

PL-1746 QUICK START

1. **Set PL-1746, PS-4108, and PS-6400 DIP switches as described in Chapter 2.**
2. **Mount all external equipment.** This includes as much of the following equipment as the particular installation requires. See Chapter 2 for installation details.
 - Electro Cam Corp. Resolver
 - PS-6400 Keypad/Display
 - I/O power supply (provides power to the front of the PL-1746 module)
 - PS-4108 I/O rack (s)
 - Solid State Relays installed into PS-4108 I/O rack (s)
3. **Plug the PL-1746 module into the SLC chassis.**
4. **Cable all external equipment to the PL-1746 module.**
 - Electro Cam Corp. Resolver
 - PS-6400 Keypad/Display
 - I/O power supply (provides power to the front of the PL-1746 module)
 - PS-4108 I/O rack (s)
5. **In Rockwell programming software, ensure that the PL-1746 module's card type is set to OTHER, with ID# 13235.**
6. **In Rockwell programming software, set the PL-1746 module's M0 file length to 16320 and its M1 file length to 16380.**
7. **Configure the PL-1746 module.** Enter as many of the indicated configuration items as apply to the particular installation. This may be done via the M0 File or via the PS-6400 Keypad/Display screens.

<i>Configuration Item</i>	<i>M0 File</i>	<i>PS-6400 Keypad Screen</i>	<i>Installations Using Groups and Modes</i>	<i>Installations NOT Using Groups and Modes</i>	<i>Reference Page</i>
Direction of Increasing Rotation	M0:S.34	DIR OF ROTATION	x	x	4-4
Scale Factor	M0:S.32	SCALE FACTOR	x	x	4-37
Machine Position	M0:S.24	MACHINE OFFSET			4-14
Keyboard Quantity	M0:S.48	KEYBOARD QTY	x	x	4-13
PS-4108 I/O Rack Quantity	M0:S.56	RACK QTY	x	x	4-34
Analog Output Module Quantity	M0:S.40	ANALOG QTY	x	x	4-2
Number of Output Groups	M0:S.64	OUTPUT GROUPS	x	x	4-20
Resolver Mode (Master/Slave)	M0:S.60	RESOLVER MODE	x	x	4-36
Group Channel Quantities	M0:S.66 - M0:S.71	OUTPUT GROUPS	x		4-20
Group Modes	M0:S.82 - M0:S.87	OUTPUT GROUPS	x		4-20
Group Offsets	M0:S.74 - M0:S.79	GROUP OFFSET	x		4-8
Group Position Display Mode	M0:S.65	GRP POS DISP	x		4-10

8. **Program PL-1746 pulses.**
9. **Program PL-1746 advanced features.** This includes any advanced features to be used in the particular installation: speed compensation, timed outputs, motion ANDing, and so forth.

Introduction to Programmable Limit Switches

Resolvers & Encoders

The PL-1746 Programmable Limit Switch uses a resolver or encoder instead of a cam to indicate machine position. A resolver uses fixed and rotating coils of wire to generate an electronic signal that represents shaft position. The resolver or encoder is usually coupled to a machine shaft at a 1:1 ratio so that one resolver or encoder shaft rotation corresponds to one machine cycle. Resolvers have no brushes, contacts, or any frictional moving parts to wear out.

Based on the resolver or encoder signal, the PL-1746 Programmable Limit Switch turns electrical circuits, or "Outputs," on and off, simulating the mechanical roller limit switch. Because the PL-1746 combined with the resolver or encoder system is completely electronic and has no frictional parts, it offers several advantages over mechanical cam switches:

- Long service life with no parts to wear out.
- "On" and "off" points can be adjusted instantly from the keypad; there are no cams to rotate or replace.
- Adjustment is possible with the machine running or stopped.
- Programmable logic allows complex switching functions that are impossible with mechanical cams.
- Operation at speeds up to 3000 RPM.

PL-1746-C01 Module Description

The PL-1746-C01 PLS (Programmable Limit Switch) Module is designed to plug into an Allen-Bradley SLC™ 500 Series PLC (Programmable Logic Controller) chassis.

An absolute position signal is generated by a resolver connected to the module. Output status, position, and speed information is provided to the user through the backplane of the SLC™ 500 chassis. In addition, real world high speed power outputs and inputs can be provided by utilizing an external PS-4108 I/O rack.

The PL-1746-C01 can be programmed either through the backplane or through a standard PS-6400 keypad/display, which plugs into the front of the module. The module has a total of 32 outputs, which are capable of driving real world devices at high speed via PS-4108 I/O racks. All 32 outputs are accessible through the backplane.

The PLS module will display either position or rpm, depending on speed, via a 4-digit LED display.

The PL-1746-C01 will support:

- 32 outputs total. All outputs to be accessible through the backplane. All 32 outputs will be available on PS-4100-13-L16 I/O racks for high speed, real world outputs.
- 8 inputs consisting of 6 group inputs, 1 First Cycle Enable input, and 1 Output Enable input.
- 2 analog outputs, which are only available on the PS-4108 I/O rack where slimline analog output modules can be plugged in.
- Up to 2 remote PS-6400 keypads.
- High resolution (as a standard feature), up to 4096 (12 bits).
- Leading/Trailing edge speed compensation is standard.

PL-1746-C02/C03 Module Description

The PL-1746-C02/C03-R1 Programmable Limit Switch is designed to plug into an Allen-Bradley SLC 500 series Programmable Logic Controller rack. It accepts an absolute position signal from any one of the standard Electro Cam Corp. resolvers. It provides 32 outputs, along with position and speed information, via the backplane of the SLC 500.

The PL-1746-C02/C03-E1 Programmable Limit Switch is designed to plug into an Allen-Bradley SLC 500 series Programmable Logic Controller rack. It accepts a position signal from a 1000 count quadrature incremental encoder. It provides 32 outputs, along with position and speed information, via the backplane of the SLC 500.

On the -C02 ALL outputs are SOURCING, on the -C03 ALL outputs are SINKING.

Of the 32 outputs, 6 are real-world, high-speed power outputs. These 6 outputs and 8 high-speed inputs are mounted on the front of the PL-1746 module.

The PL-1746-C02/C03 can be programmed through the backplane or through a standard PS-6400 Keypad/Display. The PL-1746-C02/C03 does not support real-world analog outputs. However, the analog values, with offset and high RPM computations included, are available through the backplane.

The card displays either position or RPM, depending on speed, via a local 4-digit LED display on the front of the card. It supports up to 2 remote PS-6400 keypad/displays.

High Resolution (12 bits) from the resolver (or 4000 counts from an encoder) and Leading/Trailing edge speed compensation, are both standard features.

PL-1746-C04 Module Description

The PL-1746-C04 is a PL-1746-C01 PL μ S[®] Plug-In Module with the local display and rack interface removed.

It differs from the PL-1746-C01 as follows:

- The -C04 is capable of 32 outputs total, through the backplane only. Group inputs, first cycle enable, and output enable also will come strictly through the backplane.
- I/O racks and solid state relays are not available with the -C04 card.
- Resolver mode is selected via dip switch S1:2 (master = ON, slave = OFF). Power to the SLC chassis must be removed prior to setting switch.
- Registers are available through the backplane to set parameters for two analog outputs (Analog 1 & Analog 2).
- Analog quantity refers to analog modules, and will default to 0. Attempts to change analog quantity through the backplane will result in read only errors.
- There is no local 4-digit RPM/Position display on the front of the module.
- Attempts to change rack quantity will result in read only errors.

Basic Terminology

The following terms will be used throughout this manual to explain PL-1746 installation, programming and operation:

Channels

Each Channel (CHN) in the PL-1746 controller contains “on” and “off” pulses for one revolution of the resolver shaft. Channels are one of two types:

Output Channels—Output Channels are used to control machine functions based on shaft position. The output turns on when the shaft position is within the bounds of a pulse that has been programmed into the channel. If a rack is attached to the PL-1746-C01 module, two analog output channels are also available if analog modules are installed. Analog outputs are proportional to shaft rpm.

Group Channels—These channels control the interaction between groups of outputs and an input received from a sensor or other controlling device. See Chapter 6 for details on Group Channels.

Chassis

An enclosure that provides receptacles into which modules are inserted. The chassis provides connections between the SLC processor, power supply and the modules.

Setpoints

“Setpoints” are the points within one rotation of the resolver at which a channel turns on or off. Setpoints can be programmed into a channel through the keypad/display, or they can be entered through the backplane. The PL-1746 can turn any given channel on and off multiple times within one rotation.

Module

A device that provides I/O functions in a SLC-500 PLC System.

Pulses

A pulse begins at the ON edge and ends at the OFF edge.

Programs

Programs are sets of pulses programmed into specified channels. By selecting different programs, a machine can be easily reconfigured to run variations in products. The PL-1746 will store up to 48 programs.

The active program can be selected through the PS-6400 keypad or via the backplane.

Solid State Relay

Formerly referred to as a module and now called an SSR, this device, when installed in a PS-4108 rack, allows the PL-1746-C01 to control high power devices.

Inputs

The PL-1746-C01 accepts up to 8 DC input signals from mechanical switches, relay contacts, two or three-wire sensors, or solid state relays when a PS-4108 rack is attached. These hardware inputs are logically OR'ed with those from the backplane (O:S.0).

Processor

This device is the main control unit of a SLC-500 PLC system.

Groups and Modes

Output channels can be combined into “groups”, and each group can be associated with an input terminal in any of six different “modes” of operation. For example, some modes activate the group only when the corresponding input has signaled that product is present. Glue control is a typical application where outputs are disabled until product is sensed. See Chapter 6 for details.

Internal High Speed Logic

A feature in certain PLuS controllers that allows the user to divide channels into groups, each of which can be controlled by assigned inputs. Groups can operate in any one of six modes.

Rack

A PS-4108 rack is a device containing solid state relays and analog output blocks that connects to the PL-1746-C01 module.

Resolver

A resolver is a device that converts shaft position to an electrical signal that can be read by the PLS module.

PL-1746 Additional Features

Scale Factor	The user can program the number of increments per revolution, or “Scale Factor.” For example, to make the controller display position in degrees, a Scale Factor of 360 is used. For some applications, Scale Factor may be set to define increments in terms of linear distance, such as one increment equals 0.1" of travel. The PL-1746 module has a maximum of 4096 increments per revolution.
Programming Access	Three levels of programming access are provided: Operator, Setup, and Master. Each level can be assigned a password that must be entered to allow programming at that level. In addition, the Operator and Master levels can be activated on an individual keypad through hardware terminals on the back. Careful use of programming access levels can provide key personnel the flexibility they need in programming the controller, while protecting settings against accidental or unauthorized changes.
Speed Compensation	Speed compensation advances the pulses in an output channel as machine speed increases. This eliminates the need to manually adjust the pulses for fixed-response devices when machine speeds are changed. Speed compensation provides greater accuracy, higher production speeds, and reduced downtime for machine adjustment. See Chapter 5 for details.
Motion ANDing	Two speed ranges can be programmed into the controller, and outputs can be ANDed with either speed range so that they will be disabled unless the machine speed is within the range. A common use for this feature is disabling outputs to glue valves to turn off glue flow if the machine stops.
Timed Outputs	Timed outputs are programmed like standard channels to turn on and off at specific points of resolver rotation. However, once a timed output is on, it will remain on for a specified time period, regardless of RPM. If the programmed “off” position is reached before the time period passes, the output will turn off. Timed outputs are used to drive devices such as pneumatic cylinders which require a fixed time to perform a task, regardless of machine speed.
Analog Outputs	PL-1746-C01 controllers can drive two analog output modules whose output signals will be linearly proportional to RPM. The analog signal level at zero RPM can be programmed, as well as the RPM that corresponds to maximum signal. No measuring equipment is required for initial setup, and calibration is not needed. Typical uses for the analog output are to control glue pressure as machine speeds change, or to match speeds of other equipment to the machine being controlled by the PL-1746.
Positions & Offsets	The illustration below indicates how resolver, machine, and group positions & offsets are computed.

