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Motion: LS Electric Servo Systems

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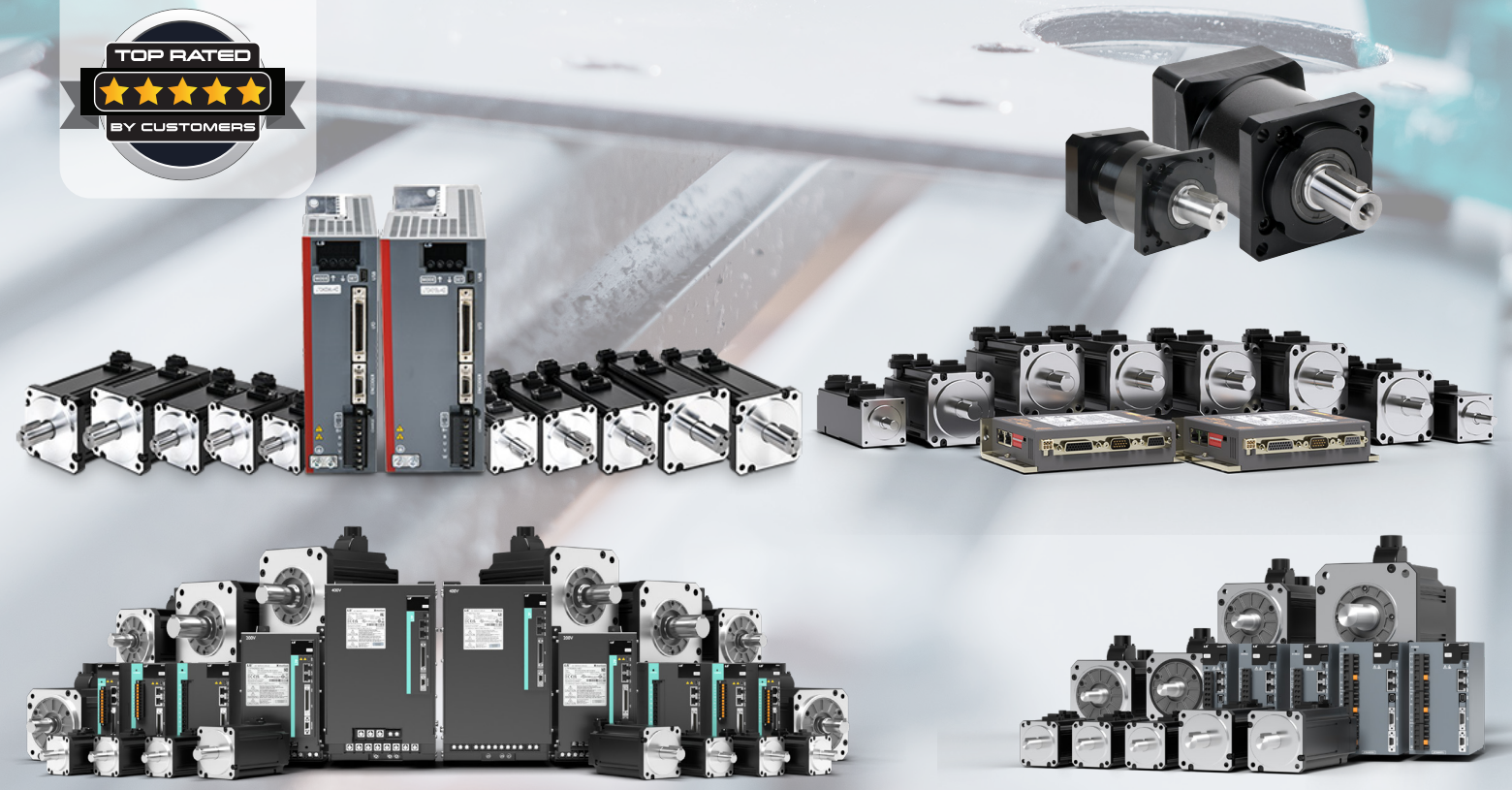
LS ELECTRIC



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 systems offer an impressive array of servo features at the price of some stepper systems. Step up to an intermediate system 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 servo system 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)

Servo System Features

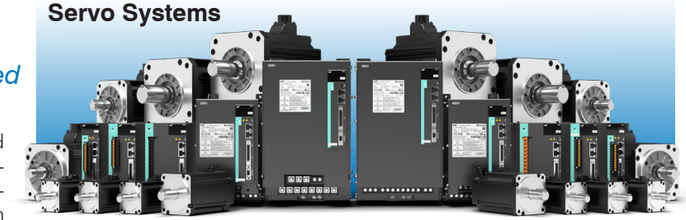
- Control via analog speed or torque signal, high-speed pulse train, or internal indexing or network control
- Free Drive CM set-up software
- Compatible with most AutomationDirect PLCs; or any other host controller or HMI
- IP67 motors and IP65 gearboxes
- Select servo drives feature on-board motion 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

L7C Basic Servo Systems

L7C Basic Servo Systems

- 5 Sizes from 100W to 1kW
- Low inertia models
- 230VAC single-phase input power
- Speed/torque, pulse train, internal indexing and/or serial Modbus control

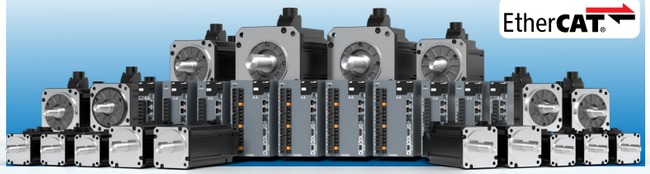
L7P Intermediate Servo Systems



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)
- Speed/torque, pulse train, internal indexing and/or serial Modbus control

iX7 Advanced Servo Systems



iX7 Advanced Servo Systems

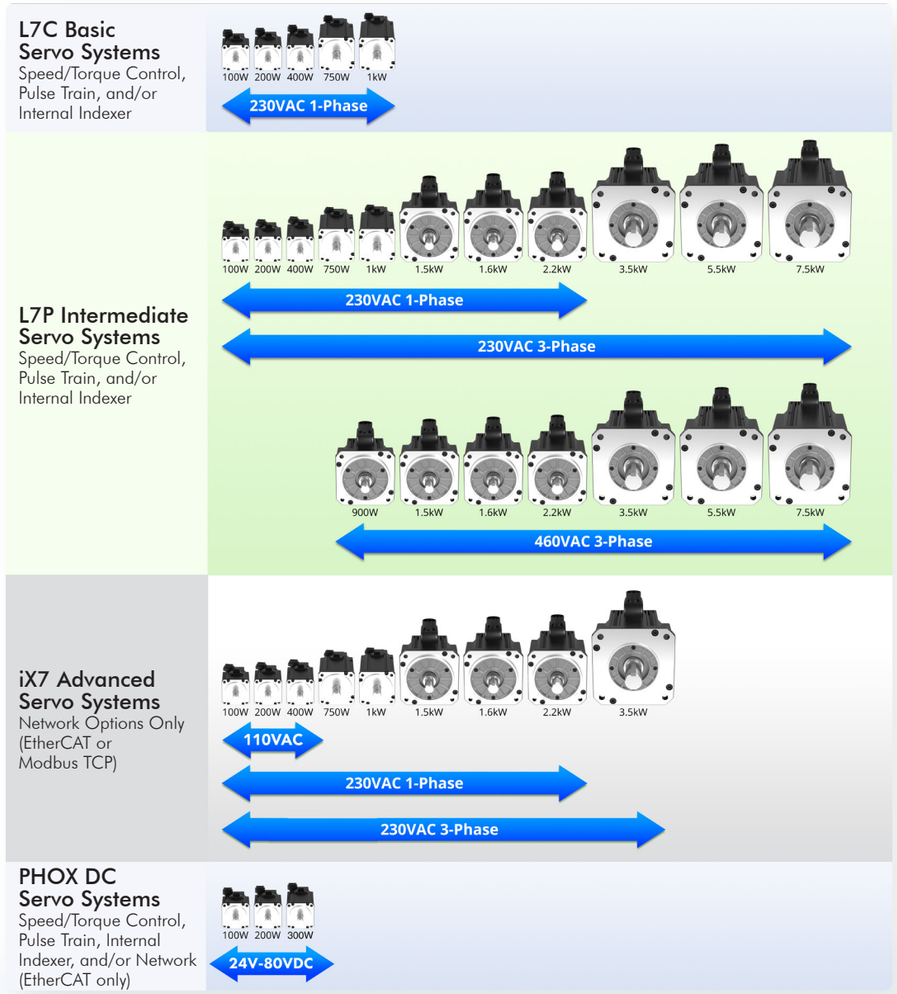
- 9 Sizes from 100W to 3.5kW
- EtherCAT and ModbusTCP connectivity
- Low and medium inertia models
- 110VAC single-phase up to 400W
- 230VAC single-phase up to 2.2kW
- All sizes accept 230VAC 3ϕ input power

PHOX DC Servo Systems

PHOX DC Servo Systems

- 4 Sizes from 100W to 300W
- Non-EtherCAT speed/torque, pulse train, and/or internal indexer control
- Network control with EtherCAT
- Supports external encoder feedback for full closed loop control
- Perfect for mobile applications
- Or share a DC power source between multiple axes

Control Types, Motor Sizes & Input Power options



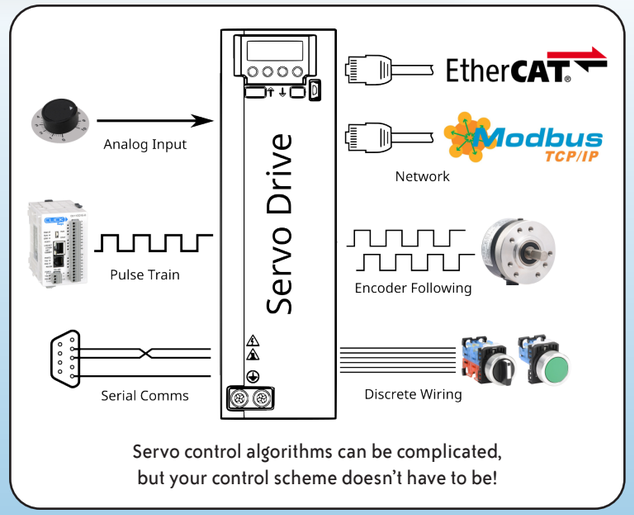
Control Options (see chart above - not all systems accept all control options)

Speed or Torque Control: The servo drive accepts 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. LS Electric 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; the servo drive accepts a high-speed pulse input signal up to 1.4MHz (line driver) or 200kHz (open collector). If your PLC has a slower pulse train output (max speed), the servo drive can scale the value. Works with all AutomationDirect PLC families (hardware must support high-speed outputs). Most LS servo systems also accept quadrature pulse and CW/CCW input signals for encoder following applications.

Internal Indexing: Get high-performance motion control with a simple PLC (or no PLC at all). The servo drive accepts 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 selector switches to select predefined moves 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: Achieve 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 ervo systems to enable high-performance multi-axis control for demanding applications.

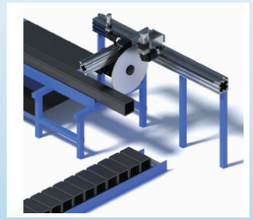
- The XGB PLC offers:
  - Built-in ModbusTCP and Ethernet connectivity
  - EtherCAT option modules
  - EtherNet/IP option modules
  - Several IEC programming languages including structured text and ladder logic programming
  - High-speed inputs for encoders, and other motion related I/O
  - High-speed outputs to control stepping systems
  - More into about XGB in the PLC section of our catalog here
- EtherCAT compatible 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 simplify your control scheme.

Network connections also enable these advanced features:

(When using EtherCAT compatible 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).

Electronic Camming

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

Registration

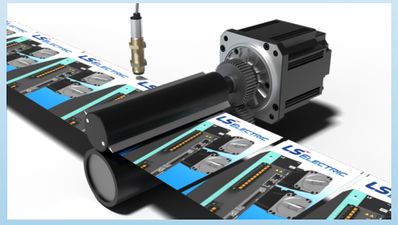
Set up precise registration corrections with a sensor input, and automatically correct for inconsistencies or variations in products or processes.

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, iX7 & PHOX 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

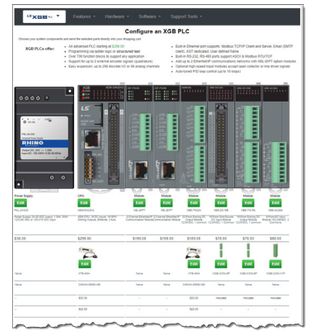
Servo Motor with Precision Gearbox Attached

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…



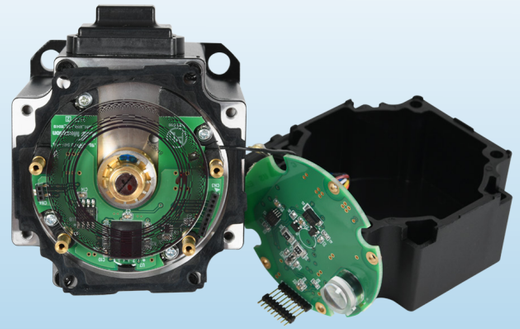
www.automationdirect.com/ls/config

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, and PHOX motors sport either 18-bit or 19-bit absolute encoders.

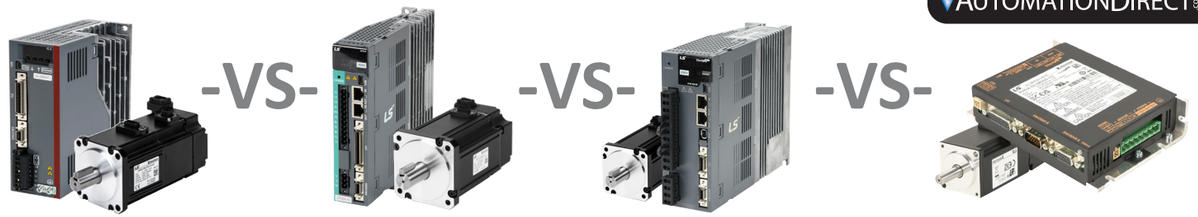
The motors with absolute encoders not only know their 360 degree position when powered up, they know how many times the shaft has turned when the power was off (an encoder battery is factory-mounted on each encoder cable). Home these axes once and the drive will always know exactly where the motor is (even if the motor was moved while the power was off).

- 17-bit Incremental encoders (L7C motors)
  - Highly accurate (131,072 discrete pulses per revolution)
  - Some applications will require "homing" on power-up
- 18-bit Absolute encoders (PHOX 100W FAL motor only)
  - Even more accurate (262,144 discrete pulses per revolution)
  - The servo drive will know the exact rotor position on power-up
- 19-bit Absolute encoders (L7P, iX7 and PHOX FBL motors)
  - The most 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-, 18-, 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, or if you prefer DC, that may dictate which family of servo system you must choose. We offer capable systems for many power input types.

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" or creep. 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 (a 10:1 gearbox reduces reflected intertia by 100x)! 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 target and match 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	PHOX DC Servo Systems
Motor power range	100W to 1kW	100W to 7.5kW	100W to 3.5kW	100W to 300W
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)	24-80VDC
Bandwidth (velocity loop)	1 kHz			
Motor encoder resolution	131,072 ppr (17 bit) incremental	524,288 ppr (19 bit) absolute	524,288 ppr (19 bit) absolute	262,144 ppr (18 bit) absolute 524,288 ppr (19 bit) absolute
Encoder output	Line Driver	Line Driver & Open Collector	Line Driver, up to 6.5 Mpps	Line Driver, up to 6.4 Mpps
Absolute encoder	No	Yes (with included battery)		
Pulse input (PLS/DIR, CW/CWW & AB quadrature modes)	Yes 1MHz line driver and 200kHz open collector		None	Yes 4MHz line driver
Speed modes	+-10 VDC analog control Up to 8 predefined speed registers selected via discrete inputs		Yes: via EtherCAT® or ModbusTCP	Yes +-10 VDC analog control or Up to 8 predefined registers or EtherCAT®
Torque modes	+-10 VDC analog control		Yes: via EtherCAT® or ModbusTCP	Yes +-10 VDC analog control or EtherCAT®
Analog input deadband option	Speed and Torque Modes	Speed Mode	No	Speed and Torque Modes
Torque limit in speed mode	Yes			
Speed limit in torque mode	Yes			
Vibration elimination	No	Yes		
Notch filters	4			
Max inertia mismatch	up to 20:1	up to 30:1	up to 30:1	up to 30:1
Safe Torque Off (STO)	No	No	Yes	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	Position Registers up to 16 Relative and Absolute Moves Simple motion sequencing Simple Registration Blended moves Rotary Table indexing (up to 16 indexes) Supports Cyclic Mode via EtherCAT® Profile Mode via EtherCAT®
Electronic camming (E-Cam)	No	No	Yes: via EtherCAT®	Yes: via EtherCAT®
Registration	Basic	Basic	Yes: via EtherCAT®	Yes: via EtherCAT®
High speed capture/compare	No	No	Yes: via EtherCAT®	Yes: via EtherCAT®
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)		EtherCAT® or ModbusTCP	EtherCAT®
Communications ports	Discretely wired	Two dedicated RJ45 serial ports	Two dedicated RJ45 Ethernet ports	
Regenerative and dynamic braking	Yes			No
Digital inputs	10 configurable	16 configurable	6 configurable	4 configurable
Analog inputs	2 (+/- 10VDC)	2 (+/- 10VDC)	1 (+/- 10VDC) for torque limit only	1 (+/- 10VDC)
Digital outputs	5 configurable, 3 fixed for alarms	8 configurable	3 configurable	4 configurable
Analog outputs	0	2 (+/- 10VDC)	2 (+/- 10VDC)	2 (+/- 10VDC)
	Drives start at $325.00 **Motors start at $238.00**	**Drives start at $446.00** **Motors start at $309.00**	**Drives start at $561.00** **Motors start at $309.00**	**Drives start at$477.00** **Motors start at $294.00**