## Drive features

- Power: 100W–1kW single-phase 220VAC
- Fully digital with up to 1kHz velocity loop response
- Easy setup and diagnostics with built-in keypad/display or the DriveCM PC-based software
- Field upgradeable firmware ensures the drive can always be upgraded to the latest operating system
- · Command options include:
- ± 10V torque or velocity command
- Pulse train or master encoder position command (accepts line driver or open collector) with real-time selectable electronic gearing
- Internal Indexer for position/speed-based moves. 64 individual move statements can be configured in the drive. Each Index contains its own distance, speed, accel, decel, and dwell parameters. These indexes can be set up through DriveCM software or modified in realtime with serial communication (PLC, HMI, etc.). The indexes can be initiated via Digital Inputs or through serial comms.
- The 1 kHz bandwidth allows for high-level automatic tuning. Several modes of tuning are available including Off-Line Auto Tuning (the drive initiates its own move commands while Auto tuning), On-Line Auto Tuning (an external controller sends the move commands while the drive Auto tunes), and Manual Tuning (all tuning values are adjusted by the user).
- Optically isolated digital inputs (10) and (5) general purpose (userconfigurable) outputs + (3) outputs permanently configured as alarm/ status binary code, analog inputs for speed and torque control (2), and line driver output for encoder (with scalable resolution).
- Advanced Scope feature that can monitor a variety of command and status signals, including output speed, torque, power, etc.

## **Tuning Technology**

The L7C drive closes the loop on current, velocity, and position (depending on control mode selection). The 1kHz bandwidth in the drive assures precise speed and current control and easy tuning. Proportional gain, integral gain and compensation, feed forward compensation, command low pass filter, and four (4) notch filters for resonance suppression are available. Auto Tuning has been greatly improved and can tune FBL/FCL motors up to 20:1 inertia mismatch.

There is an inertia estimation function that analyzes the motor and load to measure how much inertia is coupled to the motor.

The drive has several tuning methods available:

- Online Auto Tuning–the drive can either tune the load live while an external controller moves the load to different positions or using the drive's internal tuning motion profile.
- Offline Auto Tuning-the drive tunes the load using the drive's internal tuning motion profile.
- Manual Tuning-all parameters are available to give power users the ultimate flexibility to tune their systems.

## **Built-in Indexer**

While the L7C drives can accept traditional commands from host controllers, they can also provide their own internal motion control. 64 point-to-point position moves can be configured in the drive. These moves can be populated through the DriveCM configuration software or they can be written to by a PLC through the drive's RS422/485 serial port. The moves can be initiated by digital inputs or by serial commands. and can be sequenced internally with delays in between the moves or moves can be linked together so they are processed one after the other.

Multi-axis systems can be controlled via digital inputs, or serial communication. The motion can be commanded from a powerful external controller that sends out high speed pulses to each drive, or the motion can be initiated by a lowlevel controller (the simplest CLICK PLC) since each drive has a powerful indexer inside. Applications include press feeds, auger fillers, rotary tables, robots for pick and place, test or assembly operations, drilling, cutting, tapping, and similar applications using simple index moves for single or multi-axis motion.

## **Optional Holding Brake**

Each L7C motor can be ordered with an optional 24VDC spring-set holding brake that holds the motor in place when power is removed.

### LS Electric MSS Series **In-Line Planetary Precision Gearboxes for** Servo Motors

Need more torque from the motor? Have an inertia balancing issue in your design? The LS Electric MSS series gearboxes easily mate to FBL/FCL motors. Everything you need to mount your LS electric servo is included!

- Three gear ratios available (5:1, 10:1, 20:1)
- · Mounting hardware included for attaching to FBL/FCL motors.
- Industry-standard mounting dimensions
- Thread-in mounting style
- Very low backlash: 7 arc-min single stage (5:1 and 10:1 ratios), 9 arc-min for two-stage (20:1 ratios).
- 1-year warranty





· Low inertia models:

couplings

revolution)

20m

leads

- 100W, 200W, 400W, 750W and 1kW

· Permanent magnet 3-phase synchronous motor

· Keyed drive shafts support clamp-on style couplings or key-style

• Standard hook-up cables for motor power, encoder, and brake (separate

Integrated encoder with 17-bit resolution (131,072 pulses per

Optional 24 VDC spring-set holding brakes (AYK2 motors)

Speeds up to 5,000 rpm

brake cable for brake motors)



### • Motor cables available in standard or flex-rated lengths of 3, 5, 10, and • Standard 50-pin DIN-rail mounted break-out kit for the drive's CN1 connector (with screw terminal connections), or 50-pin cables with flying

Note: These parts available for sale to North American locations only.

### Servo motor overview

#### **Encoder Connector**

9-pin watertight connector (8 pins used) for the 17-bit serial encoder. The encoder transmits motor/encoder identification information to the drive at power-up and it sends position feedback during operation.

Non-**Braking** Motor

#### Motor Power Connector

4-pin watertight connector for motor power (U, V, W, and ground)



#### Low Inertia Motors

Low inertia designs result in high responsiveness and high speeds.

- 100W 60mm flange
- 200W 60mm flange
- 400W 60mm flange
- 750W 80mm flange
- 1kW 80mm flange

#### **Keyed Shafts**

"FBL and FCL motors are supplied with extra-large keyways, and slightly oversized keys which must be "fitted" into the keyway for performance and longevity. Clamp or compression couplings (without key) are recommended".

- 100W 14mm diameter shaft
- 200W 14mm diameter shaft
- 400W 14mm diameter shaft
- 750W 19mm diameter shaft
- 1kW 19mm diameter shaft

All LS Electric L7C motors have keyed shafts for use with servo-grade clamp or compression couplings (recommended) or servo-grade keyed couplings. Some sanding/filing of the key may be required before pressing into the keyway. Do not modify the shaft/keyway.

#### **Brake Power Connector**

2-pin watertight connector available on brake motors only. The 24VDC brake is located between the motor coils and the encoder. Motors ending in AYK2 have brakes. The brakes must have 24VDC applied to them before the motor is set in motion.

#### **Encoder Connector**

9-pin watertight connector (8 pins used) for the 17-bit serial encoder. The encoder transmits motor/encoder identification information to the drive at power-up and it sends position feedback during operation.

#### **Brake** Motor

#### **Motor Power** Connector

4-pin watertight connector for motor power (U, V, W, and ground)



**IP67 Housing** 

#### **Keyed Shafts**

"FBL and FCL motors are supplied with extra-large keyways, and slightly oversized keys which must be "fitted" into the keyway for performance and longevity. Clamp or compression couplings (without key) are recommended".

- 100W 14mm diameter shaft
- 200W 14mm diameter shaft
- 400W 14mm diameter shaft
- 750W 19mm diameter shaft
- 1kW 19mm diameter shaft



### How to select and apply L7C systems

The primary purpose of the AC servo system is to precisely control the motion of the load. The most fundamental

considerations in selecting the servo system are "reflected" load inertia, servo system maximum speed requirement, servo system continuous torque requirement, and servo system peak torque requirement. In a retrofit application, select the largest torque servo system that most closely matches these parameters for the system being replaced. In a new application, these parameters should be determined through calculation and/or



measurement. The Drive CM software has the ability to measure the load (reflected) inertia and accurately measure the motor torque output.

AutomationDirect has teamed with Copperhill Technologies to provide free servo-sizing software. "VisualSizer-SureServo" software will assist in determining the correct motor and drive for your application by calculating the reflected load inertia and required speed and torque based on the load configuration. "VisualSizer-SureServo" software can be downloaded from https://support.automationdirect.com/products/sureservo.html.

#### 1. "Reflected" load inertia

The inertia of everything attached to the servo motor driveshaft needs to be considered and the total "reflected" inertia needs to be determined. This means that all elements of any mechanical transmission and load inertia need to be translated into an equivalent inertia as if attached directly to the motor driveshaft. The ratio of "reflected" load inertia to motor inertia needs to be carefully considered when selecting the servo system.

In general, applications that need high response or bandwidth

will benefit from keeping the ratio of load inertia to motor inertia as low as possible and ideally under 10:1. L7C Auto Tuning will still tune a system with very high response, up to 20:1 inertia mismatch. Higher system ratios can be implemented, but corresponding lower bandwidth or responsiveness must be accepted. The servo response including the attached load inertia is determined by the servo tuning. The L7C servo systems may be tuned automatically by the software/drive or manually by the user.

#### 2. Torque and speed

With knowledge of the motion profile and any mechanical transmission between the motor and load, calculations can be made to determine the required servo motor continuous torque, peak torque, and maximum motor speed. The required amount of continuous torque must fall inside the continuous operating region of the system torque-speed curve (you can check the continuous torque at the average speed of the motion profile). The required amount of peak torque must also fall within the servo system's intermittent operating region of the system torque-speed curve (you need to check this value at the required maximum speed or torque). If you have an L7C system, these values are easily captured and recorded with the Scope feature built into the Drive CM software. If you are designing the system from scratch, use VisualSizer to define the system and calculate expected inertia and required power.

Compare the application's Continuous and Intermittent torque requirements to the torque-speed curves found in Chapter 16 of the L7C User Manual.



# LSELECTRIC L7C AC Servo Systems

# Application tip - coupling considerations

The LS Electric FBL/FCL motors have keyed shafts that can be used with keyed couplings or with clamp-on or compression style couplings. For standard keyed couplings, the servo key must be "fitted" into the keyway for optimum performance and longevity. Some minor filing and pressing of the key may be required. "Servo-grade" clamp-on or compression style couplings are usually the best choice when you consider stiffness, torque rating, and inertia. Higher stiffness (lb-in/radian) is needed for better response but there is a trade-off between stiffness and the added inertia of the coupling. Concerning the torque rating of the coupling, use a safety factor of 1.25 over the servo's **peak** torque requirement of your application.

#### Click here for Available Couplings

## **Mechanical transmissions**

Common mechanical transmissions include leadscrews, rack & pinion mechanisms, conveyors, gears, and timing belts. The use of leadscrew, rack & pinion, or conveyor are common ways to translate the rotary motion of the servo motor into linear motion of the load. Matched gearboxes are available from LS Electric that will work with the FBL and FCL motors. Each gearbox is selected to accept the 300% maximum available torque that could be generated by the motor. Gearboxes are available in 5:1, 10:1, and 20:1 ratios. The use of a speed reducer such as a gearbox or timing belt can be very beneficial as follows:

## 1. Reduction of reflected load inertia

As a general rule, it is beneficial to keep the reflected load inertia as low as possible while using the full range of servo speed. The LS Electric motors can rotate at a rated speed of 3000rpm (rated torque at rated speed). Their max speed (slightly less available torque) is 5000rpm. See the speed-torque curves for more information.

Example: A gearbox reduces the motor's required torque by a factor of the gear ratio, and reduces the reflected load inertia by a factor of the gear ratio squared. A 10:1 gearbox reduces output speed to 1/10, increases output torque 10 times, and decreases reflected inertia to 1/100.

However, when investigating the effect of different speed reduction ratios DO NOT forget to include the added inertia of couplings, gearbox, or timing belt pulleys. These added inertias can be significant, and can negate any inertia reduction due to the speed reduction.

## 2. Low speed and high torque applications

If the application requires low speed and high torque then it is common to introduce a speed reducer so that the servo system can operate over more of the available speed range. This could also have the added benefit of reducing the servo motor torque requirement which could allow you to use a smaller and lower cost servo system. Additional benefits are also possible with reduction in reflected inertia, increased number of motor encoder counts at the load, and increased ability to reject load disturbances due to mechanical advantage of the speed reducer.

## 3. Space limitations and motor orientation

FBL/FCL motors can be mounted in any orientation, but the shaft seal should not be immersed in oil (open-frame gearbox, etc.). Reducers can possibly allow the use of a smaller motor or allow the motor to be repositioned.



Motor	Proko Motor	LS Electric MSS Planetary In-Line Gearboxes					
INICION	DIAKE MULUI	5:1 Gearbox	10:1 Gearbox	20:1 Gearbox			
APMC-FBL01AYK-AD	APMC-FBL01AYK2-AD	96200004	96200005	<u>96200103</u> (MSS0902B-020KS-			
APMC-FBL02AYK-AD	APMC-FBL02AYK2-AD	(MSS0601A-005KS-	(MSS0601A-010KS-				
APMC-FBL04AYK-AD	APMC-FBL04AYK2-AD	B3110103C14)	B3110103C14)	B3110103C14)			
APMC-FCL08AYK-AD	APMC-FCL08AYK2-AD	<u>96200007</u>	<u>96200008</u>	<u>96200257</u>			
APMC-FCL10AYK-AD	APMC-FCL10AYK2-AD	(MSS0901A-005KS- C3110103C19)	(MSS0901A-010KS- C3110103C19)	(MSS1152B-020KS- C3110103C19)			

Here is a link to our Timing Belts and Pulleys

## **Ordering guide instructions**

The following four pages are your ordering guide for LS Electric L7C servo systems. Each system has a torque-speed curve included for reference. This is the fundamental information that you need to select the servo motor and matching drive for your application.

#### Each system needs:

- Motor
- Drive
- Motor Power Cable
- Motor Encoder Cable
- I/O connections (either a 50-pin CN1 cable+terminals kit or a 50-pin flying lead cable(user provides terminal blocks))
- For brake motors you will also need a brake cable (connectorized on the motor end, two ferruled flying leads on the opposite end).

## L7C series drives and motors part numbering system



## Example of what you will need to build a complete servo system:



NOTE: Unit can be programmed via keypad. Optional programming software (free download). Use a standard USB-A to USB miniB cable for connectivity (SV2-PGM-USB15, MOSAIC-CSU, or equivalent)

NOTE: If you need a gear box for your configuration, reference the gearbox chart on the previous page. Ratios of 5:1, 10:1, and 20:1 are available for each FBL/FCL motor.



Servo Moto

## **Torque to L7C System Quick Reference**

System Rated Torque (N·m)	System Maximum Torque (N∙m)	Suggested Servo Motor	<b>Required Servo Drive</b>		
0.22	0.06	APMC-FBL01AYK-AD			
0.32	0.90	APMC-FBL01AYK2-AD	_		
0.04	4.04	APMC-FBL02AYK-AD			
0.64	1.91	APMC-FBL02AYK2-AD	- <u>L7CA0040-AD</u>		
4.07	2.00	APMC-FBL04AYK-AD			
1.27	3.82	APMC-FBL04AYK2-AD			
0.00	7.40	APMC-FCL08AYK-AD			
2.39	7.16	APMC-FCL08AYK2-AD			
0.40	0.55	APMC-FCL10AYK-AD	<u>L/GAU1UU-AD</u>		
3.18	9.55	APMC-FCL10AYK2-AD	-		

www.automationdirect.com

Servo Systems

## L7C AC servo drive, motor, and cable combinations

xx = Cable length in meters

BN, EN, or PN = Standard cable (not continuous flex) BF, EF, or PF = Flex-rated cable

AYK motors = no brake AYK2 motors = mechanical holding brake

Туре	System Torque Chart	L7C Drive	APMC Motor	Power Cable	Encoder Cable	Brake Cable	I/O Cable and Breakout
stem	Torque(N.m) 200V 1.00 230V			APCS-PNxxLSC-AD	APCS-ENxxES-AD	n/a	
ertia Sy:	0.80 Peak Operating Range			APCS-PFxxLSC-AD	APCS-EFxxES-AD	n/a	
N LOW In	0.40 0.20 Continuous Operating Range			APCS-PNxxLSC-AD	APCS-ENxxES-AD	APCS-BNxxQS-AD	
100	0 1000 2000 3000 4000 5000 Speed(RPM)			APCS-PFxxLSC-AD	APCS-EFxxES-AD	APCS-BFxxQS-AD	
stem	Torque(N.m)200V 2.00		APMC-FBL02AYK-AD	APCS-PNxxLSC-AD	APCS-ENxxES-AD	n/a	
ertia Sys	1.60 1.20 Peak Operating Range	L7CA004U-AD		APCS-PFxxLSC-AD	APCS-EFxxES-AD	n/a	APC-VSCN1Txx-AD
N LOW In	0.80 0.40 Continuous Operating Range		APMC-FBL02AYK2-AD	APCS-PNxxLSC-AD	APCS-ENxxES-AD	APCS-BNxxQS-AD	or APC-CN10xA-AD
200	0 1000 2000 3000 4000 5000 Speed(RPM)			APCS-PFxxLSC-AD	APCS-EFxxES-AD	APCS-BFxxQS-AD	
tem	Torque(N.m) 200V 230V			APCS-PNxxLSC-AD	APCS-ENxxES-AD	n/a	
ertia Sys	3,20 2,40 1,60 0,80 Continuous Operating Range		A NO-I DEOGRAM	APCS-PFxxLSC-AD	APCS-EFxxES-AD	n/a	
W Low In		L1CAUU4U-AD		APCS-PNxxLSC-AD	APCS-ENxxES-AD	APCS-BNxxQS-AD	
400	0 1000 2000 3000 4000 5000 Speed(RPM)		APMC-FBL04AYK2-AD	APCS-PFxxLSC-AD	APCS-EFxxES-AD	APCS-BFxxQS-AD	

## L7C AC servo drive, motor, and cable combinations, continued

Туре	System Torque Chart	L7C Drive	APMC Motor	Power Cable	Encoder Cable	Brake Cable	I/O Cable and Breakout
tem	Torque(N.m) 200V 230V 8.00			APCS-PNxxLSC-AD	APCS-ENxxES-AD	n/a	
iertia Sys	6.40 4.80 Peak Operating Range		ALMO-I CLOOATICAD	APCS-PFxxLSC-AD	APCS-EFxxES-AD	n/a	
IN TOW II	3.20 1.60 Continuous Operating Range		APMC-FCL08AYK2-AD	APCS-PNxxLSC-AD	APCS-ENxxES-AD	APCS-BNxxQS-AD	
750	0 1000 2000 3000 4000 5000 Speed(RPM)			APCS-PFxxLSC-AD	APCS-EFxxES-AD	APCS-BFxxQS-AD	APC-VSCN1Txx-AD
		[	r				or
stem	Torque(N.m) 200V 230V			APCS-PNxxLSC-AD	APCS-ENxxES-AD	n/a	APC-CN10xA-AD
iertia Sy	8.00 6.00 Peak Operating Range	L7CA010U-AD	APMC-FCL10AYK-AD	APCS-PFxxLSC-AD	APCS-EFxxES-AD	n/a	
W Low Ir	4.00 2.00 Continuous Operating Range		APMC-FCL10AYK2-AD	APCS-PNxxLSC-AD	APCS-ENxxES-AD	APCS-BNxxQS-AD	
1.0K	0 1000 2000 3000 4000 5000 Speed(RPM)			APCS-PFxxLSC-AD	APCS-EFxxES-AD	APCS-BFxxQS-AD	
	<u> </u>						

## **Non-brake Motor Specifications**

	L7C Non-brake Motor Specifications							
Model	<u>APMC-FBL01AYK-AD</u>	<u>APMC-FBL02AYK-AD</u>	APMC-FBL04AYK-AD	<u>APMC-FCL08AYK-AD</u>	<u>APMC-FCL10AYK-AD</u>			
Price	\$238.00	\$281.00	\$295.00	\$349.00	\$426.00			
Drawing	PDF	PDF	PDF	PDF	PDF			
Flange Size	60	60	60	80	80			
Rated Power [kW]	0.1	0.2	0.4	0.75	1			
Rated Torque [N·m]	0.32	0.64	1.27	2.39	3.18			
Max. Torque [N·m]	0.96	1.91	3.82	7.16	9.55			
Rated Speed [rpm]			3000					
Max. Speed [rpm]			5000					
Mechanical Time Constant [ms]	0.926	0.518	0.374	0.609	0.492			
Rated current [Amps] rms	0.95	1.45	2.6	5.02	5.83			
Max. Instantaneous Current [Amps] rms	2.85	4.35	7.8	15.07	17.5			
Rated Power Rate [kW/s]	11.09	27.6	27.07	45.09	62.08			
Electrical Time Constant [ms]	2.416	3.488	4.271	5.774	6.919			
Insulation Class			Class BE (CE, UL)					
Insulation Resistance			>10MΩ, 500VDC					
Insulation Strength			1.8 kVAC, 1 second					
Rotor Inertia [x10 <sup>-4</sup> kg m <sup>2</sup> ]	0.091	0.147	0.248	1.264	1.632			
Allowable Load Inertia Ratio		20 times motor inertia 15 times motor inertia						
Max Radial Loading [N]		206		29	55			
Max Axial Loading [N]		69		9	8			
Vibration Grade [µm]			V15					
Vibration Capacity			19.6m/s <sup>2</sup> or lower (2.5G)					

Note 1-The rated torque is the continuous permissible torque between the 0°C and 40°C operating temperature which is suitable for a servo motor mounted with the following heat sink dimensions: 250mm x 250mm x 6mm made from aluminum (or mounted to equipment with an equivalent heat sinking capability).



## Non-brake Motor Specifications, continued

	L7C Non-brake Motor Specifications, <i>continued</i>							
Model	<u>APMC-FBL01AYK-AD</u>	APMC-FBL01AYK-AD APMC-FBL02AYK-AD APMC-FBL04AYK-AD APMC-FCL0		<u>APMC-FCL08AYK-AD</u>	<u>APMC-FCL10AYK-AD</u>			
Speed/Position Detector		Serial Single-Turn Encoder (17-bit), built-in						
IP Rating			Fully closed, self cooling IP67	,				
Rated Time			Continuous					
<b>Operating Temperature</b>		0°C to 40°C						
Storage Temperature			-10°C to 60°C					
Operating Humidity			Below 80% relative humidity					
Storage Humidity		Below 9	0% relative humidity, no cond	ensation				
Atmosphere		Avoid direct sunlight,	no corrosive gas, inflammable	e gas, oil mist, or dust				
E/V		Elevation/vibration 49m/s <sup>2</sup> (5G)						
Weight [kg]	0.56	0.56 0.74 1.06 2.68 3.3						
Agency Approvals			<sub>C</sub> UR <sub>US</sub> (E255738), CE					

Note 1-The rated torque is the continuous permissible torque between the 0°C and 40°C operating temperature which is suitable for a servo motor mounted with the following heat sink dimensions: 250mm x 250mm x 6mm made from aluminum (or mounted to equipment with an equivalent heat sinking capability).

#### 1-800-633-0405

# **LSELECTRIC** L7C Series AC Servo Systems

## **Brake Motor Specifications**

	L7C Brake Motor Specifications							
Model	APMC-FBL01AYK2-AD	<u>APMC-FBL02AYK2-AD</u>	<u>APMC-FBL04AYK2-AD</u>	APMC-FCL08AYK2-AD	<u>APMC-FCL10AYK2-AD</u>			
Price	\$438.00	\$492.00 \$503.00		\$549.00	\$645.00			
Drawing	PDF	PDF	PDF	PDF	PDF			
Flange Size	60	60	60	80	80			
Rated Power [kW]	0.1	0.2	0.4	0.75	1			
Rated Torque [N·m]	0.32	0.64	1.27	2.39	3.18			
Max. Torque [N·m]	0.96	1.91	3.82	7.16	9.55			
Rated Speed [rpm]			3000					
Max. Speed [rpm]		ſ	5000	1	1			
Mechanical Time Constant [ms]	0.926	0.518	0.374	0.609	0.492			
Rated current [Amps] rms	0.95	1.45	2.6	5.02	5.83			
Max. Instantaneous Current [Amps] rms	2.85	4.35	7.8	15.07	17.5			
Rated Power Rate [kW/s]	11.09	27.6	27.07	45.09	62.08			
Electrical Time Constant [ms]	2.416	3.488	4.271	5.774	6.919			
Insulation Class			Class BE (CE, UL)					
Insulation Resistance			>10MΩ, 500VDC					
Insulation Strength		I	1.8 kVAC, 1 second	1	1			
Rotor Inertia [x10 <sup>-4</sup> kg m <sup>2</sup> ]	0.091	0.147	0.248	1.264	1.632			
Allowable Load Inertia Ratio		20 times motor inertia		15 times n	notor inertia			
Max Radial Loading [N]		206		2	55			
Max Axial Loading [N]		69		9	98			
Brake Holding Torque [N·m (min)]		1.47		3.	23			
Brake Power Consumption (at 20°C) [W]		6.5			9			
Brake Release Time [ms (max)]			20	1				
Brake Pull-in Time [ms (max)]		50		6	60			
Vibration Grade [µm]			V15					
Vibration Capacity		19.6m/s <sup>2</sup> or lower (2.5G)						

Note 1–The rated torque is the continuous permissible torque between the 0°C and 40°C operating temperature which is suitable for a servo motor mounted with the following heat sink dimensions: 250mm x 250mm x 6mm made from aluminum (or mounted to equipment with an equivalent heat sinking capability).



## Brake Motor Specifications, continued

	L7C Brake Motor Specifications, <i>continued</i>							
Model	<u>APMC-FBL01AYK2-AD</u>	<u>APMC-FBL02AYK2-AD</u>	<u>APMC-FBL04AYK2-AD</u>	<u>APMC-FCL08AYK2-AD</u>	<u>APMC-FCL10AYK2-AD</u>			
Speed/Position Detector		Serial Multi-Turn Built-in Type (17-bit)						
IP Rating			Fully closed, self cooling IP6	7				
Rated Time			Continuous					
<b>Operating Temperature</b>			0°C to 40°C					
Storage Temperature			-10°C to 60°C					
Operating Humidity			Below 80% relative humidity	,				
Storage Humidity		Below 9	00% relative humidity, no cond	lensation				
Atmosphere		Avoid direct sunlight,	no corrosive gas, inflammab	e gas, oil mist, or dust				
E/V		Elevation/vibration 49m/s <sup>2</sup> (5G)						
Weight [kg]	1.28	1.46	1.78	3.45	4.07			
Agency Approvals		·	<sub>C</sub> UR <sub>US</sub> (E255738), CE	·				

Note 1–The rated torque is the continuous permissible torque between the 0°C and 40°C operating temperature which is suitable for a servo motor mounted with the following heat sink dimensions: 250mm x 250mm x 6mm made from aluminum (or mounted to equipment with an equivalent heat sinking capability).



# L7C/L7P Series AC Servo Systems

## Accessories

#### **CN1** Accessories

For L7x series drives, two methods are available for creating I/O connections.

#### **Option 1**:

Terminal blocks + cables:

- APC-VSCN1T-AD
- APC-VSCN1T01-AD
- APC-VSCN1T02-AD

APC-VSCN1T terminals ship with a universal labeling strip (A1-A25, B1-B25). A labeling template with designations specifically for the L7x drive can be downloaded from any of the drive pages or the terminal block page (www.automationdirect.com/pn/apc-vscn1t-ad).



APC-VSCN1T-AD

#### **Option 2:**

Flying lead cables:

- <u>APC-CN101A-AD</u>
- <u>APC-CN102A-AD</u>
- <u>APC-CN103A-AD</u>



APC-CN101A-AD

IOTE: For L7C drives, do not use APC-VSCN1T(xx)-AD feedthrough terminal block
if using PLC/Drive serial communication. Communication errors may occur
due to disconnects in cable shields. Use APC-CN10xA-AD flying lead cables.

Part Number	Price	Description	Cable Length	Drawing	Compatible Drives	
<u>APC-VSCN1T-AD</u>	\$85.00		0.5 m [1.6 ft]	PDF		
<u>APC-VSCN1T01-AD</u>	\$96.00	terminal block, 50-pole, DIN	1.0 m [3.2 ft]	PDF		
APC-VSCN1T02-AD	\$105.00		2.0 m [6.5 ft]	PDF		
APC-CN101A-AD	\$52.00		1.0 m [3.2 ft]	PDF	All L/C and L/P drives	
APC-CN102A-AD	\$57.00	LS Electric control cable, 50- pin connector to pigtail.	2.0 m [6.5 ft]	PDF		
<u>APC-CN103A-AD</u>	\$63.00		3.0 m [9.8 ft]	PDF		

# LSELECTRIC L7C Series AC Servo Systems

## Accessories

#### L7C Terminal Assignment Table

*CAUTION*: This terminal assignment table is for use with L7C drives ONLY. Using this table with non-L7C series drives could damage your equipment as terminal assignments are different for each drive series.

#### APC-VSCN1T-AD



You can download a printable terminal label at https://www.automationdirect.com/pn/APC-VSCN1T-AD

	L7C Driv	e Termina	l Assign		
Terminal	Drive I/O Pin/Wire #	Description	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	ZO	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



# **SELECTRIC** LS Electric AC Servo Systems

## Accessories, continued

NOTE: These parts available for sale to North American locations only

#### L7C/L7P/iX7NH System Motor Encoder Cables

Part Number	Price	Flex Rated	Length	Gauge	Drawing	Compatible Motors
APCS-EN03ES-AD	\$54.00		3m [9.8 ft]		PDF	
APCS-EN05ES-AD	\$66.00	N	5m [16.4 ft]		PDF	
<u>APCS-EN10ES-AD</u>	\$76.00	IN	10m [32.8 ft]		PDF	ADMC motors with
<u>APCS-EN20ES-AD</u>	\$89.00		20m [65.6 ft]	24 AMG	PDF	17-bit incremental
<u>APCS-EF03ES-AD</u>	\$79.00		3m [9.8 ft]	24400	PDF	encoders
<u>APCS-EF05ES-AD</u>	\$94.00	~	5m [16.4 ft]		PDF	
<u>APCS-EF10ES-AD</u>	\$131.00	I	10m [32.8 ft]		PDF	
<u>APCS-EF20ES-AD</u>	\$213.00		20m [65.6 ft]		PDF	
<u>APCS-EN03ES1-AD</u>	\$89.00		3m [9.8 ft]		PDF	
<u>APCS-EN05ES1-AD</u>	\$94.00	N	5m [16.4 ft]		PDF	FBL/FCL series motors with 19-bit encoders
<u>APCS-EN10ES1-AD</u>	\$109.00		10m [32.8 ft]		PDF	
<u>APCS-EN20ES1-AD</u>	\$136.00		20m [65.6 ft]		PDF	
<u>APCS-EF03ES1-AD</u>	\$112.00		3m [9.8 ft]		PDF	
<u>APCS-EF05ES1-AD</u>	\$133.00	v	5m [16.4 ft]		PDF	
APCS-EF10ES1-AD	\$180.00		10m [32.8 ft]		PDF	
APCS-EF20ES1-AD	\$276.00		20m [65.6 ft]	244WG	PDF	
<u>APCS-EN03DS1-AD</u>	\$94.00	_	3m [9.8 ft]	247.00	PDF	
<u>APCS-EN05DS1-AD</u>	\$100.00	N	5m [16.4 ft]		PDF	
<u>APCS-EN10DS1-AD</u>	\$112.00		10m [32.8 ft]		PDF	
<u>APCS-EN20DS1-AD</u>	\$140.00		20m [65.6 ft]		PDF	APM-FE/APM-FF
<u>APCS-EF03DS1-AD</u>	\$118.00		3m [9.8 ft]		PDF	series motors
<u>APCS-EF05DS1-AD</u>	\$136.00	v	5m [16.4 ft]		PDF	
<u>APCS-EF10DS1-AD</u>	\$180.00		10m [32.8 ft]		PDF	
APCS-EF20DS1-AD	\$278.00		20m [65.6 ft]		PDF	



**APCS-EN** series encoder cable



APCS-ENxxxES1 series encoder cable



#### L7P/iX7NH System Encoder Accessories

Part Number	Price	Description	Compatible Drives		
<u>APC-EFOOBS-AD</u>	\$22.50	17-pin motor encoder connector.	APM-FE and APM- FF series motors		
<u>APCS-BATT36-AD</u>	\$40.50	Encoder battery. One (1) AA ER6V lithium battery with extended leads and an encoder cable connector.	All LS Electric motors with 19-bit encoders		

APC-EF00BS-AD



APCS-BATT36-AD



# **LSELECTRIC** LS Electric AC Servo Systems

## Accessories, continued

NOTE: These parts available for sale to North American locations only

#### L7C/L7P/iX7NH System Motor Brake Power Cables

Part Number	Price	Flex Rated	Length	Gauge	Drawing	Compatible Motors
APCS-BN03QS-AD	\$59.00		3m [9.8 ft]		PDF	
APCS-BN05QS-AD	\$63.00	- N -	5m [16.4 ft]	18AWG	PDF	
APCS-BN10QS-AD	\$69.00		10m [32.8 ft]		PDF	
APCS-BN20QS-AD	\$84.00		20m [65.6 ft]		PDF	APMC FBL/FCL
APCS-BF03QS-AD	\$66.00		3m [9.8 ft]		PDF	(100W – 1kW)
APCS-BF05QS-AD	\$72.00	v	5m [16.4 ft]		PDF	
APCS-BF10QS-AD	\$89.00	Ŷ	10m [32.8 ft]		PDF	
<u>APCS-BF20QS-AD</u>	\$122.00		20m [65.6 ft]	]	PDF	



**APCS-BN** series brake cable

## Accessories, continued

NOTE: These parts available for sale to North American locations only

#### L7C System Motor Power Cables

Part Number	Price	Flex Rated	Length	Gauge	Drawing	Compatible Motors	
APCS-PN03LSC-AD	\$45.00		3m [9.8 ft]		PDF		
APCS-PN05LSC-AD	\$54.00	- N -	5m [16.4 ft]	18AWG	PDF		
APCS-PN10LSC-AD	\$70.00		10m [32.8 ft]		PDF		
APCS-PN20LSC-AD	\$97.00		20m [65.6 ft]		PDF	motors	
APCS-PF03LSC-AD	\$59.00		3m [9.8 ft]		PDF	(100W – 1kW)	
APCS-PF05LSC-AD	\$77.00	v	5m [16.4 ft]		PDF		
APCS-PF10LSC-AD	\$109.00	Υ –	10m [32.8 ft]		PDF		
<u>APCS-PF20LSC-AD</u>	\$172.00		20m [65.6 ft]		PDF		



**APCS-PN** series motor cable



# **LS Drive System Accessories**

## Accessories, continued

#### LS Drive System Replacement Connectors

Part Number	Price	Description	Compatible Drives	Image
<u>5452573</u>	\$10.00	AutomationDirect replacement drive power connector.	All L7C drives	A REAL PROPERTY OF
<u>APC-CN1NNA-AD</u>	\$35.50	LS solder-type CN1 50-pin Electric I/O connector.	All L7C and L7P series drives	
<u>APC-CN2NNA-AD</u>	\$28.50	LS Electric I/O connector, replacement, 20-pin.	All iX7NH series drives	
<u>APC-CN3NNA-AD</u>	\$35.50	LS Electric solder-type CN2 14-pin drive encoder connector.	All L7C, L7P, and iX7NH series drives	
<u>APCS-CN6K-AD</u>	\$33.50	LS Electric STO connector, replacement, 6-pin. For use with all LS Electric iX7 series drives.	All iX7NH series drives	
<u>IX7-CON-A</u>	\$21.00	AutomationDirect drive power connector, replacement, 11-pin. Note: Do not wire to pin 4 (the "-" terminal).	iX7NH series drives, 400W, 750W, and 1kW	
<u>IX7-CON-B</u>	\$21.00	AutomationDirect drive power connector for motor power, replacement, 4-pin.	iX7NH series drives, 400W, 750W, and 1kW	
<u>IX7-CON-C</u>	\$10.00	AutomationDirect drive power connector release, replacement.	iX7NH series drives, 400W, 750W, and 1kW	Care a
<u>IX7-CON-D</u>	\$21.00	AutomationDirect drive power connector for motor power, replacement, 4-pin	iX7NH series drives, 2kW and 3.5 kW	
<u>IX7-CON-E</u>	\$21.00	AutomationDirect drive control power connector, replacement, 5-pin.	iX7NH series drives, 2kW and 3.5 kW	100
<u>IX7-CON-F</u>	\$21.00	AutomationDirect drive main power connector, replacement, 6-pin.	iX7NH series drives, 2kW and 3.5 kW	
<u>L7P-CON-A</u>	\$16.50	Replacement 11-pin drive power connector. Do not wire to pin 4 (the "N" terminal)	L7PA series 230VAC 400W and 1kW drives	a summer and
<u>L7P-CON-B</u>	\$8.75	Replacement 3-pin drive power connector.	L7PA series 230VAC 400W and 1kW drives	
		Continued on nex	t page	



# LS Electric AC Servo Systems

### Accessories, continued

#### L7C/L7P/iX7NH System Braking Resistors

Use external braking resistors to provide additional regenerative capacity and to dissipate heat away from the servo drive.

Part Number	Price	Description	Drawing	Compatible Drive Series	Compatible Drive Models
<u>APCS-140R50-AD</u>	\$21.00	LS Electric 140W $30\Omega$ encapsulated braking resistor	<u>PDF</u>	All 400W LS drives	L7CA004U-AD L7PA004U-AD IX7NHA004U-AD
<u>APCS-300R30-AD</u>	\$27.00	LS Electric 300W 30Ω encapsulated braking resistor	<u>PDF</u>	All 230VAC 750W and 1kW LS drives	L7CA010U-AD L7PA010U-AD IX7NHA008U-AD IX7NHA010U-AD
<u>APC-600R30-AD</u>	\$48.00	LS Electric 600W 30Ω encapsulated braking resistor.	<u>PDF</u>	All 230VAC 2.2 kW and 3.5 kW LS drives	L7PA020U-AD L7PA035U-AD IX7NHA020U-AD IX7NHA035U-AD
<u>APC-600R28-AD</u>	\$73.00	LS Electric 600W $28\Omega$ encapsulated braking resistor.	<u>PDF</u>	All 230VAC 5.5 kW and 7.5 kW LS drives	L7PA050U-AD L7PA075U-AD
<u>APCS-300R82-AD</u>	\$18.00	LS Electric 300W 82Ω encapsulated braking resistor.	<u>PDF</u>	All 460VAC 1kW LS drives	L7PB010U-AD
<u>APCS-600R140-AD</u>	\$48.00	LS Electric 600W 140 $\Omega$ encapsulated braking resistor.	PDF	Alternate resistor for 460VAC 2.2 kW and 3.5 kW LS drives	Alternate resistor for L7PB020U-AD L7PB035U-AD
<u>APCS-600R75-AD</u>	\$48.00	LS Electric 600W 75Ω encapsulated braking resistor.	<u>PDF</u>	All 460VAC 2.2, 3.5, 5.5, and 7.5 kW LS drives	L7PB020U-AD L7PB035U-AD L7PB050U-AD L7PB075U-AD

NOTE: 600W resistors require customer-supplied M5-.8 bolts and cable lugs for connection.



APCS-140R50-AD



# **ELECTRIC** LS Electric AC Servo Systems

## Accessories, continued

NOTE: These parts available for sale to North American locations only

#### L7C/L7P/iX7NH/PHOX System Planetary Gearboxes

Precision planetary gearboxes can increase the torque output of servo systems while reducing the reflected load inertia for higher response. Gearboxes offer high stiffness, high efficiency, and very quiet operation. Input motor shaft clamp, oversized output shaft key, and mounting hardware are included for mating to LS Electric motors.

#### Features:

- Maintenance free (no need to replace lubrication)
- IP65
- Operating temperature range of -10°C to +90°C [14°F to 194°F]
- Uses VIGO Grease RE #0



**MSS Series Planetary Gearbox** 

MSS Series Planetary Gearbox Specfications											
Model	<u>96200004</u>	96200005	<u>96200103</u>	<u>96200007</u>	96200008	96200257	<u>96200373</u>	<u>96200378</u>	<u>96200393</u>	<u>96200459</u>	
Manufacturer Part Number	MSS0601A- 005KS- B3110103C14	MSS0601A- 010KS- B3110103C14	MSS0902B- 020KS- B3110103C14	MSS0901A- 005KS- C3110103C19	MSS0901A- 010KS- C3110103C19	MSS1152B- 020KS- C3110103C19	MSS0901A- 005KS- C4120103C19	MSS0901A- 010KS- C4120103C19	MSS1152B- 020KS- C4120103C19	MSS1151A- 005KS- D3110103C22	
Compatible Motors	APMC-F a	BL series 100, 2 and 400 W motor	200, 300, s	APMC FCL series 750W and 1kW motors			APM-FE ser	APM-FE series 1.6 kW motors			
Price	\$327.00	\$336.00	\$598.00	\$426.00	\$439.00	\$864.00	\$385.00	\$396.00	\$792.00	\$549.00	
Drawing	PDF	PDF	PDF	PDF	PDF	PDF	PDF	<u>PDF</u>	PDF	<u>PDF</u>	
Ratio	5:1	10:1	20:1	5:1	10:1	20:1	5:1	10:1	20:1	5:1	
Nominal Output Torque	54 N∙m	42 N∙m	143 N∙m	160 N∙m	121 N∙m	295 N∙m	160 N∙m	121 N∙m	295 N∙m	332 N∙m	
Inertia	0.13 kg/cm <sup>2</sup>	0.13 kg/cm <sup>2</sup>	0.13 kg/cm <sup>2</sup>	0.48 kg/cm <sup>2</sup>	0.44 kg/cm <sup>2</sup>	0.48 kg/cm <sup>2</sup>	0.48 kg/cm <sup>2</sup>	0.44 kg/cm <sup>2</sup>	0.48 kg/cm <sup>2</sup>	2.81 kg/cm <sup>2</sup>	
Output Shaft Diameter	16mm	16mm	22mm	22mm	22mm	32mm	22mm	22mm	32mm	32mm	
Stage	1	1	2	1	1	2	1	1	2	1	
Frame	60mm	60mm	90mm	90mm	90mm	115mm	90mm	90mm	115mm	115mm	
Nominal Input Speed (rpm)	5,000	5,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	4,000	
Max Input Speed (rpm)	10,000	10,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	
Emergency Stop Torque					3 times nomina	al output torque					
Noise (dB)	≤54	≤54	≤56	≤56	≤56	≤59	≤56	≤56	≤59	≤59	
Efficiency (%)	≥97	≥97	≥94	≥97	≥97	≥94	≥97	≥97	≥94	≥97	
Backlash (Arcmin)	≤7	≤7	≤9	≤7	≤7	≤9	≤7	≤7	≤9	≤7	
Max Radial Load (N)	1,280	1,280	3,200	3,200	3,200	6,800	3,200	3,200	6,800	6,800	
Max Axial Load (N)	690	690	1,600	1,600	1,600	3,400	1,600	1,600	3,400	3,400	
Service Life (Hours)				20,00	00 (10,000 under	continuous ope	ration)				
				Continu	ied on next pag	e					



**LS**ELECTRIC LS Electric AC Servo Systems

## Accessories, continued

MSS Series Planetary Gearbox Specifications											
Model	<u>96200464</u>	<u>96200479</u>	<u>96200010</u>	<u>96200011</u>	<u>96200445</u>	<u>96200013</u>	<u>96200014</u>	<u>96200701</u>	<u>96200016</u>	<u>96200017</u>	<u>96200862</u>
Manufacturer Part Number	MSS1151A- 010KS- D3110103C22	MSS1422B- 020KS- D3110103C22	MSS1151A- 005KS- D3110103C24	MSS1151A- 010KS- D3110103C24	MSS1422B- 020KS- D3110103C24	MSS1421A- 005KS- E3110103C35	MSS1421A- 010KS- E3110103C35	MSS1802B- 020KS- E3110103C35	MSS1801A- 005KS- F3110103C42	MSS1801A- 010KS- F3110103C42	MSS1802A- 015KS- F3110103C42
Compatible Motors	APM-FE se mo	eries 1.6 kW tors	APM-FI	E series 2.2 kW	motors	APM-FF serie	es 3.5 kW and 5	5.5 kW motors	APM-FF series 7.5 kW motors		
Price	\$565.00	\$1,167.00	\$549.00	\$565.00	\$1,167.00	\$847.00	\$872.00	\$2,035.00	\$1,628.00	\$1,676.00	\$2,096.00
Drawing	PDF	<u>PDF</u>	PDF	PDF	PDF						
Ratio	10:1	20:1	5:1	10:1	20:1	5:1	10:1	20:1	5:1	10:1	15:1
Nominal Output Torque	262 N∙m	295 N∙m	332 N∙m	262 N∙m	295 N∙m	634 N∙m	500 N∙m	1060 N∙m	1195 N∙m	960 N∙m	897 N∙m
Inertia	2.59 kg/cm <sup>2</sup>	2.81 kg/cm <sup>2</sup>	2.81 kg/cm <sup>2</sup>	2.59 kg/cm <sup>2</sup>	2.81 kg/cm <sup>2</sup>	7.52 kg/cm <sup>2</sup>	7.05 kg/cm <sup>2</sup>	7.52 kg/cm <sup>2</sup>	24.29 kg/cm <sup>2</sup>	23.51 kg/cm <sup>2</sup>	24.29 kg/cm <sup>2</sup>
Output Shaft Diameter	32mm	40mm	32mm	32mm	40mm	40mm	40mm	55mm	55mm	55mm	55mm
Stage	1	2	1	1	2	1	1	2	1	1	2
Frame	115mm	142mm	115mm	115mm	142mm	142mm	142mm	180mm	180mm	180mm	180mm
Nominal Input Speed (rpm)	4,000	3,000	4,000	4,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Max Input Speed (rpm)	8,000	6,000	8,000	8,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Emergency Stop Torque					3 times	nominal output	t torque				
Noise (dB)	≤59	≤62	≤59	≤59	≤62	≤62	≤62	≤64	≤64	≤64	≤64
Efficiency (%)	≥97	≥94	≥97	≥97	≥94	≥97	≥97	≥94	≥97	≥97	≥94
Backlash (Arcmin)	≤7	≤9	≤7	≤7	≤9	≤7	≤7	≤9	≤7	≤7	≤9
Max Radial Load (N)	6,800	9,300	6,800	6,800	9,300	9,300	9,300	15,100	15,100	15,100	15,100
Max Axial Load (N)	3,400	4,500	3,400	3,400	4,500	4,500	4,500	7,500	7,500	7,500	7,500
Service Life (Hours)					20,000 (10,00	0 under continu	ious operation)				