



Motion: LS Electric Servo Systems

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LS ELECTRIC AC Servo Systems

LS Electric AC servo systems

The LS Electric families of brushless servo systems are fully digital and offer a rich set of features to cover a broad range of motion control applications. There are 46 standard servo motors, with and without holding brakes, which can be operated in combination with one of 18 standard servo drives.

The LS families include standard accessories such as: factory-made encoder cables & power/ brake cables, and DIN-rail mount I/O break-out kits for easy connection of external command and I/O signals, optional external braking resistors, and optional AC input filters and even a set of matched gearboxes available in three gear ratios for each motor.

Basic, intermediate, and advanced features at fantastic prices!

LS Electric Servos provide the most requested features: setup wizards, auto tuning, built-in indexer and more - in an extremely cost-effective package. The Basic L7C systems offer an impressive array of servo features at the price of some stepper systems. Step up to the intermediate L7P for a 19-bit absolute encoder, along with vibration reduction circuitry, additional I/O capability - with greater range of power input options. Or upgrade to the advanced iX7 servo systems for precision coordinated multi-axis control over EtherCAT or ModbusTCP networks.

Why use a servo?

Servo systems provide the highest possible level of performance for precise control of position, velocity, and torque. Compared to lower cost stepping systems, servo systems provide:

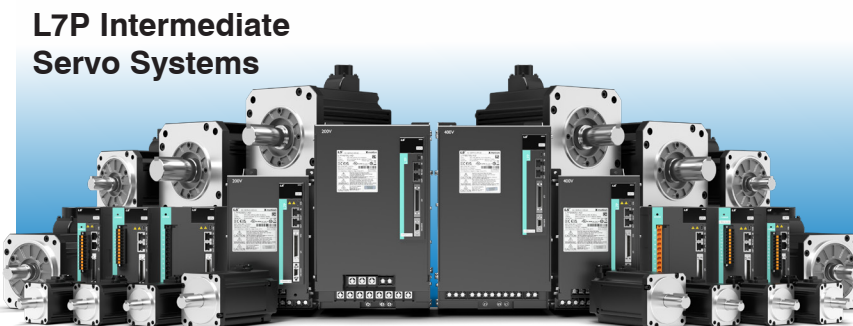
- More torque at higher speeds (up to 5,000 rpm)
- Higher response with closed-loop control (high hit rate without stalling or lost position)



L7C Basic Servo Systems

L7C Basic Servo Systems

- 5 Sizes from 100W to 1kW
- Low inertia models
- 230VAC single-phase input power
- Analog/Pulse/Serial Modbus Control



L7P Intermediate Servo Systems

L7P Intermediate Servo Systems

- 12 Sizes from 100W to 7.5kW
- Low and medium inertia models
- 230VAC & 460VAC three-phase input power (230VAC single-phase up to 2.2kW)
- Analog/Pulse/Serial Modbus Control



iX7 Advanced Servo Systems

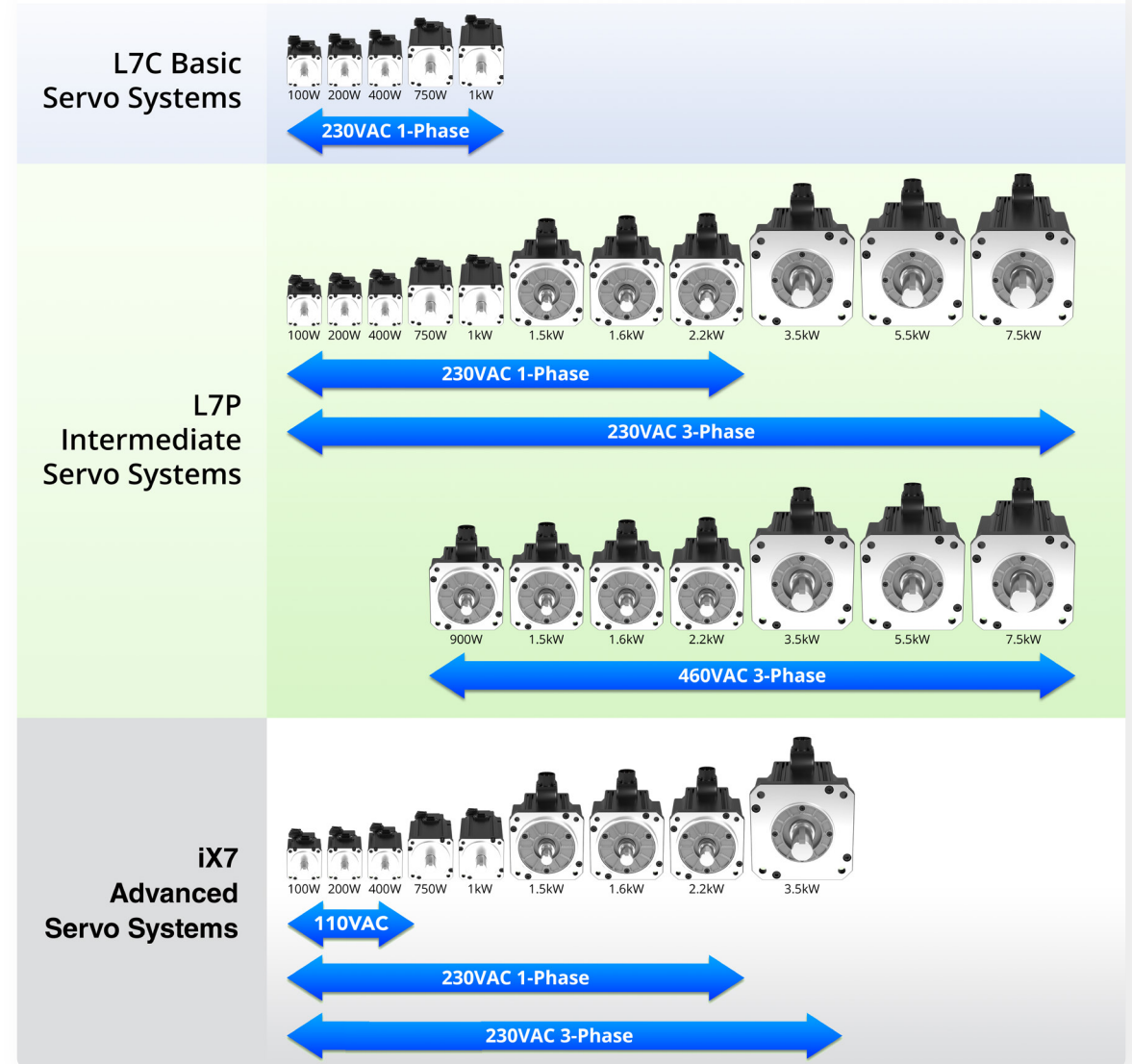
iX7 Advanced Servo Systems

- 9 Sizes from 100W to 3.5kW
- EtherCAT and ModbusTCP connectivity
- Low and medium inertia models
- 110VAC single-phase up to 400W
- 230VAC single-phase up to 2.2kW
- All sizes accept 230VAC 3φ input power

Servo System Features

- Control via analog speed or torque signal, high-speed pulse train, or internal indexing or network control
- Free Drive CM set-up software
- Compatible with most AutomationDirect PLCs; or any other host controller or HMI
- IP67 motors and IP65 gearboxes
- Select servo drives feature on-board motion controller (initiate moves with PLC outputs or with serial Modbus communication)
- Field upgradable firmware to keep your systems up-to-date
- Professionally manufactured cables for motor power, encoder feedback, and brake - with standard and continuous flexing cable options

Motor Size - vs - Input Power Options



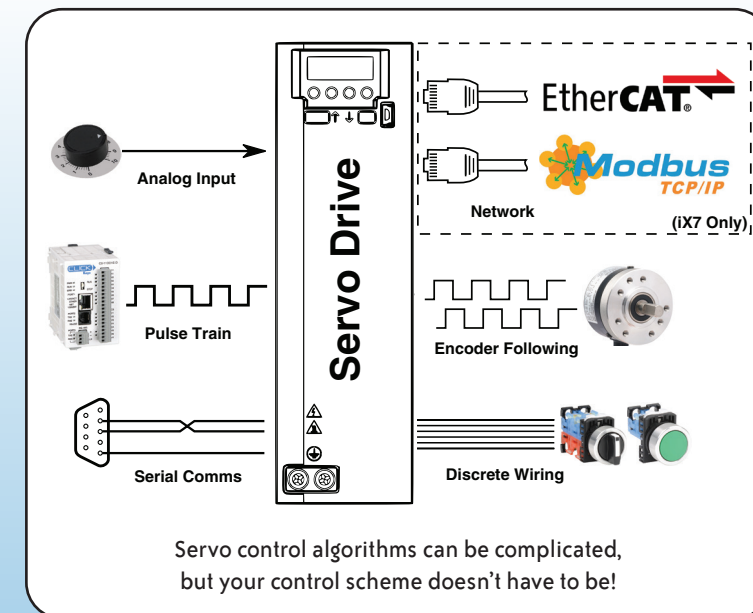
Control Options

Analog Velocity or Torque Control: Both L7C and L7P systems accept a +10/-10V signal from a motion controller, PLC, or potentiometer. Just scale the voltage signal to your desired speed or torque (in the servo drive), it's that simple. These servo drives even allow an "analog deadband" setting to eliminate jitter or drift when using a manual (potentiometer) signal for speed control.

Pulse Train: This is the most popular option for PLC-based control; L7C and L7P systems accept a high-speed pulse input signal up to 1MHz (line driver) or 200kHz (open collector). If your PLC has a slower pulse train output (max speed), the servo drive is happy to scale the values. Works with all Automation Direct PLC families (hardware must support high-speed outputs). LS servo systems also accept quadrature pulse and CW/CCW input signals for encoder following applications.

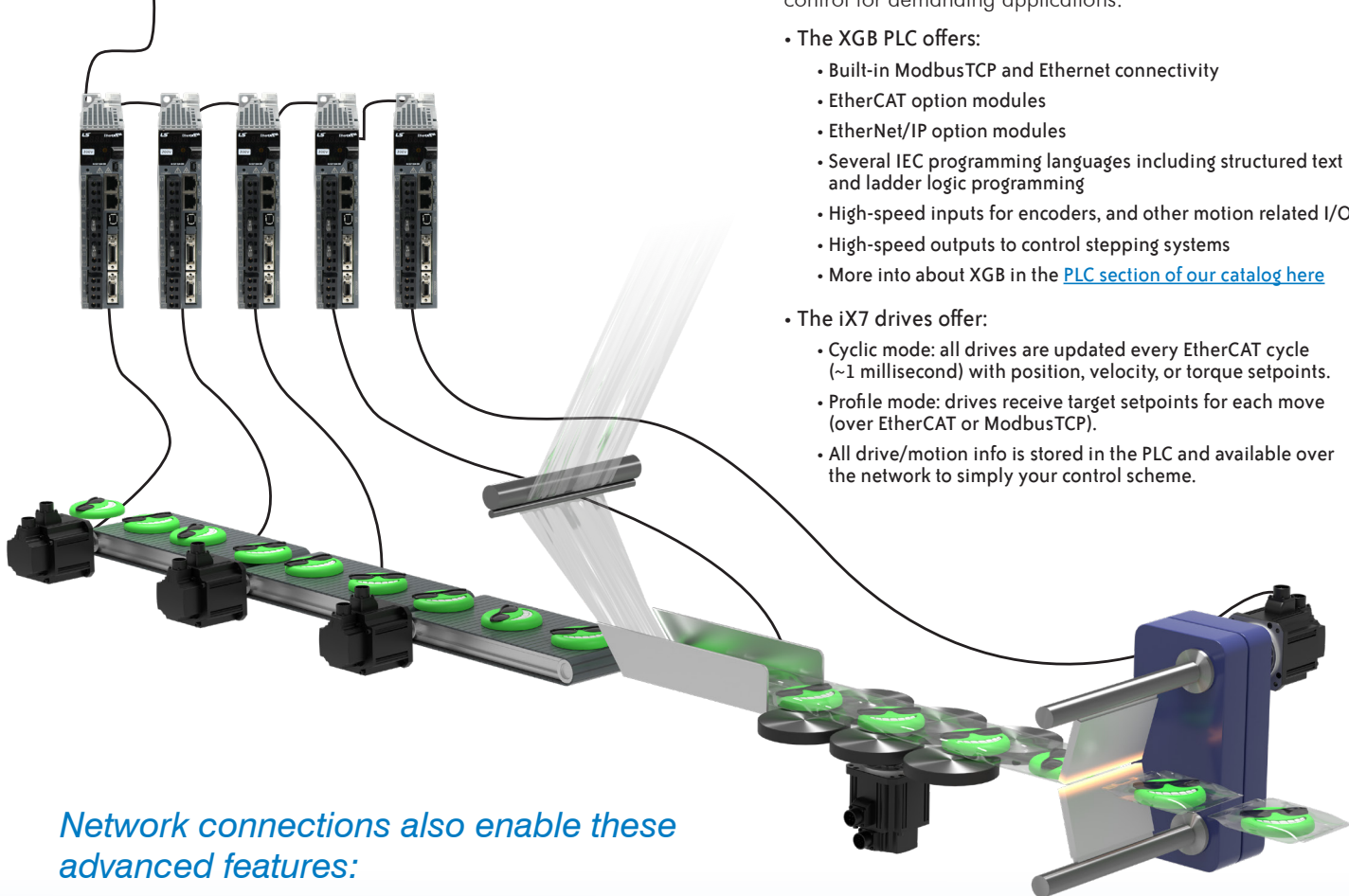
Internal Indexing: Get high-performance/full-blown motion control with a simple PLC (or no PLC at all). L7C and L7P systems accept standard PLC discrete outputs to command internally predefined moves OR use serial communications (Modbus) commands to set dynamic speeds & distances AND to initiate those moves. You can even use the internal indexer to provide manual machine control with just a few buttons and switches. For example, use a selector switch to select a predefined move from an index, and then use a pushbutton to START that move. Simple registration operations can even be handled with the built-in indexer - see the user manual for details.

Network Command and Control: Step up to iX7 servo systems for advanced control of multi-axis servo systems over EtherCAT or ModbusTCP networks. With EtherCAT cyclic modes, all drives are updated every EtherCAT cycle (~1 millisecond) with position, velocity, or torque setpoints. In profile modes, drives receive target setpoints for each move (over EtherCAT or ModbusTCP).



Servo control algorithms can be complicated, but your control scheme doesn't have to be!

LS ELECTRIC AC Servo Systems



EtherCAT® Multi-Axis Servo Systems

Use the LS Electric XGB PLC in conjunction with LS Electric iX7 servo systems to enable high-performance multi-axis control for demanding applications.

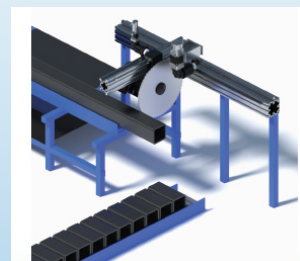
- The XGB PLC offers:
 - Built-in ModbusTCP and Ethernet connectivity
 - EtherCAT option modules
 - EtherNet/IP option modules
 - Several IEC programming languages including structured text and ladder logic programming
 - High-speed inputs for encoders, and other motion related I/O
 - High-speed outputs to control stepping systems
 - More into about XGB in the [PLC section of our catalog here](#)
- The iX7 drives offer:
 - Cyclic mode: all drives are updated every EtherCAT cycle (~1 millisecond) with position, velocity, or torque setpoints.
 - Profile mode: drives receive target setpoints for each move (over EtherCAT or ModbusTCP).
 - All drive/motion info is stored in the PLC and available over the network to simply your control scheme.

Network connections also enable these advanced features:

(When using LS Electric iX7 servo systems in combination with an LS Electric XGB PLC)

Define up to 400 position setpoints (per axis!) in the PLC

Then trigger those moves over the network. (All the motion parameters are stored, loaded and triggered in the PLC – simplifying your control scheme).



Flying Shear

Traversing axis tracks the motion of material feed to make cuts “on the fly”, without having to stop or pause production (material flow).

Registration

Set up precise registration corrections with a sensor input, and automatically correct for inconsistencies or variations in products or processes.

Electronic Camming

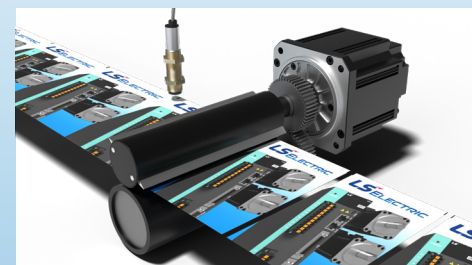
Eight cam profiles (per axis) can be configured from a mix of 20 predefined curve shapes.

Electronic Gearing

Create multiple gear ratios between axes. Switch ratios “on the fly”.

Advanced Torque Control

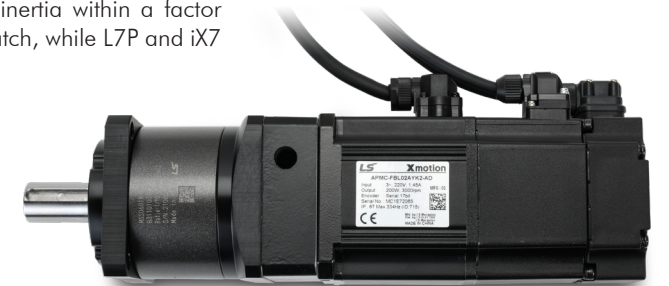
Perfect for precise tensioning and winding applications.



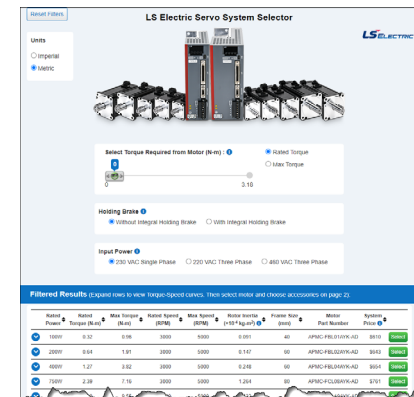
Need more torque?

The LS Electric servo families also offer matched sets of gear reducers to increase the available output torque or to solve inertia mismatch problems with high-mass loads (Rule-of-thumb for highest performance: keep the reflected load inertia within a factor of 10:1 of the motor.) L7C systems can handle a 20:1 inertia mismatch, while L7P and iX7 systems can operate with up to a 30:1 mismatch.

- 5:1, 10:1 and 20:1 gearboxes matched to every motor size (15:1 max ratio for 7.5kW motor)
- Increase the motor output torque 5x, 10x or 20x (less the inefficiency of the gearbox)
- Full motor output torque allowed for all pairings
- Reflected inertia of the load is reduced by the square of the reduction ratio (be sure to add the gearbox inertia when calculating)
- Mounting hardware included



Servo Motor with Precision Gearbox Attached

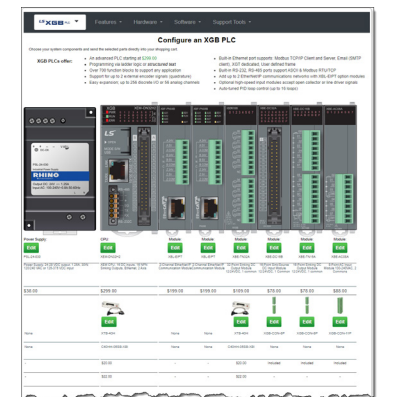


www.automationdirect.com/selectors/ls-servo

Worry-Free System Selection Tools

Use our online LS servo system selector to properly size and specify all the required and optional parts for your servo systems on the first order.

Then pop over to the XGB Online PLC Configuration Tool and configure your XGB PLC...



www.automationdirect.com/ls/config

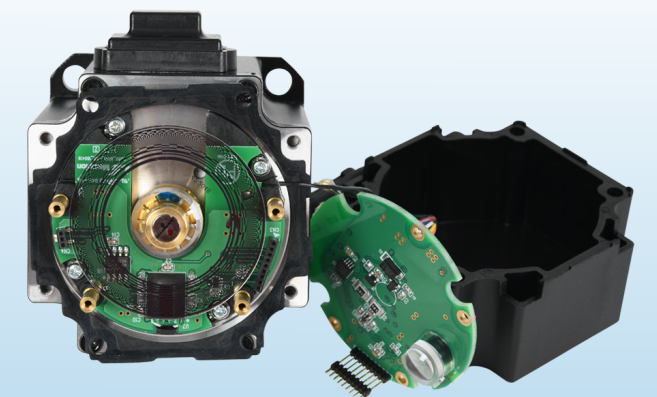
Precise Encoder Feedback

The LS families use different encoder technologies. Both are very accurate – so for many applications it may not be a critical factor. The L7C motors have a 17-bit incremental encoder, while the L7P & iX7 motors sport a 19-bit absolute encoder:

- 17-bit Incremental encoders (L7C motors)
 - Highly accurate (131,072 discrete pulses per revolution)
 - Some applications will require “homing” on power-up
- 19-bit Absolute encoders (L7P & iX7 motors)
 - Even more accurate (524,288 discrete pulses per revolution)
 - The servo drive will know the exact rotor position on power-up

Take Advantage of User Units

Use the Electronic Gear Ratio feature to setup custom User Units for your convenience. For example, you could set the user units to 360 so that a move of 360 user units would rotate the shaft exactly one turn. And rest assured that the drive is still using that impressive 17- or 19-bit encoder precision behind the scenes. User units allow you to dispense with those large encoder count values and may help simplify any calculations you are performing in your application.





What type of input power is available?

This question is often essential to selecting a servo family. If you only have 110 VAC available, or if you have 230V but only in single-phase, that may dictate which family of servo system you must choose. But we offer capable systems for any power input type.

What type of encoder is required?

See the previous page for an explanation of the encoder types and resolutions that are offered

How do you control a servo system?

The previous pages also have details about the various ways to control your servo system.

Do you need deadband?

Analog applications may benefit from adjustable input deadband, when there is an "at rest" position of the shaft/load where no motion is desired, but the analog signal is not 100% stable. Without deadband the servo system may create unwanted "jitter". Application examples include rotary tables or conveyors that are controlled by potentiometers (operator controlled speed).

What is inertia Mismatch?

Inertia mismatch is caused when the fairly small inertia of the servo motor rotor/shaft is attached to a high-inertia load. Dynamic applications with high hit rates will always benefit from a lower inertia ratio. Servo systems can overcome mismatches to a point, but performance may suffer. So, it's a good idea to keep the inertia of the driven load as small as possible. But sometimes mismatches are unavoidable.

If your application has a very high inertia, you may wish to consider a precision gearbox. Gearboxes reduce the reflected load inertia (to the motor) by the square of the gear ratio! But, of course, the top speed at the gearbox output shaft will be reduced considerably.

If you need a gearbox, we offer a set of perfectly matched gearboxes for each servo motor, complete with mounting hardware. See the previous page for details.

What is registration?

Registration refers to the capability of matching the speed and position of one axis-of-motion with that of another. Examples include printing on a moving target, flying shear applications, or punching or drilling accurately on a moving part. The servo system must be able to accurately sense the motion of the target during the active (or "registered") portion of the process.

	L7C Basic Servo Systems	L7P Intermediate Servo Systems	iX7 Advanced Servo Systems
Motor power range	100W to 1kW	100W to 7.5kW	100W to 3.5kW
Input power	230VAC 1-phase	230/460VAC 3-phase (230 1Φ up to 2kW)	230VAC 3-phase (110VAC 1Φ up to 400W, 230VAC 1Φ up to 2.2kW)
Bandwidth (velocity loop)	1 kHz		
Motor encoder resolution	131,072 ppr (17 bit)	524,288 ppr (19 bit)	524,288 ppr (19 bit)
Encoder output	Line Driver	Line Driver & Open Collector	Line Driver, up to 6.5 Mpps
Absolute encoder	No	Yes (with included battery)	Yes (with included battery)
Pulse input (PLS/DIR, CW/CWW & AB quadrature modes)	Yes 1MHz line driver and 200kHz open collector		None
Speed modes	+10 VDC analog control Up to 8 predefined speed registers selected via discrete inputs		Yes: via EtherCAT® or ModbusTCP
Torque modes	+10 VDC analog control		Yes: via EtherCAT® or ModbusTCP
Analog input deadband option	Speed and Torque modes	Speed mode	Deadband for Position Control only (no analog input)
Torque limit in speed mode	Yes		
Speed limit in torque mode	Yes		
Vibration elimination	No	Yes	Yes
Notch filters	4		
Max inertia mismatch	up to 20:1	up to 30:1	up to 30:1
Safe Torque Off (STO)	No	No	Yes
Indexing modes	Position Registers up to 64 Relative and Absolute Moves Simple motion sequencing Simple Registration Blended moves Rotary Table indexing (up to 64 indexes)		One position register Supports Cyclic Mode via EtherCAT® Profile Mode via EtherCAT® or ModbusTCP.
Electronic camming (E-Cam)	No	No	Yes: via EtherCAT®
Registration	Basic	Basic	Yes: via EtherCAT® or ModbusTCP
High speed capture/compare	No	No	Yes: via EtherCAT® or Modbus TCP
Software config and troubleshooting	Yes		
Software oscilloscope	Up to 4 channels		
USB software connectivity	Yes		
Communications available	Serial: RS-422 Modbus-RTU (compatible with RS-485)		Ethernet: ModbusTCP EtherCAT®
Communications ports	Discretely wired	Two dedicated RJ45 serial ports	Two dedicated RJ45 Ethernet ports
Regenerative and dynamic braking	Yes		
Digital inputs	10 configurable	16 configurable	6 configurable
Analog inputs	2 (+/- 10VDC)	2 (+/- 10VDC)	1 (+/- 10VDC) for torque limit only
Digital outputs	5 configurable, 3 fixed for alarms	8 configurable	3 configurable
Analog outputs	0	2 (+/- 10VDC)	2 (+/- 10VDC)
	Drives start at \$286.00 Motors start at \$210.00	Drives start at \$375.00 Motors start at \$260.00	Drives start at \$495.00 Motors start at \$260.00