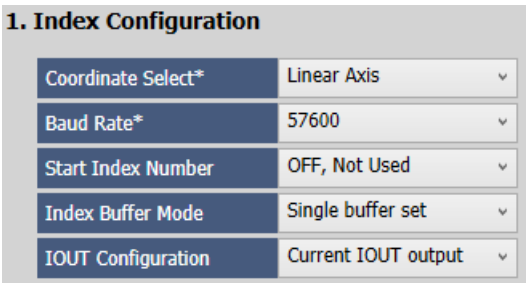
Step 1: Drive Selection

	Substep	Task
Index Mode Step 1	A	Using a standard USB A to USB mini-B cable (such as SV2-PGM-USB15, MOSAIC-CSU, etc.), connect the PC to the Drive.
	B	Start Drive CM software.
	C	Select **L7C: Indexing Drive** and press the **Connect** button. The software should begin to communicate with the drive. A green flashing square should appear in the bottom right corner of the screen indicating comms traffic. 
	D	Click on **Setup Wizard**.
	E	In the USB Connection window, choose **On-Line** and click **Yes** to read parameters from the drive.  If the **On-Line** radio button is not available and greyed out, click on **Setup Wizard** again. This should restart the Setup Wizard and enable the button. Click **On-Line** and **Yes** to read drive parameters.
	F	Click **Next**.

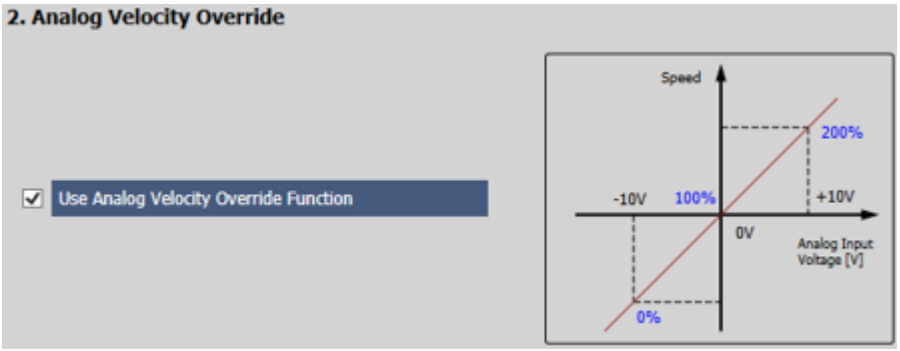
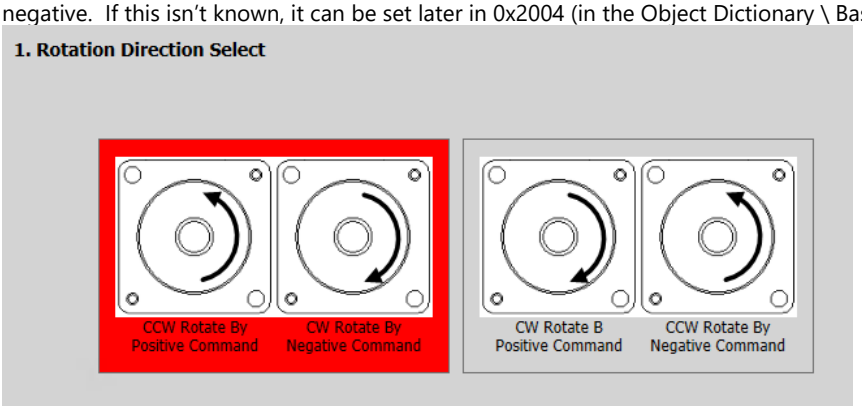
Step 2: Motor/Encoder Selection

	Substep	Task
Index Mode Step 2	A	Select **Auto Setting** for motor selection. 
	B	Click **Next**.

Step 3: Control Mode Selection

	Substep	Task
Index Mode Step 3	A	On the **Select Control Mode** screen, select **Index Position** for Control Mode (Object 0x3000).  Click **Next**.
	B	Select Linear or Rotary axis. **Linear Axis** is selected for this example. (Object 0x3001). 
	C	Set **Baud Rate** (Object 0x3002) as appropriate. This setting does not matter unless you will be communicating RS422/RS485 to the drive from a PLC. Be sure to set the drive's serial address in the **Node ID** parameter 0x2003 (Object Dictionary \ Basic tab). For the most reliable PLC/drive communication, limit the drive baud rate to a maximum of 19,200 baud.
	D	Set **Start Index Number** (Object 0x3008). This allows you to select index numbers 0-63 for which index number will be called when the START signal is applied. Setting this parameter to a value of 64 allows you to use the digital inputs for index selection using a binary pattern (ISEL0~ISEL5). Option 64 is selected for this example.
	E	Set **Index Buffer Mode** (Object 0x3009) allows you to trigger the START signal once or twice. In this example, **Single buffer set** is selected. [AutomationDirect advises using **Single buffer set**]
	F	Set **IOUT Configuration** (Object 0x300A). This determines which binary pattern via digital outputs are represented. If **Current IOUT output** is selected and index 3 is executing, IOUT0 and IOUT1 will be active (binary 3). If **Previous IOUT output** is selected and index 3 is being executed, IOUT0 will be inactive and IOUT1 will be active (binary 2).
	G	Click **Next**.

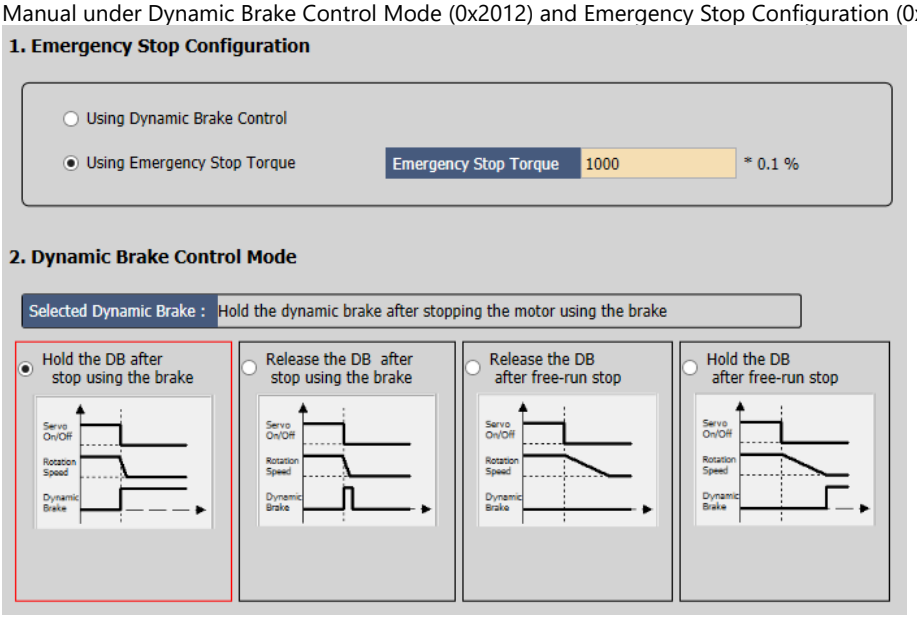
Step 4: Set Analog Velocity Override

	Substep	Task
Index Mode Step 4	A	If it is desired to have a commanded speed slightly adjusted or overridden, then select the **Analog Velocity Override Function** (only available in **Index Mode**). This will allow the -10V to +10V analog velocity input scale to override the commanded velocity 0% to 200%. See Section 4.5 in the User Manual for more details about 0x2215, 0x220F, 0x221E, and 0x221E. 
	B	Click **Next** to set the **Rotation Direction**. This sets which motor direction is considered positive or negative. If this isn't known, it can be set later in 0x2004 (in the Object Dictionary \ Basic tab). 
	C	Click **Next**.

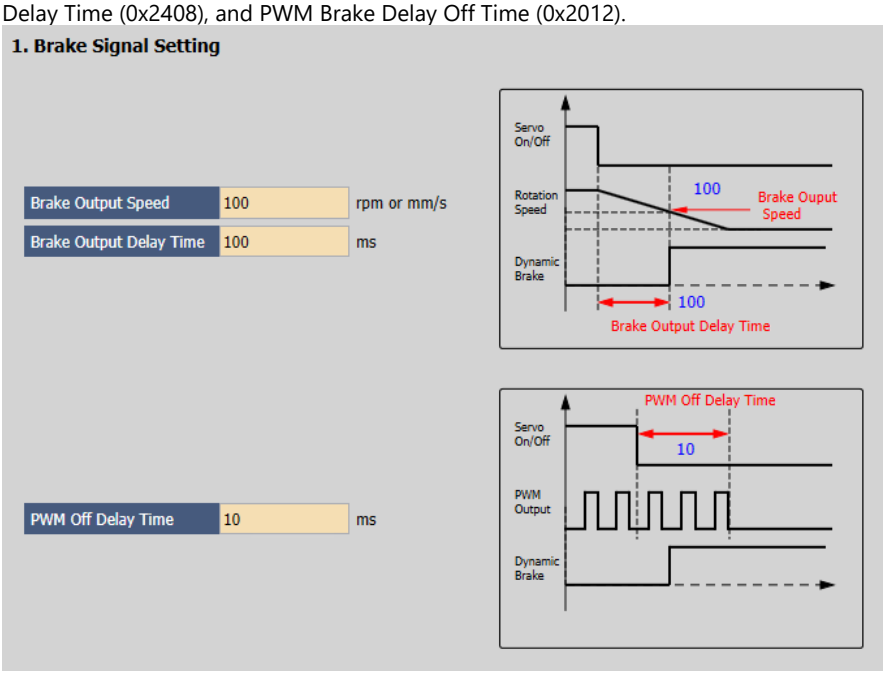
Step 5: Set Electronic Gear Ratio

	Substep	Task
Index Mode Step 5	A	On the Electronic Gear Ratio screen, keep the **Electric Gear Mode** selection set to **Use Electric Gear 1~4**. **1. Electronic Gear Ratio** Electric Gear Mode: Use Electric Gear 1~4 Electric Gear | EGEAR 1 | EGEAR 2 | Numerator Value | Denomiater Value Electric Gear 1 | OFF | OFF | 131072 | 360 Electric Gear 2 | ON | OFF | 1 | 1
	B	If no gear ratios are changed (all numerators and denominators have default values=1), then a position command of 131072 user units (UU) will result in one motor shaft revolution. This is because the LS APMC servo motors that are compatible with the L7C drive and sold by Automation Direct have 17-bit serial encoders (17 bits=131072 pulses/rev). To convert this into an easier number to use for positioning adjust the Electronic Gear ratios in step C.
	C	If desired, set the Electronic Gear ratio so that one motor revolution = 360 user units (360 user units/rev will be used later in the Index example). To do this, set the Electronic Gear numerator to the 17-bit encoder value (encoder pulses per motor rev) and set the denominator to your desired User Units/rev. • Set Electronic Gear Numerator 1 (0x300C) = 131072 (encoder pulses per motor rev) • Set Electronic Gear Denominator 1 (0x3010) = 360 (user units per motor rev) Now all Index positions, speeds, accelerations, and decelerations will be referenced in degrees. $\text{Actual Move Distance} = 720 \text{ user units} \times \frac{131072 \text{ encoder pulses}}{\text{motor rev}} \times \frac{1 \text{ motor rev}}{360 \text{ user units}} = 2 \times 131072 \text{ encoder pulses}$ (which is 2 motor revs) **NOTE:** You will probably want more resolution than 360 user units per motor rev. The basic rule of thumb is: • Set Electronic Gear Numerator 1 = 131072 • Set Electronic Gear Denominator 1 = your desired pulses per motor rev.
	D	[This is located on the same screen with Electronic Gear Ratio] Configure the Encoder Output signal if desired. If the definition isn't known, the Encoder Output can be configured later with Encoder Output Pulse (0x3006) and Encoder Output Mode (0x3007) on the Object Dictionary \ Index tab. **2. Encoder Output Setup** Encoder Output Pulse: 10000 Pulse / Resolution Encoder Output Mode: Line Drive only Encoder Output Logic: Phase A lead
	E	Click **Next**.

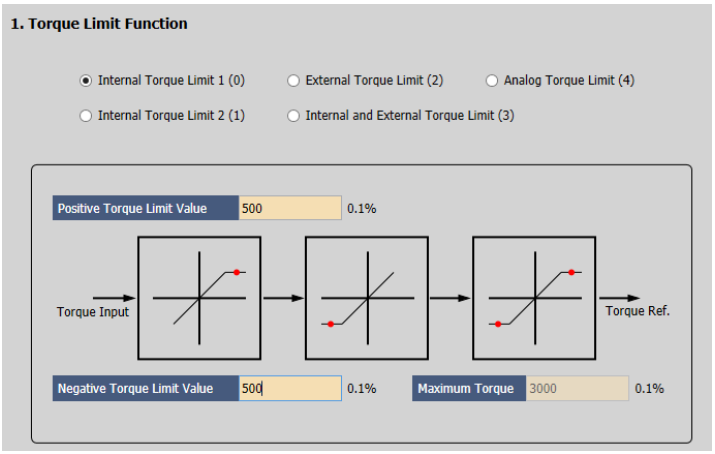
Step 6: Set Emergency Stop and Dynamic Brake Control

	Substep	Task
Index Mode Step 6	A	For initial setup and testing, choose the defaults for these settings on the **Emergency Stop Configuration** and **Dynamic Brake Control Mode** screen. More information can be found in the User Manual under Dynamic Brake Control Mode (0x2012) and Emergency Stop Configuration (0x2013). 
	B	Click **Next**.

Step 7: Set Brake Signal Setting

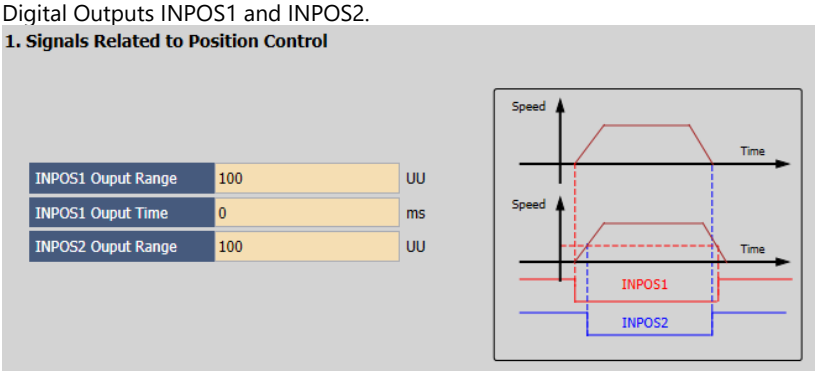
	Substep	Task
Index Mode Step 7	A	For initial setup and testing, choose the defaults for these settings on the **Brake Signal Setting** screen. More information can be found in the User Manual under Brake Output Speed (0x2407), Brake Output Delay Time (0x2408), and PWM Brake Delay Off Time (0x2012). 
	B	Click **Next**.

Step 8: Set the Torque Limit Function

	Substep	Task
Index Mode Step 8	A	Set the **Torque Limit Function**.  Select a method for limiting the torque applied to the load while the motor is trying to attain commanded speed and final position. For initial testing and setup, a value less than max torque is recommended. The above example sets the torque limits to 50% of system **rated** torque. These values can be increased after initial commissioning by adjusting 0x3022 and 0x3023 in the **Object Dictionary \ Index** tab. Default values are 3000 (300%).
	B	Click **Next**.

Option	Description
Internal Torque Limit 1 (0)	• Uses the value of 0x3022 as the Fwd direction torque limit • Uses the value of 0x3023 as the Rev direction torque limit
Internal Torque Limit 2 (1)	Uses a constant 300% of rated motor torque as the Fwd and Rev torque limits
External Torque Limit (2)	• Uses the value of 0x2111 as the Fwd direction torque limit • Uses the value of 0x2112 as the Rev direction torque limit
Internal and External Torque Limit (3)	• Uses the value of 0x3022 when Digital Input P_CL is on and the value of 0x2111 when Digital Input P_CL is off for the Fwd direction torque limit. • Uses the value of 0x3023 when Digital Input N_CL is on and the value of 0x2112 when Digital Input N_CL is off for the Rev direction torque limit.
Analog Torque Limit (4)	Uses the analog value that is supplied to pin1 of CN1 (TRQCOM)

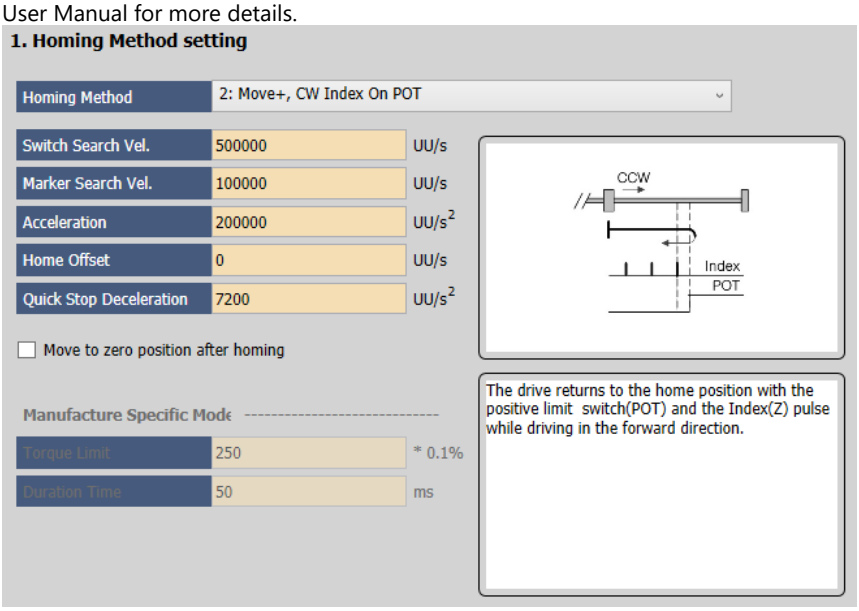
Step 9: Set Signals Related to Position Control

	Substep	Task
Index Mode Step 9	A	Configure the "In Position" signals on the **Signals Related to Position Control** screen if you will use Digital Outputs INPOS1 and INPOS2. 
	B	Click **Next**.

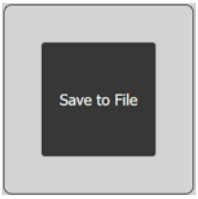
Step 10: Set the I/O Signal Setting

	Substep	Task
Index Mode Step 10	A	Configure Inputs 1 through 7 as shown below on the **Digital Input** screen. Configure additional inputs as needed for your application. **1. Digital Input** Input 1 — Logic: High — Signal: SV_ON Input 2 — Logic: High — Signal: ISEL0 Input 3 — Logic: High — Signal: ISEL1 Input 4 — Logic: High — Signal: START Input 5 — Logic: High — Signal: STOP Input 6 — Logic: High — Signal: P_CL Input 7 — Logic: High — Signal: N_CL Below is a binary map of how the Index Select digital inputs can select any of 0–63 indexes using ISEL0 through ISEL5. ISEL Input Signal Index No: ISEL5 ISEL4 ISEL3 ISEL2 ISEL1 ISEL0 0: X X X X X X 1: X X X X X O 2: X X X X O X 3: X X X X O O 4: X X X O X X … 60: O O O O X X 61: O O O O X O 62: O O O O O X 63: O O O O O O
	B	Click **Next** to Go to **Digital Output** in the Setup Wizard.
	C	Configure Outputs 1 through 3 as shown below. Configure additional outputs as needed for your application. The IOUT outputs will signal the Index that is currently in operation (in binary code). Output 1 — Logic: High — Signal: IOUT0 Output 2 — Logic: High — Signal: IOUT1 Output 3 — Logic: High — Signal: IOUT2
	D	Click **Next**.

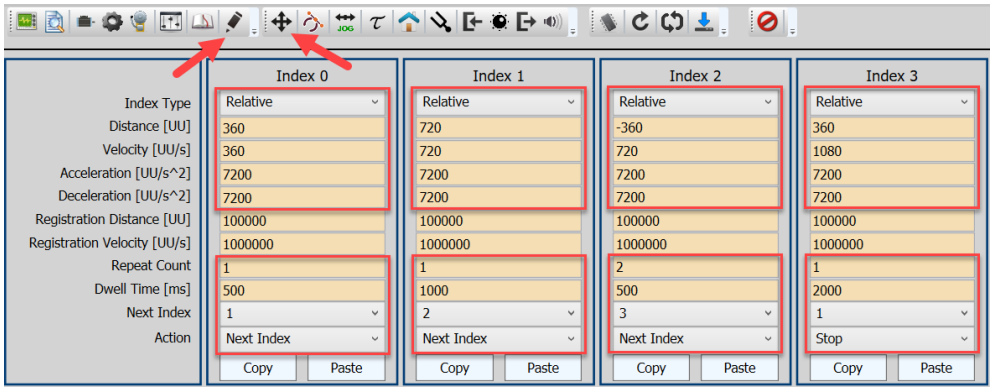
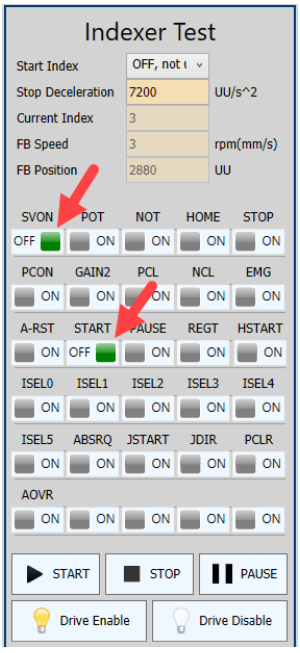
Step 11: Set Homing Method Setting

	Substep	Task
Index Mode Step 11	A	On the **Homing Method Setting** screen, select the Homing method appropriate for your application. For initial setup and testing, choose the defaults for these settings. Refer to Chapter 9 Homing in the User Manual for more details. 
	B	Click **Next**.

Step 12: Save Your Configuration

	Substep	Task
Index Mode Step 12	A	Select **Save to File** to save the Setup Wizard configuration file to your PC. **Note:** The Setup Wizard configuration "save" is distinct from both the Objection Dictionary configuration "save" and the Index Configuration "save". 
	B	Select **Write to Drive** to download the configuration to the drive. The drive **MUST NOT** be enabled during download. The software will not acknowledge that certain parameters were not changed, so ensure that the drive is not enabled before pressing **Write to Drive**. This **Write to Drive** button also saves the settings to memory. 
	C	After download is complete either power cycle the drive (ensuring the LED display turns off) or click on the **Software Reset** icon in the upper toolbar. 

Step 13: Open Index Edit and Index Test Windows

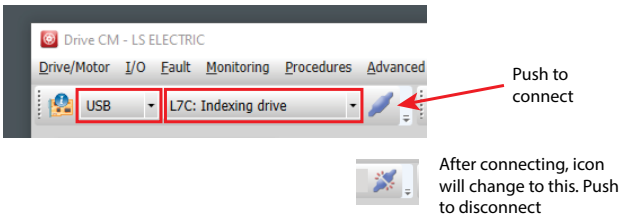
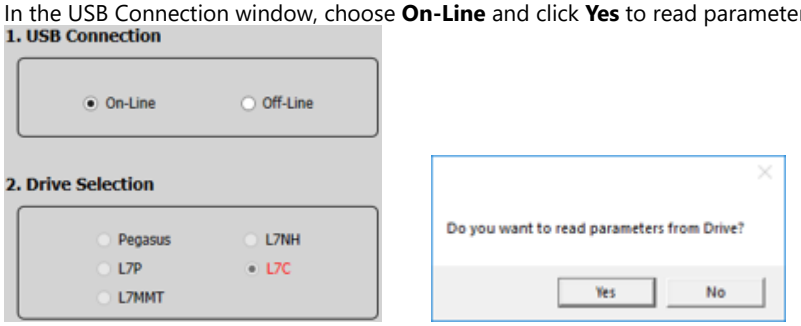
	Substep	Task
Index Mode Step 13	A	Click the **Index Edit** button on the Drive CM toolbar. 
	B	Configure Index 0, Index 1, Index 2, and Index 3 per the image below:  After each entry the text will turn red indicating it has not been downloaded to the drive. Press the **Enter** key after typing a new value to write this value to the drive. The value will turn black indicating it has been downloaded. This will only push the value to the drive's RAM (volatile memory). You must still press the **Save Index to EEPROM** button for the settings to survive a power cycle.
	C	Click the **Indexer Test** button on the toolbar.  The Indexer Test window will open. 
	D	Switch **SVON** [DI1] to **ON**.
	E	Switch **START** [DI3] to **ON**. Sometimes the START button must be pressed twice to initiate an index when using Drive CM software control.
	F	Index 0 will begin executing if all ISELx digital inputs are off and Start Index is set to OFF (64). See Step 3C for more information about Start Index and how to use the DIs to select the active index. As the drive cycles through the index moves you can monitor the current index number in the **Index Tester** window (Current Index) or by viewing the status of IOUT0 through IOUT2
	G	Index 2 will execute twice (because Repeat Count = 2) and after Index 3 is complete the Index sequence will stop (because Action = Stop). Index Position Mode Commissioning is now complete.

Pulse Input Position Mode

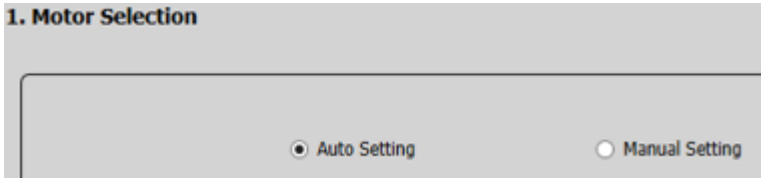
Pulse Input Position Mode Using the Setup Wizard for Simple Motion Commissioning

Below is a simple walkthrough of minimal settings to establish a pulse input controlled application. Other object configuration settings may be required for your specific needs. See the User Manual for details

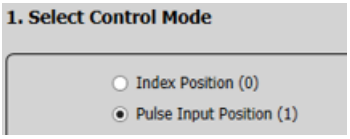
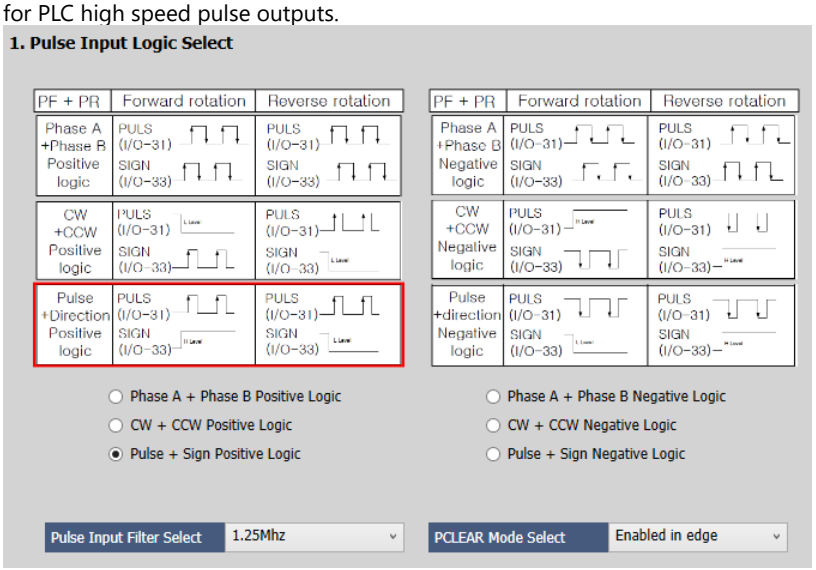
Step 1: Drive Selection

	Substep	Task
Pulse Mode Step 1	A	Using a standard USB A to USB mini-B cable (such as SV2-PGM-USB15, MOSAIC-CSU, etc.), connect the PC to the Drive.
	B	Start Drive CM software.
	C	Select **L7C: Indexing Drive** and press the **Connect** button. The software should begin to communicate with the drive. A green flashing square should appear in the bottom right corner of the screen indicating comms traffic. 
	D	Click on **Setup Wizard**.
	E	In the USB Connection window, choose **On-Line** and click **Yes** to read parameters from the drive.  If the **On-Line** radio button is not available and greyed out, click on **Setup Wizard** again. This should restart the Setup Wizard and enable the button. Click **On-Line** and **Yes** to read drive parameters.
	F	Click **Next**.

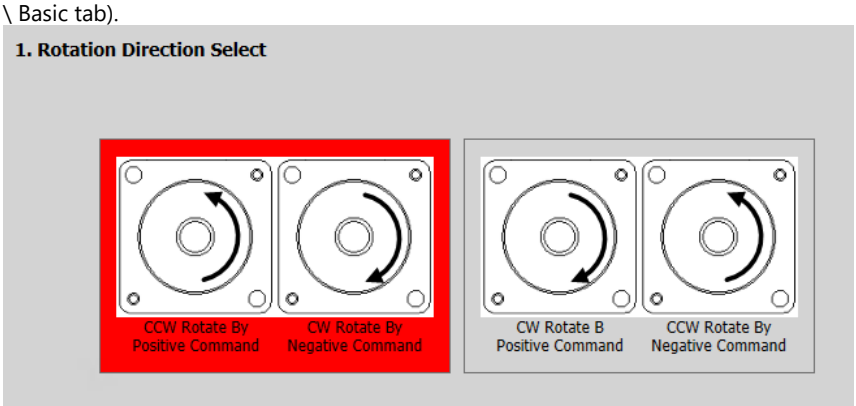
Step 2: Motor/Encoder Selection

	Substep	Task
Pulse Mode Step 2	A	Select **Auto Setting** for motor selection. 
	B	Click **Next**.

Step 3: Control Mode Selection

	Substep	Task
Pulse Mode Step 3	A	On the **Select Control Mode** screen, select **Pulse Input Position (1)** for Control Mode (Object 0x3000).  Click **Next**.
	B	On the **Pulse Input Logic Select** screen, select the type of pulse train you want to use from the host controller or PLC. **Pulse + Sign Positive Logic** is selected in the image below. This is the typical setting for PLC high speed pulse outputs.  For the L7C drive CN1 connector, the pulse inputs terminate as follows: • Pulse (or CW) signal will terminate to pin 9 PF+ (A5) and pin 10 PF- (B5) • Sign (or CCW) signal will terminate to pin 11 PR+ (A6) and pin 12 PR- (B6) See section 2.5.6 of the User Manual for more details (and how to connect Open Collector high speed pulses). **Note:** The pin numbers in the image in the software are for a different LS Electric drive. Be sure to use pins 9, 10, 11, and 12.
	C	For Pulse Input Filter Select and PCLEAR Mode Select, use the default settings for initial setup/testing.
	D	Click **Next**.

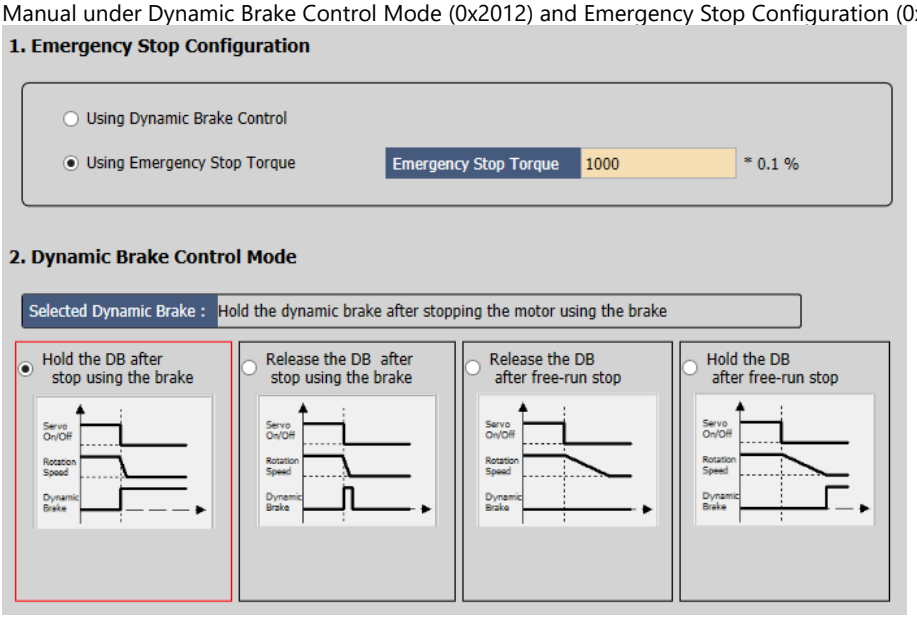
Step 4: Set Rotation Direction

	Substep	Task
Pulse Mode Step 4	A	Set rotation direction on the **Rotation Direction Select** screen. This sets which motor direction is considered positive or negative. If this isn't known, it can be set later in 0x2004 (in the Object Dictionary \ Basic tab). 
	B	Click **Next**.

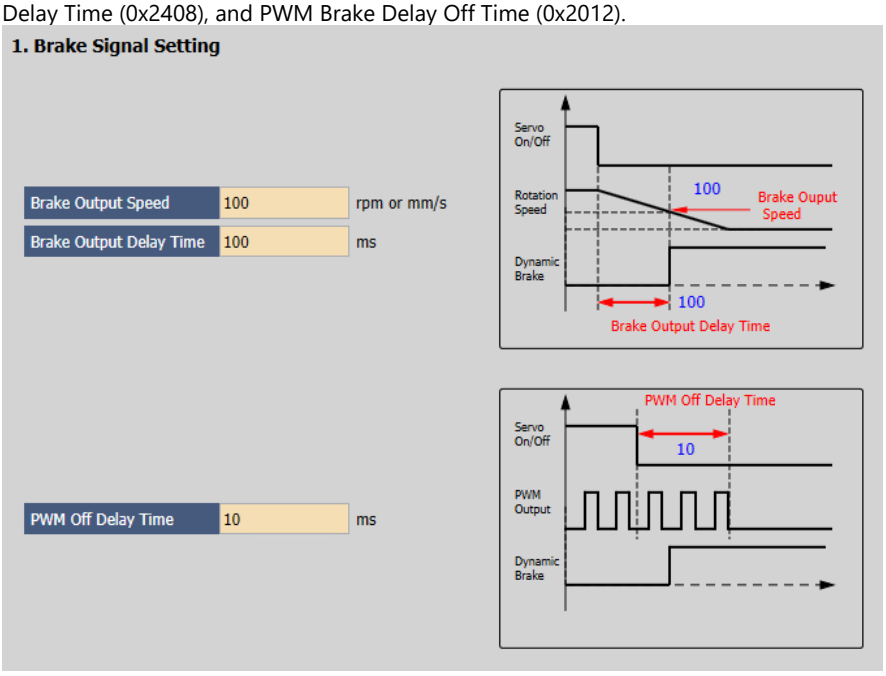
Step 5: Set Electronic Gear Ratio

	Substep	Task
Pulse Mode Step 5	A	On the **Electronic Gear Ratio** screen, keep the **Electric Gear Mode** selection set to **Use Electric Gear 1~4**. Pulse Input Position Mode can use all four Electronic Gear Ratios as Index Mode will only use ratio 1. Assigning EGEAR1 and EGEAR2 to any digital inputs will result in an immediate change in Electric Gear 1, 2, 3, or 4 when selected using a binary pattern **1. Electronic Gear Ratio** Electric Gear Mode: Use Electric Gear 1~4 Electric Gear 1: EGEAR 1 OFF, EGEAR 2 OFF, Numerator Value 131072, Denomiater Value 100000 Electric Gear 2: EGEAR 1 ON, EGEAR 2 OFF, Numerator Value 131072, Denomiater Value 50000 Electric Gear 3: EGEAR 1 OFF, EGEAR 2 ON, Numerator Value 131072, Denomiater Value 200000
	B	Set the desired gear ratio for Electric Gear 1, 2, 3, and/or 4. If no gear ratios are changed (all numerators and denominators have default values=1), then a position command of 131072 user units (UU) will result in one motor shaft revolution. This is because the LS APMC servo motors sold by Automation Direct have 17 bit serial encoders (17 bits=131072 pulses/rev). To convert this into an easier number to use for positioning adjust the Electronic Gear ratios in step C.
	C	If desired, set the Electronic Gear ratio so that one motor revolution = 360 user units (360 user units/rev will be used later in the Index example). To do this, set the Electronic Gear numerator to the 17-bit encoder value (encoder pulses per motor rev) and set the denominator to your desired User Units/rev. • Set Electronic Gear Numerator 1 (0x300C) = 131072 (encoder pulses per motor rev) • Set Electronic Gear Denominator 1 (0x3010) = 360 (user units per motor rev) Now all Index positions, speeds, accelerations, and decelerations will be referenced in degrees. $\text{Actual Move Distance} = 720 \text{ user units} \times \frac{131072 \text{ encoder pulses}}{\text{motor rev}} \times \frac{1 \text{ motor rev}}{360 \text{ user units}} = 2 \times 131072 \text{ encoder pulses (which is 2 motor revs)}$ **NOTE:** You will probably want more resolution than 360 user units per motor rev. The basic rule of thumb is: • Set Electronic Gear Numerator 1 = 131072 • Set Electronic Gear Denominator 1 = your desired pulses per motor rev.
	D	[This is located on the same screen with Electronic Gear Ratio] Configure the Encoder Output signal if desired. If the definition isn't known, the Encoder Output can be configured later with Encoder Output Pulse (0x3006) and Encoder Output Mode (0x3007) on the Object Dictionary \ Index tab. Be sure to select the "Line Drive Only" option for Encoder Output mode. **2. Encoder Output Setup** Encoder Output Pulse: 10000 Pulse / Resolution Encoder Output Mode: Line Drive only Encoder Output Logic: Phase A lead
	E	Click **Next**.

Step 6: Set Emergency Stop and Dynamic Brake Control

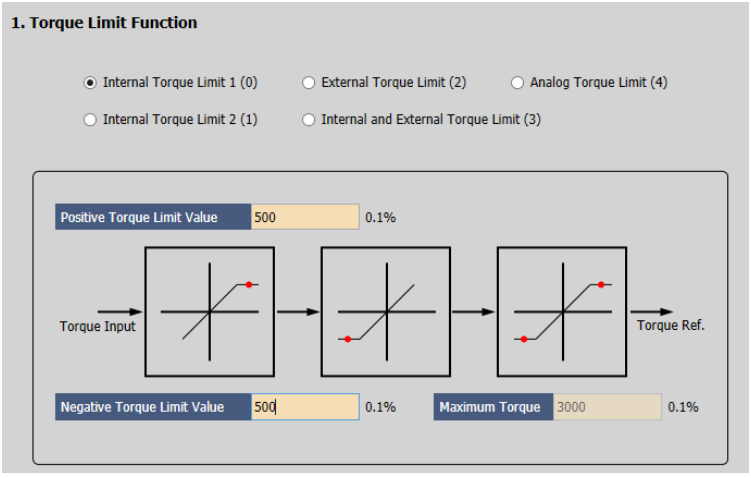
	Substep	Task
Pulse Mode Step 6	A	For initial setup and testing, choose the defaults for these settings on the **Emergency Stop Configuration** and **Dynamic Brake Control Mode** screen. More information can be found in the User Manual under Dynamic Brake Control Mode (0x2012) and Emergency Stop Configuration (0x2013). 
	B	Click **Next**.

Step 7: Set Brake Signal Setting

	Substep	Task
Pulse Mode Step 7	A	For initial setup and testing, choose the defaults for these settings on the **Brake Signal Setting** screen. More information can be found in the User Manual under Brake Output Speed (0x2407), Brake Output Delay Time (0x2408), and PWM Brake Delay Off Time (0x2012). 
	B	Click **Next**.

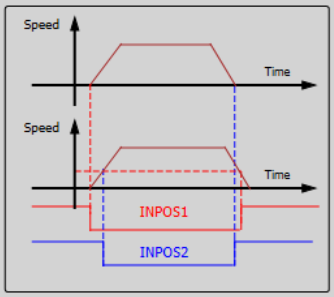
Step 8: Set Torque Limit Function

Pulse Mode Step 8

Substep	Task
A	Set the **Torque Limit Function**.  Select a method for limiting the torque applied to the load while the motor is trying to attain commanded speed and final position. For initial testing and setup, a value less than max torque is recommended. The above example sets the torque limits to 50% of system **rated** torque. These values can be increased after initial commissioning by adjusting 0x3022 and 0x3023 in the **Object Dictionary \ Index** tab. Default values are 3000 (300%).
B	Click **Next**.

Option	Description
Internal Torque Limit 1 (0)	• Uses the value of 0x3022 as the Fwd direction torque limit • Uses the value of 0x3023 as the Rev direction torque limit
Internal Torque Limit 2 (1)	Uses a constant 300% of rated motor torque as the Fwd and Rev torque limits
External Torque Limit (2)	• Uses the value of 0x2111 as the Fwd direction torque limit • Uses the value of 0x2112 as the Rev direction torque limit
Internal and External Torque Limit (3)	• Uses the value of 0x3022 when Digital Input P_CL is on and the value of 0x2111 when Digital Input P_CL is off for the Fwd direction torque limit. • Uses the value of 0x3023 when Digital Input N_CL is on and the value of 0x2112 when Digital Input N_CL is off for the Rev direction torque limit.
Analog Torque Limit (4)	Uses the analog value that is supplied to pin1 of CN1 (TRQCOM)

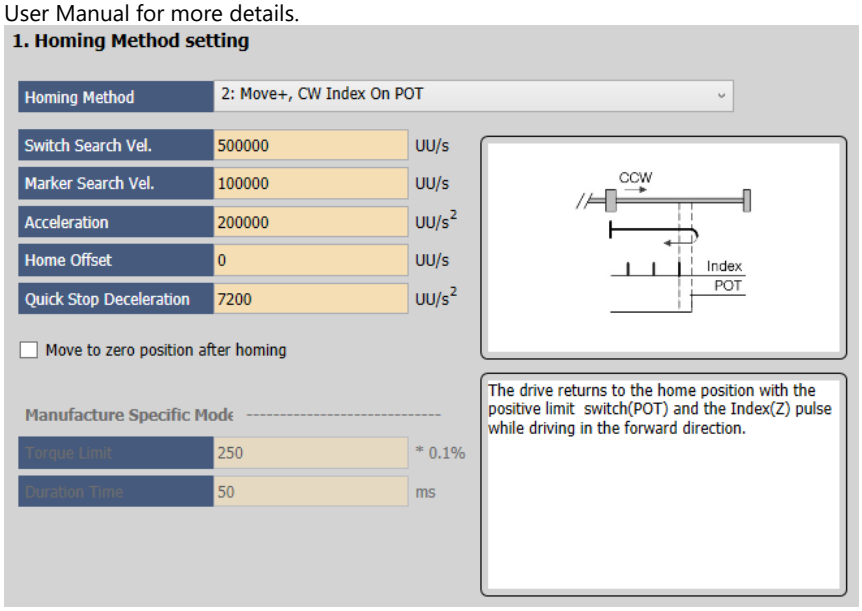
Step 9: Set Signals Related to Position Control

	Substep	Task
Pulse Mode Step 9	A	On the **Signals Related to Position Control** screen, configure the "In Position" signals if you will use Digital Outputs INPOS1 and INPOS2. **1. Signals Related to Position Control** INPOS1 Ouput Range: 100 UU INPOS1 Ouput Time: 0 ms INPOS2 Ouput Range: 100 UU 
	B	Click **Next**.

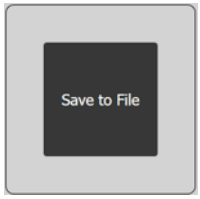
Step 10: Set the I/O Signal Setting

	Substep	Task
Pulse Mode Step 10	A	On the **Digital Input** screen, configure Inputs 1 through 5 as shown below. Configure additional inputs as needed for your application. Ensure that there are no two digital inputs with the same function assignment or else the function will not work correctly. **1. Digital Input** Input 1: High — SV_ON Input 2: High — INHIB Input 3: High — EGEAR1 Input 4: High — EGEAR2 Input 5: Low — EMG
	B	Click **Next** to go to **Digital Output** in the Setup Wizard.
	C	Configure Outputs 1 through 3 as shown below. Configure additional outputs as needed for your application. Output 1: High — READY Output 2: High — WARN Output 3: High — ALARM
	D	Click **Next**.

Step 11: Set Homing Method Setting

	Substep	Task
Pulse Mode Step 11	A	On the **Homing Method Setting** screen, select the Homing method appropriate for your application. For initial setup and testing, choose the defaults for these settings. Refer to Chapter 9 Homing in the User Manual for more details. 
	B	Click **Next**.

Step 12: Save Your Configuration

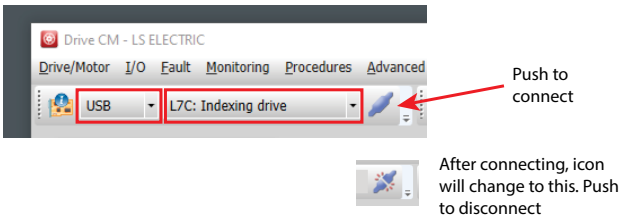
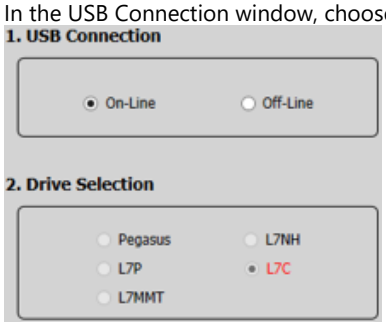
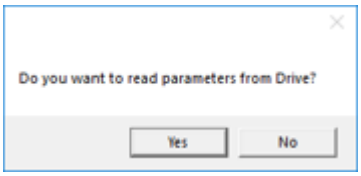
	Substep	Task
Pulse Mode Step 12	A	Select **Save to File** to save the configuration file to your PC. 
	B	Select **Write to Drive** to download the configuration to the drive. The drive **MUST NOT** be enabled during download. The software will not acknowledge that certain parameters were not changed, so ensure that the drive is not enabled before pressing **Write to Drive**. This **Write to Drive** button also saves the settings to memory. 
	C	After download is complete either power cycle the drive (ensuring the LED display turns off) or click on the **Software Reset** icon in the upper toolbar. 
	D	Pulse Input Position Mode Commissioning is now complete.

Velocity Mode

Velocity Mode (Speed Command) using the Setup Wizard for Simple Motion Commissioning

Below is a simple walk through of minimal settings to establish a speed application with a variable torque limit. Other object configuration settings may be required for your specific needs. See the user manual section 10.4 for details. The example below will allow the application to select between 8 preset speeds (saved in the drive) and/or the analog speed input. The changes are made by toggling 3 digital inputs: SPD1, SPD2, SPD3

Step 1: Drive Selection

	Substep	Task
Velocity Mode Step 1	A	Using a standard USB A to USB mini-B cable (such as SV2-PGM-USB15, MOSAIC-CSU, etc.), connect the PC to the Drive.
	B	Start Drive CM software.
	C	Select **L7C: Indexing Drive** and press the **Connect** button. The software should begin to communicate with the drive. A green flashing square should appear in the bottom right corner of the screen indicating comms traffic. 
	D	Click on **Setup Wizard**.
	E	In the USB Connection window, choose **On-Line** and click **Yes** to read parameters from the drive.   If the **On-Line** radio button is not available and greyed out, click on **Setup Wizard** again. This should restart the Setup Wizard and enable the button. Click **On-Line** and **Yes** to read drive parameters.
	F	Click **Next**.

Step 2: Motor/Encoder Selection

	Substep	Task
Velocity Mode Step 2	A	Select **Auto Setting** for motor selection. 
	B	Click **Next**.

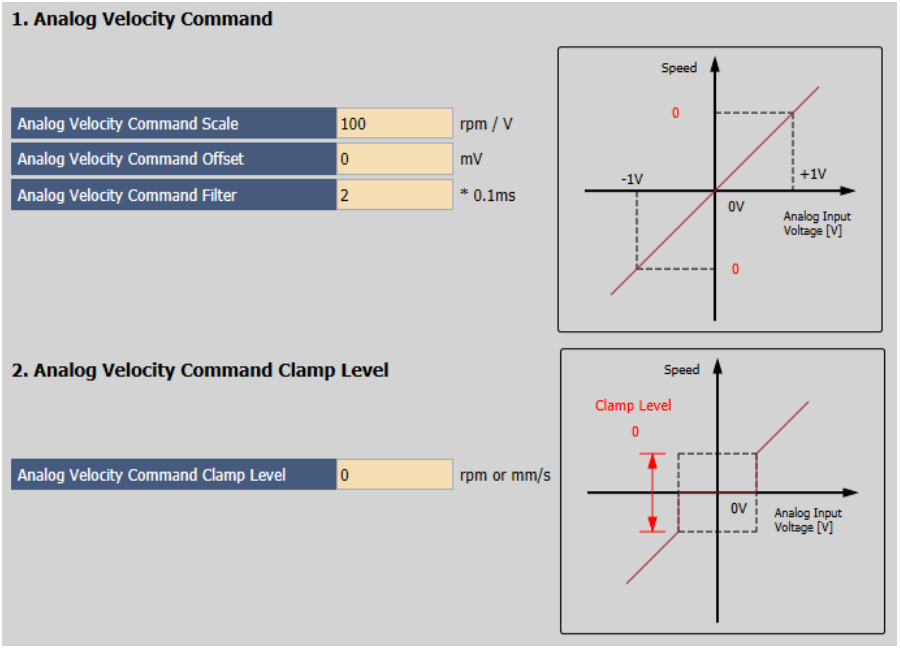
Step 3: Control Mode Selection

Velocity Mode Step 3

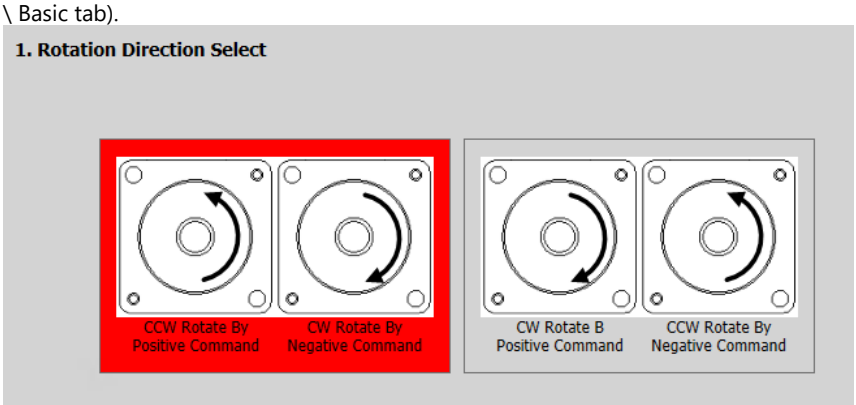
Substep	Task
A	On the **Select Control Mode** screen, select **Velocity (2)** for Control Mode (Object 0x3000). **1. Select Control Mode** ○ Index Position (0) ○ Pulse Input Position (1) ◉ Velocity (2) Click **Next**.
B	On the **Velocity Command Switch Select** screen, select the desired velocity command. In the example below, **Analog Velocity/SPD1, SPD2, SPD3 Input (2)** (Object 0x231A) is selected. This will allow you to have seven predefined speeds selectable via DI and one analog input for variable speed control. **1. Velocity Command Switch Select** ○ Analog Velocity (0) ◉ Analog Velocity / SPD 1,2,3 Input (2) ○ Analog Velocity / SPD 1,2 Input (1) ○ SPD 1,2,3 Input (3) **2. Multi-Step Operation Speed** Multi-Step Operation Speed 1: 0 rpm or mm/s Multi-Step Operation Speed 2: 5 rpm or mm/s Multi-Step Operation Speed 3: 10 rpm or mm/s Multi-Step Operation Speed 4: 20 rpm or mm/s Multi-Step Operation Speed 5: 40 rpm or mm/s Multi-Step Operation Speed 6: 80 rpm or mm/s Multi-Step Operation Speed 7: 150 rpm or mm/s Multi-Step Operation Speed 8: 300 rpm or mm/s **Note:** *If SPD 1,2,3 Input (3) is selected, after completing the Setup Wizard manually set 0x231A in the Object Dictionary to a value of 3. The Setup Wizard correctly populates values 0–2, but does not currently write a value of 3.*
C	Enter the desired values for the speed registers. Speed register 1 is recommended to be 0 so there is at least one consistent 0 speed command with holding torque. See the table below for the relationship between SPD1, SPD2, SPD3, Analog Input SPDCOM, and the command velocity.
D	Click **Next**.

Setting Values	Setting Details	SPD1	SPD2	SPD3	Speed Command
0	Use analog velocity commands.	n/a	n/a	n/a	Analog Input
1	Use SPD1, SPD2 contact and analog velocity commands.	OFF	OFF	n/a	Speed 1 - 0x2312
		ON	OFF	n/a	Speed 2 - 0x2313
		OFF	ON	n/a	Speed 3 - 0x2314
		ON	ON	n/a	Analog input
2	Use SPD1, SPD2, and SPD3 contact and analog velocity commands.	OFF	OFF	OFF	0x2312
		ON	OFF	OFF	0x2313
		OFF	ON	OFF	0x2314
		ON	ON	OFF	0x2315
		OFF	OFF	ON	0x2316
		ON	OFF	ON	0x2317
		OFF	ON	ON	0x2318
		ON	ON	ON	Analog input
3	Use velocity commands for SPD1, SPD2, and SPD3 contact.	OFF	OFF	OFF	0x2312
		ON	OFF	OFF	0x2313
		OFF	ON	OFF	0x2314
		ON	ON	OFF	0x2315
		OFF	OFF	ON	0x2316
		ON	OFF	ON	0x2317
		OFF	ON	ON	0x2318
		ON	ON	ON	0x2319

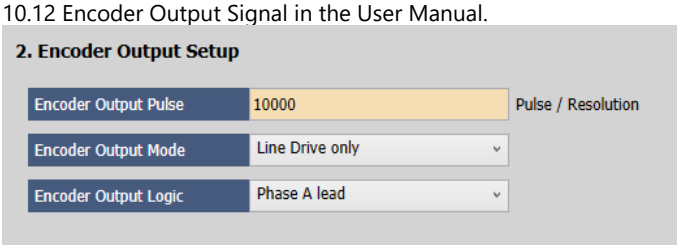
Step 4: Set Analog Velocity Command and Clamp Level

	Substep	Task
Velocity Mode Step 4	A	Set the **Analog Velocity Command Scale** (Object 0x2214). The analog signal is set for +/-10V = +/-1000rpm (100rpm/V x 10V). For initial testing and setup, leave these settings at default values. If your application needs different scaling, adjust these settings. For more information, see 0x2214 - 0x2217 in the User Manual. 
	C	Set the **Analog Velocity Command Clamp Level** (Object 0x2216). This is the same as a deadband. The value entered here will cause the shaft speed to remain at 0 RPMs until the analog speed command is above 20 RPMs.
	D	Click **Next**.

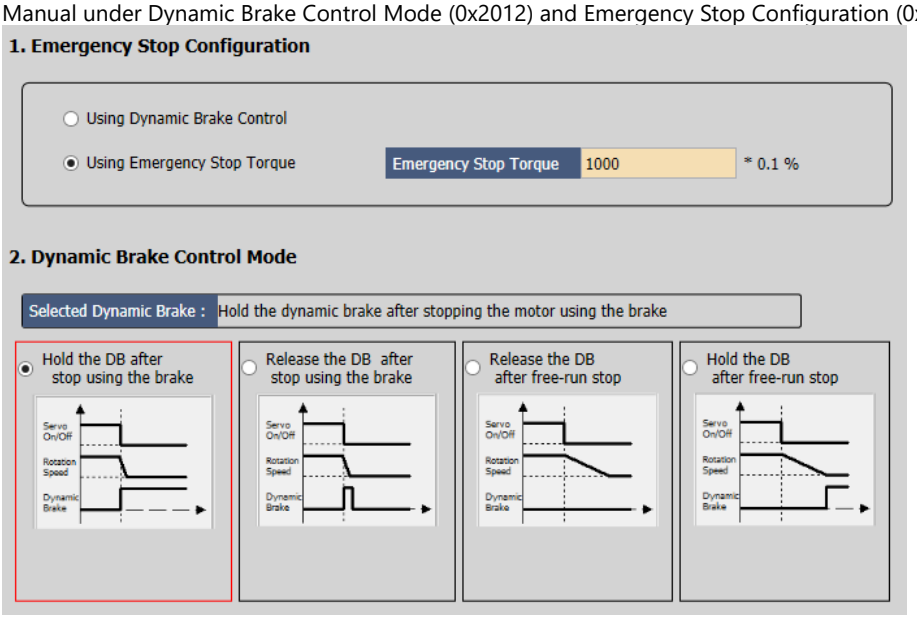
Step 5: Set Rotation Direction

	Substep	Task
Velocity Mode Step 5	A	Set rotation direction on the **Rotation Direction Select** screen. This sets which motor direction is considered positive or negative. If this isn't known, it can be set later in 0x2004 (in the Object Dictionary \ Basic tab). 
	B	Click **Next**.

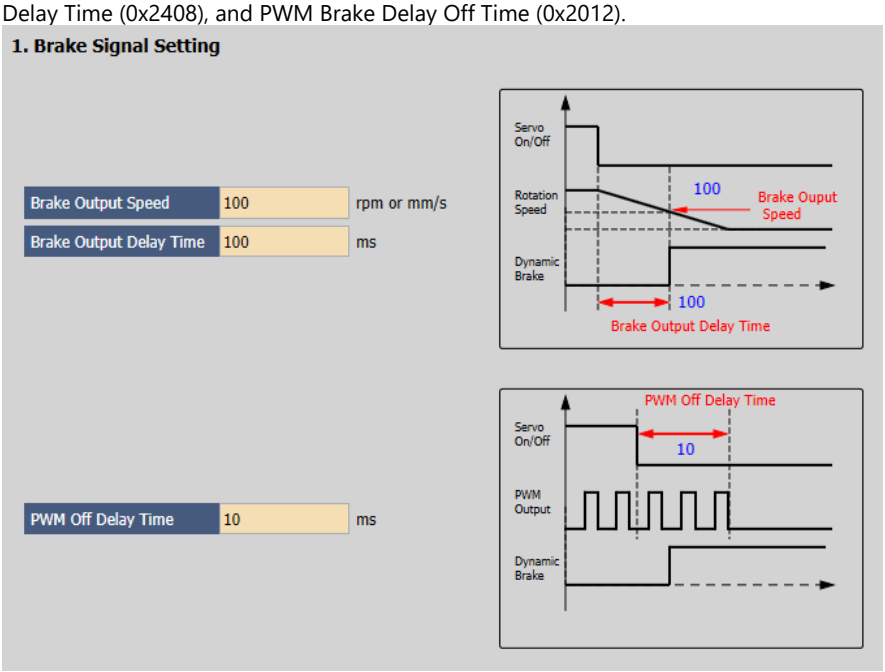
Step 6: Set Electronic Gear Ratio

	Substep	Task
Velocity Mode Step 6	A	Leave the Electronic Gear Ratio settings at default values. They have no affect on Velocity Mode.
	B	If your application will use the Encoder Output, enter the desired pulses per revolution and Output Mode/Logic. For initial test and setup, leave these settings at default. For more information, see section 10.12 Encoder Output Signal in the User Manual. 
	C	Click **Next**.

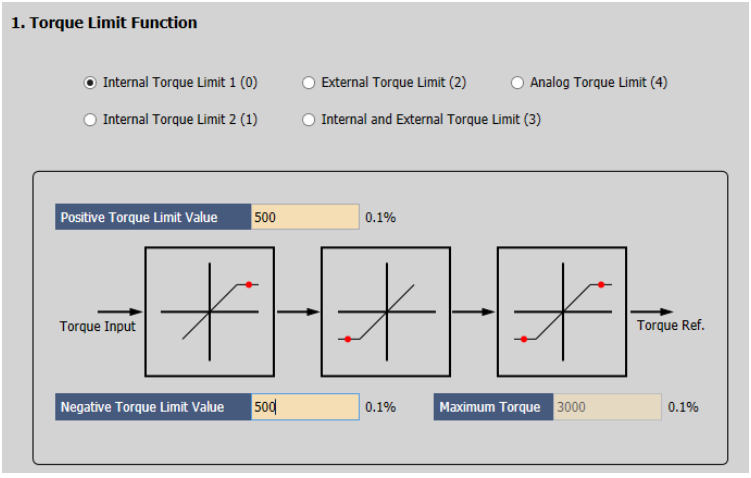
Step 7: Set Emergency Stop and Dynamic Brake Control

	Substep	Task
Velocity Mode Step 7	A	For initial setup and testing, choose the defaults for these settings on the **Emergency Stop Configuration** and **Dynamic Brake Control Mode** screen. More information can be found in the User Manual under Dynamic Brake Control Mode (0x2012) and Emergency Stop Configuration (0x2013). 
	B	Click **Next**.

Step 8: Set Brake Signal Setting

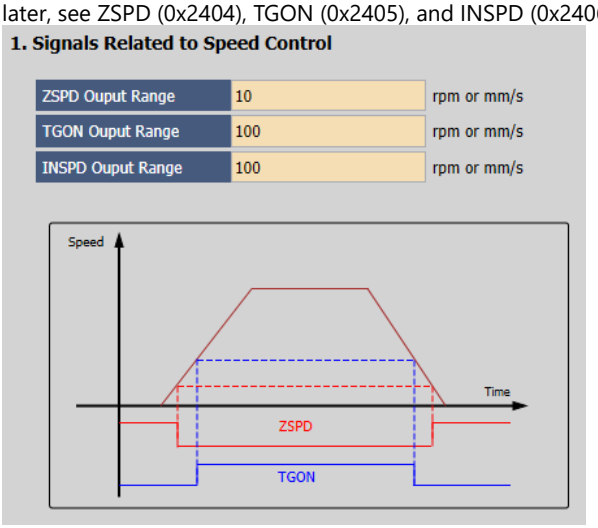
	Substep	Task
Velocity Mode Step 8	A	For initial setup and testing, choose the defaults for these settings on the **Brake Signal Setting** screen. More information can be found in the User Manual under Brake Output Speed (0x2407), Brake Output Delay Time (0x2408), and PWM Brake Delay Off Time (0x2012). 
	B	Click **Next**.

Step 9: Set Torque Limit Function

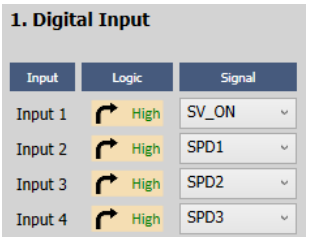
	Substep	Task
Velocity Mode Step 9	A	Set the **Torque Limit Function**.  Select a method for limiting the torque applied to the load while the motor is trying to attain commanded speed. For initial testing and setup, a value less than max torque is recommended. The above example sets the torque limits to 50% of system rated torque. These values can be increased after initial commissioning by adjusting 0x3022 and 0x3023 in the Object Dictionary \ Index tab. Default values are 3000 (300%).
	B	Click **Next**.

Option	*Description*
Internal Torque Limit 1 (0)	• Uses the value of 0x3022 as the Fwd direction torque limit • Uses the value of 0x3023 as the Rev direction torque limit
Internal Torque Limit 2 (1)	Uses a constant 300% of rated motor torque as the Fwd and Rev torque limits
External Torque Limit (2)	• Uses the value of 0x2111 as the Fwd direction torque limit • Uses the value of 0x2112 as the Rev direction torque limit
Internal and External Torque Limit (3)	• Uses the value of 0x3022 when Digital Input P_CL is on and the value of 0x2111 when Digital Input P_CL is off for the Fwd direction torque limit. • Uses the value of 0x3023 when Digital Input N_CL is on and the value of 0x2112 when Digital Input N_CL is off for the Rev direction torque limit.
Analog Torque Limit (4)	Uses the analog value that is supplied to pin1 of CN1 (TRQCOM)

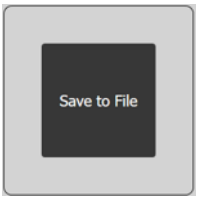
Step 10: Set Signals Related to Speed Control

	Substep	Task
Velocity Mode Step 10	A	On the **Signals Related to Speed Control** screen, configure the speed output ranges that will trigger the digital outputs ZSPD, TGON, and INSPD. For initial testing and setup, these can be left as default. For more information, see section 10.4.4 Velocity Control Signals in the User Manual. To adjust these values later, see ZSPD (0x2404), TGON (0x2405), and INSPD (0x2406) in the Object Dictionary \ Misc. tab. 
	B	Click **Next**.

Step 11: Set the I/O Signal Setting

	Substep	Task
Velocity Mode Step 11	A	On the **Digital Input** screen, configure Inputs 1 through 4 as shown below. Configure additional inputs and outputs as needed for your application. 
	B	Click **Next** to configure Digital Outputs. For initial setup and testing, these values can be left at defaults. For more information, see Section 2.5.1 Names and Functions of Digital Input/Output Signals in the User Manual.
	C	Click **Next**.

Step 12: Save Your Configuration

Velocity Mode Step 12	Substep	Task
	A	Select **Save to File** to save the configuration file to your PC. 
	B	Select **Write to Drive** to download the configuration to the drive. The drive **MUST NOT** be enabled during download. The software will not acknowledge that certain parameters were not changed, so ensure that the drive is not enabled before pressing **Write to Drive**. This **Write to Drive** button also saves the settings to memory. 
	C	After download is complete either power cycle the drive (ensuring the LED display turns off) or click on the **Software Reset** icon in the upper toolbar. 
	D	Velocity Mode Commissioning is now complete.

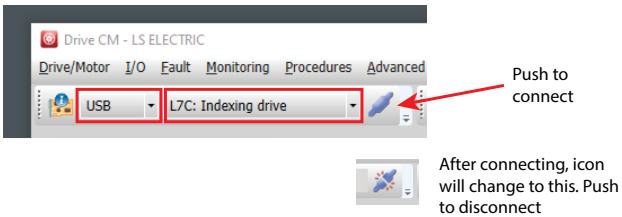
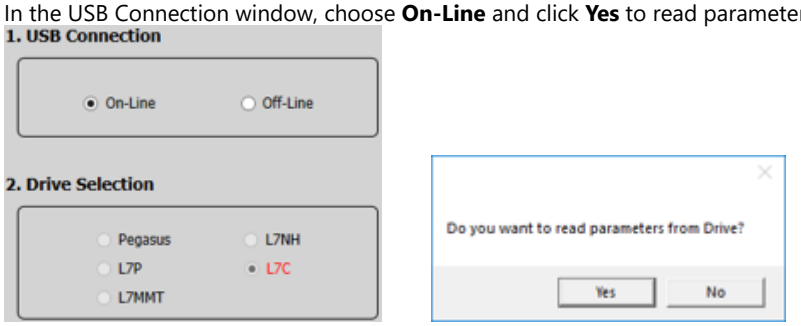
NOTE: If you wil be using Velocity Mode and commanding the motor to be at 0 speed, you may want to set 0x2311 Servo-lock Function. When commanded to 0 RPM in Velocity Mode, the drive will temporarily switch to position-based control to hold the motor in place. Otherwise, slight drifting may occur if commanded to 0 RPM in Velocity Mode. See section 10.4.3 in the user manual for more details.

Torque Mode

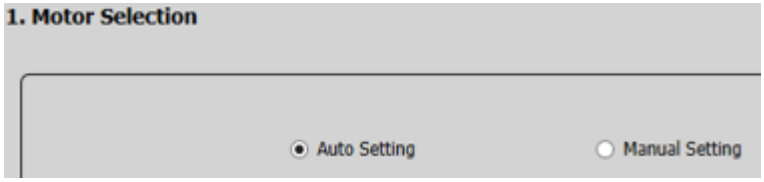
Torque Mode Using the Setup Wizard for Simple Motion Commissioning

Below is a simple walk through of minimal settings to establish a variable torque application with a variable speed limit. Other object configuration settings may be required for your specific needs. See the User Manual for details.

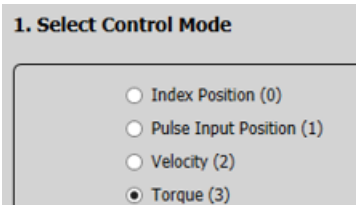
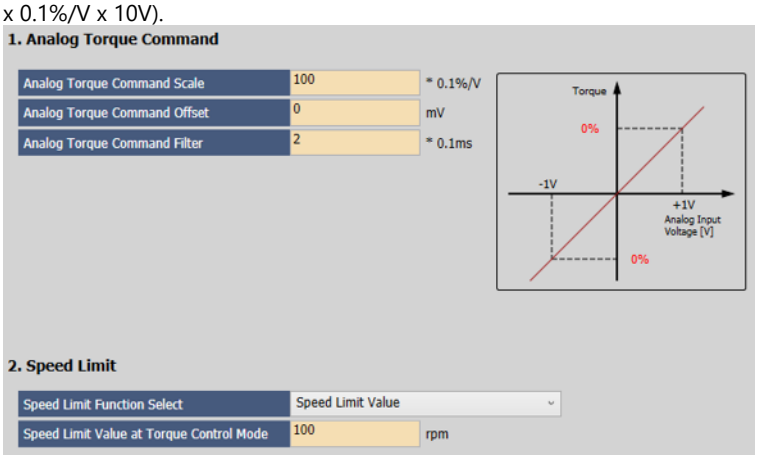
Step 1: Drive Selection

	Substep	Task
Torque Mode Step 1	A	Using a standard USB A to USB mini-B cable (such as SV2-PGM-USB15, MOSAIC-CSU, etc.), connect the PC to the Drive.
	B	Start Drive CM software.
	C	Select **L7C: Indexing Drive** and press the **Connect** button. The software should begin to communicate with the drive. A green flashing square should appear in the bottom right corner of the screen indicating comms traffic. 
	D	Click on **Setup Wizard**.
	E	In the USB Connection window, choose **On-Line** and click **Yes** to read parameters from the drive.  If the **On-Line** radio button is not available and greyed out, click on **Setup Wizard** again. This should restart the Setup Wizard and enable the button. Click **On-Line** and **Yes** to read drive parameters.
	F	Click **Next**.

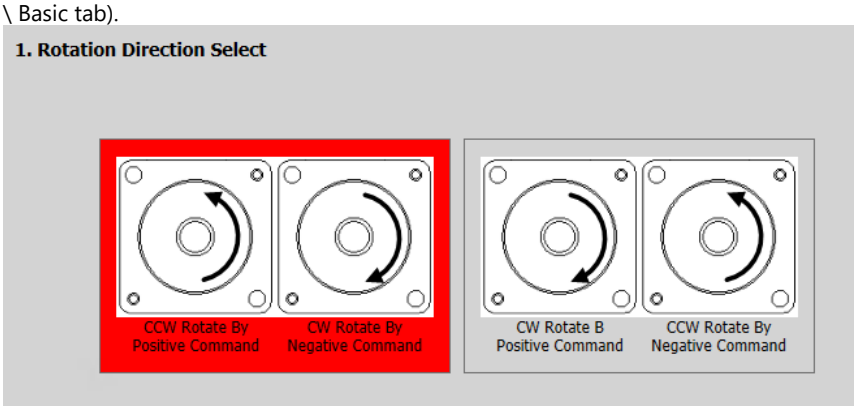
Step 2: Motor/Encoder Selection

	Substep	Task
Torque Mode Step 2	A	Select **Auto Setting** for motor selection. 
	B	Click **Next**.

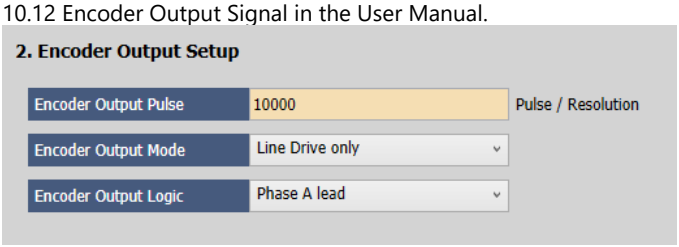
Step 3: Control Mode Selection

	Substep	Task
Torque Mode Step 3	A	On the **Select Control Mode** screen, select **Torque (3)** for Control Mode (Object 0x3000).  Click **Next**.
	B	Set the **Analog Torque Command Scale** (Object 0x2210). This is how much rated torque you want the motor to output at every volt increment when using the analog input. The analog input has a rated voltage swing of -10VDC to +10VDC. The example below will output 100% torque at +10VDC input (100 x 0.1%/V x 10V). 
	C	Set the **Speed Limit Function Select** dropdown to **Speed Limit Value**.
	D	Enter a **Speed Limit Value at Torque Control Mode** (Object 0x230E). In torque mode the motor will continue to spin faster and faster until the commanded torque is reached. Without a proper speed limit, the motor may reach dangerous speeds depending on your application. The default value is 1000RPM. For initial testing and setup, a smaller value is recommended (100RPM). The 0x230E value can be changed later in the **Object Dictionary**. For more information, see Section 3.5 "Torque Operation" in the User Manual.
	E	Click **Next**.

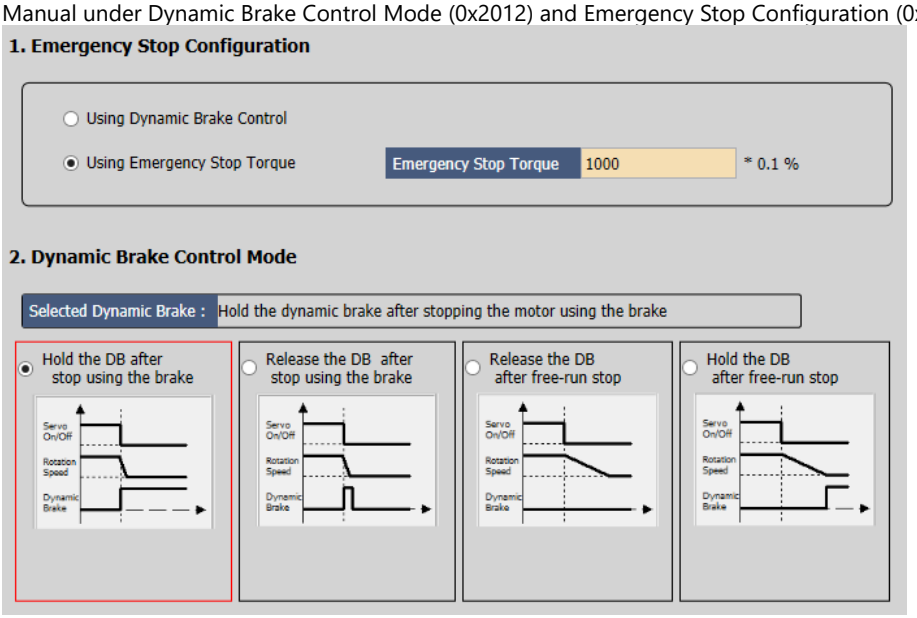
Step 4: Set Rotation Direction

	Substep	Task
Torque Mode Step 5	A	Set rotation direction on the **Rotation Direction Select** screen. This sets which motor direction is considered positive or negative. If this isn't known, it can be set later in 0x2004 (in the Object Dictionary \ Basic tab). 
	B	Click **Next**.

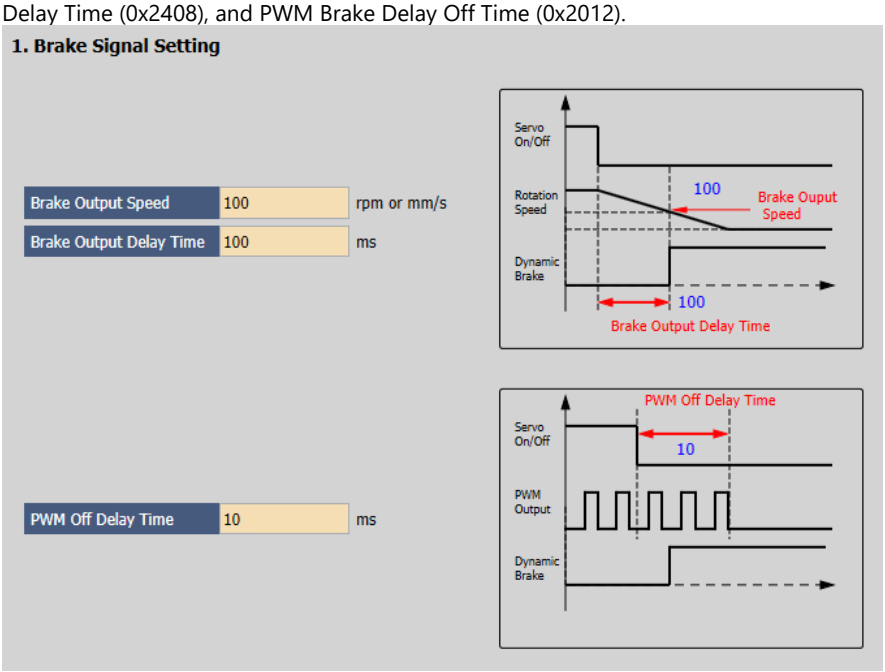
Step 5: Set Electronic Gear Ratio

	Substep	Task
Torque Mode Step 5	A	Leave the Electronic Gear Ratio settings at default values. They have no affect on Velocity Mode.
	B	If your application will use the Encoder Output, enter the desired pulses per revolution and Output Mode/Logic. For initial test and setup, leave these settings at default. For more information, see section 10.12 Encoder Output Signal in the User Manual. 
	C	Click **Next**.

Step 6: Set Emergency Stop and Dynamic Brake Control

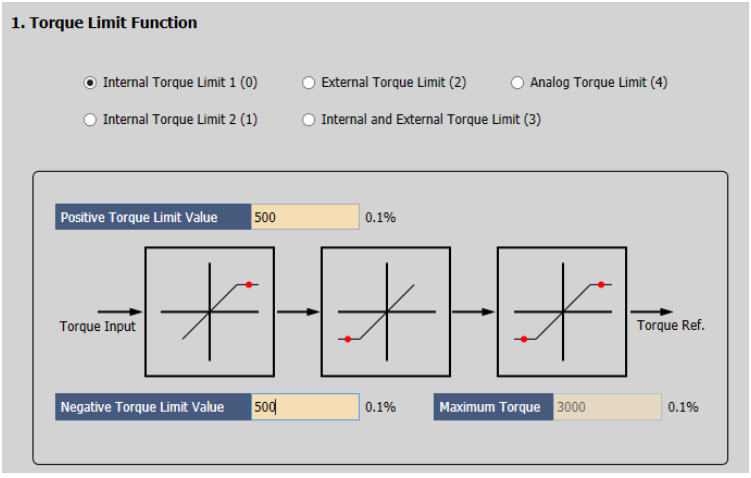
	Substep	Task
Torque Mode Step 6	A	For initial setup and testing, choose the defaults for these settings on the **Emergency Stop Configuration** and **Dynamic Brake Control Mode** screen. More information can be found in the User Manual under Dynamic Brake Control Mode (0x2012) and Emergency Stop Configuration (0x2013). 
	B	Click **Next**.

Step 7: Set Brake Signal Setting

	Substep	Task
Torque Mode Step 7	A	For initial setup and testing, choose the defaults for these settings on the **Brake Signal Setting** screen. More information can be found in the User Manual under Brake Output Speed (0x2407), Brake Output Delay Time (0x2408), and PWM Brake Delay Off Time (0x2012). 
	B	Click **Next**.

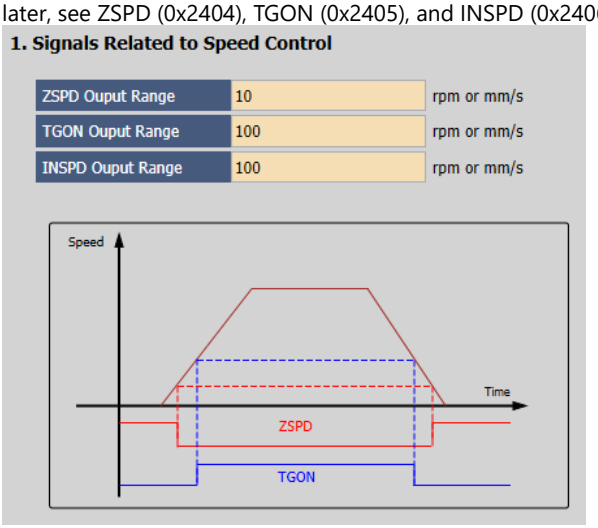
Step 8: Set Torque Limit Function

Torque Mode Step 8

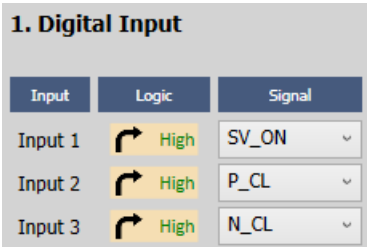
Substep	Task
A	Set the **Torque Limit Function**.  Select a method for limiting the torque applied to the load. Here the Analog Torque Limit does not apply since the TRQCOM input is being used as a command and not a limit. Setting the desired torque limit registers will ensure Analog Torque command does not issue dangerous force on the load in either the FWD or REV direction. For initial testing and setup, a value less than max torque is recommended. The above example sets the torque limits to 50% of system rated torque. These values can be increased after initial commissioning by adjusting 0x3022 and 0x3023 in the Object Dictionary \ Index tab. Default values are 3000 (300%).
B	Click **Next**.

Option	Description
Internal Torque Limit 1 (0)	• Uses the value of 0x3022 as the Fwd direction torque limit • Uses the value of 0x3023 as the Rev direction torque limit
Internal Torque Limit 2 (1)	Uses a constant 300% of rated motor torque as the Fwd and Rev torque limits
External Torque Limit (2)	• Uses the value of 0x2111 as the Fwd direction torque limit • Uses the value of 0x2112 as the Rev direction torque limit
Internal and External Torque Limit (3)	• Uses the value of 0x3022 when Digital Input P_CL is on and the value of 0x2111 when Digital Input P_CL is off for the Fwd direction torque limit. • Uses the value of 0x3023 when Digital Input N_CL is on and the value of 0x2112 when Digital Input N_CL is off for the Rev direction torque limit.
Analog Torque Limit (4)	Not applicable in Torque Mode.

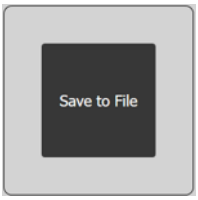
Step 9: Set Signals Related to Speed Control

	Substep	Task
Torque Mode Step 9	A	On the **Signals Related to Speed Control** screen, configure the speed output ranges that will trigger the digital outputs ZSPD, TGON, and INSPD. For initial testing and setup, these can be left as default. For more information, see section 10.4.4 Velocity Control Signals in the User Manual. To adjust these values later, see ZSPD (0x2404), TGON (0x2405), and INSPD (0x2406) in the Object Dictionary \ Misc. tab. 
	B	Click **Next**.

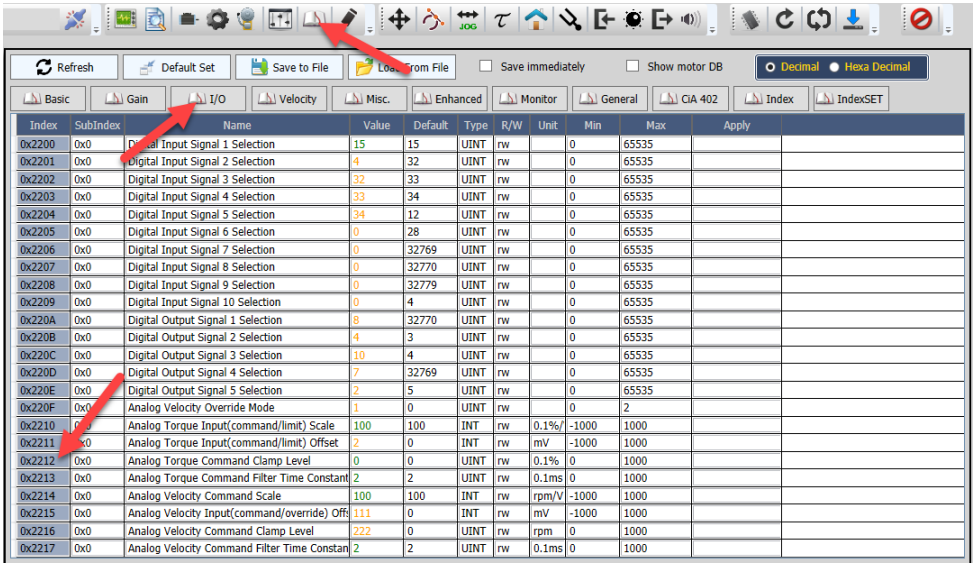
Step 10: Set the I/O Signal Setting

	Substep	Task
Torque Mode Step 10	A	On the **Digital Input** screen, configure Inputs 1 through 3 as shown below. Configure additional inputs and outputs as needed for your application. P_CL and N_CL are only needed if Internal and External Torque Limit (3) was selected. 
	B	Click **Next**.

Step 11: Save Your Configuration

	Substep	*Task*
Torque Mode Step 11	A	Select **Save to File** to save the configuration file to your PC. 
	B	Select **Write to Drive** to download the configuration to the drive. The drive **MUST NOT** be enabled during download. The software will not acknowledge that certain parameters were not changed, so ensure that the drive is not enabled before pressing **Write to Drive**. This **Write to Drive** button also saves the settings to memory. 
	C	After download is complete either power cycle the drive (ensuring the LED display turns off) or click on the **Software Reset** icon in the upper toolbar. 

Step 12: Set Analog Torque Command Clamp Level

	Substep	Task
Torque Mode Step 12	A	Go to the **Object Dictionary** in the Drive CM software.
	B	Find **Analog Torque Command Clamp Level** (Object 0x2212). This parameter is the same as a deadband. 
	C	Enter a value to avoid undesired motion as a result of signal noise. The value entered here will cause the shaft speed to remain at 0 RPMs until the analog voltage is above a set mV value
	D	Torque Mode Commissioning is now complete.

Index	SubIndex	Name	Value	Default	Type	R/W	Unit	Min	Max	Apply
0x2200	0x0	Digital Input Signal 1 Selection	15	15	UINT	rw		0	65535	
0x2201	0x0	Digital Input Signal 2 Selection	4	32	UINT	rw		0	65535	
0x2202	0x0	Digital Input Signal 3 Selection	32	33	UINT	rw		0	65535	
0x2203	0x0	Digital Input Signal 4 Selection	33	34	UINT	rw		0	65535	
0x2204	0x0	Digital Input Signal 5 Selection	34	12	UINT	rw		0	65535	
0x2205	0x0	Digital Input Signal 6 Selection	0	28	UINT	rw		0	65535	
0x2206	0x0	Digital Input Signal 7 Selection	0	32769	UINT	rw		0	65535	
0x2207	0x0	Digital Input Signal 8 Selection	0	32770	UINT	rw		0	65535	
0x2208	0x0	Digital Input Signal 9 Selection	0	32779	UINT	rw		0	65535	
0x2209	0x0	Digital Input Signal 10 Selection	0	4	UINT	rw		0	65535	
0x220A	0x0	Digital Output Signal 1 Selection	8	32770	UINT	rw		0	65535	
0x220B	0x0	Digital Output Signal 2 Selection	4	3	UINT	rw		0	65535	
0x220C	0x0	Digital Output Signal 3 Selection	10	4	UINT	rw		0	65535	
0x220D	0x0	Digital Output Signal 4 Selection	7	32769	UINT	rw		0	65535	
0x220E	0x0	Digital Output Signal 5 Selection	2	5	UINT	rw		0	65535	
0x220F	0x0	Analog Velocity Override Mode	1	0	UINT	rw		0	2	
0x2210	0x0	Analog Torque Input(command/limit) Scale	100	100	INT	rw	0.1%/	-1000	1000	
0x2211	0x0	Analog Torque Input(command/limit) Offset	2	0	INT	rw	mV	-1000	1000	
0x2212	0x0	Analog Torque Command Clamp Level	0	0	UINT	rw	0.1%	0	1000	
0x2213	0x0	Analog Torque Command Filter Time Constant	2	2	UINT	rw	0.1ms	0	1000	
0x2214	0x0	Analog Velocity Command Scale	100	100	INT	rw	rpm/V	-1000	1000	
0x2215	0x0	Analog Velocity Input(command/override) Off	111	0	INT	rw	mV	-1000	1000	
0x2216	0x0	Analog Velocity Command Clamp Level	222	0	UINT	rw	rpm	0	1000	
0x2217	0x0	Analog Velocity Command Filter Time Constan	2	2	UINT	rw	0.1ms	0	1000	

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