Electro Cam Corp.

Since 1977, Innovative Engineering for Position Sensing & Control Applications

Programmable Limit Switch Family

1746 Series

PLµS® Programmable Limit Switches are used in a wide variety of rotating-shaft control applications:

- Switching machine devices On and Off directly (solenoid valves, clutch/brakes, etc.)
- Interfacing to other microprocessor-based control systems (like Programmable Logic Controllers—PLC's)
- A combination of both of these configurations for direct output to "real-time" critical functions (PLC scan delays can deteriorate high speed accuracy needed for machine functions—gluing, hole punching, vacuum pickup, etc.)

Electro Cam's PLµS® controllers provide simplicity of keyboard programming to ensure rapid machine setup. The ease of programming allows adjustments during motion at the operator level, permitting fine tuning and quick changeovers.

PLµS® controllers can store multiple programs of timing setpoints for solenoids, cylinders, glue guns and other mechanisms. This allows quick production line changeover, reducing downtime and improving productivity.

Automatic Speed Compensation automatically compensates for fixed lag times of solenoid glue guns. Combine this with fast, microprocessor-based firmware and a PLµS® controller responds quickly to changes in line speed and product movement, minimizing machine errors, reducing scrap and down time.

The PLµS® typically monitors the production line every 300 to 500 microseconds, approximately 100 times faster than an average PLC with its more extensive programming. Although the PLC does interface directly with the production line, the functions it controls are low speed, relatively non-critical ones like data acquisition. For high speed, critical functions like label-to-product registration, the PLµS® provides faster control and improved precision, reducing scrap and rejects.

By handling complex automation functions under rapidly changing line conditions, PLµS® controllers allow an operator to concentrate on product flow into and out of the line, rather than constantly monitoring the line for malfunctions and manually adjusting setpoints. PLµS® controllers reduce operator stress and contribute to smooth, efficient production.

The **PS-5000 Series** features an integral keypad with controller and bright LED displays. With either 8-bit Gray Code encoder or resolver input and models with 9 to 64 (or more on some specials) outputs, the 5000 Series is flexible enough to meet most application requirements.

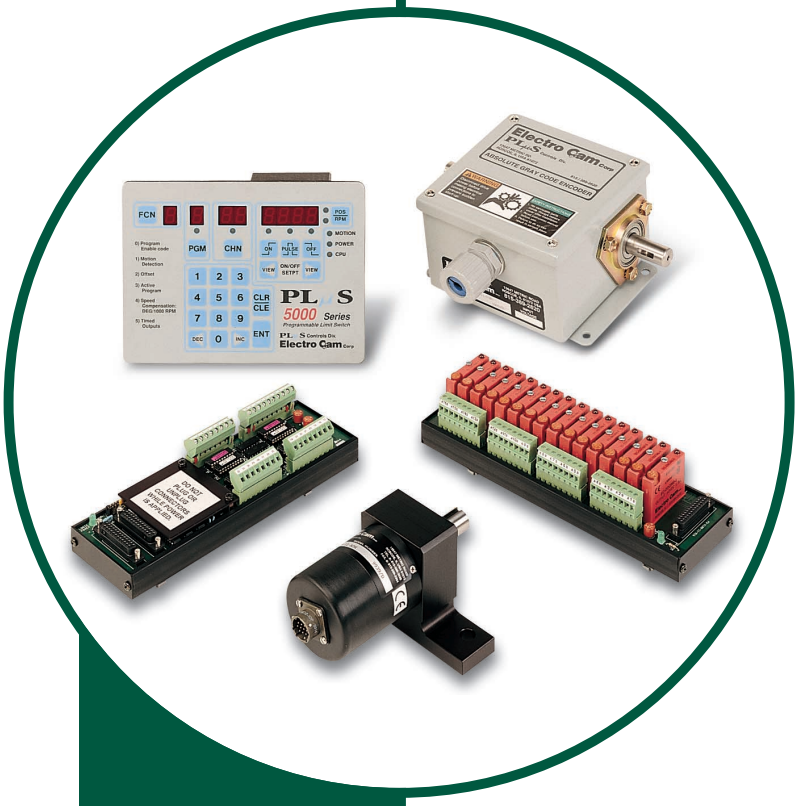
The **PS-6000 Series** features a remote, removable 1/4 DIN backlit LCD keypad/display. With its DIN rail mount controller and onboard I/O, the 6000 Series is designed to easily interface directly with PLCs as well as fire solenoids directly. PS-6344 dual axis models are available to control functions associated with two independent axes of rotation. Features such as high resolution (4096) and leading/trailing speed compensation are standard on this full-featured controller.

The **PL-1746 Series** PLµS® Plug-In Module is specifically designed utilizing technology from Allen-Bradley to plug into the SLC-500 PLCs. Programming may be done through the backplane using Rockwell Automation software or direct through an Electro Cam® 6400 keypad. With its own onboard micro-processor and non-volatile memory, it provides the added "horsepower" to provide both the speed-compensated, fast response outputs as well as the accurate 12-bit position information for the PLC.

Selected models of PLµS® controllers offer these features:

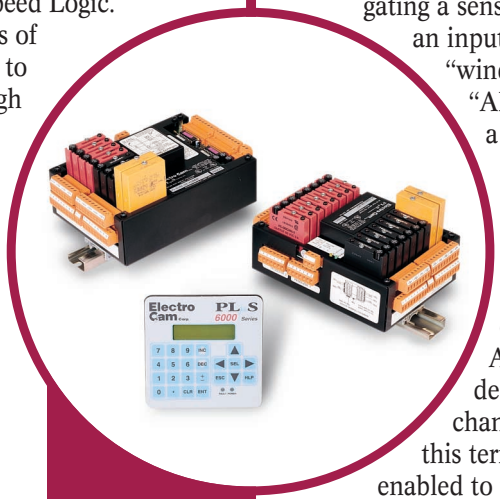
- Analog output capability (some models)
- Multiple program capacity
- Output speed compensation
- Output grouping and modes of operation to perform various machine logic functions
- Timed outputs
- Programmable resolver scale factor
- Serial communications
- Multi-level logic speed ranges
- Dual resolver inputs
- Shift register

For product changeovers, the PLC can send commands and operating parameters to the PLµS® controller to change setpoint programs via serial communications. Communications are available on most PLµS® models. In addition, selected Series 6000 models are available with standard Modbus™ ASCII compatibility.



5000 Series

The 6000 and select 5000 Series models have the capability to perform machine logic through the ability of using inputs to enable outputs. Electro Cam® refers to this ability to perform machine logic as Internal High Speed Logic. There are six modes of operation available to perform various high speed machine logic functions. The outputs can be configured into groups and assigned a mode of operation where the sensor input enables the output group. This can help reduce or eliminate the need for hard-wired logic or PLC interface.



6000 Series

The six different modes of operation provide the flexibility to set logic such as resetting position upon an input, gating a sensor to only allow an input within a "window," or to "AND" outputs with a sensor input.

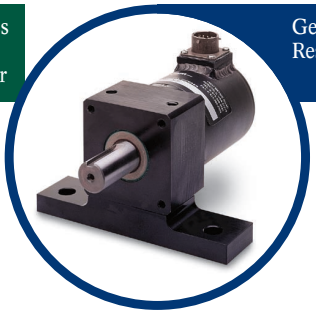
Output enable ANDing allows any output channels to be combined with an AND to any dedicated input. A channel ANDed with this terminal will be enabled to turn ON at its programmed setpoints only while the input is energized.

By handling complex functions like speed compensation, timed outputs and sensor gating, the PLµS® controller becomes a valuable compliment to PLC users, in that it relieves the PLC program of these functions, reducing the overall size of the program and decreasing overall scan times of the PLC. It also relieves a programmer of having to write complicated PLC control programming from scratch. The PLC software can exchange process variables and control data with the PLµS® controller, which handles direct high speed machine control through its own dedicated software.

All Plµs® models are c UL us and select models are CE. Consult factory for more information.

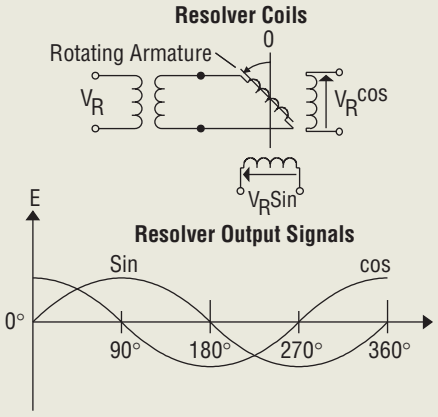
Resolvers... or Encoders

Multiple Resolver Models Available



Resolvers

Absolute position resolvers come housed in rugged industrial grade housings (NEMA 12 and NEMA 4X) with dual bearing construction. These highly accurate and repeatable brushless resolvers utilize a two phase stator and a single phase rotor to generate voltages that are transmitted back to an analog to digital converter in the controller. As the shaft rotates, the sin angle between the rotor and the stators represents absolute positions that can be scaled through setup in the controller from 2-4096 counts per revolution. Internally geared resolvers of various ratios from 2:1 to 36:1 are available to meet a wide variety of applications. High quality, shielded cables assembled at the factory with connectors, complete the system, providing fast, simple installation and reliable operation.



Resolvers are available in various mounts:

Foot Mount
- 3/4" Shaft
- Side or End Cable Connection
- Heavy-Duty Dual Bearings

Flange Mount
- 3/8" or 5/8" Shaft
- Side or End Cable Connection
- Heavy-Duty Dual Bearings

Servo Mount
- 3/8" Shaft
- Side or End Cable Connection
- Heavy-Duty Dual Bearings

Size 11 Servo Mount
- .120" Shaft

Stainless Steel
- 5/8" Shaft
- Right or Left Cable Connection
- Heavy-Duty Dual Bearings

Geared
- 3/4" Shaft
- 2:1 through 36:1 Gear Ratios Available
- Reduces multiple machine revolutions to one resolver shaft rotation
- Heavy-Duty Dual Bearings
- Consult factory about specific ratio needs

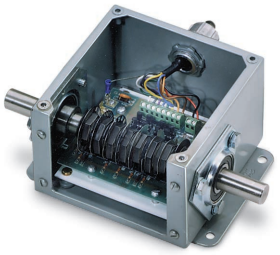
Note: All resolvers except Size 11 and NEMA 4X, use Mil-Spec type connectors. Size 11 has lead wires and NEMA 4X has one 1/2" NPT conduit fitting.

Encoders

The NEMA 12 and NEMA 4X Absolute Gray Code Encoders come housed in rugged, industrial-grade enclosures. These encoders provide 8-bit Gray Code signals to the PLµS® microprocessor for error-free transmission of shaft position information in applications not requiring position accuracy greater than ±0.7°. Encoder cables are built and tested at the factory for simple plug-in installation.

The code discs employed in the 8-bit Gray Code encoders are made of stainless steel instead of the more traditionally used glass, for rugged durability. Standard models are rated at speeds up to 1000 RPM, and high speed models operate at speeds up to 2000 RPM. The heavy-duty 3/4-inch input shaft can be directly coupled, chain driven or driven by timing belts.

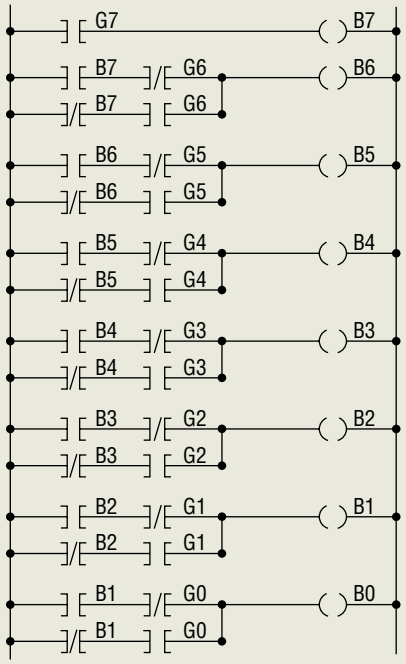
PLµS® controllers use encoders that output RS-422 signal levels for reliable long-distance transmission. These Gray Code encoders are also available with transistor outputs, either sinking, sourcing, high true or low true, for direct interface to PLCs or other electronic control systems.



Cutaway of sinking/sourcing encoder for demonstration only

Encoders use stainless-steel code discs for rugged durability

Gray Code to Binary Conversion



G0 - G7 = Gray Code Input Bits from Encoder to PLC

B0 - B7 = Binary Equivalent of Gray Code Position from Encoder

Also appropriate for G option on PLµS® controllers

Consult factory for logic configuration on individual models.

The PLµS® Family of Programmable Limit Switches

Model Number	Number of Program Selections	Number of Outputs	Type of Outputs	Output Enable Mode Logic	Speed Compensation	Timed Outputs	Position Transducer	Supply Voltage	Optional Features *
PL-1746-C01	48	32	SLIMLINE® Modules via PS-4108 I/O Rack or SLC-500 Backplane	6 Output Enable Modes	Yes, 16 Channels Max	Yes	1 Resolver	24 VDC Except CPU (From Backplane)	–
PL-1746-C04	48	32	Available to SLC-500 Backplane Only	6 Output Enable Modes; Backplane Only	Yes, 16 Channels Max	Yes	1 Resolver	24 VDC Except CPU (From Backplane)	–
PL-1746-C02/C03 -R1	48	32	6 real world high speed DC outputs on front of module C02 = 6 Sourcing C03= 6 Sinking 32 outputs backplane	6 Output Enable Modes	Yes, 16 Channels Max	Yes	1 Resolver	24 VDC Except CPU (From Backplane)	Shift Register (-S)
PL-1746-C02/C03 -E1-S	48	32	6 real world high speed DC outputs on front of module C02 = 6 Sourcing C03= 6 Sinking 32 outputs backplane	6 Output Enable Modes	Yes, 16 Channels Max	Yes	1 Encoder	24 VDC Except CPU (From Backplane)	Shift Register (-S) Standard
PS-6144 (M17)	48	17	17 SLIMLINE® Plug-In Modules, Including 1-2 Analog Modules	6 Output Enable Modes	Yes, 16 Channels Max	Yes	1 Resolver	24 VDC	F, H, L, MB, MAP, MSV, W, V
PS-6144 (X16M09)	48	25	16 Transistor Outputs, Sinking or Sourcing, 9 SLIMLINE® Plug-In Modules, Including 1-2 Analog	6 Output Enable Modes	Yes, 16 Channels Max	Yes	1 Resolver	24 VDC	F, G, G10, G360, H, L, MAP, MB, MSV, W, V
PS-6344 (M17)	48	17	17 SLIMLINE® Plug-In Modules, Including 1-2 Analog Modules	6 Output Enable Modes	Yes, 16 Channels Max	Yes	1 or 2 Resolvers	24 VDC	W, V
PS-6344 (X16M09)	48	25	16 Transistor Outputs, Sinking or Sourcing, 9 SLIMLINE® Plug-In Modules, Including 1-2 Analog	6 Output Enable Modes	Yes, 16 Channels Max	Yes	1 or 2 Resolvers	24 VDC	W, V
PS-5001 PS-5101	64 with 16 Outputs, 48 with 24 Outputs, 24 with 48 Outputs	16, 24 or 48	Standard Plug-In Module–Remote Rack or SLIMLINE® Module Remote Rack on 16 Output Units	No	Yes, 16 Channels Max	Yes	1 Encoder 1 Resolver	120 VDC, 240 VAC, or 24 VDC	A, F, G, L, P, V, W A, D, F, G, G360, H, L, P, V, W
PS-5004 PS-5104	64 with 16 Outputs, 48 with 24 Outputs, 24 with 48 Ouptuts	16, 24 or 48	Standard Plug-In Module–Remote Rack or SLIMLINE® Module Remote Rack on 16 Output Units	5 Output Enable Modes	Yes, 16 Channels Max	Yes	1 Encoder 1 Resolver	120 VAC 240 VAC, or 24 VDC	A, F, G, L, P, V, W A, D, F, G, G360, H, L, P, V, W
PS-5011 PS-5111	64	8 or 16 or Sourcing	Transistor Sinking	No Each Output	Yes,	Yes	1 Encoder 24 VDC 1 Resolver	120 VAC, 240 VAC, or	F, G, L, P, V, W D, F, G, H, L, P, V, W
PS-5021 PS-5121	64	9	SLIMLINE® Plug-In Modules on Control	No	Yes, Each Output	Yes	1 Encoder 1 Resolver	120 VAC 240 VAC, or 24 VDC	A, F, L, V, W A, D, F, H, L, P, U, V, W
PS-5024 PS-5124	64	Total of 9 Input or Output	SLIMLINE® Plug-In Modules on Control	5 Output Enable Modes	Yes, Each Output	Yes	1 Encoder 1 Resolver	120 VAC 240 VAC, or 24 VDC	A, F, L, V, W A, D, F, H, L, P, U, V, W
PS-5034 PS-5134	32 with 32 Outputs, 16 with 64 Outputs	32 or 64	Transistor Rack Sinking or Sourcing	5 Output Enable Modes	Yes, 16 Channels Max	Yes	1 Encoder 1 Resolver	120 VAC 240 VAC, or 24 VDC	F, G, L, V, W F, D, G, G360, H, L, U, V, W
PS-5144 (M17)	48	17	17 SLIMLINE® Plug-In Modules, Including 1-2 Analog Modules	6 Output Enable Modes	Yes, 16 Channels Max	Yes	1 Resolver	24 VDC	F, H, L, MB, MSV, W V, MAP
PS-5144 (X16M09)	48	25	16 Transistor Outputs, Sinking or Sourcing, 9 SLIMLINE® Plug-In Modules, Including 1-2 Analog	6 Output Enable Modes	Yes, 16 Channels Max	Yes	1 Resolver	24 VDC	F, G, G10, G360, H, L, MB, MSV, W, V MAP

***Optional Features**

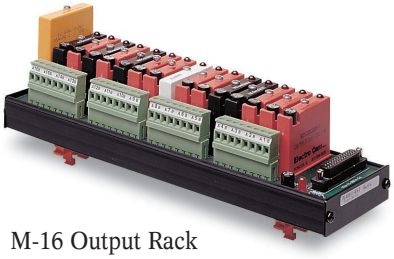
A – Analog output proportional to speed (Not available on 24 or 48 output units)
D – Outputs based on the direction the resolver is rotating.
F – Additional setpoint/program storage
G – Gray Code position output (8 bit)
G360 – Provides 360 count graycode that is 9-bit graycode truncated to 360 counts.
G10 – Gray Code position output (10 bit)
H – High resolution (12 bits - 4096 increments, resolver units only)
L – Individual leading and trailing edge compensation
MAP – Analog output proportional to position
MSV – Master/Slave resolver mode for multiple controllers used with 1 resolver
MB – Modbus TM ASCII communication
P – Register mark phasing (eliminates external PG SEL capability) (16 and 9 outputs)
S - Shift Register.
U – CE Mark; Requires 24 VDC input
V – Vibration protective coating
W – Washdown boot

NOTE: Limitations to combinations of options may apply (i.e. F and H on a 5104, 48 output unit may require a special unit; consult factory).

Output Racks, Modules & Accessories

Output Racks & Cables

Input/output racks are available in 8, 16, 24 or 32 output versions. Options can address expansion and larger output needs, up to 64 outputs. All cables are shielded and jacketed. They are fully assembled and tested, ready to install. Output rack cables use industry-standard DB-9 or DB-25 connectors.



M-16 Output Rack

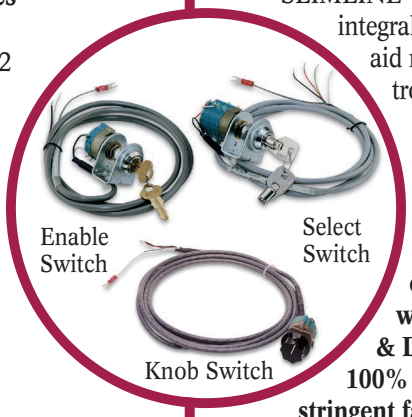
Input & Output Modules

-- used in both Electronic Rotary Cam Switches and PLµS® Programmable Limit Switch Controls.

Standard output modules are available for switching AC or DC circuits up to 3 amps. Dry contact reed relays are available for low level resistive loads. Analog outputs (0-10V and 4-20mA) are also available for use with selected models.

Standard input modules are available for receiving AC or DC signals that provide the Enable mode for selected models.

Standard Output Modules



SLIMLINE® modules have integral fuses and LEDs to aid monitoring and troubleshooting.

Electro Cam Corp. output and input modules are 100% guaranteed to operate properly with our controls. AC & DC modules are 100% tested to meet our stringent false fire criteria. Modules not obtained from Electro Cam® Corp. will not be guaranteed to operate properly with our controls.

Enclosures

-- simplify the installation of PLµS® Programmable Limit Switch systems. These NEMA 12 enclosures (NEMA 4X available) house all system components, saving the time of mounting and installing individual system components. All components of the system are mounted at the factory. Custom configurations are available.

Enclosures

Program Enable Switch

-- a locking keyswitch that prevents programming changes by unauthorized personnel.

Program Select Switch

-- allows remote selection of the active program. It allows the operator to change programs, without allowing access to output channel setpoint timing. Up to eight programs are selectable. Keyswitch or selector switch types available.

SLIMLINE® Output Modules

Module Specifications

For proper application, refer to individual product specifications.

DC Output

	Standard	SLIMLINE®
	EC-ODC5	EC-ODC060-3
Voltage Rating:	0-60 VDC	0-60 VDC
Current Rating:	3 Amps Max	3 Amp Resistive Load 1.5 Amp Motor Load
	EC-ODC5A	EC-ODC200-1
Voltage Rating:	0-200 VDC	0-200 VDC
Current Rating:	1 Amp	1 Amp Resistive Load .5 Amp Motor Load

AC Output

	Standard	SLIMLINE®
	EC-OAC5A-11	EC-OAC240-3
	Random Turn On	Random Turn On
Voltage Rating:	24-280 VAC	24-280 VAC
Current Rating:	3 Amps Max	3 Amp Resistive Load 1.5 Amp Motor Load

Relay Output

	Standard	SLIMLINE®
	EC-ORR5	EC-ORR000-0
Output Configuration:	Reed Relay	Reed Relay
Minimum Life:	50 Million Cycles	50 Million Cycles
Max Switching Voltage:	200 VDC or Peak AC	100 VDC or 130 VAC
Max Switching Current:	0.5 Amp DC or Peak AC	0.5 Amp DC or AC
Max Carry Current:	1 Amp DC or Peak AC	1.5 Amp DC or AC

Analog Output

	Standard	SLIMLINE®
	EC-ANLG-010V	EC-SANL-010V
Output Voltage:	0-10 VDC	0-10 VDC
	EC-ANLG-420M	EC-SANL-420M
Output Current:	4-20 mA DC	4-20 mA DC

DC Input

	Standard	SLIMLINE®
	EC-IDC5	EC-IDC032
Input Voltage:	10-32 VDC	10-32 VDC

AC Input

	Standard	SLIMLINE®
	EC-IAC5	EC-IAC120
AC Input Voltage:	90-140 VAC	90-140 VAC
	EC-IAC5A	EC-IAC240
AC Input Voltage:	180-280 VAC	180-280 VAC

Custom Engineered Products

Net Forward Encoder Interface

The PS-2252-12-TP1 Net Forward Encoder Interface (NFEI) is the result of a custom engineered product. It is designed to provide perfect alignment in industrial motion control applications including web processes, printing, bar coding, conveyors, and packaging/labeling.

NFEI

The NFEI eliminates erroneous encoder pulse counts caused by uncontrolled backward movement, and counts forward pulses until reverse motion occurs. It then stops counting pulses (reverse or forward) until encoder position exceeds the last forward position. The NFEI works with standard quadrature encoders.

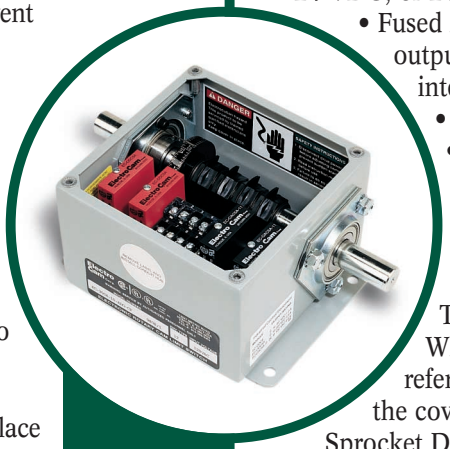
For example, when a web process stops, backward movement occurs; upon re-start, the process will overlap a portion of the web. Electro Cam's® NFEI counts pulses until reverse occurs, then withholds pulses until the exact point the process stopped. If the process stops halfway through a printing character, the character will be finished when the process restarts.

By allowing perfect registration, the NFEI reduces scrap and downtime.

For custom-engineered products, consult the factory.
800/228-5487

For years, Electro Cam Corp.'s Electronic Rotary Cam Limit Switches have provided control solutions for improving productivity in shaft-based automated machinery. Used as stand-alone ON/OFF switching controls or as a shaft position sensor input to a PLC, they can be used to control machine devices like glue guns, solenoids, air cylinders or mechanical relays. Control of these devices may be interfaced through a PLC or other logic circuitry. Direct switching of devices is also possible, and often advantageous when PLC scan delays prevent consistent control of critical machine functions.

These controls are used most often in dedicated machine functions that do not require adjustable setpoints to accommodate speed changes or product changeover. They replace traditional cams and electro-mechanical limit switches to eliminate contact wear and bounce. They are shaft-driven, using interrupter discs with photocouplers for ON/OFF switching and position sensing. Electronic Rotary Cam Limit Switches come in rugged NEMA 12 or NEMA 4X enclosures.



Cam Switch

EC-2000/2400 Series

- Require 12-30 VDC input power
- Provide NPN (sinking) outputs
- Sinking current rating of 200 mA per output
- 4, 8 or 12 outputs

EC-3000/3400 Series

(except 240 VAC input)

- Accept 108-132 VAC (50/60 Hz) input power (Also available in 12 or 24 VDC, or 240 VAC)
- Fused AC and DC plug-in output modules–may be intermixed
- 4, 8 or 12 outputs
- 280 VAC or 200 VDC max switching

Options

The Outside Degree Wheel is a means to reference position with the cover in place. The Sprocket Disengagement Clutch can be used to disengage a chain sprocket from a 3/4" shaft to speed set-up, clear a jam, etc., without jogging the machine.

The optional factory-installed pulse generating discs are available in a wide range of configurations. Discs must be specified when ordering control units. Each pulse disc replaces one set of adjustable cams (output module is still required on EC-3000/3400 Series).

Series	Shaft	Number of Outputs	Enclosure	Input Voltage	Type of Outputs
EC-2000	Left, Right or Double	4, 8, 12,	NEMA 12	12-30 VDC	Sinking Transistor
EC-2400	Double Only	4, 8, 12,	NEMA 4X	12-30 VDC	Sinking Transistor
EC-3000	Left, Right or Double	4, 8, 12,	NEMA 12 12 or 24 VDC	120 VAC or 240 VAC	AC and/or DC Output Modules
EC-3400	Double Only	4, 8, 12,	NEMA 4X 12 or 24 VDC	120 VAC or 240 VAC	AC and/or DC Output Modules

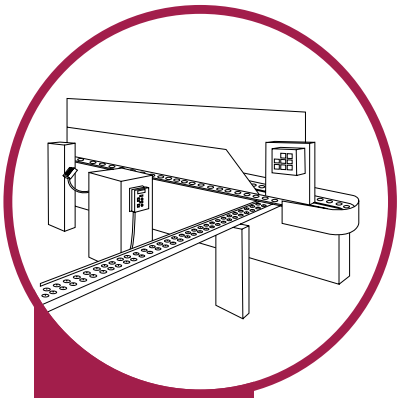
* Note in most cases if more than 12 outputs are needed, the PLµS® 5000 Series is a cost effective alternative.

Electro Cam Corp. has manufactured rugged electronic control products since 1977. We take pride in our experience and abilities to analyze machine control problems and find economical solutions that enhance productivity and product quality. Our line of products is designed for harsh industrial environments where accurate and reliable shaft position sensing is necessary.

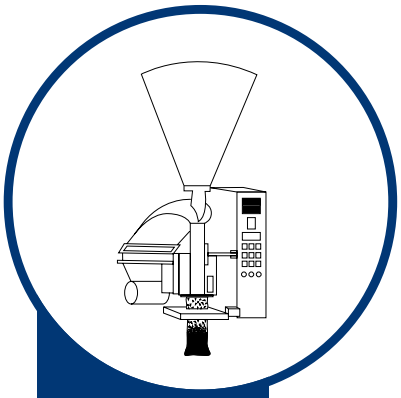
Progressive research and development, state-of-the-art manufacturing and extensive quality testing make both our Electronic Rotary Cam Limit Switches and our family of PLµS® Programmable Limit Switches the best in the industry. Electro Cam® is known industry wide as a manufacturer of quality products, offering excellent customer service and off-the-shelf delivery.

Whether you need help in specifying a programmable limit switch for your application, or you require a custom-engineered product, Electro Cam® will work with you to find your best solution.

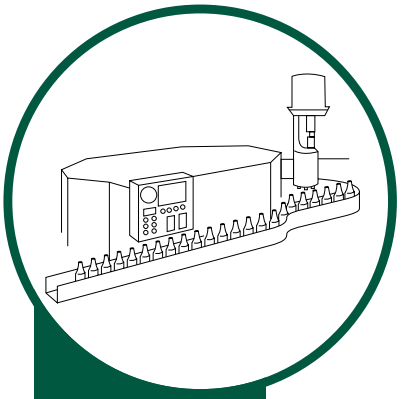
Our goal is 100% customer satisfaction.



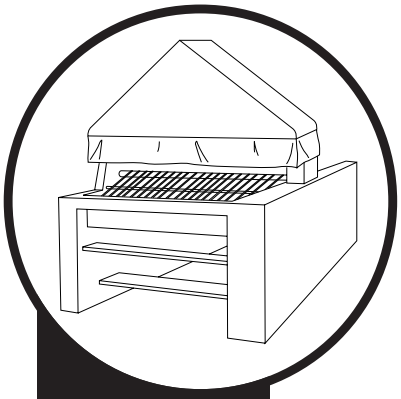
Automatic Assembly



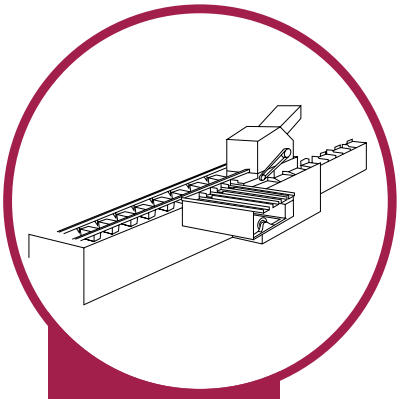
Horizontal & Vertical Form, Fill & Seal Machines



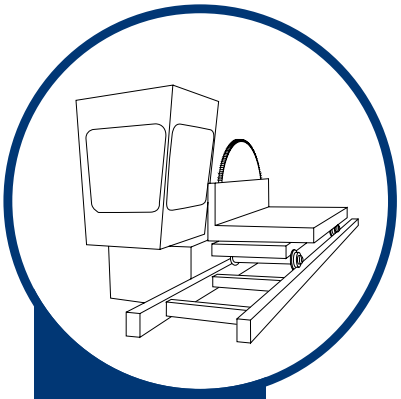
Liquid Filling Equipment



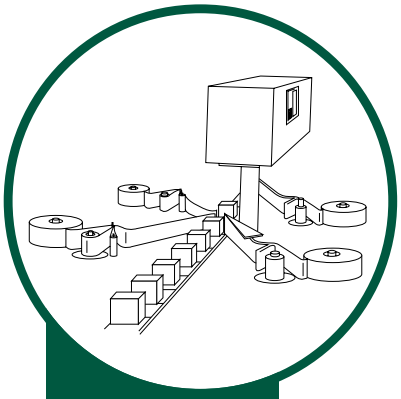
Polybag Machines



Cartoners and Case Packers



Lumber Industry



Labeling and Decorating Machinery

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Programmable Limit Switches • Electronic Cam Switches • Encoders

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