ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

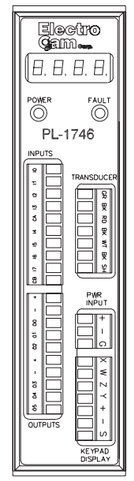
Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

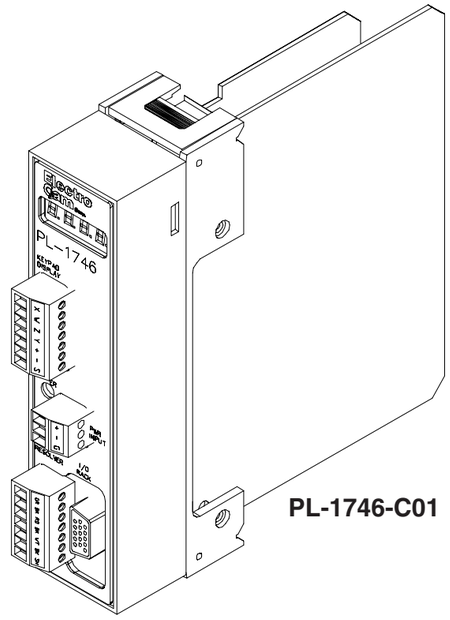
Find the *Electro Cam PL-1746-C02-R1* at our website: ***Click HERE***

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746 PLμS® Plug-In Module
for the Allen-Bradley SLC 500 PLC



PL-1746-C02/C03



PL-1746-C01

c UL us

CE

Programming & Installation Manual

October 2006

ROCKWELL AUTOMATION
ENCOMPASS
AMERICAS PARTNER

Electro Cam Corp.
800-228-5487 (U.S.A. and Canada) • Web Site: www.electrocam.com • email: ecam@electrocam.com
PRINTED IN U.S.A
298 10/06

Electro Cam Corp.
13647 Metric Rd • Roscoe, IL 61073 USA • 815/389-2620 • FAX 815/389-3304 • 800-228-5487 (U.S.A. and Canada)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Copyright © 2000
All Rights Reserved

Neither this document nor any part may be reproduced or transmitted in any form or by any means without permission in writing from the publisher.

Electro Cam, PLµS, **SLIMLINE**, and PLµSNET are all registered trademarks of **Electro Cam** Corp.

This product incorporates technology which is licensed by Allen-Bradley Company, Inc. A-B has not technically approved, nor does it warrant or support this product. All warranty and support for this product and its application is provided solely by Electro Cam Corp.

Notes

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Notes

Table of Contents

Chapter 1 - Introduction
Quick Start & Setup 1-1
Introduction to Programmable Limit Switches 1-3
Resolvers & Encoders 1-3
PL-1746-C01 Module Description 1-3
PL-1746-C02/C03 Module Description 1-4
Basic Terminology 1-5
PL-1746 Additional Features 1-6
Positions & Offsets 1-6

Chapter 2 - Installation
General Installation 2-1
PL-1746-C01 Module 2-2
PL-1746-C02/C03 Module 2-2
Resolver Installation 2-5
Resolver & Encoder Cables 2-7
PS-4108-13-L16 I/O Rack Installation 2-8
PS-4108-13-L08 I/O Rack Installation 2-13
PS-6400 Keypad Installation 2-18
DIP Switch Settings 2-19

Chapter 3 - How to Program the PLS
Backplane Programming 3-1
Remote I/O 3-4
Register Mapping 3-4
Quick Reference 3-5
PS-6400 Keypad Overview 3-14
Menu Tree 3-15

Chapter 4 - PLS Functions
Analog Output ..... Based on Speed 4-1
Analog Quantity 4-2
Channel Copy 4-2
Default Program/Active Program 4-4
Direction of Rotation 4-4
EEPROM Checksum 4-5
Enable Codes ..... Operator, Setup, & Master Passwords 4-5
Enable Options ..... Operator Access to PLS Features 4-7
Group Offset ..... Reset Group Electrical Zero to Mechanical Zero 4-8
Group Position Display 4-10
Input Maps ..... Map M File Data to Input File Registers 4-11
Input Status 4-11
Interrupt Enable ..... Enable a PLS Output to Interrupt the SLC Processor 4-12
Interrupt Level 4-12
Keyboard Quantity 4-13
Machine Offset ..... Reset Global Electrical Zero to Mechanical Zero 4-14
Main Screen ..... Shows Position, Speed, and Active Program 4-15
Memory Tests 4-16
Model & Options 4-17
Motion ANDing ..... Associate Channels with Motion Detection Levels 4-17
Motion Detection ..... Set Speed Levels to Enable Outputs 4-18
Output Assignment 4-19
Output Enable ANDing ..... Select PLS Outputs to be Gated by Output Enable Input 4-19
Output Groups ..... Divide Outputs into Groups 4-20
Output Maps ..... Map Output File Registers to M File Data 4-22
Output Status ..... View or Force PLS Outputs 4-23
Password 4-24
Per Channel Enable ..... Enable Operator-Level Programming of Selected Channels 4-25
Program Copy 4-25
Pulse Copy 4-27
Pulses Used ..... View Total Number of Currently Programmed Pulses 4-29
Pulse Edit ..... Create, Modify, or Delete Pulses 4-30
Pulses ..... Create, Modify, or Delete Pulses 4-32
Rack Quantity 4-34

(Continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table of Contents (cont'd)

Chapter 4 - PLS Functions (cont'd)
Rate Setup ..... Configure Speed Display 4-35
Resolver Mode 4-36
RPM Update Rate ..... Set How Frequently the Speed Display is Updated 4-36
Scale Factor 4-37
Shift Count 4-38
Shift Position 4-41
Shift Register Display 4-41
Shift Window 4-42
Software Version 4-43
Speed Compensation ..... Compensating PLS Output Timing for Delays in External Devices 4-44
Speed Comp Mode ..... Select Whether Leading & Trailing Pulse Edges Have Unique Values 4-45
Timed Outputs ..... Assign Timeout Durations to Pulses 4-45
Toggle RPM ..... Set the Speed at which the Display Changes from Position to Speed 4-46

Chapter 5 - Speed Compensation - Compensating PLS Output Timing for Delays in External Devices
Introduction to Speed Compensation 5-1
Standard Speed Compensation 5-1
Leading/Trailing Edge Speed Compensation 5-4
Negative Speed Compensation 5-6
Speed Compensation Guidelines 5-6

Chapter 6 - Groups & Modes - Using External Inputs to Condition PLS Outputs
Introduction to Groups & Modes 6-1
Mode 0 ..... Straight Cam Logic 6-2
Mode 1 ..... Reset to Preset Position 6-3
Mode 2 ..... Reset to Preset Position with One Cycle Enable 6-4
Mode 3 ..... Outputs Gated by Group Inputs 6-5
Mode 4 ..... One Cycle Enable with Edge-Triggered Input 6-6
Mode 5 ..... One Cycle Enable with Level-Triggered Input and First Cycle Enable 6-7

Chapter 7 - Troubleshooting
General Troubleshooting 7-1
PS-6400 Keypad Troubleshooting 7-2
Resolver Troubleshooting 7-3
Rack Troubleshooting 7-4
Error Messages: PL-1746-C01 Module 7-6
Error Messages: PL-1746-C02/C03 Module 7-6
Error Messages: PS-6400 Keypad 7-7

Chapter 8 - Utility & Example Ladder Programs
Overview of Utility & Example Ladder Programs 8-1
C01 Configuration.rss 8-2
C01 Pulses.rss 8-4
C01 Example.rss 8-6
C02 & C03 Configuration.rss 8-19
C02 & C03 Pulses.rss 8-20
C02 & C03 Example.rss 8-20
C02 & C03-S Configuration.rss 8-20
C02 & C03-S Pulses.rss 8-20
C02 & C03-S Example.rss 8-20

Chapter 9 - Specifications & Factory Defaults
PL-1746-C01 Module Specifications 9-1
PL-1746-C02/C03 Module Specifications 9-2
Solid State Relay Specifications 9-4
Module Factory Defaults 9-5
Resolver Specifications 9-6

Appendix - Output Pulse Programming Information

Index

Index

S

Scale Factor 1-6, 3-10, 4-37
Sensor Lag 5-6
Setpoint Reading 8-4, 8-5
Setpoints 1-5
Setting Speed Comp 5-2
Setup Password 3-9
Shift Count 4-40
Shift Position 3-11, 4-38, 4-41
Shift Register 3-11
Shift Register Display 4-41
Shift Window 4-42
Sinking/Sourcing 2-11, 2-16, 2-18
Software Version 4-43
Solid State Relay 1-5
Solid State Relay Mounting 2-1
Specifications, Module 9-1, 9-2, 9-3
Specifications, Solid State Relay 9-4
Speed Comp Mode 3-12, 4-45
Speed Comp, Repsonse Times 5-4
Speed Comp, Sensor Lag 5-6
Speed Comp, Setting 5-2
Speed Compensation 1-6, 3-12, 4-44, 5-1
Standard Speed Comp 5-1
System M0 Interlock 3-1

T

Terminal Blocks 2-1
Timed Outputs 1-6, 3-13, 4-45
Toggle RPM 3-10, 4-46
Trailing Edge 3-12

U

Utility & Example Ladder Programs 8-1

W

Watchdog Timer Test 4-16
Wiring Guidelines 2-1
Wiring Inputs 2-16, 2-17

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Index

M

M0 File 3-1
M1 File 3-1
Machine Offset 3-10, 4-14
Machine Position 3-10
Machine Speed 4-15
Main Screen 4-15
Major Revision 3-13
Master Password 3-9
Memory Tests 4-16
Menu Tree 3-15
Mode 0 Operation 6-2
Mode 1 Operation 6-3
Mode 2 Operation 6-4
Mode 3 Operation 6-5
Mode 4 Operation 6-6
Mode 5 Operation 6-7
Mode Assignments 6-2
Model 3-13
Model & Options 4-17
Module 1-5
Module Connections 2-2
Module Defaults 9-5
Module Installation 2-2
Motion ANDing 1-6, 4-17
Motion ANDing/Detection 3-8
Motion Detector 4-17
Motion Level Band 4-18

N

Negative Speed Comp 4-44, 5-6
Numeric Keys 3-14

O

Offset 4-1
Operator Enable Options 3-9
Operator Password 3-9
Options 3-13
Output Assignment Screen 4-19
Output Assignments 3-7
Output Channels 1-5
Output Enable 3-3
Output Enable ANDing 3-7, 4-19
Output File 3-1
Output Groups 4-20, 4-21
Output Mapping Registers 3-8
Output Pulse Programming Appendix-1
Output Status 3-8, 4-23
Output Word 3-1

P

Password 4-24
Per Channel Enable 4-25
Per-Channel Operator Access 3-9
Phase Adjustment 6-1
Pluses.rss 8-20
Power Supply Wiring 2-1
Processor 1-5
Program Copy 3-8, 4-25
Program Copy Command/Status 3-8
Program Copy Destination Program 3-8
Program Copy Source Program 3-8
Program Enable 3-9
Program Initialization 8-6
Programmable Limit Switch 1-2
Programming Access 1-6, 4-5
Programming Access Levels 4-6
Programming Error Register 3-6
Programming Preset 4-9
Programs 1-5
PS-4108-13-L16 I/O Rack Description 2-14, 2-16, 2-17
Pulse Copy 3-9, 4-27
Pulse Copy Channel 3-9
Pulse Copy Count 3-9
Pulse Copy Duration 3-9
Pulse Copy Program 3-9
Pulse Edit 3-9
Pulse Edit Channel 3-9
Pulse Edit Command/Status 3-9
Pulse Edit Pulse Index 3-9
Pulse Edit Pulse Quantity 3-9
Pulse Modes 4-33
Pulses 1-5, 3-10, 4-30
Pulses Used 3-13, 4-29
Pulses.rss 8-4, 8-5

Q

Quick Reference 3-5

R

Rack 1-5
Rack Cable 2-9
rack cable 2-14
Rack Installation 2-8
Rack Quantity 3-13, 4-34
Rack Troubleshooting 7-4
Rate Divisor 3-10
Rate Multiplier 3-10
Rate Setup 4-35
Raw Resolver Position 3-1, 3-6
Relay Mounting 2-1
Resolver 1-3, 1-5
Resolver Cables 2-7
Resolver Dimensions 2-6
Resolver, Electrical Problems 7-3
Resolver Installation 2-5
Resolver, Mechanical Problems 7-3
Resolver Mode 3-10, 4-36
Resolver Position 3-10
Resolver Specifications 9-6
Resolver Speed 3-10
Resolver Troubleshooting 7-3
Resolver Wiring 2-5
Response Times 5-4
Reverse Rotation 4-45
RPM Update Rate 3-10, 4-36

WARRANTY

1. Electro Cam Corp. warrants that for a period of twelve (12) months from the date of shipment to the original purchaser, its new product will be free from defects in material and workmanship and that the product conforms to applicable drawings and specifications approved by the Manufacturer. This warranty period will be extended on Distributor or OEM orders to a maximum of eighteen months to take into consideration Distributor or OEM shelf time.

2. The remedy obligations of Electro Cam Corp. under this warranty are exclusive and are limited to the repair, or at its option, the replacement or refund of the original purchase price of any new apparatus which proves defective or not in conformity with the drawings and specifications. Shipment of the claimed defective product to Electro Cam Corp. shall be at the cost of the consumer. Shipment of the repaired or replacement product to the consumer shall be at the cost of Electro Cam Corp. All claims must be made in writing to Electro Cam Corp., 13647 Metric Road, Roscoe, IL 61073 USA.

3. In no event, and under no circumstances, shall Electro Cam Corp. be liable for:

   a. Any product damaged or lost in shipment. Inspection for damage should be made before acceptance or signing any delivery documents releasing responsibility of the delivering carrier.

   b. Product failure or damages due to misuse, abuse, improper installation or abnormal conditions of temperature, dirt or other contaminants as determined at the sole discretion of Electro Cam Corp.

   c. Product failures due to operation, intentional or otherwise, above rated capacities as determined at the sole discretion of Electro Cam Corp.

   d. Non-authorized expenses for removal, inspection, transportation, repair or rework. Nor shall the manufacturer ever be liable for consequential and incidental damages, or in any amount greater than the purchase price of the equipment.

4. There are no warranties which extend beyond the description on the face hereof. This warranty is in LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED INCLUDING (BUT NOT LIMITED TO) ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ALL OF WHICH ARE EXPRESSLY DISCLAIMED. Any legal proceeding arising out of the sale or use of this apparatus must be commenced within (18) months of the date of shipment from the manufacturer.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank

Index

Symbols

1746 Description 1-3
4108-13-L08 I/O Rack 2-13
4108-13-L16 I/O Rack 2-8

A

Active Program 3-13
Adding a Pulse 4-32
Adding Multiple Pulses 4-32
Analog Offset 4-1
Analog Output 4-1
Analog Outputs 1-6, 2-10, 2-15, 3-5
Analog Quantity 4-2

B

Backplane Interlock 3-13
Backplane Programming 3-1
Base Revision 3-13

C

C01 Configuration.rss 8-2, 8-3
C01 Example.rss 8-6
C01 Pulses.rss 8-4, 8-5
C02 & C03 Configuration.rss 8-19
C02 & C03 Pluses.rss 8-20
CE Installations 2-1
Changing Setpoints 4-33
Channel Always ON 4-33
Channel Copy 3-5, 4-2
Channel Not Enabled 7-7
Channel to Edit 4-33
Channels 1-5
Clear Error 3-3
Comm Failure 7-7
Configuration Checksum Error 7-7
Configuration.rss 8-2, 8-3, 8-19
Cursor Keys 3-14

D

Decimal Point Location 3-10
Default Program 3-13, 4-4
Defaults 9-5
Deleting a Pulse 4-33
DIP Switch Settings 2-19, 2-20
DIP Switches 2-1
Direction of Rotation 3-10, 4-4
Displayed Units 3-10
Downloading PLC Program 8-9

E

EEPROM Checksum 3-13, 4-5
EEPROM memory 4-29
Enable Codes 4-5
Enable Options 4-7
Encoder 1-3
Encoder cable 2-7
Environment 2-1
Error Index Number Register 3-2
Error Messages: Keypad 7-7
Error Messages: PL-1746-C01 Module 7-6
Error Messages: PL-1746-C02/C03 Module 7-6
Error Number Register 3-6
ESC, SEL, HLP Keys 3-14
Example.rss 8-6

F

Fixed Response Times 5-1
Force Outputs 3-8
Function 7000 4-16
Function 7001 4-16
Function 7002 4-16
Function 7998 4-16

G

General Mounting & Wiring 2-1
General Troubleshooting 7-1, 7-2
Group Channels 1-5
Group Offset 4-8
Group Programming 6-2
Groups 3-7
Groups & Modes 1-5
Groups & Modes Introduction 6-1

H

Hardware Status/Error Register 3-6

I

INC, DEC Keys 3-14
Input File 3-1, 3-5
Input Mapping Registers 3-6
Input Status 4-11, 4-12
Input Word 3-1
Inputs 1-5
Internal High Speed Logic 6-1
Interrupt Enable 4-12
Interrupts 3-6

K

Keyboard Diagnostics 7-2
Keyboard Quantity 3-13, 4-13
Keypad Display 2-1
Keypad Overview 3-14
Keypad Wiring 2-18
Keypad/Display, Mounting 2-1

L

Ladder Program 3-1
Leading Edge 3-12
Leading Trailing Speed Comp 5-4
Logic Inputs 3-7
Logic Inputs Status 3-7, 4-8, 4-20

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746 Quick Start & Setup

What the Card Does

PLS - Programmable Limit Switch: The PL-1746 Card turns outputs on and off based on machine position determined by the rotation of the resolver. All 32 outputs are available to the SLC-500 backplane and can be used in ladder logic. Most models also provide additional high speed real world outputs. Outputs can also be gated by inputs from sensors or photo eyes.

Use it as a Resolver Card for Machine Position in Ladder Logic: While the PL-1746 provides outputs based on its own internal high speed logic, it also supplies real time machine position to the SLC-500 backplane. The position can be used in ladder logic for position dependant functions.

Wiring the Card

1. Wire 24 Volts DC to the Power input connector on the front of the card.
2. Wire the resolver to the resolver input connector on the front of the card.
3. Wire the PL-6400-24-001 keypad / Display (optional - not required for operation).

Installing the PL-1746 in the SLC-500 PLC

1. After performing a “Read I/O” in Rockwell software, the card type will be automatically set to “OTHER” and the ID Code will be set to 13235.
2. In “advanced Config” you must set the “MO Length” to 16320
3. In “advanced Config” you must set the “M1 Length” to 16380

DIP Switch Settings

This is set at the factory and normally will not need to be changed unless special functions are required. The DIP Switch is located on the back of the card. See the manual for settings if needed.

Monitoring the Error Registers

It is recommended to monitor the following error registers in the PL-1746.

1. *Programming Errors*: It is recommended to monitor the “Any Error Bit” I:S.7/15. This will let you know a programming error has occurred while writing to the M0 files. Bits 0 through 14 in the Module Status register I:S.7 will signify what type of error it is. Clear these errors by toggling the Clear Error bit O:S.0/8 from a “0” to a “1”. **Note: Errors in this register must be cleared or no further programming will be accepted on some models.**

2. *Hardware Errors:* (PL-1746-C02 / C03 models only) It is recommended to monitor the “Any Fault Bit” I:S.5/15. This will let you know a hardware error has occurred. Bits 0 through 14 in the Hardware Status / Error Register: I:S.5 will signify what type of error it is. After correcting the fault, the user must clear the errors by toggling the Clear Error bit O:S.0/8 from a “0” to a “1”

How To Program PL-1746 Settings

All settings such as “Machine Zero” and “Setpoint ON/OFF positions” are retained in permanent memory and can be programmed via two different methods:
1. Through the optional Electro Cam Keypad - model PS-6400-24-001.
2. Through the M0 files in the SLC-500

Programming Settings Via M0 Files

Writing a value to the M0 files is typically done by a move command. Once the value is written to an M0 file, it resides in permanent memory within the PL-1746 card. **Note:** Setup parameters only need to be written to the M0 files once upon initial programming. Writing to the M0 files every ladder scan will cause faults and possibly damage the memory.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746 Quick Start & Setup

Programming the PL-1746 to Turn on Outputs Based on Position

The four steps below are all that is needed to get the PL-1746 operating in a basic programmable limit switch setup. More advanced features can then be added as needed.

1. ***Set the Direction of Increasing Rotation:*** Verify that the PL-1746 position counts in an increasing direction when the machine is in motion. If not, you will need to change the Direction Of Rotation setting through the PS-6400 keypad or in M0:S.34. In this M0 file, a value of "0" = Counter Clockwise. A value of "1" = Clockwise.

2. ***Set the Scale Factor:*** This will determine the number of counts per revolution of the resolver. The factory default is 360 which gives position in degrees. A higher scale factor (4096 max) allows ON/OFF positions to be programmed more accurately. This can be set either through the PL-6400 keypad "Scale Factor" menu or in M0:S.32

3. ***Synchronize the PL-1746 with mechanical machine position:*** Stop the machine in a known position such as zero. Enter this value in the "Machine Position" setting either through the PS-6400 keypad or in M0:S.24.

4. ***Program the ON / OFF setpoints:*** This will determine the positions where the outputs will turn on and off. Each output or channel can be set to have multiple ON/OFF pulses within each machine cycle. Programming can be done either through the "Pulses" menu in the PL-6400 keypad or through the "Pulse Edit" M0 files. Refer to the "Pulse Edit" section and "Output Pulse Programming" Apendix-1 in the PL-1746 manual.

Where to Read PL-1746 Outputs in the Ladder

All 32 PL-1746 outputs are available in two 16 bit words. Each output is represented by a single bit that will reflect that outputs ON/OFF status by a "1" or "0" respectively.
I:S.0 Outputs 0 through 15
I:S.1 Outputs 16 through 31
With the above steps completed, you are now ready to run the card with the outputs turning On and OFF at the specified positions.

Add Advanced Features for Even More Precise Control of Output Devices

Motion Anding
Select outputs to turn on only when machine speed is within user specified speed ranges. A common use of this feature is to disable glue valves when the machine stops.

Speed Compensation
Select outputs to be advanced in proportion to machine speed to compensate for devices with fixed response times. This prevents "drift" of such devices as glue guns as machine speed increases and insures accuracy over the full range of machine speeds.

Timed Outputs
Select a time value in milliseconds for the ON duration of an output rather than a position range. This feature is useful for devices that require a fixed time to perform a task regardless of machine speed. Note: You will still need to program an ON and OFF setpoint to use this feature.

Input logic / Groups and Modes
Gate specified outputs with sensor inputs for "product present" requirements. Glue control is a typical application where outputs are disabled until product is sensed. Outputs can be divided into groups and each group can be triggered by one of six available inputs.

Refer to the appropriate section of this manual for programming details on these features.

Output Pulse Programming

Table 4: Commands entered in Command Status Register M0:S.902 bits 0 through 4.

Command	bit 4	bit 3	bit 2	bit 1	bit 0	(decimal)
Read	0	0	0	0	1	1
Write	0	0	0	1	1	3
Increment ON	0	0	1	0	1	5
Decrement ON	0	0	1	1	1	7
Increment OFF	0	1	0	0	1	9
Decrement OFF	0	1	0	1	1	11
Inc both ON/OFF	0	1	1	0	1	13
Dec both ON/OFF	0	1	1	1	1	15
Inc all in channel	1	0	0	0	1	17
Dec all in channel	1	0	0	1	1	19
Change ON	1	0	1	0	1	21
Change OFF	1	0	1	1	1	23

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Pulse Programming

Once the Read command is sent, the information requested will be written to the M0 files (see table 2).
In this example you would see the following information returned:

Info returned	M0 file	Purpose
90	M0:S.898	On: start position of pulse
180	M0:S.899	Off: end position of pulse
0	M0:S.900	Number of the pulse being read
1	M0:S.901	Quantity of pulses in the channel

Where to monitor outputs for use in a ladder program:
The ON/OFF status for each of the 32 outputs (or channels) can be monitored in the first two 16 bit input words.
I:S.0 Outputs 0-15
I:S.1 Outputs 16-31

Special pulse edits:
To clear all pulses in a channel write a pulse of ON = 0, OFF = 0.
To delete one of the pulses in a channel containing multiple pulses change the OFF value to equal the ON value.
To turn a channel on all the time write a pulse of ON = 1, OFF = 1.

Table 1: Data requirements in M0 files before executing specific commands.

Command	Program	Channel	On/off	*Pulse #
Read	x	x		x*
Write	x	x	x	
Inc ON	x	x		x*
Dec ON	x	x		x*
Inc OFF	x	x		x*
Dec OFF	x	x		x*
Inc both ON/OFF	x	x		x*
Dec both ON/OFF	x	x		x*
Inc all in channel	x	x		
Dec all in channel	x	x		
Change ON	x	x	x (ON)	x*
Change OFF	x	x	x (OFF)	x*

*Pulse number only required if there is more than one pulse in a channel.

Table 2: Where to write (& read) pulse edit data.

M0:S.896	Program number
M0:S.897	Channel number
M0:S.898	On: Start position of pulse
M0:S.899	Off: End position of pulse
M0:S.900	Number of the pulse being read
M0:S.901	Quantity of pulses in the channel (read only)

Table 3: Command Status Register M0:S.902.

Bit #	Purpose
0	command (execute / busy)
1	command bit
2	command bit
3	command bit
4	command bit
5 - 9	not used
10	error: incorrect pulse number entered
11	error: ON pulse out of scale factor range
12	error: OFF pulse out of scale factor range
13	error: channel number out of range
14	error: program number out of range
15	error: any above error causes this bit to go high

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

Output Pulse Programming

This section will explain how to program ON/OFF pulses or “dwells” in the PL-1746 card via the SLC 500 backplane M0 files, using a ladder program or a touch screen interface.

Monitoring The Error Registers & Execute Busy Bit
It is recommended that the following error registers be monitored when writing information to the PL-1746.
If a command is written and no result is seen, check these error registers to see what type of error has occurred.

1. Module Status register I:S.7 (Clear errors with bit O:S.0/8). *Note: Errors in this register must be cleared or no further commands will be accepted.*
2. The error bits 10 through 15 in Pulse Edit Command Status register M0:S.902.
3. It is also recommended to monitor the execute/busy bit in the Pulse Edit Command Status register M0:S.902 bit 0. This bit is required to execute commands,and will stay high until a pulse edit command has been completed. Writing subsequent commands before this bit goes low will result in errors.

Programming ON/OFF Pulses to the PL-1746 Memory
There are 2 steps in this process as follows:
1. Enter the data to be written in the Pulse Edit M0 files (M0:S.896 – M0:S.901).
2. Enter the proper read or write command in the Command Status register (M0:S.902) to execute the M0 file data.

Example 1: Program a pulse in Program 0, Channel 1, of ON = 90, OFF = 180.

1. Since this is a write command, it requires (see table 1) that we enter the program, channel and on/off data in the M0 files (see table 2).

Data to enter	M0 file	Purpose
0	M0:S.896	Program number
1	M0:S.897	Channel number
90	M0:S.898	On: Start position of pulse
180	M0:S.899	Off: End position of pulse

1. After entering the proper information above, a command is now required in the Command Status register M0:S.902 (see tables 3 & 4).

Command	bit 4	bit 3	bit 2	bit 1	bit 0	(decimal)
Write	0	0	0	1	1	3

Once the command bits are entered, the data in the M0 files will be written to the PL-1746 memory. The execute/busy bit 0 will stay a “1” until the write is completed when it will return to “0”.

Example 2: Read the ON 90, OFF 180 pulse programmed in Program 0, Channel 1 in Example 1 above.

1. Since this is a Read command, it requires (see table 1) that we enter the program & channel data in the M0 files (see table 2). Note: If there were more that one pulse in the channel being read, we would also need to specify the Pulse number. First pulse in channel is considered pulse #0, second pulse #1, etc.

Data to enter	M0 file	Purpose
0	M0:S.896	Program number
1	M0:S.897	Channel number

1. After entering the proper information above, the command for a read is now required in the command status register M0:S.902 (see tables 3 & 4).

Command	bit 4	bit 3	bit 2	bit 1	bit 0	(decimal)
Read	0	0	0	0	1	1

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Resolver Specifications

Operating Temp:	-40° to 125°C (-40° to 257°F)
Storage Temp:	-40° to 125°C (-40° to 257°F)
Operating Humidity:	95% Relative non-condensing
NEMA Rating:	NEMA 4 NEMA 4X
Maximum RPM:	3000 RPM
Max Cable Length:	1000 Ft.
Type:	Single Turn - Brushless
Resolution (all):	12 Bits (4096 increments)
Linearity (standard):	+/-20 arc minutes (resolver only) (+/-30 arc minutes combined with R/D converter in controller)
Linearity (specials):	+/-3 to +/-10 arc minutes (resolver only) (+/-7 to +/-14 arc minutes combined with R/D converter in controller)

Note: A resolver's linearity errors are repeatable at all positions of its 360 degree rotation. Therefore, once appropriate setpoints are established, machine performance is consistent every cycle.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

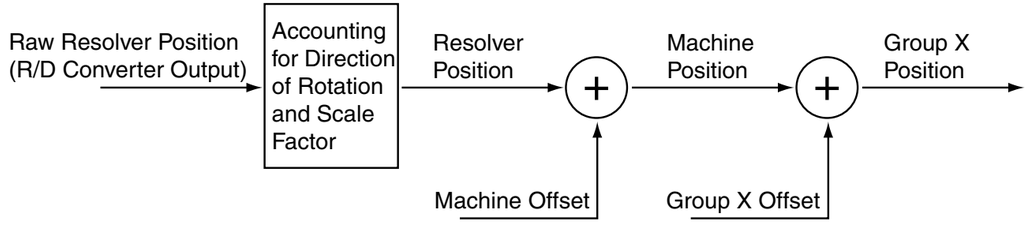
Timed outputs are programmed like standard channels to turn on and off at specific points of resolver rotation. However, once a timed output is on, it will remain on for a specified time period, regardless of RPM. If the programmed “off” position is reached before the time period passes, the output will 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.



Module Factory Defaults

Analog Outputs	
Quantity:	0
Offset:	0
High RPM:	2000
Default Program:	0
Enable Codes	
Operator:	1
Setup:	2
Master:	3
Enable Options:	ON for all functions
Increasing Direction:	CCW
Input ANDing:	OFF
Keyboard Quantity:	1
Motion ANDing:	OFF
Motion Detection:	Lo 10 RPM, Hi 3000 RPM both levels
Machine Offset:	0
Per Channel Enable:	All channels ON
RPM Update:	1/s
Output Enable ANDing:	OFF
Speed Comp:	All channels 0
Toggle RPM:	20 RPM
Scale Factor	360
Speed Comp Mode:	L/T
Group Qty:	1
Group 0 Channel Qty:	32
Group 0 Mode:	1
Group Position Display:	Each
Group 0 Offset:	0
Rate Multiplier:	1
Rate Divisor:	1
Decimal Point Location:	0
Display Units:	RPM
Pulses Used:	0
Input File Mapping Registers:	Unmapped
Output File Mapping Registers:	Unmapped
Interrupt Levels:	Zero to one transition
Interrupt Enables:	Disabled

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Solid State Relay Specifications

Note: The maximum current rating for each module installed in the PS-4108 rack is as stated in the module's specifications, OR 1.5 amps, whichever is less.

AC Outputs — **Part # EC-OAC240-3**

Output Voltage:	24 VAC rms minimum 280 VAC rms maximum
Output Current:	30 mA rms minimum 3 amps rms maximum @/below 35°C (95°F). Above 35°C derate 50 mA/°C (27.8 mA/°F)
Input Voltage:	5 VDC nominal 8 VDC maximum
Turn On Time:	100 µs maximum @ 60 Hz
Turn Off Time:	8.3 ms maximum @ 60 Hz
Off State Leakage:	2 mA AC rms @ 120 VAC rms, 60 Hz
Operating Temp.	-30°C to +70°C (–22° to +158°F)

DC Output, 60 VDC — **Part # EC-ODC060-3**

Output Voltage:	0 to 60 VDC
Output Current:	3 amps DC @/below 35°C (95°F) Above 35°C derate 35.7 mA/°C (19.8 mA/°F)
Turn On Time:	50 µs maximum
Turn Off Time:	50 µs maximum
Off State Leakage:	1 µA DC maximum @ 24 VDC
Operating Temp.	-30°C to +70°C (–22° to +158°F)

DC Outputs, 200 VDC — **Part # EC-ODC200-1 (Slimline)**

Output Voltage:	0 to 200 VDC
Output Current:	1 amp DC @/below 45°C (113°F). Above 45°C derate 18 mA/°C (10 mA/°F)
Turn On:	50 µs maximum
Turn Off:	50 µs maximum
Off State Leakage:	1 µA maximum
Operating Temp.	-30°C to +70°C (–22° to +158°F)

Analog Output, 0-10 VDC — **Part # EC-SANL-010V**

Resolution:	12 Bits (4096 Increments)
Output Voltage:	0 to 10 VDC
Output Current:	10 mA maximum
Load Resistance:	1 K Ohm minimum
Linearity:	±0.3% full scale @ 25°C (77°F)

Analog Output, 4-20 mA — **Part # EC-SANL-420M**

Resolution:	12 Bits (4096 Increments)
Output Current:	4 to 20 mA DC
Load Resistance:	450 Ohm maximum
Linearity:	±0.3% full scale @ 25°C (77°F)

Reed Relays — **EC-ORR000-0 (SLIMLINE)**

Output Type:	N/O Reed Relay Contacts
Contact Rating:	10 VA maximum
Switching Voltage:	100 VDC or 130 VAC maximum
Switching Current:	0.5 A maximum
Carry Current:	1.5 A maximum
Turn On Time:	500 ms
Turn Off Time:	500 µs
Mechanical Life:	5 x 10^6 cycles
Operating Temp:	-30 to +70°C (-22° to +158°F)

General Installation

⚠ CAUTION **If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.**

Keypad/Display

Mount the keypad/display to a panel using the four studs on the back of the keyboard. Enclosures are available from Electro Cam if an appropriate mounting location does not exist.

DIP Switches

For convenience, set the DIP switches to their proper positions before mounting the keypads and the module.

Environment

1. Ambient temperature range is 0° to 55°C (32° to 130°F).
2. Locate the chassis and keypad away from devices that generate electrical noise, such as contactors and drives.
3. Use the keypad/display gasket provided to prevent contaminants from getting into the cabinet.

Terminal Blocks

All terminal blocks can be unplugged from the PLS module and rack (PL-1746-C01). Each block is keyed so it cannot be plugged into the wrong socket. All terminals are labeled on each block.

Wiring Guidelines

Follow normal wiring practices associated with the installation of electronic controls. Some guidelines are:

1. Route input and output wiring away from high voltage, motor drive, and other high level control signals.
2. Use shielded cables for resolver and input circuits. Also shield module output circuits that are driving low current electronic input circuits.
3. Ground shielded cables at the PL-1746 end **only** (except for resolver cable).
4. Use appropriate suppression devices where module outputs are directly driving inductive loads.

CE Installations

For installations that must comply with CE requirements the PL-1746 module and PS-4108 rack must be mounted inside a metal enclosure. In addition, a CoreCom 20VK6 or equivalent single stage PI filter must be connected across the AC input to the SLC power supply. A Steward 28A2025-0A0 or equivalent ferrite bead must be snapped onto the resolver cable as close to the enclosure wall (inside) as possible.

! IMPORTANT **CE Installations must comply with all other manufacturer's requirements.**

Power Supply Wiring

Connect a 20 to 30 VDC power supply to the PLS module's power supply terminal block. Reversing the polarity will cause the power supply circuit to shut down. The PLS module will not be damaged, but you must correct the polarity for correct operation to resume.

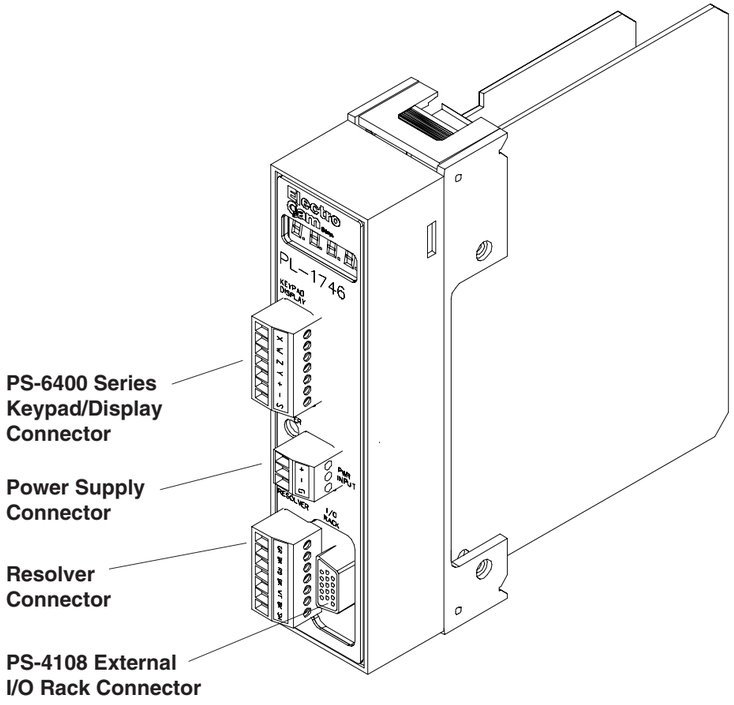
To insure electrical noise immunity, connect a good electrical ground to the ground terminal on the power supply terminal block.

Solid State Relay Mounting

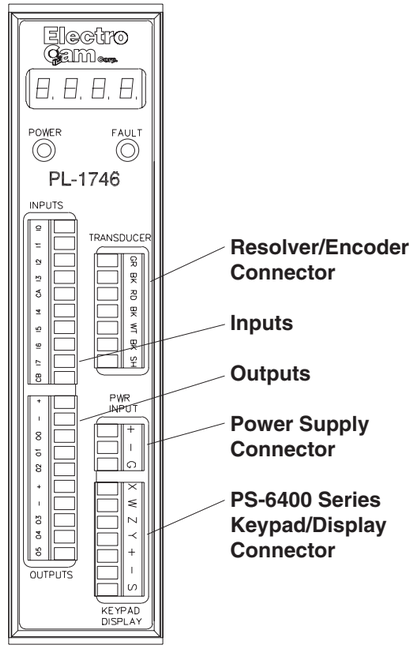
(PL-1746-C01 only) A phillips head screw holds each SSR in place. Individual SSR's can be removed and installed without affecting other modules. **Be sure to disconnect power to the rack before changing SSR's.**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746-C01 Module



PL-1746-C02/C03 Module



PL-1746-C02/C03 Module Specifications (Cont'd)

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

Output Specifications

	Minimum	Typical	Maximum
Operating Voltage	20 V dc	24 V dc	30 V dc
Carry Current			1.5A dc
Leakage Current			150 μA dc
Turn-On Time		10 μs	50 μs
Turn-Off Time		20 μs	50 μs

Input Specifications

	Minimum	Typical	Maximum
Absolute Maximum Voltage			30 V dc
Pickup Voltage		9.2 V dc	11.0 V dc
Dropout Voltage	7.0 V dc	9.2 V dc	
Current Draw		3.5 mA dc	20 mA dc

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746-C02/C03 Module Specifications

Electrical (The PL-1746 controller is UL and UL-C listed)

Input Power:	20-30 VDC. Keypad/display is powered from controller.
Backplane Power:	5 VDC @ 500 mA max.
I/O Power:	20-30 VDC @ 90 mA max. plus 150 mA per PS-6400 keypad. Certain types of power supplies employ a self protection feature called current fold back limiting. The inrush currents of the high efficiency switching regulators may cause power supplies to enter current limit mode. Power supplies with current fold back limiting should be sufficient to supply three times the steady state current of the system.
Permanent Memory:	EEPROM (no battery required).

Environment

Operating Temp:	0° to 55°C (32° to 131°F).
Storage Temp:	-40° to 70°C (-40° to 160°F).
Humidity:	95% maximum relative non-condensing.
NEMA Rating:	Keypad/Display: NEMA 4

Physical

Weight:	PLS Module: 0.5 lbs (0.2 kg). Keypad/Display: 0.5 lbs. (0.2 kg).

Mounting

Controller:	Mounts in SLC-500 chassis.
Keypad/Display:	Mounts up to 1000' from controller. Multiple keypads may be connected to one controller.

Inputs On Module

DC Inputs:	8 DC inputs, optically isolated, sinking or sourcing in banks of 4.
Input ON State Voltage:	20-30 VDC.
Input Current:	11 mA @ 24 VDC.
Response:	2 μs max.

Outputs On Module

Real World Outputs:	6 DC outputs @ 1.5A each, 20-30 volts. **On the -C02 ALL outputs are SOURCING, on the -C03 ALL outputs are SINKING.**
Analog Output:	Analog outputs accessible through backplane only; they are proportional to RPM.
Resolution:	12 bit.
Update Frequency:	10 ms.
Set-up:	Offset and full scale RPM are programmable.

Operation

Scan Time:	Less than 1000 μs typical (exact time determined by programming).
Position Resolution:	12 bits (4096 increments).
Speed Compensation:	Programmed in 0.1 msec steps. 16 individually compensated outputs max. Separate leading/trailing edge compensation standard.
Timed Outputs:	1.0 ms time base (accuracy: +1, -0 ms).
Number of Timed Outputs:	4 maximum.
Multiple Programs:	48 programs standard.
Total Pulse Memory:	1252 pulses standard.
Pulses per Program:	512 maximum standard.
Pulses per Output:	512 maximum standard.
Maximum Speed:	3000 RPM.

PL-1746-C02/C03 Module

Outputs

32 outputs are accessible through the backplane. 6 (of the 32) optically isolated outputs are provided on the pluggable output header on the front panel for high speed, real world outputs. The outputs are either all sinking or all sourcing, depending on the part number ordered. The outputs are over-current protected by standard fast-acting 2A, 250V, TR5 fuses. They are over-voltage and reverse-voltage protected by zener diodes.

Note: Both positive and negative terminals must be connected to power supply for outputs to function.

Pluggable Output Header

Terminal Label	Function
+	Supply positive for outputs 0-2
-	Supply negative for outputs 0-2
00	Output 0
01	Output 1
02	Output 2
+	Supply positive for outputs 3-5
-	Supply negative for outputs 3-5
03	Output 3
04	Output 4
05	Output 5

Inputs

8 dc inputs are provided on the pluggable input header on the front panel: 6 group inputs, 1 First Cycle Enable input, and 1 Output Enable input. Each input is optically isolated. The 8 inputs are separated into two groups of four inputs; each group shares a common terminal. An input's state is a logic one when current is flowing through its terminal on the connector, and it's state is a logic zero when current is not flowing. The inputs are not fused. To source current to the inputs, wire the group's common terminal to the negative terminal of an external power supply. To sink current from the inputs, wire the group's common terminal to the positive terminal of an external power supply.

Pluggable Input Header

Terminal Label	Function
I0	Input 0 (Group 0)
I1	Input 1 (Group 1)
I2	Input 2 (Group 2)
I3	Input 3 (Group 3)
CA	Common for inputs 0-3
I4	Input 4 (Group 4)
I5	Input 5 (Group 5)
I6	Input 6 (FCE)
I7	Input 7 (OE)
CB	Common for inputs 4-7

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank

PL-1746-C01 Module Specifications

Electrical (The PL-1746 controller and PS-4108 rack are both UL and UL-C listed)

Input Power:	20-30 VDC. Keypad/display is powered from controller.
Backplane Power:	5VDC @ 500 mA max.
I/O Power:	20-30 VDC, 80 mA +150 mA per keyboard + 230 mA per rack.
	Example: Total = 840 mA with 2 keyboards and 2 racks.
	Certain types of power supplies employ a self protection feature called current fold back limiting. The inrush currents of the high efficiency switching regulators may cause power supplies to enter current limit mode. Power supplies with current fold back limiting should be sufficient to supply three times the steady state current of the system.
	Inrush current @ 30v, 40 amps max. for 600 µs (2 keyboards, 2 racks).
Permanent Memory:	EEPROM (no battery required).

Environment

Operating Temp:	0° to 55°C (32° to 131°F).
Storage Temp:	-40° to 70°C (-40° to 160°F).
Humidity:	95% maximum relative non-condensing.
NEMA Rating:	Keypad/Display: NEMA 4.

Physical

Weight:	PLS Module: 0.5 lbs (0.2 kg). Keypad/Display: 0.5 lbs. (0.2 kg).

Mounting

Controller:	Mounts in SLC-500 chassis.
Rack:	Brackets accept EN-50035 (“G” profile) or EN-50022 (“Top Hat” profile) DIN rail.
Keypad/Display:	Mounts up to 1000' from controller. Multiple keypads may be connected to one controller.

Inputs On Rack

DC Inputs:	8 sinking or sourcing DC inputs, optically isolated (first rack only).
Input ON State Voltage:	10-30 VDC.
Input Current:	11 mA @ 24 VDC.
Response:	2 µs max.

Outputs On Rack

Real World Outputs:	Up to sixteen Slimline modules may be mounted on the rack. Modules may be any mix of AC, DC, and reed relay. All modules (except reed relay) are optically isolated.
Analog Output:	Up to two Slimline analog output modules may be mounted on the rack in addition to the sixteen digital modules.
Output Types:	4-20 mA or 0-10 VDC, proportional to RPM.
Resolution:	12 bit.
Update Frequency:	10 ms.
Linearity:	±0.3% of full scale @ 25°C (77°F).
Set-up:	Offset and full scale RPM are programmable.

Operation

Scan Time:	Less than 1000 µs typical (exact time determined by programming).
Position Resolution:	12 bits (4096 increments).
Speed Compensation:	Programmed in 0.1 msec steps. 16 individually compensated outputs max. Updated five times per second. Separate leading/trailing edge compensation standard.
Output Timeout:	1.0 ms time base (accuracy: +1, -0 ms).
Number of Timed Outputs:	Four maximum.
Multiple Programs:	48 programs standard.
Total Pulse Memory:	1252 pulses standard.
Pulses per Program:	512 maximum standard.
Pulses per Output:	512 maximum standard.
Maximum Speed:	3000 RPM, Note: Pulses generated with Pulse Train command are not included in pulses per program or pulses per output counts.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C02 & C03 Pulses.rss

Purpose
This program provides a way to upload, preserve, and download PLS pulse data. Performing a read means uploading pulse data from the PLS and storing it in an N file. To preserve the pulse data, save the .rss file in RS-Logix, including data files, after performing a read. Performing a write means downloading the pulse data from an N file into the PLS.

Read Instructions
1. Download the ladder program into the SLC processor.
2. Run the ladder program.
3. Open the Command/Status custom data monitor.
4. Clear the TransferDirection bit.
5. Set the Start bit. When all data has been transferred, the Done bit is set.

Write Instructions
1. Download the ladder program into the SLC processor.
2. Run the ladder program.
3. Open the Command/Status custom data monitor.
4. Clear all pulse data from the C02/C03. (This is easily accomplished by using Memory Test Function 7002 if a PS-6400 keypad/display is available. If a keypad/display is not available, each channel must be cleared individually; see Pulse Edit for instructions.)
5. Set the TransferDirection bit.
6. Set the Start bit. When all data has been transferred, the Done bit is set.

Notes
1. If pulses are to be downloaded as well as configuration data, the pulses should be downloaded after the configuration data has been downloaded as described above.
2. This program is intended for use with the C02 installed in slot 1 of the SLC rack. If that slot is unavailable, all references to slot 1 will have to be changed to the appropriate slot number.
3. Index Across Data Files (S:2/3) must be set to “Yes” for proper operation of this program.
4. See the documentation contained within the program for further details on its operation
5. See the chapter 3 of this manual for further details on errors.

Errors
Errors are indicated in the Command/Status Custom Data Monitor. If an error occurs, correct the problem, toggle the O:S.0/8 Clear Error bit (if necessary), and start the transfer again.

Hardware Status/Error Register This word indicates hardware status/errors in the C02.

Error Number Register	This word provides the Mapping Index Number of the register associated with the error indicated by the Module Status Register.
Programming Error Register	This word indicates programming errors.
Clear Error	This bit may be used to clear errors in either the Hardware Status Register or the Module Status Register.

C02 & C03 Example.rss

This program provides examples of ladder programming for modifying PL-1746 configuration and pulse data while in run mode. These examples can be followed, for example, when making HMIs operate with the PL-1746.

C02 & C03 -S Configuration.rss

See instructions for the C02 & C03 Configuration.rss ladder program.

C02 & C03 -S Pulses.rss

See instructions for the C02 & C03 Pulses.rss ladder program.

C02 & C03 -S Example.rss

See instructions for the C02 & C03 Example.rss ladder program.

Resolver Installation

General Information

Choose a mounting location for the resolver that allows convenient mechanical connection of the resolver shaft to the machine. The resolver is normally driven at a 1:1 ratio to machine cycles, but this is not true in all applications. Commonly used methods for driving the resolver shaft include flexible couplings, timing belts and pulleys, and chains and sprockets. Insure that the coupling method used is tight enough to minimize backlash without placing excessive side load on the resolver shaft.

No provision need be made for physically rotating the resolver shaft with respect to the machine shaft. The PL-1746 can be easily programmed to set any resolver position as the 0° position.

If possible, select a location that shelters the resolver from accidental mechanical abuse, lubricants, washdown chemicals or any other liquids. Most Electro Cam resolvers have a NEMA 4 rating or better, but avoiding contaminants will maximize their reliability and service life.

Ambient Temperature

Electro Cam resolvers have an ambient temperature range of -40° to +125°C (-40° to +257°F).

Resolver Wiring

Cables for non-stainless Electro Cam resolvers are shipped with one end soldered to the resolver connector. The connector for the other end is mounted on the Plug-In Module.

The shield is connected at both ends of the cable to prevent damage due to electrostatic discharge. If electrical noise problems are suspected when the control is in operation, call Electro Cam Corp. for advice regarding shielding.

The resolver cable used with the stainless steel resolvers (PS-5300-02-XXX) does not have a connector at the resolver end because screw terminals are used inside that resolver. When properly connected, both ends of the cable shield will be connected. If electrical noise problems are suspected when the control is in operation, call Electro Cam Corp. for advice regarding shielding.

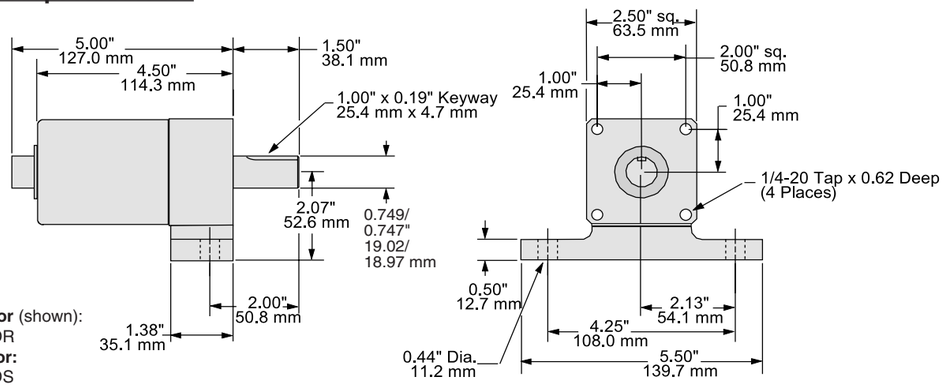
Resolver cables supplied by Electro Cam are a special type consisting of three individually twisted/shielded pairs with a common braid shield. This insures that reliable position information is being received by the controller. The use of other cable types could degrade the accuracy of the position signals and make them more susceptible to electrical noise. For these reasons, it is recommended that customers do not make their own resolver cables. Electro Cam will make resolver cables any length up to 1000' and can expedite shipment as required.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Resolver Installation

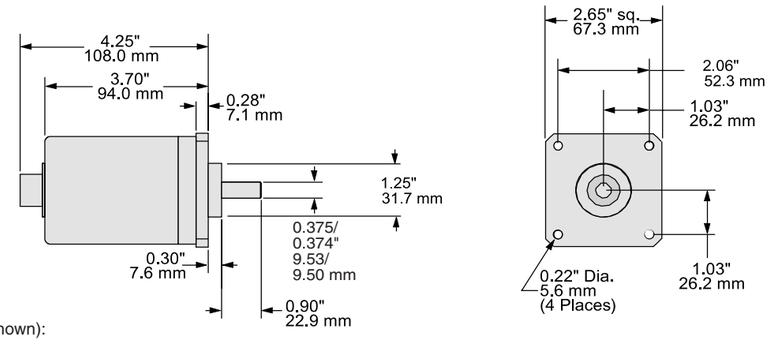
Electro Cam Corp. Resolvers

Foot Mount



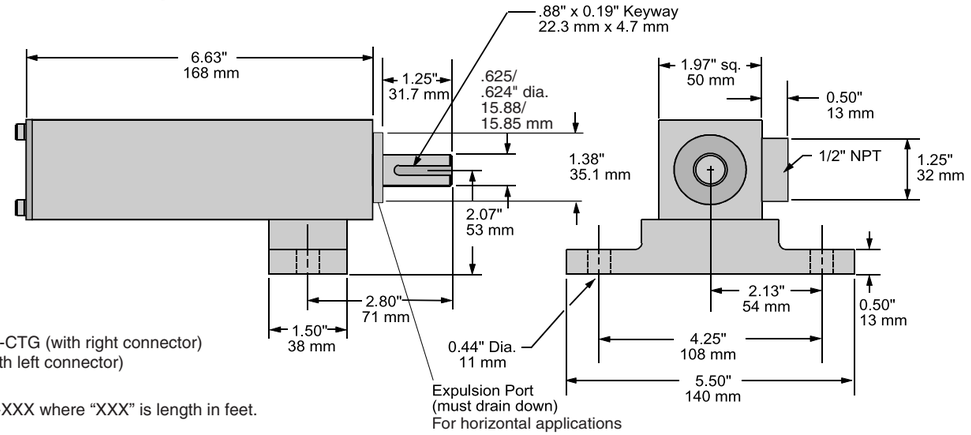
With Rear Connector (shown):
PS-5275-11-ADR
With Side Connector:
PS-5275-11-ADS
Cable:
PS-5300-01-XXX where "XXX" is length in feet.

Flange Mount



With Rear Connector (shown):
PS-5238-11-ADR
With Side Connector:
PS-5238-11-ADS
Cable:
PS-5300-01-XXX where "XXX" is length in feet.

Stainless Steel



(shown) PS-5262-11-CTG (with right connector)
PS-5262-11-CTL (with left connector)

Cable: PS-5300-02-XXX where "XXX" is length in feet.

C02 & C03 Configuration.rss

Purpose
This program provides a way to upload, preserve, and download PLS configuration data (all PLS data other than pulse data). Performing a read means uploading configuration data from the PLS and storing it in an N file. To preserve the configuration, save the .rss file in RS-Logix, including data files, after performing a read. Performing a write means downloading the configuration data from an N file into the PLS.

Read Instructions
1. Download the ladder program into the SLC processor.
2. Run the ladder program.
3. Open the Command/Status custom data monitor.
4. Clear the TransferDirection bit.
5. Set the Start bit. When all data has been transferred, the Done bit is set.

Write Instructions
1. Download the ladder program into the SLC processor.
2. Run the ladder program.
3. Open the Command/Status custom data monitor.
4. Set the TransferDirection bit.
5. Set the Start bit. When all data has been transferred, the Done bit is set.

Notes
1. If pulses are to be downloaded as well as configuration data, the pulses should be downloaded, as described in that program's instructions, after the configuration data has been downloaded as described above.
2. This program is intended for use with the C02 installed in slot 1 of the SLC rack. If that slot is unavailable, all references to slot 1 will have to be changed to the appropriate slot number.
3. Index Across Data Files (S:2/3) must be set to "Yes" for proper operation of this program.
4. See the documentation contained within the program for further details on its operation
5. See the chapter 3 of this manual for further details on errors.

Errors
Errors are indicated in the Command/Status Custom Data Monitor. If an error occurs, correct the problem, toggle the O:S.0/8 Clear Error bit (if necessary), and start the transfer again.

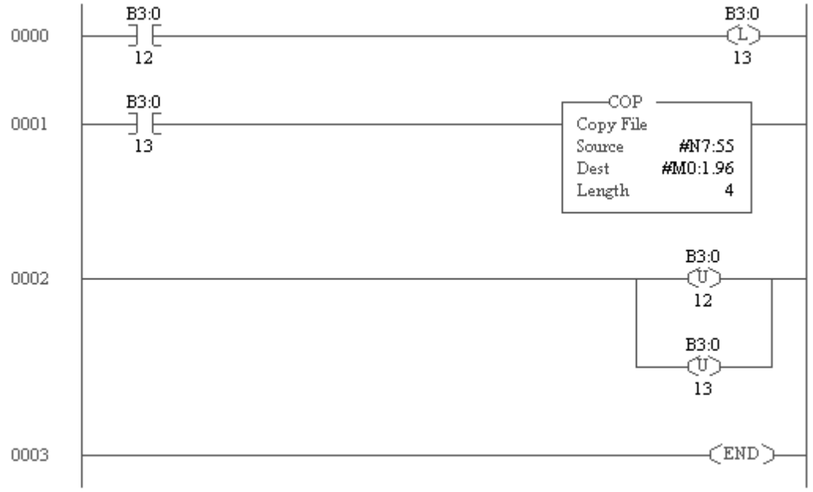
Bulk Error	This bit is set if an error occured during the bulk transfer, which includes all configura tion data other than the group configuration data.
Group Count Error	This bit is set if there was an out-of-range group count.
Group Position Display	This bit is set if there was an out-of-range group position display value.
Group Channel Count Error	This bit is set if there was an illegal group channel count condition.
Group Offset Error	This bit is set if there was an out-of-range group offset.
Group Mode Error	This bit is set if there was an out-of-range group mode.
Hardware Status/Error Register	This word indicates hardware status/errors in the C02.
Error Number Register	This word provides the Mapping Index Number of the register associated with the error indicated by the Module Status Register.
Programming Error Register	This word indicates programming errors.
Clear Error	This bit may be used to clear errors in either the Hardware Status Register or the Module Status Register.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss (cont'd)

Motion Detection and Motion Limits (cont'd)
The remaining ladder diagrams and CDMs are self-explanatory. They are set up to test some of the functional operations of the PL-1746. If you have any specific questions in regards to how they function, please feel free to contact our Application Engineering or Customer Service Staff at 1-800-228-5487. You can also send your questions via FAX to 1-815-389-3304 or via email to ecam@electrocam.com.

Subroutine (Motion Limits)



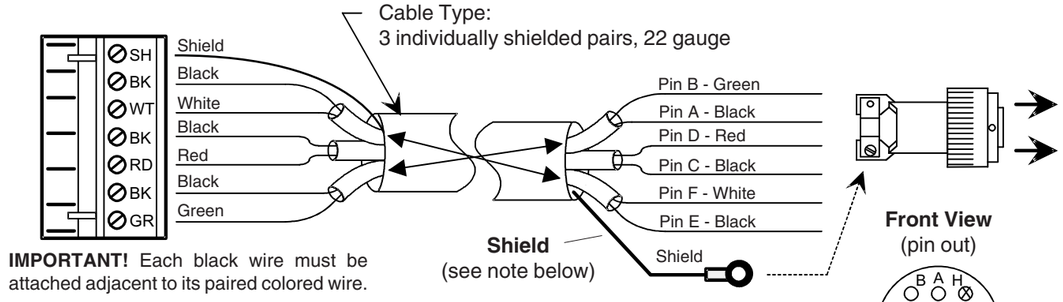
CDM 5 - MOTION LIMITS

Address	Value
B3/12	0
Motion Level :1	
low limit	
Actual	
M0:1.96	?
New Value	
N7:55	200
Motion Level :1	
high limit	
Actual	
M0:1.97	?
New Value	
N7:56	950
Motion Level : 2	
low limit	
Actual	
M0:1.98	?
New Value	
N7:57	500
Motion Level : 2	
high limit	
Actual	
M0:1.99	?
New Value	
N7:58	850

Resolver Installation

Cable for Resolver with Cannon Connector
PT# PS-5300-01-XXX (XXX = Length in Feet)

Connector - Controller End



⊗ = Not Used

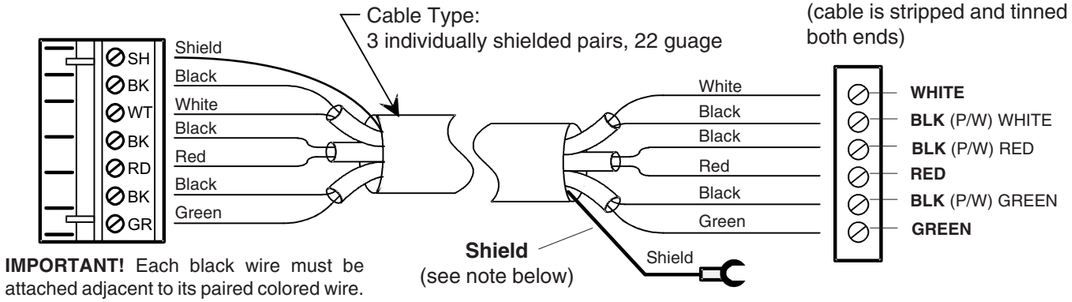
IMPORTANT! Each black wire must be attached adjacent to its paired colored wire.

Shielding Note: Resolver cables made after 3-2-93 have a ring lug on a black shield wire at the resolver end. The ring lug should be attached to one of the resolver connector strain relief screws to protect against static discharge through the resolver cable. In some installations, it may be advisable to disconnect the ring lug to prevent ground loops through the cable shield. Consult Electro Cam if electrical noise problems are suspected.

Cable for Stainless Steel Resolver with Terminal Strip Connections
PT# PS-5300-02-XXX (XXX = Length in Feet)

Connector - Controller End

Connector Inside Resolver
(cable is stripped and tinned at both ends)

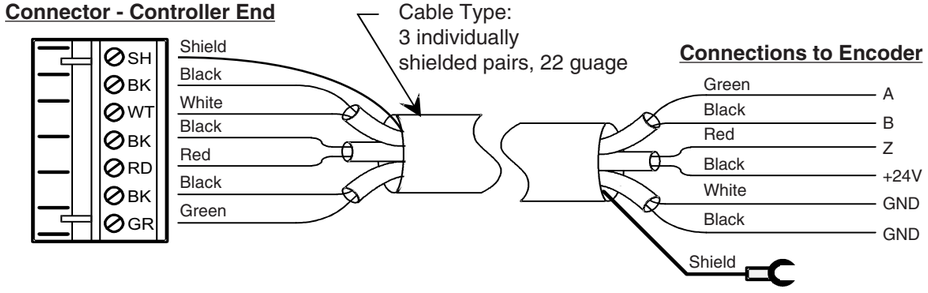


IMPORTANT! Each black wire must be attached adjacent to its paired colored wire.

Shielding Note: This type of resolver cable will have a spade lug connected to the shield at the resolver end. The lug should be attached to the grounding stud on the cover plate of the resolver. In some installations, it may be advisable to disconnect the lug to prevent ground loops through the cable shield. Consult Electro Cam if electrical noise problems are suspected.

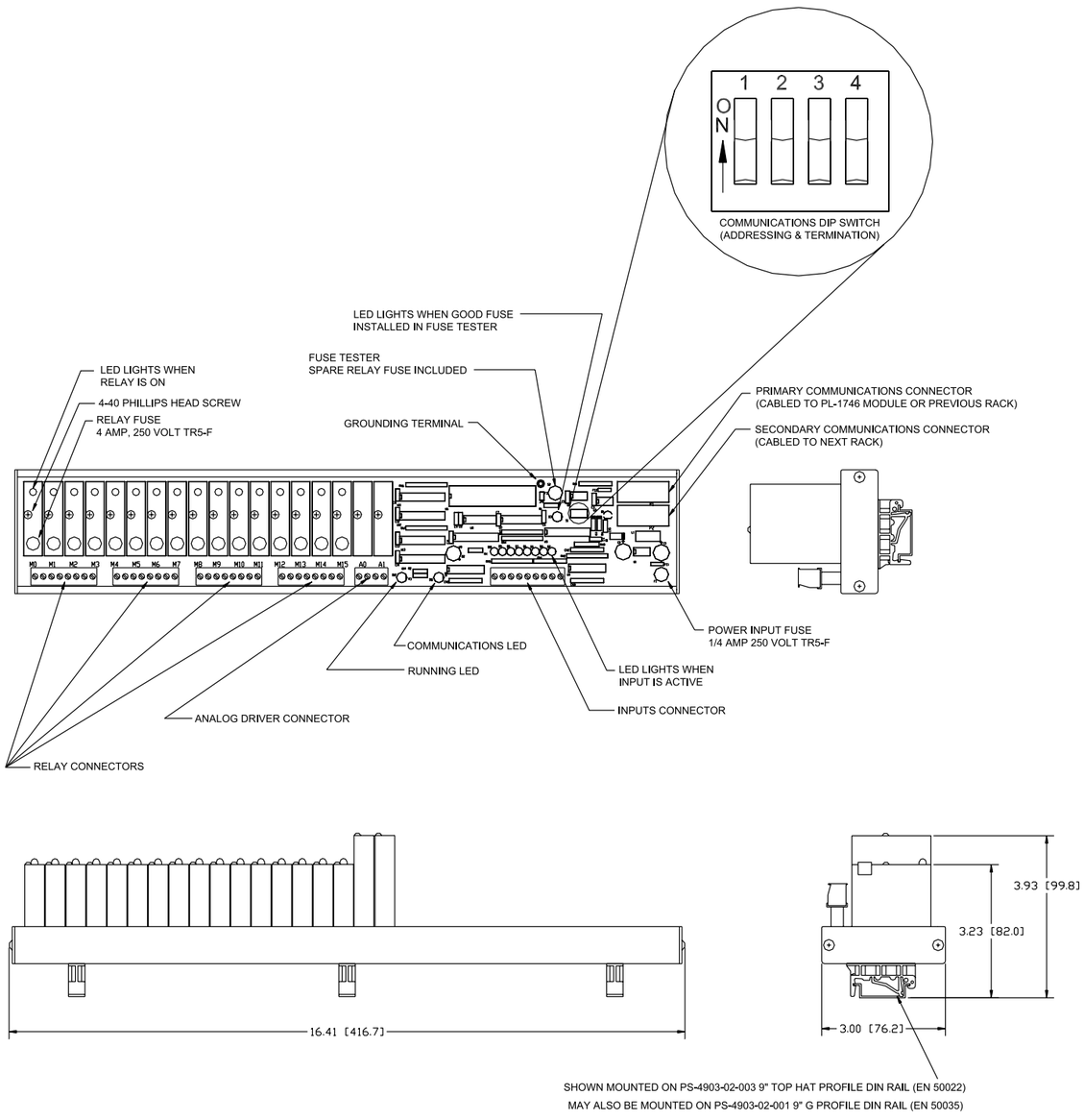
Cable for Encoder with Terminal Strip Connections
PT# PS-5300-02-XXX (XXX = Length in Feet)

Connector - Controller End



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108-13-L16 I/O Rack Installation



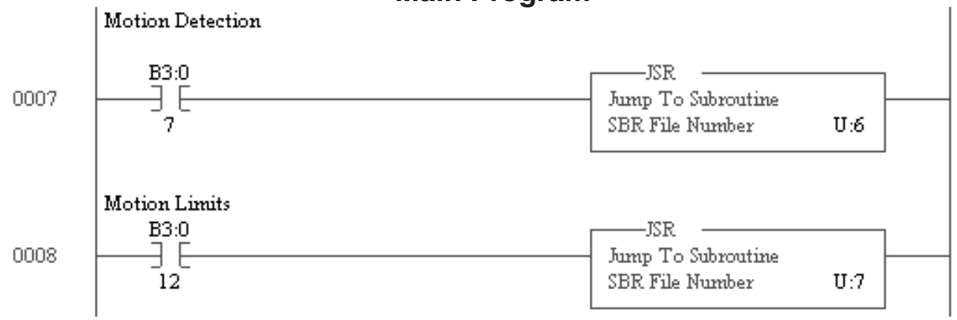
C01 Example.rss (cont'd)

Motion Detection and Motion Limits

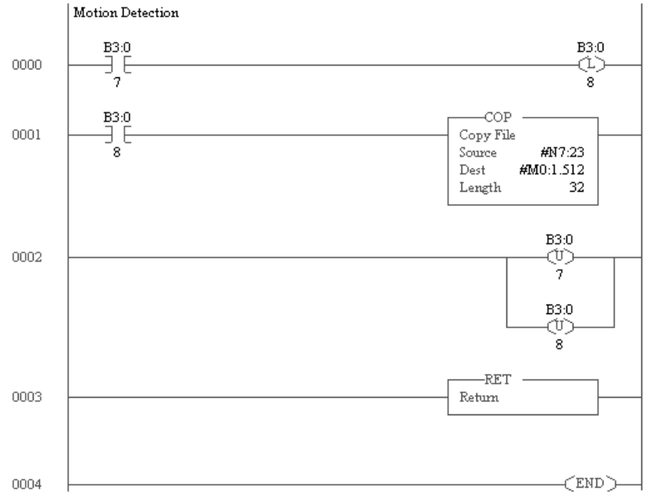
Motion Detection and Motion Limits work together. Motion Detection determines which motion limit each channel will be Anded to (0= no motion limit, 1= Limit 1, 2= Limit 2.) Motion Limits sets what the actual limit will be for Motion Limit 1 and Motion Limit 2. (Low Limit 1--High Limit 1, Low Limit 2--High Limit 2.).

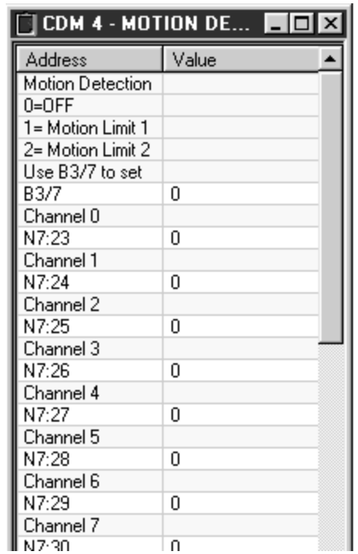
The Custom Data Monitor for both function the same as previous examples. In the Motion Detection CDM, each output channel has an integer register assigned to it. By writing a 0, 1, or 2 you declare if it will be Anded to a limit and which one. In the Motion Limits CDM, each limit has its own integer register in which you write the motion limit. (Low Limit 1=N7:55, High Limit 1=N7:56, Low Limit 2 = N7:57, High Limit 2 = N7:58).

Main Program



Subroutine (Motion Detection Limits)





Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

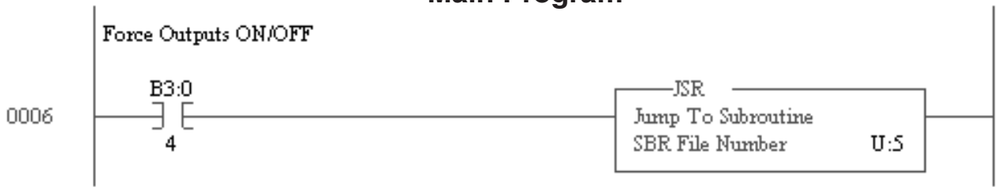
C01 Example.rss (cont'd)

Force Outputs On/Off

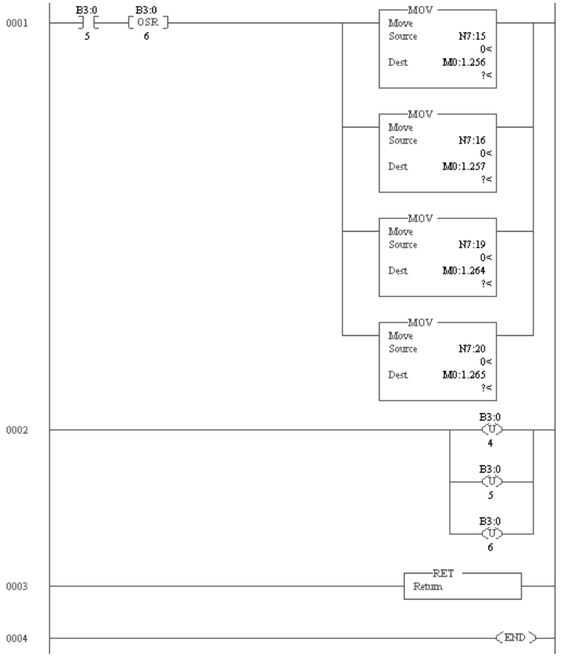
By performing the move command shown in the subroutine, we can force the outputs either 'ON' or 'OFF'. A force 'OFF' takes precedence over a force 'ON'. By toggling B3/4, we move N7:15, N7:16, N7:19 and N7:20 to M0:1.256, M0:1.257, M0:1.264 and M0:1.265. By writing a '1' to the bit locations in the 'N' registers N7:15 or N7:16, we force those outputs 'ON'. By writing a '1' to the bit locations in the 'N' registers N7:19 or N7:20, we force those outputs 'OFF'.

N7:15 and N7:19
Channels 0-15
15<----------0
0000 0000 0000 0000
N7:16 and N7:20
Channels 16-31
31<----------0
0000 0000 0000 0000

Main Program



Subroutine



CDM 2 - FORCE ON/OFF

Address	Value
Use B3/4 to activate	
B3/4	0
Force Outputs ON 0 (15 <---0)	
N7:15	0000 0000 0000 0000
Force Outputs ON 1 (31<---16)	
N7:16	0000 0000 0000 0000
FORCE OUTPUTS OFF	
Use B3/4 to activate	
B3/4	0
Force Outputs OFF 0 (15 <---0)	
N7:19	0000 0000 0000 0000
Force Outputs OFF 1 (31<---16)	
N7:20	0000 0000 0000 0000
MODULE STATUS REGISTER	
I:1.7	0000 0000 0000 0000
O:1/8	0

PS-4108-13-L16 I/O Rack Installation

Overview

The PS-4108-13-L16 I/O rack provides inputs, analog outputs, and digital power outputs (requiring Slimline™ solid state relays) for the PL-1746-C01 PLS plug-in modules. The rack is UL/C-UL listed. CE marking is pending.

PS	The rack is a member of Electro Cam Corp.'s PLμS product line.
41	The rack is mounted external to the Allen-Bradley module chassis.
08	The rack has 8 inputs.
13	The rack and PLS module communicate via Electro Cam Corp.'s proprietary *Type 13* communications.
L	The rack has two SLIMLINE analog output module slots. The rack is mounted on either EN 50035 G Profile or EN 50022 Top Hat Profile DIN rail.
16	The rack has 16 SLIMLINE solid state relays.

Environmental Requirements

Operating Temperature	0 to 55 ∞C (32 to 131 ∞F)
Storage Temperature	-40 to 70 ∞C (-40 to 160 ∞F)
Humidity	95% maximum, non-condensing

For indoor use only.
For use at altitudes up to 2000 m (meters).
Overvoltage Category I. Pollution Degree I.

CE Installations

For installations that must comply with CE requirements the PL-1746-C01 and PS-4108 must be mounted inside a metal enclosure. In addition, a CoreCom 20VK6 or equivalent single stage PI filter must be connected across the AC input to the SLC power supply. A Steward 28A2025-0A0 or equivalent ferrite bead must be snapped onto the resolver cable as close to the enclosure wall (inside) as possible.
Installations must comply with all other manufacturer's requirements.

Mounting & Grounding

The rack's mounting channel is held to either EN 50035 G profile or EN 50035 top hat profile DIN rail via three mounting clips. The rack has a 4-40 captive nut connected to the ground plane that must be tied to earth ground in the customer's installation. This must be done to maintain EMC and electrical safety.

Cabling

The primary communications connector on the rack is connected to the PLS module via the special rack cable. The secondary communications connector allows the user to daisy-chain a second rack to the first. These connections provide both for receiving input power from the PLS and for communication with the PLS. The aggregate length of all rack cables attached to a given PLS module must be 50 feet or less. The cable's shield is tied to the metal jacket covering the connectors on both ends. The jackscrews of the second DB9 are tied to ground on the PCB, while those of the first DB9 are not. Thus the shield of each cable is tied to ground at only one end.

Power

The input voltage delivered to the PS-4108 rack from the PL-1746-C01 PLS module is nominally 24V (20V min, 30V max) at a maximum of 250mA.

Fusing

Power Input Fuse (F1)	1/4 A, 250 V, TR5-F (European Style)
Spare Output Module Fuse(F3)	4 A, 250 V, TR5-F (European Style)
Fuse Tester	The rack includes a green LED (D3) that lights when a good fuse is installed in the fuse tester.

Communications

DIP switch S1 selects the rack's physical address. Note that if only one rack is used it must be addressed as rack 0.

Physical Address	Switch 1 (A0)	Switch 2 (A1)
0	ON	ON
1	OFF	ON

Rack Addressing

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108-13-L16 I/O Rack Installation

Termination resistors for the data and clock differential pairs are switched into the communications circuit by the S1 DIP switch. Line termination should be employed only on the rack furthest from the PLS module.

Switch	OFF	ON
3	Data Line Not Terminated	Data Line Terminated into 120W
4	Clock Line Not Terminated	Clock Line Terminated into 120W

Line Termination

Inputs

The rack has 8 inputs, and up to two racks can be daisy-chained in a given system; however, the inputs for the second rack are ignored. Each input is optically isolated and has a green LED status indicator. The terminals are labeled I0 through I7. All user connections to the inputs are made via a pluggable header. Each input has a single terminal and there is one common terminal, labeled C. An input's state is a logic one when current is flowing through its terminal on the connector, and it's state is a logic zero when current is not flowing. The inputs are not fused.

- To source current to the inputs, wire the rack's common terminal to the negative terminal of an external power supply (see page 3-6).
- To sink current from the inputs, wire the rack's common terminal to the positive terminal of an external power supply (see page 3-6).

	Minimum	Typical	Maximum
Absolute Maximum Voltage	----	----	30 V dc
Pickup Voltage		9.2 V	11.0V
Dropout Voltage	7.0V	9.2V	----
Current Draw	----	3.5mA	20 mA dc

See datasheet for Phoenix 1755804 header and 1792825 plug for insulation ratings.

Digital Outputs

The rack has 16 relay slots, so the maximum of two racks allows a system total of 32 power outputs. Digital outputs are provided by SLIMLINE solid state relays or reed relays, and thus have specifications dependent on the relays used. All user connections to the outputs are made via pluggable headers, and plugs are included with the rack when it is shipped from the factory. The output terminals are labeled M0A, M0B through M15A, M15B, where the number is the output number and dc conventional current flows into the B terminal and out of the A terminal.
The maximum current rating for each module installed in the PS-4108 rack is as stated in the module's specifications, OR 1.5 amps, whichever is less.

See datasheet for Phoenix 1755794 header and 1792812 plug for insulation ratings.

Analog Outputs

The rack can control up to two analog modules in positions A0 and A1. Only one rack (the one with address 0) in a given system can have analog outputs. Analog outputs are provided by slimline analog modules, and thus have specifications dependent on the modules used. A pluggable header is used for wiring to the analog outputs, and a plug is included with the rack when it is shipped from the factory. The terminals are labeled such that, for analog output 0, conventional current flows out of the A0 terminal, through the load, and returns to the - terminal for analog output 0. Similarly, for analog output 1, conventional current flows out of the A1 terminal, through the load, and returns to the - terminal for analog output 1.

See datasheet for Phoenix 1755752 header and 1792773 plug for insulation ratings

Status Indicators

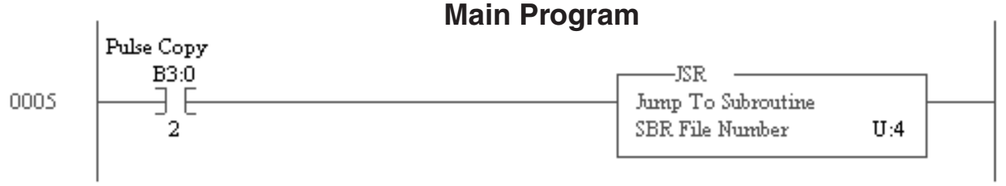
RUNNING	During normal operation the green *RUNNING* LED (D12) is lit.
COMMUNICATIONS	When Rack-to-PLS communications are ongoing the yellow *COMMUNICATIONS* LED (D11) is lit.

C01 Example.rss (cont'd)

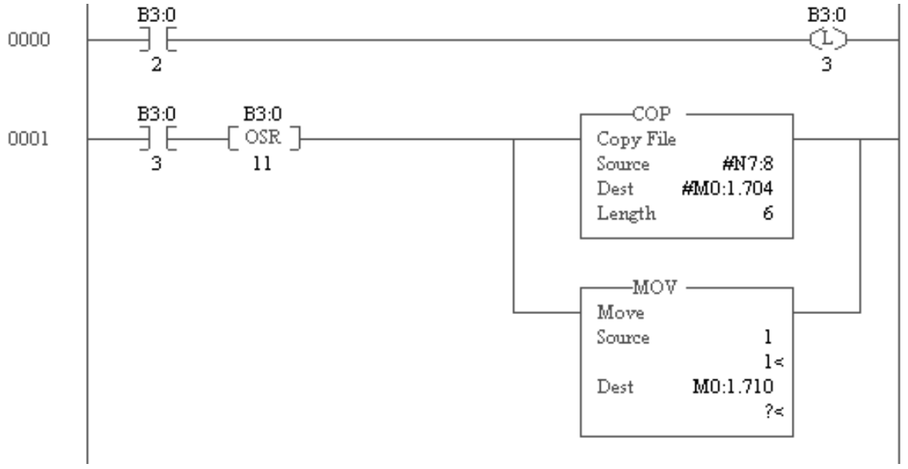
Pulse Copy

With the Pulse Copy function we can program a series or a 'train' of pulses into a specific channel without having to enter the ON and OFF setpoints for each pulse we would like to program. Pulse Copy uses the main program, subroutine, and CDM in the same manner as the Pulse Edit function.

Main Program



Subroutine



To perform a Pulse Copy:

1. Enter the program number in N7:8.
2. Enter the channel number in N7:9.
3. Enter the 'copy on' point in N7:10.
4. Enter the 'copy off' point in N7:11.
5. Enter the 'pulse count'(how many pulses you would like the 'train to consist of), in N7:12.
6. Enter the 'pulse duration'(how long you would like each pulse in that train to be), in N7:13.
7. Enter a '1' to B3/2 to activate Pulse Copy.

While the Pulse Copy is active, B3/2 will remain '1'. Once B3/2 goes to '0', Pulse Copy is complete. Ensure that pulses do not overlap, otherwise an error bit will be generated in the Module Status Register. If an error occurs, 'toggle' the 'CLEAR ERROR BIT', O:1/8. The values contained in the CDM shown to the right will copy a total of 10 pulses in Program 0, Channel 1. The pulse 'train' will start at 0 and end at 350. Each pulse will have a duration of 10 degrees.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss (cont'd)

Pulse Edit (cont'd)
Once the steps above have been completed, the pulses 'ON' value can be read from N7:2, and the 'OFF' value can be read from N7:3. After the first pulse has been read back, we can read the value located in N10:7, which will tell us how many pulses are in that channel. If there are multiple pulses in that channel, you can enter the pulse number you would like to read into N7:4, then enter a '1' in B3/0. That pulses ON and OFF values can be read from N7:2 and N7:3, respectively.

Write to a word/integer/bit
Note: Do not overlap pulses in one channel. If you overlap pulses in one channel, an internal error will be generated in the Module Status Register. If an error is generated, enter a '1' in O:1/8 'Clear Error Bit'.

To enter a pulses' on/off values from the CDM, do the following:
1. Enter the program in which we would like to write the pulse to in N7:0
2. Enter the channel which we would like the pulse to be written to in N7:1.
3. Enter the pulse's 'ON' value in N7:2.
4. Enter the pulse's 'OFF' value in N7:3.
5. Enter '3' in N7:6
6. Enter '1' in B3/0.

Once the above steps have been completed, we can read the pulses' on/off value as explained in example 1.

Increment On
To increment the on edge of a pulse from the CDM, we do the following:
1. Enter the program in N7:0
2. Enter the channel number in N7:1.
3. Enter the pulse number which you would like to increment in N7:4.
4. Enter '5' in N7:6.
5. Enter '1' in B3/0.

Notice that each time you 'toggle' B3/0 to one, you increment the ON edge of that pulse by one increment.

Decrement On
To decrement the ON edge of a pulse from the CDM we do the following:

1. Enter the program in N7:0.
2. Enter the Channel in N7:1.
3. Enter the pulse number in N7:4 if there are multiple pulses in the channel.
4. Enter '7' in N7:6.
5. Enter '1' in B3/0.

Notice that each time you 'toggle' B3/0, the pulses on edge is decremented by 1.

The remaining pulse edit functions available are Increment OFF edge, Decrement OFF edge, Increment both the ON and OFF edge, and Decrement both the ON and OFF edge. These functions are all performed in the same fashion as functions 3 and 4, except you change the value that is written into N7:6. The values entered for each function are as follows:

1 = Read.
3 = Write.
5 = Increment ON Edge.
7 = Decrement ON Edge.
9 = Increment OFF Edge.
11 = Decrement OFF Edge.
13 = Increment both the ON and OFF Edge.
15 = Decrement both the ON and OFF Edge.

PS-4108-13-L16 I/O Rack Installation

Sinking/Sourcing Defined

Sinking means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a DC common or ground to the connected device.

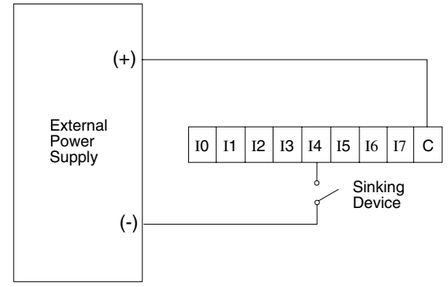
Sourcing means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a +DC voltage to the connected device.

This information is important when interfacing an Electro Cam Corp. product with another electronic device. If you are using an Electro Cam Corp. product input to an Allen-Bradley 1746-IN16 "sinking" input card* or similar A-B device, you have to supply a +DC voltage (Electro Cam Corp. ***Sourcing*** output) to this card, NOT a DC common or ground. In these cases, ***Sinking*** is what the card does with the input voltage; sinks it to common or ground.

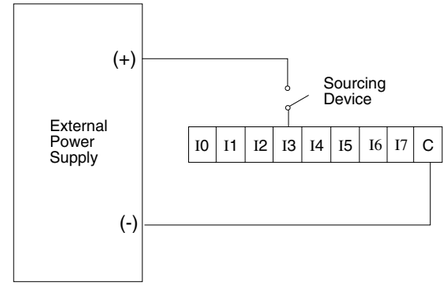
*Other manufacturers include, but not limited to: Koyo (formerly GE Series 1, Texas Instruments, or Siemens SIMATIC PLS's) that use descriptions similar to Allen-Bradley.

Wiring Inputs

Sinking Devices



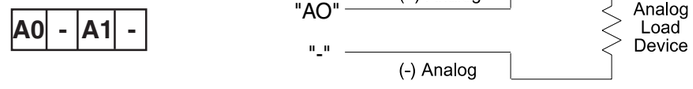
Sourcing Devices



I0	Group One Input
I1	Group Two Input
I2	Group Three Input
I3	Group Four Input
I4	Group Five input
I5	Group Six Input
I6	1st Cycle Enable
I7	Output Enable

See page 6-2 for more info.

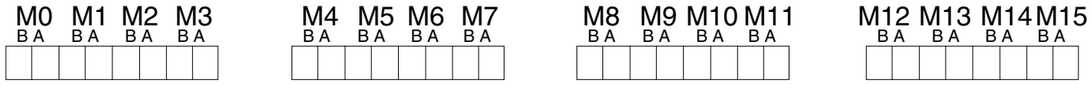
Wiring Analog Outputs



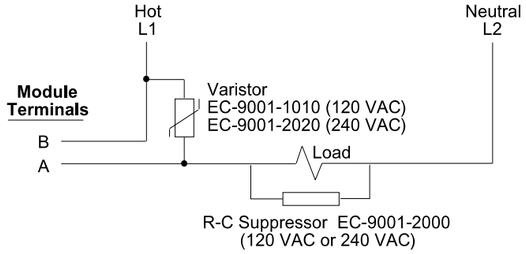
- Analog output modules source the analog signal.
- No external supply is required.
- Analog output signals are isolated.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wiring Digital Outputs



AC Output

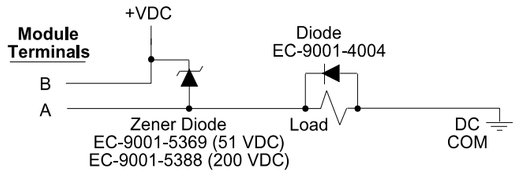


Most applications will not need the varistor or R-C suppressor shown above. However, when other switching devices are in series or parallel with the AC module, voltage spikes may damage the module. Use one of the following two methods to suppress voltage spikes.

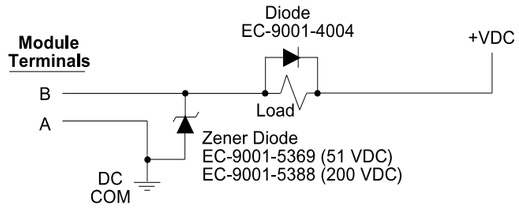
- For infrequent switching, connect a varistor (MOV) across the terminals.
- For continuous switching, wire an R-C suppressor in parallel with the load.

DC Output

Sourcing



Sinking



Most applications will not need the diodes shown above. However, highly inductive DC loads may damage modules by generating voltage spikes when switched off. Suppress these voltage spikes using one of these two methods:

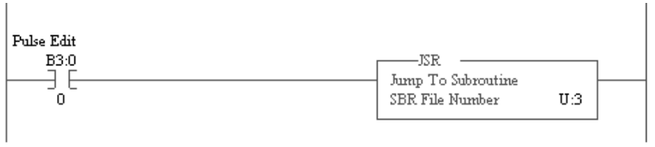
- Connect a Zener diode across the terminals. This will not significantly increase the load turn off time. Voltage rating of the diode must be greater than the normal circuit voltage.
- Connect a reverse-biased diode across the load. This may increase the load turn off time.

Pulse Edit

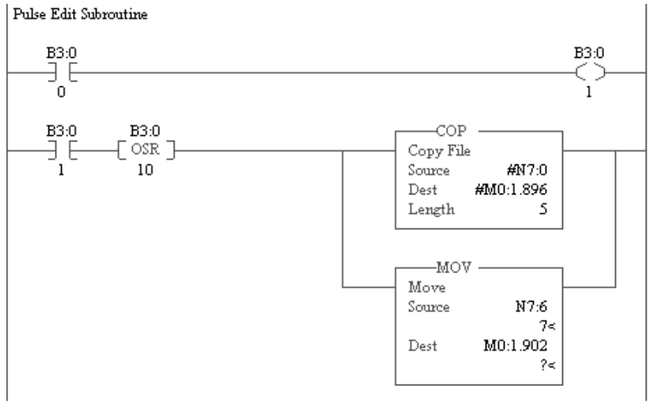
Next we will talk about the Pulse Edit functions available through the backplane of the SLC CPU to the PL-1746. The first thing that must be understood is the relationship between the Custom Data Monitor, the Main Program, and the Subroutines. The Custom Data Monitor (CDM) provides an interface between your computer and the SLC PLC program running in the SLC CPU. With the CDM, we can enter data into integer registers, binary registers, etc. We can also read from registers internal to the SLC CPU. With the Pulse Edit CDM we enter data into the integer registers, which can then be moved into the M0 registers in the SLC CPU. We also read from the M0 registers into the integer registers.

When we enter a '1' in B3/0 in the CDM, the program jumps to the subroutine. Once in the subroutine, B3/0 sets B3/1 to a high. B3/1 triggers (O)ne (S)hot (R)ising B3/10, which then copies N7:0, N7:1, N7:2, N7:3 and N7:4 to M0:1.896, M0:1.897, M0:1.898, M0:1.899 and M0:1.900. If you refer to the PL-1746 manual quick reference chart for M0 and M1 files, you can see what each M0 register is doing with the data that is being moved to it. Once the above tasks have been completed, all data is moved and/or copied to the appropriate 'N' register, 'B' registers are reset to zero, and the subroutine returns to the main program to await furthur instructions.

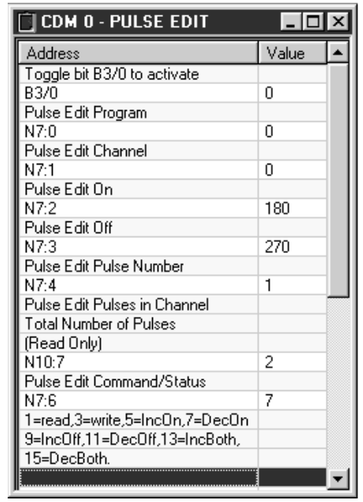
Main Program



Subroutine



Custom Data Monitor



The Pulse Edit functions can do a variety of different tasks for 'editing' pulses. We can read, write, increment the ON edge of a pulse, increment the OFF edge of a pulse, decrement the ON edge of a pulse, decrement the OFF edge of a pulse, increment both the ON and OFF edge of a pulse, or decrement both the ON and OFF edge of a pulse. We will now perform a few of the functions to familiarize you with how they can be used.

Read

To read the ON/OFF values from the CDM, we must do the following:

1. Enter the program in which we would like to edit a pulse from in N7:0.
2. Enter the channel where the pulse is located in N7:1.
3. If there is more than one pulse in this channel, we must write the pulse number that we would like to edit in N7:4. Until we know how many pulses are in that channel we can enter '0' (remember that in the 'Digital Universe', counting systems start at '0', so entering a '0' here will allow us to edit the first pulse in that channel.)
4. Enter '1' in N7:6.
5. Enter '1' in B3/0.

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss PLC Program Introduction (cont'd)

As discussed earlier, the subroutines contain the ladder programs used to perform the various PLS functions selected. To enter data into the program for use by the backplane, you can choose one of two methods. The first method is shown in figure 14, in which each individual data file associated with the specific program function is called up. The second method is shown in figure 14, where all data entry points required to perform the given task are organized into a Custom Data Monitor. Using the CDM for this makes this the task much less cumbersome than having to access each individual data file.

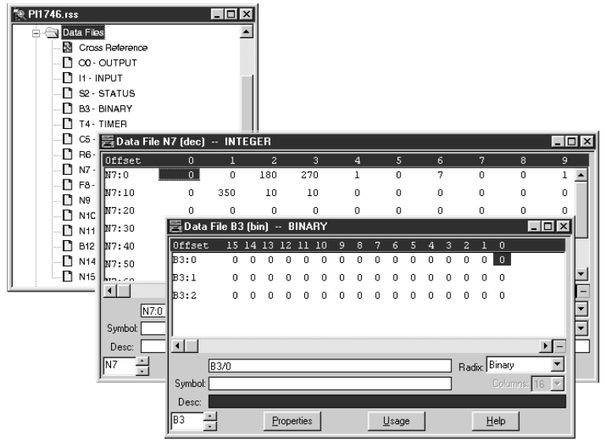


Figure 14

Entering the data by accessing each individual data file works fine, but using the CDM, as shown in figure 15, makes accessing data much easier. All data entry points can be centralized in one location, and each can be given a name of your choosing.

To access the Custom Data Monitor, double click on the icon for the particular CDM you want to open, as shown in figure 15a below.

Figure 15a

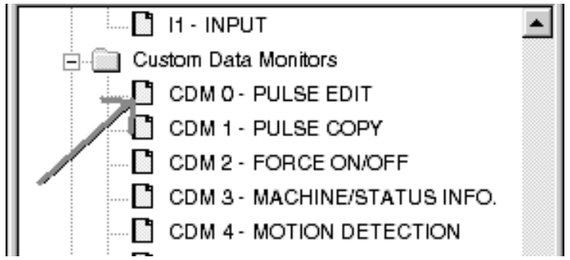
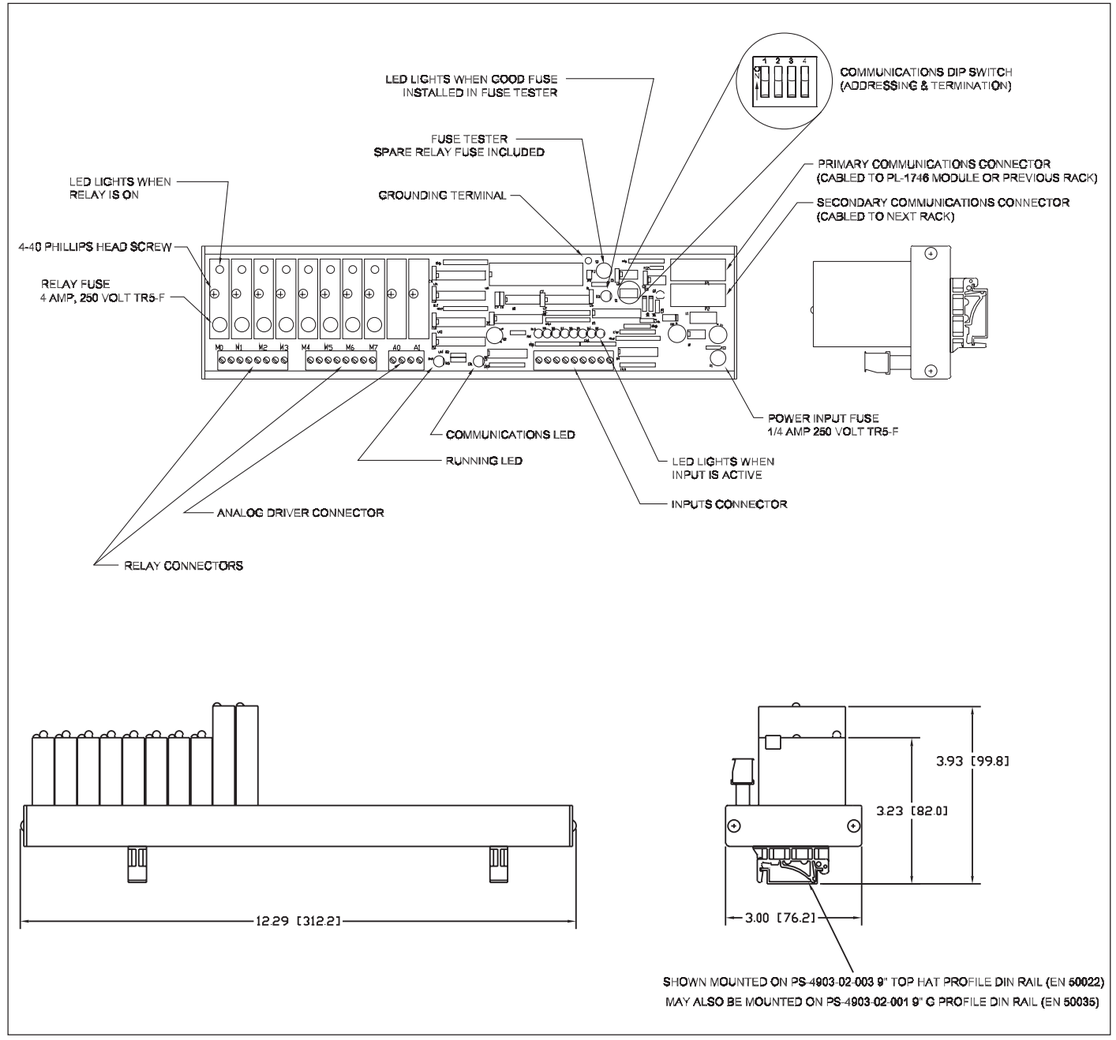


Figure 15

CDM 0 - PULSE EDIT

Address	Value
Toggle bit B3/0 to activate	
B3/0	0
Pulse Edit Program	
N7:0	0
Pulse Edit Channel	
N7:1	0
Pulse Edit On	
N7:2	180
Pulse Edit Off	
N7:3	270
Pulse Edit Pulse Number	
N7:4	1
Pulse Edit Pulses in Channel	
Total Number of Pulses	
(Read Only)	
N10:7	2
Pulse Edit Command/Status	
N7:6	7
1=read,3=write,5=IncOn,7=DecOn	
9=IncOff,11=DecOff,13=IncBoth,	
15=DecBoth.	



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108-13-L08 I/O Rack Installation

Overview
The PS-4108-13-L08 I/O rack provides inputs, analog outputs, and digital power outputs (requiring Slimline™ solid state relays) for the PL-1746 programmable limit switch plug-in modules. The rack is UL/C-UL listed. CE marking is pending.

PS	The rack is a member of Electro Cam Corp.'s PLµS product line.
41	The rack is mounted external to the Allen-Bradley module chassis.
08	The rack has 8 inputs.
13	The rack and PLS module communicate via Electro Cam Corp.'s proprietary *Type 13* communications.
L	The rack has two SLIMLINE analog output module slots.
08	The rack has 8 SLIMLINE solid state slots.

Environmental Requirements

Operating Temperature	0 to 55°C (32 to 131°F)
Storage Temperature	-40 to 70°C (-40 to 160°F)
Humidity	95% maximum, non-condensing

For indoor use only.
For use at altitudes up to 2000 m (meters).
Overvoltage Category I. Pollution Degree I.

CE Installations
For installations that must comply with CE requirements the PL-1746 and PS-4108 must be mounted inside a metal enclosure. In addition, a CoreCom 20VK6 or equivalent single stage PI filter must be connected across the AC input to the SLC power supply. A Steward 28A2025-0A0 or equivalent ferrite bead must be snapped onto the resolver cable as close to the enclosure wall (inside) as possible.
Installations must comply with all other manufacturer's requirements.

Mounting & Grounding
The rack's mounting channel is held to either EN 50035 G profile or EN 50035 top hat profile DIN rail via three mounting clips. The rack has a 4-40 captive nut connected to the ground plane that must be tied to earth ground in the customer's installation. This must be done to maintain EMC compatibility.

Cabling
The primary communications connector (see the connections drawing) on the rack is connected to the PLS module via the special rack cable. The secondary communications connector allows the user to daisy-chain a second rack to the first. These connections provide both for receiving input power from the PLS and for communication with the PLS. The aggregate length of all rack cables attached to a given PLS module must be 50 feet or less. The cable's shield is tied to the metal jacket covering the connectors on both ends. The jackscrews of the second DB9 are tied to ground on the PCB, while those of the first DB9 are not. Thus the shield of each cable is tied to ground at only one end.

Power
The input voltage delivered to the PS-4108 rack from the PL-1746 PLS module is nominally 24V (20V min, 30V max) at a maximum of 250mA.

Fusing

Power Input Fuse (F1)	1/4 A, 250 V, TR5-F (European Style)
Spare Output Module Fuse(F3)	4 A, 250 V, TR5-F (European Style)
Fuse Tester	The rack includes a green LED (D3) that lights when a good fuse is installed in the fuse tester.

Communications
DIP switch S1 selects the rack's physical address. Note that if only one rack is used it must be addressed as rack 0.

Physical Address	Switch 1 (A0)	Switch 2 (A1)
0	ON	ON
1	OFF	ON

Rack Addressing

C01 Example.rss (cont'd)

C01 Example.rss PLC Program Introduction
Now that the program is installed and running on your computer, and has been downloaded to the SLC CPU, we will begin using it to program PLS functions through the backplane. The examples included with this program show one way of programming the included functions, but by no means are the only way to program the various functions available through the backplane. These supplemental programming examples are meant to assist in the implementation of the PL-1746 into your operating enviroment.

'MAIN PROG'
The first ladder we will discuss is LAD 2-MAIN PROG. This ladder can be thought of as the 'control' ladder. All subroutine ladders 'jump' from this ladder, and upon completion of the tasks assigned to them, they 'return' to the MAIN PROG ladder to await furthur instructions.

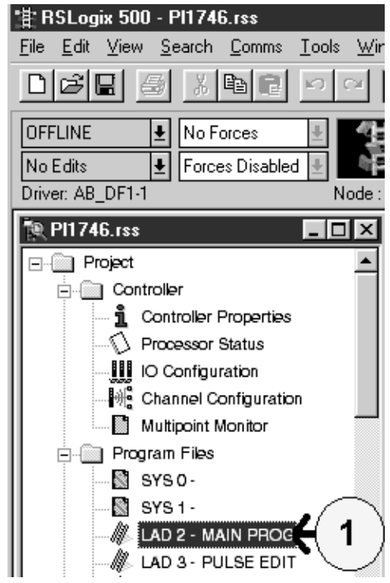


Figure 12

Figure 12 shows the location of the 'MAIN PROG' Ladder. To view this ladder, double click on 'MAIN PROG'. Once this has been done, you will see the active program 'MAIN PROG' as shown in Figure 13.

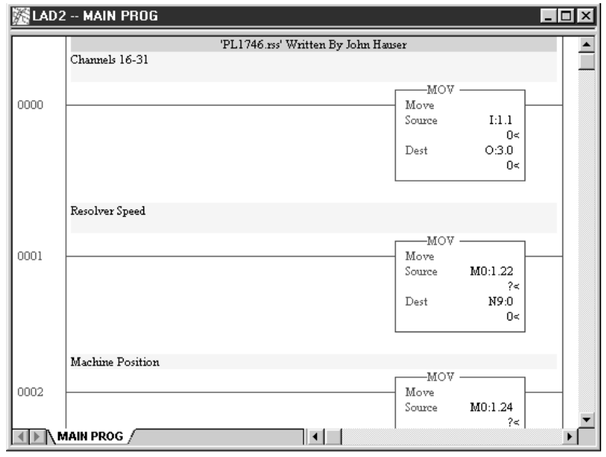


Figure 13

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

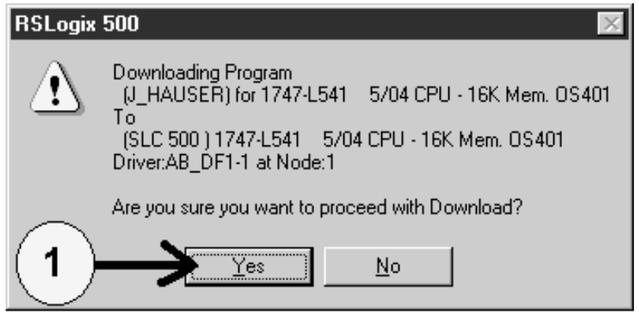


Figure 9

Figures 9 and 10 are the pop-up windows that will be viewed while downloading the program to the SLC CPU. Figure 9 confirms whether or not you would like to download the program you have specified. Remember that only one program can remain resident in the CPU at a time, so if you currently have a program in your PLC that may be needed again, be sure you can place it back into the memory of the PLC. Once the program has been downloaded, you have the choice of whether or not you would like to go online, simular to Figure 10. Select yes. Once online, you can monitor the status of the SLC CPU and the ladder program itself while it is running. From within the RS Logix program, if the selector switch on the SLC processor is in the REM position, you can select the operating condition (remote run, remote program) of the SLC CPU and the ladder program, as shown in Figure 11.



Figure 10

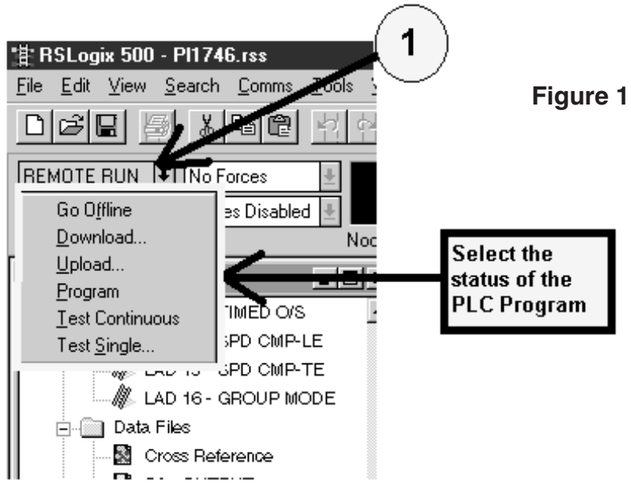


Figure 11

Termination resistors for the data and clock differential pairs are switched into the communications circuit by the S1 DIP switch. Line termination should be employed only on the rack furthest from the PLS module.

Switch	OFF	ON
3	Data Line Not Terminated	Data Line Terminated into 120W
4	Clock Line Not Terminated	Clock Line Terminated into 120W

Line Termination

Inputs

The rack has 8 inputs, and up to two racks can be daisy-chained in a given system; however, the inputs for the second rack are ignored. Each input is optically isolated and has a green LED status indicator. The terminals are labeled I0 through I7. All user connections to the inputs are made via a pluggable header. Each input has a single terminal and there is one common terminal, labeled C. An input's state is a logic one when current is flowing through its terminal on the connector, and it's state is a logic zero when current is not flowing. The inputs are not fused.

- To source current to the inputs, wire the rack's common terminal to the negative terminal of an external power supply.
- To sink current from the inputs, wire the rack's common terminal to the positive terminal of an external power supply.

	Minimum	Typical	Maximum
Absolute Maximum Voltage	----	----	30 V dc
Pickup Voltage		9.2 V	11.0V
Dropout Voltage	7.0V	9.2V	----
Current Draw	----	3.5mA	20 mA dc

See datasheet for Phoenix 1755804 header and 1792825 plug for insulation ratings.

Digital Outputs

The rack has 8 relay slots, so the maximum of two racks allows a system total of 16 power outputs. Additionally, a PS-4108-13-L16 can be added to a PS-4108-13-L08, but be aware that real-world outputs 8-15 will be skipped. Digital outputs are provided by SLIMLINE solid state relays or reed relays, and thus have specifications dependent on the relays used. All user connections to the outputs are made via pluggable headers, and plugs are included with the rack when it is shipped from the factory. The output terminals are labeled M0A, M0B through M7A, M7B, where the number is the output number and dc conventional current flows into the B terminal and out of the A terminal.
The maximum current rating for each module installed in the PS-4108 rack is as stated in the module's specifications, OR 1.5 amps, whichever is less.

See datasheet for Phoenix 1755794 header and 1792812 plug for insulation ratings.

Analog Outputs

The rack can control up to two analog modules in positions A0 and A1. Only one rack (the one with address 0) in a given system can have analog outputs. Analog outputs are provided by slimline analog modules, and thus have specifications dependent on the modules used. A pluggable header is used for wiring to the analog outputs, and a plug is included with the rack when it is shipped from the factory. The terminals are labeled such that, for analog output 0, conventional current flows out of the A0 terminal, through the load, and returns to the - terminal for analog output 0. Similarly, for analog output 1, conventional current flows out of the A1 terminal, through the load, and returns to the - terminal for analog output 1.

See datasheet for Phoenix 1755752 header and 1792773 plug for insulation ratings

Status Indicators

RUNNING	During normal operation the green *RUNNING* LED (D12) is lit.
COMMUNICATIONS	When Rack-to-PLS communications are ongoing the yellow *COMMUNICATIONS* LED (D11) is lit.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108-13-L08 I/O Rack Installation

Sinking/Sourcing Defined

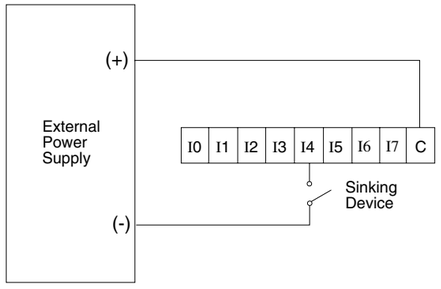
Sinking means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a DC common or ground to the connected device.

Sourcing means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a +DC voltage to the connected device.

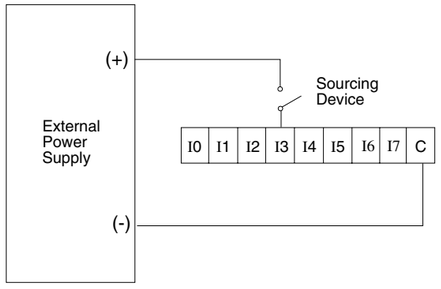
This information is important when interfacing an Electro Cam Corp. product with another electronic device. If you are using an Electro Cam Corp. product input to an Allen-Bradley 1746-IN16 "sinking" input card* or similar A-B device, you have to supply a +DC voltage (Electro Cam Corp. ***Sourcing*** output) to this card, NOT a DC common or ground. In these cases, ***Sinking*** is what the card does with the input voltage; sinks it to common or ground.

*Other manufacturers include, but not limited to: Koyo (formerly GE Series 1, Texas Instruments, or Siemens SIMATIC PLS's) that use descriptions similar to Allen-Bradley.

Sinking Devices

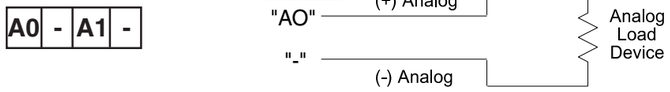


Sourcing Devices



I0	Group One Input
I1	Group Two Input
I2	Group Three Input
I3	Group Four Input
I4	Group Five input
I5	Group Six Input
I6	1st Cycle Enable
I7	Output Enable

Analog Output



- Analog output modules source the analog signal.
- No external supply is required.
- Analog output signals are isolated.

C01 Example.rss (cont'd)

Downloading the PLC Program to the SLC CPU

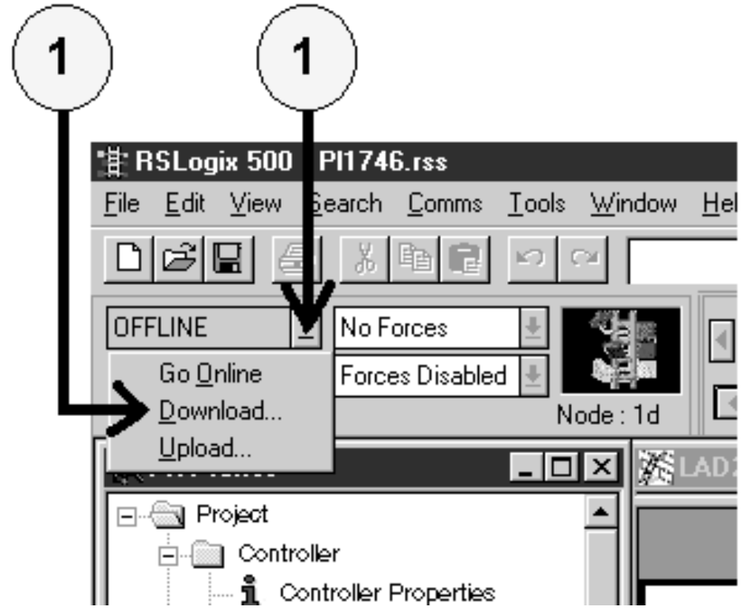


Figure 7

Before you begin downloading, it is best if you already have communications running through RS Linx to your PLC. Once the communications are up and running, you may proceed. There are two different ways to download a program from RS Logix, as shown in Figures 7 and 8. Either way will download the program the same way. In Figure 7, you click the down arrow once, then click the 'Download' item once. In Figure 8, you click on 'Comms' once, then 'Download' once.

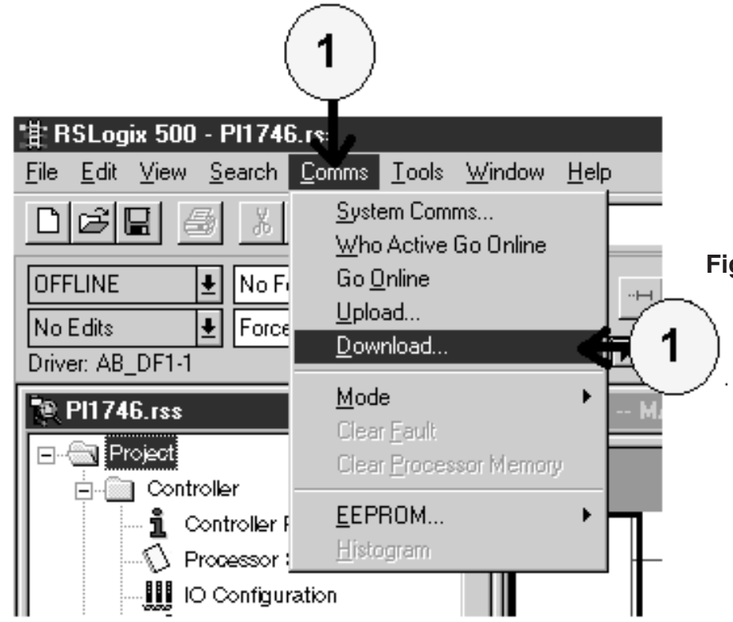


Figure 8

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss (cont'd)

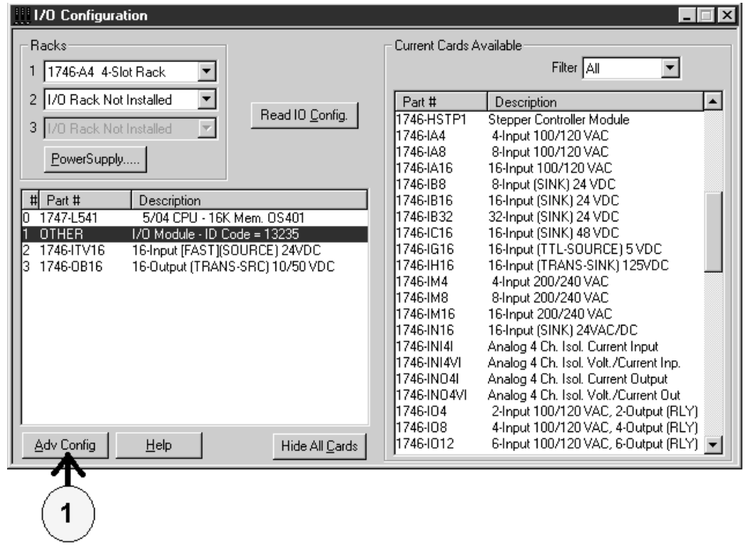


Figure 5

The final step in the initial programming of the PL-1746 is the M0 and M1 file length entry. The first step is to highlight the PL-1746 module Part # OTHER, Description-I/O Module-ID Code 13235. The next step is to click the 'Adv Config' button once, as shown in Figure 5.

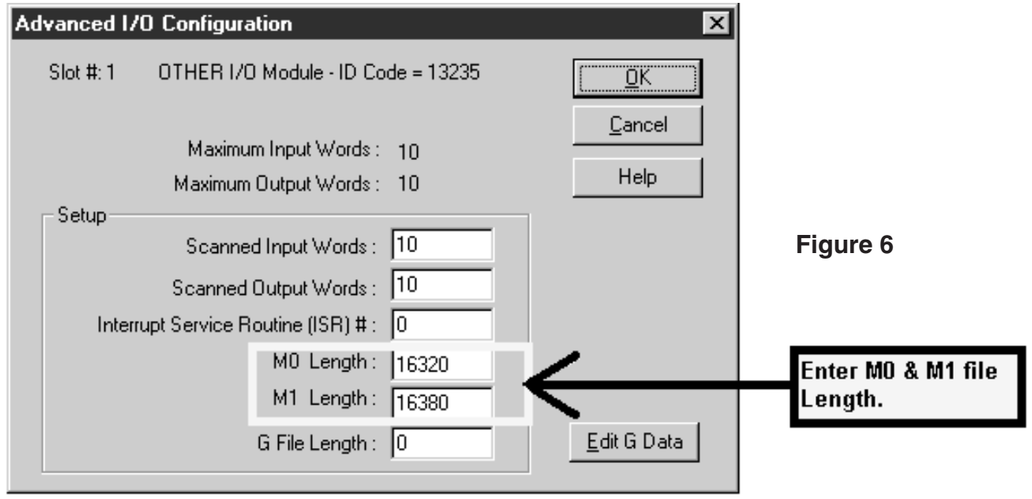
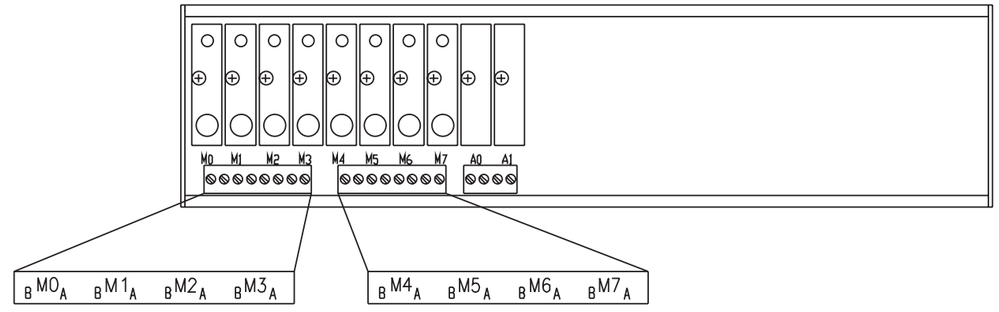


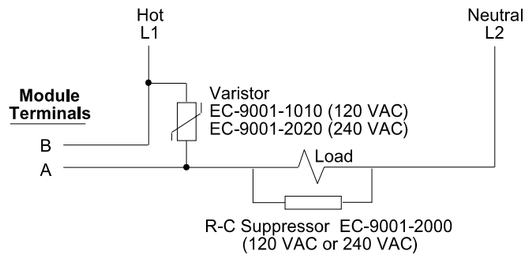
Figure 6

Once the 'Adv Config' button is clicked, the window shown in Figure 6 appears. Enter the M0 and M1 file length, as shown in Figure 6, then press 'OK'. Once this is done, the program is ready to be downloaded to the SLC CPU. Please keep in mind that if your setup has any specialty modules installed in your rack other than the PL-1746 and A-B Input or Output modules, these may require additional setup time.

PS-4108-13-L08 I/O Rack Installation



AC Output

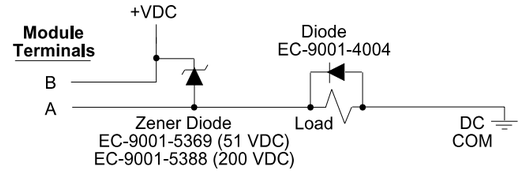


Most applications will not need the varistor or R-C suppressor shown above. However, when other switching devices are in series or parallel with the AC module, voltage spikes may damage the module. Use one of the following two methods to suppress voltage spikes.

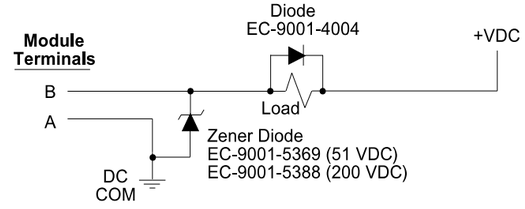
- For infrequent switching, connect a varistor (MOV) across the terminals.
- For continuous switching, wire an R-C suppressor in parallel with the load.

DC Output

Sourcing



Sinking



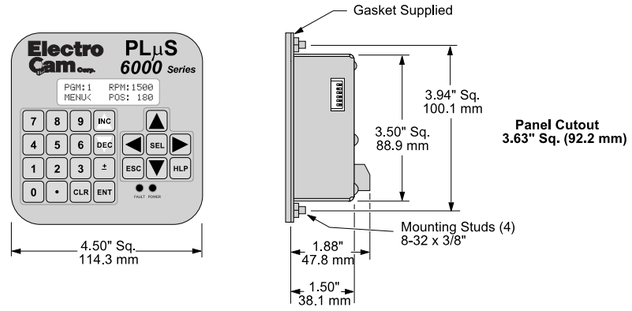
Most applications will not need the diodes shown above. However, highly inductive DC loads may damage modules by generating voltage spikes when switched off. Suppress these voltage spikes using one of these two methods:

- Connect a Zener diode across the terminals. This will not significantly increase the load turn off time. Voltage rating of the diode must be greater than the normal circuit voltage.
- Connect a reverse-biased diode across the load. This may increase the load turn off time.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-6400 Keypad Installation

Note:
The PS-6400 keypad is not designed to be hot-swapped (plugged or unplugged while power is ON).



Number of Keypads

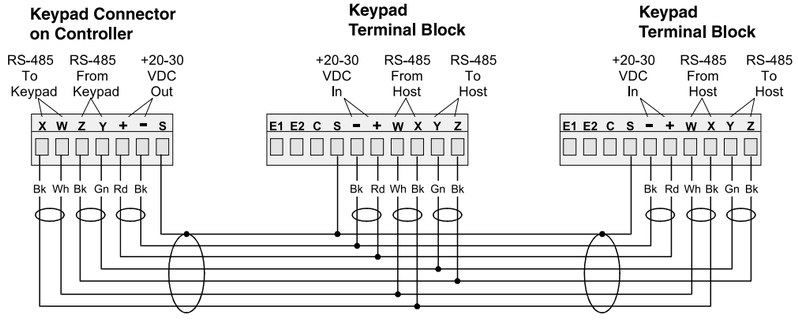
One or two keypads may be connected to a PL-1746 controller as shown in the illustration below.

Programming Enable

The wiring connector on the back of each keypad includes terminals to select Operator or Master level programming for that keypad. These terminals can be temporarily jumpered during setup to allow entry of programming access codes, or they can be switched with a variety of devices including mechanical switches, relay contacts, and PLC DC outputs. See ENABLE CODES in the programming section for details on programming access.

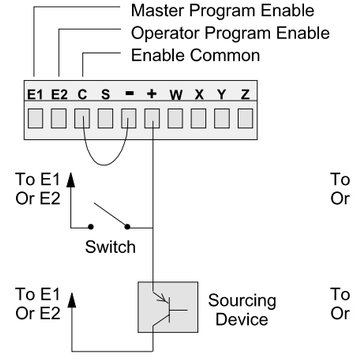
If a solid state device will be activating the Programming Enable terminals, that device will determine whether sourcing or sinking wiring should be used. For mechanical devices such as jumpers or key switches, either sourcing or sinking wiring may be used.

Keypad Wiring

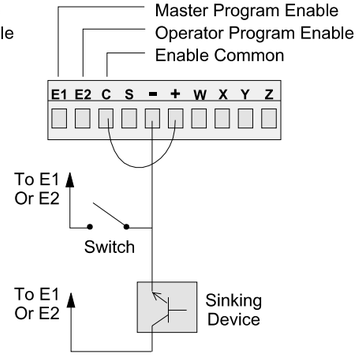


Programming Access	Display	Operator	Setup	Master
Keypad Terminal	---	Yes (E2)	No	Yes (E1)
Password	---	Yes	Yes	Yes

Programming Enable, Sourcing



Programming Enable, Sinking



Sinking/Sourcing Defined

Sinking means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a DC common or ground to the connected device.

Sourcing means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a +DC voltage to the connected device.

This information is important when interfacing an Electro Cam Corp. product with another electronic device. If you are using an Electro Cam Corp. product input to an Allen-Bradley 1746-IN16 "sinking" input card* or similar A-B device, you have to supply a +DC voltage (Electro Cam Corp. ***Sourcing*** output) to this card, NOT a DC common or ground. In these cases, ***Sinking*** is what the card does with the input voltage; sinks it to common or ground.

*Other manufacturers include, but not limited to: Koyo (formerly GE Series 1, Texas Instruments, or Siemens SIMATIC PLS's) that use descriptions similar to Allen-Bradley.

C01 Example.rss (cont'd)

Once the 'I/O Configuration' has been pushed, the window shown in figure 3 will open. In order to read what the I/O Configuration is in your unit, the 'Read IO Config' button shown in Figure 3 must be clicked once.

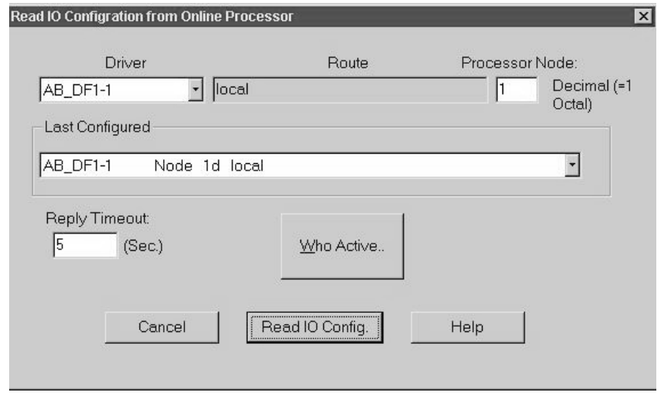


Figure 3

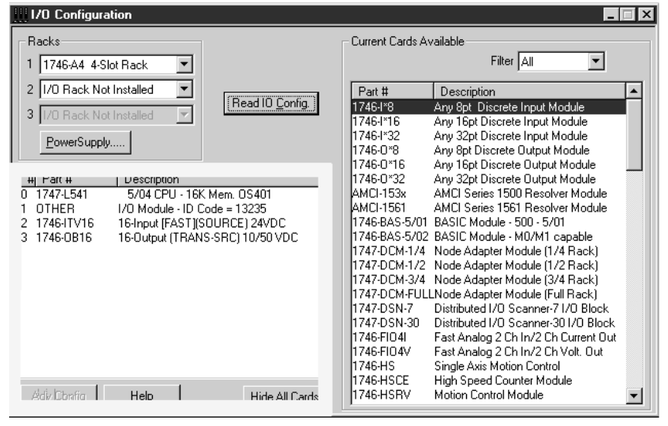
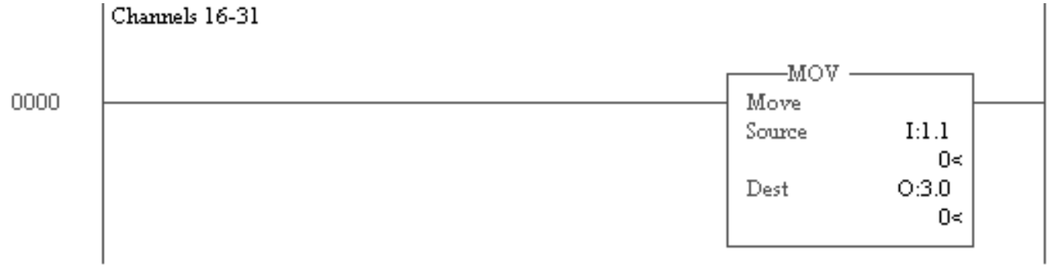


Figure 4

Once the I/O Configuration of your rack is read, the cards which are installed in the rack you are working with will be listed as in the highlighted box shown in figure 4. In this example, slot 1 contains the PL-1746, slot 2 contains an A-B 16 input card, and slot 3 contains an A-B 16 output card. As you may already know, the SLC CPU must reside in Slot 0. Depending on the type of CPU, input/output and A-B rack size, your setup might not look the same. Yours will probably be different than the example shown above. The only requirement for the PL-1746 to operate is that your CPU is 5/03 or higher. Neither input nor output cards are necessary for this program to run in your system. The only exception to this is if you would like to have the output channels from the PL-1746 present in one of your output channels. If no output module is present in your rack, then Rung 0000 will need to be deleted in order for this program to run prorperly. Click on rung 0000 once, then push the delete button.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss

Initial Programming steps are covered in the PL-1746 PLµS Plug-In Module manual. The main topics discussed in this supplement will be specific programming examples through RS Logix 500 programming software. This section was written for persons with some PLC Ladder programming experience. These supplemental programming examples will assist in the implementation of the PL-1746 into your operating enviroment.

To be used in conjunction with this document is the RS Logix program C01 Example.rss. It is recommended that you copy this program onto your hard drive for a 'working copy' of the program, and leave the copy on the disk in its original state.*To obtain copies of these RS-Logix programs, please contact Electro Cam Corp.by phone or email. 1-800-228-5487 or ecam@electrocam.com.*

Initialization of Program

In order for this program to be of use to you, you must re-configure it for your setup. In the example provided, we will start from scratch with a 4-slot rack with a 5/04 CPU already running RS Linx and RS Logix. Once the C01 Example.rss program has been selected and is running from within the RS Logix Program, double click on the item 'IO Configuration' as shown in Figure 1.

Once you have double-clicked on IO Configuration, the window I/O Configuration will appear, as shown below in Figure 2. Click once on the Read I/O Config button.

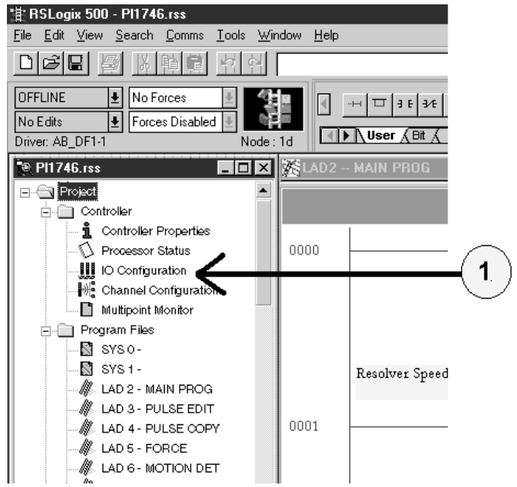


Figure 1

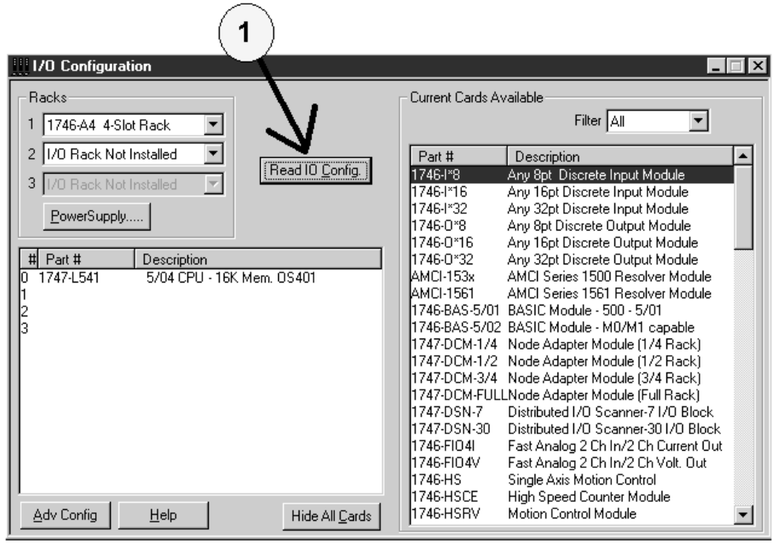


Figure 2

DIP Switch Settings

Overview

Installation

Each PS-6400 keypad and PL-1746 module has a DIP switch. For convenience, set these DIP switches before installing the keypads or module.

Termination Resistors

The PS-6400 keypad and PL-1746 PLS modules have built-in termination resistors for the RS-485 network across which they communicate. The two devices at the physical end of the RS-485 network must have their termination resistors connected; all devices between them must have their termination resistors disconnected. The termination resistors are connected or disconnected by setting the appropriate DIP switches on each device as indicated below.

PS-6400 Keypad DIP Switch Settings

Termination Resistors

To connect the termination resistors, set switches 5 & 6 ON; to disconnect the termination resistors, set switches 5 & 6 to OFF.

Address

Set switches 1-4 per the following chart to establish the desired address for the keypad. Keypad addresses must begin with 0 and increase sequentially. The physical location of a keypad has no intrinsic relationship to its address. During initial programming, the KEYBOARD QTY must be used to enter the number of keypads in the chain; it can only be accessed through the keypad whose address is 0 or through the backplane.

Address	Switch 1 (B3)	Switch 2 (B2)	Switch 3 (B1)	Switch 4 (B0)
0	ON	ON	ON	ON
1	ON	ON	ON	OFF
2	ON	ON	OFF	ON
3	ON	ON	OFF	OFF
4	ON	OFF	ON	ON
5	ON	OFF	ON	OFF
6	ON	OFF	OFF	ON
7	ON	OFF	OFF	OFF
8	OFF	ON	ON	ON
9	OFF	ON	ON	OFF
10	OFF	ON	OFF	ON
11	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON
13	OFF	OFF	ON	OFF
14	OFF	OFF	OFF	ON
15	OFF	OFF	OFF	OFF

PL-1746-C01 DIP Switch Settings (All reserved switches must be ON)

Switch	ON	OFF
1	Local I/O Module	Remote I/O Module
2	Reserved	Reserved
3	Reserved	Reserved
4	Reserved	Reserved
5	Connect Termination Resistors	Disconnect Termination Resistors
6	Reserved	Reserved
7	Reserved	Reserved

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DIP Switch Settings (cont'd)

PL-1746-C02/C03 DIP Switch Settings (All reserved switches must be OFF)

Switch	ON	OFF
1	Local I/O Module	Remote I/O Module
2	Resolver Mode: Master	Resolver Mode: Slave
3	Connect Termination Resistors	Disconnect Termination Resistors
4	Reserved	Reserved
5	Reserved	Reserved
6	Reserved	Reserved
7	Reserved	Reserved

C01 Pulses.rss: Setpoint Reading, Restoration, and Storage Program

"Write" Setpoints from PLC Program to PL-1746

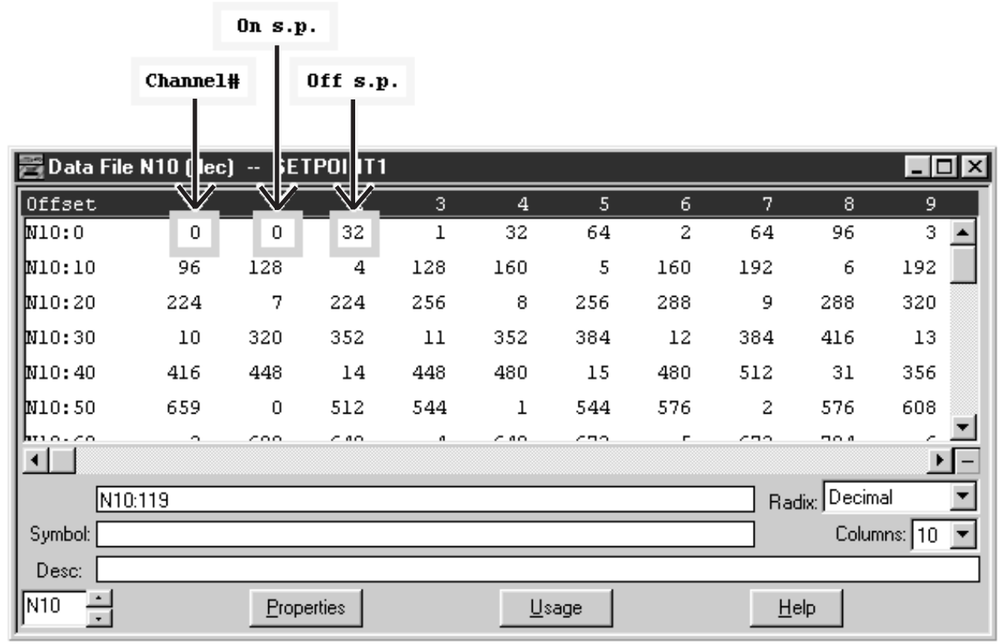
To 'Write' setpoints from the PLC program to the PL-1746, perform the following steps:

1. Ensure keyswitch is in the 'PROG' state on your SLC CPU.
2. Download C01 Pulses.rss PLC program into your SLC CPU.
3. Set B3/15 to '1' (WRITE).
4. Turn the SLC CPU keyswitch to 'RUN'.
5. Toggle B3/2 high (set to 1).

Once this has been accomplished, all setpoint information stored in the Data Files N10-SETPOINT1 through N24-SETPOINT15 will be transferred from the PLC program to the setpoint memory in the PL-1746.

Zero All Setpoints

If you would like to zero all setpoints that are in the controller, you must go to the Data Files, enter all zeroes into the Setpoint 'ON' and 'OFF ' values, then write these values back into the controller. Refer to the Data File shown above. In order to write a zero to that setpoint, the Channel Number must remain in the Data File. Only the 'ON' setpoint and the 'OFF' setpoint must be set to zero.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Pulses.rss: Setpoint Reading, Restoration, and Storage Program

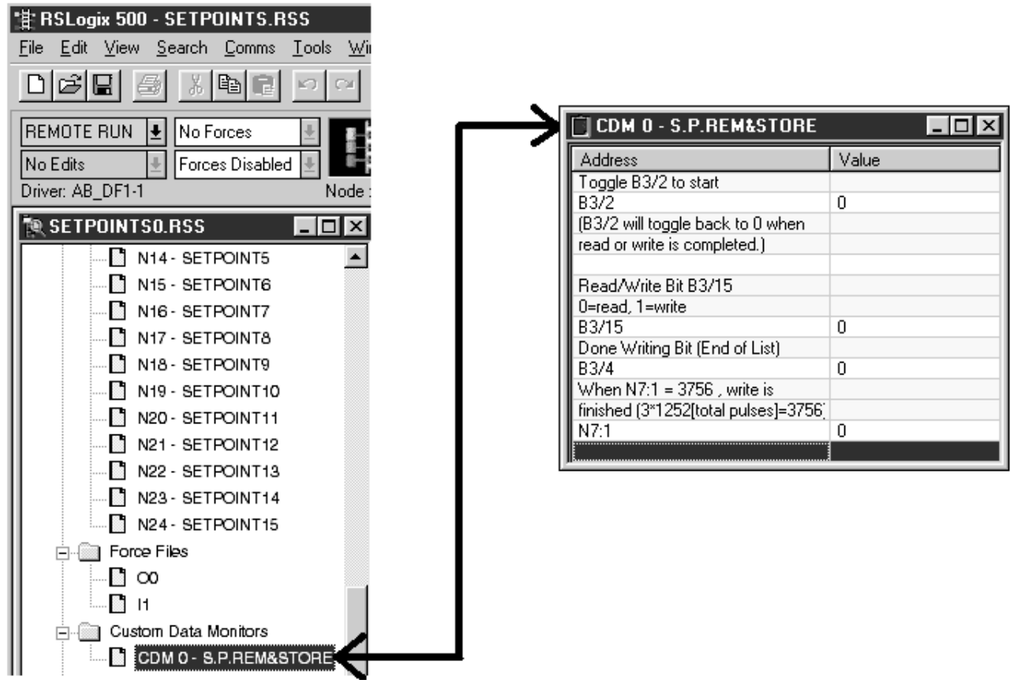
Included with these instructions you will need the RS Logix PLC program C01 & Pulses.rss. This program provides a way to read setpoints from the PL-1746 as well as a setpoint storage medium, to use the same setpoints for more than one controller. This program is intended for use with RS Logix 500 software, PL-1746 PLµS Plug-In Module, and SLC CPU 5/03 or higher. No input or output cards are necessary for this program to run properly, the only requirement is that the SLC CPU is in Slot 0 and the PL-1746 is in Slot 1.

Prior to downloading and running the program, it must be configured for your setup the same way as described in the C01 Example.rss PLC program initialization. Once the program has been configured and downloaded, use these instructions to assist in setpoint reading and storage. The CDM shown below is the operational interface for setpoint reading and restoration.

"Read" setpoints from PL-1746 to PLC PROGRAM
To ensure that the setpoints contained in your PL-1746 are not accidentally erased when making backups, follow these steps to 'Read' setpoint information from the PL1746:

1. Ensure Key is in the 'PROG' state on your SLC CPU.
2. Download C01 Pulses.rss program into your SLC CPU.
3. Set B3/15 to '0' (READ)
4. Turn the SLC CPU keyswitch to 'RUN'.
5. Toggle B3/2 high (set to 1).

Once all setpoints have been downloaded from the SLC CPU, B3/2 will toggle back to '0'. To save these setpoints, go to the upper left corner and click 'File', 'Save as'- give the setpoints a name. Now the setpoints can be viewed in the Data Files N10 through N25. Each setpoint takes up three integer words, 'channel', 'on' value and 'off' value. The data tables are large enough to hold up to 1252 total setpoints. The more setpoints you have in the PL-1746, the more time it will take to either read or write setpoints.



Backplane Programming

The PL-1746 Programmable Limit Switch Module was designed to work in a SLC-500 series chassis. All of the module's channels, enable inputs, configuration data, and pulse information is available to the SLC-500 processor through the backplane of the chassis. All of the data in the PLS module accessible by the SLC-500 processor is contained in one of four data files. These are the Input file, Output file, M0 file, and M1 file. Each data element in these files is referred to in the ladder program by a specific address. Addresses are constructed as follows:

Addressing
F:S.R/B where:
F is the file specifier. It is I for input files, O for output files, M0 for the M0 files and M1 for the M1 files.
S is the number of the slot in which the PLS module is installed.
R is the desired register number.
B is the number of the desired bit in the specified register.

If you are accessing an entire register, the /B parameter is not needed. It is only used to access specific bits of a register. For instance, if the ladder program needs the resolver speed, and the PLS module is installed in slot three of the SLC-500 chassis, the ladder program would reference address M0:3.22. When the ladder program checks the status of the Any Error bit in the Programming Error Register, it would reference address I:3.7/15. Because this flag is a single bit, the /B parameter is required.

Input File
The input file in the PL-1746 module contains ten data words. The first two words (I:S.0-I:S.1) contain the status of all 32 of the PLS outputs. The next three words (I:S.2-I:S.4) in the input file are not pre-defined by the PLS. The Error Number Register is in I:S.6, and the Programming Error Register is in I:S.7. Raw Resolver Position, updated every scan cycle, is in I:S.8.

Output File
The output file also contains ten data words but only the first two words are pre-defined by the PLS. The first contains the Input Status Register. The PL-1746's six Group Inputs, the First Cycle Enable Input, and the Output Enable Input can be set or cleared by writing to O:S.0. The second word in the output file is the Active Program Register, O:S.1. This register controls which program in the PL-1746 is controlling the PLS outputs; if it contains zero, the program number in the Default Program register is used. Although data may be written to the eight other output file registers, it will be ignored by the PL-1746.

M0 & M1 Files
All PLS configuration data is accessed through the module's M0 file and all pulse data is accessed through the M1 file. Some registers in the M0 file are unused and are reserved for future expansion. All of the data in the M1 file, and most of the data in the M0 file, is stored in non-volatile memory and is retained during power down.

The M0 and M1 files are usually accessed through the use of a block transfer command such a MOV. In the PL-1746, the M1 file is read only. You can move a maximum of 1000 words with one block transfer. An error will be generated if a larger block size is attempted. The number of the last accepted register is placed in the error location register.

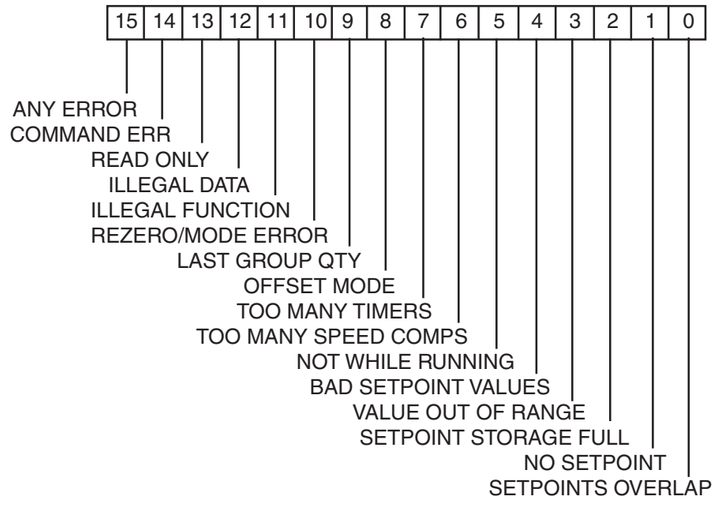
When the ladder program changes data in the M0 file, the change is checked for validity, and if valid, is stored in the non-volatile memory. After storing, the change takes effect. If the change is found to be invalid, the change is rejected, the Programming Error Register (I:S.7) is set to indicate the nature of the error, and the number of the register that generated the error is loaded into the Error Number Register (I:S.6). After making a change to the M0 file, the ladder program should test the status of the Programming Error Register. If an error was generated, the ladder program should correct the cause, and then clear the error by toggling the Clear Error bit (O:S.0/8) in the Input Status Register from 0 to 1.

Backplane Interlock
The PLS configuration data is stored in EE-PROM in the PL-1746. This type of non-volatile memory has very slow write cycles. Since the PL-1746 runs slower while storing configuration data than the SLC-500 ladder program, the possibility of backplane overflow exists. Also, in the C02/C03, copy commands should be limited to a maximum of 12 words, or the C02/C03 may cause a "specialty I/O module in slot 1 has not responded to a lock shared memory command within the required time limit" fault in the SLC program. To avoid these conditions, a register is available at M0:S.866 called Backplane Interlock. The ladder program writes a command or a series of commands to the PL-1746. It then writes a one to the backplane and tests that location to see when it changes back to zero. Whenever the PL-1746 detects a write to the Interlock, it will respond by writing zero back to that location. This allows the ladder program to know when the previous command has been executed. Then another command or series of commands can be delivered.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Backplane Programming (cont'd)

PROGRAMMING ERROR REGISTER (I:S.7)



PROGRAMMING ERROR REGISTER BITS:

I:S.7/15	The ANY ERROR bit comes on if any other error bit in the Programming Error Register is turned on. No commands are executed if the ANY ERROR bit is on. To clear the ANY ERROR bit and the current error, toggle O:S.0/8 on and off. The errors are actually cleared on the rising edge of O:S.0/8. Then another error can be reported.
I:S.7/14	The COMMAND ERR bit is set by an error from a programming command. The programming commands are Channel Copy, Program Copy, Pulse Copy and Pulse Edit.
I:S.7/13	The READ ONLY error will be set if you write to a read only register.
I:S.7/12	The ILLEGAL DATA error is reported when the specified data is out of the range permitted for that parameter.
I:S.7/11	The ILLEGAL FUNCTION error is reported for all non-supported parameters.
I:S.7/10	The REZERO/MODE ERROR is reported if an unsupported mode is specified.
I:S.7/9	The LAST GROUP QTY error is reported when changing the quantity of the last group is attempted.
I:S.7/8	The OFFSET MODE error is reported when changing the group mode to EACH while the group's mode is 1 or 2.
I:S.7/7	The TOO MANY TIMERS error is caused by changing the timed output quantity to a value greater than four.
I:S.7/6	The TOO MANY SPEED COMPS error by changing the quantity of speed compensated channels to a value greater than sixteen.
I:S.7/5	The NOT WHILE RUNNING error is reported when attempting to change a variable that can only be changed when the machine is stopped.
I:S.7/4	The BAD SETPOINT VALUES error is caused by creating or changing both edges of a pulse to a value other than 0 (deleting pulse) or 1 (ON all the time).
I:S.7/3	The VALUE OUT OF RANGE error is reported when attempting to change a the contents of a variable to an excessive value.
I:S7/2	The SETPOINT STORAGE FULL error will be reported if the non-volatile memory is full.
I:S7/1	The NO SETPOINT error is reported if a command requires a pulse edge and none is provided.
I:S7/0	The SETPOINTS OVERLAP error will be reported if a command results in on/off edges that overlap.

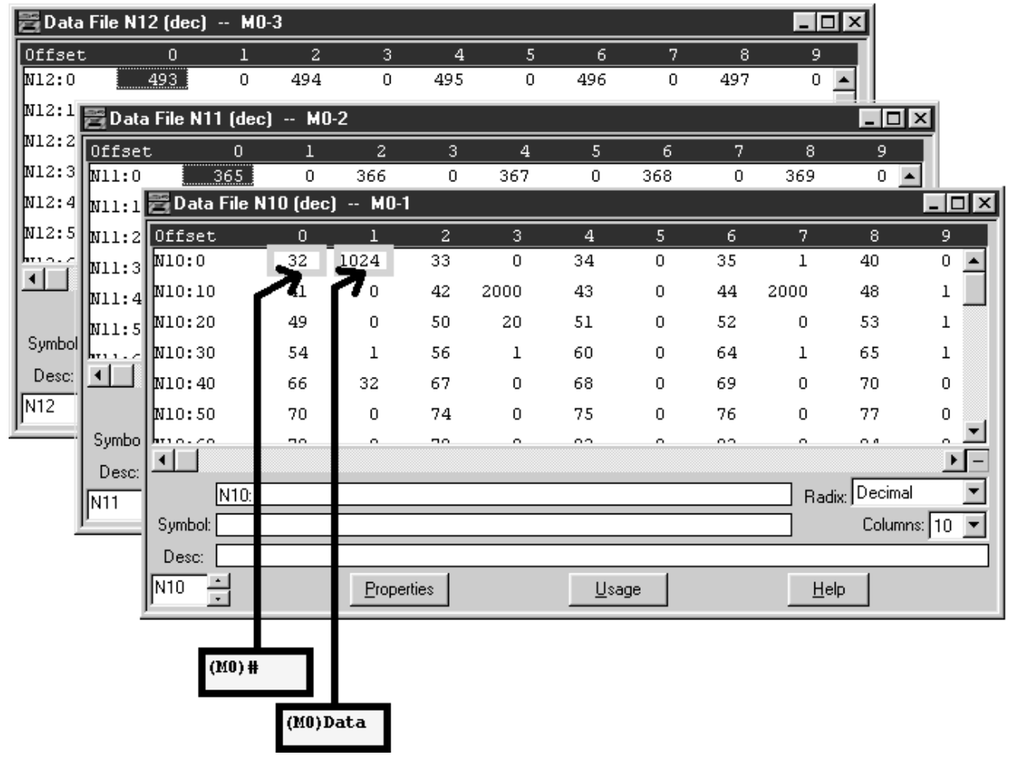
C01 Configuration.rss (cont'd)

"Write" Configuration Information from PLC Program to PL-1746
To "Write" configuration information from the PLC program to the PL-1746, perform the following steps:

1. Ensure keyswitch is in the 'PROG' state on your SLC CPU.
2. Download C01 Configuration.rss PLC program into your SLC CPU.
3. Set B3/15 to '1' (WRITE).
4. Turn the SLC CPU keyswtich to 'RUN'.
5. Toggle B3/2 high (set to 1).

Once this has been accomplished, all configuration information stored in the Data Files N10-(M0-1), N11-(M0-2) and N12-(M0-3) will be transferred from the PLC program to the configuration memory in the PL-1746.

Zero All Configuration Data
If you would like to zero all configuration information that is stored in the controller, you must go to the Data Files, enter all zeroes into the configuration values leaving the M0 # alone, then write these values back into the controller. Refer to the Data File shown above. In order to write a zero to that M0 register, the M0 Number must remain in the Data File, only the 'Data' must be set to zero.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Configuration.rss

Included with these instructions you will need the RS Logix 500* PLC program C01 Configuration.rss. This program provides a way to read controller configuration from the PL-1746, as well as a configuration storage medium, to use the same configuration for more than one controller. This program is intended for use with RS Logix 500 software, PL-1746 PLµS Plug-In Module, and SLC CPU 5/03 or higher. No input or output cards are necessary for this program to run properly. The only requirement is that the SLC CPU is in Slot 0 and the PL-1746 is in Slot 1 (You must change all addressif module is in another slot).

Prior to downloading and running the program, it must be configured for your setup the same way as described in the C01 Example.rss PLC program initialization. Once the program has been configured and downloaded, use these instructions to assist in setpoint reading and storage. The CDM shown below is the operational interface for setpoint reading and restoration. This program is intended to be used in conjunction with the PLC program C01 Pulses.rss to read all information from the controller.

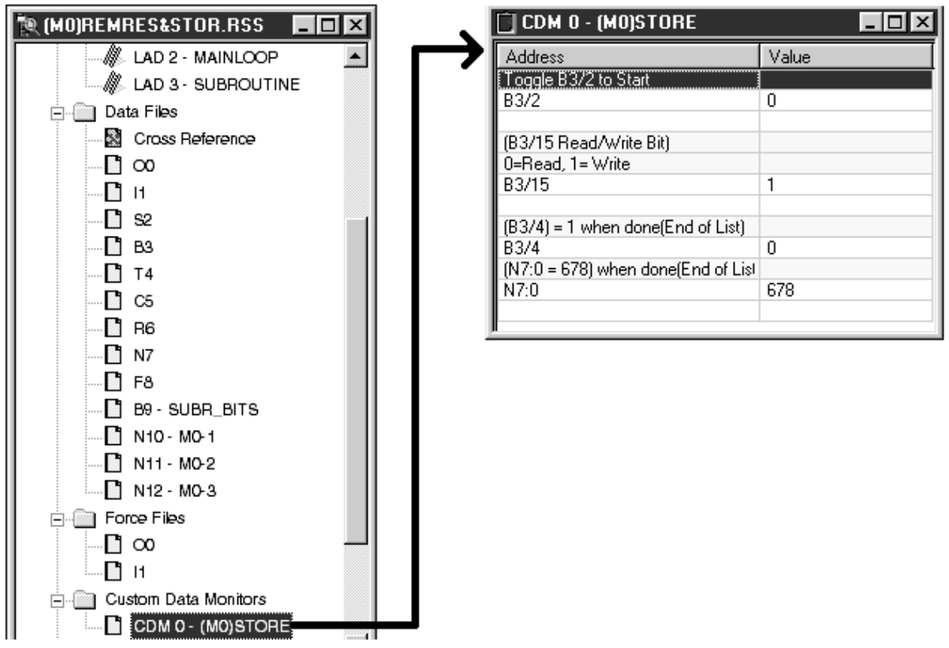
*RS Logix 500 and RS Linx are registered trademarks of Rockwell Software, Inc.

"Read" Configuration from PL-1746 to PLC PROGRAM

To ensure that the configuration information contained in your PL-1746 is not accidentally erased, follow these steps to 'Read' configuration information from the PL1746. The Custom Data Monitor '(M0)STORE' can be thought of as an operational interface between the PL-1746 and your computer, All data files necessary for program operation are available through this CDM.

1. Ensure Key is in the 'PROG' state on your SLC CPU.
2. Set Bit S:2/3 to 'Yes' [otherwise an error will occur]
3. Download C01 Configuration.rss program into you SLC CPU.
4. Set B3/15 to '0' (READ)
5. Turn the SLC CPU keyswitch to 'RUN'.
6. Toggle B3/2 high (set to 1).

Once all of the configuration information has been downloaded from the SLC CPU, B3/2 will toggle back to '0'. To save this information, go to the upper left corner and click 'File', 'Save as'- give the configuration information a name that you choose. Now the configuration can be viewed in the Data Files N10-(M0-1), N11-(M0-2) and N13-(M0-3).



Backplane Programming (cont'd)

ERROR NUMBER REGISTER (I:S.6)

When an error is reported and the Any Error bit in the Programming Error Register is set, the register number of the command that caused the error is placed in the Error Number Register. This register is available from the PL-1746 in it's input file at location I:S.6 (unless I:S.6 is mapped).

HARDWARE ERROR REGISTER (I:S.5) — C02 AND C03 MODELS ONLY

Errors reported in the Hardware Error Register (I:S.5) are in one of two classes: non-fatal (bits 6, 12, 13, and 15) and fatal (all other bits). Fatal errors are those that prevent the PLS from continuing operations. Non-fatal errors are those that do not prevent the PLS from operating but must be corrected before outputs can be exercised in the normal manner. The PLS never directly causes a SLC fault. However, in the case of some fatal errors the fault will occur as a result of the PLS's inability to continue operating. When a fault occurs the PLS turns off its outputs. It shows the relevant error code on the local display (built into the PL-1746). It sets the error-specific bit, along with the Any Error bit, in the Hardware Error Register. To clear this bit the SLC must toggle the Clear Bit (O:S/0/8) high or else the SLC's mode must be toggled to PROG mode and back to RUN mode. If the fault condition remains, it will again be reported in the same manner. If multiple errors occur, their respective error bits accumulate in the Hardware Error Register. In all cases the PLS only updates the Hardware Error Register if it is unmapped. The PLS also reports the error to the remote PS-6400 Keypad/ Display, if any are in use. That error screen can be cleared by pressing the PS-6400's ESC key.

ERROR CODES

The Bit column shows the bit numbers within the Hardware Error Register (I:S.5). Only the C02 and C03 models have this register. The other models are included here for completeness and because the error codes are shown in the local display, preceded by "Ex".

Bit	*Error Code*	*Proposed Manual Description*	*C01*	*C02ES C03ES*	*C02R C03R*	*C02RS C03RS*	*Troubleshooting*
15		Any fault	x	x	x	x	
14	0F	Rack timeout and data error	x	x			Call factory.
		Exceeded configuration limit			x		Call factory.
		Reserved				x	
13	0E	Rack data error	x	x			Call factory.
		Nearing configuration limit			x		Call factory.
		System busy				x	See SYSTEM BUSY BIT section.
		Exceeded configuration limit					Call factory.
12	0D	I/O power supply failed	x	x	x	x	Check 24V on front panel.
11	0C	Rack timeout error	x				Call factory.
		Queue overflow		x	x	x	Call factory.
10	0B	SLC access timer timeout	x	x	x	x	Call factory.
9	0A	Fatal error	x	x	x	x	Call factory.
		Nearing configuration limit					Call factory.
8	09	Pipe overflow	x	x	x	x	Call factory.
7	08	Fifo overflow	x	x	x	x	Check SLC program for excessive writes.
6	07	Resolver not ok	x	x	x	x	Check resolver wiring.
5	06	NMI without power failure	x	x	x		Call factory.
		Reserved				x	
4	05	Illegal interrupt	x	x	x	x	Call factory.
3	04	Startup failed	x	x	x		Call factory.
		Reserved				x	
2	03	Illegal interrupt parameter	x	x	x		Call factory.
		Reserved				x	
1	02	Code checksum failed	x	x	x		Call factory.
		Reserved				x	
0	01	Memory test failed	x	x	x		Call factory.
		Reserved				x	

SYSTEM BUSY BIT — C02RS and C03RS MODELS ONLY

The SLC program should assume the C02 is not ready for data whenever the System Busy bit is set. This can happen, for example, during startup and when the user changes scalefactor. Unlike the other status bits, the System Busy bit and the Any Error bit (I:S.5/15) cannot be cleared by the SLC program; in this instance these bits are cleared by the C02 only. Also, when the system is busy, it doesn't turn off outputs, doesn't light the fault LED, and doesn't show anything on the local display.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INPUT STATUS REGISTER 0:S.0

0:S.0/15	0:S.0/14	0:S.0/13	0:S.0/12	0:S.0/11	0:S.0/10	0:S.0/9	0:S.0/8
						Clear Shift Reg.	Clear Error

0:S.0/7	0:S.0/6	0:S.0/5	0:S.0/4	0:S.0/3	0:S.0/2	0:S.0/1	0:S.0/0
Output Enable	1st Cycle Enable	Group 5 Input	Group 4 Input	Group 3 Input	Group 2 Input	Group 1 Input	Group 0 Input

For GROUP "X" INPUT and 1ST CYCLE ENABLE see Chapter 6: Groups and Modes.

OUTPUT ENABLE
This input enables Channels that have their output anding enable bit set; those channels will be turned off when this bit is low.

CLEAR ERROR
Toggle this bit ON to clear the "Any Error" bit in the Programming Error Register (I:S.7).

Remote I/O

The Remote I/O feature permits the PL-1746 module to be used in a remote I/O rack with a 1747-ASB RIO adapter module. The RIO adapter permits the SLC processor to access only the Input and Output files of modules installed in the remote rack. To access the PL-1746's M0 file data while in the remote rack:

1. Prior to installing the PL-1746 in the remote rack, and with power off, set DIP switch 1 to OFF.
2. Using Rockwell programming software, set the PL-1746's card type is set to OTHER, with ID# 3535, M0 file length 16320, and M1 file length 16380.
3. Set up the desired input and output file register mappings as described in the Register Mapping section.

M1 File data is not accessible while the PL-1746 is operating in Remote I/O mode.

Register Mapping

Register Mapping provides an automatic way to reflect M0 File or M1 File data into any of the first eight Input File words (I:S.0 - I:S.7) and to reflect data from any of the first eight Output File words (O:S.0 - O:S.7) into the M0 File or M1 File. Register Mapping may be used with the PL-1746 operating in either Local I/O mode or Remote I/O mode; however, M1 Files may not be accessed when the PL-1746 is operating in Remote I/O mode.

To set up a mapping, enter a Mapping Index Number into the Mapping Source register for the desired Input File word or Output File word. This can be accomplished by using a PS-6400 Keypad as described in the Input Maps and Output Maps sections in chapter 4. It can also be done over the backplane, if the PL-1746 is operating in Local I/O mode. It cannot be done over the backplane if the PL-1746 is operating in Remote I/O mode, since, in that case, the RIO adapter prevents access to the PL-1746's M0 File. The Mapping Index Number for each M0 File word and each M1 File word is indicated in the Quick Reference. Entering a value of 0 as a Mapping Index Number causes the Input or Output File word to revert to it's pre-assigned meaning; those meanings are indicated in the Quick Reference.

For example, suppose that, using a PL-1746 in slot 4, it is desirable to work with Analog Output 1 via mapping, rather than than directly through the M0 file. Using the PS-6400 Keypad:

1. **Enter the value 210 as the Output Map # for Reg # 2.**
   This puts the Mapping Index Number for Analog Output 1
   Offset into the Mapping Source Register for Output File word 2 (O:4.2).
2. **Enter the value 212 into the Output Map # for Reg # 3.**
   This puts the Mapping Index Number for Analog Output 1
   High RPM into the Mapping Source Register for Output File word 3 (O:4.3).
3. **Enter the value 214 into the Input Map # for Reg # 2**
   This puts the Mapping Index Number for Analog Output 1
   Value into the Mapping Source Register for Input File word 2 (I:4.2).

The same purpose could be achieved over the backplane:
1. Move the value 210 into M0:4.193.
2. Move the value 212 into M0:4.194.
3. Move the value 214 into M0:4.210.

Now new Offset and High RPM values can be written via the Output File and read the Analog Value via the Input File.

Overview of Utility & Example Ladder Programs

Electro Cam Corp. has developed the following three types of ladder program for use with the PL-1746 products:

Configuration
These programs provide a way to back up PL-1746 configuration data (all data other than pulse data). See descriptions below.

Pulses
These programs provide a way to back up PL-1746 pulse data. See descriptions below.

Example
These programs provide examples of ladder programming for modifying PL-1746 configuration and pulse data while in run mode. These examples can be followed, for example, when making HMIs operate with the PL-1746.

The following chart shows which program sets are used with which PLS models.
Note: A version number, such as 200, may follow the filename and precede the .rss filename extension.

Program Set	PLS Models
C01 Configuration.rss C01 Pulses.rss C01 Example.rss	PL-1746-C01-R1
C02 & C03 Configuration.rss C02 & C03 Pulses.rss C02 & C03 Example.rss	PL-1746-C02-R1 PL-1746-C03-R1 PL-1746-C02-E1 PL-1746-C03-E1
C02 & C03 -S Configuration.rss C02 & C03 -S Pulses.rss C02 & C03 -S Example.rss	PL-1746-C02-R1-S PL-1746-C03-R1-S PL-1746-C02-E1-S PL-1746-C03-E1-S

Note: To obtain copies of RX-Logix programs, please contact Electro Cam Corp. by phone (1-800-228-5487) or email (ecam@electrocam.com).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Error Messages: PS-6400 Keypad (cont'd)

Error Message:	Description:
Too many speed compensated channels	The maximum number of speed compensated channels have already been programmed. **Solution:** *Press ESC key to clear the error.*
Too many timed outputs	The maximum number of timed outputs have been used. **Solution:** *Press ESC key to clear the error.*
A group is in Mode 1 or Mode 2: Can't go to ONE	There are groups that are in modes that affect the offset of the group. Cannot change Group Position Display to ONE offset for all groups. **Solution:** *Press ESC key to clear the error.*
Can't change # of channels in last group	There was an attempt to change the number of channels in the last group. The last group receives all remaining channels available in the controller. **Solution:** *Press ESC key to clear the error.*
Mode cannot be 1 or 2 if Group Position Display in ONE	There was an attempt to set a group to mode 1 or 2 when the Group Position Display is set to ONE. **Solution:** *Press ESC key to clear the error. Change the Group Position Display to "EACH".*
Keypad RS-485 link was broken	Check for Loose Wires. One of the wire connections from the controller to keypad has experienced an intermittent connection or maintained an open connection. **Solution:** *Press ESC key to clear the error. Check to make sure cable connections are securely plugged in. Check wires going into connectors for broken wires or loose connections. Check for continuity between connectors while flexing the cable to check for intermittent connections.*
Too many setpoints	There was an attempt to program in another setpoint after the maximum number of setpoints were already in the controller. **Solution:** *Press ESC key to clear the error.*
Value out of limit	A number was entered that exceeds allowable limits for the item being programmed. Some examples are: A setpoint value that exceeds the scale factor, a channel number that exceeds the number of channels available, a program number higher than is allowed by the controller, etc. **Solution:** *Press ESC key to clear the error and re-enter a value that is within the limits of the parameter.*
Pulse will overlap another pulse in the same channel	There was an attempt to program a pulse that has either an ON or OFF point overlapping an existing pulse in the channel. **Solution:** *Press ESC key to clear the error. Review the existing setpoints to determine the cause of the overlap condition and re-enter values.*
I/O power fail (PL-1746-C01 only)	This indicates that the power supply for the isolated circuitry and rack has failed. **Solution:** *Press ESC key to clear the error. Check power source and connections to I/O rack power input.*
EEPROM reset to factory defaults	The configuration data in the PLS has been reset to factory default values. This happens when the user executes a memory test function 7000 or 7001.

Quick Reference

PL-1746 Quick Reference (Applies to all PL-1746 models, except as noted)

Revised 6-9-00

Notes:

1.I/O Module ID Code: Local = 13235, Remote = 3535

2.M0 file size = 16320. M1 file size = 16380.

3Mapping Index Number for M0 file: (Address * 2) + 128.

4.Registers in the M0 file are not contiguous; space has been left between register groups for future expansion. To maintain future compatibility, SLC programs should not access unlisted registers; writes to these registers result in Illegal Function Errors.

5.In the Read/Write Capability column, R/W means Read/Write, R/O means Read-Only, W/O means Write-Only, and starred items cannot be written while the resolver/encoder is in motion.

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Analog Outputs					
Analog Quantity	M0:S.40	208	R/W	0-2 Model C01	4-2
(Real-World Outputs)			R/O	0 Models C02,C03	
Analog Output 1 Offset	M0:S.41	210	R/W	0-4095	4-1
Analog Output 1 High RPM	M0:S.42	212	R/W	0-3000	4-1
Analog Output 1 Value	M0:S.43	214	R/O	0-4095	4-1
Analog Output 2 Offset	M0:S.44	216	R/W	0-4095	4-1
Analog Output 2 High RPM	M0:S.45	218	R/W	0-3000	4-1
Analog Output 2 Value	M0:S.46	220	R/O	0-4095	4-1
Channel Copy					
Channel Copy Source Program	M0:S.800	1728	R/W*	0-47	4-2
Channel Copy Source Channel	M0:S.802	1732	R/W*	0-31	4-2
Channel Copy Destination Program	M0:S.801	1730	R/W*	0-47	4-2
Channel Copy Destination Channel	M0:S.803	1734	R/W*	0-31	4-2
Channel Copy Command/Status	M0:S.804	1736	R/W*	Bit 15 Error Bit 14 Source Pgm Error Bit 13 Dest Pgm Error Bit 12 Source Chn Error Bit 11 Dest Chn Error Bit 10 Reserved Bits Error Bit 9 Dest Chn Not Empty Erro Bit 8-1 Reserved Bit 0 Execute/Busy	4-2
Input File					
Input Word 0 PL-1746 Output Channel 0-15 Status, 1bit/channel	I:S.0	None	R/O	0=Off 1=On	4-23
Input Word 1 PL-1746 Output Channel 16-31 Status, 1bit/channel	I:S.1	None	R/O	0=Off 1=On	4-23
Input Word 2	I:S.2	None	R/O	-32768 to 32767	3-1
Input Word 3	I:S.3	None	R/O	-32768 to 32767	3-1
Input Word 4	I:S.4	None	R/O	-32768 to 32767	3-1

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Input Word 5 Hardware Status/Error Register Models C02,C03 only. If an error occurs in this register, it must be cleared before any further data can be written to the PL-1746 registers. To clear this register, toggle O:S.0/8 from 0 to 1.	I:S.5	None	R/O	Bit 15 Any Error Bit 14 Reserved Bit 13 System Busy Bit 12 Power Supply Failure Bit 11 Queue Overflow Bit 10 SLC Access Timer Timeout Bit 9 SLC Fatal Error Bit 8 Pipe Overflow Bit 7 Backplane Overflow Bit 6 Resolver Failure Bit 5 NMI Without Power Failure Bit 4 Interrupt from Unused Vector Bit 3-0 Reserved	3-3
Input Word 6 Error Number Register	I:S.6	None	R/O	Mapping Index Number associated with error	3-3
Input Word 7 Programming Error Register If an error occurs in this register, it must be cleared before any further data can be written to the PL-1746 registers. To clear this register, toggle O:S.0/8 from 0 to 1.	I:S.7	None	R/O	Bit 15 Any Error Bit 14 Command Bit 13 Read-Only Bit 12 Illegal Data Bit 11 Illegal Function Bit 10 RezeroMode Bit 9 Last Group Quantity Bit 8 Offset Mode Bit 7 Too Many Timers Bit 6 Too Many Speed Comps Bit 5 Not While Running Bit 4 Bad Pulse Values Bit 3 Out of Range Bit 2 Pulse Storage Full Bit 1 No Pulse Bit 0 Pulse Overlap	3-2
Input Word 8 - Raw Resolver Pos Input Word 9 - Machine Pos	I:S.8 I:S.9	None 560	R/O R/O	0-4095 0-4095 Update at the same high rate as the PLS outputs.	3-1 4-14
Input Mapping Registers					
Input Word 0 Map #	M0:S.208	544	R/W	0-32767	4-11
Input Word 1 Map #	M0:S.209	546	R/W	0-32767	4-11
Input Word 2 Map #	M0:S.210	548	R/W	0-32767	4-11
Input Word 3 Map #	M0:S.211	550	R/W	0-32767	4-11
Input Word 4 Map #	M0:S.212	552	R/W	0-32767	4-11
Input Word 5 Map #	M0:S.213	554	R/W	0-32767	4-11
Input Word 6 Map #	M0:S.214	556	R/W	0-32767	4-11
Input Word 7 Map #	M0:S.215	558	R/W	0-32767	4-11
Interrupts					
Interrupt Enables Channels 0-31, 1bit/channel	M0:S.132- M0:S.133	392- 394	R/W	0=Disabled 1=Enabled	4-12
Interrupt Levels Channels 0-31, 1bit/channel	M0:S.128- M0:S.129	384- 386	R/W	0= Rising Edge 1= Falling Edge	4-12

Error Messages: PS-6400 Keypad

The following PL-1746 error messages will assist in troubleshooting:

Error Message:	**Description:**
Comm failure host to keyboard	Occurs when there is a communication time out between keypad/display and controller card. **Solution:** *Press the ESC key to clear the error. If error re-occurs, check connections between keypad and controller.*
Resolver not connected	Bad or no connection to resolver detected. **Solution:** *Press the ESC key to clear the error. Check connections between the resolver and controller.*
Flash checksum error	The system firmware has become corrupted and the system has shut down. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Configuration checksum error	The configuration information is corrupted and default values have been loaded. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Pulse checksum error	The pulse information is corrupted and all pulse data has been cleared. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Rack link failure	Either the communication interface between the controller and the rack has been broken or the rack has failed. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Watchdog timer time-out	The system watchdog timer has timed out and reset the system. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
SLC-500 bus time-out	The SLC-500 backplane bus access timer has timed out. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Operator enable minimum	There was an attempt to adjust a setting without at least the operator enable hardwire, or password. **Solution:** *Press the ESC key to clear the error. Enter the operator enable code, or add the hardwire.*
Function not enabled for operator use	There was an attempt to adjust a function to which the operator has not been given access. **Solution:** *Press the ESC key to clear the error. Use a higher level of programming enable (setup, master) to access the function. Or have a master set the enable options feature to give the operator access to the function.*
Channel not enabled for operator use	There was an attempt to adjust a channel, at operator level, to which the operator has not been given access. **Solution:** *Press the ESC key to clear the error. Use a higher level of programming enable (setup, master) to access the function. Or have a master set the enable options feature to give the operator access to the function.*
Not allowed while running	There was an attempt to change a programmed item that can only be changed while the transducer is stationary. **Solution:** *Press the ESC key to clear the error. Stop motion of the transducer and change the programmed item.*
No resolver reference	There is no resolver signal present. **Solution:** *Press the ESC key to clear the error. Either make the unit a master or connect a master to it.*

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Error Messages: PL-1746-C01 Module

IMPORTANT **The module cannot be repaired in the field. If a unit fails, do not disassemble it. Return it to the factory for replacement.**

The PL-1746 major errors will fault the SLC 500 CPU. The following are the error codes displayed on the PL-1746 module and their meanings:

PLS Module Display Readout	RS Logix 500 Major Errors - Troubleshooting	
EX 05 Interrupt from unused vector	S75	Call factory.
EX 06 NMI without PWRFAIL_	S76	Call factory.
EX 07 Resolver not OK	S77	Check resolver wiring.
EX 08 Backplane overflow	S78	Check ladder for too many writes to the M0 or M1 file.
EX 09 SLC interface pipe is full	S79	Call factory.
EX 0A SLC fatal error	S7A	Call factory.
EX 0B SLC access timer time-out	S7B	Call factory.
EX 0C Rack interface time-out	S7C	Check I/O rack configuration and DIP switches.
EX 0D Power supply failed	S7D	Check to see if 24VDC is present on front of module.
EX 0E PS-4108 Rack interface data error	S7E	Check I/O rack configuration and DIP switches.
EX 0F PS-4108 Rack interface time-out and data error	S7F	Check I/O rack configuration and DIP switches.

Error Messages: PL-1746-C02/C03 Module

IMPORTANT **The module cannot be repaired in the field. If a unit fails, do not disassemble it. Return it to the factory for replacement.**

See the Hardware Error Register section for details on error codes and troubleshooting.

Note: The PL-1746-C02/C03 has a green POWER LED, which lights to indicate that the CPU is out of reset, and a yellow FAULT LED.

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Groups					
Group Quantity	M0:S.64	256	R/W*	1-6	4-20
Group Position Display	M0:S.65	258	R/W	0=EACH 1=ONE	4-10
Logic Inputs Status	M0:S.25	178	R/O	0-255	4-11
Group 0 Channel Count	M0:S.66	260	R/W*	0-32	4-20
Group 0 Mode	M0:S.82	292	R/W*	0-5	4-20
Group 0 Offset	M0:S.74	276	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 0 Position	M0:S.16	160	R/W*	0 to (Scale Factor-1)	4-8
Group 1 Channel Count	M0:S.67	262	R/W*	0-32	4-20
Group 1 Mode	M0:S.83	294	R/W*	0-5	4-20
Group 1 Offset	M0:S.75	278	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 1 Position	M0:S.17	162	R/W*	0 to (Scale Factor-1)	4-8
Group 2 Channel Count	M0:S.68	264	R/W*	0-32	4-20
Group 2 Mode	M0:S.84	296	R/W*	0-5	4-20
Group 2 Offset	M0:S.76	280	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 2 Position	M0:S.18	164	R/W*	0 to (Scale Factor-1)	4-8
Group 3 Channel Count	M0:S.69	266	R/W*	0-32	4-20
Group 3 Mode	M0:S.85	298	R/W*	0-5	4-20
Group 3 Offset	M0:S.77	282	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 3 Position	M0:S.19	166	R/W*	0 to (Scale Factor-1)	4-8
Group 4 Channel Count	M0:S.70	268	R/W*	0-32	4-20
Group 4 Mode	M0:S.86	300	R/W*	0-5	4-20
Group 4 Offset	M0:S.78	284	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 4 Position	M0:S.20	168	R/W*	0 to (Scale Factor-1)	4-8
Group 5 Channel Count	M0:S.71	270	R/O	0-32	4-20
Group 5 Mode	M0:S.87	302	R/W*	0-5	4-20
Group 5 Offset	M0:S.79	286	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 5 Position	M0:S.21	170	R/W*	0 to (Scale Factor-1)	4-8
Output Assignments C02,C03 only					
Output Assignments Outputs 0-5, 1word/output	M0:S.600-M0:S.605	1328-1338	R/W*	0-31	4-19
Output Enable ANDing					
Output Enable ANDing Channels 0-31, 1bit/channel	M0:S.272-M0:S.273	672-674	R/W	0=On 1=Off	4-19
Output File					
Output Word 0 Logic Inputs	O:S.0	None	W/O	Bit 16-10 Reserved Bit 9 Clear Shift Register (Models C02,C03 only) Bit 8 Clear Error Bit 7 Output Enable Bit 6 First Cycle Enable Bit 5 Group 5 Input Bit 4 Group 4 Input Bit 3 Group 3 Input Bit 2 Group 2 Input Bit 1 Group 1 Input Bit 0 Group 0 Input	3-3, 4-11

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Output Word 1	O:S.1	None	W/O	-32768 to 32767	3-1
Output Word 2	O:S.2	None	W/O	-32768 to 32767	3-1
Output Word 3	O:S.3	None	W/O	-32768 to 32767	3-1
Output Word 4	O:S.4	None	W/O	-32768 to 32767	3-1
Output Word 5	O:S.5	None	W/O	-32768 to 32767	3-1
Output Word 6	O:S.6	None	W/O	-32768 to 32767	3-1
Output Word 7	O:S.7	None	W/O	-32768 to 32767	3-1
Output Mapping Registers					
Output Word 0 Map #	M0:S.192	512	R/W	0-32767	3-4, 4-22
Output Word 1 Map #	M0:S.193	514	R/W	0-32767	3-4, 4-22
Output Word 2 Map #	M0:S.194	516	R/W	0-32767	3-4, 4-22
Output Word 3 Map #	M0:S.195	518	R/W	0-32767	3-4, 4-22
Output Word 4 Map #	M0:S.196	520	R/W	0-32767	3-4, 4-22
Output Word 5 Map #	M0:S.197	522	R/W	0-32767	3-4, 4-22
Output Word 6 Map #	M0:S.198	524	R/W	0-32767	3-4, 4-22
Output Word 7 Map #	M0:S.199	526	R/W	0-32767	3-4, 4-22
Output Status					
Force Outputs On Channels 0-31, 1bit/channel	M0:S.256- M0:S.257	640- 642	R/W	1=Force Active 0=Force Inactive	4-23
Force Outputs Off Channels 0-31, 1bit/channel	M0:S.264- M0:S.265	656- 658	R/W	1=Force Active 0=Force Inactive	4-23
Motion ANDing/Detection					
Motion Level 1 Low Limit (ML1L)	M0:S.96	320	R/W	0 to (ML1H-1)	4-18
Motion Level 1 High Limit (ML1H)	M0:S.97	322	R/W	(ML1L+1) to 3000	4-18
Motion Level 2 Low Limit (ML2L)	M0:S.98	324	R/W	0 to (ML2H-1)	4-18
Motion Level 2 High Limit (ML2H)	M0:S.99	326	R/W	(ML2L+1) to 3000	4-18
Motion ANDing Channels 0-31, 1word/channel	M0:S.512- M0:S.543	1152- 1214	R/W*	0=OFF 1=ML1 2=ML2	4-17
Program Copy					
Program Copy Destination Program	M0:S.769	1666	R/W*	0-47	4-25
Program Copy Source Program	M0:S.768	1664	R/W*	0-47	4-25
Program Copy Command/Status	M0:S.770	1668	R/W*	Bit 15 Error Bit 14 Source Pgm Error Bit 13 Dest Pgm Error Bit 12 Reserved Bits Error Bit 11 Dest Pgm Not Empty Error Bit 10-1 Reserved Bit 0 Execute/Busy	4-25

PS-4108 Rack Troubleshooting

Problem	Possible Solutions
An input to an external device that is driven by a digital AC output stays on continuously	1. Verify that the LED on the solid state relay lights at the correct times. 2. Verify that the channel's status, as viewed on the PS-6400 Keypad/Display's I/O status screen, operates correctly. 3. Verify that the setpoint programming in the PL-1746 is correct. 4. Check for other programming such as timed outputs, group and mode logic, and enable windows (9x channels) in the PL-1746 that can inhibit outputs. 5. See if installing a 10k, 5W resistor in parallel with the external device's input corrects the problem. 6. Replace the solid state relay with a known good relay. 7. Contact the factory.
A digital DC output stays on continuously	1. Verify that the LED on the solid state relay lights at the correct times. 2. Verify that the channel's status, as viewed on the PS-6400 keypad's I/O status screen, operates correctly. 3. Verify that the setpoint programming in the PL-1746 is correct. 4. Check for other programming such as timed outputs, group and mode logic, and enable windows (9x channels) in the PL-1746 that can inhibit outputs. 5. Verify correct wiring from the output to the load. Polarity must be observed when wiring DC outputs. 6. Replace the solid state relay with a known good relay. 7. Contact the factory.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108 Rack Troubleshooting

Problem	Possible Solutions
A digital output does not operate	1. Verify correct wiring from the output to the load. 2. Verify that the LED on the solid state relay lights at the correct times. 3. Verify that the channel's status, as viewed on the PS-6400 Keypad/Display's I/O status screen, operates correctly. 4. Verify that the setpoint programming in the PL-1746 is correct. 5. Check for other programming such as timed outputs, group and mode logic, and enable windows (9x channels) in the PL-1746 that can inhibit outputs. 6. Verify that the relay's fuse is operational using the on-board fuse tester. 7. Replace the solid state relay with a known good relay. 8. Check the RUNNING (green) LED (D12). It should be continuously lit. 9. Check the COMMUNICATIONS (yellow) LED (D11). It should be continuously lit. 10. Verify that the PL-1746 module is operating correctly. If not, see the PL-1746 troubleshooting guide. 11. Verify that the cable connections between PL-1746 module and the PS-4108 racks are correct. 12. Verify that the rack's addressing switches are set correctly. 13. Verify that the rack's termination switches are set correctly. 14. Verify that the rack quantity is set correctly in the PL-1746.
An analog output does not operate	1. Verify correct wiring from the output to the load. 2. Verify that the analog programming in the PL-1746 is correct. 3. Replace the analog module with a known good module. 4. Check the RUNNING (green) LED (D12). If it is dark, go to step 6. 5. Check the COMMUNICATIONS (yellow) LED (D11). It should be continuously lit. 6. Verify that the PL-1746 module is operating correctly. It should be continuously lit. 7. Verify that the cable connections between PL-1746 module and the PS-4108 racks are correct. 8. Verify that the rack's addressing switches are set correctly. 9. Verify that the rack's termination switches are set correctly. 10. Verify that the rack quantity is set correctly in the PL-1746.
An input does not operate	1. Verify correct wiring to the input. 2. Verify that the input's LED is operating correctly. 3. Verify that the input's status, as viewed on the PS-6400 keypad's I/O status screen, operates correctly. 4. Verify the group and mode programming and the enable window programming (9x channels) in the PL-1746. 5. Check the RUNNING (green) LED (D12). It should be continuously lit. 6. Check the COMMUNICATIONS (yellow) LED (D11). It should be continuously lit. 7. Verify that the PL-1746 module is operating correctly. If not, see the PL-1746 troubleshooting guide. 8. Verify that the cable connections between PL-1746 module and the PS-4108 racks are correct. 9. Verify that the rack's addressing switches are set correctly. 10. Verify that the rack's termination switches are set correctly. 11. Verify that the rack quantity is set correctly in the PL-1746.

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Program Enable					
Master Password	M0:S.106	340	R/W	0-9999	4-5
Setup Password	M0:S.105	338	R/W	0-9999	4-5
Operator Password	M0:S.104	336	R/W	0-9999	4-5
Per-Channel Operator Access Channels 0-31, 1 bit/channel	M0:S.280-M0:S.281	688-690	R/W	0=Operator Accessible 1=Operator Inaccessible	4-5
Operator Enable Options	M0:S.107	342	R/W	Bit 15-8 Reserved Bit 7 Machine Offset Bit 6 Group Offset Bit 5 Default Program Bit 4 Motion Detect/ANDing Bit 3 Analog Outputs Bit 2 Timed Outputs Bit 1 Speed Comp Bit 0 Pulses	4-7
Pulse Copy (Creates Pulse Train)					
Pulse Copy Program	M0:S.704	1536	R/W	0-47	4-27
Pulse Copy Channel	M0:S.705	1538	R/W	0-31	4-27
Pulse Copy On (Train Start)	M0:S.706	1540	R/W	0 to (Scale Factor-1)	4-27
Pulse Copy Off (Train End)	M0:S.707	1542	R/W	0 to (Scale Factor-1)	4-27
Pulse Copy Count (Number of Pulses)	M0:S.708	1544	R/W	1 to ((Off-On)/2)	4-27
Pulse Copy Duration (of each pulse)	M0:S.709	1546	R/W	1 to (off-on-count)/count)	4-27
Pulse Copy Command/Status	M0:S.710	1548	R/W*	Bit 15 Error Bit 14 Program Error Bit 13 Channel Error Bit 12 On > Scale Factor Error Bit 11 Off > Scale Factor Error Bit 10 Overlap Error Bit 9 Duration Error Bit 8 Reserved Bits Error Bit 7-1 Reserved Bit 0 Execute/Busy	4-27
Pulse Edit					
Pulse Edit Program	M0:S.896	1920	R/W	0-47	4-30
Pulse Edit Channel	M0:S.897	1922	R/W	0-31	4-30
Pulse Edit On (Leading Edge)	M0:S.898	1924	R/W	0 to Scale Factor	4-30
Pulse Edit Off (Trailing Edge)	M0:S.899	1926	R/W	0 to Scale Factor	4-30
Pulse Edit Pulse Index (within channel)	M0:S.900	1928	R/W	0 to (Pulse Quantity-1)	4-30
Pulse Edit Pulse Quantity (within channel)	M0:S.901	1930	R/O	0 to (Scale Factor/2)	4-30
Pulse Edit Command/Status	M0:S.902	1932	R/W	Bit 15 Error Bit 14 Program Error Bit 13 Channel Error Bit 12 On > Scale Factor Error Bit 11 Off > Scale Factor Error Bit 10 Pulse Index Error Bit 9 Reserved Bits Error Bit 8-5 Reserved Bit 4-1 Command (see below) Bit 0 Execute/Busy	4-30

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

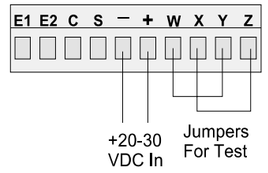
Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
				Commands (bits 4-1): 0000 Read 0001 Write 0010 Increment On 0011 Decrement On 0100 Increment Off 0101 Decrement Off 0110 Increment Both 0111 Decrement Both 1000 Increment All 1001 Decrement All 1010 Change On 1011 Change Off 1100 Reserved 1101 Reserved 1110 Reserved 1111 Reserved	
Pulses (Bulk Pulse Storage in M1 File)					
Pulse Number (P is the Pulse Number.)	M1:S.A where A = 4 ×(P-1)	32768+8 ×(P-1)	R/O	1-1252Models C01 1-787Models C02,C03 Note: A pulse number 0 indicates an invalid pulse.	
Pulse Program/Channel Program in high byte Channel in low byte	M1:S.B where B= 4 ×(P-1)+1	32768+8 ×(P-1)+2	R/O	Program: 0-47 Channel: 0-31	
Pulse On	M1:S.C where C= 4 ×(P-1)+2	32768+8 ×(P-1)+4	R/O	0 to (Scale Factor-1)	
Pulse Off	M1:S.D where D = 4 ×(P-1)+3	32768+8 ×(P-1)+6	R/O	0 to (Scale Factor-1)	
Rate Display					
RPM Update Rate	M0:S.49	226	R/W	0=1/s 1=2/s 2=10/s	4-36
Toggle RPM	M0:S.50	228	R/W	0-9999	4-46
Displayed Units	M0:S.51	230	R/W	0=RPM 1=BPM 2=CPM 3=IPM	4-35
Decimal Point Location	M0:S.52	232	R/W	0-3	4-35
Rate Multiplier	M0:S.53	234	R/W	1-1091	4-35
Rate Divisor	M0:S.54	236	R/W	1-63	4-35
Resolver					
Direction of Rotation	M0:S.34	196	R/W*	0=CCW 1=CW	4-4
Machine Offset	M0:S.33	194	R/W*	0 to (Scale Factor-1)	4-14
Machine Position	M0:S.24	176	R/W*	0 to (Scale Factor-1)	4-14
Resolver Mode	M0:S.60	248	R/W* (-C01) R/O models	0=Master 1=Slave C02,C03, (set via DIP Switch)	4-36
Resolver Position	M0:S.23	174	R/O	0 to (Scale Factor-1)	4-14
Resolver Speed	M0:S.22	172	R/O	0-3000	4-15
Scale Factor	M0:S.32	192	R/W*	2-4096 Resolver-Based Units (-R in model #) 2-4000 Encoder-Based Units (-E in model #)	4-37

PS-6400 Keypad Troubleshooting (cont'd)

Keypad Communications Port Test Setup

Keypad Terminal Block



When the COMM PORT diagnostic is run with keypad terminals W, X, Y, and Z jumpered as shown, a string of “plus” signs will scroll across the display. When either jumper is removed, the scrolling will stop.

Resolver Troubleshooting

Mechanical Problems

If the resolver is generating erratic RPM or position readings, or the position appears to be shifting periodically with respect to the machine cycle, check the mechanical coupling between the resolver and the machine.

If the coupling is not slipping, loosen the coupling and rotate the resolver shaft in both directions with sudden, jerky motions. If the controller displays unusual position or RPM readings, the resolver may be need to be replaced.

IMPORTANT

Resolvers cannot be repaired in the field. If a unit fails, do not disassemble it. Return it to the factory for replacement.

Electrical Problems

If any wire in one of the three individually shielded pairs becomes disconnected, the following error message will appear on the keypad/display:

```
ERROR: RESOLVER
NOT CONNECTED!
```

The output channels will immediately be disabled until the resolver is reconnected. Press ESC to clear the error message.

Note that ESC will clear the message and restore access to keypad programming even if the resolver has not been reconnected.

Follow this procedure to troubleshoot electrical problems:

1. Verify that the electrical connections at each end of the resolver cable are secure.
2. Disconnect the cable at the controller. Measure the resistances between all wires on the terminal block. The paired wires should have the resistances shown in the table below, while the resistance between every other combination of wires should be infinite. If the resistances are correct, the controller may need to be replaced.
3. If the resistances in Step 2 are incorrect, the problem may be in the cable or in the resolver. Disconnect the cable at the resolver and measure the resistances at the resolver pins. If the resistances are correct, the cable is bad. If the resistances are wrong, the resolver should be replaced.

Wire Pair	Resistance	or	Resistance
White/Black	15 to 25 Ohms		60 to 85 Ohms
Red/Black	20 to 40 Ohms		135 to 185 Ohms
Green/Black	20 to 40 Ohms		135 to 185 Ohms

Note: The resolver resistance will fall into one set of ranges or the other, depending on the date of manufacture.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

General Troubleshooting (cont'd)

Problem	Possible Solution
Backplane: Unable to write to the 1746 programming functions in the M:O files	The Programming Error Register (I:S.7) or the Hardware Status/Error Register (I:S.5) may have an error bit set. This will prevent writing any data to the M:O files until the error is cleared. Clear the error by toggling bit O:S.0/8 from a 0 to a 1.

PS-6400 Keypad Troubleshooting

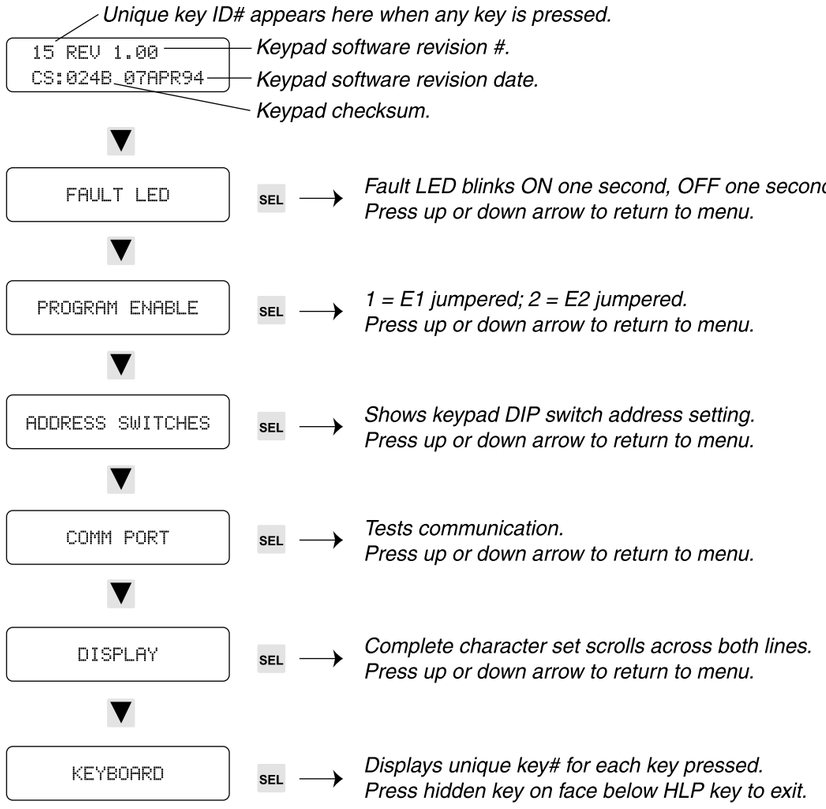
IMPORTANT **The keypad cannot be repaired in the field. If a unit fails, do not disassemble it. Return it to the factory for replacement.**

Keypad Fault LED

If the Fault LED on the keypad lights, turn the controller off and back on. If the keypad Fault LED does not go off, the keypad microprocessor has malfunctioned. Return the keypad to the factory.

Keypad Diagnostics

The keypad includes a series of diagnostics that show the status of various keypad functions. To start the diagnostics, turn the controller off, then restart the controller while pressing any key on the keypad.



Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Shift Register Models C02,C03 only					
Shift Position	M0:S.917	1962	R/W	0 to (Scale Factor-1)	4-39
Window On	M0:S.918	1964	R/W	0 to (Scale Factor-1)	4-39
Window Width	M0:S.919	1966	R/W	0 to (Scale Factor-1)	4-39
Program 0 Shift Counts	M0:S.920-	1968-	R/W	0-255	4-39
(Channels 0-31)	M0:S.951	2030			
Program 1 Shift Counts	M0:S.952-	2032-	R/W	0-255	4-39
(Channels 0-31)	M0:S.983	2094			
Program 2 Shift Counts	M0:S.984-	2096-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1015	2158			
Program 3 Shift Counts	M0:S.1016-	2160-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1047	2222			
Program 4 Shift Counts	M0:S.1048-	2224-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1079	2286			
Program 5 Shift Counts	M0:S.1080-	2288-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1111	2350			
Program 6 Shift Counts	M0:S.1112-	2352-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1143	2414			
Program 7 Shift Counts	M0:S.1144-	2416-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1175	2478			
Program 8 Shift Counts	M0:S.1176-	2480-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1207	2542			
Program 9 Shift Counts	M0:S.1208-	2544-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1239	2606			
Program 10 Shift Counts	M0:S.1240-	2608-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1271	2670			
Program 11 Shift Counts	M0:S.1272-	2672-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1303	2734			
Program 12 Shift Counts	M0:S.1304-	2736-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1335	2798			
Program 13 Shift Counts	M0:S.1336-	2800-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1367	2862			
Program 14 Shift Counts	M0:S.1368-	2864-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1399	2926			
Program 15 Shift Counts	M0:S.1400-	2928-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1431	2990			
Program 16 Shift Counts	M0:S.1432-	2992-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1463	3054			
Program 17 Shift Counts	M0:S.1464-	3056-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1495	3118			
Program 18 Shift Counts	M0:S.1496-	3120-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1527	3182			
Program 19 Shift Counts	M0:S.1528-	3184-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1559	3246			
Program 20 Shift Counts	M0:S.1560-	3248-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1591	3310			
Program 21 Shift Counts	M0:S.1592-	3312-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1623	3374			
Program 22 Shift Counts	M0:S.1624-	3376-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1655	3438			
Program 23 Shift Counts	M0:S.1656-	3440-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1687	3502			
Program 24 Shift Counts	M0:S.1688-	3504-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1719	3566			

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Program 25 Shift Counts (Channels 0-31)	M0:S.1720-M0:S.1751	3568-3630	R/W	0-255	4-39
Program 26 Shift Counts (Channels 0-31)	M0:S.1752-M0:S.1783	3632-3694	R/W	0-255	4-39
Program 27 Shift Counts (Channels 0-31)	M0:S.1784-M0:S.1815	3696-3758	R/W	0-255	4-39
Program 28 Shift Counts (Channels 0-31)	M0:S.1816-M0:S.1847	3760-3822	R/W	0-255	4-39
Program 29 Shift Counts (Channels 0-31)	M0:S.1848-M0:S.1879	3824-3886	R/W	0-255	4-39
Program 30 Shift Counts (Channels 0-31)	M0:S.1880-M0:S.1911	3888-3950	R/W	0-255	4-39
Program 31 Shift Counts (Channels 0-31)	M0:S.1912-M0:S.1943	3952-4014	R/W	0-255	4-39
Program 32 Shift Counts (Channels 0-31)	M0:S.1944-M0:S.1975	4016-4078	R/W	0-255	4-39
Program 33 Shift Counts (Channels 0-31)	M0:S.1976-M0:S.2007	4080-4142	R/W	0-255	4-39
Program 34 Shift Counts (Channels 0-31)	M0:S.2008-M0:S.2039	4144-4206	R/W	0-255	4-39
Program 35 Shift Counts (Channels 0-31)	M0:S.2040-M0:S.2071	4208-4270	R/W	0-255	4-39
Program 36 Shift Counts (Channels 0-31)	M0:S.2072-M0:S.2103	4272-4334	R/W	0-255	4-39
Program 37 Shift Counts (Channels 0-31)	M0:S.2104-M0:S.2135	4336-4398	R/W	0-255	4-39
Program 38 Shift Counts (Channels 0-31)	M0:S.2136-M0:S.2167	4400-4462	R/W	0-255	4-39
Program 39 Shift Counts (Channels 0-31)	M0:S.2168-M0:S.2199	4464-4526	R/W	0-255	4-39
Program 40 Shift Counts (Channels 0-31)	M0:S.2200-M0:S.2231	4528-4590	R/W	0-255	4-39
Program 41 Shift Counts (Channels 0-31)	M0:S.2232-M0:S.2263	4592-4654	R/W	0-255	4-39
Program 42 Shift Counts (Channels 0-31)	M0:S.2264-M0:S.2295	4656-4718	R/W	0-255	4-39
Program 43 Shift Counts (Channels 0-31)	M0:S.2296-M0:S.2327	4720-4782	R/W	0-255	4-39
Program 44 Shift Counts (Channels 0-31)	M0:S.2328-M0:S.2359	4784-4846	R/W	0-255	4-39
Program 45 Shift Counts (Channels 0-31)	M0:S.2360-M0:S.2391	4848-4910	R/W	0-255	4-39
Program 46 Shift Counts (Channels 0-31)	M0:S.2392-M0:S.2423	4912-4974	R/W	0-255	4-39
Program 47 Shift Counts (Channels 0-31)	M0:S.2424-M0:S.2455	4976-5038	R/W	0-255	4-39
Speed Compensation					
Speed Comp Mode	M0:S.35	198	R/W	0=ONE 1=L/T	4-45
Leading Edge Channels 0-31, 1word/channel	M0:S.384-M0:S.415	896-958	R/W	-999.9 to 999.9	4-44
Trailing Edge Channels 0-31, 1word/channel	M0:S.448-M0:S.479	1024-1086	R/W	-999.9 to 999.9	4-44

General Troubleshooting

IMPORTANT The PL-1746 controller, PS-4108 rack, and PS-6400 keypads cannot be repaired in the field. If a unit fails, do not disassemble it. Contact Customer Service

Problem	Possible Solution
Controller & keypad dead	1. Check main fuse. 2. Check power supply to controller.
Keypad dead, but controller LED's are ON	1. Check wiring between keypad and controller.
Keypad Fault LED ON	1. Keypad microprocessor has malfunctioned. Turn the controller off and back on. If the keypad Fault LED does not go off, contact Customer Service.
Menu operation slow on keypad display	1. Check KEYBOARD QTY programming. If it is set for two keypads, but only one is connected, menu operation will be very slow.
Power up is slow	1. When more than one keypad/display is attached to one controller, some power supplies will take longer to come up (i.e., Condor HB24-1.2-A+).
COMM FAILURE—HOST TO KEYBOARD message	1. This message may flash briefly on power-up under normal conditions. 2. If the message persists, check keypad wiring connections at keypad and controller. 3. Check DIP switch settings. 4. While performing processor-intensive programming tasks such as recalculating many setpoints due to a change in SCALE FACTOR, or creating many setpoints through PULSE COPY, the controller may temporarily cease communication with the keypad. Once the calculations are complete, contact will be re-established. Press ESC to clear any remnants of the error message.
Programming functions not accessible	1. Programming is not enabled. See ENABLE CODES for details.
ERROR: RESOLVER NOT CONNECTED message	1. Resolver or resolver cable may have failed. See Resolver Troubleshooting.
ERROR: WD RESET message	1. This indicates that the watchdog timer has timed out. To clear, turn power to keypad OFF and ON. If this doesn't help, keypad is probably defective.
POS (position) moves opposite to machine direction	1. Check INCREASING DIR for the correct direction of rotation. 2. Check resolver wiring.
POS (position) does not match machine position	1. Verify that OFFSET is correct. Once set, the offset value should not change. If it does, check the resolver coupling to be sure it is not loose. Also see Resolver Troubleshooting.
Outputs cycling regularly at incorrect machine positions	1. Check that the correct program number is active. 2. Check the setpoints of the output(s) in question. Also check SPEED COMP settings. 3. Verify that OFFSET is correct.
Erratic Operation	1. Run the Watchdog Timer test described under MEMORY TESTS in the programming section of this manual. 2. See Resolver Troubleshooting.
Analog output not working	1. Check that ANALOG QTY and ANALOG OUTPUT are programmed correctly. 2. Check that analog output module is located in the correct module position. 3. Check correct wiring of analog output. 4. Verify that the load is within specifications for the analog module. 5. Try a different analog output module.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mode 5 - One Cycle Enable with Level-Triggered Input and First Cycle Enable

Mode 5 Programming

1. Use OUTPUT GROUPS to establish groups and modes.
2. Use GROUP OFFSET to program the absolute offset value for any groups operating in mode 5.
3. Jog the machine to the point where the group input terminal will energize. Program a pulse in the group channel that will be on during any portion of the input terminal signal. The smaller the overlap between the input signal and the group channel pulse, the narrower the portion of the machine cycle in which the input signal will enable the outputs.
4. Using the start of the overlap from Step 3 as a reference point, program pulses into the group's output channels. Don't overlap the pulses with the group channel pulse programmed in Step 3.

Quick Reference

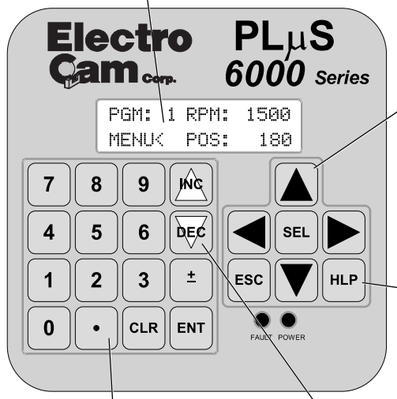
PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
System					
Model	M0:S.0	128	R/O	1746	4-17
Options	M0:S.2	132	R/O	0 = Standard, 1 = Shift Register	4-17
Base Revision	M0:S.4	136	R/O	0-32767	4-43
Major Revision	M0:S.3	134	R/O	0-32767	4-43
Keyboard Quantity	M0:S.48	224	R/W	0-2	4-13
Rack Quantity	M0:S.56	240	R/W	0-2 Model C01 N/A C02, C03 0 Models C02,C03	4-34
Default Program	M0:S.120	368	R/W	0-47 Models C01	4-4
Active Program	M0:S.121	370	R/W	0-47 Models C02, C03	4-4
EEPROM Checksum Models C02,C03 only	M0:S.5	138	R/O	-32768 to 32767	4-5
EEPROM Checksum Command/Status Models C02,C03 only	M0:S.6	140	R/W	0=Done 1=Execute/Busy	4-5
Output Quantity	M0:S.1	130	R/O	32	
Pulses Total (C01)	M0:S.26	180	R/O	1252 Units without Shift Register (no -S in model #) 787 Units with Shift Register (-S in model #)	4-29
Pulses Total (C02, C03)	M0:S.26	180	R/O	1250 Units without Shift Register (no -S in model #) 785 Units with Shift Register (-S in model #)	4-29
Pulses Used	M0:S.27	182	R/O	0 to Pulses Total	4-29
Backplane Interlock	M0:S.866	1860	R/W	0=Done 1=Execute/Busy	3-1
Timed Outputs					
Time (ms) Channels 0-31, 1word/channel	M0:S.320- M0:S.351	768- 830	R/W	0-9999	4-45

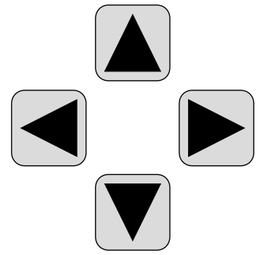
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-6400 Keypad Overview

Main Screen

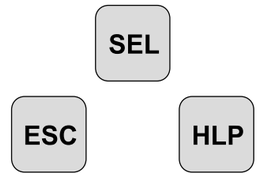
- Shows Active Program, RPM, Position, and Group # (if applicable).
- **See MAIN SCREEN** Section for details.
- **Press SEL key when cursor is on "MENU"** to enter Menu Tree and initiate programming.





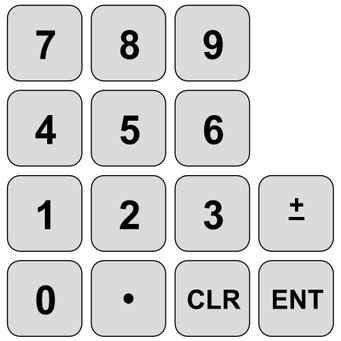
Cursor Keys

- Scroll through Menu Tree.
- Move around **within a screen.**
- Scroll through pulses.



ESC, SEL, HLP Keys

- **ESC** exits from current menu level to previous menu, or aborts numeric entry.
- **SEL** enters a new menu level; toggles a value; and selects an output group if multiple groups are used.
- **HLP** shows help regarding menu selection and what keys to press. **Use this key if unsure what to do.**





INC, DEC Keys

- Increment or decrement a value **within a field.**
- Hold for rapid scrolling of value.

Numeric Keys

- Input numeric values within a field.
- **ENT must be pressed to enter the value;** entry will flash until ENT is pressed.
- **CLR** will backspace within an entry.
- ± will convert a positive number to a negative number, or vice versa.

Mode 5 - One Cycle Enable with Level-Triggered Input and First Cycle Enable

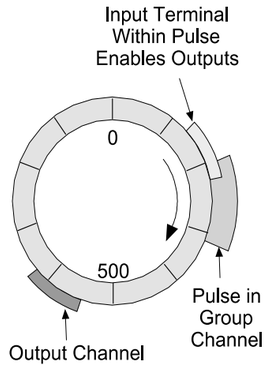
Description

Mode 5 operation is similar to Mode 4 operation, with the following differences:

- In Mode 4, the **leading edge** of the input terminal signal must occur within the pulse programmed into the group channel.

  In Mode 5, the group outputs will be enabled if **any portion** of the input signal occurs within the pulse.
- If the machine stops, the group outputs will be disabled immediately. This prevents an operation such as gluing from continuing if the machine stops while the glue gun is on.
- If the machine is stopped and the group's input terminal is ON, energizing the First Cycle Enable terminal will re-enable the outputs. This allows the operation to be completed on a product that was in process when the machine stopped.

Mode 5 Typical Setup



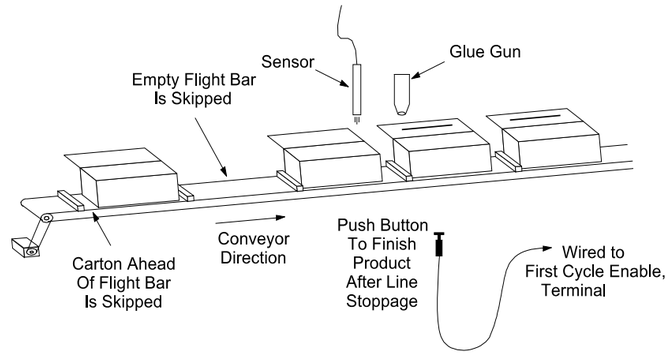
Details

- Regardless of its programmed OFF point, the pulse in the group channel will end as soon as any of the outputs in the group turn on.
- Each program in the controller can have different setpoints for output channels and group channels.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs operating in mode 5. Use MOTION ANDING to prevent the First Cycle Enable terminal from re-activating the outputs while the machine is stopped.
- The machine position for a group operating in mode 5 can be set through GROUP OFFSET programming.

Mode 5 Example Application

The glue gun will be enabled for one machine cycle if the sensor sees a carton during the pulse programmed into the group channel. If a carton is missing, the glue gun will not activate.

If the line stops, the glue gun will be disabled immediately. To re-enable the glue gun on the same machine cycle, depress the push button while the product sensor is ON.



(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mode 4 - One Cycle Enable with Edge-Triggered Input

Description

For a group in Mode 4, outputs will be enabled to turn on at their programmed setpoints for one machine cycle if the corresponding input terminal turns on within a pulse programmed into the group channel. Outputs will be disabled at the start of the next pulse in the group channel.

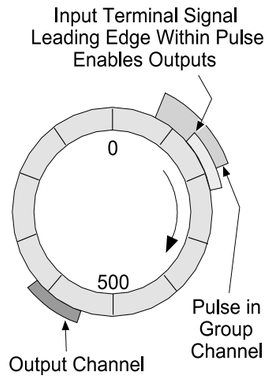
Applications

Use this mode to check the presence and correct positioning of a product before enabling the outputs for this machine cycle.

Details

- The leading edge of the signal from the input terminal must occur during the pulse in the group channel. If the leading edge occurs before or after the pulse, the outputs will not be enabled.
- Each program in the controller can have different pulses for output channels and group channels.
- If the resolver position is increasing as shaft rotates, the ON edge of the pulse will disable the outputs. If the resolver position is decreasing as shaft rotates, the OFF edge of the pulse will disable the outputs.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a group operating in mode 4.
- The machine position for a group operating in mode 4 can be set through GROUP OFFSET programming.

Mode 4 Typical Setup



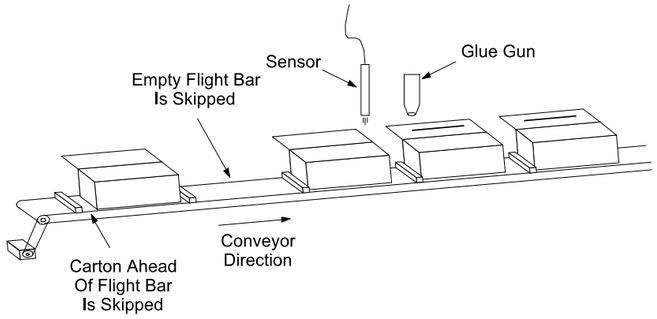
Mode 4 Programming

1. Use OUTPUT GROUPS to establish groups and modes.
2. Use GROUP OFFSET to establish the absolute offset value for any groups operating in mode 4.
3. Jog the machine to the point where the group input terminal will energize. Program a pulse in the group channel that will turn on a little earlier than this point, and off a little later. The shorter the pulse, the narrower the portion of the machine cycle in which the input signal will enable the outputs.
4. Program pulses into the group's output channels. Remember that the leading edge of the pulse in the group channel will disable the output channels in the group.

Mode 4 Example Application

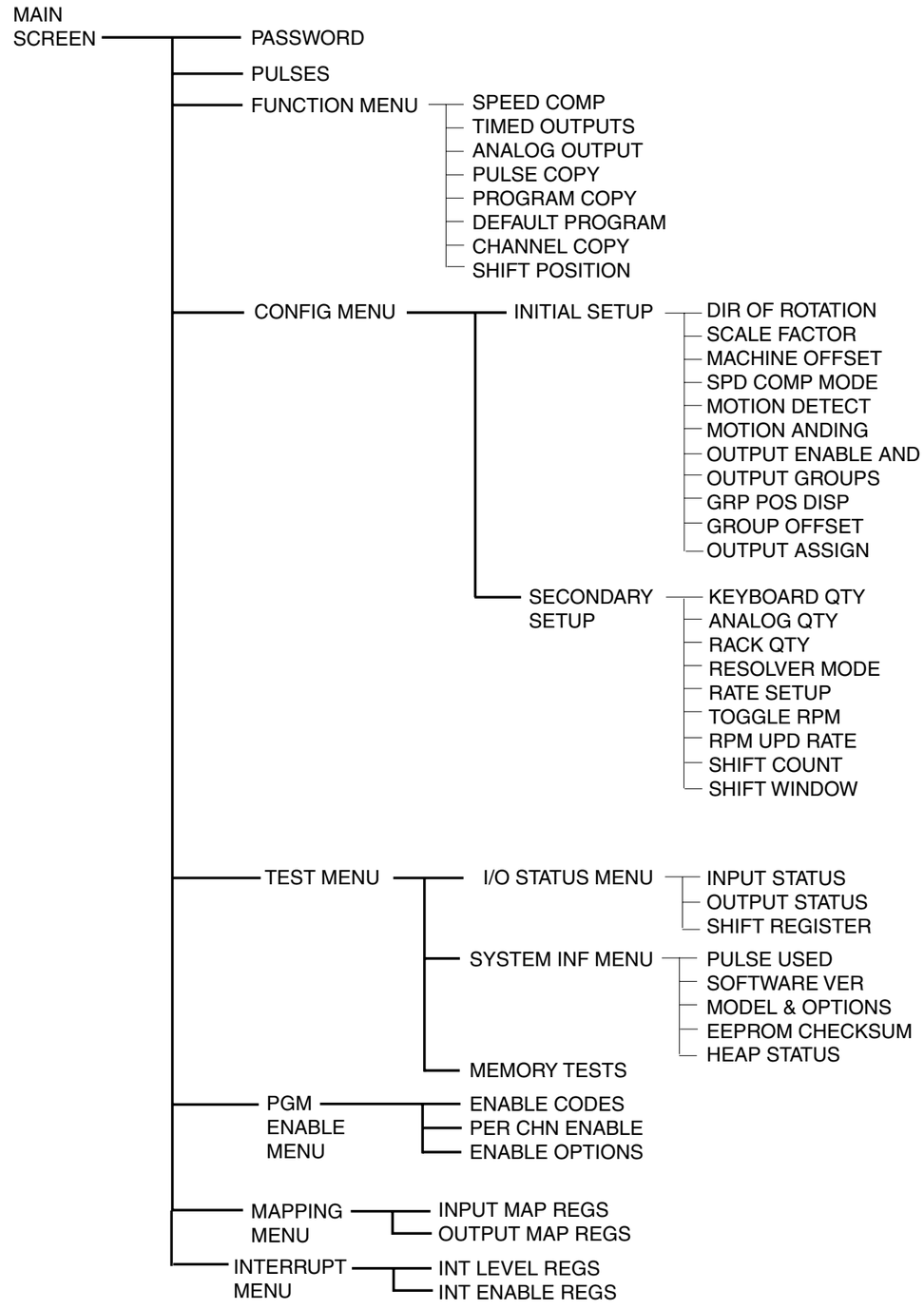
The glue gun will be enabled for one machine cycle only if the sensor detects the leading edge of a carton during the pulse programmed in the group channel. If a carton is missing or incorrectly positioned, the glue gun will not activate.

Mode 4 operation is appropriate for flight bar conveyors, rotary index tables, and similar types of machinery.



Menu Tree

Functions are listed alphabetically in Chapter 4.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

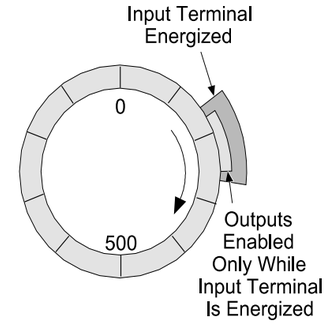
This page intentionally left blank

Mode 3 - Outputs Gated by Group Inputs

Description

Outputs in a group assigned to Mode 3 are on only while their programmed setpoints are on AND the corresponding input terminal is energized. If the input is off, all of the outputs in the group will be off, regardless of setpoint programming.

Mode 3 Typical Setup



Applications

Use this mode where outputs should be active only while a sensor or limit switch is on.

Details

- The group channel for a group operating in Mode 3 has no effect.
- Each program in the controller can have different setpoints for output channels in the group.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a group operating in mode 3.
- The machine position for a group operating in mode 3 can be set through GROUP OFFSET programming.

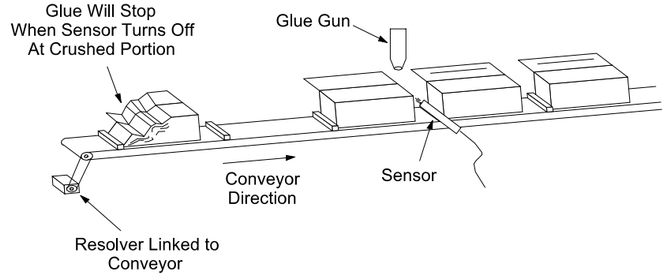
Mode 3 Programming

1. Program OUTPUT GROUPS to establish groups and modes.
2. Use GROUP OFFSET to program the absolute offset value for the group.
3. Program pulses into the output channels in the group.

Mode 3 Example Application

In this illustration the glue head will operate only while the photo eye sees the top edge of a carton. Gluing will stop on crushed or improperly erected cartons when the eye loses sight of the top edge.

Mode 3 operation eliminates the need to hard-wire photoeyes and other sensors in series with the corresponding controller outputs. Instead, the sensor is ANDed with the output through Mode 3 programming.



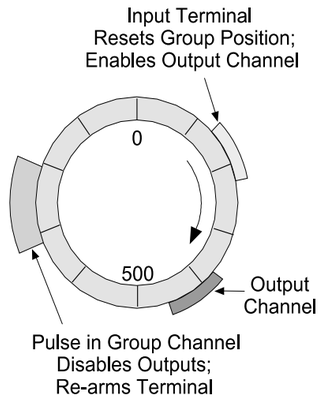
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mode 2 - Reset to Preset Position with One Cycle Enable

Description

Outputs in a Mode 2 group are disabled until the corresponding input terminal is energized. The outputs are then enabled to turn on per their programmed pulses, and the group position immediately resets to the value programmed through the GROUP OFFSET function. The leading edge of a pulse in the corresponding group channel disables the group's outputs and re-arms the input terminal.

Mode 2 Typical Setup



Applications

This mode is used where products may not be evenly spaced and the group outputs should cycle only when a product has been sensed.

Details

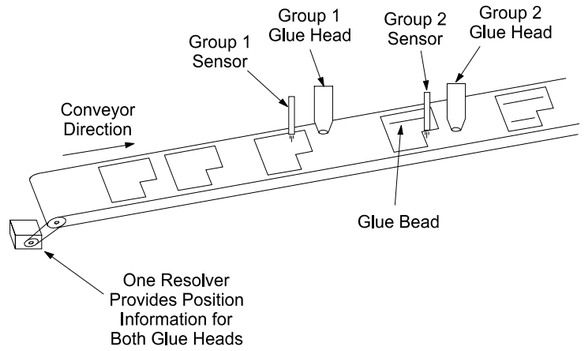
- Outputs are enabled and the group position resets at the leading edge of the input terminal signal, regardless of how long the terminal is on.
- Once a reset occurs, the input terminal has no effect until it is de-energized and the leading edge of a pulse in the corresponding group channel re-arms the terminal.
- When the position of a group resets, group channel is affected in the same manner as the output channels.
- On power-up, outputs are disabled, the input terminal is armed, and the group position is the same as the value programmed in MACHINE OFFSET.
- If position is increasing as shaft rotates, the "on" edge of the pulse will re-arm the terminal. If position is decreasing as shaft rotates, the "off" edge of the pulse will re-arm the terminal.
- Each program in the controller can have different pulses for output channels and group channels.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a group operating in mode 2.

Mode 2 Example Application

Two glue heads at different locations on the conveyor are controlled independently by a single PLuS controller and resolver. The spacing between parts being glued is **random**.

The sensors are connected to the input terminals for the corresponding groups. When a sensor detects a product, it resets the corresponding group's position to the preset values and enables the group's outputs to turn on the glue guns at the correct pulse edges.

When parts are not present, the outputs will be inactive.



Mode 2 Programming

1. Program OUTPUT GROUPS to establish groups and modes.
2. Use GROUP OFFSET to program the preset value for any groups operating in mode 2.
3. Jog the machine to the point where the group input terminal will energize. Using this point as a reference, program pulses into the output channels in the group.
4. Program a pulse in the group channel to disable the output channels and re-arm the input terminal. This pulse must be after all of the output channels have completed their functions, but before the input terminal will be energized.

Analog Output

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Analog Output 1 Offset	M0:S.41	210	R/W	0-4095
Analog Output 1 High RPM	M0:S.42	212	R/W	0-3000
Analog Output 1 Value	M0:S.43	214	R/O	0-4095
Analog Output 2 Offset	M0:S.44	216	R/W	0-4095
Analog Output 2 High RPM	M0:S.45	218	R/W	0-3000
Analog Output 2 Value	M0:S.46	220	R/O	0-4095

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to ANALOG OUTPUT SEL

```
ANALOG OUTPUT: 1<
OF: 20  HI: 1500
```

Analog Output Number
Analog Output High RPM
Analog Output Offset

To enter an Analog Output number, move the cursor to "Module" and use the numeric keys and ENT.

To program High RPM, move the cursor to "HI" and use the numeric keys and ENT.

To program Analog Output Offset, move the cursor to "OF" and use the numeric keys and ENT.

Description

Analog output signals are linearly proportional to resolver RPM. Two types of analog output modules are available: 0-10 VDC and 4-20 mA.

This function assigns Offset and High RPM values to analog outputs.

- Characteristics can be programmed for Analog Outputs #1 and #2 even if no analog modules are physically installed in the PS-4108 rack.
- Before programming Offset and High RPM for Module #2, be sure the Analog Quantity function is set to 2. Otherwise, programming for Analog Output #2 will not be available.

High RPM

Analog High RPM is the resolver speed at which full scale analog output will occur. It is programmed in whole RPM. When this speed is reached, the analog output signal level will be at full scale (10 VDC or 20 mA). Increasing speed beyond the High RPM will **not** increase the analog output beyond full scale.

Offset

Analog Offset is the analog signal level that will be output when the resolver is at zero RPM. This allows the minimum analog signal to be greater than 0V or 4 mA. Because the analog output has 4096 increments (12 bits) of signal level available, the offset is specified as the number of increments of signal that should be output at zero RPM. Calculate Analog Output Offset values as follows:

For 0-10 VDC: (Minimum Signal/10) x 4096
Example: For a 2 VDC minimum signal; Offset = (2/10) x 4096 = 819

For 4-20 mA: ((Minimum Signal - 4)/16) x 4096
Example: For a 5 mA minimum signal; Offset = ((5-4)/16) x 4096 = 256

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Analog Quantity

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Analog Quantity (Real-World Outputs)	M0:S.40	208	R/W R/O	0-2 Model C01 0 Models C02,C03

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to ANALOG QTY SEL

```
ANALOG
QTY: 1<
```
Number of Analog Outputs

This screen does not appear in C02 or C03 models.

Use the numeric keys to enter the number of analog channels. An analog output module is required to generate an analog output signal.

Description

This screen displays the number of analog outputs that will be programmed into the controller.

The controller can have zero, one or two analog outputs, and each can be offset and scaled by different values. Also see ANALOG OUTPUT.

Channel Copy

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Channel Copy Source Program	M0:S.800	1728	R/W*	0-47
Channel Copy Source Channel	M0:S.802	1732	R/W*	0-31
Channel Copy Destination Program	M0:S.801	1730	R/W*	0-47
Channel Copy Destination Channel	M0:S.803	1734	R/W*	0-31
Channel Copy Command/Status	M0:S.804	1736	R/W* *Not while running	Bit 15 Error Bit 14 Source Pgm Error Bit 13 Dest Pgm Error Bit 12 Source Chn Error Bit 11 Dest Chn Error Bit 10 Reserved Bits Error Bit 9 Dest Chn Not Empty Error Bit 8-1 Reserved Bit 0 Execute/Busy

Command/Status Register Bits

M0:S.804/0 Execute/Busy. Set this bit to execute the channel copy; it remains ON until the copy is complete or an error occurs.

M0:S.804/1-8 Reserved bits. Writing a one to any of these bits will cause a reserved bits error (see M0:S.804/10).

M0:S.804/9 The Destination Channel Not Empty Error Bit is set if the destination channel already contains one or more output pulses. This bit only applies to the C02 and C03 models.

Mode 1 - Reset to Preset Position

Description

Outputs in a group assigned to Mode 1 are always enabled to turn on at their programmed setpoints. However, when the corresponding input terminal is energized, the machine position for the group immediately resets to the preset value programmed through the GROUP OFFSET function. Once the position is reset, the input terminal will have no effect until it is turned off and the resolver reaches the leading edge of a pulse programmed into the corresponding group channel.

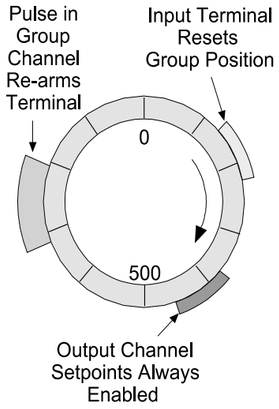
Applications

This mode can be used to automatically adjust phase relationships between machine sections. It can also be used in applications where some machine sections run multiple cycles per resolver revolution.

Details

- The group position resets at the leading edge of the input terminal signal, regardless of how long the terminal is on.
- Once a reset occurs, the input terminal has no effect until it is de-energized and the leading edge of a pulse in the corresponding group channel re-arms the terminal.
- When the position of a group resets, the group channel is affected in the same manner as the output channels.
- On start-up, the input terminal is armed and the group position is the same as the value programmed in MACHINE OFFSET. On power-down, the group's current position setting will be lost.
- If position is increasing as shaft rotates, the "on" edge of the pulse will re-arm the terminal. If position is decreasing as shaft rotates, the "off" edge of the pulse will re-arm the terminal.
- Each program in the controller can have different pulses in its output channels and corresponding group channels.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a group operating in mode 1.

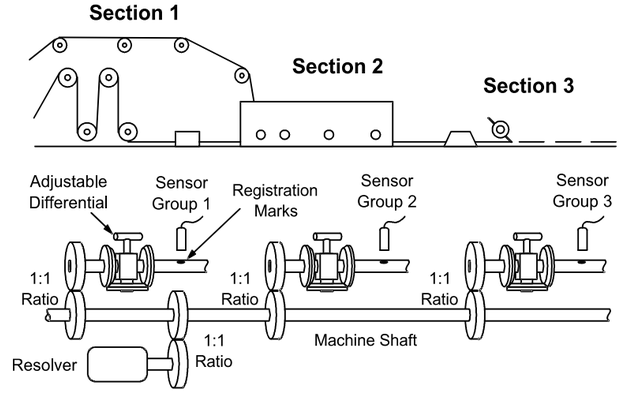
Mode 1 Typical Setup



Mode 1 Example Application

Three sections of an adjustable phase converting machine are controlled by a single PLµS controller and resolver. Groups 1, 2 and 3 all operate in Mode 1. The position of each group is reset to the "preset" value when the group's sensor detects the registration mark on the shaft for the corresponding machine section. This keeps the electrical control signals properly synchronized to the mechanical devices in each section when phase adjustments are made.

One resolver provides the position information needed for all sections of the machine, regardless of their phase relationship.



Mode 1 Programming

1. Program OUTPUT GROUPS to establish groups and modes.
2. Program the preset value for the group using GROUP OFFSET.
3. Jog the machine to the point where the group input terminal will energize. Using this point as a reference, program pulses into the group's output channels.
4. Program a pulse in the group channel.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Introduction to Groups & Modes (cont'd)

Each group also has an associated Group Channel that is used to signal when group logic should be reset. Group channels are numbered 90 through 95. Pulses are programmed into group channels just as they are programmed into output channels.

Group Programming

Output channels are divided into groups through OUTPUT GROUP programming. When dividing outputs into groups, keep these rules in mind:

- Output channels are assigned to groups sequentially. Group 0 will begin with Output Channel 0 and include the specified number of channels; Group 1 will begin with the next output channel and continue sequentially for its specified number of channels; etc. The last group will automatically include all of the remaining output channels.

Grouping Example 1—All Outputs in One Group

Output Group	Includes Output Channels	Group Input	Group Channel
0	0 thru 31	0	90

Grouping Example 2—Two Groups

Output Group	Includes Output Channels	Group Input	Group Channel
0	0 thru 3	0	90
1	4 thru 31	1	91

Grouping Example 3—Three Groups

Output Group	Includes Output Channels	Group Input	Group Channel
0	0 & 1	0	90
1	2 & 3	1	91
2	4 thru 31	2	92

Mode Assignments

During OUTPUT GROUP programming, each group is assigned any one of six modes of operation that control the interaction between the group, its group input, and its group channel. Detailed discussions of each operating mode follow.

Mode 0 - Straight Cam Logic

Description

Output channels in a group assigned to Mode 0 are not affected by the corresponding input terminal or group channel.

Details

- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a Mode 0 group.
- The machine position for a Mode 0 group can be set through GROUP OFFSET programming, Chapter 4.

Mode 0 Programming

During OUTPUT GROUP programming, group together output channels that should remain unaffected by Modes, and assign them Mode 0.

Channel Copy (cont'd)

Command/Status Register Bits (continued)

M0:S.804/10 Reserved bits error. This bit is set if a one is written to any of the reserved bits.

M0:S.804/11 The Destination Channel error bit is set if the destination channel value is out of the range.

M0:S.804/12 The Source Channel error bit is set if the source channel value is out of the range.

M0:S.804/13 The Destination Program error bit is set if the destination program is out of the range.

M0:S.804/14 The Source Program error bit is set if the source program is out of the range.

M0:S.804/15 The Error bit is set if any of the above error bits is set. This provides a single bit to test for command success/failure. When this bit is set, test the other bits to determine the exact cause.

In the C01 model, all pulses in the destination program and channel will be deleted before any pulses are copied. In the C02 and C03 models, the copy is not permitted unless the destination channel is empty. When the error bit M0:S.804/15 is set, the Command Error bit and the Any Error bit are set in the Programming Error Register (I:S.7). To clear the error condition, toggle the Clear Error bit (O:S.0/8) ON. No additional commands will be accepted until the error bits are cleared.

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to CHANNEL COPY SEL

The Channel Copy function has five screens:

```
SOURCE PGM:---<
```
Program containing channel to be copied from

```
DEST PGM:---<
```
Program containing channel to be copied into

```
SOURCE CHN:---<
```
Channel to be copied from

```
DST CHN:---<
```
Destination channel to be copied into

```
DEST CHN:
      EXECUTE<
```
Move cursor to EXECUTE, then press SEL to copy channel

Use the numeric keys and SEL to enter program numbers. During programming, the cursor keys allow you to move between the screens to allow you to change values before selecting EXECUTE.

Description

Channel Copy allows you to copy all the pulses in the source channel to the destination channel.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Default Program

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Default Program Models C01, Active Program Models C02, C03	M0:S.120 M0:S.121	368 370	R/W R/W	0-47 0-47

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to DEFAULT PROGRAM SEL

```
DEFAULT PGM: 0
ACTIVE PGM:  0
```

Use the numeric keys and ENT to enter or modify the Default Program.

Description

The Default Program screen displays the current values of the Default Program and the Active Program, and allows the Default Program number to be modified.

The PL-1746 controller can store up to 48 programs in its memory. These programs are selected by either the Default Program register or the lowest six bits of O:S:1. The Active Program is the program that currently controls the output channels.

The following rules determine which program is the Active Program:

Model C01: If the contents of O:S:1 are equal to zero, the Active Program is specified by the Default program register. If O:S:1 does not contain zero, then that is the Active Program number (up to max. value of 47).

Models C02, C03: The active program always directly matches the value entered for the active PGM (M0:S.121).

Direction of Rotation

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Direction of Rotation	M0:S.34	196	R/W* Not while running	0=CCW 1=CW

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL to INITIAL SETUP SEL to DIR OF ROTATION SEL

```
   INCREASING
DIR: CCW
```

Press SEL to toggle the value. The new value will begin flashing. Press the ENT key to confirm your selection.

Description

The Direction of Rotation screen displays the direction of resolver rotation (CW or CCW as viewed from the shaft end) that will cause the position display to increase in value. This is normally set so the position value increases as the machine turns in its forward direction.

Introduction to Groups & Modes - Using External Inputs to Condition PLS Outputs

Background

In many industrial applications, the action of a machine component such as a glue gun, solenoid, or pneumatic cylinder is related to an input signal from a limit switch, sensor, or controller such as a PLC. Input signals are commonly used in two ways:

- **Product Present**

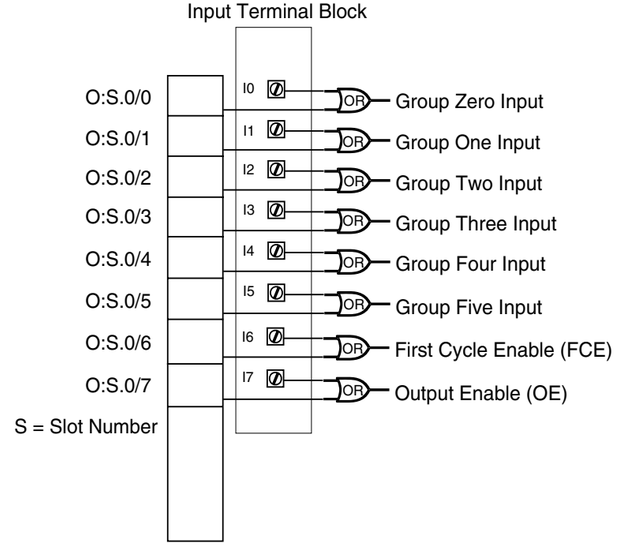
  The device being controlled is allowed to function only if an input signal occurs. A typical example is gluing, where a photoeye senses the presence of a product immediately before gluing should occur. If the product is not present, the glue gun is not enabled to turn on at its programmed setpoints.

- **Register Marks**

  The device being controlled must maintain a certain relationship to other devices on the machine. For example, web converting lines such as disposable diaper machines usually have several machine sections each performing a different operation on a continuous web of material. As line speed increases, the phase relationships between different machine sections are adjusted to compensate for stretching of the web material. To keep a device synchronized within its machine section, a sensor is used to detect a registration mark on a component such as shaft or disk. The sensor signal "resets" the position of the device each revolution, ensuring that the device operates at the correct position on the web of moving material.

Input Signals

When the Output File word 0 (O:S.0) is not mapped, its low byte, containing group inputs, the First Cycle Enable input, and the Output Enable input, is or'ed with the input status terminals, which may be located on a PS-4108 rack (for C01 model) or on the front panel (C02 & C03 models). When the first word of the SLC output file is mapped, the group inputs, FCE and output enable inputs are driven directly strictly be the input terminals.



Groups & Modes

The PL-1746 PLuS Module includes powerful programming capabilities that allow output channels to be linked to input signals from sensors or other devices. Output channels can be divided into as many as six groups, each of which is associated with a group input. Each group can then be assigned to operate in one of six modes which determines the relationship between the channels in the group and the input signals.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Negative Speed Compensation

Negative Speed Comp

Normal speed compensation **advances** the pulse edges in an output channel to compensate for a fixed response time in the device being controlled. In some applications, however, **negative** speed compensation is required to **retard** the edges in an output channel. Negative speed compensation is usually found in two situations:

"Wrap-Up"

As some machines increase in speed, the drive train at some point between the resolver and the product "wraps-up," or shifts with respect to the resolver. If the wrap-up is proportional to machine speed, negative speed compensation can be used to retard an output channel's setpoints from the true resolver position, thus maintaining output accuracy.

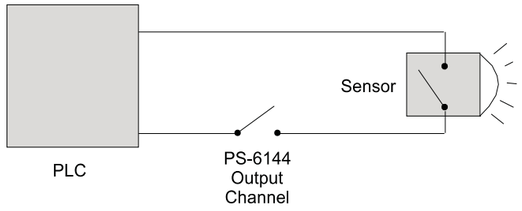
Sensor Lag

While output channels are usually used to switch devices on and off, another use is to "gate" a sensor into a PLC or other computer. The illustration below shows a basic sensor gating scheme. In the illustration, the signal from the sensor reaches the PLC only when the output channel from the PLS is turned on.

Most sensing devices have very fast response times. However, if a sensor's response time is slow, its signal will appear later and later in the machine cycle as the machine speeds up. Eventually, the sensor may lag the resolver so much that its signal fails to appear during the window programmed into the PL-1746's output channel.

Negative speed compensation will correct this problem by causing the output channel to lag its programmed machine position by a specified number of milliseconds. Negative speed compensation is calculated using the same method as standard speed compensation. See SPEED COMP in Chapter 4 for details on programming negative speed comp.

Simple Sensor Gating Scheme



Speed Compensation Guidelines

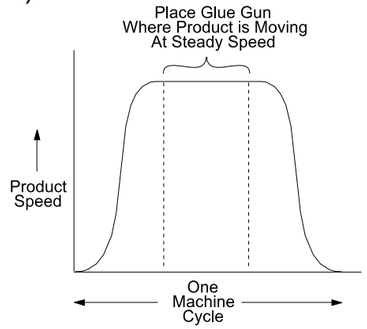
Device Placement

For speed compensation to work most effectively, the device being controlled by the output channel should be located on the machine in a position where the product is moving past the device at a constant speed. The illustration below is an example. In the case of a glue gun, if the gun is ON when the speed is changing, the glue distribution may be inconsistent from carton to carton at varying machine speeds.

Speed Comp & Modes

When using Operating Modes as discussed in Chapter 6, be aware of the effects of speed compensation on the relationship between the pulse edges, the Group Input signal, and the pulse programmed into the Group Channel. **Speed compensation will not affect Group Channels (channels 91-96).**

Product Speed Should be Constant Past Controlled Device



EEPROM Checksum

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
EEPROM Checksum Models C02,C03 only	M0:S.5	138	R/O	-32768 to 32767
EEPROM Checksum Command/Status Models C02,C03 only	M0:S.6	140	R/W	0=Done 1=Execute/Busy

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to SYSTEM INF MENU SEL ▼ to EEPROM CHECKSUM SEL

```
EEPROM CHECKSUM:
          IFC2
```

Description

This feature on the C02/C03 computes a checksum of the contents of all EEPROM (non-volatile memory). To cause the checksum to be computed, first write a 1 to the EEPROM Checksum Command/Status register (M0:S.6). Then wait until that register's contents change back to 0. Finally, read the new checksum from M0:S.5.

Enable Codes

Backplane Information

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Master Password	M0:S.106	340	R/W	0-9999
Setup Password	M0:S.105	338	R/W	0-9999
Operator Password	M0:S.104	336	R/W	0-9999
Per-Channel Operator Access Channels 0-31, 1 bit/channel	M0:S.280- M0:S.281	688- 690	R/W	0=Operator Accessible 1=Operator Inaccessible

Screen

MAIN SCREEN SEL ▼ to PGM ENABLE MENU SEL to ENABLE CODES SEL

```
LEVEL: OPERATOR
PASSWORD: 1234
```

Use the SEL key to toggle between enable levels. Use the numeric keys, followed by ENT to assign codes.

Description

This function is used to establish the numbers that will be used as passwords to enable the Operator, Setup, and Master levels.

The PL-1746 has three levels of programming access: Operator, Setup, and Master in order of increasing capabilities. The table on the next page lists the functions that can be programmed under the various levels of access. Programming levels can be activated, or "enabled," by entering a password on the keypad, or by activating Terminals E1 or E2 on the back of the keypad.

- Each programming level can have only one code. That code is stored in the controller and applies to all keypads connected to that controller.
- If a code is entered into a keypad that has a programming enable terminal energized, the access level will be the highest of the two.
- If both keypads in a two-keypad system are enabled, each keypad will operate at the programming level enabled on it. For example, if Operator Level is enabled on Keypad 1, and Setup Level is enabled on Keypad 2, Keypad 1 will operate at the Operator Level and Keypad 2 will operate at the Setup Level.

Also see PER CHN ENABLE, ENABLE OPTIONS, and PASSWORD.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Enable Codes (cont'd)

Programming Access Levels for Functions

Menu Item Access	PROGRAMMING LEVEL: Normal Display	Operator	Setup	Master
Password	Enter	Enter	Enter	Program
Pulses	View	Program[1]	Program	Program
Function Menu				
Speed Comp	View	Program[1]	Program	Program
Timed Outputs	View	Program[1]	Program	Program
Analog Output	View	Program[1]	Program	Program
Pulse Copy	---	---	Program	Program
Program Copy	---	---	Program	Program
Default Program	View	Program[1]	Program	Program
Channel Copy	---	---	Program	Program
Shift Position	View	Program[1]	Program	Program
Config Menu				
Initial Setup				
Dir of Rotation	---	---	---	Program
Scale Factor	---	---	---	Program
Machine Offset	View	Program[1]	Program	Program
Speed Comp Mode	---	---	---	Program
Motion Detection	View	Program[1]	Program	Program
Motion ANDing	---	---	---	Program
Outp Enable ANDing	---	---	---	Program
Output Groups	---	---	---	Program
Group Position Display	---	---	---	Program
Group Offset	View	Program[1]	Program	Program
Output Assign	---	---	---	Program
Secondary Setup				
Keyboard Qty	---	---	---	Program[2]
Analog Qty	---	---	---	Program
Rack Qty	---	---	---	Program
Resolver Mode	---	---	---	Program
Rate Setup	---	---	---	Program
Toggle RPM	---	---	---	Program
RPM Update Rate	---	---	---	Program
Shift Count	---	---	---	Program
Shift Window	---	---	---	Program
Test Menu				
I/O Status Menu				
Input Status	View	View	View	View
Output Status	View	View	Force	Force
Shift Register	View	View	View	View
System Info Menu				
Pulse Use	View	View	View	View
Software Version	View	View	View	View
Model & Options	View	View	View	View
EEPROM Checksum	View	View	View	View
Heap Status	View	View	View	View
Memory Tests	---	---	---	Run
System Tests				
Program Enable Menu				
Enable Codes	---	---	---	Program
Per Chn Enable	---	---	---	Program
Enable Options				
Pulses ---	---	---	Program	
Speed Comp	---	---	---	Program
Timed Outputs	---	---	---	Program
Analog Output	---	---	---	Program
Motion Detect	---	---	---	Program
Default Program	---	---	---	Program
Group Offset	---	---	---	Program
Machine Offset	---	---	---	Program
Mapping Registers				
Input Maps	---	---	---	Program
Output Maps	---	---	---	Program
Interrupt Menu				
Interrupt Level	---	---	---	Program
Interrupt Enable	---	---	---	Program

[1] Can be programmed only if specified through Per Channel Enable and Enable Options.

[2] Keyboard Quantity can be programmed only through the keypad whose address is "0".

Leading/Trailing Edge Speed Compensation (cont'd)

Example for Calculating Leading and Trailing Edge

	RPM	Glue On	Glue Off	Difference
1st Line Speed:	200	73°	156°	83°
2nd Line Speed:	680	49°	144°	95°

Note that the length of the pulse is 83° at 200 RPM, and 95° at 680 RPM. This means that the leading and trailing edges require different speed compensation values.

Leading Edge:

Difference in Position: 73° - 49° = 24°
Difference in Speed: 680 RPM - 200 RPM = 480 RPM

Speed Compensation Value: Divide difference in position by difference in speed:

24°/480 RPM = 0.05° per 1 RPM

Since a shaft at 1 RPM rotates 0.006°/msec (see page 4-2), this shaft would require (0.05/0.006), or 8.3 msec to rotate 0.05°. So the correct leading edge speed compensation value to enter is 8.3.

Trailing Edge:

Difference in Position: 156° - 144° = 12°
Difference in Speed: 680 RPM - 200 RPM = 480 RPM

Speed Compensation Value: Divide difference in position by difference in speed:

12°/480 RPM = 0.025°/1 RPM

Since a shaft at 1 RPM rotates 0.006°/msec, this shaft would require (0.025/0.006), or 4.2 msec to rotate 0.05°. So the correct trailing edge speed compensation value to enter is 4.2.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Leading/Trailing Edge Speed Compensation

Leading/Trailing

In the previous example, the response time of the glue gun was the same whether turning on or turning off. While this applies to many systems, some devices have different on/off response times. For these devices the Leading/Trailing Edge feature provides the ability to program different speed compensation values for the leading and trailing edges of the pulse driving the device.

Setting Leading/Trailing Speed Comp

If the ON and OFF response times are known, jog the line to determine ON and OFF setpoints at zero speed. Then enter the speed compensation values through SPEED COMP programming, as described in Chapter 4. When programming SPEED COMP, enter the leading edge, or ON response time at the “LE” prompt, and the trailing edge, or OFF response time at the “TE” prompt.

⚠ IMPORTANT

When setting speed compensation on a system where zero-speed edges have been established, always adjust the speed compensation value. Do not adjust the individual pulse edges!

Response Times Unknown

If the response times are unknown, jog the line to determine ON and OFF edges at zero speed. Estimate both ON and OFF response times and enter them through the SPEED COMP function. The leading edge, or “LE” value will control the ON timing, while the trailing edge, or “TE” value will control the OFF timing. Start the line, run product through it at a fixed speed, and adjust each **speed compensation value** as required for proper gluing. This can be done while the line is in motion. Once programmed, vary the line speed to confirm proper operation at all speeds, and fine tune the SPEED COMP values if necessary.

Can’t Be Jogged?

If it is impossible to jog the line, run the line at a fixed speed and set the ON and OFF edges as required with SPEED COMP set to zero for both the leading and trailing edges. Write down the ON and OFF edges.

Next, increase the line speed and adjust the edges to restore proper gluing. You might be tempted to adjust speed comp values to do this. However, since the edges were adjusted at the first speed with zero compensation, any change in compensation value now will upset the first pair of edges.

Once the second pair of edges is established, calculate separate leading and trailing edge speed comp values, as shown in the previous example.

Since the new speed compensation value will affect the ON and OFF edges already programmed, you will need to start the line one more time and, at a constant speed, adjust the **ON and OFF edges** for proper gluing. Once set, vary the line speed to confirm that the speed compensation values are accurately adjusting the edges over the operating speed range.

(Continued)

Enable Options

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Operator Enable Options	M0:S.107	342	R/W	Bit 15-8 Reserved Bit 7 Machine Offset Bit 6 Group Offset Bit 5 Default Program Bit 4 Motion Detect/ANDing Bit 3 Analog Outputs Bit 2 Timed Outputs Bit 1 Speed Comp Bit 0 Pulses

Screen

MAIN SCREEN SEL ▼ to PGM ENABLE MENU SEL ▼ to ENABLE OPTIONS SEL

```
SETPOINTS<
ENABLE: ON
```

Press the Up Cursor and Down Cursor keys to select the function you wish to change. Press the SEL key to turn Operator access ON or OFF.

Description

This screen lists the various items in the SETUP MENU, and allows you to turn Operator access to those items on or off.

⚠ IMPORTANT

Access to the “on” items will be available only for those output channels that have been turned ON in PER CHN ENABLE.

Access can be turned on or off for the following SETUP MENU items:

PULSES	MOTION DETECT
DEFAULT PROGRAM	ANALOG OUTPUTS
SPEED COMP	TIMED OUTPUTS
GROUP OFFSET	MACHINE OFFSET

Also see PER CHN ENABLE.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Group Offset

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Group Quantity	M0:S.64	256	R/W*	1-6
Group Position Display	M0:S.65	258	R/W	0=EACH 1=ONE
Logic Inputs Status	M0:S.25	178	R/O	0-255
Group 0 Channel Count	M0:S.66	260	R/W*	0-32
Group 0 Mode	M0:S.82	292	R/W*	0-5
Group 0 Offset	M0:S.74	276	R/W	0 to (Scale Factor-1)
Group 0 Position	M0:S.16	160	R/W*	0 to (Scale Factor-1)
Group 1 Channel Count	M0:S.67	262	R/W*	0-32
Group 1 Mode	M0:S.83	294	R/W*	0-5
Group 1 Offset	M0:S.75	278	R/W	0 to (Scale Factor-1)
Group 1 Position	M0:S.17	162	R/W*	0 to (Scale Factor-1)
Group 2 Channel Count	M0:S.68	264	R/W*	0-32
Group 2 Mode	M0:S.84	296	R/W*	0-5
Group 2 Offset	M0:S.76	280	R/W	0 to (Scale Factor-1)
Group 2 Position	M0:S.18	164	R/W*	0 to (Scale Factor-1)
Group 3 Channel Count	M0:S.69	266	R/W*	0-32
Group 3 Mode	M0:S.85	298	R/W*	0-5
Group 3 Offset	M0:S.77	282	R/W	0 to (Scale Factor-1)
Group 3 Position	M0:S.19	166	R/W*	0 to (Scale Factor-1)
Group 4 Channel Count	M0:S.70	268	R/W*	0-32
Group 4 Mode	M0:S.86	300	R/W*	0-5
Group 4 Offset	M0:S.78	284	R/W	0 to (Scale Factor-1)
Group 4 Position	M0:S.20	168	R/W*	0 to (Scale Factor-1)
Group 5 Channel Count	M0:S.71	270	R/O	0-32
Group 5 Mode	M0:S.87	302	R/W*	0-5
Group 5 Offset	M0:S.79	286	R/W	0 to (Scale Factor-1)
Group 5 Position	M0:S.21	170	R/W* *Not while running	0 to (Scale Factor-1)

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to GROUP OFFSET SEL

GROUP OFFSET Screen—Group Mode 0, 3, 4 or 5

```
GRP:1< POS:   0
       ABS: 132
```

GROUP OFFSET Screen—Group Mode 1 or 2

```
GRP:1< POS: 359
       PRE:  30
```

To change the offset or position for an output group, move the cursor to GRP and then use INC or DEC, or the numeric keypad, followed by ENT to select the group.

Enter the offset by moving the cursor to ABS (or PRE) and entering the value on the numeric keypad, followed by ENT.

Enter the position by moving the cursor to POS and entering the value on the numeric keypad, followed by ENT.

Standard Speed Compensation (cont'd)

IMPORTANT **When setting speed compensation on a system where zero-speed pulses have been established, always adjust the speed compensation value. Do not adjust the individual pulse edges!**

Response Time Unknown

Suppose that in the previous example, the response time was unknown. To set up the machine, jog a carton through the machine and set the glue gun ON and OFF edges as described earlier. Then, estimate a response time and enter it into the controller using the SPEED COMP function described in Chapter 4.

Start the line and run cartons through it at a fixed line speed. Program SPEED COMP to adjust the **speed compensation value** as required for proper gluing. This can be done while the line is in motion. Once programmed, vary the line speed to confirm proper operation at all speeds, and fine tune the SPEED COMP value if necessary.

Can't Be Jogged?

Some machinery can't be jogged to determine ON and OFF edges. To set up this type of equipment, set speed comp to zero, start the line, run cartons through it at a fixed line speed, and set the ON and OFF edges as required for proper gluing. Write them down for reference in the next step.

Next, increase the line speed and adjust the edges to restore proper gluing. You might be tempted to enter a speed compensation value to do this. However, since the edges were adjusted at the first speed with zero compensation, any change in compensation value now will upset the first pair of edges.

Once the second pair of edges is established, compare them to the first pair that you wrote down. Establish a ratio of degrees the edges advance versus the speed as shown in the example below. Convert this ratio to response time and enter it as the speed compensation value.

Since the new speed compensation value will affect the ON and OFF edges already programmed, you will need to start the line one more time and, at a constant speed, adjust the **ON and OFF edges** for proper gluing. Once set, vary the line speed to confirm that the speed compensation value is accurately adjusting the edges over the operating speed range.

Example for Calculating Speed Compensation

	RPM	Glue On	Glue Off	Difference
1st Line Speed:	200	73°	156°	83°
2nd Line Speed:	680	49°	132°	83°

Difference in Position: 73° - 49° = 24°
Difference in Speed: 680 RPM - 200 RPM = 480 RPM

Speed Compensation Value: Divide difference in position by difference in speed:

24°/480 RPM = 0.05° per 1 RPM

Since a shaft at 1 RPM rotates 0.006°/msec, this shaft would require (0.05/0.006), or 8.3 msec to rotate 0.05°. So the correct speed compensation value to enter is 8.3.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Standard Speed Compensation (cont'd)

Calculation

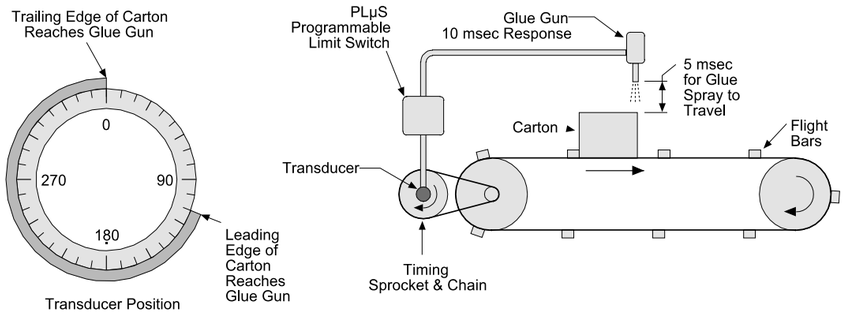
To calculate the amount of speed compensation required, use the following relationships between the transducer's RPM (revolutions per minute) and degrees of rotation:

1 RPM = 360°/min = 6°/sec = 0.006°/msec,

RPM x 0.006 = deg/msec,

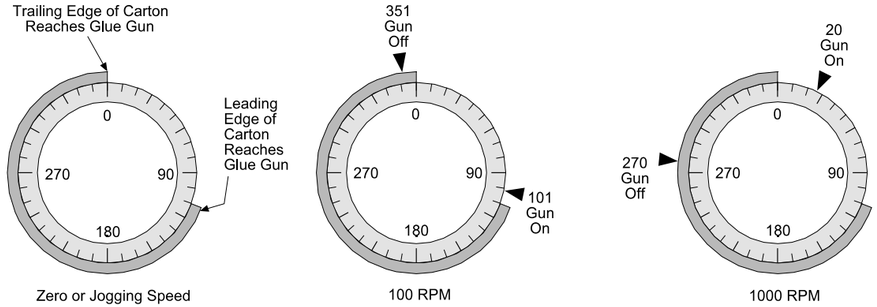
thus: @ 100 RPM, the transducer will rotate 0.6°/msec
@ 1000 RPM, the transducer will rotate 6.0°/msec

Simple Application Using Speed Compensation



In the previous example, the gluing system requires 15 msec from the time the gun is energized to the time the glue hits the carton. At 100 RPM, the transducer will rotate 0.6°/msec. Therefore, in the 15 msec response time, the transducer will rotate (15 msec x 0.6°), or 9°. This means the glue gun must be energized at 101°, which is 9° before the box arrives under the gun, and de-energized at 351°. At 1000 RPM, the transducer will rotate (15 msec x 6°), or 90° during the response time, and the gun must be energized at 20° and de-energized at 270°. These values are visually represented in the illustration below.

Speed Compensation at Various Speeds



Setting Speed Comp

In many applications, speed compensation can be set by jogging the line to determine ON and OFF edges at zero speed, then entering the speed compensation value into the controller. In the previous example, the line would be jogged until the leading edge of the box reaches the gun at 110° of transducer rotation. The glue gun output would be set to turn on at this point. Then, the line would be jogged until the trailing edge is under the gun at 360°, and the glue gun output would be set to turn off.

Once these on and off edges are entered, the glue system response time of 15 msec would be entered through SPEED COMP programming as described in Chapter 4. As line speed increases, the PL-1746 will automatically advance the edges to maintain the accuracy of the glue bead position.

Group Offset (cont'd)

Description

In many machines with rotary motion, it is often necessary to provide some means to adjust the phase or angular position of one shaft with respect to another. This adjustability is usually obtained through the use of timing chains or belts, or possibly clutches, differentials, or couplings. All of these devices allow the position of a driven shaft to be offset from the position of the driving shaft. The PL-1746 has the ability to add offsets to the resolver position. This feature of the PL-1746 allows the user to change the timing of machine functions without incurring the time consuming task of mechanically altering the machine.

The group functions in the PL-1746 work off of machine position (see Positions & Offsets in Chapter 1 for more information). The PL-1746 always has at least one group and may have up to six groups. Each group can be individually offset from the machine position to allow individual functions to be properly timed with respect to the rest of the machine.

When a group is operating in modes 0, 3, 4, or 5, machine offset is entered by the user and remains fixed. The value is also stored in non-volatile memory and so is in effect during subsequent power cycles.

When a group is operating in modes 1 or 2, the user supplies a preset position or offset. When the group enable becomes active, the PL-1746 calculates an offset from the current machine position, such that the group position becomes the preset position. This allows the timing of outputs in groups operating in these modes to be synchronized to machine operations that do not occur at the same time during each machine revolution.

Group Position

Jog the machine to a position that corresponds to the desired group position and enter the group position.

- For standard PL-1746 controllers using Electro Cam resolvers, the ABS value will directly show the relationship between the group position and machine position in scale factor increments. For example, suppose that machine position is at 0 and SCALE FACTOR is set to 360. If the ABS of a group is 20, its position will be 20 degrees.
- If groups have been programmed with their own offsets, changing machine offset will change all of the group positions at once. **It is usually best to set machine offset to the desired zero position in the machine cycle before programming individual group offsets.**
- If groups have been programmed with their own offsets, changing GRP POS DISP to "ONE" will immediately change ABS for all groups to value programmed for Group 0.

Programming Preset

Preset is programmed in scale factor units.

- The **preset** value is stored in the controller on power down. However, the last **group position** is not. On power up, the group position will be the same as machine position. When the group's input terminal is energized, then the group position will reset to the preset value.

Also see MACHINE OFFSET, GRP POS DISP, OUTPUT GROUPS, and Section 6 for details on Output Grouping & Modes.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Group Position Display

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Group Position Display	M0:S.65	258	R/W	0=EACH 1=ONE

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to GRP POS DISP SEL

```
GROUP POSITION
DISPLAY: EACH<
```

Group Position Display Mode: EACH = Each output group has its own offset value; ONE = One value of offset is shared by all output groups.

Enter the GRP POS DISP function and press SEL to toggle between "ONE" and "EACH."

- GRP POS DISP must be set to "EACH" to assign different offsets to groups through OFFSET programming.
- If groups have been assigned different offsets through GROUP OFFSET programming, setting GRP POS DISP to "ONE" will immediately change the individual group offsets to the value of Group 0.

The value selected in this screen determines the appearance of the main screen as shown below:

Main Screen— • One Output Group
• Multiple Output Groups, and GRP POS DISP set to "One"

```
PGM: 1 RPM: 1500
MENU< POS:  180
```

Machine Speed
Machine Position = Resolver Position + Machine Offset

Main Screen— • Multiple Output Groups and GRP POS DISP Set to "Each"

IMPORTANT

```
PGM: 1 RPM: 1500
MENU< GRP1:  180
```

Mode 1 or 2: Position = Preset + change since last reset
Mode 0, 3, 4, 5: Position = Machine Position + Group Offset
Group#: To change, place cursor here and press SEL

Description

The Group Position Display determines whether each output group can have its own position in the machine cycle, or if all groups share one position. Because the position of a group operating in Mode 1 or 2 changes each time the group's input terminal is energized, GRP POS DISP must be set to EACH if any groups are assigned to Mode 1 or Mode 2.

Also see GROUP OFFSET, MACHINE OFFSET, OUTPUT GROUPS, and MAIN SCREEN.

Introduction To Speed Compensation

What Is It?

"Speed compensation" refers to the ability of the PL-1746 controller to automatically advance or retard setpoints in any output channel depending on the speed of the machine. Speed compensation allows devices with fixed response times, such as glue guns, to perform their functions with high accuracy over a wide range of machine speeds. Without speed compensation, a glue bead may tend to "drift" out of position as machine speed increases. By properly programming speed compensation for the output channel controlling the glue gun, the glue bead position can be maintained precisely over the complete range of machine speeds.

Benefits

Proper use of speed compensation can provide substantial benefits:

- **Increased Productivity—**If a machine incorporates components with fixed response times, the use of speed compensation can often increase line speeds by as much as 50%.
- **Reduced Scrap Rate—**Speed compensation maintains the accuracy of critical operations such as gluing, thereby reducing rejects, rework, and scrap.
- **Simplified PLC Systems—**Programming speed compensation into standard motion control equipment such as PLC's, stepper motors, and stepper motor controls is difficult. In addition, to perform speed compensation at high machine speeds, the PLC hardware must be extremely fast, and therefore expensive. Integrating a PL-1746 into the control system eliminates the need to write custom PLC speed compensation programming, and provides excellent high speed control at a fraction of the hardware cost.

Fixed Response Times

Electromechanical components of automated systems often have fixed response times regardless of the line speed. For example, a glue gun may require ten milliseconds from the time the gun is actuated to the time that glue begins flowing. At the slowest line speed, the gun might need to be triggered when the carton is one inch away, so that the carton arrives under the gun just as glue begins flowing. As the line speed increases and the product travels faster, the lead distance from the carton to the gun must increase in order for the gun, with its fixed response time, to still hit the correct spot on the product. By programming speed compensation into the PL-1746, the timing of glue guns and similar mechanisms can be automatically advanced as speed increases, maintaining proper operation over a wide range of machine speeds.

Standard Speed Compensation

Example

The illustration on page 5-2 shows a simple carton gluing application. A conveyor moves cartons under a glue gun which releases glue onto the flaps. The conveyor is connected through a timing chain and sprocket to a transducer which rotates one revolution for each carton that passes under the gun.

As the transducer dial shows, SHAFT POSITION has been programmed so that the leading edge of the box passes under the gun at 110° and the trailing edge at 360°. Glue begins flowing ten msec after the gun is energized, and it stops flowing ten msec after the gun is de-energized. Once the glue leaves the nozzle, it requires another five msec to travel to the carton. Combining the glue gun response time with the travel time results in a system response time of 15 msec, regardless of line speed.

At very slow, or essentially zero speed, the gun would be energized at a transducer position of 110° and de-energized at 360°. As the line speed increases, however, the gun needs to be energized before 110° to allow the glue to hit the carton in the correct spot. The faster the line speed, the earlier in the transducer cycle the gun must be triggered.

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Toggle RPM

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Toggle RPM	M0:S.50	228	R/W	0-9999

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to TOGGLE RPM SEL

```
TOGGLE
RPM:  50
```

Use the numeric keys and ENT to enter a new value, or use INC and DEC to change an existing value.

Description

Toggle RPM is the resolver speed at which the Position display on the Main Screen will disappear. At speeds below the Toggle RPM the Position display will be visible; at speeds above the Toggle RPM the Position will not be shown.

Input Maps

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Input Word 0 Map #	M0:S.208	544	R/W	0-32767
Input Word 1 Map #	M0:S.209	546	R/W	0-32767
Input Word 2 Map #	M0:S.210	548	R/W	0-32767
Input Word 3 Map #	M0:S.211	550	R/W	0-32767
Input Word 4 Map #	M0:S.212	552	R/W	0-32767
Input Word 5 Map #	M0:S.213	554	R/W	0-32767
Input Word 6 Map #	M0:S.214	556	R/W	0-32767
Input Word 7 Map #	M0:S.215	558	R/W	0-32767

Screen

MAIN SCREEN SEL ▼ to MAPPING MENU SEL to INPUT MAP REGS SEL

```
REG#  INPUT MAP#
  0          0
```

Use INC/DEC keys to select the desired mapping register. Use select, then the numeric keypad, to enter the mapping index number followed by the ENT key. See the section on Remote I/O and Register Mapping for more information. These registers allow the user to select M0 or M01 file registers for reading through the eight Input file registers.

Description

This screen displays the input mapping registers. When a mapping index number is placed in one of these registers, the corresponding M0 or M1 register will be mapped into the indicated input file register.

Input Status

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Output Word 0 Logic Inputs	O:S.0	None	W/O	Bit 16-10 Reserved Bit 9 Clear Shift Register (Models C02,C03 only) Bit 8 Clear Error Bit 7 Output Enable Bit 6 First Cycle Enable Bit 5 Group 5 Input Bit 4 Group 4 Input Bit 3 Group 3 Input Bit 2 Group 2 Input Bit 1 Group 1 Input Bit 0 Group 0 Input
Logic Inputs Status	M0:S.25	178	R/O	0-255

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to I/O STATUS SEL ▼ to INPUT STATUS SEL

```
INPUTS 76543210
0-7    00000000
```

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input Status (cont'd)

Description

The input status screen displays the Logic Inputs status of the group inputs (0-5), first cycle enable (6), and output enable (7).

The SLC-500 writes a "1" to activate an input in the Logic Inputs word (O:S.0).

The Logic Inputs Status Register (M0:S.25) contains the current state of the hardware inputs from the rack OR'ed with the corresponding bits O:S.0, but when O:S.0 is mapped, the Logic Inputs Status Register only contains the bits from the PS-4108 rack or the inputs on the front of the C02/C03.

Interrupt Enable

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Interrupt Enables Channels 0-31, 1bit/channel	M0:S.132- M0:S.133	392- 394	R/W	0=Disabled 1=Enabled

Screen

MAIN SCREEN SEL ▼ to INTERRUPT MENU SEL ▼ to INTERRUPT ENABLE REGS SEL

```
ENABLES 76543210
0-7     00000000
```

Use the SEL key to select a set of eight channels, then the left or right arrow keys to select the enable bit for an individual channel. Use the SEL key to toggle that channel's bit.

Description

Setting a bit to one will enable that channel to cause an interrupt to the SLC-500 ladder program when one active transition occurs. See "INTERRUPT LEVEL" for more information about transitions.

Interrupt Level

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Interrupt Levels Channels 0-31, 1bit/channel	M0:S.128- M0:S.129	384- 386	R/W	0= Rising Edge 1= Falling Edge

Screen

MAIN SCREEN SEL ▼ to INTERRUPT MENU SEL ▼ to INTERRUPT LEVEL REGS SEL

```
LEVELS 76543210
0-7    00000000
```

Use the SEL key to select a set of eight channels, then the left or right arrow keys to select the level bit for an individual channel. Use the SEL key to toggle that channel's bit.

Description

This screen shows which transition of each output channel is selected to generate an interrupt to the SLC-500 ladder program. Setting a bit to zero will select the zero to one transition of the specified output channel. Setting a bit to one will select the one to zero transition of the specified ouput channel.

Speed Comp Mode

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Speed Comp Mode	M0:S.35	198	R/W	0=ONE 1=L/T

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to SPEED COMP MODE SEL

```
SPEED COMP
MODE:ONE
```

Press SEL key to toggle between ONE and L/T. Press ENT to confirm your selection.

Description

Speed Comp Mode determines whether standard or leading/trailing edge speed compensation is in effect. When the Speed Comp Mode is ONE, the same value of speed comp is used for both leading and trailing edges. When the Speed Comp Mode is “L/T”, the leading and trailing edges of a pulse may have different values of speed comp.

Also see SPEED COMPENSATION.

Timed Outputs

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Time (ms) Channels 0-31, 1word/channel	M0:S.320- M0:S.351	768- 830	R/W	0-9999

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to TIMED OUTPUTS SEL

```
CHANNEL:   1
TIME(mS):  20
```

Use numeric entry or INC/DEC to change CHANNEL. Use numeric entry to set TIME in milliseconds.

Description

Any four outputs can be programmed to time out rather than remain on until an OFF setpoint is reached. This makes the output duration constant regardless of machine speed. If the OFF setpoint is reached before the specified time has elapsed, the timing will be aborted and the output will turn off immediately.
Once an output times out, it will not turn on until the next ON setpoint is reached. Each timed output can have a unique time delay length.

A timed output must be programmed with ON and OFF position setpoints in order for output timing to take effect.

If the machine is rotating in the reverse direction, timed outputs will energize when the OFF edge of the pulse occurs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

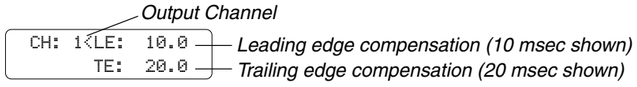
Speed Compensation

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Leading Edge Channels 0-31, 1word/channel	M0:S.384-M0:S.415	896-958	R/W	-999.9 to 999.9
Trailing Edge Channels 0-31, 1word/channel	M0:S.448-M0:S.479	1024-1086	R/W	-999.9 to 999.9

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ SPEED COMP SEL



To change output channels, move the cursor to the channel number and enter a new one. You may also INC or DEC the channel number.

To change speed comp values, use the numeric keys or INC and DEC. To enter tenths of msec, use the decimal point. When entering whole ms values, the decimal point is not needed: “12 ENT” will result in a value of 12.0.

To program negative speed comp, press the +/- key **after** entering a number but **before** pressing ENT. You may also decrement a value below zero.

Note: Speed compensation requires time to respond to accelerations, and large scale factors increase that response time.

Description

Speed Compensation advances or retards selected outputs a specified amount of time at any machine speed.

Some devices such as pneumatic cylinders and glue guns require a fixed amount of time to perform their function. As a machine speeds up, these devices need to be actuated earlier in the cycle in order to complete their action at the required time. Speed compensation automatically advances the pulses of specified output channel(s) as the machine speeds up, maintaining proper synchronization at all speeds. See Chapter 5 for a detailed discussion of speed compensation.

Speed compensation is programmed by entering the response time of the output device in milliseconds (.001sec). The output will always turn on this number of ms before the programmed ON position is reached, and turn off this number of ms before the programmed OFF position is reached. As speed increases, the number of degrees of advance will automatically increase to maintain the number of ms of advance.

Negative Speed Comp
Negative values of speed compensation cause an output channel to lag its programmed machine position by the specified number of msec. See Chapter 5 for details on applying negative speed compensation.

Also see Speed Comp Mode.

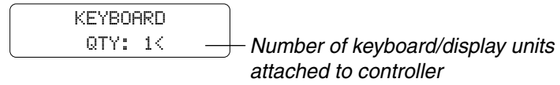
Keyboard Quantity

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Keyboard Quantity	M0:S.48	224	R/W	0-2

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to KEYBOARD QTY SEL



Use numeric entry followed by ENT to change keyboard quantity.

Description

The Keyboard Quantity screen shows the number of keypads communicating with the controller. The controller will attempt to establish communication with as many keypads as are programmed through this screen. Keypads are assumed to be addressed sequentially, starting at address “0”.

Keypad “0”
The keypad with address "0" is used to change the number of keypads shown in KEYBOARD QTY. *If KEYBOARD QTY is set to “2,” but only one keypad is physically connected, Menu Tree operation will be very slow. Change KEYBOARD QTY to “1” to restore normal Menu Tree speed.*

Special conditions that apply when KEYBOARD QTY is set to zero: To improve system performance, the KEYBOARD QTY may be set to zero to stop the keypad communications task in the PL-1746. This provides a slight improvement in scan time, and reduces timing jitter in output pulses. However, the user may wish to regain keyboard communications at some time. This can be accomplished in two slightly different ways:

One way is to program the KEYBOARD QTY variable in the M0 file, M0:S.48. The KEYBOARD QTY variable will be changed immediately, but access to the keyboards will not occur until after the unit is power cycled.

The other way is to install a correctly configured keypad, then cycle power. The PL-1746 will identify the presence of the keypad, and enable communications with it. At this time, the KEYBOARD QTY may be changed to reflect the actual number of keypads.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Machine Offset

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Machine Offset	M0:S.33	194	R/W*	0 to (Scale Factor-1)
Machine Position	M0:S.24	176	R/W*	0 to (Scale Factor-1)
Resolver Position	M0:S.23	174	R/O *Not while running	0 to (Scale Factor-1)

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to MACHINE OFFSET SEL

```
MCHN POS:
MCHN OFST:
```

Use the INC/DEC keys, or the numeric keys followed by ENT to change MACHINE POSITION and/or MACHINE OFFSET.

Description

Because the PL-1746 is a programmable device, it can be set to display a position of "zero" at any point in the machine cycle. Usually, the machine is jogged to the beginning of a cycle, and MACHINE POSITION is set to zero at this point. This function eliminates the need to adjust the physical coupling between the machine and resolver in order to change the displayed machine position. The MACHINE OFFSET can also be set directly by entering it's value.

Set MACHINE POSITION or MACHINE OFFSET before doing any PULSE or GROUP OFFSET programming.

Note: When direction of motion reverses, one circular unit out of 4096 will be skipped. This prevents position transducer jitter.

See Positions & Offsets in Chapter 1.

Shift Window (Cont'd)

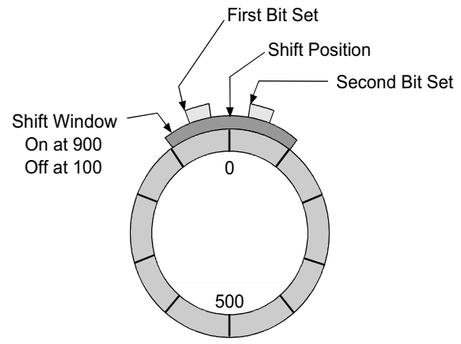
When the Shift Window overlaps the shift position as shown here, two problems may occur.

One Product, Two Bits: Due to variations in conditions, sensors sometimes generate more than one pulse for a product. If the product sensor sends a pulse early in the window, that pulse will shift when the encoder reaches the shift position. If the sensor sends a second pulse for the same product after the shift position, a second bit will be set for the same product.

Inconsistent Timing: Some products may appear early in the Shift Window, while others appear late. For early products, a bit will be set, then immediately shifted at the shift position. For late products, a bit will be set after the shift position, and a full revolution will occur before the bit shifts to 1.

In most applications, programming Shift Window to overlap the Shift Position will cause problems.

Shift Window Overlaps Shift Position—Not Recommended!



Software Version

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Base Revision	M0:S.4	136	R/O	0-32767
Major Revision	M0:S.3	134	R/O	0-32767

Screen

Menu Path

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to SYSTEM INFO SEL ▼ to SOFTWARE VERSION SEL

```
MAJOR REV:1.75
 BASE REV:1.17
```

There are no values that can be changed in this screen.

Description

The Software Version screen displays the revision number of the firmware contained within the controller. This information may be useful if the unit needs to be returned for service.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Shift Window

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Window On	M0:S.918	1964	R/W	0 to (Scale Factor-1)
Window Width	M0:S.919	1966	R/W	0 to (Scale Factor-1)

Screen

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL SHFT WINDOW SEL

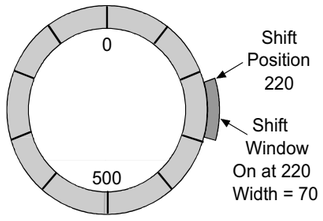
```
SHIFT WINDOW
ON:  0  WT: 0
```
Beginning of window = ON; WT is the width (size)

Use numeric entry, followed by ENT, to change ON and WT.

Description

The point in a revolution at which Terminal IO of the pluggable input header enters a bit into bit 0 of the Shift Register is programmed through the Shift Window screen. When programming Shift Position and the Shift Window, remember the following:

Don't Place the Shift Position at the Start of the Shift Window



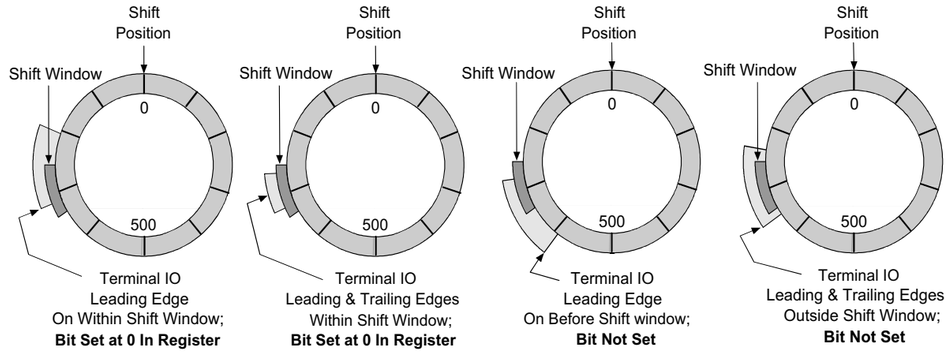
When a pulse starts at the beginning of the Shift Window, as shown here, the pulse will be enabled as soon as a bit is shifted into the programmed shift count.

Although the output will function normally on this revolution, a small output spike may occur on the following revolution as the bit is shifted to the next shift count.

The Product Present input (terminal IO) is rising edge triggered. The leading edge of the signal must appear in the Shift Window for a bit to be set in the Shift Register.

Edge Sensitivity of the Product Present Input

(Shift Window programmed "on" at 650, "width" of 100 in this example; Shift Position = 0)



Main Screen

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Active Program	O:S.1	None	W/O	0-47
Resolver Speed	M0:S.22	1742	R/O	0 to 3000
Machine Offset	M0:S.33	194	R/W* *Not while running	0 to (Scale Factor-1)

Screen

On power-up, or after five minutes of keypad inactivity, the controller will display one of two main screens:

Main Screen— • One Output Group
• Multiple Output Groups, and GRP POS DISP set to "One"

```
PGM: 1 RPM: 1500
MENU<  POS:  180
```
Machine Speed
Machine Position = Resolver Position + Machine Offset

Main Screen— • Multiple Output Groups and GRP POS DISP set to "Each"

```
PGM: 1 RPM: 1500
MENU< GRP1:  180
```
Mode 1 or 2: Position = Preset + change since last reset
Mode 0, 3, 4, 5: Position = Machine Position + Group Offset
Group#: To change, place cursor here and press SEL

Description

Active Program
The PL-1746 can store up to 48 programs of setpoints. The "Active Program" is the program currently controlling the output channels.

If active program at O:S.1 is set to zero, default program is displayed. If active program is not zero, active program is displayed

Machine Speed
When the machine is moving, Machine Speed is displayed in user selectable units of RPM (revolutions per minute), BPM (bags per minute), or CPM (cartons per minute). See RATE SETUP for details.

Group Position
Group Position is displayed only when the resolver speed is below the TOGGLE RPM speed. At higher speeds, Group Position will be blank. See TOGGLE RPM for details.

```
PGM: 1 RPM: 1500
MENU<
```
Machine position not shown above toggle RPM

Menu
To enter the Menu Tree from the Main Screen, move the cursor to "MENU" and press the SEL key.

Also see DEFAULT PROGRAM, RATE SETUP, TOGGLE RPM, GRP POS DISP GROUP OFFSET, and the Positions & Offsets section in Chapter 1.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Memory Tests

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to MEMORY TESTS SEL

```
MEMORY TESTS
FCN:----<
```
Enter function here

To perform one of the memory test functions, enter the function number using the numeric keys and press SEL.

Description

This menu selection provides several functions listed below.

Function 7000
Clears all pulses and configuration settings from the controller's EEPROM. After clearing the pulses, the controller will reload the factory default settings.

When the function is complete, the address of the last memory location cleared is displayed. Press ESC to continue.

The PLS will then reset and the PS-6400 keypad will show "EEPROM reset to factory defaults".

Function 7001
Clears all configuration settings from the controller's EEPROM. These include all programming other than pulses. When finished, the controller will reload the factory default settings.

When the function is complete, the address of the last memory location cleared is displayed. Press ESC to continue.

The PLS will then reset and the PS-6400 keypad will show "EEPROM reset to factory defaults".

Function 7002
Clears all pulses from the controller's EEPROM.

When the function is complete, the address of the last memory location cleared is displayed. Press ESC to continue.

Function 7998
Watchdog Timer Test. The "Watchdog Timer" monitors the operation of the controller's microprocessor and shuts the controller down if any internal malfunction is detected. If the Watchdog Timer fails, the controller may continue to operate. However, any subsequent malfunctions or noise-induced irregularities may go undetected, and the controller may begin to operate erratically.

To test the Watchdog Timer, run Function 7998. If the controller's Watchdog Timer is working properly, the controller will reset and the display will show "STATUS WATCHDOG TIMER TIMEOUT". If Function 7998 does not reset the controller, the Watchdog Timer has failed. Replace the controller immediately and return the faulty unit to the factory.

⚠ WARNING

Failure of controller to pass the watchdog timer test can cause erratic operation, resulting in injury and damage to equipment.

Shift Position

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Shift Position	M0:S.917	1962	R/W	0 to (Scale Factor-1)

Screen

Menu Path

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to SHIFT POSITION SEL

```
SHIFT POS:  350
```
Position at which Shift Register will shift.

Use INC and DEC, or the numeric keys and ENT.

Description

The Shift Position is the point in the encoder revolution at which the shift register data shifts. Also see Shift Count and Shift Window.

Shift Register Display

Backplane

Reset the shift register by setting O:S.0/9.

Screens

MAIN SCREEN SEL ▼ to TEST MENU SEL to I/O STATUS MENU SEL ▼ SHIFT REGISTER SEL

```
063 SHFT-REG 000
0000000000000000
```
Shift register contents positions 0-63
16 hexidecimal digits

```
127 SHFT-REG 064
0000000000000000
```
Shift register contents positions 64-127
16 hexidecimal digits

```
191 SHFT-REG 128
0000000000000000
```
Shift register contents positions 128-191
16 hexidecimal digits

```
255 SHFT-REG 192
0000000000000000
```
Shift register contents positions 192-255
16 hexidecimal digits

All four parts of the Shift Register can be viewed by using the left/right arrow keys to change to the next part. Note that the contents of the individual positions cannot be changed.

Description

The Shift Register screen shows the current contents of the Shift Register. To reset all positions in the Shift Register press the CLR key.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Shift Count (cont'd)

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL SHFT COUNT SEL

```
PGM:0 CHN:  1
SHIFT COUNT:  0
```

Output Channel to be ANDed
Shift Count That Will Enable Output Channel

To select the output's channel, program, and shift count, use the numeric keys and ENT, or use the INC and DEC keys.

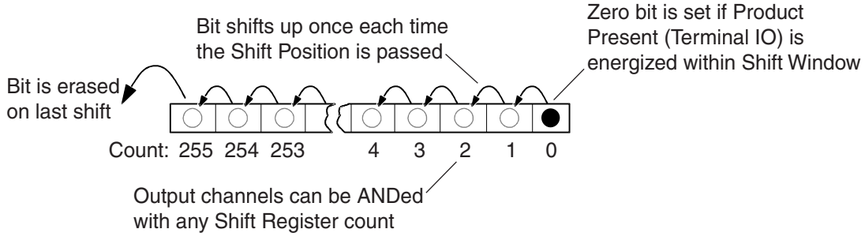
Input Window

A bit is set in Position "0" of the shift register when the Product Present Input (Terminal IO of the pluggable input header) is energized. A Shift Window is provided to limit the portion of revolution during which the signal will be accepted from Terminal IO. A bit is set in the Shift Register only if Terminal IO becomes energized within that window.

Description

The shift register is a form of electronic memory that sets a "bit" in the zero count of the register when a signal is applied to Terminal IO. Afterwards, each time the position passes the point programmed as the SHIFT POSITION, the register "shifts" the bit to the next higher count. The bit passes along the shift register until, on the 256th shift, the bit is erased.

An output channel can be ANDed with any count in the shift register, so that the channel is enabled only when a bit appears in that count. In this way, output channels can be enabled up to 255 revolutions after Terminal IO is energized.



- ANDing an output channel with Count "0" is the same as turning Shift Register ANDing off. The shift register will have no affect on channel operation.
- Any number of output channels can be ANDed to a single shift register count.
- Shift Register ANDing, Input ANDing, and Motion ANDing can be combined for any given output channel.

Model & Options

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Model Options	M0:S.0 M0:S.2	128 132	R/O R/O	1746 0 = Standard, 1 = Shift Register

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to SYSTEM INFO MENU SEL ▼ to MODEL & OPTIONS SEL

```
PL-1746-C02/3-R1
OPTIONS:STD
```

Description

This screen displays the model type and the options included (designated by letters).

Motion ANDing

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Motion ANDing Channels 0-31, 1word/channel	M0:S.512- M0:S.543	1152- 1214	R/W* Not while running	0=OFF 1=ML1 2=ML2

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to MOTION ANDING SEL

```
    CHN: 12
MOTION AND: L1
```

Channel number
Motion ANDing level: L1, L2, or OFF.
(Toggle with SEL key)

This screen displays the channel number and the motion ANDing limit band for Motion ANDing: L1, L2, or OFF. The channel will not be Motion ANDed if the enable is OFF. Select a new channel by pressing the INC/DEC keys, or through direct numeric entry followed by ENT. Press the SEL key to toggle the ANDing to L1, L2, or OFF.

Description

This function is used to tie the operation of output channels to the motion detection levels programmed through MOTION ANDING LIMIT BANDS. Each output channel may be ANDed with either motion ANDing limit band. If an output is Motion ANDed, it will turn ON only when the resolver RPM is in the range band specified for that motion ANDing limit band, AND the setpoints progammed for that channel are ON.

Operation

- Any number of output channels can be ANDed to a single Motion Detection level.
- Motion ANDing and Output Enable ANDing can be combined for any given output channel.
- When Motion ANDing is activated for a channel, it will apply to that channel in all programs.

Motion Detector

An output channel can be used as a motion detector by programming it to be on at "1" and off at "1," and then ANDing it with the desired Motion Level. This will turn the output on constantly as long as the machine speed is within the specified Motion Level range.

Outputs that must always operate, regardless of machine speed, should **not** be ANDed with a motion ANDing limit band. Also see MOTION DETECTION.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

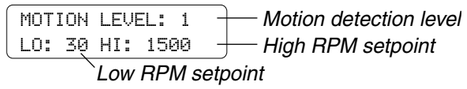
Motion Detection

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Motion Level 1 Low Limit (ML1L)	M0:S.96	320	R/W	0 to (ML1H-1)
Motion Level 1 High Limit (ML1H)	M0:S.97	322	R/W	(ML1L+1) to 3000
Motion Level 2 Low Limit (ML2L)	M0:S.98	324	R/W	0 to (ML2H-1)
Motion Level 2 High Limit (ML2H)	M0:S.99	326	R/W	(ML2L+1) to 3000

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to MOTION DETECT SEL



Use the numeric keys and ENT to change values.

Description

Motion Detection establishes one or two “Motion Detection Levels,” or speed ranges, with low and high RPM values. These two ranges are independent of each other.

Each output channel can be ANDed with either Motion Level. ANDed outputs will be enabled only when the resolver speed is within the specified speed range. Output channels that are not ANDed will be “on” whenever the machine position is within their programmed setpoints, regardless of machine speed. One use of Motion Detection Levels and Motion ANDing is to turn off devices such as glue guns if the machine stops or jams.

The MOTION DETECTION function is used to establish one or two Motion Detection Levels. Once the Motion Detection Levels are programmed, use MOTION ANDING to tie individual output channels to the Motion Detection Levels.

Motion Detector
An output channel can be used as a motion detector by programming it to be on at “1” and off at “1,” and then ANDing it with the desired Motion Detection Level. This will turn the output on constantly as long as the machine speed is within the specified Motion Detection Level range.

Also see MOTION ANDING.

Shift Count (cont’d)

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Program 25 Shift Counts (Channels 0-31)	M0:S.1720-M0:S.1751	3568-3630	R/W	0-255
Program 26 Shift Counts (Channels 0-31)	M0:S.1752-M0:S.1783	3632-3694	R/W	0-255
Program 27 Shift Counts (Channels 0-31)	M0:S.1784-M0:S.1815	3696-3758	R/W	0-255
Program 28 Shift Counts (Channels 0-31)	M0:S.1816-M0:S.1847	3760-3822	R/W	0-255
Program 29 Shift Counts (Channels 0-31)	M0:S.1848-M0:S.1879	3824-3886	R/W	0-255
Program 30 Shift Counts (Channels 0-31)	M0:S.1880-M0:S.1911	3888-3950	R/W	0-255
Program 31 Shift Counts (Channels 0-31)	M0:S.1912-M0:S.1943	3952-4014	R/W	0-255
Program 32 Shift Counts (Channels 0-31)	M0:S.1944-M0:S.1975	4016-4078	R/W	0-255
Program 33 Shift Counts (Channels 0-31)	M0:S.1976-M0:S.2007	4080-4142	R/W	0-255
Program 34 Shift Counts (Channels 0-31)	M0:S.2008-M0:S.2039	4144-4206	R/W	0-255
Program 35 Shift Counts (Channels 0-31)	M0:S.2040-M0:S.2071	4208-4270	R/W	0-255
Program 36 Shift Counts (Channels 0-31)	M0:S.2072-M0:S.2103	4272-4334	R/W	0-255
Program 37 Shift Counts (Channels 0-31)	M0:S.2104-M0:S.2135	4336-4398	R/W	0-255
Program 38 Shift Counts (Channels 0-31)	M0:S.2136-M0:S.2167	4400-4462	R/W	0-255
Program 39 Shift Counts (Channels 0-31)	M0:S.2168-M0:S.2199	4464-4526	R/W	0-255
Program 40 Shift Counts (Channels 0-31)	M0:S.2200-M0:S.2231	4528-4590	R/W	0-255
Program 41 Shift Counts (Channels 0-31)	M0:S.2232-M0:S.2263	4592-4654	R/W	0-255
Program 42 Shift Counts (Channels 0-31)	M0:S.2264-M0:S.2295	4656-4718	R/W	0-255
Program 43 Shift Counts (Channels 0-31)	M0:S.2296-M0:S.2327	4720-4782	R/W	0-255
Program 44 Shift Counts (Channels 0-31)	M0:S.2328-M0:S.2359	4784-4846	R/W	0-255
Program 45 Shift Counts (Channels 0-31)	M0:S.2360-M0:S.2391	4848-4910	R/W	0-255
Program 46 Shift Counts (Channels 0-31)	M0:S.2392-M0:S.2423	4912-4974	R/W	0-255
Program 47 Shift Counts (Channels 0-31)	M0:S.2424-M0:S.2455	4976-5038	R/W	0-255

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Shift Count

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Shift Register Models C02,C03 only				
Program 0 Shift Counts (Channels 0-31)	M0:S.920- M0:S.951	1968- 2030	R/W	0-255
Program 1 Shift Counts (Channels 0-31)	M0:S.952- M0:S.983	2032- 2094	R/W	0-255
Program 2 Shift Counts (Channels 0-31)	M0:S.984- M0:S.1015	2096- 2158	R/W	0-255
Program 3 Shift Counts (Channels 0-31)	M0:S.1016- M0:S.1047	2160- 2222	R/W	0-255
Program 4 Shift Counts (Channels 0-31)	M0:S.1048- M0:S.1079	2224- 2286	R/W	0-255
Program 5 Shift Counts (Channels 0-31)	M0:S.1080- M0:S.1111	2288- 2350	R/W	0-255
Program 6 Shift Counts (Channels 0-31)	M0:S.1112- M0:S.1143	2352- 2414	R/W	0-255
Program 7 Shift Counts (Channels 0-31)	M0:S.1144- M0:S.1175	2416- 2478	R/W	0-255
Program 8 Shift Counts (Channels 0-31)	M0:S.1176- M0:S.1207	2480- 2542	R/W	0-255
Program 9 Shift Counts (Channels 0-31)	M0:S.1208- M0:S.1239	2544- 2606	R/W	0-255
Program 10 Shift Counts (Channels 0-31)	M0:S.1240- M0:S.1271	2608- 2670	R/W	0-255
Program 11 Shift Counts (Channels 0-31)	M0:S.1272- M0:S.1303	2672- 2734	R/W	0-255
Program 12 Shift Counts (Channels 0-31)	M0:S.1304- M0:S.1335	2736- 2798	R/W	0-255
Program 13 Shift Counts (Channels 0-31)	M0:S.1336- M0:S.1367	2800- 2862	R/W	0-255
Program 14 Shift Counts (Channels 0-31)	M0:S.1368- M0:S.1399	2864- 2926	R/W	0-255
Program 15 Shift Counts (Channels 0-31)	M0:S.1400- M0:S.1431	2928- 2990	R/W	0-255
Program 16 Shift Counts (Channels 0-31)	M0:S.1432- M0:S.1463	2992- 3054	R/W	0-255
Program 17 Shift Counts (Channels 0-31)	M0:S.1464- M0:S.1495	3056- 3118	R/W	0-255
Program 18 Shift Counts (Channels 0-31)	M0:S.1496- M0:S.1527	3120- 3182	R/W	0-255
Program 19 Shift Counts (Channels 0-31)	M0:S.1528- M0:S.1559	3184- 3246	R/W	0-255
Program 20 Shift Counts (Channels 0-31)	M0:S.1560- M0:S.1591	3248- 3310	R/W	0-255
Program 21 Shift Counts (Channels 0-31)	M0:S.1592- M0:S.1623	3312- 3374	R/W	0-255
Program 22 Shift Counts (Channels 0-31)	M0:S.1624- M0:S.1655	3376- 3438	R/W	0-255
Program 23 Shift Counts (Channels 0-31)	M0:S.1656- M0:S.1687	3440- 3502	R/W	0-255
Program 24 Shift Counts (Channels 0-31)	M0:S.1688- M0:S.1719	3504- 3566	R/W	0-255

Output Assignment

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
C02,C03 only Output Assignments Outputs 0-5, 1word/output	M0:S.600- M0:S.605	1328- 1338	R/W* Not while running	0-31

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL to INITIAL SETUP SEL ▼ OUTPUT ASSIGN SEL

```
OUTPUT:  0
CHANNEL: 0
```

To select the output to assign or the channel to use for that output, use the numeric keys and ENT, or use the INC and DEC keys.

Description

The Output Assignment screen allows selection of any channel to drive each of the front panel output terminals.

Output Enable ANDing

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Output Enable ANDing Channels 0-31, 1bit/channel	M0:S.272- M0:S.273	672- 674	R/W	0=On 1=Off

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to OUTPUT ENABLE ANDING SEL

```
CHN: 12<
OUTPUT AND: OFF
```

Channel number
Output Enable ANDing: ON or OFF. (Toggle with SEL key)

Select a new channel by pressing INC/DEC, or using the numeric keys followed by ENT. Use the SEL key to toggle ANDing on and off.

Description

Output Enable ANDing allows you to AND any output channels with the Output Enable Signal. A channel ANDed with this signal will be enabled to turn on at its programmed setpoints only while the Output Enable Signal is energized. The signal is the logical OR of bit 7 in the register at address O.S.0 and PS-4108 rack input 7 (or dc input 7 on the front panel of C02/C03 models). Note that if output word 0 is mapped to another register, its value is ignored (set to zero) and the source for this signal is rack (dc input) input 7 alone.

Also see INPUT STATUS.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

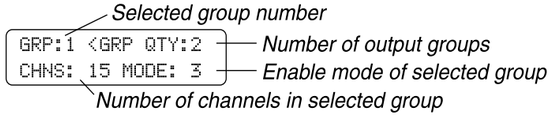
Output Groups

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Group Quantity	M0:S.64	256	R/W*	1-6
Group Position Display	M0:S.65	258	R/W	0=EACH 1=ONE
Logic Inputs Status	M0:S.25	178	R/O	0-255
Group 0 Channel Count	M0:S.66	260	R/W*	0-32
Group 0 Mode	M0:S.82	292	R/W*	0-5
Group 0 Offset	M0:S.74	276	R/W	0 to (Scale Factor-1)
Group 0 Position	M0:S.16	160	R/W*	0 to (Scale Factor-1)
Group 1 Channel Count	M0:S.67	262	R/W*	0-32
Group 1 Mode	M0:S.83	294	R/W*	0-5
Group 1 Offset	M0:S.75	278	R/W	0 to (Scale Factor-1)
Group 1 Position	M0:S.17	162	R/W*	0 to (Scale Factor-1)
Group 2 Channel Count	M0:S.68	264	R/W*	0-32
Group 2 Mode	M0:S.84	296	R/W*	0-5
Group 2 Offset	M0:S.76	280	R/W	0 to (Scale Factor-1)
Group 2 Position	M0:S.18	164	R/W*	0 to (Scale Factor-1)
Group 3 Channel Count	M0:S.69	266	R/W*	0-32
Group 3 Mode	M0:S.85	298	R/W*	0-5
Group 3 Offset	M0:S.77	282	R/W	0 to (Scale Factor-1)
Group 3 Position	M0:S.19	166	R/W*	0 to (Scale Factor-1)
Group 4 Channel Count	M0:S.70	268	R/W*	0-32
Group 4 Mode	M0:S.86	300	R/W*	0-5
Group 4 Offset	M0:S.78	284	R/W	0 to (Scale Factor-1)
Group 4 Position	M0:S.20	168	R/W*	0 to (Scale Factor-1)
Group 5 Channel Count	M0:S.71	270	R/O	0-32
Group 5 Mode	M0:S.87	302	R/W*	0-5
Group 5 Offset	M0:S.79	286	R/W	0 to (Scale Factor-1)
Group 5 Position	M0:S.21	170	R/W* *Not while running	0 to (Scale Factor-1)

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to OUTPUT GROUPS SEL



Begin by moving the cursor to GRP QTY and entering the number of groups desired, followed by ENT (or use the INC/DEC keys).

Next, move the cursor to GRP and enter “0” followed by ENT.

Move the cursor to CHNS and enter the number of output channels to be included in Group 0, followed by ENT (or use the INC/DEC keys).

Move the cursor to MODE and enter the operating mode for the group from zero to five, followed by ENT (or use the INC/DEC keys). See Section 6 for an explanation of the operating characteristics of each mode.

Move the cursor back to GRP and repeat these steps for each group to be programmed.

When output channels are divided into groups, the appearance of the Main Screen will change slightly. See MAIN SCREEN for details.

(continued)

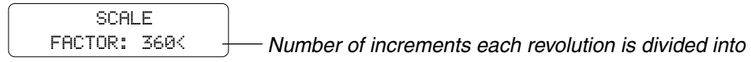
Scale Factor

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Scale Factor	M0:S.32	192	R/W* *Not while running	2-4096

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to SCALE FACTOR SEL



Note: The PS-6400 keypad may time out if there are a large number of pulses when changing scale factor. Do not cycle power during this operation, or data may be lost.

Description

This function controls the number of increments into which one resolver revolution is divided. A scale factor of 360 (0 to 359) allows the controller to operate in degrees. A higher scale factor allows positions to be programmed more accurately. In some applications the scale factor can be set so each increment equals a unit of linear travel.

When the scale factor is changed, all programmed setpoints are recalculated to convert them to the new scale factor. The keypad/display will be inoperative until the calculations are done.

Note: Speed compensation requires time to respond to accelerations, and longer scale factors increase that response time.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Resolver Mode

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Resolver Mode N/A C02, C03 Set via DIP switch on plug-in card	M0:S.60	248	R/W* *Not while running	0=Master 1=Slave

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to RESOLVER MODE SEL

```
RESOLVER MODE
MASTER<
```

Use SEL to set the opposite mode, followed by ENT to assign the new selection, or ESC to cancel the new selection.

Description

It is sometimes necessary to connect two PL-1746 controls to a single resolver. This function allows one PL-1746 to provide excitation to the resolver (master) and the second PL-1746 to monitor the position of the resolver (slave).

This screen is used to select the resolver mode for PL-1746-C01 ONLY. For C02/C03 the Resolver Mode is set via DIP switch, and the screen/register is read-only.

NOTE: Setting a module to slave mode turns off the reference signal to the resolver. If a reference signal is not supplied by another module, the resolver position and speed data will be random, and (in C02/C03 models) an "EX07 Resolver not OK" message will result.

RPM Update Rate

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
RPM Update Rate	M0:S.49	226	R/W	0=1/s 1=2/s 2=10/s

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to RPM UPD RATE SEL

```
RPM UPDATE
RATE: 1/S<
```

Press the SEL key to toggle the selection.

Description

The RPM Update Rate is how often the RPM display on the Main Screen is updated.

Output Groups (cont'd)

Description

This function allows you to divide output channels into groups, and assign operating modes to the groups. Operating modes provide a powerful tool for relating output channel operation to sensor signals or other inputs. Incorporating modes into a control system can greatly improve line efficiency, reduce scrap, and improve control accuracy between machine sections at high speeds. See Section 6 for a complete explanation of the uses and applications of operating modes.

Establishing Groups

When dividing outputs into groups, keep these rules in mind:

- Output channels are assigned to groups sequentially. Group 0 will begin with Output 0 and include the specified number of outputs; Group 1 will begin with the next output and continue sequentially for its specified number of outputs; and so on. The last group will automatically include all of the remaining outputs.
- You can establish as many as six groups or as few as one.
- Each group can operate in any of the six modes.

Grouping Example 1—All Outputs in One Group

Output Group	Includes Outputs
0	0 thru 31

Grouping Example 2—Two Groups

Output Group	Includes Outputs
0	0 thru 3
1	4 thru 31

Grouping Example 3—Three Groups

Output Group	Includes Outputs
0	0 & 1
1	2 & 3
2	4 thru 31

Also see MAIN SCREEN, GROUP OFFSET, and GRP POS DISP.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Maps

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Output Word 0 Map #	M0:S.192	512	R/W	0-32767
Output Word 1 Map #	M0:S.193	514	R/W	0-32767
Output Word 2 Map #	M0:S.194	516	R/W	0-32767
Output Word 3 Map #	M0:S.195	518	R/W	0-32767
Output Word 4 Map #	M0:S.196	520	R/W	0-32767
Output Word 5 Map #	M0:S.197	522	R/W	0-32767
Output Word 6 Map #	M0:S.198	524	R/W	0-32767
Output Word 7 Map #	M0:S.199	526	R/W	0-32767

Screen

MAIN SCREEN SEL ▼ to MAPPING MENU SEL to OUTPUT MAP REGS SEL

```
REG# OUTPUT MAP#
  0          0
```

Use INC/DEC keys to select the desired mapping register. Use select, then the numeric keypad, to enter the mapping index number followed by the ENT key. See the section on Remote I/O and Register Mapping for more information. These registers allow the user to select M0 or M1 file registers for writing through the eight Output file registers.

Description

This screen displays the output mapping registers. When a mapping index number is placed in one of these registers, the corresponding M0 or M1 register will be mapped into the indicated output file register.

Rate Setup

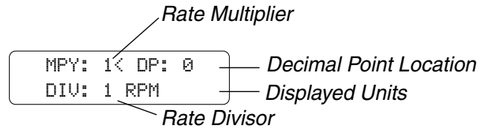
Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Displayed Units	M0:S.51	230	R/W	0=RPM 1=BPM 2=CPM 3=IPM
Decimal Point Location	M0:S.52	232	R/W	0-3
Rate Multiplier	M0:S.53	234	R/W	1-1091
Rate Divisor	M0:S.54	236	R/W	1-63

Screen

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to RATE SETUP SEL



Units—Move the cursor to the “Units” field and use SEL to toggle between values.

MPY & DIV—Move the cursor to MPY or DIV and use the numeric keys followed by ENT to enter a value.
DP—Move the cursor to DP and use SEL to toggle between values.

Following are a few examples of the relationships between multiplier (MPY), divider (DIV), decimal points (DP), actual resolver speed, and displayed resolver speed:

If MPY Is…	**And DIV Is…**	**And DP Is…**	**Then MPY/DIV Is…**	**And a Resolver Speed Of…**	**Is Displayed As…**
1	2	0	.5	100 RPM	50 RPM
1	2	1	.5	100 RPM	5.0 RPM
1	2	2	.5	100 RPM	.50 RPM
1	2	3	.5	100 RPM	.050 RPM
1	1	0	1.0	100 RPM	100 RPM
1	1	1	1.0	100 RPM	10.0 RPM
1	1	2	1.0	100 RPM	1.00 RPM
1	1	3	1.0	100 RPM	.100 RPM
2	1	0	2.0	100 RPM	200 RPM
2	1	1	2.0	100 RPM	20.0 RPM
2	1	2	2.0	100 RPM	2.00 RPM
2	1	3	2.0	100 RPM	.200 RPM

Description

The Rate Setup function allows you to configure the RPM display on the Main Screen.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Rack Quantity

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Rack Quantity	M0:S.56	240	R/W	0-2 Model C01 **N/A C02, C03**

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to RACK QTY SEL

```
RACK
QTY: 0<
```

Use the numeric keys followed by ENT to select number of PS-4108 racks connected to the PL-1746.

Description

The PL-1746-C01 can provide very fast output update with the optional PS-4108 I/O rack. Each rack can provide up to 16 output modules and 8 TTL level inputs. The first rack can also provide up to 2 analog outputs.

Also see ANALOG QTY.

Output Status

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Input Word 0 PL-1746 Output Channel 0-15 Status, 1bit/channel	I:S.0	None	R/O	0=Off 1=On
Input Word 1 PL-1746 Output Channel 16-31 Status, 1bit/channel	I:S.1	None	R/O	0=Off 1=On
Force Outputs On Channels 0-31, 1bit/channel	M0:S.256- M0:S.257	640- 642	R/W	1=Force Active 0=Force Inactive
Force Outputs Off Channels 0-31, 1bit/channel	M0:S.264- M0:S.265	656- 658	R/W	1=Force Active 0=Force Inactive

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to I/O STATUS SEL ▼ to OUTPUT STATUS SEL

```
OUTPUTS 76543210
0-7<    00000000
```

Press the SEL key to change the set of outputs displayed.

Press ◀ to access Output 0, causing the “0” to blink. Press SEL to turn this output on. The “0” will change to a “1”. Select other desired outputs by pressing ▶ or ◀. If the output is already on, a “1” will be present instead of a “0”. So, the “1” will change to a “0” when the output is forced.

Press ESC to return to output number selection. Outputs will remain forced until you leave the Output Status screen.

Description

This screen shows the On/Off state of the output channels, and it allows the outputs to be forced.

Setting a bit in one of the force outputs on registers will cause the corresponding output to turn ON. Setting a bit in one of the force outputs OFF registers will cause the corresponding output to turn OFF. Force OFF takes precedence over force ON. If outputs are forced from the keyboard, the forcings are cleared when the status menu is exited and the bits in these registers will be cleared.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

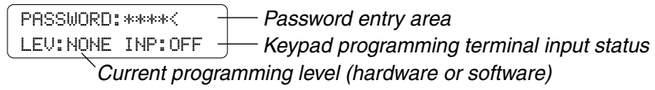
Password

Backplane

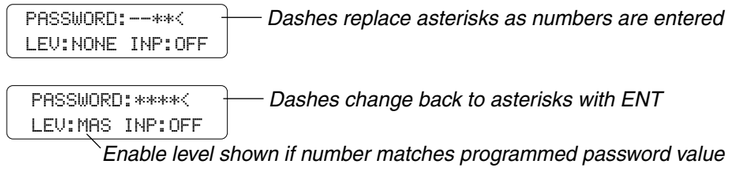
PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Master Password	M0:S.106	340	R/W	0-9999
Setup Password	M0:S.105	338	R/W	0-9999
Operator Password	M0:S.104	336	R/W	0-9999

Screen

MAIN SCREEN SEL ▼ to PASSWORD SEL



Enter a password through the numeric keypad followed by ENT. As you press the number keys, the asterisks will be replaced by dashes. If you make a mistake, press CLR to erase the last key you pushed.



Description

This screen provides an area to enter a password. It also shows the current programming access level and the status of the Programming Enable terminals on the back of the keypad.

There are three programming access levels; OPERATOR, SETUP, and MASTER. The codes that correspond to each level are established in the ENABLE CODES screen.

If you enter a password that has been programmed through ENABLE CODES, the keypad will function at the corresponding programming level. See ENABLE CODES for a description of the various levels.

If either of the programming enable terminals on the back of the keypad is active when a password is entered, the programming level will be whichever is greater.

When programming operations are completed, enter a password value of “0”, then ENT to clear the enable level.

If a keypad is left unattended with an active password, the access code will clear after five minutes of keypad inactivity and the keypad will revert to the “Normal Display” mode.

There is no password for the backplane. All configuration and setpoint data is always accessible.

Also see ENABLE CODES.

Pulses (cont’d)

Changing Pulse Edges
Change an edge value with the numeric keys followed by ENT, or with the INC and DEC keys.

Pulse Modes
The Pulse Mode controls how the INC and DEC keys modify pulses. There are three modes; **EDG** (edge), **PUL** (pulse), and **CHN** (channel.) Change the Pulse Mode by pressing the SEL key when the cursor points to the Pulse Mode.

In **EDG** mode, the INC and DEC keys will affect the selected ON or OFF edge only.

In **PUL** mode, both ON and OFF edges will be incremented or decremented simultaneously.

In **CHN** mode, **all** ON and OFF edges for all pulses in the channel will be incremented or decremented simultaneously.

Deleting a Pulse
A pulse may be deleted by making ON equal to OFF, or vice versa. If there is more than one pulse in the channel, the next pulse will appear in the on/off edges area. If the channel has no more pulses, the ON and OFF edges will both be zero.

Clearing a Channel
To clear a channel of all pulses, enter a new pulse with ON and OFF edges of “0.”

Channel Always ON
A channel may be programmed to be on for a full revolution (always on) by entering a new pulse with both ON and OFF =edges equal to “1.”

Programming Recommendations
For most installations, before programming edges, it is best to set MACHINE POSITION to zero at the start of a machine cycle. This allows you to jog the machine to various points in the machine cycle where output channels must turn on or off, note these machine positions from the PL-1746 display, and enter them into pulse programming. Pulses programmed in this manner will relate directly to the machine position. If pulses are programmed before MACHINE POSITION is set, and MACHINE POSITION is subsequently changed, the pulses will no longer correlate with the machine zero position. The same logic applies if GROUP OFFSET will be used for individual output groups. Program the group offsets before establishing pulses for the channels in the groups.

Description

This set of screens provides a means to add pulses to channels, edit existing pulses, increment or decrement pulses in one of the three modes, delete pulses, clear a channel, or turn a channel ON all the time.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pulses

Screen

MAIN SCREEN SEL ▼ to PULSES SEL
When PULSES is selected, a preliminary screen specifies the program whose channels will be programmed.

```
PGM NUMBER: <
```
Program to view or modify

The active program is displayed, but any other program can be specified by using the numeric keys or INC and DEC to choose a program, then pressing SEL to move to pulse programming.

<-P-> indicates multiple pulses in channel

```
<-P-> CH:1<EDG
ON: 90 OF: 270
```

Blank if only 1 pulse in channel
Channel

```
   CH: 1 <EDG
ON: 90 OF: 270
```
Pulse mode
OFF edge
ON edge

Channel to Edit
Use the numeric keypad and ENT to select the channel to program.

- **Channels 90 through 95 are special channels used for Output Grouping and Modes. See Chapter 6 for details.**

Pulse Edges
Use the left and right arrow keys to move between the ON and OFF edges.

- If a channel has more than one pulse, you may view the other pulses by pressing the right cursor key when viewing the OFF edge, or by pressing the left cursor key when viewing the ON edge.
- If a channel contains no pulses, the ON and OFF edges will be “0.”
- If a channel is always on, both the ON and OFF edges will be “1.”

```
   CH:1 EDG
ON: 0< OF: 0
```
ON and OFF edges both 0 if no pulses in channel. Both 1 if channel always ON

```
   CH:1 EDG
ON:---< OF:---
```
Enter ON edge, then ENT or right cursor to OF. Enter OFF edge, then press ENT.

Adding a Pulse
You may add a new pulse to a channel by pressing the SEL key when the cursor points to either the ON or the OFF edge.

The display will change to show blank ON and OFF edges; the cursor will point to the ON edge. Enter the ON edge through the numeric keypad, and then press the ENT key or the right cursor to move to the OFF edge. Enter the OFF edge through the numeric keypad and then press the ENT key.

Adding Multiple Pulses
If ON and OFF edges for a pulse are visible on the screen and you press SEL to program a new pulse, the original pulse will remain in the output channel. If the ON or OFF edges entered overlap an existing pulse in the channel, you will see an “Error: Pulse Overlap” message. To abort entering a pulse at any time, press ESC.

Per Channel Enable

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Per-Channel Operator Access Channels 0-31, 1 bit/channel	M0:S.280- M0:S.281	688- 690	R/W	0=Operator Accessible 1=Operator Inaccessible

Screen

MAIN SCREEN SEL ▼ to PROGRAM ENABLE SEL ▼ to PER CHN ENABLE SEL

```
    CHN: 12<
CHN ENABLE: ON
```
Channel number
Per channel enable: ON/OFF
(Toggle with SEL key)

Press the INC/DEC keys, or use the numeric keys and ENT.
Press the SEL key to toggle the enable ON or OFF.

Description

This screen is used to enable Operator Level access to individual output channels. PER CHN ENABLE is used in conjunction with the ENABLE OPTIONS screen to assign Operator Level access to selected programming functions.

Also see ENABLE OPTIONS.

Program Copy

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Program Copy Destination Program	M0:S.769	1666	R/W*	0-47
Program Copy Source Program	M0:S.768	1664	R/W*	0-47
Program Copy Command/Status	M0:S.770	1668	R/W*	Bit 15 Error
			*Not while running	Bit 14 Source Pgm Error
				Bit 13 Dest Pgm Error
				Bit 12 Reserved Bits Error
				Bit 11 Dest Pgm Not Empty Error
				Bit 10-1 Reserved
				Bit 0 Execute/Busy

M0:S.770/0 Execute Program Copy. This bit remains on until the copy is complete or an error occurs. Either condition will clear this bit.

M0:S.770/1-10 Reserved bits. Writing a one to any of these bits will cause a reserved bits error (see M0:S.770/12).

M0:S.770/11 This bit is set if the destination program already has pulses in it.

M0:S.770/12 Reserved bits. This bit is set if a one is written to any of the reserved bits.

M0:S.770/13 The Destination Program error bit is set if the destination program is out of the range.

M0:S.770/14 The Source Program error bit is set if the source program is out of the range.

(Continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Program Copy (cont'd)

M0:S.770/15 The Error bit is set if any of the above error bits is set. This provides a single bit to test for command success/failure. When the Error Bit is set, test the other bits to determine the exact cause.

When the error bit M0:S.770/15 is set, the Command Error bit and the Any Error bit are set in the Programming Error Register (I:S.7). To clear the error condition, toggle the Clear Error bit (O:S.0/8) ON. No additional commands will be accepted until the error bits are cleared.

Screen

MAIN SCREEN SEL ▼ to FUNCTION SEL ▼ to PGM COPY SEL

```
OUTPUTS 76543210
0-7     00000000
```

The Program Copy function consists of four screens:

```
SRC PROGRAM:---<
```
Program to be copied from

```
DST PROGRAM:---<
```
Destination to be copied to

```
DST PROGRAM: 6<
      EXECUTE<
```
Move cursor to EXECUTE, then press SEL to copy program

```
DST PROGRAM: 6
     COMPLETE<
```
COMPLETE indicates program successfully copied

Use the numeric keys and SEL to enter program numbers.
During programming, the cursor keys allow you to move between the Source and Destination screens to allow you to change values before selecting EXECUTE.

Description

Program Copy allows you to copy all the pulses in the source program to the destination program. It may be easier to copy an existing program and modify it, than to enter a completely new program.

Pulse Edit (cont'd)

Command /Status Register Bits

M0:S.902/0 Execute Pulse Edit. This bit remains on until the edit is complete or an error occurs. Either condition will clear this bit.
M0:S.902/1 to 4 Command bits specify which command to execute as shown in the COMMANDS table. Using a reserved code will cause a reserved bits error.
M0:S.902/5 to 8 Reserved bits. Writing a one to any of these bits will also cause a reserved bits error (see M0:S.902/12).
M0:S.902/9 Reserved bits. This bit is set if a one is written to any of the reserved bits.
M0:S.902/10 The Pulse Number error bit is set if the pulse number in a channel with more than one pulse exceeds the actual number of pulses in that channel.
M0:S.902/11 The Pulse Edit Off value exceeds the scale factor.
M0:S.902/12 The Pulse Edit On value exceeds the scale factor.
M0:S.902/13 The Channel error bit is set if the channel value is out of range.
M0:S.902/14 This Program error bit is set if the program value is out of range.
M0:S.902/15 The Error bit is set if any of the above errors is set. This provides a single bit to test for command success/failure. When the Error bit is set, test the other bits to determine the exact cause.

Screen

No screen is available. This function is programmed through the backplane only. To edit pulses via the keypad, see the Pulses Section.

Description

The selected pulse is created, modified or deleted. A pulse is created if no other pulse has the specified program/channel. A pulse is deleted when the on and off values are both zero. If a pulse is found that matches the specified program/channel, it's on and off setpoints are changed to the values specified. When the error bit M0:S.710/15 is set, the Command Error bit and the Any Error bit are set in the Programming Error Register (I:S.7). To clear the error condition, toggle the Clear Error (O:S.0/8) ON. No additional commands will be accepted until the error bits are cleared.

Pulse Edit Command Requirements

The READ command requires the following information: PULSE EDIT PROGRAM and PULSE EDIT CHANNEL. If there are multiple pulses in the channel, the PULSE EDIT PULSE NUMBER selects which pulse to read. The first pulse is number zero. The PL-1746 responds to this command by providing the PULSE EDIT ON, PULSE EDIT OFF and PULSE EDIT PULSES IN CHANNEL values.

The WRITE command requires the following information: PULSE EDIT PROGRAM, PULSE EDIT CHANNEL, PULSE EDIT ON, and PULSE EDIT OFF. If there are no pulses in the specified channel, a new pulse will be created. The PL-1746 responds to this command by creating the specified pulse. If the channel already has at one or more pulses in it, multiple pulses will be created. If the PULSE EDIT ON and PULSE EDIT OFF values are both zero, all pulses in the specified channel will be deleted.

All the INC and DEC commands for ON, OFF, and BOTH require the following information: PULSE EDIT PROGRAM and PULSE EDIT CHANNEL. If there are multiple pulses in the channel, the PULSE EDIT PULSE NUMBER is also required. The PL-1746 responds to these commands by performing the specified operation on the PULSE EDIT ON value, PULSE EDIT OFF value, or both.

The INC ALL and DEC ALL commands require the following information: PULSE EDIT PROGRAM and PULSE EDIT CHANNEL. The PL-1746 responds to these commands by performing the specified operation on all the pulses in the channel.

The CHANGE ON and CHANGE OFF commands require the following information: PULSE EDIT PROGRAM, PULSE EDIT CHANNEL, and depending on which command, PULSE EDIT ON, or PULSE EDIT OFF. The PL-1746 responds to these commands by storing the specified ON or OFF edge value. If the PULSE EDIT ON value is the same as the PULSE EDIT OFF value, that pulse will be deleted leaving other pulses in the same channel unchanged.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pulse Edit

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Pulse Edit Program	M0:S.896	1920	R/W	0-47
Pulse Edit Channel	M0:S.897	1922	R/W	0-31
Pulse Edit On (Leading Edge)	M0:S.898	1924	R/W	0 to Scale Factor
Pulse Edit Off (Trailing Edge)	M0:S.899	1926	R/W	0 to Scale Factor
Pulse Edit Pulse Index (within channel)	M0:S.900	1928	R/W	0 to (Pulse Quantity-1)
Pulse Edit Pulse Quantity (within channel)	M0:S.901	1930	R/O	0 to (Scale Factor/2)
Pulse Edit Command/Status	M0:S.902	1932	R/W	Bit 15 Error Bit 14 Program Error Bit 13 Channel Error Bit 12 On > Scale Factor Error Bit 11 Off > Scale Factor Error Bit 10 Pulse Index Error Bit 9 Reserved Bits Error Bit 8-5 Reserved Bit 4-1 Command (see below) Bit 0 Execute/Busy Commands (bits 4-1): 0000 Read 0001 Write 0010 Increment On 0011 Decrement On 0100 Increment Off 0101 Decrement Off 0110 Increment Both 0111 Decrement Both 1000 Increment All 1001 Decrement All 1010 Change On 1011 Change Off 1100 Reserved 1101 Reserved 1110 Reserved 1111 Reserved

(continued)

Note: See Appendix for Output Pulse Programming information.

Pulse Copy

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Pulse Copy Program	M0:S.704	1536	R/W	0-47
Pulse Copy Channel	M0:S.705	1538	R/W	0-31
Pulse Copy On (Train Start)	M0:S.706	1540	R/W	0 to (Scale Factor-1)
Pulse Copy Off (Train End)	M0:S.707	1542	R/W	0 to (Scale Factor-1)
Pulse Copy Count (Number of Pulses)	M0:S.708	1544	R/W	1 to ((Off-On)/2)
Pulse Copy Duration (of each pulse)	M0:S.709	1546	R/W	1 to ((Off-On)/2*Count)
Pulse Copy Command/Status	M0:S.710	1548	R/W* *Not while running	Bit 15 Error Bit 14 Program Error Bit 13 Channel Error Bit 12 On > Scale Factor Error Bit 11 Off > Scale Factor Error Bit 10 Overlap Error Bit 9 Duration Error Bit 8 Reserved Bits Error Bit 7-1 Reserved Bit 0 Execute/Busy

M0:S.710/0 Execute Pulse Copy. This bit remains on until the copy is complete or an error occurs. Either condition will clear this bit.

M0:S.710/1-7 Reserved bits. Writing a one to any of these bits will cause a reserved bits error (see M0:S.710/8).

M0:S.710/8 Reserved bits. This bit is set if a one is written to any of the reserved bits.

M0:S.710/9 The Duration Error bit is set if the pulse duration is < 1.

M0:S.710/10 The Overlap Error bit is set if the number of pulses created exceeds one half the scale factor, which would cause pulses to be overlapped.

M0:S.710/11 The Off Pulse Copy value exceeds the scale factor.

M0:S.710/12 The On Pulse Copy value exceeds the scale factor.

M0:S.710/13 The channel error bit is set if channel value is out of range.

M0:S.710/14 The program error bit is set if program value is out of range.

M0:S.710/15 The Error bit is set if any of the above errors is set. This provides a single bit to test for command success/failure. When the Error bit is set, test the other bits to determine the exact cause.

When the error bit M0:S.710/15 is set, the Command Error bit and the Any Error bit are set in the Progamming Error Register (I:S.7). To clear the error condition, toggle Clear Error bit (O:S.0/8) ON. No additional commands will be accepted until the error bits are cleared.

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pulse Copy (cont'd)

Screens

Menu Path

MAIN SCREEN SEL ▼ to FUNCTION SEL ▼ to PULSE COPY SEL

The Pulse Copy function consists of eight screens:

```
PROGRAM:---<
```
Program to add pulses to;
Enter number, then SEL to go to next screen

```
CHANNEL:---<
```
Channel to add pulses to;
Enter number, then SEL to go to next screen

```
ON:---<
```
"On" time of leading edge of first pulse;
Enter number, then ENT & SEL to go to next screen

```
OFF:---<
```
"Off" time of trailing edge of last pulse;
Enter number, then ENT & SEL to go to next screen

```
COUNT---<
```
Total number of pulses to be added;
Enter number, then ENT & SEL to go to next screen

```
DURATION:---<
```
Duration of each pulse added;
Enter number, then ENT & SEL to go to next screen

```
DURATION: 35
   EXECUTE<
```
Move cursor to EXECUTE, then press SEL to generate pulses. To review values before executing, move cursor to top row and press SEL as needed

```
DURATION: 35
  COMPLETE<
```
COMPLETE indicates pulses have been generated

Example

Generate a train of pulses as follows:

Pulse	On	Off
1	0	50
2	100	150
3	200	250
4	300	350
5	400	450
6	500	550
7	600	650
8	700	750
9	800	850
10	900	950

Each pulse is 50 increments wide, separated from the next pulse by 50 increments.

Description

Pulse Copy allows you to program a series, or "train" of pulses into a channel without having to enter the On and Off edges for each pulse. The Pulse Copy function prompts you for the beginning and ending edges for the pulse train; the number of pulses in the train; and the duration of a pulse. Pulse Copy then divides the designated portion of the resolver cycle into the specified number of pulses, evenly dividing the unused portion of the segment between the pulses.

(continued)

Pulse Copy (cont'd)

```
PROGRAM:---<
```
Program to add pulses to;
Enter number, then SEL to go to next screen

```
CHANNEL:---<
```
Channel to add pulses to;
Enter number, then SEL to go to next screen

```
ON:  0<
```
"On" time of leading edge of first pulse;
Enter 0, then ENT & SEL to go to next screen

```
OFF:950<
```
"Off" time of trailing edge of last pulse;
Enter 950, then ENT & SEL to go to next screen

```
COUNT 10<
```
Total number of pulses to be added;
Enter 10, then ENT & SEL to go to next screen

```
DURATION: 50<
```
Duration of each pulse added;
Enter 50, then ENT & SEL to go to next screen

```
DURATION: 50
   EXECUTE<
```
Move cursor to EXECUTE, then press SEL to generate pulses.

```
DURATION: 35
  COMPLETE<
```
COMPLETE indicates pulses have been generated

Go to SETPOINTS to confirm the pulse train:

```
<-P-> CH: 1 <EDG
  ON: 0   OF: 50
```
Move cursor to OF and use arrow keys to review pulse setpoints

Pulses Used

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Pulses Total (C01)	M0:S.26	180	R/O	1252 Units without Shift Register (no -S in model #) 787 Units with Shift Register (-S in model #)
Pulses Total (C02, C03)	M0:S.26	180	R/O	1250 Units without Shift Register (no -S in model #) 785 Units with Shift Register (-S in model #)
Pulses Used	M0:S.27	182	R/O	0 to Pulses Total

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to SYSTEM INFO SEL ▼ to PULSES USED SEL

```
TOTAL: 1200
  USED: 64
```
Total number of pulses available for programming
Number of pulses programmed into all channels of all programs

Description

The number of pulses shown as "Used" is the sum of all pulses that are programmed into all channels of all programs. The "Total" value is the number of pulses that can be stored in non-volatile EEPROM memory. The difference between the two numbers is the number of pulses available for programming. The number of pulses programmed into all channels of all programs cannot exceed the value displayed as Total. There are no values that can be changed in this screen.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pulse Copy (cont'd)

Screens

Menu Path

MAIN SCREEN SEL ▼ to FUNCTION SEL ▼ to PULSE COPY SEL

The Pulse Copy function consists of eight screens:

```
PROGRAM:---<
```
Program to add pulses to;
Enter number, then SEL to go to next screen

```
CHANNEL:---<
```
Channel to add pulses to;
Enter number, then SEL to go to next screen

```
ON:---<
```
"On" time of leading edge of first pulse;
Enter number, then ENT & SEL to go to next screen

```
OFF:---<
```
"Off" time of trailing edge of last pulse;
Enter number, then ENT & SEL to go to next screen

```
COUNT---<
```
Total number of pulses to be added;
Enter number, then ENT & SEL to go to next screen

```
DURATION:---<
```
Duration of each pulse added;
Enter number, then ENT & SEL to go to next screen

```
DURATION: 35
   EXECUTE<
```
Move cursor to EXECUTE, then press SEL to generate pulses. To review values before executing, move cursor to top row and press SEL as needed

```
DURATION: 35
  COMPLETE<
```
COMPLETE indicates pulses have been generated

Example

Generate a train of pulses as follows:

Pulse	On	Off
1	0	50
2	100	150
3	200	250
4	300	350
5	400	450
6	500	550
7	600	650
8	700	750
9	800	850
10	900	950

Each pulse is 50 increments wide, separated from the next pulse by 50 increments.

Description

Pulse Copy allows you to program a series, or "train" of pulses into a channel without having to enter the On and Off edges for each pulse. The Pulse Copy function prompts you for the beginning and ending edges for the pulse train; the number of pulses in the train; and the duration of a pulse. Pulse Copy then divides the designated portion of the resolver cycle into the specified number of pulses, evenly dividing the unused portion of the segment between the pulses.

(continued)

Pulse Copy (cont'd)

```
PROGRAM:---<
```
Program to add pulses to;
Enter number, then SEL to go to next screen

```
CHANNEL:---<
```
Channel to add pulses to;
Enter number, then SEL to go to next screen

```
ON:  0<
```
"On" time of leading edge of first pulse;
Enter 0, then ENT & SEL to go to next screen

```
OFF:950<
```
"Off" time of trailing edge of last pulse;
Enter 950, then ENT & SEL to go to next screen

```
COUNT 10<
```
Total number of pulses to be added;
Enter 10, then ENT & SEL to go to next screen

```
DURATION: 50<
```
Duration of each pulse added;
Enter 50, then ENT & SEL to go to next screen

```
DURATION: 50
   EXECUTE<
```
Move cursor to EXECUTE, then press SEL to generate pulses.

```
DURATION: 35
  COMPLETE<
```
COMPLETE indicates pulses have been generated

Go to SETPOINTS to confirm the pulse train:

```
<-P-> CH: 1 <EDG
  ON: 0   OF: 50
```
Move cursor to OF and use arrow keys to review pulse setpoints

Pulses Used

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Pulses Total (C01)	M0:S.26	180	R/O	1252 Units without Shift Register (no -S in model #) 787 Units with Shift Register (-S in model #)
Pulses Total (C02, C03)	M0:S.26	180	R/O	1250 Units without Shift Register (no -S in model #) 785 Units with Shift Register (-S in model #)
Pulses Used	M0:S.27	182	R/O	0 to Pulses Total

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to SYSTEM INFO SEL ▼ to PULSES USED SEL

```
TOTAL: 1200
  USED: 64
```
Total number of pulses available for programming
Number of pulses programmed into all channels of all programs

Description

The number of pulses shown as "Used" is the sum of all pulses that are programmed into all channels of all programs. The "Total" value is the number of pulses that can be stored in non-volatile EEPROM memory. The difference between the two numbers is the number of pulses available for programming. The number of pulses programmed into all channels of all programs cannot exceed the value displayed as Total. There are no values that can be changed in this screen.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pulse Edit

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Pulse Edit Program	M0:S.896	1920	R/W	0-47
Pulse Edit Channel	M0:S.897	1922	R/W	0-31
Pulse Edit On (Leading Edge)	M0:S.898	1924	R/W	0 to Scale Factor
Pulse Edit Off (Trailing Edge)	M0:S.899	1926	R/W	0 to Scale Factor
Pulse Edit Pulse Index (within channel)	M0:S.900	1928	R/W	0 to (Pulse Quantity-1)
Pulse Edit Pulse Quantity (within channel)	M0:S.901	1930	R/O	0 to (Scale Factor/2)
Pulse Edit Command/Status	M0:S.902	1932	R/W	Bit 15 Error Bit 14 Program Error Bit 13 Channel Error Bit 12 On > Scale Factor Error Bit 11 Off > Scale Factor Error Bit 10 Pulse Index Error Bit 9 Reserved Bits Error Bit 8-5 Reserved Bit 4-1 Command (see below) Bit 0 Execute/Busy Commands (bits 4-1): 0000 Read 0001 Write 0010 Increment On 0011 Decrement On 0100 Increment Off 0101 Decrement Off 0110 Increment Both 0111 Decrement Both 1000 Increment All 1001 Decrement All 1010 Change On 1011 Change Off 1100 Reserved 1101 Reserved 1110 Reserved 1111 Reserved

(continued)

Note: See Appendix for Output Pulse Programming information.

Pulse Copy

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Pulse Copy Program	M0:S.704	1536	R/W	0-47
Pulse Copy Channel	M0:S.705	1538	R/W	0-31
Pulse Copy On (Train Start)	M0:S.706	1540	R/W	0 to (Scale Factor-1)
Pulse Copy Off (Train End)	M0:S.707	1542	R/W	0 to (Scale Factor-1)
Pulse Copy Count (Number of Pulses)	M0:S.708	1544	R/W	1 to ((Off-On)/2)
Pulse Copy Duration (of each pulse)	M0:S.709	1546	R/W	1 to ((Off-On)/2*Count)
Pulse Copy Command/Status	M0:S.710	1548	R/W* *Not while running	Bit 15 Error Bit 14 Program Error Bit 13 Channel Error Bit 12 On > Scale Factor Error Bit 11 Off > Scale Factor Error Bit 10 Overlap Error Bit 9 Duration Error Bit 8 Reserved Bits Error Bit 7-1 Reserved Bit 0 Execute/Busy

M0:S.710/0 Execute Pulse Copy. This bit remains on until the copy is complete or an error occurs. Either condition will clear this bit.

M0:S.710/1-7 Reserved bits. Writing a one to any of these bits will cause a reserved bits error (see M0:S.710/8).

M0:S.710/8 Reserved bits. This bit is set if a one is written to any of the reserved bits.

M0:S.710/9 The Duration Error bit is set if the pulse duration is < 1.

M0:S.710/10 The Overlap Error bit is set if the number of pulses created exceeds one half the scale factor, which would cause pulses to be overlapped.

M0:S.710/11 The Off Pulse Copy value exceeds the scale factor.

M0:S.710/12 The On Pulse Copy value exceeds the scale factor.

M0:S.710/13 The channel error bit is set if channel value is out of range.

M0:S.710/14 The program error bit is set if program value is out of range.

M0:S.710/15 The Error bit is set if any of the above errors is set. This provides a single bit to test for command success/failure. When the Error bit is set, test the other bits to determine the exact cause.

When the error bit M0:S.710/15 is set, the Command Error bit and the Any Error bit are set in the Progamming Error Register (I:S.7). To clear the error condition, toggle Clear Error bit (O:S.0/8) ON. No additional commands will be accepted until the error bits are cleared.

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Program Copy (cont'd)

M0:S.770/15 The Error bit is set if any of the above error bits is set. This provides a single bit to test for command success/failure. When the Error Bit is set, test the other bits to determine the exact cause.

When the error bit M0:S.770/15 is set, the Command Error bit and the Any Error bit are set in the Programming Error Register (I:S.7). To clear the error condition, toggle the Clear Error bit (O:S.0/8) ON. No additional commands will be accepted until the error bits are cleared.

Screen

MAIN SCREEN SEL ▼ to FUNCTION SEL ▼ to PGM COPY SEL

```
OUTPUTS 76543210
0-7     00000000
```

The Program Copy function consists of four screens:

```
SRC PROGRAM:---<
```
Program to be copied from

```
DST PROGRAM:---<
```
Destination to be copied to

```
DST PROGRAM: 6<
      EXECUTE<
```
Move cursor to EXECUTE, then press SEL to copy program

```
DST PROGRAM: 6
     COMPLETE<
```
COMPLETE indicates program successfully copied

Use the numeric keys and SEL to enter program numbers.
During programming, the cursor keys allow you to move between the Source and Destination screens to allow you to change values before selecting EXECUTE.

Description

Program Copy allows you to copy all the pulses in the source program to the destination program. It may be easier to copy an existing program and modify it, than to enter a completely new program.

Pulse Edit (cont'd)

Command /Status Register Bits

M0:S.902/0 Execute Pulse Edit. This bit remains on until the edit is complete or an error occurs. Either condition will clear this bit.
M0:S.902/1 to 4 Command bits specify which command to execute as shown in the COMMANDS table. Using a reserved code will cause a reserved bits error.
M0:S.902/5 to 8 Reserved bits. Writing a one to any of these bits will also cause a reserved bits error (see M0:S.902/12).
M0:S.902/9 Reserved bits. This bit is set if a one is written to any of the reserved bits.
M0:S.902/10 The Pulse Number error bit is set if the pulse number in a channel with more than one pulse exceeds the actual number of pulses in that channel.
M0:S.902/11 The Pulse Edit Off value exceeds the scale factor.
M0:S.902/12 The Pulse Edit On value exceeds the scale factor.
M0:S.902/13 The Channel error bit is set if the channel value is out of range.
M0:S.902/14 This Program error bit is set if the program value is out of range.
M0:S.902/15 The Error bit is set if any of the above errors is set. This provides a single bit to test for command success/failure. When the Error bit is set, test the other bits to determine the exact cause.

Screen

No screen is available. This function is programmed through the backplane only. To edit pulses via the keypad, see the Pulses Section.

Description

The selected pulse is created, modified or deleted. A pulse is created if no other pulse has the specified program/channel. A pulse is deleted when the on and off values are both zero. If a pulse is found that matches the specified program/channel, it's on and off setpoints are changed to the values specified. When the error bit M0:S.710/15 is set, the Command Error bit and the Any Error bit are set in the Programming Error Register (I:S.7). To clear the error condition, toggle the Clear Error (O:S.0/8) ON. No additional commands will be accepted until the error bits are cleared.

Pulse Edit Command Requirements

The READ command requires the following information: PULSE EDIT PROGRAM and PULSE EDIT CHANNEL. If there are multiple pulses in the channel, the PULSE EDIT PULSE NUMBER selects which pulse to read. The first pulse is number zero. The PL-1746 responds to this command by providing the PULSE EDIT ON, PULSE EDIT OFF and PULSE EDIT PULSES IN CHANNEL values.

The WRITE command requires the following information: PULSE EDIT PROGRAM, PULSE EDIT CHANNEL, PULSE EDIT ON, and PULSE EDIT OFF. If there are no pulses in the specified channel, a new pulse will be created. The PL-1746 responds to this command by creating the specified pulse. If the channel already has at one or more pulses in it, multiple pulses will be created. If the PULSE EDIT ON and PULSE EDIT OFF values are both zero, all pulses in the specified channel will be deleted.

All the INC and DEC commands for ON, OFF, and BOTH require the following information: PULSE EDIT PROGRAM and PULSE EDIT CHANNEL. If there are multiple pulses in the channel, the PULSE EDIT PULSE NUMBER is also required. The PL-1746 responds to these commands by performing the specified operation on the PULSE EDIT ON value, PULSE EDIT OFF value, or both.

The INC ALL and DEC ALL commands require the following information: PULSE EDIT PROGRAM and PULSE EDIT CHANNEL. The PL-1746 responds to these commands by performing the specified operation on all the pulses in the channel.

The CHANGE ON and CHANGE OFF commands require the following information: PULSE EDIT PROGRAM, PULSE EDIT CHANNEL, and depending on which command, PULSE EDIT ON, or PULSE EDIT OFF. The PL-1746 responds to these commands by storing the specified ON or OFF edge value. If the PULSE EDIT ON value is the same as the PULSE EDIT OFF value, that pulse will be deleted leaving other pulses in the same channel unchanged.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pulses

Screen

MAIN SCREEN SEL ▼ to PULSES SEL
When PULSES is selected, a preliminary screen specifies the program whose channels will be programmed.

```
PGM NUMBER: <
```
Program to view or modify

The active program is displayed, but any other program can be specified by using the numeric keys or INC and DEC to choose a program, then pressing SEL to move to pulse programming.

<-P-> indicates multiple pulses in channel

```
<-P-> CH:1<EDG
ON: 90 OF: 270
```

Blank if only 1 pulse in channel
Channel

```
   CH: 1 <EDG
ON: 90 OF: 270
```
Pulse mode
OFF edge
ON edge

Channel to Edit
Use the numeric keypad and ENT to select the channel to program.

- **Channels 90 through 95 are special channels used for Output Grouping and Modes. See Chapter 6 for details.**

Pulse Edges
Use the left and right arrow keys to move between the ON and OFF edges.

- If a channel has more than one pulse, you may view the other pulses by pressing the right cursor key when viewing the OFF edge, or by pressing the left cursor key when viewing the ON edge.
- If a channel contains no pulses, the ON and OFF edges will be “0.”
- If a channel is always on, both the ON and OFF edges will be “1.”

```
   CH:1 EDG
ON: 0< OF: 0
```
ON and OFF edges both 0 if no pulses in channel. Both 1 if channel always ON

```
   CH:1 EDG
ON:---< OF:---
```
Enter ON edge, then ENT or right cursor to OF. Enter OFF edge, then press ENT.

Adding a Pulse
You may add a new pulse to a channel by pressing the SEL key when the cursor points to either the ON or the OFF edge.

The display will change to show blank ON and OFF edges; the cursor will point to the ON edge. Enter the ON edge through the numeric keypad, and then press the ENT key or the right cursor to move to the OFF edge. Enter the OFF edge through the numeric keypad and then press the ENT key.

Adding Multiple Pulses
If ON and OFF edges for a pulse are visible on the screen and you press SEL to program a new pulse, the original pulse will remain in the output channel. If the ON or OFF edges entered overlap an existing pulse in the channel, you will see an “Error: Pulse Overlap” message. To abort entering a pulse at any time, press ESC.

Per Channel Enable

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Per-Channel Operator Access Channels 0-31, 1 bit/channel	M0:S.280- M0:S.281	688- 690	R/W	0=Operator Accessible 1=Operator Inaccessible

Screen

MAIN SCREEN SEL ▼ to PROGRAM ENABLE SEL ▼ to PER CHN ENABLE SEL

```
    CHN: 12<
CHN ENABLE: ON
```
Channel number
Per channel enable: ON/OFF
(Toggle with SEL key)

Press the INC/DEC keys, or use the numeric keys and ENT.
Press the SEL key to toggle the enable ON or OFF.

Description

This screen is used to enable Operator Level access to individual output channels. PER CHN ENABLE is used in conjunction with the ENABLE OPTIONS screen to assign Operator Level access to selected programming functions.

Also see ENABLE OPTIONS.

Program Copy

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Program Copy Destination Program	M0:S.769	1666	R/W*	0-47
Program Copy Source Program	M0:S.768	1664	R/W*	0-47
Program Copy Command/Status	M0:S.770	1668	R/W*	Bit 15 Error
			*Not while running	Bit 14 Source Pgm Error
				Bit 13 Dest Pgm Error
				Bit 12 Reserved Bits Error
				Bit 11 Dest Pgm Not Empty Error
				Bit 10-1 Reserved
				Bit 0 Execute/Busy

M0:S.770/0 Execute Program Copy. This bit remains on until the copy is complete or an error occurs. Either condition will clear this bit.

M0:S.770/1-10 Reserved bits. Writing a one to any of these bits will cause a reserved bits error (see M0:S.770/12).

M0:S.770/11 This bit is set if the destination program already has pulses in it.

M0:S.770/12 Reserved bits. This bit is set if a one is written to any of the reserved bits.

M0:S.770/13 The Destination Program error bit is set if the destination program is out of the range.

M0:S.770/14 The Source Program error bit is set if the source program is out of the range.

(Continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

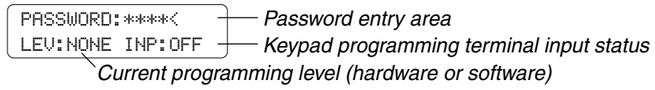
Password

Backplane

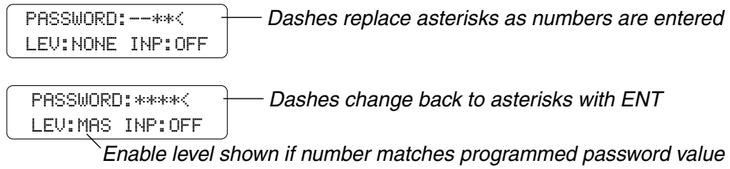
PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Master Password	M0:S.106	340	R/W	0-9999
Setup Password	M0:S.105	338	R/W	0-9999
Operator Password	M0:S.104	336	R/W	0-9999

Screen

MAIN SCREEN SEL ▼ to PASSWORD SEL



Enter a password through the numeric keypad followed by ENT. As you press the number keys, the asterisks will be replaced by dashes. If you make a mistake, press CLR to erase the last key you pushed.



Description

This screen provides an area to enter a password. It also shows the current programming access level and the status of the Programming Enable terminals on the back of the keypad.

There are three programming access levels; OPERATOR, SETUP, and MASTER. The codes that correspond to each level are established in the ENABLE CODES screen.

If you enter a password that has been programmed through ENABLE CODES, the keypad will function at the corresponding programming level. See ENABLE CODES for a description of the various levels.

If either of the programming enable terminals on the back of the keypad is active when a password is entered, the programming level will be whichever is greater.

When programming operations are completed, enter a password value of “0”, then ENT to clear the enable level.

If a keypad is left unattended with an active password, the access code will clear after five minutes of keypad inactivity and the keypad will revert to the “Normal Display” mode.

There is no password for the backplane. All configuration and setpoint data is always accessible.

Also see ENABLE CODES.

Pulses (cont’d)

Changing Pulse Edges
Change an edge value with the numeric keys followed by ENT, or with the INC and DEC keys.

Pulse Modes
The Pulse Mode controls how the INC and DEC keys modify pulses. There are three modes; **EDG** (edge), **PUL** (pulse), and **CHN** (channel.) Change the Pulse Mode by pressing the SEL key when the cursor points to the Pulse Mode.

In **EDG** mode, the INC and DEC keys will affect the selected ON or OFF edge only.

In **PUL** mode, both ON and OFF edges will be incremented or decremented simultaneously.

In **CHN** mode, **all** ON and OFF edges for all pulses in the channel will be incremented or decremented simultaneously.

Deleting a Pulse
A pulse may be deleted by making ON equal to OFF, or vice versa. If there is more than one pulse in the channel, the next pulse will appear in the on/off edges area. If the channel has no more pulses, the ON and OFF edges will both be zero.

Clearing a Channel
To clear a channel of all pulses, enter a new pulse with ON and OFF edges of “0.”

Channel Always ON
A channel may be programmed to be on for a full revolution (always on) by entering a new pulse with both ON and OFF =edges equal to “1.”

Programming Recommendations
For most installations, before programming edges, it is best to set MACHINE POSITION to zero at the start of a machine cycle. This allows you to jog the machine to various points in the machine cycle where output channels must turn on or off, note these machine positions from the PL-1746 display, and enter them into pulse programming. Pulses programmed in this manner will relate directly to the machine position. If pulses are programmed before MACHINE POSITION is set, and MACHINE POSITION is subsequently changed, the pulses will no longer correlate with the machine zero position. The same logic applies if GROUP OFFSET will be used for individual output groups. Program the group offsets before establishing pulses for the channels in the groups.

Description

This set of screens provides a means to add pulses to channels, edit existing pulses, increment or decrement pulses in one of the three modes, delete pulses, clear a channel, or turn a channel ON all the time.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Rack Quantity

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Rack Quantity	M0:S.56	240	R/W	0-2 Model C01 **N/A C02, C03**

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to RACK QTY SEL

```
RACK
QTY: 0<
```

Use the numeric keys followed by ENT to select number of PS-4108 racks connected to the PL-1746.

Description

The PL-1746-C01 can provide very fast output update with the optional PS-4108 I/O rack. Each rack can provide up to 16 output modules and 8 TTL level inputs. The first rack can also provide up to 2 analog outputs.

Also see ANALOG QTY.

Output Status

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Input Word 0 PL-1746 Output Channel 0-15 Status, 1bit/channel	I:S.0	None	R/O	0=Off 1=On
Input Word 1 PL-1746 Output Channel 16-31 Status, 1bit/channel	I:S.1	None	R/O	0=Off 1=On
Force Outputs On Channels 0-31, 1bit/channel	M0:S.256- M0:S.257	640- 642	R/W	1=Force Active 0=Force Inactive
Force Outputs Off Channels 0-31, 1bit/channel	M0:S.264- M0:S.265	656- 658	R/W	1=Force Active 0=Force Inactive

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to I/O STATUS SEL ▼ to OUTPUT STATUS SEL

```
OUTPUTS 76543210
0-7<    00000000
```

Press the SEL key to change the set of outputs displayed.

Press ◀ to access Output 0, causing the “0” to blink. Press SEL to turn this output on. The “0” will change to a “1”. Select other desired outputs by pressing ▶ or ◀. If the output is already on, a “1” will be present instead of a “0”. So, the “1” will change to a “0” when the output is forced.

Press ESC to return to output number selection. Outputs will remain forced until you leave the Output Status screen.

Description

This screen shows the On/Off state of the output channels, and it allows the outputs to be forced.

Setting a bit in one of the force outputs on registers will cause the corresponding output to turn ON. Setting a bit in one of the force outputs OFF registers will cause the corresponding output to turn OFF. Force OFF takes precedence over force ON. If outputs are forced from the keyboard, the forcings are cleared when the status menu is exited and the bits in these registers will be cleared.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Maps

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Output Word 0 Map #	M0:S.192	512	R/W	0-32767
Output Word 1 Map #	M0:S.193	514	R/W	0-32767
Output Word 2 Map #	M0:S.194	516	R/W	0-32767
Output Word 3 Map #	M0:S.195	518	R/W	0-32767
Output Word 4 Map #	M0:S.196	520	R/W	0-32767
Output Word 5 Map #	M0:S.197	522	R/W	0-32767
Output Word 6 Map #	M0:S.198	524	R/W	0-32767
Output Word 7 Map #	M0:S.199	526	R/W	0-32767

Screen

MAIN SCREEN SEL ▼ to MAPPING MENU SEL to OUTPUT MAP REGS SEL

```
REG# OUTPUT MAP#
  0          0
```

Use INC/DEC keys to select the desired mapping register. Use select, then the numeric keypad, to enter the mapping index number followed by the ENT key. See the section on Remote I/O and Register Mapping for more information. These registers allow the user to select M0 or M1 file registers for writing through the eight Output file registers.

Description

This screen displays the output mapping registers. When a mapping index number is placed in one of these registers, the corresponding M0 or M1 register will be mapped into the indicated output file register.

Rate Setup

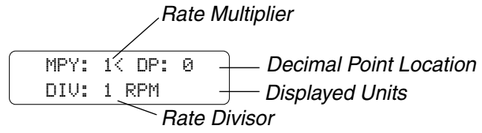
Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Displayed Units	M0:S.51	230	R/W	0=RPM 1=BPM 2=CPM 3=IPM
Decimal Point Location	M0:S.52	232	R/W	0-3
Rate Multiplier	M0:S.53	234	R/W	1-1091
Rate Divisor	M0:S.54	236	R/W	1-63

Screen

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to RATE SETUP SEL



Units—Move the cursor to the “Units” field and use SEL to toggle between values.

MPY & DIV—Move the cursor to MPY or DIV and use the numeric keys followed by ENT to enter a value.
DP—Move the cursor to DP and use SEL to toggle between values.

Following are a few examples of the relationships between multiplier (MPY), divider (DIV), decimal points (DP), actual resolver speed, and displayed resolver speed:

If MPY Is…	**And DIV Is…**	**And DP Is…**	**Then MPY/DIV Is…**	**And a Resolver Speed Of…**	**Is Displayed As…**
1	2	0	.5	100 RPM	50 RPM
1	2	1	.5	100 RPM	5.0 RPM
1	2	2	.5	100 RPM	.50 RPM
1	2	3	.5	100 RPM	.050 RPM
1	1	0	1.0	100 RPM	100 RPM
1	1	1	1.0	100 RPM	10.0 RPM
1	1	2	1.0	100 RPM	1.00 RPM
1	1	3	1.0	100 RPM	.100 RPM
2	1	0	2.0	100 RPM	200 RPM
2	1	1	2.0	100 RPM	20.0 RPM
2	1	2	2.0	100 RPM	2.00 RPM
2	1	3	2.0	100 RPM	.200 RPM

Description

The Rate Setup function allows you to configure the RPM display on the Main Screen.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Resolver Mode

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Resolver Mode N/A C02, C03 Set via DIP switch on plug-in card	M0:S.60	248	R/W* *Not while running	0=Master 1=Slave

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to RESOLVER MODE SEL

```
RESOLVER MODE
MASTER<
```

Use SEL to set the opposite mode, followed by ENT to assign the new selection, or ESC to cancel the new selection.

Description

It is sometimes necessary to connect two PL-1746 controls to a single resolver. This function allows one PL-1746 to provide excitation to the resolver (master) and the second PL-1746 to monitor the position of the resolver (slave).

This screen is used to select the resolver mode for PL-1746-C01 ONLY. For C02/C03 the Resolver Mode is set via DIP switch, and the screen/register is read-only.

NOTE: Setting a module to slave mode turns off the reference signal to the resolver. If a reference signal is not supplied by another module, the resolver position and speed data will be random, and (in C02/C03 models) an "EX07 Resolver not OK" message will result.

RPM Update Rate

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
RPM Update Rate	M0:S.49	226	R/W	0=1/s 1=2/s 2=10/s

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to RPM UPD RATE SEL

```
RPM UPDATE
RATE: 1/S<
```

Press the SEL key to toggle the selection.

Description

The RPM Update Rate is how often the RPM display on the Main Screen is updated.

Output Groups (cont'd)

Description

This function allows you to divide output channels into groups, and assign operating modes to the groups. Operating modes provide a powerful tool for relating output channel operation to sensor signals or other inputs. Incorporating modes into a control system can greatly improve line efficiency, reduce scrap, and improve control accuracy between machine sections at high speeds. See Section 6 for a complete explanation of the uses and applications of operating modes.

Establishing Groups

When dividing outputs into groups, keep these rules in mind:

- Output channels are assigned to groups sequentially. Group 0 will begin with Output 0 and include the specified number of outputs; Group 1 will begin with the next output and continue sequentially for its specified number of outputs; and so on. The last group will automatically include all of the remaining outputs.
- You can establish as many as six groups or as few as one.
- Each group can operate in any of the six modes.

Grouping Example 1—All Outputs in One Group

Output Group	Includes Outputs
0	0 thru 31

Grouping Example 2—Two Groups

Output Group	Includes Outputs
0	0 thru 3
1	4 thru 31

Grouping Example 3—Three Groups

Output Group	Includes Outputs
0	0 & 1
1	2 & 3
2	4 thru 31

Also see MAIN SCREEN, GROUP OFFSET, and GRP POS DISP.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

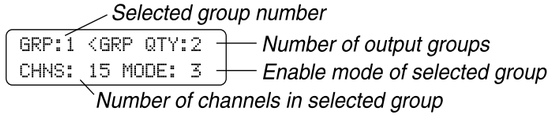
Output Groups

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Group Quantity	M0:S.64	256	R/W*	1-6
Group Position Display	M0:S.65	258	R/W	0=EACH 1=ONE
Logic Inputs Status	M0:S.25	178	R/O	0-255
Group 0 Channel Count	M0:S.66	260	R/W*	0-32
Group 0 Mode	M0:S.82	292	R/W*	0-5
Group 0 Offset	M0:S.74	276	R/W	0 to (Scale Factor-1)
Group 0 Position	M0:S.16	160	R/W*	0 to (Scale Factor-1)
Group 1 Channel Count	M0:S.67	262	R/W*	0-32
Group 1 Mode	M0:S.83	294	R/W*	0-5
Group 1 Offset	M0:S.75	278	R/W	0 to (Scale Factor-1)
Group 1 Position	M0:S.17	162	R/W*	0 to (Scale Factor-1)
Group 2 Channel Count	M0:S.68	264	R/W*	0-32
Group 2 Mode	M0:S.84	296	R/W*	0-5
Group 2 Offset	M0:S.76	280	R/W	0 to (Scale Factor-1)
Group 2 Position	M0:S.18	164	R/W*	0 to (Scale Factor-1)
Group 3 Channel Count	M0:S.69	266	R/W*	0-32
Group 3 Mode	M0:S.85	298	R/W*	0-5
Group 3 Offset	M0:S.77	282	R/W	0 to (Scale Factor-1)
Group 3 Position	M0:S.19	166	R/W*	0 to (Scale Factor-1)
Group 4 Channel Count	M0:S.70	268	R/W*	0-32
Group 4 Mode	M0:S.86	300	R/W*	0-5
Group 4 Offset	M0:S.78	284	R/W	0 to (Scale Factor-1)
Group 4 Position	M0:S.20	168	R/W*	0 to (Scale Factor-1)
Group 5 Channel Count	M0:S.71	270	R/O	0-32
Group 5 Mode	M0:S.87	302	R/W*	0-5
Group 5 Offset	M0:S.79	286	R/W	0 to (Scale Factor-1)
Group 5 Position	M0:S.21	170	R/W* *Not while running	0 to (Scale Factor-1)

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to OUTPUT GROUPS SEL



Begin by moving the cursor to GRP QTY and entering the number of groups desired, followed by ENT (or use the INC/DEC keys).

Next, move the cursor to GRP and enter “0” followed by ENT.

Move the cursor to CHNS and enter the number of output channels to be included in Group 0, followed by ENT (or use the INC/DEC keys).

Move the cursor to MODE and enter the operating mode for the group from zero to five, followed by ENT (or use the INC/DEC keys). See Section 6 for an explanation of the operating characteristics of each mode.

Move the cursor back to GRP and repeat these steps for each group to be programmed.

When output channels are divided into groups, the appearance of the Main Screen will change slightly. See MAIN SCREEN for details.

(continued)

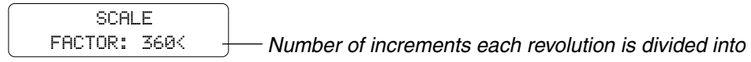
Scale Factor

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Scale Factor	M0:S.32	192	R/W* *Not while running	2-4096

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to SCALE FACTOR SEL



Note: The PS-6400 keypad may time out if there are a large number of pulses when changing scale factor. Do not cycle power during this operation, or data may be lost.

Description

This function controls the number of increments into which one resolver revolution is divided. A scale factor of 360 (0 to 359) allows the controller to operate in degrees. A higher scale factor allows positions to be programmed more accurately. In some applications the scale factor can be set so each increment equals a unit of linear travel.

When the scale factor is changed, all programmed setpoints are recalculated to convert them to the new scale factor. The keypad/display will be inoperative until the calculations are done.

Note: Speed compensation requires time to respond to accelerations, and longer scale factors increase that response time.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Shift Count

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Shift Register Models C02,C03 only				
Program 0 Shift Counts (Channels 0-31)	M0:S.920- M0:S.951	1968- 2030	R/W	0-255
Program 1 Shift Counts (Channels 0-31)	M0:S.952- M0:S.983	2032- 2094	R/W	0-255
Program 2 Shift Counts (Channels 0-31)	M0:S.984- M0:S.1015	2096- 2158	R/W	0-255
Program 3 Shift Counts (Channels 0-31)	M0:S.1016- M0:S.1047	2160- 2222	R/W	0-255
Program 4 Shift Counts (Channels 0-31)	M0:S.1048- M0:S.1079	2224- 2286	R/W	0-255
Program 5 Shift Counts (Channels 0-31)	M0:S.1080- M0:S.1111	2288- 2350	R/W	0-255
Program 6 Shift Counts (Channels 0-31)	M0:S.1112- M0:S.1143	2352- 2414	R/W	0-255
Program 7 Shift Counts (Channels 0-31)	M0:S.1144- M0:S.1175	2416- 2478	R/W	0-255
Program 8 Shift Counts (Channels 0-31)	M0:S.1176- M0:S.1207	2480- 2542	R/W	0-255
Program 9 Shift Counts (Channels 0-31)	M0:S.1208- M0:S.1239	2544- 2606	R/W	0-255
Program 10 Shift Counts (Channels 0-31)	M0:S.1240- M0:S.1271	2608- 2670	R/W	0-255
Program 11 Shift Counts (Channels 0-31)	M0:S.1272- M0:S.1303	2672- 2734	R/W	0-255
Program 12 Shift Counts (Channels 0-31)	M0:S.1304- M0:S.1335	2736- 2798	R/W	0-255
Program 13 Shift Counts (Channels 0-31)	M0:S.1336- M0:S.1367	2800- 2862	R/W	0-255
Program 14 Shift Counts (Channels 0-31)	M0:S.1368- M0:S.1399	2864- 2926	R/W	0-255
Program 15 Shift Counts (Channels 0-31)	M0:S.1400- M0:S.1431	2928- 2990	R/W	0-255
Program 16 Shift Counts (Channels 0-31)	M0:S.1432- M0:S.1463	2992- 3054	R/W	0-255
Program 17 Shift Counts (Channels 0-31)	M0:S.1464- M0:S.1495	3056- 3118	R/W	0-255
Program 18 Shift Counts (Channels 0-31)	M0:S.1496- M0:S.1527	3120- 3182	R/W	0-255
Program 19 Shift Counts (Channels 0-31)	M0:S.1528- M0:S.1559	3184- 3246	R/W	0-255
Program 20 Shift Counts (Channels 0-31)	M0:S.1560- M0:S.1591	3248- 3310	R/W	0-255
Program 21 Shift Counts (Channels 0-31)	M0:S.1592- M0:S.1623	3312- 3374	R/W	0-255
Program 22 Shift Counts (Channels 0-31)	M0:S.1624- M0:S.1655	3376- 3438	R/W	0-255
Program 23 Shift Counts (Channels 0-31)	M0:S.1656- M0:S.1687	3440- 3502	R/W	0-255
Program 24 Shift Counts (Channels 0-31)	M0:S.1688- M0:S.1719	3504- 3566	R/W	0-255

Output Assignment

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
C02,C03 only Output Assignments Outputs 0-5, 1word/output	M0:S.600- M0:S.605	1328- 1338	R/W* Not while running	0-31

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL to INITIAL SETUP SEL ▼ OUTPUT ASSIGN SEL

```
OUTPUT:  0
CHANNEL: 0
```

To select the output to assign or the channel to use for that output, use the numeric keys and ENT, or use the INC and DEC keys.

Description

The Output Assignment screen allows selection of any channel to drive each of the front panel output terminals.

Output Enable ANDing

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Output Enable ANDing Channels 0-31, 1bit/channel	M0:S.272- M0:S.273	672- 674	R/W	0=On 1=Off

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to OUTPUT ENABLE ANDING SEL

```
CHN: 12<
OUTPUT AND: OFF
```

Channel number
Output Enable ANDing: ON or OFF. (Toggle with SEL key)

Select a new channel by pressing INC/DEC, or using the numeric keys followed by ENT. Use the SEL key to toggle ANDing on and off.

Description

Output Enable ANDing allows you to AND any output channels with the Output Enable Signal. A channel ANDed with this signal will be enabled to turn on at its programmed setpoints only while the Output Enable Signal is energized. The signal is the logical OR of bit 7 in the register at address O.S.0 and PS-4108 rack input 7 (or dc input 7 on the front panel of C02/C03 models). Note that if output word 0 is mapped to another register, its value is ignored (set to zero) and the source for this signal is rack (dc input) input 7 alone.

Also see INPUT STATUS.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

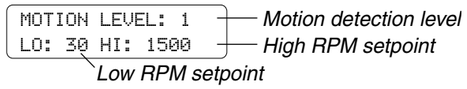
Motion Detection

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Motion Level 1 Low Limit (ML1L)	M0:S.96	320	R/W	0 to (ML1H-1)
Motion Level 1 High Limit (ML1H)	M0:S.97	322	R/W	(ML1L+1) to 3000
Motion Level 2 Low Limit (ML2L)	M0:S.98	324	R/W	0 to (ML2H-1)
Motion Level 2 High Limit (ML2H)	M0:S.99	326	R/W	(ML2L+1) to 3000

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to MOTION DETECT SEL



Use the numeric keys and ENT to change values.

Description

Motion Detection establishes one or two “Motion Detection Levels,” or speed ranges, with low and high RPM values. These two ranges are independent of each other.

Each output channel can be ANDed with either Motion Level. ANDed outputs will be enabled only when the resolver speed is within the specified speed range. Output channels that are not ANDed will be “on” whenever the machine position is within their programmed setpoints, regardless of machine speed. One use of Motion Detection Levels and Motion ANDing is to turn off devices such as glue guns if the machine stops or jams.

The MOTION DETECTION function is used to establish one or two Motion Detection Levels. Once the Motion Detection Levels are programmed, use MOTION ANDING to tie individual output channels to the Motion Detection Levels.

Motion Detector
An output channel can be used as a motion detector by programming it to be on at “1” and off at “1,” and then ANDing it with the desired Motion Detection Level. This will turn the output on constantly as long as the machine speed is within the specified Motion Detection Level range.

Also see MOTION ANDING.

Shift Count (cont’d)

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Program 25 Shift Counts (Channels 0-31)	M0:S.1720-M0:S.1751	3568-3630	R/W	0-255
Program 26 Shift Counts (Channels 0-31)	M0:S.1752-M0:S.1783	3632-3694	R/W	0-255
Program 27 Shift Counts (Channels 0-31)	M0:S.1784-M0:S.1815	3696-3758	R/W	0-255
Program 28 Shift Counts (Channels 0-31)	M0:S.1816-M0:S.1847	3760-3822	R/W	0-255
Program 29 Shift Counts (Channels 0-31)	M0:S.1848-M0:S.1879	3824-3886	R/W	0-255
Program 30 Shift Counts (Channels 0-31)	M0:S.1880-M0:S.1911	3888-3950	R/W	0-255
Program 31 Shift Counts (Channels 0-31)	M0:S.1912-M0:S.1943	3952-4014	R/W	0-255
Program 32 Shift Counts (Channels 0-31)	M0:S.1944-M0:S.1975	4016-4078	R/W	0-255
Program 33 Shift Counts (Channels 0-31)	M0:S.1976-M0:S.2007	4080-4142	R/W	0-255
Program 34 Shift Counts (Channels 0-31)	M0:S.2008-M0:S.2039	4144-4206	R/W	0-255
Program 35 Shift Counts (Channels 0-31)	M0:S.2040-M0:S.2071	4208-4270	R/W	0-255
Program 36 Shift Counts (Channels 0-31)	M0:S.2072-M0:S.2103	4272-4334	R/W	0-255
Program 37 Shift Counts (Channels 0-31)	M0:S.2104-M0:S.2135	4336-4398	R/W	0-255
Program 38 Shift Counts (Channels 0-31)	M0:S.2136-M0:S.2167	4400-4462	R/W	0-255
Program 39 Shift Counts (Channels 0-31)	M0:S.2168-M0:S.2199	4464-4526	R/W	0-255
Program 40 Shift Counts (Channels 0-31)	M0:S.2200-M0:S.2231	4528-4590	R/W	0-255
Program 41 Shift Counts (Channels 0-31)	M0:S.2232-M0:S.2263	4592-4654	R/W	0-255
Program 42 Shift Counts (Channels 0-31)	M0:S.2264-M0:S.2295	4656-4718	R/W	0-255
Program 43 Shift Counts (Channels 0-31)	M0:S.2296-M0:S.2327	4720-4782	R/W	0-255
Program 44 Shift Counts (Channels 0-31)	M0:S.2328-M0:S.2359	4784-4846	R/W	0-255
Program 45 Shift Counts (Channels 0-31)	M0:S.2360-M0:S.2391	4848-4910	R/W	0-255
Program 46 Shift Counts (Channels 0-31)	M0:S.2392-M0:S.2423	4912-4974	R/W	0-255
Program 47 Shift Counts (Channels 0-31)	M0:S.2424-M0:S.2455	4976-5038	R/W	0-255

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Shift Count (cont'd)

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL SHFT COUNT SEL

```
PGM:0 CHN:  1
SHIFT COUNT:  0
```

Output Channel to be ANDed
Shift Count That Will Enable Output Channel

To select the output's channel, program, and shift count, use the numeric keys and ENT, or use the INC and DEC keys.

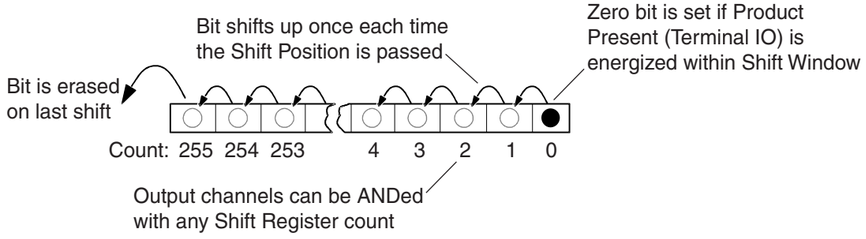
Input Window

A bit is set in Position "0" of the shift register when the Product Present Input (Terminal IO of the pluggable input header) is energized. A Shift Window is provided to limit the portion of revolution during which the signal will be accepted from Terminal IO. A bit is set in the Shift Register only if Terminal IO becomes energized within that window.

Description

The shift register is a form of electronic memory that sets a "bit" in the zero count of the register when a signal is applied to Terminal IO. Afterwards, each time the position passes the point programmed as the SHIFT POSITION, the register "shifts" the bit to the next higher count. The bit passes along the shift register until, on the 256th shift, the bit is erased.

An output channel can be ANDed with any count in the shift register, so that the channel is enabled only when a bit appears in that count. In this way, output channels can be enabled up to 255 revolutions after Terminal IO is energized.



- ANDing an output channel with Count "0" is the same as turning Shift Register ANDing off. The shift register will have no affect on channel operation.
- Any number of output channels can be ANDed to a single shift register count.
- Shift Register ANDing, Input ANDing, and Motion ANDing can be combined for any given output channel.

Model & Options

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Model Options	M0:S.0 M0:S.2	128 132	R/O R/O	1746 0 = Standard, 1 = Shift Register

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to SYSTEM INFO MENU SEL ▼ to MODEL & OPTIONS SEL

```
PL-1746-C02/3-R1
OPTIONS:STD
```

Description

This screen displays the model type and the options included (designated by letters).

Motion ANDing

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Motion ANDing Channels 0-31, 1word/channel	M0:S.512- M0:S.543	1152- 1214	R/W* Not while running	0=OFF 1=ML1 2=ML2

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to MOTION ANDING SEL

```
    CHN: 12
MOTION AND: L1
```

Channel number
Motion ANDing level: L1, L2, or OFF.
(Toggle with SEL key)

This screen displays the channel number and the motion ANDing limit band for Motion ANDing: L1, L2, or OFF. The channel will not be Motion ANDed if the enable is OFF. Select a new channel by pressing the INC/DEC keys, or through direct numeric entry followed by ENT. Press the SEL key to toggle the ANDing to L1, L2, or OFF.

Description

This function is used to tie the operation of output channels to the motion detection levels programmed through MOTION ANDING LIMIT BANDS. Each output channel may be ANDed with either motion ANDing limit band. If an output is Motion ANDed, it will turn ON only when the resolver RPM is in the range band specified for that motion ANDing limit band, AND the setpoints progammed for that channel are ON.

Operation

- Any number of output channels can be ANDed to a single Motion Detection level.
- Motion ANDing and Output Enable ANDing can be combined for any given output channel.
- When Motion ANDing is activated for a channel, it will apply to that channel in all programs.

Motion Detector

An output channel can be used as a motion detector by programming it to be on at "1" and off at "1," and then ANDing it with the desired Motion Level. This will turn the output on constantly as long as the machine speed is within the specified Motion Level range.

Outputs that must always operate, regardless of machine speed, should **not** be ANDed with a motion ANDing limit band. Also see MOTION DETECTION.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Memory Tests

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to MEMORY TESTS SEL

```
MEMORY TESTS
FCN:----<
```
Enter function here

To perform one of the memory test functions, enter the function number using the numeric keys and press SEL.

Description

This menu selection provides several functions listed below.

Function 7000
Clears all pulses and configuration settings from the controller's EEPROM. After clearing the pulses, the controller will reload the factory default settings.

When the function is complete, the address of the last memory location cleared is displayed. Press ESC to continue.

The PLS will then reset and the PS-6400 keypad will show "EEPROM reset to factory defaults".

Function 7001
Clears all configuration settings from the controller's EEPROM. These include all programming other than pulses. When finished, the controller will reload the factory default settings.

When the function is complete, the address of the last memory location cleared is displayed. Press ESC to continue.

The PLS will then reset and the PS-6400 keypad will show "EEPROM reset to factory defaults".

Function 7002
Clears all pulses from the controller's EEPROM.

When the function is complete, the address of the last memory location cleared is displayed. Press ESC to continue.

Function 7998
Watchdog Timer Test. The "Watchdog Timer" monitors the operation of the controller's microprocessor and shuts the controller down if any internal malfunction is detected. If the Watchdog Timer fails, the controller may continue to operate. However, any subsequent malfunctions or noise-induced irregularities may go undetected, and the controller may begin to operate erratically.

To test the Watchdog Timer, run Function 7998. If the controller's Watchdog Timer is working properly, the controller will reset and the display will show "STATUS WATCHDOG TIMER TIMEOUT". If Function 7998 does not reset the controller, the Watchdog Timer has failed. Replace the controller immediately and return the faulty unit to the factory.

⚠ WARNING

Failure of controller to pass the watchdog timer test can cause erratic operation, resulting in injury and damage to equipment.

Shift Position

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Shift Position	M0:S.917	1962	R/W	0 to (Scale Factor-1)

Screen

Menu Path

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to SHIFT POSITION SEL

```
SHIFT POS:  350
```
Position at which Shift Register will shift.

Use INC and DEC, or the numeric keys and ENT.

Description

The Shift Position is the point in the encoder revolution at which the shift register data shifts. Also see Shift Count and Shift Window.

Shift Register Display

Backplane

Reset the shift register by setting O:S.0/9.

Screens

MAIN SCREEN SEL ▼ to TEST MENU SEL to I/O STATUS MENU SEL ▼ SHIFT REGISTER SEL

```
063 SHFT-REG 000
0000000000000000
```
Shift register contents positions 0-63
16 hexidecimal digits

```
127 SHFT-REG 064
0000000000000000
```
Shift register contents positions 64-127
16 hexidecimal digits

```
191 SHFT-REG 128
0000000000000000
```
Shift register contents positions 128-191
16 hexidecimal digits

```
255 SHFT-REG 192
0000000000000000
```
Shift register contents positions 192-255
16 hexidecimal digits

All four parts of the Shift Register can be viewed by using the left/right arrow keys to change to the next part. Note that the contents of the individual positions cannot be changed.

Description

The Shift Register screen shows the current contents of the Shift Register. To reset all positions in the Shift Register press the CLR key.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Shift Window

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Window On	M0:S.918	1964	R/W	0 to (Scale Factor-1)
Window Width	M0:S.919	1966	R/W	0 to (Scale Factor-1)

Screen

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL SHFT WINDOW SEL

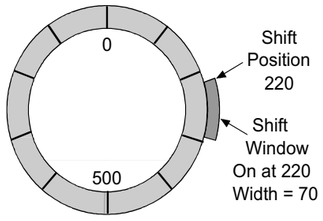
```
SHIFT WINDOW
ON:  0  WT: 0
```
Beginning of window = ON; WT is the width (size)

Use numeric entry, followed by ENT, to change ON and WT.

Description

The point in a revolution at which Terminal IO of the pluggable input header enters a bit into bit 0 of the Shift Register is programmed through the Shift Window screen. When programming Shift Position and the Shift Window, remember the following:

Don't Place the Shift Position at the Start of the Shift Window



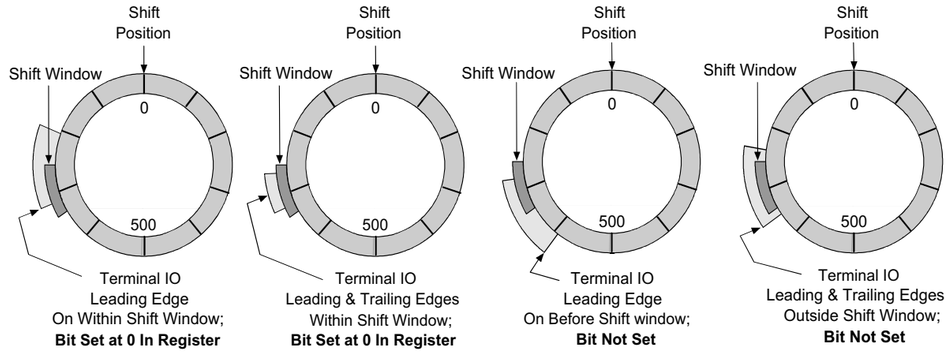
When a pulse starts at the beginning of the Shift Window, as shown here, the pulse will be enabled as soon as a bit is shifted into the programmed shift count.

Although the output will function normally on this revolution, a small output spike may occur on the following revolution as the bit is shifted to the next shift count.

The Product Present input (terminal IO) is rising edge triggered. The leading edge of the signal must appear in the Shift Window for a bit to be set in the Shift Register.

Edge Sensitivity of the Product Present Input

(Shift Window programmed "on" at 650, "width" of 100 in this example; Shift Position = 0)



Main Screen

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Active Program	O:S.1	None	W/O	0-47
Resolver Speed	M0:S.22	1742	R/O	0 to 3000
Machine Offset	M0:S.33	194	R/W* *Not while running	0 to (Scale Factor-1)

Screen

On power-up, or after five minutes of keypad inactivity, the controller will display one of two main screens:

Main Screen— • One Output Group
• Multiple Output Groups, and GRP POS DISP set to "One"

```
PGM: 1 RPM: 1500
MENU<  POS:  180
```
Machine Speed
Machine Position = Resolver Position + Machine Offset

Main Screen— • Multiple Output Groups and GRP POS DISP set to "Each"

```
PGM: 1 RPM: 1500
MENU< GRP1:  180
```
Mode 1 or 2: Position = Preset + change since last reset
Mode 0, 3, 4, 5: Position = Machine Position + Group Offset
Group#: To change, place cursor here and press SEL

Description

Active Program
The PL-1746 can store up to 48 programs of setpoints. The "Active Program" is the program currently controlling the output channels.

If active program at O:S.1 is set to zero, default program is displayed. If active program is not zero, active program is displayed

Machine Speed
When the machine is moving, Machine Speed is displayed in user selectable units of RPM (revolutions per minute), BPM (bags per minute), or CPM (cartons per minute). See RATE SETUP for details.

Group Position
Group Position is displayed only when the resolver speed is below the TOGGLE RPM speed. At higher speeds, Group Position will be blank. See TOGGLE RPM for details.

```
PGM: 1 RPM: 1500
MENU<
```
Machine position not shown above toggle RPM

Menu
To enter the Menu Tree from the Main Screen, move the cursor to "MENU" and press the SEL key.

Also see DEFAULT PROGRAM, RATE SETUP, TOGGLE RPM, GRP POS DISP GROUP OFFSET, and the Positions & Offsets section in Chapter 1.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Machine Offset

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Machine Offset	M0:S.33	194	R/W*	0 to (Scale Factor-1)
Machine Position	M0:S.24	176	R/W*	0 to (Scale Factor-1)
Resolver Position	M0:S.23	174	R/O *Not while running	0 to (Scale Factor-1)

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to MACHINE OFFSET SEL

```
MCHN POS:
MCHN OFST:
```

Use the INC/DEC keys, or the numeric keys followed by ENT to change MACHINE POSITION and/or MACHINE OFFSET.

Description

Because the PL-1746 is a programmable device, it can be set to display a position of "zero" at any point in the machine cycle. Usually, the machine is jogged to the beginning of a cycle, and MACHINE POSITION is set to zero at this point. This function eliminates the need to adjust the physical coupling between the machine and resolver in order to change the displayed machine position. The MACHINE OFFSET can also be set directly by entering it's value.

Set MACHINE POSITION or MACHINE OFFSET before doing any PULSE or GROUP OFFSET programming.

Note: When direction of motion reverses, one circular unit out of 4096 will be skipped. This prevents position transducer jitter.

See Positions & Offsets in Chapter 1.

Shift Window (Cont'd)

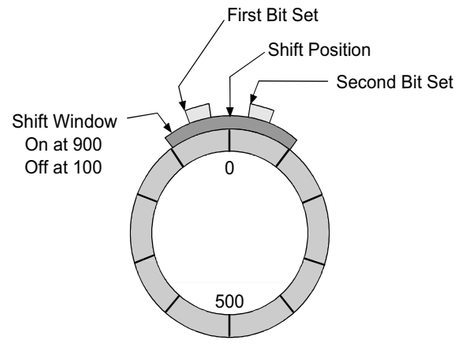
When the Shift Window overlaps the shift position as shown here, two problems may occur.

One Product, Two Bits: Due to variations in conditions, sensors sometimes generate more than one pulse for a product. If the product sensor sends a pulse early in the window, that pulse will shift when the encoder reaches the shift position. If the sensor sends a second pulse for the same product after the shift position, a second bit will be set for the same product.

Inconsistent Timing: Some products may appear early in the Shift Window, while others appear late. For early products, a bit will be set, then immediately shifted at the shift position. For late products, a bit will be set after the shift position, and a full revolution will occur before the bit shifts to 1.

In most applications, programming Shift Window to overlap the Shift Position will cause problems.

Shift Window Overlaps Shift Position—Not Recommended!



Software Version

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Base Revision	M0:S.4	136	R/O	0-32767
Major Revision	M0:S.3	134	R/O	0-32767

Screen

Menu Path

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to SYSTEM INFO SEL ▼ to SOFTWARE VERSION SEL

```
MAJOR REV:1.75
 BASE REV:1.17
```

There are no values that can be changed in this screen.

Description

The Software Version screen displays the revision number of the firmware contained within the controller. This information may be useful if the unit needs to be returned for service.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

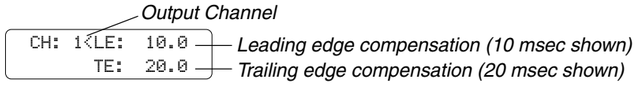
Speed Compensation

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Leading Edge Channels 0-31, 1word/channel	M0:S.384-M0:S.415	896-958	R/W	-999.9 to 999.9
Trailing Edge Channels 0-31, 1word/channel	M0:S.448-M0:S.479	1024-1086	R/W	-999.9 to 999.9

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ SPEED COMP SEL



To change output channels, move the cursor to the channel number and enter a new one. You may also INC or DEC the channel number.

To change speed comp values, use the numeric keys or INC and DEC. To enter tenths of msec, use the decimal point. When entering whole ms values, the decimal point is not needed: “12 ENT” will result in a value of 12.0.

To program negative speed comp, press the +/- key **after** entering a number but **before** pressing ENT. You may also decrement a value below zero.

Note: Speed compensation requires time to respond to accelerations, and large scale factors increase that response time.

Description

Speed Compensation advances or retards selected outputs a specified amount of time at any machine speed.

Some devices such as pneumatic cylinders and glue guns require a fixed amount of time to perform their function. As a machine speeds up, these devices need to be actuated earlier in the cycle in order to complete their action at the required time. Speed compensation automatically advances the pulses of specified output channel(s) as the machine speeds up, maintaining proper synchronization at all speeds. See Chapter 5 for a detailed discussion of speed compensation.

Speed compensation is programmed by entering the response time of the output device in milliseconds (.001sec). The output will always turn on this number of ms before the programmed ON position is reached, and turn off this number of ms before the programmed OFF position is reached. As speed increases, the number of degrees of advance will automatically increase to maintain the number of ms of advance.

Negative Speed Comp
Negative values of speed compensation cause an output channel to lag its programmed machine position by the specified number of msec. See Chapter 5 for details on applying negative speed compensation.

Also see Speed Comp Mode.

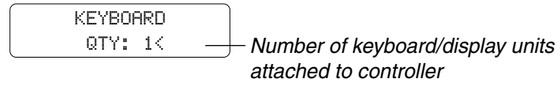
Keyboard Quantity

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Keyboard Quantity	M0:S.48	224	R/W	0-2

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to KEYBOARD QTY SEL



Use numeric entry followed by ENT to change keyboard quantity.

Description

The Keyboard Quantity screen shows the number of keypads communicating with the controller. The controller will attempt to establish communication with as many keypads as are programmed through this screen. Keypads are assumed to be addressed sequentially, starting at address “0”.

Keypad “0”
The keypad with address "0" is used to change the number of keypads shown in KEYBOARD QTY. *If KEYBOARD QTY is set to “2,” but only one keypad is physically connected, Menu Tree operation will be very slow. Change KEYBOARD QTY to “1” to restore normal Menu Tree speed.*

Special conditions that apply when KEYBOARD QTY is set to zero: To improve system performance, the KEYBOARD QTY may be set to zero to stop the keypad communications task in the PL-1746. This provides a slight improvement in scan time, and reduces timing jitter in output pulses. However, the user may wish to regain keyboard communications at some time. This can be accomplished in two slightly different ways:

One way is to program the KEYBOARD QTY variable in the M0 file, M0:S.48. The KEYBOARD QTY variable will be changed immediately, but access to the keyboards will not occur until after the unit is power cycled.

The other way is to install a correctly configured keypad, then cycle power. The PL-1746 will identify the presence of the keypad, and enable communications with it. At this time, the KEYBOARD QTY may be changed to reflect the actual number of keypads.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input Status (cont'd)

Description

The input status screen displays the Logic Inputs status of the group inputs (0-5), first cycle enable (6), and output enable (7).

The SLC-500 writes a "1" to activate an input in the Logic Inputs word (O:S.0).

The Logic Inputs Status Register (M0:S.25) contains the current state of the hardware inputs from the rack OR'ed with the corresponding bits O:S.0, but when O:S.0 is mapped, the Logic Inputs Status Register only contains the bits from the PS-4108 rack or the inputs on the front of the C02/C03.

Interrupt Enable

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Interrupt Enables Channels 0-31, 1bit/channel	M0:S.132- M0:S.133	392- 394	R/W	0=Disabled 1=Enabled

Screen

MAIN SCREEN SEL ▼ to INTERRUPT MENU SEL ▼ to INTERRUPT ENABLE REGS SEL

```
ENABLES 76543210
0-7     00000000
```

Use the SEL key to select a set of eight channels, then the left or right arrow keys to select the enable bit for an individual channel. Use the SEL key to toggle that channel's bit.

Description

Setting a bit to one will enable that channel to cause an interrupt to the SLC-500 ladder program when one active transition occurs. See "INTERRUPT LEVEL" for more information about transitions.

Interrupt Level

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Interrupt Levels Channels 0-31, 1bit/channel	M0:S.128- M0:S.129	384- 386	R/W	0= Rising Edge 1= Falling Edge

Screen

MAIN SCREEN SEL ▼ to INTERRUPT MENU SEL ▼ to INTERRUPT LEVEL REGS SEL

```
LEVELS 76543210
0-7    00000000
```

Use the SEL key to select a set of eight channels, then the left or right arrow keys to select the level bit for an individual channel. Use the SEL key to toggle that channel's bit.

Description

This screen shows which transition of each output channel is selected to generate an interrupt to the SLC-500 ladder program. Setting a bit to zero will select the zero to one transition of the specified output channel. Setting a bit to one will select the one to zero transition of the specified ouput channel.

Speed Comp Mode

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Speed Comp Mode	M0:S.35	198	R/W	0=ONE 1=L/T

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to SPEED COMP MODE SEL

```
SPEED COMP
MODE:ONE
```

Press SEL key to toggle between ONE and L/T. Press ENT to confirm your selection.

Description

Speed Comp Mode determines whether standard or leading/trailing edge speed compensation is in effect. When the Speed Comp Mode is ONE, the same value of speed comp is used for both leading and trailing edges. When the Speed Comp Mode is “L/T”, the leading and trailing edges of a pulse may have different values of speed comp.

Also see SPEED COMPENSATION.

Timed Outputs

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Time (ms) Channels 0-31, 1word/channel	M0:S.320- M0:S.351	768- 830	R/W	0-9999

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to TIMED OUTPUTS SEL

```
CHANNEL:   1
TIME(mS):  20
```

Use numeric entry or INC/DEC to change CHANNEL. Use numeric entry to set TIME in milliseconds.

Description

Any four outputs can be programmed to time out rather than remain on until an OFF setpoint is reached. This makes the output duration constant regardless of machine speed. If the OFF setpoint is reached before the specified time has elapsed, the timing will be aborted and the output will turn off immediately.
Once an output times out, it will not turn on until the next ON setpoint is reached. Each timed output can have a unique time delay length.

A timed output must be programmed with ON and OFF position setpoints in order for output timing to take effect.

If the machine is rotating in the reverse direction, timed outputs will energize when the OFF edge of the pulse occurs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Toggle RPM

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Toggle RPM	M0:S.50	228	R/W	0-9999

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to TOGGLE RPM SEL

```
TOGGLE
RPM:  50
```

Use the numeric keys and ENT to enter a new value, or use INC and DEC to change an existing value.

Description

Toggle RPM is the resolver speed at which the Position display on the Main Screen will disappear. At speeds below the Toggle RPM the Position display will be visible; at speeds above the Toggle RPM the Position will not be shown.

Input Maps

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Input Word 0 Map #	M0:S.208	544	R/W	0-32767
Input Word 1 Map #	M0:S.209	546	R/W	0-32767
Input Word 2 Map #	M0:S.210	548	R/W	0-32767
Input Word 3 Map #	M0:S.211	550	R/W	0-32767
Input Word 4 Map #	M0:S.212	552	R/W	0-32767
Input Word 5 Map #	M0:S.213	554	R/W	0-32767
Input Word 6 Map #	M0:S.214	556	R/W	0-32767
Input Word 7 Map #	M0:S.215	558	R/W	0-32767

Screen

MAIN SCREEN SEL ▼ to MAPPING MENU SEL to INPUT MAP REGS SEL

```
REG#  INPUT MAP#
  0          0
```

Use INC/DEC keys to select the desired mapping register. Use select, then the numeric keypad, to enter the mapping index number followed by the ENT key. See the section on Remote I/O and Register Mapping for more information. These registers allow the user to select M0 or M01 file registers for reading through the eight Input file registers.

Description

This screen displays the input mapping registers. When a mapping index number is placed in one of these registers, the corresponding M0 or M1 register will be mapped into the indicated input file register.

Input Status

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Output Word 0 Logic Inputs	O:S.0	None	W/O	Bit 16-10 Reserved Bit 9 Clear Shift Register (Models C02,C03 only) Bit 8 Clear Error Bit 7 Output Enable Bit 6 First Cycle Enable Bit 5 Group 5 Input Bit 4 Group 4 Input Bit 3 Group 3 Input Bit 2 Group 2 Input Bit 1 Group 1 Input Bit 0 Group 0 Input
Logic Inputs Status	M0:S.25	178	R/O	0-255

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to I/O STATUS SEL ▼ to INPUT STATUS SEL

```
INPUTS 76543210
0-7    00000000
```

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Group Position Display

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Group Position Display	M0:S.65	258	R/W	0=EACH 1=ONE

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to GRP POS DISP SEL

```
GROUP POSITION
DISPLAY: EACH<
```

Group Position Display Mode: EACH = Each output group has its own offset value; ONE = One value of offset is shared by all output groups.

Enter the GRP POS DISP function and press SEL to toggle between "ONE" and "EACH."

- GRP POS DISP must be set to "EACH" to assign different offsets to groups through OFFSET programming.
- If groups have been assigned different offsets through GROUP OFFSET programming, setting GRP POS DISP to "ONE" will immediately change the individual group offsets to the value of Group 0.

The value selected in this screen determines the appearance of the main screen as shown below:

Main Screen— • One Output Group
• Multiple Output Groups, and GRP POS DISP set to "One"

```
PGM: 1 RPM: 1500
MENU< POS:  180
```

Machine Speed
Machine Position = Resolver Position + Machine Offset

Main Screen— • Multiple Output Groups and GRP POS DISP Set to "Each"

IMPORTANT

```
PGM: 1 RPM: 1500
MENU< GRP1:  180
```

Mode 1 or 2: Position = Preset + change since last reset
Mode 0, 3, 4, 5: Position = Machine Position + Group Offset
Group#: To change, place cursor here and press SEL

Description

The Group Position Display determines whether each output group can have its own position in the machine cycle, or if all groups share one position. Because the position of a group operating in Mode 1 or 2 changes each time the group's input terminal is energized, GRP POS DISP must be set to EACH if any groups are assigned to Mode 1 or Mode 2.

Also see GROUP OFFSET, MACHINE OFFSET, OUTPUT GROUPS, and MAIN SCREEN.

Introduction To Speed Compensation

What Is It?

"Speed compensation" refers to the ability of the PL-1746 controller to automatically advance or retard setpoints in any output channel depending on the speed of the machine. Speed compensation allows devices with fixed response times, such as glue guns, to perform their functions with high accuracy over a wide range of machine speeds. Without speed compensation, a glue bead may tend to "drift" out of position as machine speed increases. By properly programming speed compensation for the output channel controlling the glue gun, the glue bead position can be maintained precisely over the complete range of machine speeds.

Benefits

Proper use of speed compensation can provide substantial benefits:

- **Increased Productivity—**If a machine incorporates components with fixed response times, the use of speed compensation can often increase line speeds by as much as 50%.
- **Reduced Scrap Rate—**Speed compensation maintains the accuracy of critical operations such as gluing, thereby reducing rejects, rework, and scrap.
- **Simplified PLC Systems—**Programming speed compensation into standard motion control equipment such as PLC's, stepper motors, and stepper motor controls is difficult. In addition, to perform speed compensation at high machine speeds, the PLC hardware must be extremely fast, and therefore expensive. Integrating a PL-1746 into the control system eliminates the need to write custom PLC speed compensation programming, and provides excellent high speed control at a fraction of the hardware cost.

Fixed Response Times

Electromechanical components of automated systems often have fixed response times regardless of the line speed. For example, a glue gun may require ten milliseconds from the time the gun is actuated to the time that glue begins flowing. At the slowest line speed, the gun might need to be triggered when the carton is one inch away, so that the carton arrives under the gun just as glue begins flowing. As the line speed increases and the product travels faster, the lead distance from the carton to the gun must increase in order for the gun, with its fixed response time, to still hit the correct spot on the product. By programming speed compensation into the PL-1746, the timing of glue guns and similar mechanisms can be automatically advanced as speed increases, maintaining proper operation over a wide range of machine speeds.

Standard Speed Compensation

Example

The illustration on page 5-2 shows a simple carton gluing application. A conveyor moves cartons under a glue gun which releases glue onto the flaps. The conveyor is connected through a timing chain and sprocket to a transducer which rotates one revolution for each carton that passes under the gun.

As the transducer dial shows, SHAFT POSITION has been programmed so that the leading edge of the box passes under the gun at 110° and the trailing edge at 360°. Glue begins flowing ten msec after the gun is energized, and it stops flowing ten msec after the gun is de-energized. Once the glue leaves the nozzle, it requires another five msec to travel to the carton. Combining the glue gun response time with the travel time results in a system response time of 15 msec, regardless of line speed.

At very slow, or essentially zero speed, the gun would be energized at a transducer position of 110° and de-energized at 360°. As the line speed increases, however, the gun needs to be energized before 110° to allow the glue to hit the carton in the correct spot. The faster the line speed, the earlier in the transducer cycle the gun must be triggered.

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Standard Speed Compensation (cont'd)

Calculation

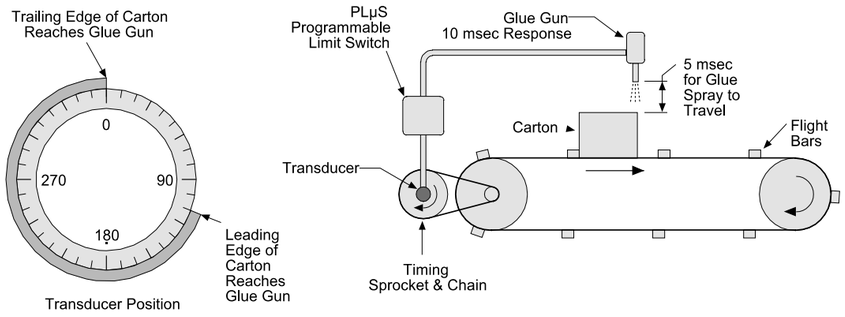
To calculate the amount of speed compensation required, use the following relationships between the transducer's RPM (revolutions per minute) and degrees of rotation:

1 RPM = 360°/min = 6°/sec = 0.006°/msec,

RPM x 0.006 = deg/msec,

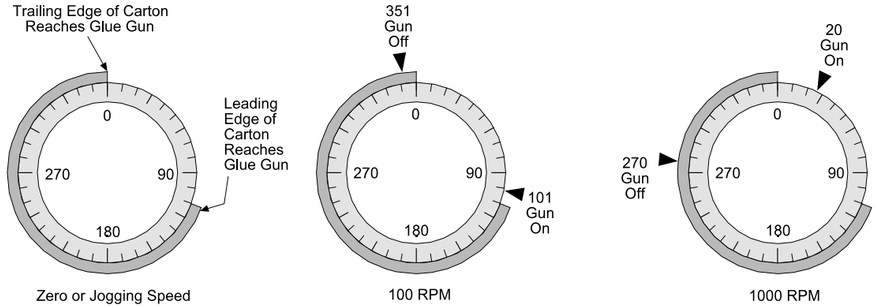
thus: @ 100 RPM, the transducer will rotate 0.6°/msec
@ 1000 RPM, the transducer will rotate 6.0°/msec

Simple Application Using Speed Compensation



In the previous example, the gluing system requires 15 msec from the time the gun is energized to the time the glue hits the carton. At 100 RPM, the transducer will rotate 0.6°/msec. Therefore, in the 15 msec response time, the transducer will rotate (15 msec x 0.6°), or 9°. This means the glue gun must be energized at 101°, which is 9° before the box arrives under the gun, and de-energized at 351°. At 1000 RPM, the transducer will rotate (15 msec x 6°), or 90° during the response time, and the gun must be energized at 20° and de-energized at 270°. These values are visually represented in the illustration below.

Speed Compensation at Various Speeds



Setting Speed Comp

In many applications, speed compensation can be set by jogging the line to determine ON and OFF edges at zero speed, then entering the speed compensation value into the controller. In the previous example, the line would be jogged until the leading edge of the box reaches the gun at 110° of transducer rotation. The glue gun output would be set to turn on at this point. Then, the line would be jogged until the trailing edge is under the gun at 360°, and the glue gun output would be set to turn off.

Once these on and off edges are entered, the glue system response time of 15 msec would be entered through SPEED COMP programming as described in Chapter 4. As line speed increases, the PL-1746 will automatically advance the edges to maintain the accuracy of the glue bead position.

Group Offset (cont'd)

Description

In many machines with rotary motion, it is often necessary to provide some means to adjust the phase or angular position of one shaft with respect to another. This adjustability is usually obtained through the use of timing chains or belts, or possibly clutches, differentials, or couplings. All of these devices allow the position of a driven shaft to be offset from the position of the driving shaft. The PL-1746 has the ability to add offsets to the resolver position. This feature of the PL-1746 allows the user to change the timing of machine functions without incurring the time consuming task of mechanically altering the machine.

The group functions in the PL-1746 work off of machine position (see Positions & Offsets in Chapter 1 for more information). The PL-1746 always has at least one group and may have up to six groups. Each group can be individually offset from the machine position to allow individual functions to be properly timed with respect to the rest of the machine.

When a group is operating in modes 0, 3, 4, or 5, machine offset is entered by the user and remains fixed. The value is also stored in non-volatile memory and so is in effect during subsequent power cycles.

When a group is operating in modes 1 or 2, the user supplies a preset position or offset. When the group enable becomes active, the PL-1746 calculates an offset from the current machine position, such that the group position becomes the preset position. This allows the timing of outputs in groups operating in these modes to be synchronized to machine operations that do not occur at the same time during each machine revolution.

Group Position

Jog the machine to a position that corresponds to the desired group position and enter the group position.

- For standard PL-1746 controllers using Electro Cam resolvers, the ABS value will directly show the relationship between the group position and machine position in scale factor increments. For example, suppose that machine position is at 0 and SCALE FACTOR is set to 360. If the ABS of a group is 20, its position will be 20 degrees.
- If groups have been programmed with their own offsets, changing machine offset will change all of the group positions at once. **It is usually best to set machine offset to the desired zero position in the machine cycle before programming individual group offsets.**
- If groups have been programmed with their own offsets, changing GRP POS DISP to "ONE" will immediately change ABS for all groups to value programmed for Group 0.

Programming Preset

Preset is programmed in scale factor units.

- The **preset** value is stored in the controller on power down. However, the last **group position** is not. On power up, the group position will be the same as machine position. When the group's input terminal is energized, then the group position will reset to the preset value.

Also see MACHINE OFFSET, GRP POS DISP, OUTPUT GROUPS, and Section 6 for details on Output Grouping & Modes.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Group Offset

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Group Quantity	M0:S.64	256	R/W*	1-6
Group Position Display	M0:S.65	258	R/W	0=EACH 1=ONE
Logic Inputs Status	M0:S.25	178	R/O	0-255
Group 0 Channel Count	M0:S.66	260	R/W*	0-32
Group 0 Mode	M0:S.82	292	R/W*	0-5
Group 0 Offset	M0:S.74	276	R/W	0 to (Scale Factor-1)
Group 0 Position	M0:S.16	160	R/W*	0 to (Scale Factor-1)
Group 1 Channel Count	M0:S.67	262	R/W*	0-32
Group 1 Mode	M0:S.83	294	R/W*	0-5
Group 1 Offset	M0:S.75	278	R/W	0 to (Scale Factor-1)
Group 1 Position	M0:S.17	162	R/W*	0 to (Scale Factor-1)
Group 2 Channel Count	M0:S.68	264	R/W*	0-32
Group 2 Mode	M0:S.84	296	R/W*	0-5
Group 2 Offset	M0:S.76	280	R/W	0 to (Scale Factor-1)
Group 2 Position	M0:S.18	164	R/W*	0 to (Scale Factor-1)
Group 3 Channel Count	M0:S.69	266	R/W*	0-32
Group 3 Mode	M0:S.85	298	R/W*	0-5
Group 3 Offset	M0:S.77	282	R/W	0 to (Scale Factor-1)
Group 3 Position	M0:S.19	166	R/W*	0 to (Scale Factor-1)
Group 4 Channel Count	M0:S.70	268	R/W*	0-32
Group 4 Mode	M0:S.86	300	R/W*	0-5
Group 4 Offset	M0:S.78	284	R/W	0 to (Scale Factor-1)
Group 4 Position	M0:S.20	168	R/W*	0 to (Scale Factor-1)
Group 5 Channel Count	M0:S.71	270	R/O	0-32
Group 5 Mode	M0:S.87	302	R/W*	0-5
Group 5 Offset	M0:S.79	286	R/W	0 to (Scale Factor-1)
Group 5 Position	M0:S.21	170	R/W* *Not while running	0 to (Scale Factor-1)

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to INITIAL SETUP SEL ▼ to GROUP OFFSET SEL

GROUP OFFSET Screen—Group Mode 0, 3, 4 or 5

```
GRP:1< POS:   0
       ABS: 132
```

GROUP OFFSET Screen—Group Mode 1 or 2

```
GRP:1< POS: 359
       PRE:  30
```

To change the offset or position for an output group, move the cursor to GRP and then use INC or DEC, or the numeric keypad, followed by ENT to select the group.

Enter the offset by moving the cursor to ABS (or PRE) and entering the value on the numeric keypad, followed by ENT.

Enter the position by moving the cursor to POS and entering the value on the numeric keypad, followed by ENT.

Standard Speed Compensation (cont'd)

IMPORTANT **When setting speed compensation on a system where zero-speed pulses have been established, always adjust the speed compensation value. Do not adjust the individual pulse edges!**

Response Time Unknown

Suppose that in the previous example, the response time was unknown. To set up the machine, jog a carton through the machine and set the glue gun ON and OFF edges as described earlier. Then, estimate a response time and enter it into the controller using the SPEED COMP function described in Chapter 4.

Start the line and run cartons through it at a fixed line speed. Program SPEED COMP to adjust the **speed compensation value** as required for proper gluing. This can be done while the line is in motion. Once programmed, vary the line speed to confirm proper operation at all speeds, and fine tune the SPEED COMP value if necessary.

Can't Be Jogged?

Some machinery can't be jogged to determine ON and OFF edges. To set up this type of equipment, set speed comp to zero, start the line, run cartons through it at a fixed line speed, and set the ON and OFF edges as required for proper gluing. Write them down for reference in the next step.

Next, increase the line speed and adjust the edges to restore proper gluing. You might be tempted to enter a speed compensation value to do this. However, since the edges were adjusted at the first speed with zero compensation, any change in compensation value now will upset the first pair of edges.

Once the second pair of edges is established, compare them to the first pair that you wrote down. Establish a ratio of degrees the edges advance versus the speed as shown in the example below. Convert this ratio to response time and enter it as the speed compensation value.

Since the new speed compensation value will affect the ON and OFF edges already programmed, you will need to start the line one more time and, at a constant speed, adjust the **ON and OFF edges** for proper gluing. Once set, vary the line speed to confirm that the speed compensation value is accurately adjusting the edges over the operating speed range.

Example for Calculating Speed Compensation

	RPM	Glue On	Glue Off	Difference
1st Line Speed:	200	73°	156°	83°
2nd Line Speed:	680	49°	132°	83°

Difference in Position: 73° - 49° = 24°
Difference in Speed: 680 RPM - 200 RPM = 480 RPM

Speed Compensation Value: Divide difference in position by difference in speed:

24°/480 RPM = 0.05° per 1 RPM

Since a shaft at 1 RPM rotates 0.006°/msec, this shaft would require (0.05/0.006), or 8.3 msec to rotate 0.05°. So the correct speed compensation value to enter is 8.3.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Leading/Trailing Edge Speed Compensation

Leading/Trailing

In the previous example, the response time of the glue gun was the same whether turning on or turning off. While this applies to many systems, some devices have different on/off response times. For these devices the Leading/Trailing Edge feature provides the ability to program different speed compensation values for the leading and trailing edges of the pulse driving the device.

Setting Leading/Trailing Speed Comp

If the ON and OFF response times are known, jog the line to determine ON and OFF setpoints at zero speed. Then enter the speed compensation values through SPEED COMP programming, as described in Chapter 4. When programming SPEED COMP, enter the leading edge, or ON response time at the “LE” prompt, and the trailing edge, or OFF response time at the “TE” prompt.

⚠ IMPORTANT

When setting speed compensation on a system where zero-speed edges have been established, always adjust the speed compensation value. Do not adjust the individual pulse edges!

Response Times Unknown

If the response times are unknown, jog the line to determine ON and OFF edges at zero speed. Estimate both ON and OFF response times and enter them through the SPEED COMP function. The leading edge, or “LE” value will control the ON timing, while the trailing edge, or “TE” value will control the OFF timing. Start the line, run product through it at a fixed speed, and adjust each **speed compensation value** as required for proper gluing. This can be done while the line is in motion. Once programmed, vary the line speed to confirm proper operation at all speeds, and fine tune the SPEED COMP values if necessary.

Can’t Be Jogged?

If it is impossible to jog the line, run the line at a fixed speed and set the ON and OFF edges as required with SPEED COMP set to zero for both the leading and trailing edges. Write down the ON and OFF edges.

Next, increase the line speed and adjust the edges to restore proper gluing. You might be tempted to adjust speed comp values to do this. However, since the edges were adjusted at the first speed with zero compensation, any change in compensation value now will upset the first pair of edges.

Once the second pair of edges is established, calculate separate leading and trailing edge speed comp values, as shown in the previous example.

Since the new speed compensation value will affect the ON and OFF edges already programmed, you will need to start the line one more time and, at a constant speed, adjust the **ON and OFF edges** for proper gluing. Once set, vary the line speed to confirm that the speed compensation values are accurately adjusting the edges over the operating speed range.

(Continued)

Enable Options

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Operator Enable Options	M0:S.107	342	R/W	Bit 15-8 Reserved Bit 7 Machine Offset Bit 6 Group Offset Bit 5 Default Program Bit 4 Motion Detect/ANDing Bit 3 Analog Outputs Bit 2 Timed Outputs Bit 1 Speed Comp Bit 0 Pulses

Screen

MAIN SCREEN SEL ▼ to PGM ENABLE MENU SEL ▼ to ENABLE OPTIONS SEL

```
SETPOINTS<
ENABLE: ON
```

Press the Up Cursor and Down Cursor keys to select the function you wish to change. Press the SEL key to turn Operator access ON or OFF.

Description

This screen lists the various items in the SETUP MENU, and allows you to turn Operator access to those items on or off.

⚠ IMPORTANT

Access to the “on” items will be available only for those output channels that have been turned ON in PER CHN ENABLE.

Access can be turned on or off for the following SETUP MENU items:

PULSES	MOTION DETECT
DEFAULT PROGRAM	ANALOG OUTPUTS
SPEED COMP	TIMED OUTPUTS
GROUP OFFSET	MACHINE OFFSET

Also see PER CHN ENABLE.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Enable Codes (cont'd)

Programming Access Levels for Functions

Menu Item Access	PROGRAMMING LEVEL: Normal Display	Operator	Setup	Master
Password	Enter	Enter	Enter	Program
Pulses	View	Program[1]	Program	Program
Function Menu				
Speed Comp	View	Program[1]	Program	Program
Timed Outputs	View	Program[1]	Program	Program
Analog Output	View	Program[1]	Program	Program
Pulse Copy	---	---	Program	Program
Program Copy	---	---	Program	Program
Default Program	View	Program[1]	Program	Program
Channel Copy	---	---	Program	Program
Shift Position	View	Program[1]	Program	Program
Config Menu				
Initial Setup				
Dir of Rotation	---	---	---	Program
Scale Factor	---	---	---	Program
Machine Offset	View	Program[1]	Program	Program
Speed Comp Mode	---	---	---	Program
Motion Detection	View	Program[1]	Program	Program
Motion ANDing	---	---	---	Program
Outp Enable ANDing	---	---	---	Program
Output Groups	---	---	---	Program
Group Position Display	---	---	---	Program
Group Offset	View	Program[1]	Program	Program
Output Assign	---	---	---	Program
Secondary Setup				
Keyboard Qty	---	---	---	Program[2]
Analog Qty	---	---	---	Program
Rack Qty	---	---	---	Program
Resolver Mode	---	---	---	Program
Rate Setup	---	---	---	Program
Toggle RPM	---	---	---	Program
RPM Update Rate	---	---	---	Program
Shift Count	---	---	---	Program
Shift Window	---	---	---	Program
Test Menu				
I/O Status Menu				
Input Status	View	View	View	View
Output Status	View	View	Force	Force
Shift Register	View	View	View	View
System Info Menu				
Pulse Use	View	View	View	View
Software Version	View	View	View	View
Model & Options	View	View	View	View
EEPROM Checksum	View	View	View	View
Heap Status	View	View	View	View
Memory Tests	---	---	---	Run
System Tests				
Program Enable Menu				
Enable Codes	---	---	---	Program
Per Chn Enable	---	---	---	Program
Enable Options				
Pulses ---	---	---	Program	
Speed Comp	---	---	---	Program
Timed Outputs	---	---	---	Program
Analog Output	---	---	---	Program
Motion Detect	---	---	---	Program
Default Program	---	---	---	Program
Group Offset	---	---	---	Program
Machine Offset	---	---	---	Program
Mapping Registers				
Input Maps	---	---	---	Program
Output Maps	---	---	---	Program
Interrupt Menu				
Interrupt Level	---	---	---	Program
Interrupt Enable	---	---	---	Program

[1] Can be programmed only if specified through Per Channel Enable and Enable Options.

[2] Keyboard Quantity can be programmed only through the keypad whose address is "0".

Leading/Trailing Edge Speed Compensation (cont'd)

Example for Calculating Leading and Trailing Edge

	RPM	Glue On	Glue Off	Difference
1st Line Speed:	200	73°	156°	83°
2nd Line Speed:	680	49°	144°	95°

Note that the length of the pulse is 83° at 200 RPM, and 95° at 680 RPM. This means that the leading and trailing edges require different speed compensation values.

Leading Edge:

Difference in Position: 73° - 49° = 24°
Difference in Speed: 680 RPM - 200 RPM = 480 RPM

Speed Compensation Value: Divide difference in position by difference in speed:

24°/480 RPM = 0.05° per 1 RPM

Since a shaft at 1 RPM rotates 0.006°/msec (see page 4-2), this shaft would require (0.05/0.006), or 8.3 msec to rotate 0.05°. So the correct leading edge speed compensation value to enter is 8.3.

Trailing Edge:

Difference in Position: 156° - 144° = 12°
Difference in Speed: 680 RPM - 200 RPM = 480 RPM

Speed Compensation Value: Divide difference in position by difference in speed:

12°/480 RPM = 0.025°/1 RPM

Since a shaft at 1 RPM rotates 0.006°/msec, this shaft would require (0.025/0.006), or 4.2 msec to rotate 0.05°. So the correct trailing edge speed compensation value to enter is 4.2.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Negative Speed Compensation

Negative Speed Comp

Normal speed compensation **advances** the pulse edges in an output channel to compensate for a fixed response time in the device being controlled. In some applications, however, **negative** speed compensation is required to **retard** the edges in an output channel. Negative speed compensation is usually found in two situations:

"Wrap-Up"

As some machines increase in speed, the drive train at some point between the resolver and the product "wraps-up," or shifts with respect to the resolver. If the wrap-up is proportional to machine speed, negative speed compensation can be used to retard an output channel's setpoints from the true resolver position, thus maintaining output accuracy.

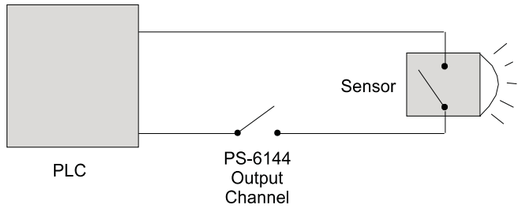
Sensor Lag

While output channels are usually used to switch devices on and off, another use is to "gate" a sensor into a PLC or other computer. The illustration below shows a basic sensor gating scheme. In the illustration, the signal from the sensor reaches the PLC only when the output channel from the PLS is turned on.

Most sensing devices have very fast response times. However, if a sensor's response time is slow, its signal will appear later and later in the machine cycle as the machine speeds up. Eventually, the sensor may lag the resolver so much that its signal fails to appear during the window programmed into the PL-1746's output channel.

Negative speed compensation will correct this problem by causing the output channel to lag its programmed machine position by a specified number of milliseconds. Negative speed compensation is calculated using the same method as standard speed compensation. See SPEED COMP in Chapter 4 for details on programming negative speed comp.

Simple Sensor Gating Scheme



Speed Compensation Guidelines

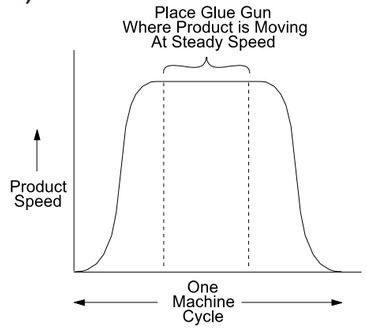
Device Placement

For speed compensation to work most effectively, the device being controlled by the output channel should be located on the machine in a position where the product is moving past the device at a constant speed. The illustration below is an example. In the case of a glue gun, if the gun is ON when the speed is changing, the glue distribution may be inconsistent from carton to carton at varying machine speeds.

Speed Comp & Modes

When using Operating Modes as discussed in Chapter 6, be aware of the effects of speed compensation on the relationship between the pulse edges, the Group Input signal, and the pulse programmed into the Group Channel. **Speed compensation will not affect Group Channels (channels 91-96).**

Product Speed Should be Constant Past Controlled Device



EEPROM Checksum

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
EEPROM Checksum Models C02,C03 only	M0:S.5	138	R/O	-32768 to 32767
EEPROM Checksum Command/Status Models C02,C03 only	M0:S.6	140	R/W	0=Done 1=Execute/Busy

Screen

MAIN SCREEN SEL ▼ to TEST MENU SEL ▼ to SYSTEM INF MENU SEL ▼ to EEPROM CHECKSUM SEL

```
EEPROM CHECKSUM:
          IFC2
```

Description

This feature on the C02/C03 computes a checksum of the contents of all EEPROM (non-volatile memory). To cause the checksum to be computed, first write a 1 to the EEPROM Checksum Command/Status register (M0:S.6). Then wait until that register's contents change back to 0. Finally, read the new checksum from M0:S.5.

Enable Codes

Backplane Information

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Master Password	M0:S.106	340	R/W	0-9999
Setup Password	M0:S.105	338	R/W	0-9999
Operator Password	M0:S.104	336	R/W	0-9999
Per-Channel Operator Access Channels 0-31, 1 bit/channel	M0:S.280- M0:S.281	688- 690	R/W	0=Operator Accessible 1=Operator Inaccessible

Screen

MAIN SCREEN SEL ▼ to PGM ENABLE MENU SEL to ENABLE CODES SEL

```
LEVEL: OPERATOR
PASSWORD: 1234
```

Use the SEL key to toggle between enable levels. Use the numeric keys, followed by ENT to assign codes.

Description

This function is used to establish the numbers that will be used as passwords to enable the Operator, Setup, and Master levels.

The PL-1746 has three levels of programming access: Operator, Setup, and Master in order of increasing capabilities. The table on the next page lists the functions that can be programmed under the various levels of access. Programming levels can be activated, or "enabled," by entering a password on the keypad, or by activating Terminals E1 or E2 on the back of the keypad.

- Each programming level can have only one code. That code is stored in the controller and applies to all keypads connected to that controller.
- If a code is entered into a keypad that has a programming enable terminal energized, the access level will be the highest of the two.
- If both keypads in a two-keypad system are enabled, each keypad will operate at the programming level enabled on it. For example, if Operator Level is enabled on Keypad 1, and Setup Level is enabled on Keypad 2, Keypad 1 will operate at the Operator Level and Keypad 2 will operate at the Setup Level.

Also see PER CHN ENABLE, ENABLE OPTIONS, and PASSWORD.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Default Program

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Default Program Models C01, Active Program Models C02, C03	M0:S.120 M0:S.121	368 370	R/W R/W	0-47 0-47

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to DEFAULT PROGRAM SEL

```
DEFAULT PGM: 0
ACTIVE PGM:  0
```

Use the numeric keys and ENT to enter or modify the Default Program.

Description

The Default Program screen displays the current values of the Default Program and the Active Program, and allows the Default Program number to be modified.

The PL-1746 controller can store up to 48 programs in its memory. These programs are selected by either the Default Program register or the lowest six bits of O:S:1. The Active Program is the program that currently controls the output channels.

The following rules determine which program is the Active Program:

Model C01: If the contents of O:S:1 are equal to zero, the Active Program is specified by the Default program register. If O:S:1 does not contain zero, then that is the Active Program number (up to max. value of 47).

Models C02, C03: The active program always directly matches the value entered for the active PGM (M0:S.121).

Direction of Rotation

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Direction of Rotation	M0:S.34	196	R/W* Not while running	0=CCW 1=CW

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL to INITIAL SETUP SEL to DIR OF ROTATION SEL

```
   INCREASING
DIR: CCW
```

Press SEL to toggle the value. The new value will begin flashing. Press the ENT key to confirm your selection.

Description

The Direction of Rotation screen displays the direction of resolver rotation (CW or CCW as viewed from the shaft end) that will cause the position display to increase in value. This is normally set so the position value increases as the machine turns in its forward direction.

Introduction to Groups & Modes - Using External Inputs to Condition PLS Outputs

Background

In many industrial applications, the action of a machine component such as a glue gun, solenoid, or pneumatic cylinder is related to an input signal from a limit switch, sensor, or controller such as a PLC. Input signals are commonly used in two ways:

- **Product Present**

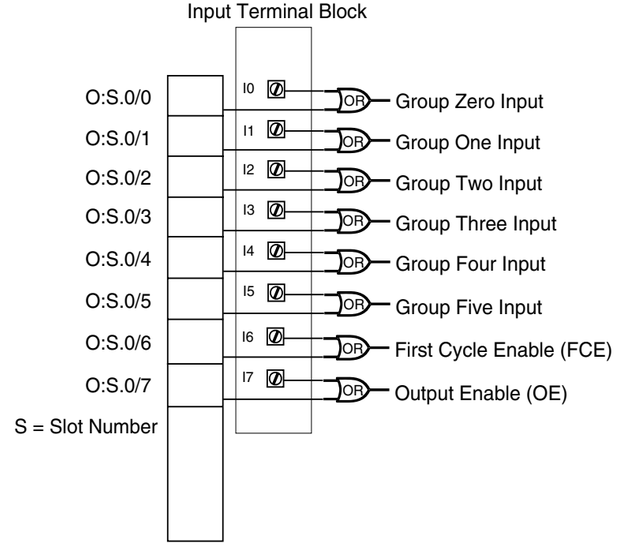
  The device being controlled is allowed to function only if an input signal occurs. A typical example is gluing, where a photoeye senses the presence of a product immediately before gluing should occur. If the product is not present, the glue gun is not enabled to turn on at its programmed setpoints.

- **Register Marks**

  The device being controlled must maintain a certain relationship to other devices on the machine. For example, web converting lines such as disposable diaper machines usually have several machine sections each performing a different operation on a continuous web of material. As line speed increases, the phase relationships between different machine sections are adjusted to compensate for stretching of the web material. To keep a device synchronized within its machine section, a sensor is used to detect a registration mark on a component such as shaft or disk. The sensor signal "resets" the position of the device each revolution, ensuring that the device operates at the correct position on the web of moving material.

Input Signals

When the Output File word 0 (O:S.0) is not mapped, its low byte, containing group inputs, the First Cycle Enable input, and the Output Enable input, is or'ed with the input status terminals, which may be located on a PS-4108 rack (for C01 model) or on the front panel (C02 & C03 models). When the first word of the SLC output file is mapped, the group inputs, FCE and output enable inputs are driven directly strictly be the input terminals.



Groups & Modes

The PL-1746 PLuS Module includes powerful programming capabilities that allow output channels to be linked to input signals from sensors or other devices. Output channels can be divided into as many as six groups, each of which is associated with a group input. Each group can then be assigned to operate in one of six modes which determines the relationship between the channels in the group and the input signals.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Introduction to Groups & Modes (cont'd)

Each group also has an associated Group Channel that is used to signal when group logic should be reset. Group channels are numbered 90 through 95. Pulses are programmed into group channels just as they are programmed into output channels.

Group Programming

Output channels are divided into groups through OUTPUT GROUP programming. When dividing outputs into groups, keep these rules in mind:

- Output channels are assigned to groups sequentially. Group 0 will begin with Output Channel 0 and include the specified number of channels; Group 1 will begin with the next output channel and continue sequentially for its specified number of channels; etc. The last group will automatically include all of the remaining output channels.

Grouping Example 1—All Outputs in One Group

Output Group	Includes Output Channels	Group Input	Group Channel
0	0 thru 31	0	90

Grouping Example 2—Two Groups

Output Group	Includes Output Channels	Group Input	Group Channel
0	0 thru 3	0	90
1	4 thru 31	1	91

Grouping Example 3—Three Groups

Output Group	Includes Output Channels	Group Input	Group Channel
0	0 & 1	0	90
1	2 & 3	1	91
2	4 thru 31	2	92

Mode Assignments

During OUTPUT GROUP programming, each group is assigned any one of six modes of operation that control the interaction between the group, its group input, and its group channel. Detailed discussions of each operating mode follow.

Mode 0 - Straight Cam Logic

Description

Output channels in a group assigned to Mode 0 are not affected by the corresponding input terminal or group channel.

Details

- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a Mode 0 group.
- The machine position for a Mode 0 group can be set through GROUP OFFSET programming, Chapter 4.

Mode 0 Programming

During OUTPUT GROUP programming, group together output channels that should remain unaffected by Modes, and assign them Mode 0.

Channel Copy (cont'd)

Command/Status Register Bits (continued)

M0:S.804/10 Reserved bits error. This bit is set if a one is written to any of the reserved bits.

M0:S.804/11 The Destination Channel error bit is set if the destination channel value is out of the range.

M0:S.804/12 The Source Channel error bit is set if the source channel value is out of the range.

M0:S.804/13 The Destination Program error bit is set if the destination program is out of the range.

M0:S.804/14 The Source Program error bit is set if the source program is out of the range.

M0:S.804/15 The Error bit is set if any of the above error bits is set. This provides a single bit to test for command success/failure. When this bit is set, test the other bits to determine the exact cause.

In the C01 model, all pulses in the destination program and channel will be deleted before any pulses are copied. In the C02 and C03 models, the copy is not permitted unless the destination channel is empty. When the error bit M0:S.804/15 is set, the Command Error bit and the Any Error bit are set in the Programming Error Register (I:S.7). To clear the error condition, toggle the Clear Error bit (O:S.0/8) ON. No additional commands will be accepted until the error bits are cleared.

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to CHANNEL COPY SEL

The Channel Copy function has five screens:

```
SOURCE PGM:---<
```
Program containing channel to be copied from

```
DEST PGM:---<
```
Program containing channel to be copied into

```
SOURCE CHN:---<
```
Channel to be copied from

```
DST CHN:---<
```
Destination channel to be copied into

```
DEST CHN:
      EXECUTE<
```
Move cursor to EXECUTE, then press SEL to copy channel

Use the numeric keys and SEL to enter program numbers. During programming, the cursor keys allow you to move between the screens to allow you to change values before selecting EXECUTE.

Description

Channel Copy allows you to copy all the pulses in the source channel to the destination channel.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Analog Quantity

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Analog Quantity (Real-World Outputs)	M0:S.40	208	R/W R/O	0-2 Model C01 0 Models C02,C03

Screen

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to SECONDARY SETUP SEL ▼ to ANALOG QTY SEL

```
ANALOG
QTY: 1<
```
Number of Analog Outputs

This screen does not appear in C02 or C03 models.

Use the numeric keys to enter the number of analog channels. An analog output module is required to generate an analog output signal.

Description

This screen displays the number of analog outputs that will be programmed into the controller.

The controller can have zero, one or two analog outputs, and each can be offset and scaled by different values. Also see ANALOG OUTPUT.

Channel Copy

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Channel Copy Source Program	M0:S.800	1728	R/W*	0-47
Channel Copy Source Channel	M0:S.802	1732	R/W*	0-31
Channel Copy Destination Program	M0:S.801	1730	R/W*	0-47
Channel Copy Destination Channel	M0:S.803	1734	R/W*	0-31
Channel Copy Command/Status	M0:S.804	1736	R/W* *Not while running	Bit 15 Error Bit 14 Source Pgm Error Bit 13 Dest Pgm Error Bit 12 Source Chn Error Bit 11 Dest Chn Error Bit 10 Reserved Bits Error Bit 9 Dest Chn Not Empty Error Bit 8-1 Reserved Bit 0 Execute/Busy

Command/Status Register Bits

M0:S.804/0 Execute/Busy. Set this bit to execute the channel copy; it remains ON until the copy is complete or an error occurs.

M0:S.804/1-8 Reserved bits. Writing a one to any of these bits will cause a reserved bits error (see M0:S.804/10).

M0:S.804/9 The Destination Channel Not Empty Error Bit is set if the destination channel already contains one or more output pulses. This bit only applies to the C02 and C03 models.

Mode 1 - Reset to Preset Position

Description

Outputs in a group assigned to Mode 1 are always enabled to turn on at their programmed setpoints. However, when the corresponding input terminal is energized, the machine position for the group immediately resets to the preset value programmed through the GROUP OFFSET function. Once the position is reset, the input terminal will have no effect until it is turned off and the resolver reaches the leading edge of a pulse programmed into the corresponding group channel.

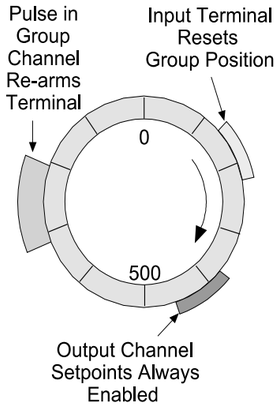
Applications

This mode can be used to automatically adjust phase relationships between machine sections. It can also be used in applications where some machine sections run multiple cycles per resolver revolution.

Details

- The group position resets at the leading edge of the input terminal signal, regardless of how long the terminal is on.
- Once a reset occurs, the input terminal has no effect until it is de-energized and the leading edge of a pulse in the corresponding group channel re-arms the terminal.
- When the position of a group resets, the group channel is affected in the same manner as the output channels.
- On start-up, the input terminal is armed and the group position is the same as the value programmed in MACHINE OFFSET. On power-down, the group's current position setting will be lost.
- If position is increasing as shaft rotates, the "on" edge of the pulse will re-arm the terminal. If position is decreasing as shaft rotates, the "off" edge of the pulse will re-arm the terminal.
- Each program in the controller can have different pulses in its output channels and corresponding group channels.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a group operating in mode 1.

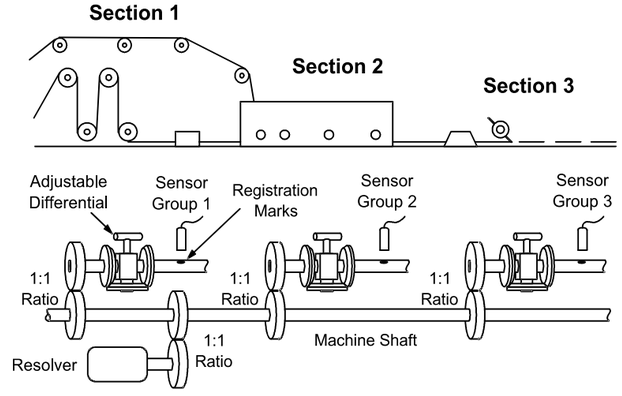
Mode 1 Typical Setup



Mode 1 Example Application

Three sections of an adjustable phase converting machine are controlled by a single PLµS controller and resolver. Groups 1, 2 and 3 all operate in Mode 1. The position of each group is reset to the "preset" value when the group's sensor detects the registration mark on the shaft for the corresponding machine section. This keeps the electrical control signals properly synchronized to the mechanical devices in each section when phase adjustments are made.

One resolver provides the position information needed for all sections of the machine, regardless of their phase relationship.



Mode 1 Programming

1. Program OUTPUT GROUPS to establish groups and modes.
2. Program the preset value for the group using GROUP OFFSET.
3. Jog the machine to the point where the group input terminal will energize. Using this point as a reference, program pulses into the group's output channels.
4. Program a pulse in the group channel.

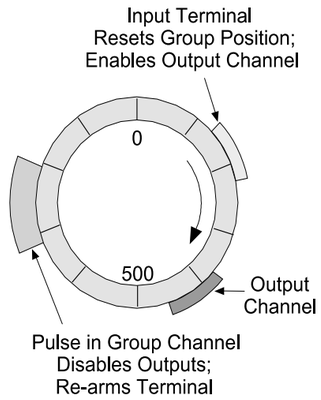
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mode 2 - Reset to Preset Position with One Cycle Enable

Description

Outputs in a Mode 2 group are disabled until the corresponding input terminal is energized. The outputs are then enabled to turn on per their programmed pulses, and the group position immediately resets to the value programmed through the GROUP OFFSET function. The leading edge of a pulse in the corresponding group channel disables the group's outputs and re-arms the input terminal.

Mode 2 Typical Setup



Applications

This mode is used where products may not be evenly spaced and the group outputs should cycle only when a product has been sensed.

Details

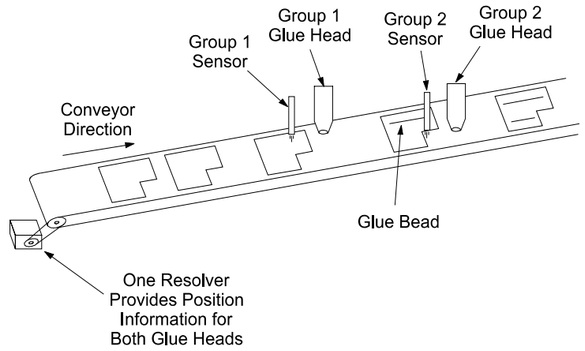
- Outputs are enabled and the group position resets at the leading edge of the input terminal signal, regardless of how long the terminal is on.
- Once a reset occurs, the input terminal has no effect until it is de-energized and the leading edge of a pulse in the corresponding group channel re-arms the terminal.
- When the position of a group resets, group channel is affected in the same manner as the output channels.
- On power-up, outputs are disabled, the input terminal is armed, and the group position is the same as the value programmed in MACHINE OFFSET.
- If position is increasing as shaft rotates, the "on" edge of the pulse will re-arm the terminal. If position is decreasing as shaft rotates, the "off" edge of the pulse will re-arm the terminal.
- Each program in the controller can have different pulses for output channels and group channels.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a group operating in mode 2.

Mode 2 Example Application

Two glue heads at different locations on the conveyor are controlled independently by a single PLuS controller and resolver. The spacing between parts being glued is **random**.

The sensors are connected to the input terminals for the corresponding groups. When a sensor detects a product, it resets the corresponding group's position to the preset values and enables the group's outputs to turn on the glue guns at the correct pulse edges.

When parts are not present, the outputs will be inactive.



Mode 2 Programming

1. Program OUTPUT GROUPS to establish groups and modes.
2. Use GROUP OFFSET to program the preset value for any groups operating in mode 2.
3. Jog the machine to the point where the group input terminal will energize. Using this point as a reference, program pulses into the output channels in the group.
4. Program a pulse in the group channel to disable the output channels and re-arm the input terminal. This pulse must be after all of the output channels have completed their functions, but before the input terminal will be energized.

Analog Output

Backplane

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*
Analog Output 1 Offset	M0:S.41	210	R/W	0-4095
Analog Output 1 High RPM	M0:S.42	212	R/W	0-3000
Analog Output 1 Value	M0:S.43	214	R/O	0-4095
Analog Output 2 Offset	M0:S.44	216	R/W	0-4095
Analog Output 2 High RPM	M0:S.45	218	R/W	0-3000
Analog Output 2 Value	M0:S.46	220	R/O	0-4095

Screen

MAIN SCREEN SEL ▼ to FUNCTION MENU SEL ▼ to ANALOG OUTPUT SEL

```
ANALOG OUTPUT: 1<
OF: 20  HI: 1500
```

Analog Output Number
Analog Output High RPM
Analog Output Offset

To enter an Analog Output number, move the cursor to "Module" and use the numeric keys and ENT.

To program High RPM, move the cursor to "HI" and use the numeric keys and ENT.

To program Analog Output Offset, move the cursor to "OF" and use the numeric keys and ENT.

Description

Analog output signals are linearly proportional to resolver RPM. Two types of analog output modules are available: 0-10 VDC and 4-20 mA.

This function assigns Offset and High RPM values to analog outputs.

- Characteristics can be programmed for Analog Outputs #1 and #2 even if no analog modules are physically installed in the PS-4108 rack.
- Before programming Offset and High RPM for Module #2, be sure the Analog Quantity function is set to 2. Otherwise, programming for Analog Output #2 will not be available.

High RPM

Analog High RPM is the resolver speed at which full scale analog output will occur. It is programmed in whole RPM. When this speed is reached, the analog output signal level will be at full scale (10 VDC or 20 mA). Increasing speed beyond the High RPM will **not** increase the analog output beyond full scale.

Offset

Analog Offset is the analog signal level that will be output when the resolver is at zero RPM. This allows the minimum analog signal to be greater than 0V or 4 mA. Because the analog output has 4096 increments (12 bits) of signal level available, the offset is specified as the number of increments of signal that should be output at zero RPM. Calculate Analog Output Offset values as follows:

For 0-10 VDC: (Minimum Signal/10) x 4096
Example: For a 2 VDC minimum signal; Offset = (2/10) x 4096 = 819

For 4-20 mA: ((Minimum Signal - 4)/16) x 4096
Example: For a 5 mA minimum signal; Offset = ((5-4)/16) x 4096 = 256

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

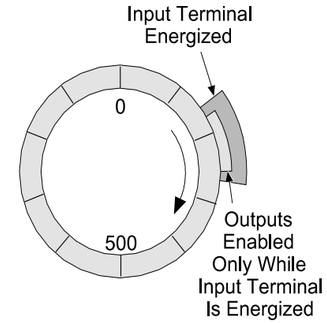
This page intentionally left blank

Mode 3 - Outputs Gated by Group Inputs

Description

Outputs in a group assigned to Mode 3 are on only while their programmed setpoints are on AND the corresponding input terminal is energized. If the input is off, all of the outputs in the group will be off, regardless of setpoint programming.

Mode 3 Typical Setup



Applications

Use this mode where outputs should be active only while a sensor or limit switch is on.

Details

- The group channel for a group operating in Mode 3 has no effect.
- Each program in the controller can have different setpoints for output channels in the group.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a group operating in mode 3.
- The machine position for a group operating in mode 3 can be set through GROUP OFFSET programming.

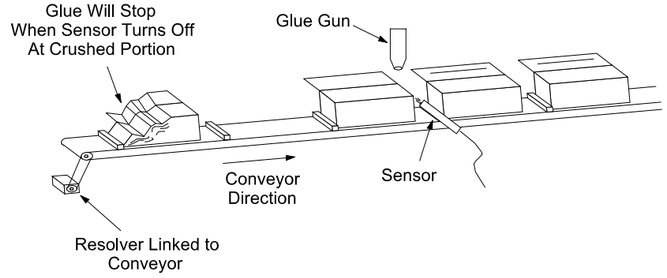
Mode 3 Programming

1. Program OUTPUT GROUPS to establish groups and modes.
2. Use GROUP OFFSET to program the absolute offset value for the group.
3. Program pulses into the output channels in the group.

Mode 3 Example Application

In this illustration the glue head will operate only while the photo eye sees the top edge of a carton. Gluing will stop on crushed or improperly erected cartons when the eye loses sight of the top edge.

Mode 3 operation eliminates the need to hard-wire photoeyes and other sensors in series with the corresponding controller outputs. Instead, the sensor is ANDed with the output through Mode 3 programming.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mode 4 - One Cycle Enable with Edge-Triggered Input

Description

For a group in Mode 4, outputs will be enabled to turn on at their programmed setpoints for one machine cycle if the corresponding input terminal turns on within a pulse programmed into the group channel. Outputs will be disabled at the start of the next pulse in the group channel.

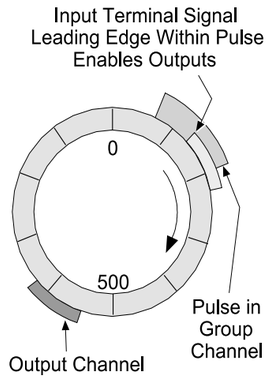
Applications

Use this mode to check the presence and correct positioning of a product before enabling the outputs for this machine cycle.

Details

- The leading edge of the signal from the input terminal must occur during the pulse in the group channel. If the leading edge occurs before or after the pulse, the outputs will not be enabled.
- Each program in the controller can have different pulses for output channels and group channels.
- If the resolver position is increasing as shaft rotates, the ON edge of the pulse will disable the outputs. If the resolver position is decreasing as shaft rotates, the OFF edge of the pulse will disable the outputs.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a group operating in mode 4.
- The machine position for a group operating in mode 4 can be set through GROUP OFFSET programming.

Mode 4 Typical Setup



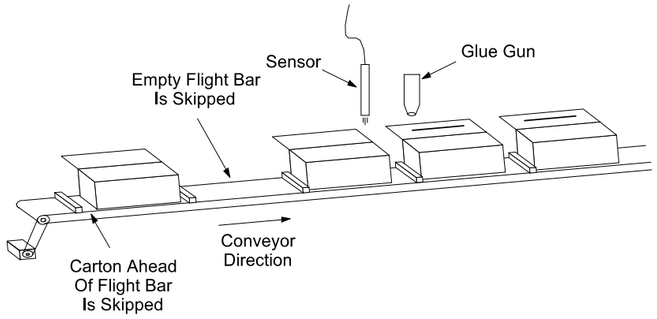
Mode 4 Programming

1. Use OUTPUT GROUPS to establish groups and modes.
2. Use GROUP OFFSET to establish the absolute offset value for any groups operating in mode 4.
3. Jog the machine to the point where the group input terminal will energize. Program a pulse in the group channel that will turn on a little earlier than this point, and off a little later. The shorter the pulse, the narrower the portion of the machine cycle in which the input signal will enable the outputs.
4. Program pulses into the group's output channels. Remember that the leading edge of the pulse in the group channel will disable the output channels in the group.

Mode 4 Example Application

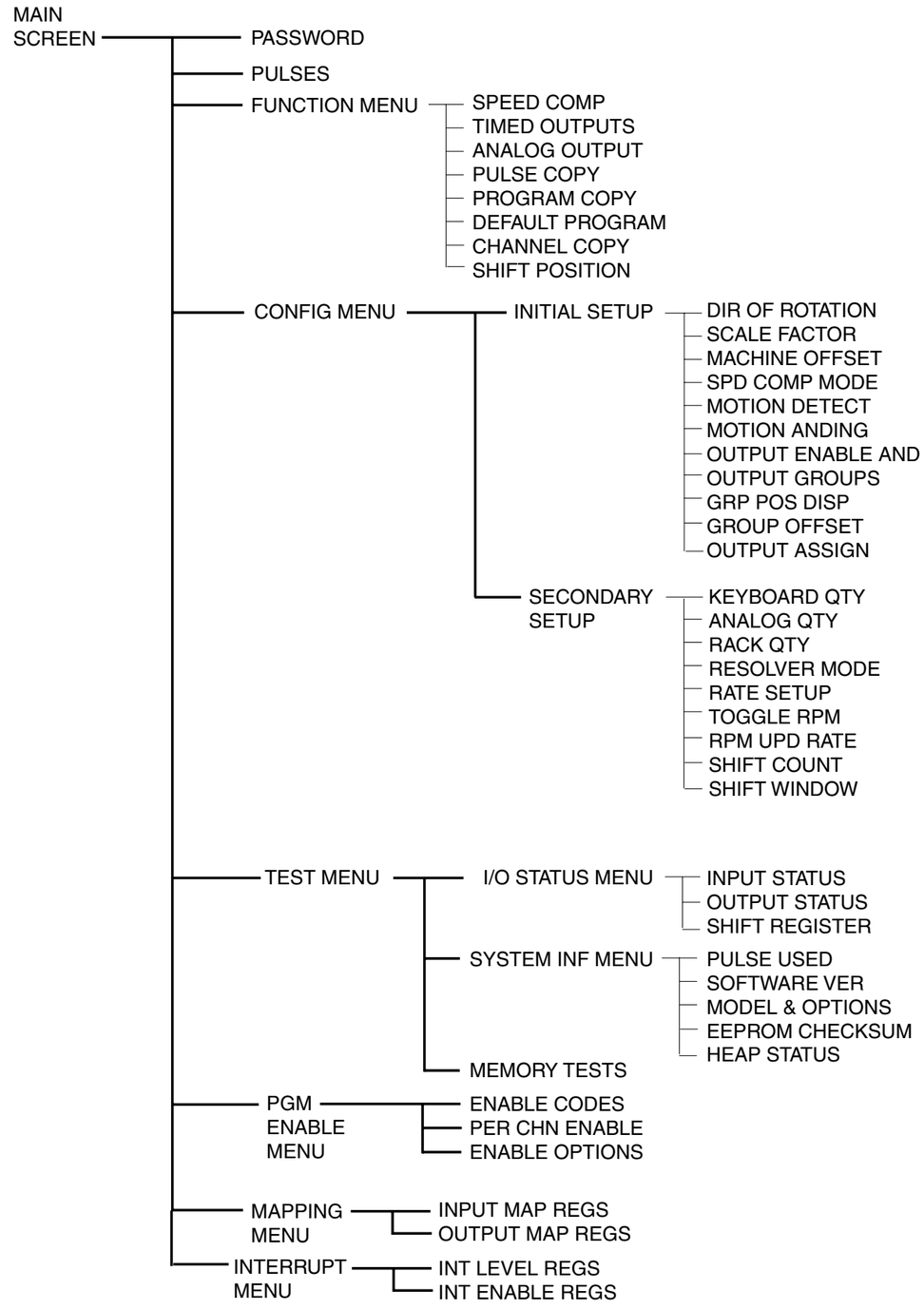
The glue gun will be enabled for one machine cycle only if the sensor detects the leading edge of a carton during the pulse programmed in the group channel. If a carton is missing or incorrectly positioned, the glue gun will not activate.

Mode 4 operation is appropriate for flight bar conveyors, rotary index tables, and similar types of machinery.



Menu Tree

Functions are listed alphabetically in Chapter 4.

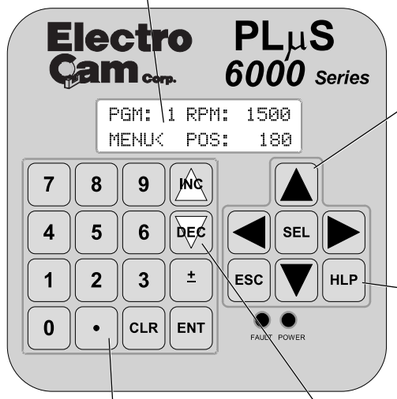


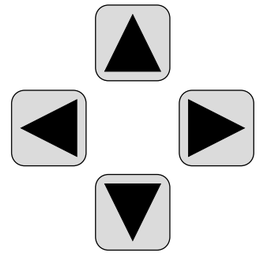
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-6400 Keypad Overview

Main Screen

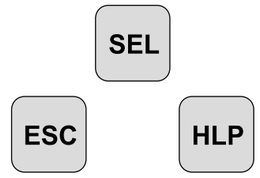
- Shows Active Program, RPM, Position, and Group # (if applicable).
- **See MAIN SCREEN** Section for details.
- **Press SEL key when cursor is on "MENU"** to enter Menu Tree and initiate programming.





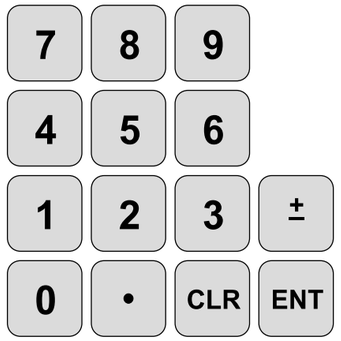
Cursor Keys

- Scroll through Menu Tree.
- Move around **within a screen.**
- Scroll through pulses.



ESC, SEL, HLP Keys

- **ESC** exits from current menu level to previous menu, or aborts numeric entry.
- **SEL** enters a new menu level; toggles a value; and selects an output group if multiple groups are used.
- **HLP** shows help regarding menu selection and what keys to press. **Use this key if unsure what to do.**





INC, DEC Keys

- Increment or decrement a value **within a field.**
- Hold for rapid scrolling of value.

Numeric Keys

- Input numeric values within a field.
- **ENT must be pressed to enter the value;** entry will flash until ENT is pressed.
- **CLR** will backspace within an entry.
- ± will convert a positive number to a negative number, or vice versa.

Mode 5 - One Cycle Enable with Level-Triggered Input and First Cycle Enable

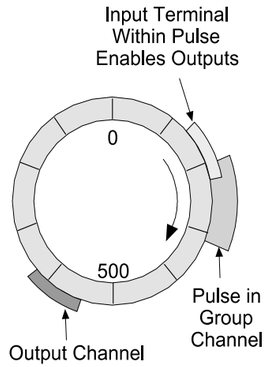
Description

Mode 5 operation is similar to Mode 4 operation, with the following differences:

- In Mode 4, the **leading edge** of the input terminal signal must occur within the pulse programmed into the group channel.

  In Mode 5, the group outputs will be enabled if **any portion** of the input signal occurs within the pulse.
- If the machine stops, the group outputs will be disabled immediately. This prevents an operation such as gluing from continuing if the machine stops while the glue gun is on.
- If the machine is stopped and the group's input terminal is ON, energizing the First Cycle Enable terminal will re-enable the outputs. This allows the operation to be completed on a product that was in process when the machine stopped.

Mode 5 Typical Setup



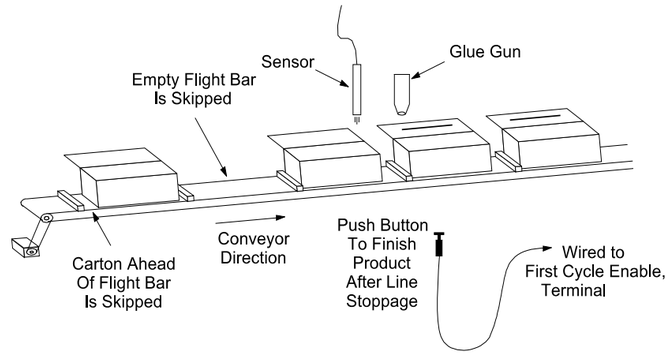
Details

- Regardless of its programmed OFF point, the pulse in the group channel will end as soon as any of the outputs in the group turn on.
- Each program in the controller can have different setpoints for output channels and group channels.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs operating in mode 5. Use MOTION ANDING to prevent the First Cycle Enable terminal from re-activating the outputs while the machine is stopped.
- The machine position for a group operating in mode 5 can be set through GROUP OFFSET programming.

Mode 5 Example Application

The glue gun will be enabled for one machine cycle if the sensor sees a carton during the pulse programmed into the group channel. If a carton is missing, the glue gun will not activate.

If the line stops, the glue gun will be disabled immediately. To re-enable the glue gun on the same machine cycle, depress the push button while the product sensor is ON.



(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mode 5 - One Cycle Enable with Level-Triggered Input and First Cycle Enable

Mode 5 Programming

1. Use OUTPUT GROUPS to establish groups and modes.
2. Use GROUP OFFSET to program the absolute offset value for any groups operating in mode 5.
3. Jog the machine to the point where the group input terminal will energize. Program a pulse in the group channel that will be on during any portion of the input terminal signal. The smaller the overlap between the input signal and the group channel pulse, the narrower the portion of the machine cycle in which the input signal will enable the outputs.
4. Using the start of the overlap from Step 3 as a reference point, program pulses into the group's output channels. Don't overlap the pulses with the group channel pulse programmed in Step 3.

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
System					
Model	M0:S.0	128	R/O	1746	4-17
Options	M0:S.2	132	R/O	0 = Standard, 1 = Shift Register	4-17
Base Revision	M0:S.4	136	R/O	0-32767	4-43
Major Revision	M0:S.3	134	R/O	0-32767	4-43
Keyboard Quantity	M0:S.48	224	R/W	0-2	4-13
Rack Quantity	M0:S.56	240	R/W	0-2 Model C01 N/A C02, C03 0 Models C02,C03	4-34
Default Program	M0:S.120	368	R/W	0-47 Models C01	4-4
Active Program	M0:S.121	370	R/W	0-47 Models C02, C03	4-4
EEPROM Checksum Models C02,C03 only	M0:S.5	138	R/O	-32768 to 32767	4-5
EEPROM Checksum Command/Status Models C02,C03 only	M0:S.6	140	R/W	0=Done 1=Execute/Busy	4-5
Output Quantity	M0:S.1	130	R/O	32	
Pulses Total (C01)	M0:S.26	180	R/O	1252 Units without Shift Register (no -S in model #) 787 Units with Shift Register (-S in model #)	4-29
Pulses Total (C02, C03)	M0:S.26	180	R/O	1250 Units without Shift Register (no -S in model #) 785 Units with Shift Register (-S in model #)	4-29
Pulses Used	M0:S.27	182	R/O	0 to Pulses Total	4-29
Backplane Interlock	M0:S.866	1860	R/W	0=Done 1=Execute/Busy	3-1
Timed Outputs					
Time (ms) Channels 0-31, 1word/channel	M0:S.320- M0:S.351	768- 830	R/W	0-9999	4-45

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Program 25 Shift Counts (Channels 0-31)	M0:S.1720-M0:S.1751	3568-3630	R/W	0-255	4-39
Program 26 Shift Counts (Channels 0-31)	M0:S.1752-M0:S.1783	3632-3694	R/W	0-255	4-39
Program 27 Shift Counts (Channels 0-31)	M0:S.1784-M0:S.1815	3696-3758	R/W	0-255	4-39
Program 28 Shift Counts (Channels 0-31)	M0:S.1816-M0:S.1847	3760-3822	R/W	0-255	4-39
Program 29 Shift Counts (Channels 0-31)	M0:S.1848-M0:S.1879	3824-3886	R/W	0-255	4-39
Program 30 Shift Counts (Channels 0-31)	M0:S.1880-M0:S.1911	3888-3950	R/W	0-255	4-39
Program 31 Shift Counts (Channels 0-31)	M0:S.1912-M0:S.1943	3952-4014	R/W	0-255	4-39
Program 32 Shift Counts (Channels 0-31)	M0:S.1944-M0:S.1975	4016-4078	R/W	0-255	4-39
Program 33 Shift Counts (Channels 0-31)	M0:S.1976-M0:S.2007	4080-4142	R/W	0-255	4-39
Program 34 Shift Counts (Channels 0-31)	M0:S.2008-M0:S.2039	4144-4206	R/W	0-255	4-39
Program 35 Shift Counts (Channels 0-31)	M0:S.2040-M0:S.2071	4208-4270	R/W	0-255	4-39
Program 36 Shift Counts (Channels 0-31)	M0:S.2072-M0:S.2103	4272-4334	R/W	0-255	4-39
Program 37 Shift Counts (Channels 0-31)	M0:S.2104-M0:S.2135	4336-4398	R/W	0-255	4-39
Program 38 Shift Counts (Channels 0-31)	M0:S.2136-M0:S.2167	4400-4462	R/W	0-255	4-39
Program 39 Shift Counts (Channels 0-31)	M0:S.2168-M0:S.2199	4464-4526	R/W	0-255	4-39
Program 40 Shift Counts (Channels 0-31)	M0:S.2200-M0:S.2231	4528-4590	R/W	0-255	4-39
Program 41 Shift Counts (Channels 0-31)	M0:S.2232-M0:S.2263	4592-4654	R/W	0-255	4-39
Program 42 Shift Counts (Channels 0-31)	M0:S.2264-M0:S.2295	4656-4718	R/W	0-255	4-39
Program 43 Shift Counts (Channels 0-31)	M0:S.2296-M0:S.2327	4720-4782	R/W	0-255	4-39
Program 44 Shift Counts (Channels 0-31)	M0:S.2328-M0:S.2359	4784-4846	R/W	0-255	4-39
Program 45 Shift Counts (Channels 0-31)	M0:S.2360-M0:S.2391	4848-4910	R/W	0-255	4-39
Program 46 Shift Counts (Channels 0-31)	M0:S.2392-M0:S.2423	4912-4974	R/W	0-255	4-39
Program 47 Shift Counts (Channels 0-31)	M0:S.2424-M0:S.2455	4976-5038	R/W	0-255	4-39
Speed Compensation					
Speed Comp Mode	M0:S.35	198	R/W	0=ONE 1=L/T	4-45
Leading Edge Channels 0-31, 1word/channel	M0:S.384-M0:S.415	896-958	R/W	-999.9 to 999.9	4-44
Trailing Edge Channels 0-31, 1word/channel	M0:S.448-M0:S.479	1024-1086	R/W	-999.9 to 999.9	4-44

General Troubleshooting

IMPORTANT The PL-1746 controller, PS-4108 rack, and PS-6400 keypads cannot be repaired in the field. If a unit fails, do not disassemble it. Contact Customer Service

Problem	Possible Solution
Controller & keypad dead	1. Check main fuse. 2. Check power supply to controller.
Keypad dead, but controller LED's are ON	1. Check wiring between keypad and controller.
Keypad Fault LED ON	1. Keypad microprocessor has malfunctioned. Turn the controller off and back on. If the keypad Fault LED does not go off, contact Customer Service.
Menu operation slow on keypad display	1. Check KEYBOARD QTY programming. If it is set for two keypads, but only one is connected, menu operation will be very slow.
Power up is slow	1. When more than one keypad/display is attached to one controller, some power supplies will take longer to come up (i.e., Condor HB24-1.2-A+).
COMM FAILURE—HOST TO KEYBOARD message	1. This message may flash briefly on power-up under normal conditions. 2. If the message persists, check keypad wiring connections at keypad and controller. 3. Check DIP switch settings. 4. While performing processor-intensive programming tasks such as recalculating many setpoints due to a change in SCALE FACTOR, or creating many setpoints through PULSE COPY, the controller may temporarily cease communication with the keypad. Once the calculations are complete, contact will be re-established. Press ESC to clear any remnants of the error message.
Programming functions not accessible	1. Programming is not enabled. See ENABLE CODES for details.
ERROR: RESOLVER NOT CONNECTED message	1. Resolver or resolver cable may have failed. See Resolver Troubleshooting.
ERROR: WD RESET message	1. This indicates that the watchdog timer has timed out. To clear, turn power to keypad OFF and ON. If this doesn't help, keypad is probably defective.
POS (position) moves opposite to machine direction	1. Check INCREASING DIR for the correct direction of rotation. 2. Check resolver wiring.
POS (position) does not match machine position	1. Verify that OFFSET is correct. Once set, the offset value should not change. If it does, check the resolver coupling to be sure it is not loose. Also see Resolver Troubleshooting.
Outputs cycling regularly at incorrect machine positions	1. Check that the correct program number is active. 2. Check the setpoints of the output(s) in question. Also check SPEED COMP settings. 3. Verify that OFFSET is correct.
Erratic Operation	1. Run the Watchdog Timer test described under MEMORY TESTS in the programming section of this manual. 2. See Resolver Troubleshooting.
Analog output not working	1. Check that ANALOG QTY and ANALOG OUTPUT are programmed correctly. 2. Check that analog output module is located in the correct module position. 3. Check correct wiring of analog output. 4. Verify that the load is within specifications for the analog module. 5. Try a different analog output module.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

General Troubleshooting (cont'd)

Problem	Possible Solution
Backplane: Unable to write to the 1746 programming functions in the M:O files	The Programming Error Register (I:S.7) or the Hardware Status/Error Register (I:S.5) may have an error bit set. This will prevent writing any data to the M:O files until the error is cleared. Clear the error by toggling bit O:S.0/8 from a 0 to a 1.

PS-6400 Keypad Troubleshooting

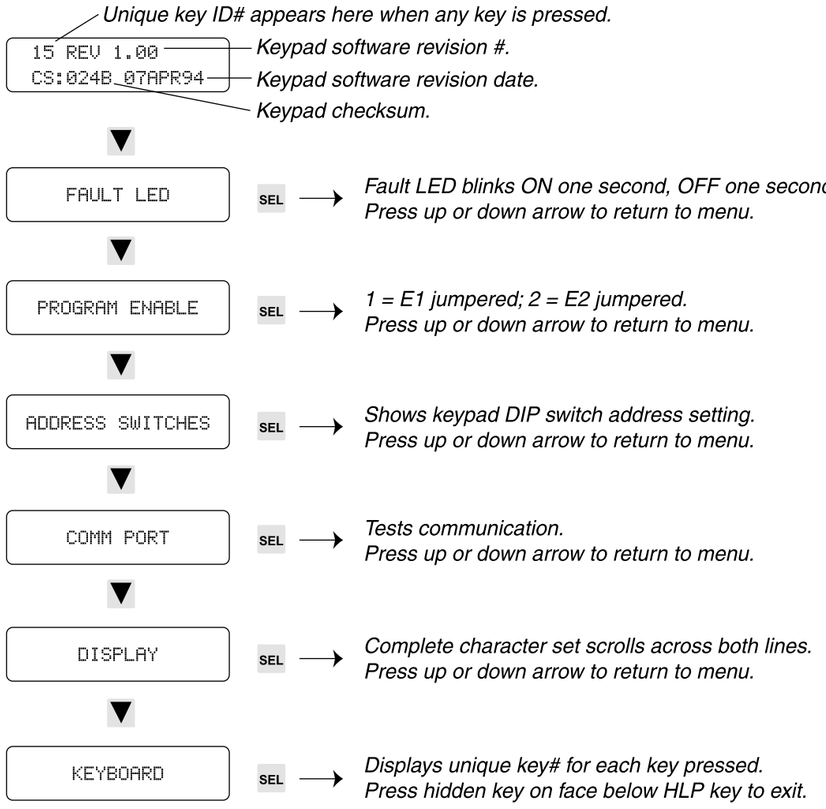
IMPORTANT **The keypad cannot be repaired in the field. If a unit fails, do not disassemble it. Return it to the factory for replacement.**

Keypad Fault LED

If the Fault LED on the keypad lights, turn the controller off and back on. If the keypad Fault LED does not go off, the keypad microprocessor has malfunctioned. Return the keypad to the factory.

Keypad Diagnostics

The keypad includes a series of diagnostics that show the status of various keypad functions. To start the diagnostics, turn the controller off, then restart the controller while pressing any key on the keypad.



Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Shift Register Models C02,C03 only					
Shift Position	M0:S.917	1962	R/W	0 to (Scale Factor-1)	4-39
Window On	M0:S.918	1964	R/W	0 to (Scale Factor-1)	4-39
Window Width	M0:S.919	1966	R/W	0 to (Scale Factor-1)	4-39
Program 0 Shift Counts	M0:S.920-	1968-	R/W	0-255	4-39
(Channels 0-31)	M0:S.951	2030			
Program 1 Shift Counts	M0:S.952-	2032-	R/W	0-255	4-39
(Channels 0-31)	M0:S.983	2094			
Program 2 Shift Counts	M0:S.984-	2096-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1015	2158			
Program 3 Shift Counts	M0:S.1016-	2160-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1047	2222			
Program 4 Shift Counts	M0:S.1048-	2224-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1079	2286			
Program 5 Shift Counts	M0:S.1080-	2288-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1111	2350			
Program 6 Shift Counts	M0:S.1112-	2352-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1143	2414			
Program 7 Shift Counts	M0:S.1144-	2416-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1175	2478			
Program 8 Shift Counts	M0:S.1176-	2480-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1207	2542			
Program 9 Shift Counts	M0:S.1208-	2544-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1239	2606			
Program 10 Shift Counts	M0:S.1240-	2608-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1271	2670			
Program 11 Shift Counts	M0:S.1272-	2672-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1303	2734			
Program 12 Shift Counts	M0:S.1304-	2736-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1335	2798			
Program 13 Shift Counts	M0:S.1336-	2800-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1367	2862			
Program 14 Shift Counts	M0:S.1368-	2864-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1399	2926			
Program 15 Shift Counts	M0:S.1400-	2928-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1431	2990			
Program 16 Shift Counts	M0:S.1432-	2992-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1463	3054			
Program 17 Shift Counts	M0:S.1464-	3056-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1495	3118			
Program 18 Shift Counts	M0:S.1496-	3120-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1527	3182			
Program 19 Shift Counts	M0:S.1528-	3184-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1559	3246			
Program 20 Shift Counts	M0:S.1560-	3248-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1591	3310			
Program 21 Shift Counts	M0:S.1592-	3312-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1623	3374			
Program 22 Shift Counts	M0:S.1624-	3376-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1655	3438			
Program 23 Shift Counts	M0:S.1656-	3440-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1687	3502			
Program 24 Shift Counts	M0:S.1688-	3504-	R/W	0-255	4-39
(Channels 0-31)	M0:S.1719	3566			

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

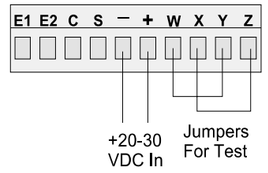
Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
				Commands (bits 4-1): 0000 Read 0001 Write 0010 Increment On 0011 Decrement On 0100 Increment Off 0101 Decrement Off 0110 Increment Both 0111 Decrement Both 1000 Increment All 1001 Decrement All 1010 Change On 1011 Change Off 1100 Reserved 1101 Reserved 1110 Reserved 1111 Reserved	
Pulses (Bulk Pulse Storage in M1 File)					
Pulse Number (P is the Pulse Number.)	M1:S.A where A = 4 ×(P-1)	32768+8 ×(P-1)	R/O	1-1252Models C01 1-787Models C02,C03 Note: A pulse number 0 indicates an invalid pulse.	
Pulse Program/Channel Program in high byte Channel in low byte	M1:S.B where B= 4 ×(P-1)+1	32768+8 ×(P-1)+2	R/O	Program: 0-47 Channel: 0-31	
Pulse On	M1:S.C where C= 4 ×(P-1)+2	32768+8 ×(P-1)+4	R/O	0 to (Scale Factor-1)	
Pulse Off	M1:S.D where D = 4 ×(P-1)+3	32768+8 ×(P-1)+6	R/O	0 to (Scale Factor-1)	
Rate Display					
RPM Update Rate	M0:S.49	226	R/W	0=1/s 1=2/s 2=10/s	4-36
Toggle RPM	M0:S.50	228	R/W	0-9999	4-46
Displayed Units	M0:S.51	230	R/W	0=RPM 1=BPM 2=CPM 3=IPM	4-35
Decimal Point Location	M0:S.52	232	R/W	0-3	4-35
Rate Multiplier	M0:S.53	234	R/W	1-1091	4-35
Rate Divisor	M0:S.54	236	R/W	1-63	4-35
Resolver					
Direction of Rotation	M0:S.34	196	R/W*	0=CCW 1=CW	4-4
Machine Offset	M0:S.33	194	R/W*	0 to (Scale Factor-1)	4-14
Machine Position	M0:S.24	176	R/W*	0 to (Scale Factor-1)	4-14
Resolver Mode	M0:S.60	248	R/W* (-C01) R/O models	0=Master 1=Slave C02,C03, (set via DIP Switch)	4-36
Resolver Position	M0:S.23	174	R/O	0 to (Scale Factor-1)	4-14
Resolver Speed	M0:S.22	172	R/O	0-3000	4-15
Scale Factor	M0:S.32	192	R/W*	2-4096 Resolver-Based Units (-R in model #) 2-4000 Encoder-Based Units (-E in model #)	4-37

PS-6400 Keypad Troubleshooting (cont'd)

Keypad Communications Port Test Setup

Keypad Terminal Block



When the COMM PORT diagnostic is run with keypad terminals W, X, Y, and Z jumpered as shown, a string of “plus” signs will scroll across the display. When either jumper is removed, the scrolling will stop.

Resolver Troubleshooting

Mechanical Problems

If the resolver is generating erratic RPM or position readings, or the position appears to be shifting periodically with respect to the machine cycle, check the mechanical coupling between the resolver and the machine.

If the coupling is not slipping, loosen the coupling and rotate the resolver shaft in both directions with sudden, jerky motions. If the controller displays unusual position or RPM readings, the resolver may be need to be replaced.

IMPORTANT

Resolvers cannot be repaired in the field. If a unit fails, do not disassemble it. Return it to the factory for replacement.

Electrical Problems

If any wire in one of the three individually shielded pairs becomes disconnected, the following error message will appear on the keypad/display:

```
ERROR: RESOLVER
NOT CONNECTED!
```

The output channels will immediately be disabled until the resolver is reconnected. Press ESC to clear the error message.

Note that ESC will clear the message and restore access to keypad programming even if the resolver has not been reconnected.

Follow this procedure to troubleshoot electrical problems:

1. Verify that the electrical connections at each end of the resolver cable are secure.
2. Disconnect the cable at the controller. Measure the resistances between all wires on the terminal block. The paired wires should have the resistances shown in the table below, while the resistance between every other combination of wires should be infinite. If the resistances are correct, the controller may need to be replaced.
3. If the resistances in Step 2 are incorrect, the problem may be in the cable or in the resolver. Disconnect the cable at the resolver and measure the resistances at the resolver pins. If the resistances are correct, the cable is bad. If the resistances are wrong, the resolver should be replaced.

Wire Pair	Resistance	or	Resistance
White/Black	15 to 25 Ohms		60 to 85 Ohms
Red/Black	20 to 40 Ohms		135 to 185 Ohms
Green/Black	20 to 40 Ohms		135 to 185 Ohms

Note: The resolver resistance will fall into one set of ranges or the other, depending on the date of manufacture.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108 Rack Troubleshooting

Problem	Possible Solutions
A digital output does not operate	1. Verify correct wiring from the output to the load. 2. Verify that the LED on the solid state relay lights at the correct times. 3. Verify that the channel's status, as viewed on the PS-6400 Keypad/Display's I/O status screen, operates correctly. 4. Verify that the setpoint programming in the PL-1746 is correct. 5. Check for other programming such as timed outputs, group and mode logic, and enable windows (9x channels) in the PL-1746 that can inhibit outputs. 6. Verify that the relay's fuse is operational using the on-board fuse tester. 7. Replace the solid state relay with a known good relay. 8. Check the RUNNING (green) LED (D12). It should be continuously lit. 9. Check the COMMUNICATIONS (yellow) LED (D11). It should be continuously lit. 10. Verify that the PL-1746 module is operating correctly. If not, see the PL-1746 troubleshooting guide. 11. Verify that the cable connections between PL-1746 module and the PS-4108 racks are correct. 12. Verify that the rack's addressing switches are set correctly. 13. Verify that the rack's termination switches are set correctly. 14. Verify that the rack quantity is set correctly in the PL-1746.
An analog output does not operate	1. Verify correct wiring from the output to the load. 2. Verify that the analog programming in the PL-1746 is correct. 3. Replace the analog module with a known good module. 4. Check the RUNNING (green) LED (D12). If it is dark, go to step 6. 5. Check the COMMUNICATIONS (yellow) LED (D11). It should be continuously lit. 6. Verify that the PL-1746 module is operating correctly. It should be continuously lit. 7. Verify that the cable connections between PL-1746 module and the PS-4108 racks are correct. 8. Verify that the rack's addressing switches are set correctly. 9. Verify that the rack's termination switches are set correctly. 10. Verify that the rack quantity is set correctly in the PL-1746.
An input does not operate	1. Verify correct wiring to the input. 2. Verify that the input's LED is operating correctly. 3. Verify that the input's status, as viewed on the PS-6400 keypad's I/O status screen, operates correctly. 4. Verify the group and mode programming and the enable window programming (9x channels) in the PL-1746. 5. Check the RUNNING (green) LED (D12). It should be continuously lit. 6. Check the COMMUNICATIONS (yellow) LED (D11). It should be continuously lit. 7. Verify that the PL-1746 module is operating correctly. If not, see the PL-1746 troubleshooting guide. 8. Verify that the cable connections between PL-1746 module and the PS-4108 racks are correct. 9. Verify that the rack's addressing switches are set correctly. 10. Verify that the rack's termination switches are set correctly. 11. Verify that the rack quantity is set correctly in the PL-1746.

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Program Enable					
Master Password	M0:S.106	340	R/W	0-9999	4-5
Setup Password	M0:S.105	338	R/W	0-9999	4-5
Operator Password	M0:S.104	336	R/W	0-9999	4-5
Per-Channel Operator Access Channels 0-31, 1 bit/channel	M0:S.280-M0:S.281	688-690	R/W	0=Operator Accessible 1=Operator Inaccessible	4-5
Operator Enable Options	M0:S.107	342	R/W	Bit 15-8 Reserved Bit 7 Machine Offset Bit 6 Group Offset Bit 5 Default Program Bit 4 Motion Detect/ANDing Bit 3 Analog Outputs Bit 2 Timed Outputs Bit 1 Speed Comp Bit 0 Pulses	4-7
Pulse Copy (Creates Pulse Train)					
Pulse Copy Program	M0:S.704	1536	R/W	0-47	4-27
Pulse Copy Channel	M0:S.705	1538	R/W	0-31	4-27
Pulse Copy On (Train Start)	M0:S.706	1540	R/W	0 to (Scale Factor-1)	4-27
Pulse Copy Off (Train End)	M0:S.707	1542	R/W	0 to (Scale Factor-1)	4-27
Pulse Copy Count (Number of Pulses)	M0:S.708	1544	R/W	1 to ((Off-On)/2)	4-27
Pulse Copy Duration (of each pulse)	M0:S.709	1546	R/W	1 to (off-on-count)/count)	4-27
Pulse Copy Command/Status	M0:S.710	1548	R/W*	Bit 15 Error Bit 14 Program Error Bit 13 Channel Error Bit 12 On > Scale Factor Error Bit 11 Off > Scale Factor Error Bit 10 Overlap Error Bit 9 Duration Error Bit 8 Reserved Bits Error Bit 7-1 Reserved Bit 0 Execute/Busy	4-27
Pulse Edit					
Pulse Edit Program	M0:S.896	1920	R/W	0-47	4-30
Pulse Edit Channel	M0:S.897	1922	R/W	0-31	4-30
Pulse Edit On (Leading Edge)	M0:S.898	1924	R/W	0 to Scale Factor	4-30
Pulse Edit Off (Trailing Edge)	M0:S.899	1926	R/W	0 to Scale Factor	4-30
Pulse Edit Pulse Index (within channel)	M0:S.900	1928	R/W	0 to (Pulse Quantity-1)	4-30
Pulse Edit Pulse Quantity (within channel)	M0:S.901	1930	R/O	0 to (Scale Factor/2)	4-30
Pulse Edit Command/Status	M0:S.902	1932	R/W	Bit 15 Error Bit 14 Program Error Bit 13 Channel Error Bit 12 On > Scale Factor Error Bit 11 Off > Scale Factor Error Bit 10 Pulse Index Error Bit 9 Reserved Bits Error Bit 8-5 Reserved Bit 4-1 Command (see below) Bit 0 Execute/Busy	4-30

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Output Word 1	O:S.1	None	W/O	-32768 to 32767	3-1
Output Word 2	O:S.2	None	W/O	-32768 to 32767	3-1
Output Word 3	O:S.3	None	W/O	-32768 to 32767	3-1
Output Word 4	O:S.4	None	W/O	-32768 to 32767	3-1
Output Word 5	O:S.5	None	W/O	-32768 to 32767	3-1
Output Word 6	O:S.6	None	W/O	-32768 to 32767	3-1
Output Word 7	O:S.7	None	W/O	-32768 to 32767	3-1
Output Mapping Registers					
Output Word 0 Map #	M0:S.192	512	R/W	0-32767	3-4, 4-22
Output Word 1 Map #	M0:S.193	514	R/W	0-32767	3-4, 4-22
Output Word 2 Map #	M0:S.194	516	R/W	0-32767	3-4, 4-22
Output Word 3 Map #	M0:S.195	518	R/W	0-32767	3-4, 4-22
Output Word 4 Map #	M0:S.196	520	R/W	0-32767	3-4, 4-22
Output Word 5 Map #	M0:S.197	522	R/W	0-32767	3-4, 4-22
Output Word 6 Map #	M0:S.198	524	R/W	0-32767	3-4, 4-22
Output Word 7 Map #	M0:S.199	526	R/W	0-32767	3-4, 4-22
Output Status					
Force Outputs On Channels 0-31, 1bit/channel	M0:S.256- M0:S.257	640- 642	R/W	1=Force Active 0=Force Inactive	4-23
Force Outputs Off Channels 0-31, 1bit/channel	M0:S.264- M0:S.265	656- 658	R/W	1=Force Active 0=Force Inactive	4-23
Motion ANDing/Detection					
Motion Level 1 Low Limit (ML1L)	M0:S.96	320	R/W	0 to (ML1H-1)	4-18
Motion Level 1 High Limit (ML1H)	M0:S.97	322	R/W	(ML1L+1) to 3000	4-18
Motion Level 2 Low Limit (ML2L)	M0:S.98	324	R/W	0 to (ML2H-1)	4-18
Motion Level 2 High Limit (ML2H)	M0:S.99	326	R/W	(ML2L+1) to 3000	4-18
Motion ANDing Channels 0-31, 1word/channel	M0:S.512- M0:S.543	1152- 1214	R/W*	0=OFF 1=ML1 2=ML2	4-17
Program Copy					
Program Copy Destination Program	M0:S.769	1666	R/W*	0-47	4-25
Program Copy Source Program	M0:S.768	1664	R/W*	0-47	4-25
Program Copy Command/Status	M0:S.770	1668	R/W*	Bit 15 Error Bit 14 Source Pgm Error Bit 13 Dest Pgm Error Bit 12 Reserved Bits Error Bit 11 Dest Pgm Not Empty Error Bit 10-1 Reserved Bit 0 Execute/Busy	4-25

PS-4108 Rack Troubleshooting

Problem	Possible Solutions
An input to an external device that is driven by a digital AC output stays on continuously	1. Verify that the LED on the solid state relay lights at the correct times. 2. Verify that the channel's status, as viewed on the PS-6400 Keypad/Display's I/O status screen, operates correctly. 3. Verify that the setpoint programming in the PL-1746 is correct. 4. Check for other programming such as timed outputs, group and mode logic, and enable windows (9x channels) in the PL-1746 that can inhibit outputs. 5. See if installing a 10k, 5W resistor in parallel with the external device's input corrects the problem. 6. Replace the solid state relay with a known good relay. 7. Contact the factory.
A digital DC output stays on continuously	1. Verify that the LED on the solid state relay lights at the correct times. 2. Verify that the channel's status, as viewed on the PS-6400 keypad's I/O status screen, operates correctly. 3. Verify that the setpoint programming in the PL-1746 is correct. 4. Check for other programming such as timed outputs, group and mode logic, and enable windows (9x channels) in the PL-1746 that can inhibit outputs. 5. Verify correct wiring from the output to the load. Polarity must be observed when wiring DC outputs. 6. Replace the solid state relay with a known good relay. 7. Contact the factory.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Error Messages: PL-1746-C01 Module

IMPORTANT **The module cannot be repaired in the field. If a unit fails, do not disassemble it. Return it to the factory for replacement.**

The PL-1746 major errors will fault the SLC 500 CPU. The following are the error codes displayed on the PL-1746 module and their meanings:

PLS Module Display Readout	RS Logix 500 Major Errors - Troubleshooting	
EX 05 Interrupt from unused vector	S75	Call factory.
EX 06 NMI without PWRFAIL_	S76	Call factory.
EX 07 Resolver not OK	S77	Check resolver wiring.
EX 08 Backplane overflow	S78	Check ladder for too many writes to the M0 or M1 file.
EX 09 SLC interface pipe is full	S79	Call factory.
EX 0A SLC fatal error	S7A	Call factory.
EX 0B SLC access timer time-out	S7B	Call factory.
EX 0C Rack interface time-out	S7C	Check I/O rack configuration and DIP switches.
EX 0D Power supply failed	S7D	Check to see if 24VDC is present on front of module.
EX 0E PS-4108 Rack interface data error	S7E	Check I/O rack configuration and DIP switches.
EX 0F PS-4108 Rack interface time-out and data error	S7F	Check I/O rack configuration and DIP switches.

Error Messages: PL-1746-C02/C03 Module

IMPORTANT **The module cannot be repaired in the field. If a unit fails, do not disassemble it. Return it to the factory for replacement.**

See the Hardware Error Register section for details on error codes and troubleshooting.

Note: The PL-1746-C02/C03 has a green POWER LED, which lights to indicate that the CPU is out of reset, and a yellow FAULT LED.

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Groups					
Group Quantity	M0:S.64	256	R/W*	1-6	4-20
Group Position Display	M0:S.65	258	R/W	0=EACH 1=ONE	4-10
Logic Inputs Status	M0:S.25	178	R/O	0-255	4-11
Group 0 Channel Count	M0:S.66	260	R/W*	0-32	4-20
Group 0 Mode	M0:S.82	292	R/W*	0-5	4-20
Group 0 Offset	M0:S.74	276	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 0 Position	M0:S.16	160	R/W*	0 to (Scale Factor-1)	4-8
Group 1 Channel Count	M0:S.67	262	R/W*	0-32	4-20
Group 1 Mode	M0:S.83	294	R/W*	0-5	4-20
Group 1 Offset	M0:S.75	278	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 1 Position	M0:S.17	162	R/W*	0 to (Scale Factor-1)	4-8
Group 2 Channel Count	M0:S.68	264	R/W*	0-32	4-20
Group 2 Mode	M0:S.84	296	R/W*	0-5	4-20
Group 2 Offset	M0:S.76	280	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 2 Position	M0:S.18	164	R/W*	0 to (Scale Factor-1)	4-8
Group 3 Channel Count	M0:S.69	266	R/W*	0-32	4-20
Group 3 Mode	M0:S.85	298	R/W*	0-5	4-20
Group 3 Offset	M0:S.77	282	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 3 Position	M0:S.19	166	R/W*	0 to (Scale Factor-1)	4-8
Group 4 Channel Count	M0:S.70	268	R/W*	0-32	4-20
Group 4 Mode	M0:S.86	300	R/W*	0-5	4-20
Group 4 Offset	M0:S.78	284	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 4 Position	M0:S.20	168	R/W*	0 to (Scale Factor-1)	4-8
Group 5 Channel Count	M0:S.71	270	R/O	0-32	4-20
Group 5 Mode	M0:S.87	302	R/W*	0-5	4-20
Group 5 Offset	M0:S.79	286	R/W	0 to (Scale Factor-1)	4-8, 4-20
Group 5 Position	M0:S.21	170	R/W*	0 to (Scale Factor-1)	4-8
Output Assignments C02,C03 only					
Output Assignments Outputs 0-5, 1word/output	M0:S.600-M0:S.605	1328-1338	R/W*	0-31	4-19
Output Enable ANDing					
Output Enable ANDing Channels 0-31, 1bit/channel	M0:S.272-M0:S.273	672-674	R/W	0=On 1=Off	4-19
Output File					
Output Word 0 Logic Inputs	O:S.0	None	W/O	Bit 16-10 Reserved Bit 9 Clear Shift Register (Models C02,C03 only) Bit 8 Clear Error Bit 7 Output Enable Bit 6 First Cycle Enable Bit 5 Group 5 Input Bit 4 Group 4 Input Bit 3 Group 3 Input Bit 2 Group 2 Input Bit 1 Group 1 Input Bit 0 Group 0 Input	3-3, 4-11

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Quick Reference

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Input Word 5 Hardware Status/Error Register Models C02,C03 only. If an error occurs in this register, it must be cleared before any further data can be written to the PL-1746 registers. To clear this register, toggle O:S.0/8 from 0 to 1.	I:S.5	None	R/O	Bit 15 Any Error Bit 14 Reserved Bit 13 System Busy Bit 12 Power Supply Failure Bit 11 Queue Overflow Bit 10 SLC Access Timer Timeout Bit 9 SLC Fatal Error Bit 8 Pipe Overflow Bit 7 Backplane Overflow Bit 6 Resolver Failure Bit 5 NMI Without Power Failure Bit 4 Interrupt from Unused Vector Bit 3-0 Reserved	3-3
Input Word 6 Error Number Register	I:S.6	None	R/O	Mapping Index Number associated with error	3-3
Input Word 7 Programming Error Register If an error occurs in this register, it must be cleared before any further data can be written to the PL-1746 registers. To clear this register, toggle O:S.0/8 from 0 to 1.	I:S.7	None	R/O	Bit 15 Any Error Bit 14 Command Bit 13 Read-Only Bit 12 Illegal Data Bit 11 Illegal Function Bit 10 RezeroMode Bit 9 Last Group Quantity Bit 8 Offset Mode Bit 7 Too Many Timers Bit 6 Too Many Speed Comps Bit 5 Not While Running Bit 4 Bad Pulse Values Bit 3 Out of Range Bit 2 Pulse Storage Full Bit 1 No Pulse Bit 0 Pulse Overlap	3-2
Input Word 8 - Raw Resolver Pos Input Word 9 - Machine Pos	I:S.8 I:S.9	None 560	R/O R/O	0-4095 0-4095 Update at the same high rate as the PLS outputs.	3-1 4-14
Input Mapping Registers					
Input Word 0 Map #	M0:S.208	544	R/W	0-32767	4-11
Input Word 1 Map #	M0:S.209	546	R/W	0-32767	4-11
Input Word 2 Map #	M0:S.210	548	R/W	0-32767	4-11
Input Word 3 Map #	M0:S.211	550	R/W	0-32767	4-11
Input Word 4 Map #	M0:S.212	552	R/W	0-32767	4-11
Input Word 5 Map #	M0:S.213	554	R/W	0-32767	4-11
Input Word 6 Map #	M0:S.214	556	R/W	0-32767	4-11
Input Word 7 Map #	M0:S.215	558	R/W	0-32767	4-11
Interrupts					
Interrupt Enables Channels 0-31, 1bit/channel	M0:S.132- M0:S.133	392- 394	R/W	0=Disabled 1=Enabled	4-12
Interrupt Levels Channels 0-31, 1bit/channel	M0:S.128- M0:S.129	384- 386	R/W	0= Rising Edge 1= Falling Edge	4-12

Error Messages: PS-6400 Keypad

The following PL-1746 error messages will assist in troubleshooting:

Error Message:	**Description:**
Comm failure host to keyboard	Occurs when there is a communication time out between keypad/display and controller card. **Solution:** *Press the ESC key to clear the error. If error re-occurs, check connections between keypad and controller.*
Resolver not connected	Bad or no connection to resolver detected. **Solution:** *Press the ESC key to clear the error. Check connections between the resolver and controller.*
Flash checksum error	The system firmware has become corrupted and the system has shut down. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Configuration checksum error	The configuration information is corrupted and default values have been loaded. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Pulse checksum error	The pulse information is corrupted and all pulse data has been cleared. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Rack link failure	Either the communication interface between the controller and the rack has been broken or the rack has failed. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Watchdog timer time-out	The system watchdog timer has timed out and reset the system. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
SLC-500 bus time-out	The SLC-500 backplane bus access timer has timed out. **Solution:** *Press the ESC key to clear the error. If error re-occurs, consult factory.*
Operator enable minimum	There was an attempt to adjust a setting without at least the operator enable hardwire, or password. **Solution:** *Press the ESC key to clear the error. Enter the operator enable code, or add the hardwire.*
Function not enabled for operator use	There was an attempt to adjust a function to which the operator has not been given access. **Solution:** *Press the ESC key to clear the error. Use a higher level of programming enable (setup, master) to access the function. Or have a master set the enable options feature to give the operator access to the function.*
Channel not enabled for operator use	There was an attempt to adjust a channel, at operator level, to which the operator has not been given access. **Solution:** *Press the ESC key to clear the error. Use a higher level of programming enable (setup, master) to access the function. Or have a master set the enable options feature to give the operator access to the function.*
Not allowed while running	There was an attempt to change a programmed item that can only be changed while the transducer is stationary. **Solution:** *Press the ESC key to clear the error. Stop motion of the transducer and change the programmed item.*
No resolver reference	There is no resolver signal present. **Solution:** *Press the ESC key to clear the error. Either make the unit a master or connect a master to it.*

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Error Messages: PS-6400 Keypad (cont'd)

Error Message:	Description:
Too many speed compensated channels	The maximum number of speed compensated channels have already been programmed. **Solution:** *Press ESC key to clear the error.*
Too many timed outputs	The maximum number of timed outputs have been used. **Solution:** *Press ESC key to clear the error.*
A group is in Mode 1 or Mode 2: Can't go to ONE	There are groups that are in modes that affect the offset of the group. Cannot change Group Position Display to ONE offset for all groups. **Solution:** *Press ESC key to clear the error.*
Can't change # of channels in last group	There was an attempt to change the number of channels in the last group. The last group receives all remaining channels available in the controller. **Solution:** *Press ESC key to clear the error.*
Mode cannot be 1 or 2 if Group Position Display in ONE	There was an attempt to set a group to mode 1 or 2 when the Group Position Display is set to ONE. **Solution:** *Press ESC key to clear the error. Change the Group Position Display to "EACH".*
Keypad RS-485 link was broken	Check for Loose Wires. One of the wire connections from the controller to keypad has experienced an intermittent connection or maintained an open connection. **Solution:** *Press ESC key to clear the error. Check to make sure cable connections are securely plugged in. Check wires going into connectors for broken wires or loose connections. Check for continuity between connectors while flexing the cable to check for intermittent connections.*
Too many setpoints	There was an attempt to program in another setpoint after the maximum number of setpoints were already in the controller. **Solution:** *Press ESC key to clear the error.*
Value out of limit	A number was entered that exceeds allowable limits for the item being programmed. Some examples are: A setpoint value that exceeds the scale factor, a channel number that exceeds the number of channels available, a program number higher than is allowed by the controller, etc. **Solution:** *Press ESC key to clear the error and re-enter a value that is within the limits of the parameter.*
Pulse will overlap another pulse in the same channel	There was an attempt to program a pulse that has either an ON or OFF point overlapping an existing pulse in the channel. **Solution:** *Press ESC key to clear the error. Review the existing setpoints to determine the cause of the overlap condition and re-enter values.*
I/O power fail (PL-1746-C01 only)	This indicates that the power supply for the isolated circuitry and rack has failed. **Solution:** *Press ESC key to clear the error. Check power source and connections to I/O rack power input.*
EEPROM reset to factory defaults	The configuration data in the PLS has been reset to factory default values. This happens when the user executes a memory test function 7000 or 7001.

Quick Reference

PL-1746 Quick Reference (Applies to all PL-1746 models, except as noted)

Revised 6-9-00

Notes:

1.I/O Module ID Code: Local = 13235, Remote = 3535

2.M0 file size = 16320. M1 file size = 16380.

3Mapping Index Number for M0 file: (Address * 2) + 128.

4.Registers in the M0 file are not contiguous; space has been left between register groups for future expansion. To maintain future compatibility, SLC programs should not access unlisted registers; writes to these registers result in Illegal Function Errors.

5.In the Read/Write Capability column, R/W means Read/Write, R/O means Read-Only, W/O means Write-Only, and starred items cannot be written while the resolver/encoder is in motion.

PL-1746 Function Name	*SLC 500 File Address*	*Mapping Index Number*	*Read/ Write Capability*	*Valid Range for Data*	*Reference Page*
Analog Outputs					
Analog Quantity	M0:S.40	208	R/W	0-2 Model C01	4-2
(Real-World Outputs)			R/O	0 Models C02,C03	
Analog Output 1 Offset	M0:S.41	210	R/W	0-4095	4-1
Analog Output 1 High RPM	M0:S.42	212	R/W	0-3000	4-1
Analog Output 1 Value	M0:S.43	214	R/O	0-4095	4-1
Analog Output 2 Offset	M0:S.44	216	R/W	0-4095	4-1
Analog Output 2 High RPM	M0:S.45	218	R/W	0-3000	4-1
Analog Output 2 Value	M0:S.46	220	R/O	0-4095	4-1
Channel Copy					
Channel Copy Source Program	M0:S.800	1728	R/W*	0-47	4-2
Channel Copy Source Channel	M0:S.802	1732	R/W*	0-31	4-2
Channel Copy Destination Program	M0:S.801	1730	R/W*	0-47	4-2
Channel Copy Destination Channel	M0:S.803	1734	R/W*	0-31	4-2
Channel Copy Command/Status	M0:S.804	1736	R/W*	Bit 15 Error Bit 14 Source Pgm Error Bit 13 Dest Pgm Error Bit 12 Source Chn Error Bit 11 Dest Chn Error Bit 10 Reserved Bits Error Bit 9 Dest Chn Not Empty Erro Bit 8-1 Reserved Bit 0 Execute/Busy	4-2
Input File					
Input Word 0 PL-1746 Output Channel 0-15 Status, 1bit/channel	I:S.0	None	R/O	0=Off 1=On	4-23
Input Word 1 PL-1746 Output Channel 16-31 Status, 1bit/channel	I:S.1	None	R/O	0=Off 1=On	4-23
Input Word 2	I:S.2	None	R/O	-32768 to 32767	3-1
Input Word 3	I:S.3	None	R/O	-32768 to 32767	3-1
Input Word 4	I:S.4	None	R/O	-32768 to 32767	3-1

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INPUT STATUS REGISTER 0:S.0

0:S.0/15	0:S.0/14	0:S.0/13	0:S.0/12	0:S.0/11	0:S.0/10	0:S.0/9	0:S.0/8
						Clear Shift Reg.	Clear Error

0:S.0/7	0:S.0/6	0:S.0/5	0:S.0/4	0:S.0/3	0:S.0/2	0:S.0/1	0:S.0/0
Output Enable	1st Cycle Enable	Group 5 Input	Group 4 Input	Group 3 Input	Group 2 Input	Group 1 Input	Group 0 Input

For GROUP "X" INPUT and 1ST CYCLE ENABLE see Chapter 6: Groups and Modes.

OUTPUT ENABLE
This input enables Channels that have their output anding enable bit set; those channels will be turned off when this bit is low.

CLEAR ERROR
Toggle this bit ON to clear the "Any Error" bit in the Programming Error Register (I:S.7).

Remote I/O

The Remote I/O feature permits the PL-1746 module to be used in a remote I/O rack with a 1747-ASB RIO adapter module. The RIO adapter permits the SLC processor to access only the Input and Output files of modules installed in the remote rack. To access the PL-1746's M0 file data while in the remote rack:

1. Prior to installing the PL-1746 in the remote rack, and with power off, set DIP switch 1 to OFF.
2. Using Rockwell programming software, set the PL-1746's card type is set to OTHER, with ID# 3535, M0 file length 16320, and M1 file length 16380.
3. Set up the desired input and output file register mappings as described in the Register Mapping section.

M1 File data is not accessible while the PL-1746 is operating in Remote I/O mode.

Register Mapping

Register Mapping provides an automatic way to reflect M0 File or M1 File data into any of the first eight Input File words (I:S.0 - I:S.7) and to reflect data from any of the first eight Output File words (O:S.0 - O:S.7) into the M0 File or M1 File. Register Mapping may be used with the PL-1746 operating in either Local I/O mode or Remote I/O mode; however, M1 Files may not be accessed when the PL-1746 is operating in Remote I/O mode.

To set up a mapping, enter a Mapping Index Number into the Mapping Source register for the desired Input File word or Output File word. This can be accomplished by using a PS-6400 Keypad as described in the Input Maps and Output Maps sections in chapter 4. It can also be done over the backplane, if the PL-1746 is operating in Local I/O mode. It cannot be done over the backplane if the PL-1746 is operating in Remote I/O mode, since, in that case, the RIO adapter prevents access to the PL-1746's M0 File. The Mapping Index Number for each M0 File word and each M1 File word is indicated in the Quick Reference. Entering a value of 0 as a Mapping Index Number causes the Input or Output File word to revert to it's pre-assigned meaning; those meanings are indicated in the Quick Reference.

For example, suppose that, using a PL-1746 in slot 4, it is desirable to work with Analog Output 1 via mapping, rather than than directly through the M0 file. Using the PS-6400 Keypad:

1. **Enter the value 210 as the Output Map # for Reg # 2.**
   This puts the Mapping Index Number for Analog Output 1
   Offset into the Mapping Source Register for Output File word 2 (O:4.2).
2. **Enter the value 212 into the Output Map # for Reg # 3.**
   This puts the Mapping Index Number for Analog Output 1
   High RPM into the Mapping Source Register for Output File word 3 (O:4.3).
3. **Enter the value 214 into the Input Map # for Reg # 2**
   This puts the Mapping Index Number for Analog Output 1
   Value into the Mapping Source Register for Input File word 2 (I:4.2).

The same purpose could be achieved over the backplane:
1. Move the value 210 into M0:4.193.
2. Move the value 212 into M0:4.194.
3. Move the value 214 into M0:4.210.

Now new Offset and High RPM values can be written via the Output File and read the Analog Value via the Input File.

Overview of Utility & Example Ladder Programs

Electro Cam Corp. has developed the following three types of ladder program for use with the PL-1746 products:

Configuration
These programs provide a way to back up PL-1746 configuration data (all data other than pulse data). See descriptions below.

Pulses
These programs provide a way to back up PL-1746 pulse data. See descriptions below.

Example
These programs provide examples of ladder programming for modifying PL-1746 configuration and pulse data while in run mode. These examples can be followed, for example, when making HMIs operate with the PL-1746.

The following chart shows which program sets are used with which PLS models.
Note: A version number, such as 200, may follow the filename and precede the .rss filename extension.

Program Set	PLS Models
C01 Configuration.rss C01 Pulses.rss C01 Example.rss	PL-1746-C01-R1
C02 & C03 Configuration.rss C02 & C03 Pulses.rss C02 & C03 Example.rss	PL-1746-C02-R1 PL-1746-C03-R1 PL-1746-C02-E1 PL-1746-C03-E1
C02 & C03 -S Configuration.rss C02 & C03 -S Pulses.rss C02 & C03 -S Example.rss	PL-1746-C02-R1-S PL-1746-C03-R1-S PL-1746-C02-E1-S PL-1746-C03-E1-S

Note: To obtain copies of RX-Logix programs, please contact Electro Cam Corp. by phone (1-800-228-5487) or email (ecam@electrocam.com).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Configuration.rss

Included with these instructions you will need the RS Logix 500* PLC program C01 Configuration.rss. This program provides a way to read controller configuration from the PL-1746, as well as a configuration storage medium, to use the same configuration for more than one controller. This program is intended for use with RS Logix 500 software, PL-1746 PLµS Plug-In Module, and SLC CPU 5/03 or higher. No input or output cards are necessary for this program to run properly. The only requirement is that the SLC CPU is in Slot 0 and the PL-1746 is in Slot 1 (You must change all addressif module is in another slot).

Prior to downloading and running the program, it must be configured for your setup the same way as described in the C01 Example.rss PLC program initialization. Once the program has been configured and downloaded, use these instructions to assist in setpoint reading and storage. The CDM shown below is the operational interface for setpoint reading and restoration. This program is intended to be used in conjunction with the PLC program C01 Pulses.rss to read all information from the controller.

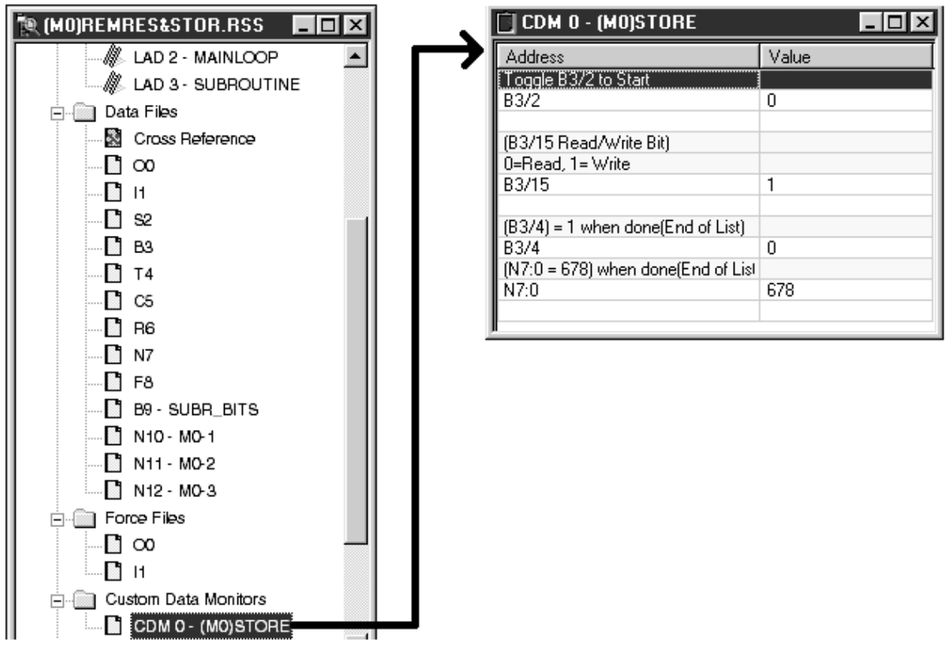
*RS Logix 500 and RS Linx are registered trademarks of Rockwell Software, Inc.

"Read" Configuration from PL-1746 to PLC PROGRAM

To ensure that the configuration information contained in your PL-1746 is not accidentally erased, follow these steps to 'Read' configuration information from the PL1746. The Custom Data Monitor '(M0)STORE' can be thought of as an operational interface between the PL-1746 and your computer, All data files necessary for program operation are available through this CDM.

1. Ensure Key is in the 'PROG' state on your SLC CPU.
2. Set Bit S:2/3 to 'Yes' [otherwise an error will occur]
3. Download C01 Configuration.rss program into you SLC CPU.
4. Set B3/15 to '0' (READ)
5. Turn the SLC CPU keyswitch to 'RUN'.
6. Toggle B3/2 high (set to 1).

Once all of the configuration information has been downloaded from the SLC CPU, B3/2 will toggle back to '0'. To save this information, go to the upper left corner and click 'File', 'Save as'- give the configuration information a name that you choose. Now the configuration can be viewed in the Data Files N10-(M0-1), N11-(M0-2) and N13-(M0-3).



Backplane Programming (cont'd)

ERROR NUMBER REGISTER (I:S.6)

When an error is reported and the Any Error bit in the Programming Error Register is set, the register number of the command that caused the error is placed in the Error Number Register. This register is available from the PL-1746 in it's input file at location I:S.6 (unless I:S.6 is mapped).

HARDWARE ERROR REGISTER (I:S.5) — C02 AND C03 MODELS ONLY

Errors reported in the Hardware Error Register (I:S.5) are in one of two classes: non-fatal (bits 6, 12, 13, and 15) and fatal (all other bits). Fatal errors are those that prevent the PLS from continuing operations. Non-fatal errors are those that do not prevent the PLS from operating but must be corrected before outputs can be exercised in the normal manner. The PLS never directly causes a SLC fault. However, in the case of some fatal errors the fault will occur as a result of the PLS's inability to continue operating. When a fault occurs the PLS turns off its outputs. It shows the relevant error code on the local display (built into the PL-1746). It sets the error-specific bit, along with the Any Error bit, in the Hardware Error Register. To clear this bit the SLC must toggle the Clear Bit (O:S/0/8) high or else the SLC's mode must be toggled to PROG mode and back to RUN mode. If the fault condition remains, it will again be reported in the same manner. If multiple errors occur, their respective error bits accumulate in the Hardware Error Register. In all cases the PLS only updates the Hardware Error Register if it is unmapped. The PLS also reports the error to the remote PS-6400 Keypad/ Display, if any are in use. That error screen can be cleared by pressing the PS-6400's ESC key.

ERROR CODES

The Bit column shows the bit numbers within the Hardware Error Register (I:S.5). Only the C02 and C03 models have this register. The other models are included here for completeness and because the error codes are shown in the local display, preceded by "Ex".

Bit	*Error Code*	*Proposed Manual Description*	*C01*	*C02ES C03ES*	*C02R C03R*	*C02RS C03RS*	*Troubleshooting*
15		Any fault	x	x	x	x	
14	0F	Rack timeout and data error	x	x			Call factory.
		Exceeded configuration limit			x		Call factory.
		Reserved				x	
13	0E	Rack data error	x	x			Call factory.
		Nearing configuration limit			x		Call factory.
		System busy				x	See SYSTEM BUSY BIT section.
		Exceeded configuration limit					Call factory.
12	0D	I/O power supply failed	x	x	x	x	Check 24V on front panel.
11	0C	Rack timeout error	x				Call factory.
		Queue overflow		x	x	x	Call factory.
10	0B	SLC access timer timeout	x	x	x	x	Call factory.
9	0A	Fatal error	x	x	x	x	Call factory.
		Nearing configuration limit					Call factory.
8	09	Pipe overflow	x	x	x	x	Call factory.
7	08	Fifo overflow	x	x	x	x	Check SLC program for excessive writes.
6	07	Resolver not ok	x	x	x	x	Check resolver wiring.
5	06	NMI without power failure	x	x	x		Call factory.
		Reserved				x	
4	05	Illegal interrupt	x	x	x	x	Call factory.
3	04	Startup failed	x	x	x		Call factory.
		Reserved				x	
2	03	Illegal interrupt parameter	x	x	x		Call factory.
		Reserved				x	
1	02	Code checksum failed	x	x	x		Call factory.
		Reserved				x	
0	01	Memory test failed	x	x	x		Call factory.
		Reserved				x	

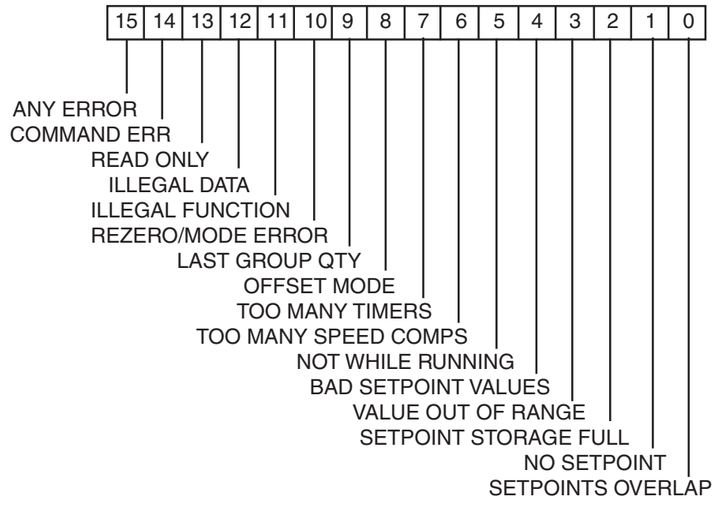
SYSTEM BUSY BIT — C02RS and C03RS MODELS ONLY

The SLC program should assume the C02 is not ready for data whenever the System Busy bit is set. This can happen, for example, during startup and when the user changes scalefactor. Unlike the other status bits, the System Busy bit and the Any Error bit (I:S.5/15) cannot be cleared by the SLC program; in this instance these bits are cleared by the C02 only. Also, when the system is busy, it doesn't turn off outputs, doesn't light the fault LED, and doesn't show anything on the local display.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Backplane Programming (cont'd)

PROGRAMMING ERROR REGISTER (I:S.7)



PROGRAMMING ERROR REGISTER BITS:

I:S.7/15	The ANY ERROR bit comes on if any other error bit in the Programming Error Register is turned on. No commands are executed if the ANY ERROR bit is on. To clear the ANY ERROR bit and the current error, toggle O:S.0/8 on and off. The errors are actually cleared on the rising edge of O:S.0/8. Then another error can be reported.
I:S.7/14	The COMMAND ERR bit is set by an error from a programming command. The programming commands are Channel Copy, Program Copy, Pulse Copy and Pulse Edit.
I:S.7/13	The READ ONLY error will be set if you write to a read only register.
I:S.7/12	The ILLEGAL DATA error is reported when the specified data is out of the range permitted for that parameter.
I:S.7/11	The ILLEGAL FUNCTION error is reported for all non-supported parameters.
I:S.7/10	The REZERO/MODE ERROR is reported if an unsupported mode is specified.
I:S.7/9	The LAST GROUP QTY error is reported when changing the quantity of the last group is attempted.
I:S.7/8	The OFFSET MODE error is reported when changing the group mode to EACH while the group's mode is 1 or 2.
I:S.7/7	The TOO MANY TIMERS error is caused by changing the timed output quantity to a value greater than four.
I:S.7/6	The TOO MANY SPEED COMPS error by changing the quantity of speed compensated channels to a value greater than sixteen.
I:S.7/5	The NOT WHILE RUNNING error is reported when attempting to change a variable that can only be changed when the machine is stopped.
I:S.7/4	The BAD SETPOINT VALUES error is caused by creating or changing both edges of a pulse to a value other than 0 (deleting pulse) or 1 (ON all the time).
I:S.7/3	The VALUE OUT OF RANGE error is reported when attempting to change a the contents of a variable to an excessive value.
I:S7/2	The SETPOINT STORAGE FULL error will be reported if the non-volatile memory is full.
I:S7/1	The NO SETPOINT error is reported if a command requires a pulse edge and none is provided.
I:S7/0	The SETPOINTS OVERLAP error will be reported if a command results in on/off edges that overlap.

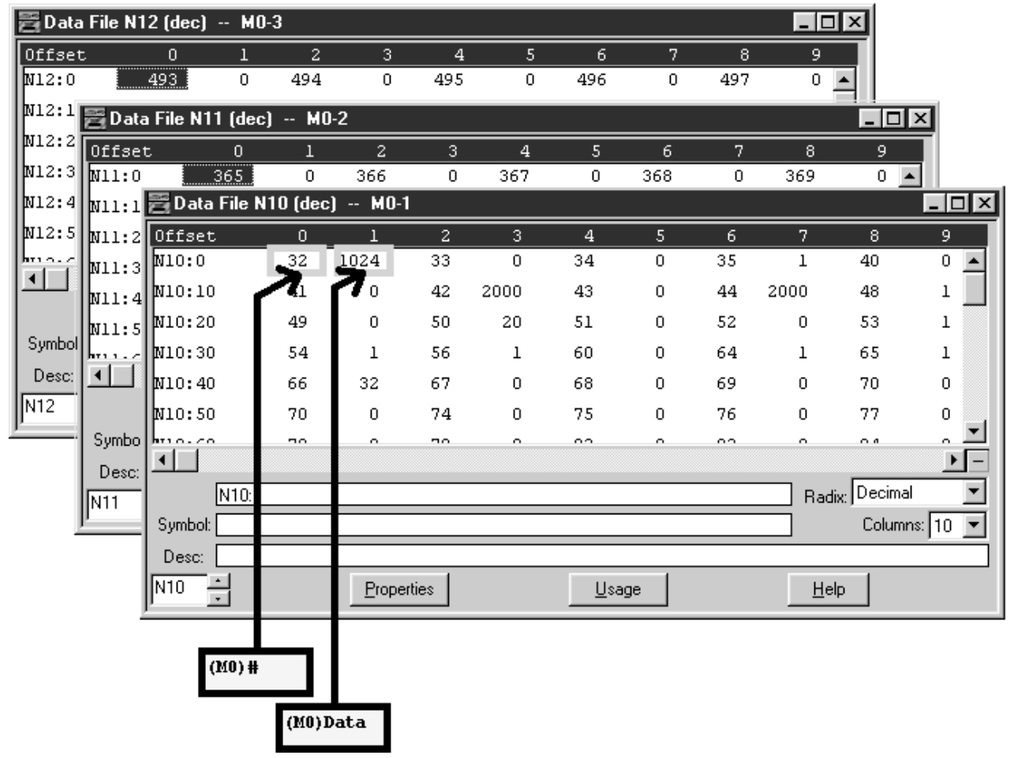
C01 Configuration.rss (cont'd)

"Write" Configuration Information from PLC Program to PL-1746
To "Write" configuration information from the PLC program to the PL-1746, perform the following steps:

1. Ensure keyswitch is in the 'PROG' state on your SLC CPU.
2. Download C01 Configuration.rss PLC program into your SLC CPU.
3. Set B3/15 to '1' (WRITE).
4. Turn the SLC CPU keyswtich to 'RUN'.
5. Toggle B3/2 high (set to 1).

Once this has been accomplished, all configuration information stored in the Data Files N10-(M0-1), N11-(M0-2) and N12-(M0-3) will be transferred from the PLC program to the configuration memory in the PL-1746.

Zero All Configuration Data
If you would like to zero all configuration information that is stored in the controller, you must go to the Data Files, enter all zeroes into the configuration values leaving the M0 # alone, then write these values back into the controller. Refer to the Data File shown above. In order to write a zero to that M0 register, the M0 Number must remain in the Data File, only the 'Data' must be set to zero.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Pulses.rss: Setpoint Reading, Restoration, and Storage Program

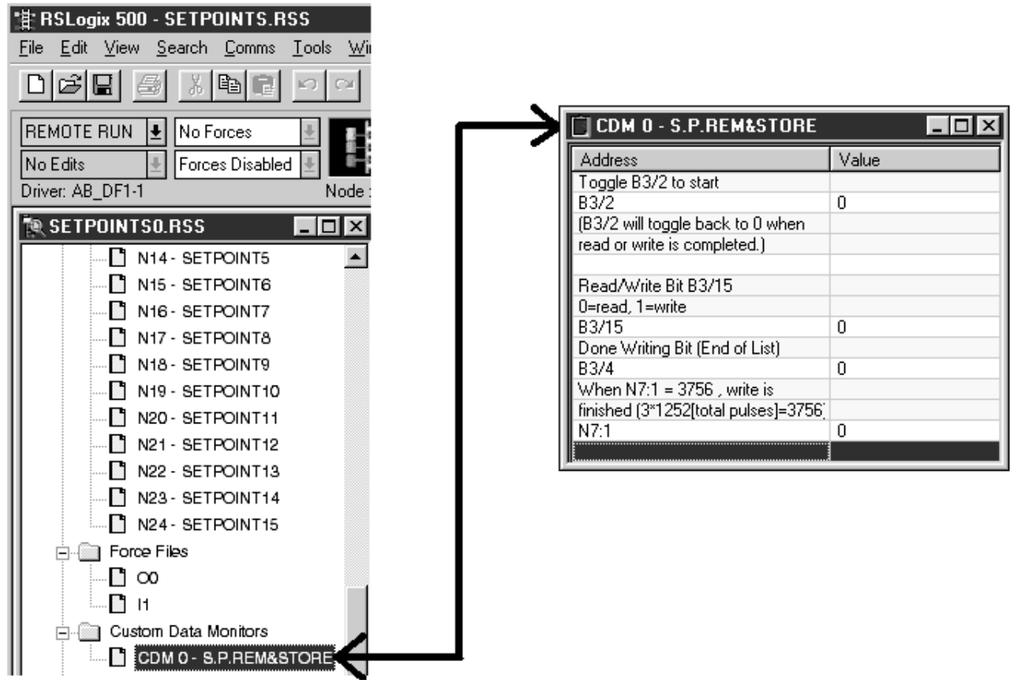
Included with these instructions you will need the RS Logix PLC program C01 & Pulses.rss. This program provides a way to read setpoints from the PL-1746 as well as a setpoint storage medium, to use the same setpoints for more than one controller. This program is intended for use with RS Logix 500 software, PL-1746 PLµS Plug-In Module, and SLC CPU 5/03 or higher. No input or output cards are necessary for this program to run properly, the only requirement is that the SLC CPU is in Slot 0 and the PL-1746 is in Slot 1.

Prior to downloading and running the program, it must be configured for your setup the same way as described in the C01 Example.rss PLC program initialization. Once the program has been configured and downloaded, use these instructions to assist in setpoint reading and storage. The CDM shown below is the operational interface for setpoint reading and restoration.

"Read" setpoints from PL-1746 to PLC PROGRAM
To ensure that the setpoints contained in your PL-1746 are not accidentally erased when making backups, follow these steps to 'Read' setpoint information from the PL1746:

1. Ensure Key is in the 'PROG' state on your SLC CPU.
2. Download C01 Pulses.rss program into your SLC CPU.
3. Set B3/15 to '0' (READ)
4. Turn the SLC CPU keyswitch to 'RUN'.
5. Toggle B3/2 high (set to 1).

Once all setpoints have been downloaded from the SLC CPU, B3/2 will toggle back to '0'. To save these setpoints, go to the upper left corner and click 'File', 'Save as'- give the setpoints a name. Now the setpoints can be viewed in the Data Files N10 through N25. Each setpoint takes up three integer words, 'channel', 'on' value and 'off' value. The data tables are large enough to hold up to 1252 total setpoints. The more setpoints you have in the PL-1746, the more time it will take to either read or write setpoints.



Backplane Programming

The PL-1746 Programmable Limit Switch Module was designed to work in a SLC-500 series chassis. All of the module's channels, enable inputs, configuration data, and pulse information is available to the SLC-500 processor through the backplane of the chassis. All of the data in the PLS module accessible by the SLC-500 processor is contained in one of four data files. These are the Input file, Output file, M0 file, and M1 file. Each data element in these files is referred to in the ladder program by a specific address. Addresses are constructed as follows:

Addressing
F:S.R/B where:
F is the file specifier. It is I for input files, O for output files, M0 for the M0 files and M1 for the M1 files.
S is the number of the slot in which the PLS module is installed.
R is the desired register number.
B is the number of the desired bit in the specified register.

If you are accessing an entire register, the /B parameter is not needed. It is only used to access specific bits of a register. For instance, if the ladder program needs the resolver speed, and the PLS module is installed in slot three of the SLC-500 chassis, the ladder program would reference address M0:3.22. When the ladder program checks the status of the Any Error bit in the Programming Error Register, it would reference address I:3.7/15. Because this flag is a single bit, the /B parameter is required.

Input File
The input file in the PL-1746 module contains ten data words. The first two words (I:S.0-I:S.1) contain the status of all 32 of the PLS outputs. The next three words (I:S.2-I:S.4) in the input file are not pre-defined by the PLS. The Error Number Register is in I:S.6, and the Programming Error Register is in I:S.7. Raw Resolver Position, updated every scan cycle, is in I:S.8.

Output File
The output file also contains ten data words but only the first two words are pre-defined by the PLS. The first contains the Input Status Register. The PL-1746's six Group Inputs, the First Cycle Enable Input, and the Output Enable Input can be set or cleared by writing to O:S.0. The second word in the output file is the Active Program Register, O:S.1. This register controls which program in the PL-1746 is controlling the PLS outputs; if it contains zero, the program number in the Default Program register is used. Although data may be written to the eight other output file registers, it will be ignored by the PL-1746.

M0 & M1 Files
All PLS configuration data is accessed through the module's M0 file and all pulse data is accessed through the M1 file. Some registers in the M0 file are unused and are reserved for future expansion. All of the data in the M1 file, and most of the data in the M0 file, is stored in non-volatile memory and is retained during power down.

The M0 and M1 files are usually accessed through the use of a block transfer command such a MOV. In the PL-1746, the M1 file is read only. You can move a maximum of 1000 words with one block transfer. An error will be generated if a larger block size is attempted. The number of the last accepted register is placed in the error location register.

When the ladder program changes data in the M0 file, the change is checked for validity, and if valid, is stored in the non-volatile memory. After storing, the change takes effect. If the change is found to be invalid, the change is rejected, the Programming Error Register (I:S.7) is set to indicate the nature of the error, and the number of the register that generated the error is loaded into the Error Number Register (I:S.6). After making a change to the M0 file, the ladder program should test the status of the Programming Error Register. If an error was generated, the ladder program should correct the cause, and then clear the error by toggling the Clear Error bit (O:S.0/8) in the Input Status Register from 0 to 1.

Backplane Interlock
The PLS configuration data is stored in EE-PROM in the PL-1746. This type of non-volatile memory has very slow write cycles. Since the PL-1746 runs slower while storing configuration data than the SLC-500 ladder program, the possibility of backplane overflow exists. Also, in the C02/C03, copy commands should be limited to a maximum of 12 words, or the C02/C03 may cause a "specialty I/O module in slot 1 has not responded to a lock shared memory command within the required time limit" fault in the SLC program. To avoid these conditions, a register is available at M0:S.866 called Backplane Interlock. The ladder program writes a command or a series of commands to the PL-1746. It then writes a one to the backplane and tests that location to see when it changes back to zero. Whenever the PL-1746 detects a write to the Interlock, it will respond by writing zero back to that location. This allows the ladder program to know when the previous command has been executed. Then another command or series of commands can be delivered.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DIP Switch Settings (cont'd)

PL-1746-C02/C03 DIP Switch Settings (All reserved switches must be OFF)

Switch	ON	OFF
1	Local I/O Module	Remote I/O Module
2	Resolver Mode: Master	Resolver Mode: Slave
3	Connect Termination Resistors	Disconnect Termination Resistors
4	Reserved	Reserved
5	Reserved	Reserved
6	Reserved	Reserved
7	Reserved	Reserved

C01 Pulses.rss: Setpoint Reading, Restoration, and Storage Program

"Write" Setpoints from PLC Program to PL-1746

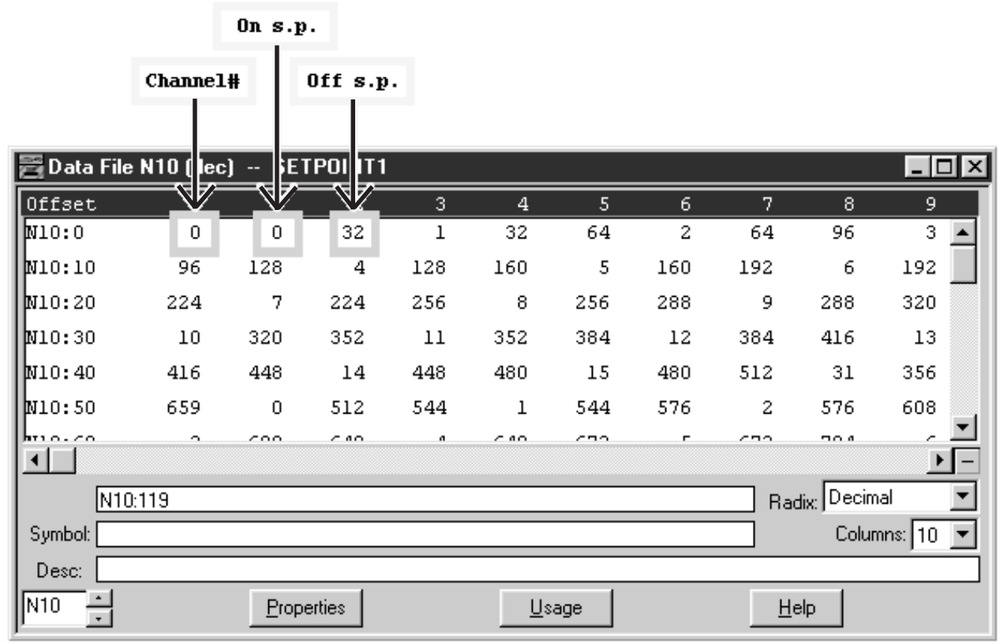
To 'Write' setpoints from the PLC program to the PL-1746, perform the following steps:

1. Ensure keyswitch is in the 'PROG' state on your SLC CPU.
2. Download C01 Pulses.rss PLC program into your SLC CPU.
3. Set B3/15 to '1' (WRITE).
4. Turn the SLC CPU keyswitch to 'RUN'.
5. Toggle B3/2 high (set to 1).

Once this has been accomplished, all setpoint information stored in the Data Files N10-SETPOINT1 through N24-SETPOINT15 will be transferred from the PLC program to the setpoint memory in the PL-1746.

Zero All Setpoints

If you would like to zero all setpoints that are in the controller, you must go to the Data Files, enter all zeroes into the Setpoint 'ON' and 'OFF ' values, then write these values back into the controller. Refer to the Data File shown above. In order to write a zero to that setpoint, the Channel Number must remain in the Data File. Only the 'ON' setpoint and the 'OFF' setpoint must be set to zero.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss

Initial Programming steps are covered in the PL-1746 PLµS Plug-In Module manual. The main topics discussed in this supplement will be specific programming examples through RS Logix 500 programming software. This section was written for persons with some PLC Ladder programming experience. These supplemental programming examples will assist in the implementation of the PL-1746 into your operating enviroment.

To be used in conjunction with this document is the RS Logix program C01 Example.rss. It is recommended that you copy this program onto your hard drive for a 'working copy' of the program, and leave the copy on the disk in its original state.*To obtain copies of these RS-Logix programs, please contact Electro Cam Corp.by phone or email. 1-800-228-5487 or ecam@electrocam.com.*

Initialization of Program

In order for this program to be of use to you, you must re-configure it for your setup. In the example provided, we will start from scratch with a 4-slot rack with a 5/04 CPU already running RS Linx and RS Logix. Once the C01 Example.rss program has been selected and is running from within the RS Logix Program, double click on the item 'IO Configuration' as shown in Figure 1.

Once you have double-clicked on IO Configuration, the window I/O Configuration will appear, as shown below in Figure 2. Click once on the Read I/O Config button.

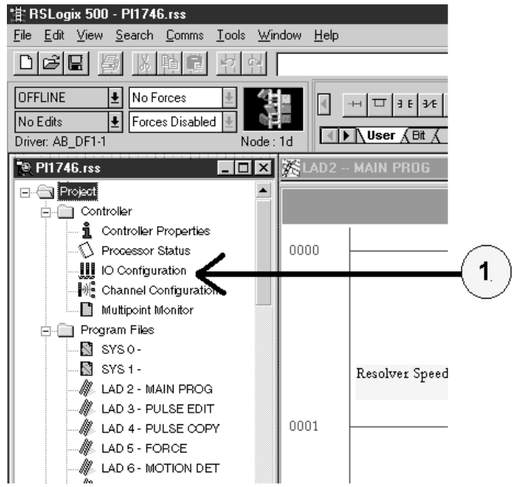


Figure 1

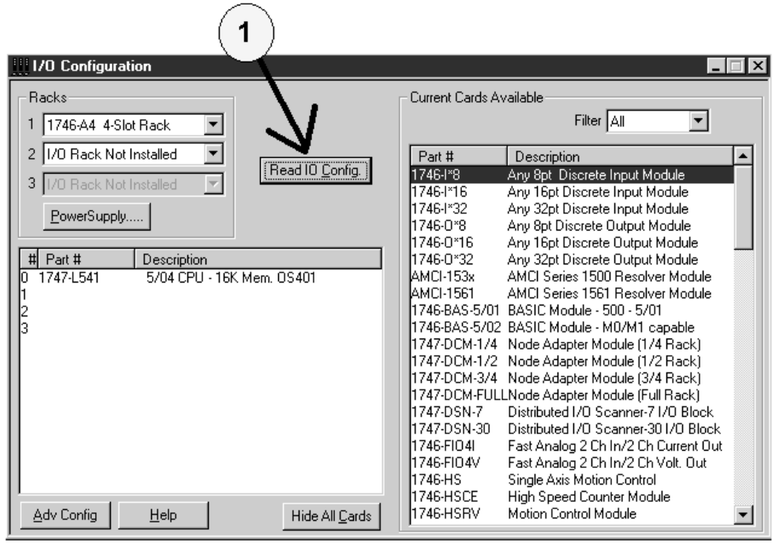


Figure 2

DIP Switch Settings

Overview

Installation

Each PS-6400 keypad and PL-1746 module has a DIP switch. For convenience, set these DIP switches before installing the keypads or module.

Termination Resistors

The PS-6400 keypad and PL-1746 PLS modules have built-in termination resistors for the RS-485 network across which they communicate. The two devices at the physical end of the RS-485 network must have their termination resistors connected; all devices between them must have their termination resistors disconnected. The termination resistors are connected or disconnected by setting the appropriate DIP switches on each device as indicated below.

PS-6400 Keypad DIP Switch Settings

Termination Resistors

To connect the termination resistors, set switches 5 & 6 ON; to disconnect the termination resistors, set switches 5 & 6 to OFF.

Address

Set switches 1-4 per the following chart to establish the desired address for the keypad. Keypad addresses must begin with 0 and increase sequentially. The physical location of a keypad has no intrinsic relationship to its address. During initial programming, the KEYBOARD QTY must be used to enter the number of keypads in the chain; it can only be accessed through the keypad whose address is 0 or through the backplane.

Address	Switch 1 (B3)	Switch 2 (B2)	Switch 3 (B1)	Switch 4 (B0)
0	ON	ON	ON	ON
1	ON	ON	ON	OFF
2	ON	ON	OFF	ON
3	ON	ON	OFF	OFF
4	ON	OFF	ON	ON
5	ON	OFF	ON	OFF
6	ON	OFF	OFF	ON
7	ON	OFF	OFF	OFF
8	OFF	ON	ON	ON
9	OFF	ON	ON	OFF
10	OFF	ON	OFF	ON
11	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON
13	OFF	OFF	ON	OFF
14	OFF	OFF	OFF	ON
15	OFF	OFF	OFF	OFF

PL-1746-C01 DIP Switch Settings (All reserved switches must be ON)

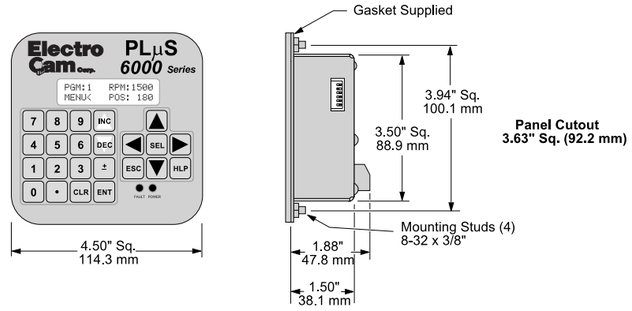
Switch	ON	OFF
1	Local I/O Module	Remote I/O Module
2	Reserved	Reserved
3	Reserved	Reserved
4	Reserved	Reserved
5	Connect Termination Resistors	Disconnect Termination Resistors
6	Reserved	Reserved
7	Reserved	Reserved

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-6400 Keypad Installation

Note:
The PS-6400 keypad is not designed to be hot-swapped (plugged or unplugged while power is ON).



Number of Keypads

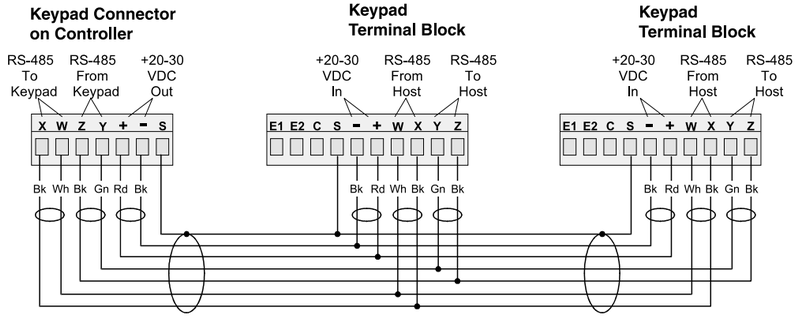
One or two keypads may be connected to a PL-1746 controller as shown in the illustration below.

Programming Enable

The wiring connector on the back of each keypad includes terminals to select Operator or Master level programming for that keypad. These terminals can be temporarily jumpered during setup to allow entry of programming access codes, or they can be switched with a variety of devices including mechanical switches, relay contacts, and PLC DC outputs. See ENABLE CODES in the programming section for details on programming access.

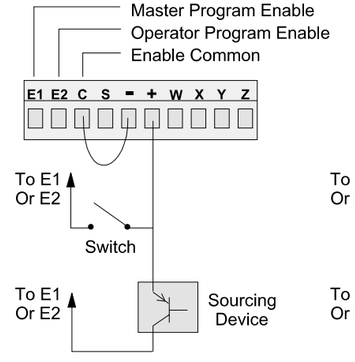
If a solid state device will be activating the Programming Enable terminals, that device will determine whether sourcing or sinking wiring should be used. For mechanical devices such as jumpers or key switches, either sourcing or sinking wiring may be used.

Keypad Wiring

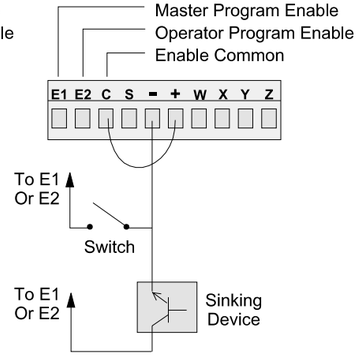


Programming Access	Display	Operator	Setup	Master
Keypad Terminal	---	Yes (E2)	No	Yes (E1)
Password	---	Yes	Yes	Yes

Programming Enable, Sourcing



Programming Enable, Sinking



Sinking/Sourcing Defined

Sinking means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a DC common or ground to the connected device.

Sourcing means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a +DC voltage to the connected device.

This information is important when interfacing an Electro Cam Corp. product with another electronic device. If you are using an Electro Cam Corp. product input to an Allen-Bradley 1746-IN16 "sinking" input card* or similar A-B device, you have to supply a +DC voltage (Electro Cam Corp. ***Sourcing*** output) to this card, NOT a DC common or ground. In these cases, ***Sinking*** is what the card does with the input voltage; sinks it to common or ground.

*Other manufacturers include, but not limited to: Koyo (formerly GE Series 1, Texas Instruments, or Siemens SIMATIC PLS's) that use descriptions similar to Allen-Bradley.

C01 Example.rss (cont'd)

Once the 'I/O Configuration' has been pushed, the window shown in figure 3 will open. In order to read what the I/O Configuration is in your unit, the 'Read IO Config' button shown in Figure 3 must be clicked once.

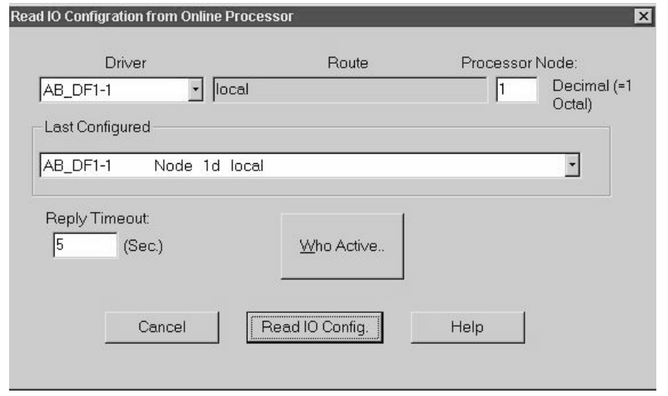


Figure 3

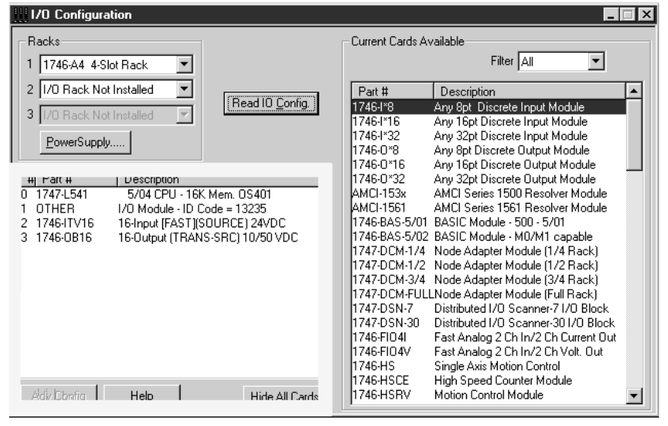
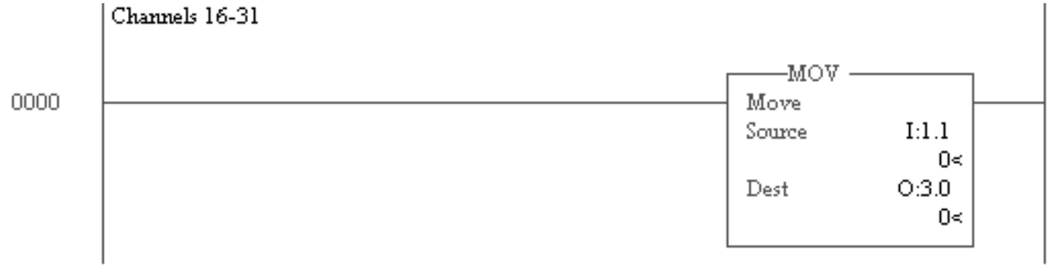


Figure 4

Once the I/O Configuration of your rack is read, the cards which are installed in the rack you are working with will be listed as in the highlighted box shown in figure 4. In this example, slot 1 contains the PL-1746, slot 2 contains an A-B 16 input card, and slot 3 contains an A-B 16 output card. As you may already know, the SLC CPU must reside in Slot 0. Depending on the type of CPU, input/output and A-B rack size, your setup might not look the same. Yours will probably be different than the example shown above. The only requirement for the PL-1746 to operate is that your CPU is 5/03 or higher. Neither input nor output cards are necessary for this program to run in your system. The only exception to this is if you would like to have the output channels from the PL-1746 present in one of your output channels. If no output module is present in your rack, then Rung 0000 will need to be deleted in order for this program to run prorperly. Click on rung 0000 once, then push the delete button.



Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss (cont'd)

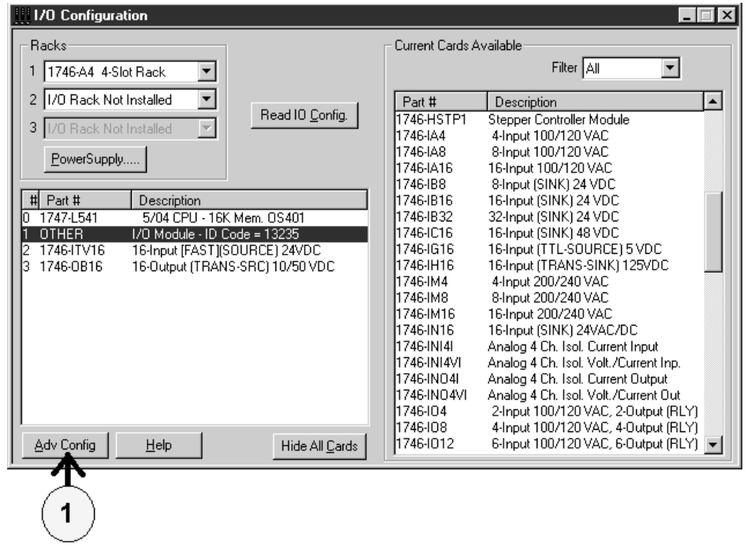


Figure 5

The final step in the initial programming of the PL-1746 is the M0 and M1 file length entry. The first step is to highlight the PL-1746 module Part # OTHER, Description-I/O Module-ID Code 13235. The next step is to click the 'Adv Config' button once, as shown in Figure 5.

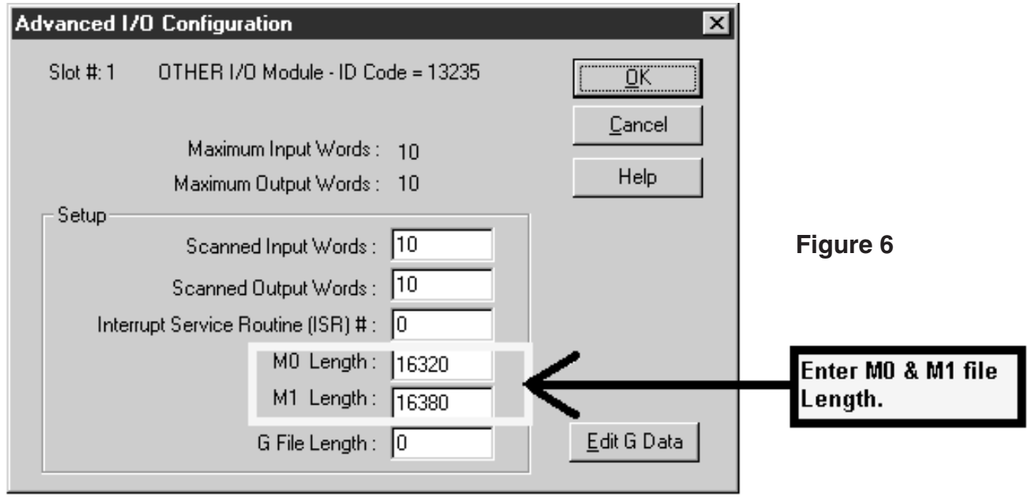
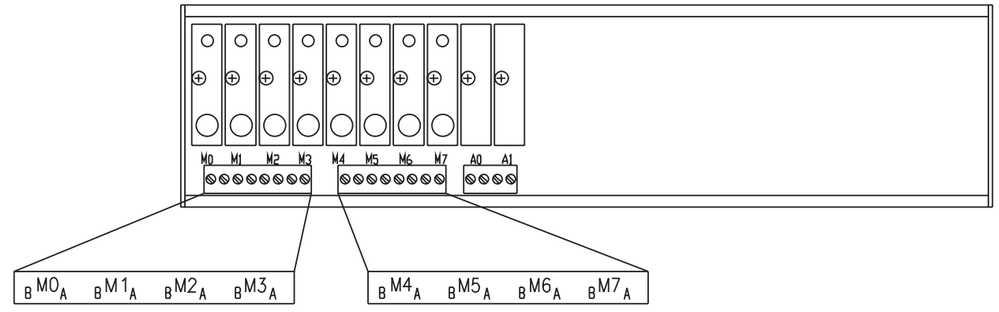


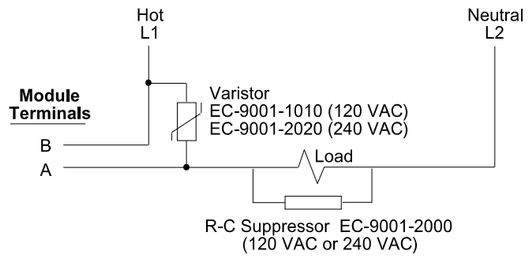
Figure 6

Once the 'Adv Config' button is clicked, the window shown in Figure 6 appears. Enter the M0 and M1 file length, as shown in Figure 6, then press 'OK'. Once this is done, the program is ready to be downloaded to the SLC CPU. Please keep in mind that if your setup has any specialty modules installed in your rack other than the PL-1746 and A-B Input or Output modules, these may require additional setup time.

PS-4108-13-L08 I/O Rack Installation



AC Output

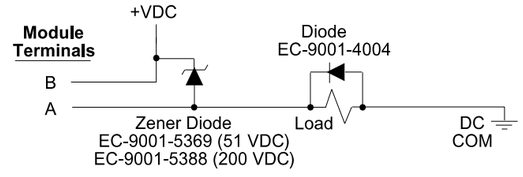


Most applications will not need the varistor or R-C suppressor shown above. However, when other switching devices are in series or parallel with the AC module, voltage spikes may damage the module. Use one of the following two methods to suppress voltage spikes.

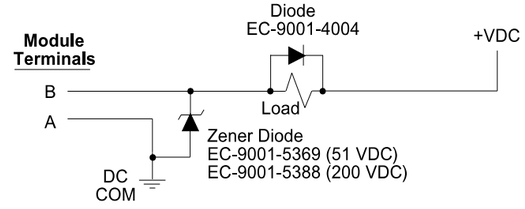
- For infrequent switching, connect a varistor (MOV) across the terminals.
- For continuous switching, wire an R-C suppressor in parallel with the load.

DC Output

Sourcing



Sinking



Most applications will not need the diodes shown above. However, highly inductive DC loads may damage modules by generating voltage spikes when switched off. Suppress these voltage spikes using one of these two methods:

- Connect a Zener diode across the terminals. This will not significantly increase the load turn off time. Voltage rating of the diode must be greater than the normal circuit voltage.
- Connect a reverse-biased diode across the load. This may increase the load turn off time.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108-13-L08 I/O Rack Installation

Sinking/Sourcing Defined

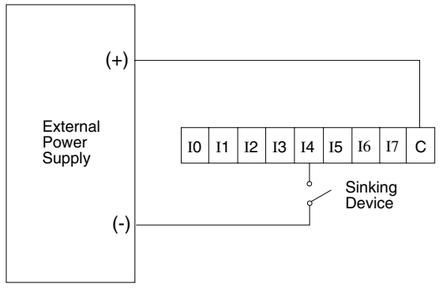
Sinking means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a DC common or ground to the connected device.

Sourcing means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a +DC voltage to the connected device.

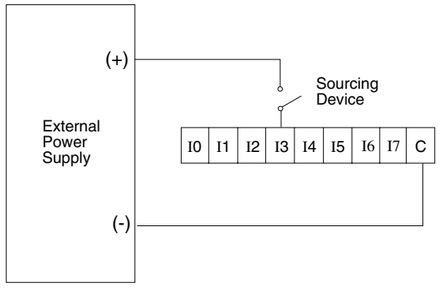
This information is important when interfacing an Electro Cam Corp. product with another electronic device. If you are using an Electro Cam Corp. product input to an Allen-Bradley 1746-IN16 "sinking" input card* or similar A-B device, you have to supply a +DC voltage (Electro Cam Corp. ***Sourcing*** output) to this card, NOT a DC common or ground. In these cases, ***Sinking*** is what the card does with the input voltage; sinks it to common or ground.

*Other manufacturers include, but not limited to: Koyo (formerly GE Series 1, Texas Instruments, or Siemens SIMATIC PLS's) that use descriptions similar to Allen-Bradley.

Sinking Devices

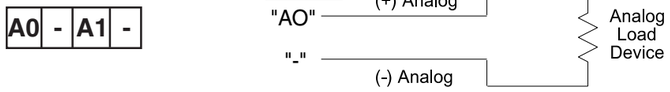


Sourcing Devices



I0	Group One Input
I1	Group Two Input
I2	Group Three Input
I3	Group Four Input
I4	Group Five input
I5	Group Six Input
I6	1st Cycle Enable
I7	Output Enable

Analog Output



- Analog output modules source the analog signal.
- No external supply is required.
- Analog output signals are isolated.

C01 Example.rss (cont'd)

Downloading the PLC Program to the SLC CPU

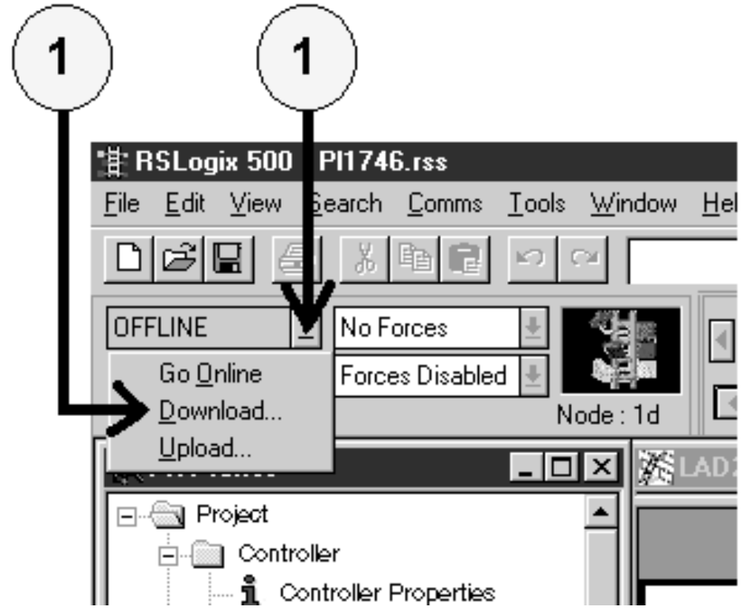


Figure 7

Before you begin downloading, it is best if you already have communications running through RS Linx to your PLC. Once the communications are up and running, you may proceed. There are two different ways to download a program from RS Logix, as shown in Figures 7 and 8. Either way will download the program the same way. In Figure 7, you click the down arrow once, then click the 'Download' item once. In Figure 8, you click on 'Comms' once, then 'Download' once.

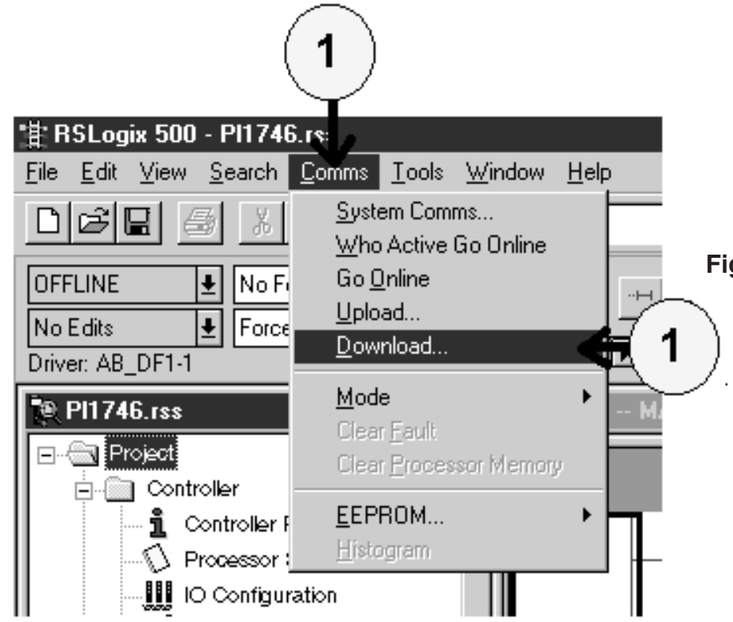


Figure 8

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

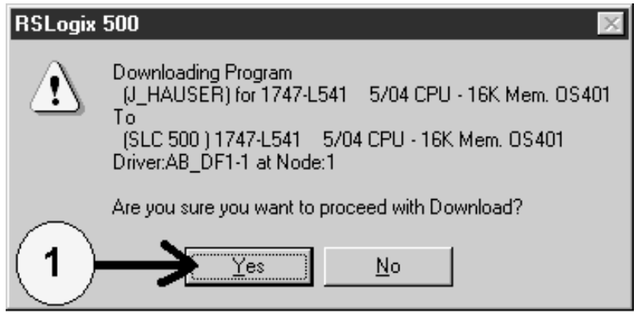


Figure 9

Figures 9 and 10 are the pop-up windows that will be viewed while downloading the program to the SLC CPU. Figure 9 confirms whether or not you would like to download the program you have specified. Remember that only one program can remain resident in the CPU at a time, so if you currently have a program in your PLC that may be needed again, be sure you can place it back into the memory of the PLC. Once the program has been downloaded, you have the choice of whether or not you would like to go online, simular to Figure 10. Select yes. Once online, you can monitor the status of the SLC CPU and the ladder program itself while it is running. From within the RS Logix program, if the selector switch on the SLC processor is in the REM position, you can select the operating condition (remote run, remote program) of the SLC CPU and the ladder program, as shown in Figure 11.



Figure 10

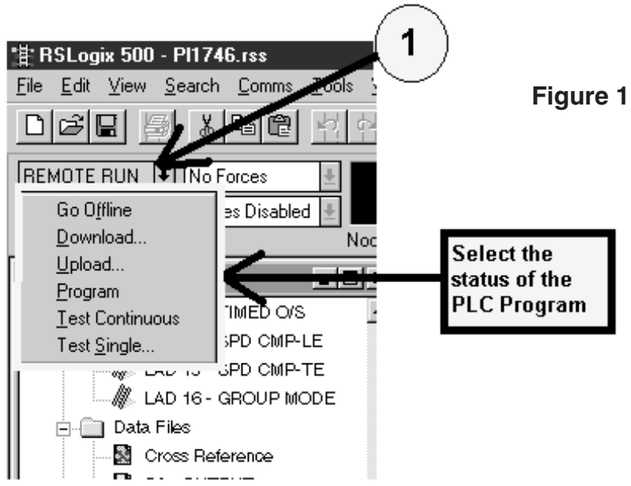


Figure 11

Termination resistors for the data and clock differential pairs are switched into the communications circuit by the S1 DIP switch. Line termination should be employed only on the rack furthest from the PLS module.

Switch	OFF	ON
3	Data Line Not Terminated	Data Line Terminated into 120W
4	Clock Line Not Terminated	Clock Line Terminated into 120W

Line Termination

Inputs

The rack has 8 inputs, and up to two racks can be daisy-chained in a given system; however, the inputs for the second rack are ignored. Each input is optically isolated and has a green LED status indicator. The terminals are labeled I0 through I7. All user connections to the inputs are made via a pluggable header. Each input has a single terminal and there is one common terminal, labeled C. An input's state is a logic one when current is flowing through its terminal on the connector, and it's state is a logic zero when current is not flowing. The inputs are not fused.

- To source current to the inputs, wire the rack's common terminal to the negative terminal of an external power supply.
- To sink current from the inputs, wire the rack's common terminal to the positive terminal of an external power supply.

	Minimum	Typical	Maximum
Absolute Maximum Voltage	----	----	30 V dc
Pickup Voltage		9.2 V	11.0V
Dropout Voltage	7.0V	9.2V	----
Current Draw	----	3.5mA	20 mA dc

See datasheet for Phoenix 1755804 header and 1792825 plug for insulation ratings.

Digital Outputs

The rack has 8 relay slots, so the maximum of two racks allows a system total of 16 power outputs. Additionally, a PS-4108-13-L16 can be added to a PS-4108-13-L08, but be aware that real-world outputs 8-15 will be skipped. Digital outputs are provided by SLIMLINE solid state relays or reed relays, and thus have specifications dependent on the relays used. All user connections to the outputs are made via pluggable headers, and plugs are included with the rack when it is shipped from the factory. The output terminals are labeled M0A, M0B through M7A, M7B, where the number is the output number and dc conventional current flows into the B terminal and out of the A terminal.
The maximum current rating for each module installed in the PS-4108 rack is as stated in the module's specifications, OR 1.5 amps, whichever is less.

See datasheet for Phoenix 1755794 header and 1792812 plug for insulation ratings.

Analog Outputs

The rack can control up to two analog modules in positions A0 and A1. Only one rack (the one with address 0) in a given system can have analog outputs. Analog outputs are provided by slimline analog modules, and thus have specifications dependent on the modules used. A pluggable header is used for wiring to the analog outputs, and a plug is included with the rack when it is shipped from the factory. The terminals are labeled such that, for analog output 0, conventional current flows out of the A0 terminal, through the load, and returns to the - terminal for analog output 0. Similarly, for analog output 1, conventional current flows out of the A1 terminal, through the load, and returns to the - terminal for analog output 1.

See datasheet for Phoenix 1755752 header and 1792773 plug for insulation ratings

Status Indicators

RUNNING	During normal operation the green *RUNNING* LED (D12) is lit.
COMMUNICATIONS	When Rack-to-PLS communications are ongoing the yellow *COMMUNICATIONS* LED (D11) is lit.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108-13-L08 I/O Rack Installation

Overview
The PS-4108-13-L08 I/O rack provides inputs, analog outputs, and digital power outputs (requiring Slimline™ solid state relays) for the PL-1746 programmable limit switch plug-in modules. The rack is UL/C-UL listed. CE marking is pending.

PS	The rack is a member of Electro Cam Corp.'s PLµS product line.
41	The rack is mounted external to the Allen-Bradley module chassis.
08	The rack has 8 inputs.
13	The rack and PLS module communicate via Electro Cam Corp.'s proprietary *Type 13* communications.
L	The rack has two SLIMLINE analog output module slots.
08	The rack has 8 SLIMLINE solid state slots.

Environmental Requirements

Operating Temperature	0 to 55°C (32 to 131°F)
Storage Temperature	-40 to 70°C (-40 to 160°F)
Humidity	95% maximum, non-condensing

For indoor use only.
For use at altitudes up to 2000 m (meters).
Overvoltage Category I. Pollution Degree I.

CE Installations
For installations that must comply with CE requirements the PL-1746 and PS-4108 must be mounted inside a metal enclosure. In addition, a CoreCom 20VK6 or equivalent single stage PI filter must be connected across the AC input to the SLC power supply. A Steward 28A2025-0A0 or equivalent ferrite bead must be snapped onto the resolver cable as close to the enclosure wall (inside) as possible.
Installations must comply with all other manufacturer's requirements.

Mounting & Grounding
The rack's mounting channel is held to either EN 50035 G profile or EN 50035 top hat profile DIN rail via three mounting clips. The rack has a 4-40 captive nut connected to the ground plane that must be tied to earth ground in the customer's installation. This must be done to maintain EMC compatibility.

Cabling
The primary communications connector (see the connections drawing) on the rack is connected to the PLS module via the special rack cable. The secondary communications connector allows the user to daisy-chain a second rack to the first. These connections provide both for receiving input power from the PLS and for communication with the PLS. The aggregate length of all rack cables attached to a given PLS module must be 50 feet or less. The cable's shield is tied to the metal jacket covering the connectors on both ends. The jackscrews of the second DB9 are tied to ground on the PCB, while those of the first DB9 are not. Thus the shield of each cable is tied to ground at only one end.

Power
The input voltage delivered to the PS-4108 rack from the PL-1746 PLS module is nominally 24V (20V min, 30V max) at a maximum of 250mA.

Fusing

Power Input Fuse (F1)	1/4 A, 250 V, TR5-F (European Style)
Spare Output Module Fuse(F3)	4 A, 250 V, TR5-F (European Style)
Fuse Tester	The rack includes a green LED (D3) that lights when a good fuse is installed in the fuse tester.

Communications
DIP switch S1 selects the rack's physical address. Note that if only one rack is used it must be addressed as rack 0.

Physical Address	Switch 1 (A0)	Switch 2 (A1)
0	ON	ON
1	OFF	ON

Rack Addressing

C01 Example.rss (cont'd)

C01 Example.rss PLC Program Introduction
Now that the program is installed and running on your computer, and has been downloaded to the SLC CPU, we will begin using it to program PLS functions through the backplane. The examples included with this program show one way of programming the included functions, but by no means are the only way to program the various functions available through the backplane. These supplemental programming examples are meant to assist in the implementation of the PL-1746 into your operating enviroment.

'MAIN PROG'
The first ladder we will discuss is LAD 2-MAIN PROG. This ladder can be thought of as the 'control' ladder. All subroutine ladders 'jump' from this ladder, and upon completion of the tasks assigned to them, they 'return' to the MAIN PROG ladder to await furthur instructions.

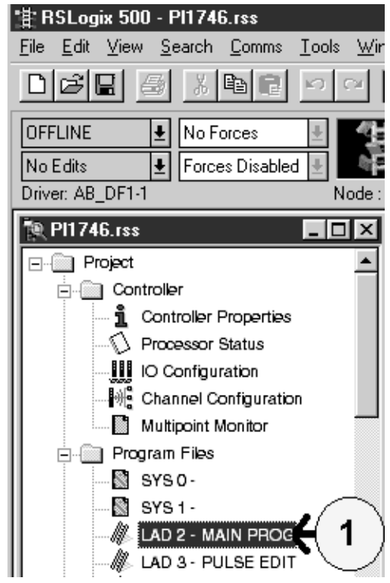


Figure 12

Figure 12 shows the location of the 'MAIN PROG' Ladder. To view this ladder, double click on 'MAIN PROG'. Once this has been done, you will see the active program 'MAIN PROG' as shown in Figure 13.

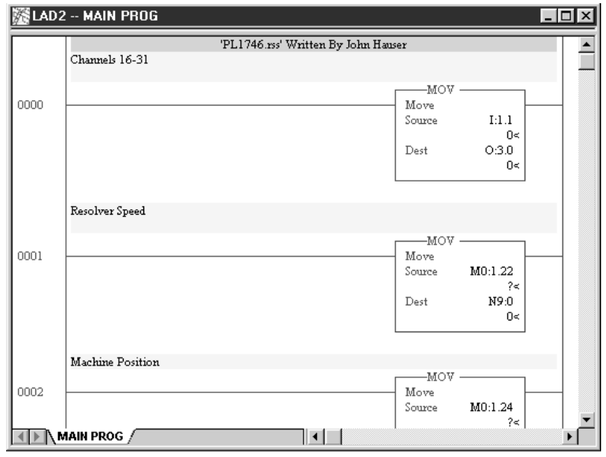


Figure 13

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss PLC Program Introduction (cont'd)

As discussed earlier, the subroutines contain the ladder programs used to perform the various PLS functions selected. To enter data into the program for use by the backplane, you can choose one of two methods. The first method is shown in figure 14, in which each individual data file associated with the specific program function is called up. The second method is shown in figure 14, where all data entry points required to perform the given task are organized into a Custom Data Monitor. Using the CDM for this makes this the task much less cumbersome than having to access each individual data file.

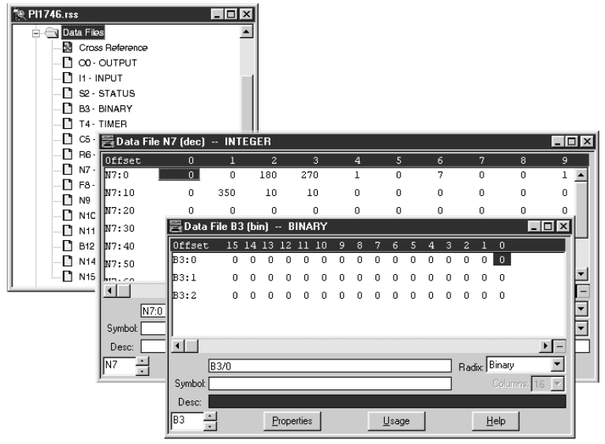


Figure 14

Entering the data by accessing each individual data file works fine, but using the CDM, as shown in figure 15, makes accessing data much easier. All data entry points can be centralized in one location, and each can be given a name of your choosing.

To access the Custom Data Monitor, double click on the icon for the particular CDM you want to open, as shown in figure 15a below.

Figure 15a

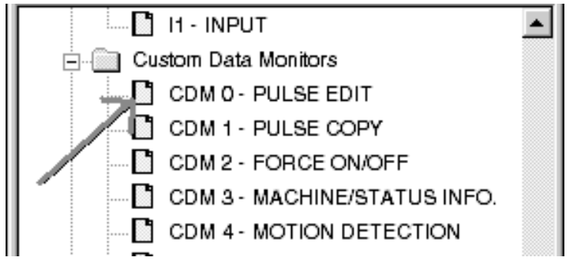
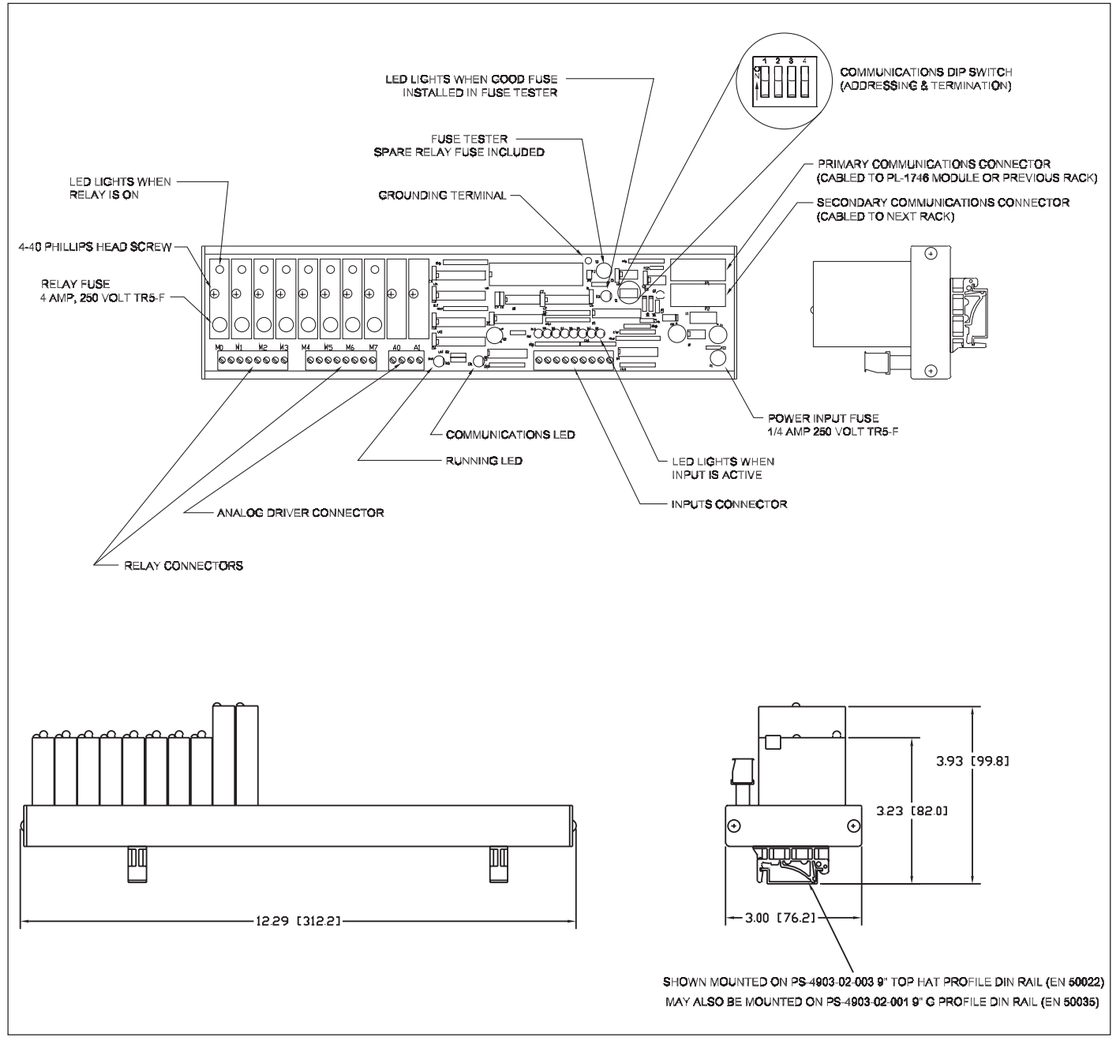


Figure 15

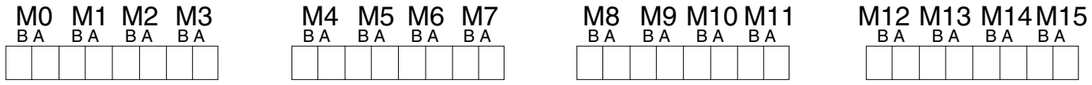
CDM 0 - PULSE EDIT

Address	Value
Toggle bit B3/0 to activate	
B3/0	0
Pulse Edit Program	
N7:0	0
Pulse Edit Channel	
N7:1	0
Pulse Edit On	
N7:2	180
Pulse Edit Off	
N7:3	270
Pulse Edit Pulse Number	
N7:4	1
Pulse Edit Pulses in Channel	
Total Number of Pulses	
(Read Only)	
N10:7	2
Pulse Edit Command/Status	
N7:6	7
1=read,3=write,5=IncOn,7=DecOn	
9=IncOff,11=DecOff,13=IncBoth,	
15=DecBoth.	

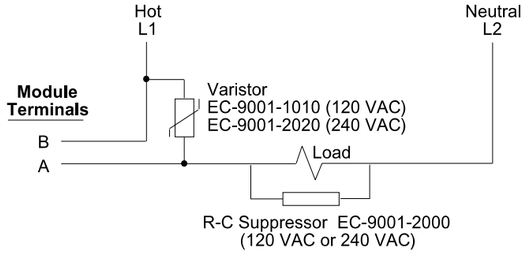


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Wiring Digital Outputs



AC Output

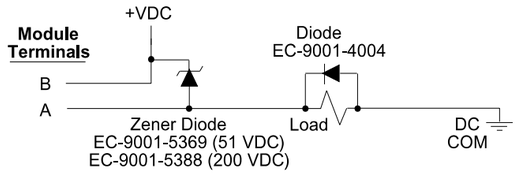


Most applications will not need the varistor or R-C suppressor shown above. However, when other switching devices are in series or parallel with the AC module, voltage spikes may damage the module. Use one of the following two methods to suppress voltage spikes.

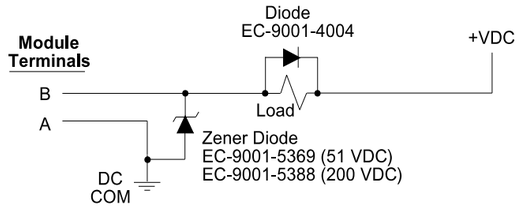
- For infrequent switching, connect a varistor (MOV) across the terminals.
- For continuous switching, wire an R-C suppressor in parallel with the load.

DC Output

Sourcing



Sinking



Most applications will not need the diodes shown above. However, highly inductive DC loads may damage modules by generating voltage spikes when switched off. Suppress these voltage spikes using one of these two methods:

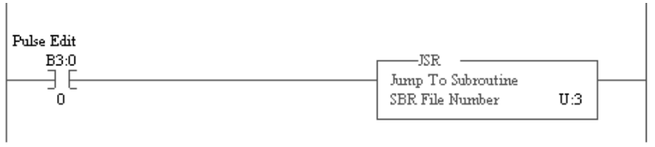
- Connect a Zener diode across the terminals. This will not significantly increase the load turn off time. Voltage rating of the diode must be greater than the normal circuit voltage.
- Connect a reverse-biased diode across the load. This may increase the load turn off time.

Pulse Edit

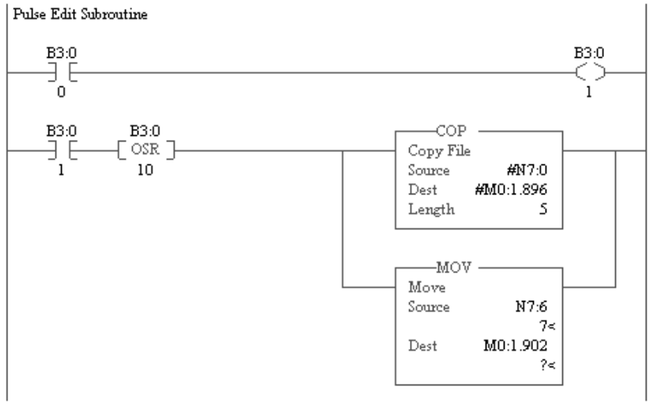
Next we will talk about the Pulse Edit functions available through the backplane of the SLC CPU to the PL-1746. The first thing that must be understood is the relationship between the Custom Data Monitor, the Main Program, and the Subroutines. The Custom Data Monitor (CDM) provides an interface between your computer and the SLC PLC program running in the SLC CPU. With the CDM, we can enter data into integer registers, binary registers, etc. We can also read from registers internal to the SLC CPU. With the Pulse Edit CDM we enter data into the integer registers, which can then be moved into the M0 registers in the SLC CPU. We also read from the M0 registers into the integer registers.

When we enter a '1' in B3/0 in the CDM, the program jumps to the subroutine. Once in the subroutine, B3/0 sets B3/1 to a high. B3/1 triggers (O)ne (S)hot (R)ising B3/10, which then copies N7:0, N7:1, N7:2, N7:3 and N7:4 to M0:1.896, M0:1.897, M0:1.898, M0:1.899 and M0:1.900. If you refer to the PL-1746 manual quick reference chart for M0 and M1 files, you can see what each M0 register is doing with the data that is being moved to it. Once the above tasks have been completed, all data is moved and/or copied to the appropriate 'N' register, 'B' registers are reset to zero, and the subroutine returns to the main program to await furthur instructions.

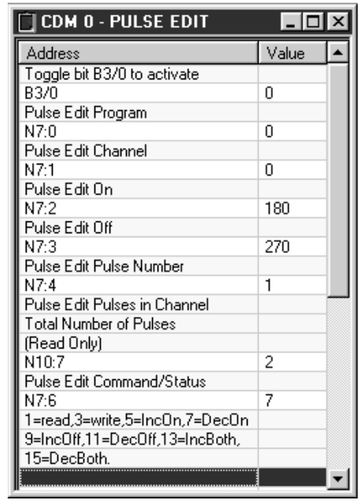
Main Program



Subroutine



Custom Data Monitor



The Pulse Edit functions can do a variety of different tasks for 'editing' pulses. We can read, write, increment the ON edge of a pulse, increment the OFF edge of a pulse, decrement the ON edge of a pulse, decrement the OFF edge of a pulse, increment both the ON and OFF edge of a pulse, or decrement both the ON and OFF edge of a pulse. We will now perform a few of the functions to familiarize you with how they can be used.

Read

To read the ON/OFF values from the CDM, we must do the following:

1. Enter the program in which we would like to edit a pulse from in N7:0.
2. Enter the channel where the pulse is located in N7:1.
3. If there is more than one pulse in this channel, we must write the pulse number that we would like to edit in N7:4. Until we know how many pulses are in that channel we can enter '0' (remember that in the 'Digital Universe', counting systems start at '0', so entering a '0' here will allow us to edit the first pulse in that channel.)
4. Enter '1' in N7:6.
5. Enter '1' in B3/0.

(continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss (cont'd)

Pulse Edit (cont'd)
Once the steps above have been completed, the pulses 'ON' value can be read from N7:2, and the 'OFF' value can be read from N7:3. After the first pulse has been read back, we can read the value located in N10:7, which will tell us how many pulses are in that channel. If there are multiple pulses in that channel, you can enter the pulse number you would like to read into N7:4, then enter a '1' in B3/0. That pulses ON and OFF values can be read from N7:2 and N7:3, respectively.

Write to a word/integer/bit
Note: Do not overlap pulses in one channel. If you overlap pulses in one channel, an internal error will be generated in the Module Status Register. If an error is generated, enter a '1' in O:1/8 'Clear Error Bit'.

To enter a pulses' on/off values from the CDM, do the following:
1. Enter the program in which we would like to write the pulse to in N7:0
2. Enter the channel which we would like the pulse to be written to in N7:1.
3. Enter the pulse's 'ON' value in N7:2.
4. Enter the pulse's 'OFF' value in N7:3.
5. Enter '3' in N7:6
6. Enter '1' in B3/0.

Once the above steps have been completed, we can read the pulses' on/off value as explained in example 1.

Increment On
To increment the on edge of a pulse from the CDM, we do the following:
1. Enter the program in N7:0
2. Enter the channel number in N7:1.
3. Enter the pulse number which you would like to increment in N7:4.
4. Enter '5' in N7:6.
5. Enter '1' in B3/0.

Notice that each time you 'toggle' B3/0 to one, you increment the ON edge of that pulse by one increment.

Decrement On
To decrement the ON edge of a pulse from the CDM we do the following:

1. Enter the program in N7:0.
2. Enter the Channel in N7:1.
3. Enter the pulse number in N7:4 if there are multiple pulses in the channel.
4. Enter '7' in N7:6.
5. Enter '1' in B3/0.

Notice that each time you 'toggle' B3/0, the pulses on edge is decremented by 1.

The remaining pulse edit functions available are Increment OFF edge, Decrement OFF edge, Increment both the ON and OFF edge, and Decrement both the ON and OFF edge. These functions are all performed in the same fashion as functions 3 and 4, except you change the value that is written into N7:6. The values entered for each function are as follows:

1 = Read.
3 = Write.
5 = Increment ON Edge.
7 = Decrement ON Edge.
9 = Increment OFF Edge.
11 = Decrement OFF Edge.
13 = Increment both the ON and OFF Edge.
15 = Decrement both the ON and OFF Edge.

PS-4108-13-L16 I/O Rack Installation

Sinking/Sourcing Defined

Sinking means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a DC common or ground to the connected device.

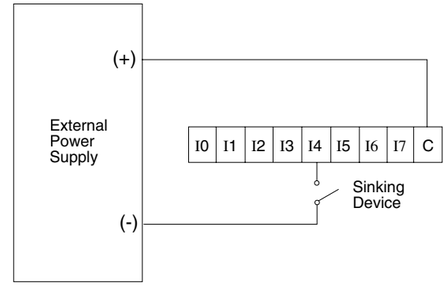
Sourcing means that when the logic is true and the output (or input device) is ON, the output (or input device) is providing a +DC voltage to the connected device.

This information is important when interfacing an Electro Cam Corp. product with another electronic device. If you are using an Electro Cam Corp. product input to an Allen-Bradley 1746-IN16 "sinking" input card* or similar A-B device, you have to supply a +DC voltage (Electro Cam Corp. ***Sourcing*** output) to this card, NOT a DC common or ground. In these cases, ***Sinking*** is what the card does with the input voltage; sinks it to common or ground.

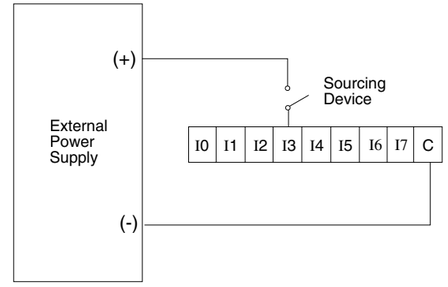
*Other manufacturers include, but not limited to: Koyo (formerly GE Series 1, Texas Instruments, or Siemens SIMATIC PLS's) that use descriptions similar to Allen-Bradley.

Wiring Inputs

Sinking Devices



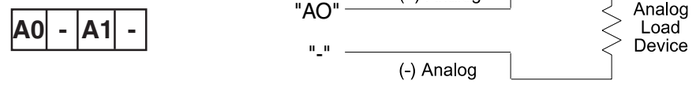
Sourcing Devices



I0	Group One Input
I1	Group Two Input
I2	Group Three Input
I3	Group Four Input
I4	Group Five input
I5	Group Six Input
I6	1st Cycle Enable
I7	Output Enable

See page 6-2 for more info.

Wiring Analog Outputs



- Analog output modules source the analog signal.
- No external supply is required.
- Analog output signals are isolated.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108-13-L16 I/O Rack Installation

Termination resistors for the data and clock differential pairs are switched into the communications circuit by the S1 DIP switch. Line termination should be employed only on the rack furthest from the PLS module.

Switch	OFF	ON
3	Data Line Not Terminated	Data Line Terminated into 120W
4	Clock Line Not Terminated	Clock Line Terminated into 120W

Line Termination

Inputs

The rack has 8 inputs, and up to two racks can be daisy-chained in a given system; however, the inputs for the second rack are ignored. Each input is optically isolated and has a green LED status indicator. The terminals are labeled I0 through I7. All user connections to the inputs are made via a pluggable header. Each input has a single terminal and there is one common terminal, labeled C. An input's state is a logic one when current is flowing through its terminal on the connector, and it's state is a logic zero when current is not flowing. The inputs are not fused.

- To source current to the inputs, wire the rack's common terminal to the negative terminal of an external power supply (see page 3-6).
- To sink current from the inputs, wire the rack's common terminal to the positive terminal of an external power supply (see page 3-6).

	Minimum	Typical	Maximum
Absolute Maximum Voltage	----	----	30 V dc
Pickup Voltage		9.2 V	11.0V
Dropout Voltage	7.0V	9.2V	----
Current Draw	----	3.5mA	20 mA dc

See datasheet for Phoenix 1755804 header and 1792825 plug for insulation ratings.

Digital Outputs

The rack has 16 relay slots, so the maximum of two racks allows a system total of 32 power outputs. Digital outputs are provided by SLIMLINE solid state relays or reed relays, and thus have specifications dependent on the relays used. All user connections to the outputs are made via pluggable headers, and plugs are included with the rack when it is shipped from the factory. The output terminals are labeled M0A, M0B through M15A, M15B, where the number is the output number and dc conventional current flows into the B terminal and out of the A terminal.
The maximum current rating for each module installed in the PS-4108 rack is as stated in the module's specifications, OR 1.5 amps, whichever is less.

See datasheet for Phoenix 1755794 header and 1792812 plug for insulation ratings.

Analog Outputs

The rack can control up to two analog modules in positions A0 and A1. Only one rack (the one with address 0) in a given system can have analog outputs. Analog outputs are provided by slimline analog modules, and thus have specifications dependent on the modules used. A pluggable header is used for wiring to the analog outputs, and a plug is included with the rack when it is shipped from the factory. The terminals are labeled such that, for analog output 0, conventional current flows out of the A0 terminal, through the load, and returns to the - terminal for analog output 0. Similarly, for analog output 1, conventional current flows out of the A1 terminal, through the load, and returns to the - terminal for analog output 1.

See datasheet for Phoenix 1755752 header and 1792773 plug for insulation ratings

Status Indicators

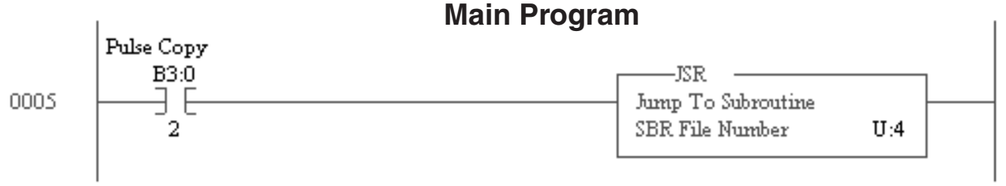
RUNNING	During normal operation the green *RUNNING* LED (D12) is lit.
COMMUNICATIONS	When Rack-to-PLS communications are ongoing the yellow *COMMUNICATIONS* LED (D11) is lit.

C01 Example.rss (cont'd)

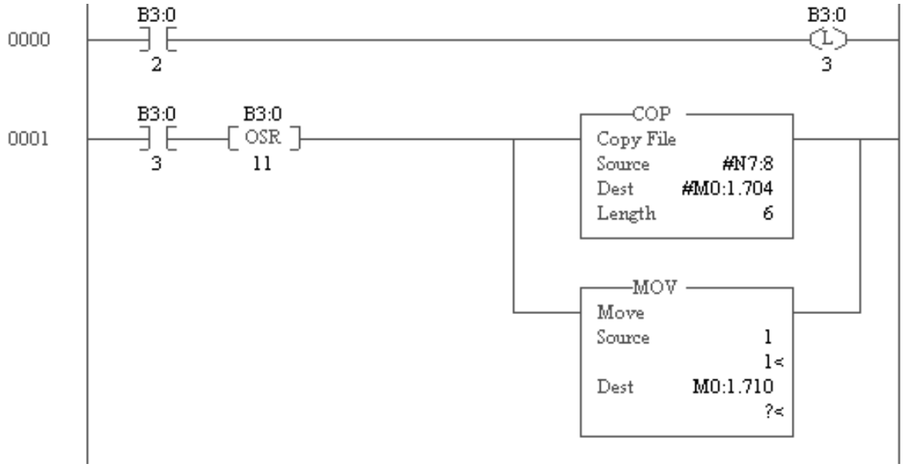
Pulse Copy

With the Pulse Copy function we can program a series or a 'train' of pulses into a specific channel without having to enter the ON and OFF setpoints for each pulse we would like to program. Pulse Copy uses the main program, subroutine, and CDM in the same manner as the Pulse Edit function.

Main Program



Subroutine



To perform a Pulse Copy:

1. Enter the program number in N7:8.
2. Enter the channel number in N7:9.
3. Enter the 'copy on' point in N7:10.
4. Enter the 'copy off' point in N7:11.
5. Enter the 'pulse count'(how many pulses you would like the 'train to consist of), in N7:12.
6. Enter the 'pulse duration'(how long you would like each pulse in that train to be), in N7:13.
7. Enter a '1' to B3/2 to activate Pulse Copy.

While the Pulse Copy is active, B3/2 will remain '1'. Once B3/2 goes to '0', Pulse Copy is complete. Ensure that pulses do not overlap, otherwise an error bit will be generated in the Module Status Register. If an error occurs, 'toggle' the 'CLEAR ERROR BIT', O:1/8. The values contained in the CDM shown to the right will copy a total of 10 pulses in Program 0, Channel 1. The pulse 'train' will start at 0 and end at 350. Each pulse will have a duration of 10 degrees.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

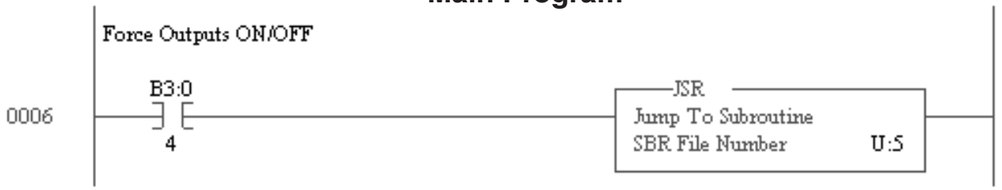
C01 Example.rss (cont'd)

Force Outputs On/Off

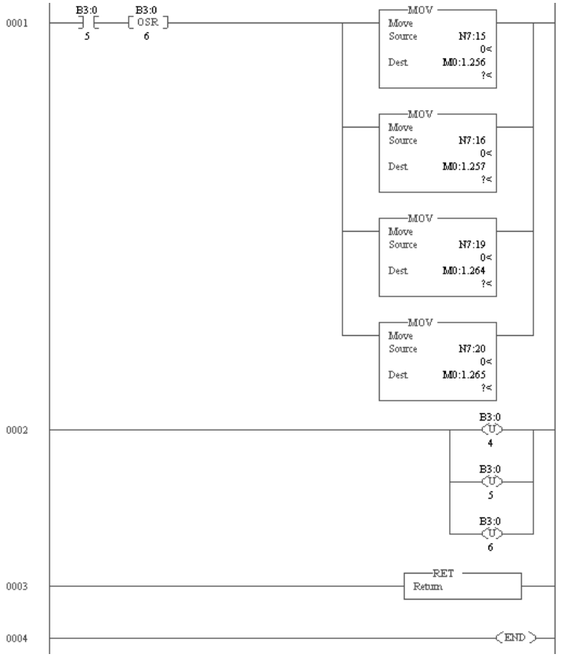
By performing the move command shown in the subroutine, we can force the outputs either 'ON' or 'OFF'. A force 'OFF' takes precedence over a force 'ON'. By toggling B3/4, we move N7:15, N7:16, N7:19 and N7:20 to M0:1.256, M0:1.257, M0:1.264 and M0:1.265. By writing a '1' to the bit locations in the 'N' registers N7:15 or N7:16, we force those outputs 'ON'. By writing a '1' to the bit locations in the 'N' registers N7:19 or N7:20, we force those outputs 'OFF'.

N7:15 and N7:19
Channels 0-15
15<----------0
0000 0000 0000 0000
N7:16 and N7:20
Channels 16-31
31<----------0
0000 0000 0000 0000

Main Program



Subroutine



CDM 2 - FORCE ON/OFF

Address	Value
Use B3/4 to activate	
B3/4	0
Force Outputs ON 0 (15 <---0)	
N7:15	0000 0000 0000 0000
Force Outputs ON 1 (31<---16)	
N7:16	0000 0000 0000 0000
FORCE OUTPUTS OFF	
Use B3/4 to activate	
B3/4	0
Force Outputs OFF 0 (15 <---0)	
N7:19	0000 0000 0000 0000
Force Outputs OFF 1 (31<---16)	
N7:20	0000 0000 0000 0000
MODULE STATUS REGISTER	
I:1.7	0000 0000 0000 0000
O:1/8	0

PS-4108-13-L16 I/O Rack Installation

Overview

The PS-4108-13-L16 I/O rack provides inputs, analog outputs, and digital power outputs (requiring Slimline™ solid state relays) for the PL-1746-C01 PLS plug-in modules. The rack is UL/C-UL listed. CE marking is pending.

PS	The rack is a member of Electro Cam Corp.'s PLμS product line.
41	The rack is mounted external to the Allen-Bradley module chassis.
08	The rack has 8 inputs.
13	The rack and PLS module communicate via Electro Cam Corp.'s proprietary *Type 13* communications.
L	The rack has two SLIMLINE analog output module slots. The rack is mounted on either EN 50035 G Profile or EN 50022 Top Hat Profile DIN rail.
16	The rack has 16 SLIMLINE solid state relays.

Environmental Requirements

Operating Temperature	0 to 55 ∞C (32 to 131 ∞F)
Storage Temperature	-40 to 70 ∞C (-40 to 160 ∞F)
Humidity	95% maximum, non-condensing

For indoor use only.
For use at altitudes up to 2000 m (meters).
Overvoltage Category I. Pollution Degree I.

CE Installations

For installations that must comply with CE requirements the PL-1746-C01 and PS-4108 must be mounted inside a metal enclosure. In addition, a CoreCom 20VK6 or equivalent single stage PI filter must be connected across the AC input to the SLC power supply. A Steward 28A2025-0A0 or equivalent ferrite bead must be snapped onto the resolver cable as close to the enclosure wall (inside) as possible.
Installations must comply with all other manufacturer's requirements.

Mounting & Grounding

The rack's mounting channel is held to either EN 50035 G profile or EN 50035 top hat profile DIN rail via three mounting clips. The rack has a 4-40 captive nut connected to the ground plane that must be tied to earth ground in the customer's installation. This must be done to maintain EMC and electrical safety.

Cabling

The primary communications connector on the rack is connected to the PLS module via the special rack cable. The secondary communications connector allows the user to daisy-chain a second rack to the first. These connections provide both for receiving input power from the PLS and for communication with the PLS. The aggregate length of all rack cables attached to a given PLS module must be 50 feet or less. The cable's shield is tied to the metal jacket covering the connectors on both ends. The jackscrews of the second DB9 are tied to ground on the PCB, while those of the first DB9 are not. Thus the shield of each cable is tied to ground at only one end.

Power

The input voltage delivered to the PS-4108 rack from the PL-1746-C01 PLS module is nominally 24V (20V min, 30V max) at a maximum of 250mA.

Fusing

Power Input Fuse (F1)	1/4 A, 250 V, TR5-F (European Style)
Spare Output Module Fuse(F3)	4 A, 250 V, TR5-F (European Style)
Fuse Tester	The rack includes a green LED (D3) that lights when a good fuse is installed in the fuse tester.

Communications

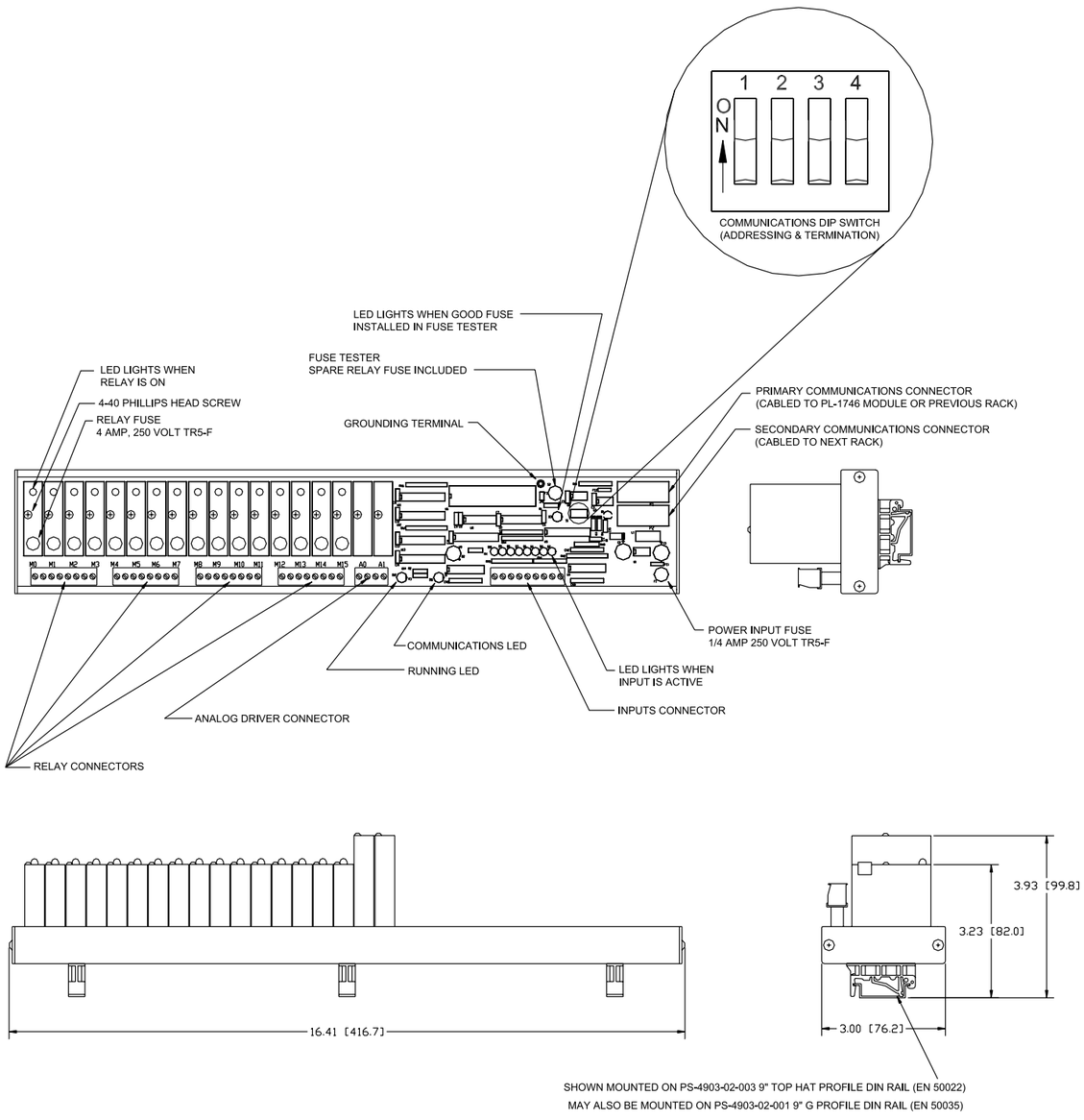
DIP switch S1 selects the rack's physical address. Note that if only one rack is used it must be addressed as rack 0.

Physical Address	Switch 1 (A0)	Switch 2 (A1)
0	ON	ON
1	OFF	ON

Rack Addressing

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PS-4108-13-L16 I/O Rack Installation



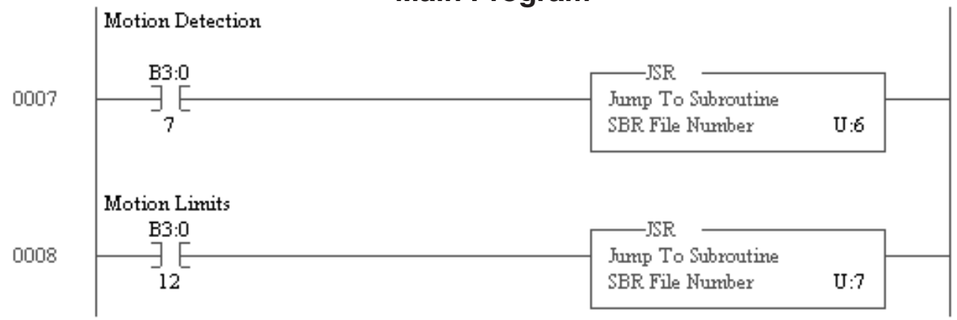
C01 Example.rss (cont'd)

Motion Detection and Motion Limits

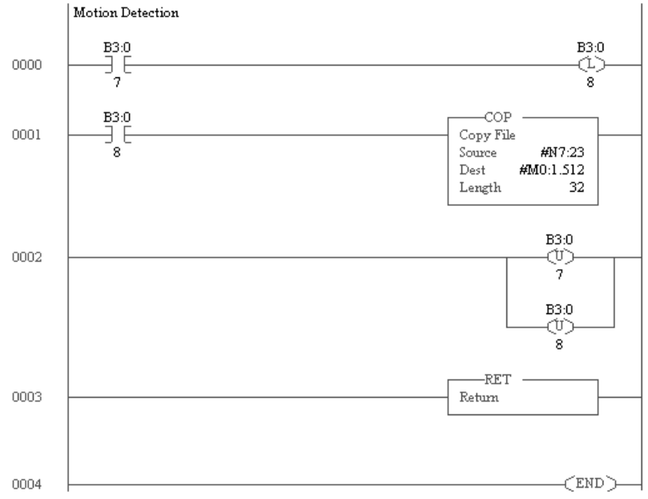
Motion Detection and Motion Limits work together. Motion Detection determines which motion limit each channel will be Anded to (0= no motion limit, 1= Limit 1, 2= Limit 2.) Motion Limits sets what the actual limit will be for Motion Limit 1 and Motion Limit 2. (Low Limit 1--High Limit 1, Low Limit 2--High Limit 2.).

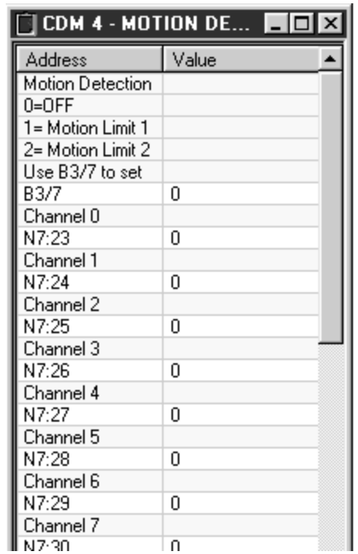
The Custom Data Monitor for both function the same as previous examples. In the Motion Detection CDM, each output channel has an integer register assigned to it. By writing a 0, 1, or 2 you declare if it will be Anded to a limit and which one. In the Motion Limits CDM, each limit has its own integer register in which you write the motion limit. (Low Limit 1=N7:55, High Limit 1=N7:56, Low Limit 2 = N7:57, High Limit 2 = N7:58).

Main Program



Subroutine (Motion Detection Limits)



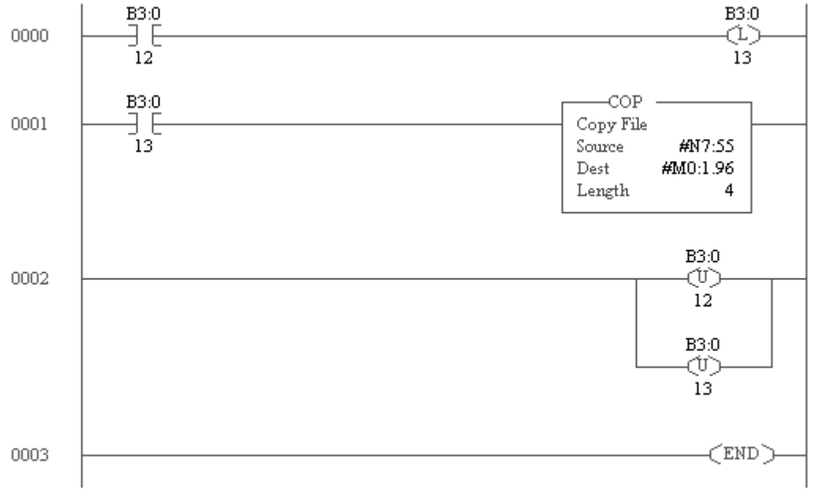


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C01 Example.rss (cont'd)

Motion Detection and Motion Limits (cont'd)
The remaining ladder diagrams and CDMs are self-explanatory. They are set up to test some of the functional operations of the PL-1746. If you have any specific questions in regards to how they function, please feel free to contact our Application Engineering or Customer Service Staff at 1-800-228-5487. You can also send your questions via FAX to 1-815-389-3304 or via email to ecam@electrocam.com.

Subroutine (Motion Limits)



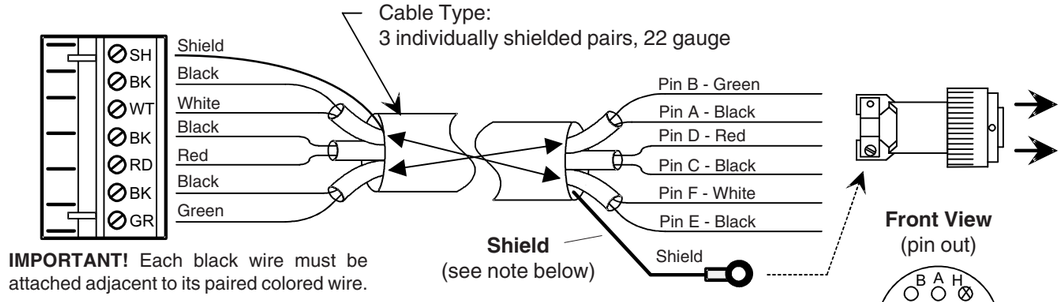
CDM 5 - MOTION LIMITS

Address	Value
B3/12	0
Motion Level :1	
low limit	
Actual	
M0:1.96	?
New Value	
N7:55	200
Motion Level :1	
high limit	
Actual	
M0:1.97	?
New Value	
N7:56	950
Motion Level : 2	
low limit	
Actual	
M0:1.98	?
New Value	
N7:57	500
Motion Level : 2	
high limit	
Actual	
M0:1.99	?
New Value	
N7:58	850

Resolver Installation

Cable for Resolver with Cannon Connector
PT# PS-5300-01-XXX (XXX = Length in Feet)

Connector - Controller End



⊗ = Not Used

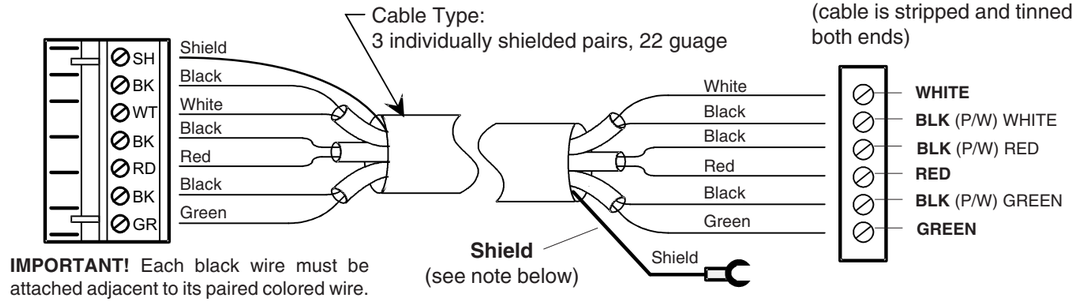
IMPORTANT! Each black wire must be attached adjacent to its paired colored wire.

Shielding Note: Resolver cables made after 3-2-93 have a ring lug on a black shield wire at the resolver end. The ring lug should be attached to one of the resolver connector strain relief screws to protect against static discharge through the resolver cable. In some installations, it may be advisable to disconnect the ring lug to prevent ground loops through the cable shield. Consult Electro Cam if electrical noise problems are suspected.

Cable for Stainless Steel Resolver with Terminal Strip Connections
PT# PS-5300-02-XXX (XXX = Length in Feet)

Connector - Controller End

Connector Inside Resolver
(cable is stripped and tinned at both ends)

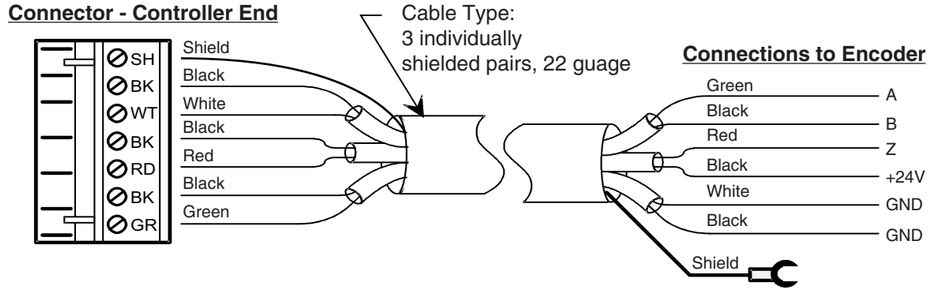


IMPORTANT! Each black wire must be attached adjacent to its paired colored wire.

Shielding Note: This type of resolver cable will have a spade lug connected to the shield at the resolver end. The lug should be attached to the grounding stud on the cover plate of the resolver. In some installations, it may be advisable to disconnect the lug to prevent ground loops through the cable shield. Consult Electro Cam if electrical noise problems are suspected.

Cable for Encoder with Terminal Strip Connections
PT# PS-5300-02-XXX (XXX = Length in Feet)

Connector - Controller End

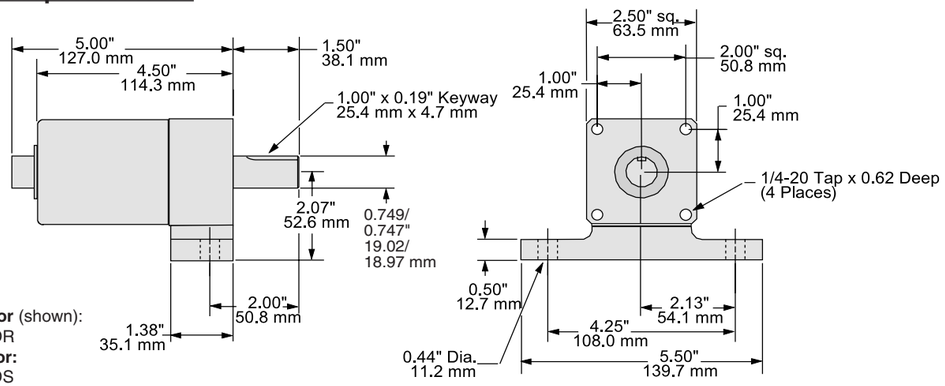


Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Resolver Installation

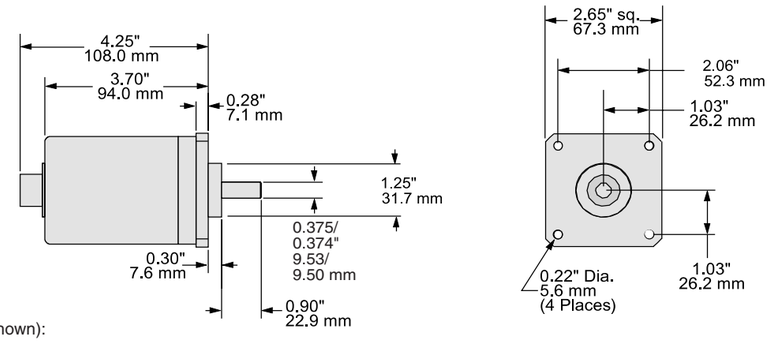
Electro Cam Corp. Resolvers

Foot Mount



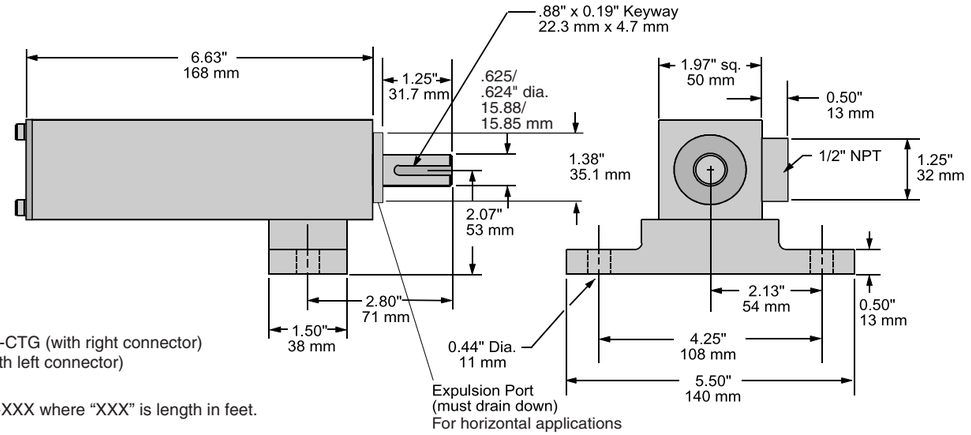
With Rear Connector (shown):
PS-5275-11-ADR
With Side Connector:
PS-5275-11-ADS
Cable:
PS-5300-01-XXX where "XXX" is length in feet.

Flange Mount



With Rear Connector (shown):
PS-5238-11-ADR
With Side Connector:
PS-5238-11-ADS
Cable:
PS-5300-01-XXX where "XXX" is length in feet.

Stainless Steel



(shown) PS-5262-11-CTG (with right connector)
PS-5262-11-CTL (with left connector)

Cable: PS-5300-02-XXX where "XXX" is length in feet.

C02 & C03 Configuration.rss

Purpose
This program provides a way to upload, preserve, and download PLS configuration data (all PLS data other than pulse data). Performing a read means uploading configuration data from the PLS and storing it in an N file. To preserve the configuration, save the .rss file in RS-Logix, including data files, after performing a read. Performing a write means downloading the configuration data from an N file into the PLS.

Read Instructions
1. Download the ladder program into the SLC processor.
2. Run the ladder program.
3. Open the Command/Status custom data monitor.
4. Clear the TransferDirection bit.
5. Set the Start bit. When all data has been transferred, the Done bit is set.

Write Instructions
1. Download the ladder program into the SLC processor.
2. Run the ladder program.
3. Open the Command/Status custom data monitor.
4. Set the TransferDirection bit.
5. Set the Start bit. When all data has been transferred, the Done bit is set.

Notes
1. If pulses are to be downloaded as well as configuration data, the pulses should be downloaded, as described in that program's instructions, after the configuration data has been downloaded as described above.
2. This program is intended for use with the C02 installed in slot 1 of the SLC rack. If that slot is unavailable, all references to slot 1 will have to be changed to the appropriate slot number.
3. Index Across Data Files (S:2/3) must be set to "Yes" for proper operation of this program.
4. See the documentation contained within the program for further details on its operation
5. See the chapter 3 of this manual for further details on errors.

Errors
Errors are indicated in the Command/Status Custom Data Monitor. If an error occurs, correct the problem, toggle the O:S.0/8 Clear Error bit (if necessary), and start the transfer again.

Bulk Error	This bit is set if an error occured during the bulk transfer, which includes all configura tion data other than the group configuration data.
Group Count Error	This bit is set if there was an out-of-range group count.
Group Position Display	This bit is set if there was an out-of-range group position display value.
Group Channel Count Error	This bit is set if there was an illegal group channel count condition.
Group Offset Error	This bit is set if there was an out-of-range group offset.
Group Mode Error	This bit is set if there was an out-of-range group mode.
Hardware Status/Error Register	This word indicates hardware status/errors in the C02.
Error Number Register	This word provides the Mapping Index Number of the register associated with the error indicated by the Module Status Register.
Programming Error Register	This word indicates programming errors.
Clear Error	This bit may be used to clear errors in either the Hardware Status Register or the Module Status Register.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

C02 & C03 Pulses.rss

Purpose
This program provides a way to upload, preserve, and download PLS pulse data. Performing a read means uploading pulse data from the PLS and storing it in an N file. To preserve the pulse data, save the .rss file in RS-Logix, including data files, after performing a read. Performing a write means downloading the pulse data from an N file into the PLS.

Read Instructions
1. Download the ladder program into the SLC processor.
2. Run the ladder program.
3. Open the Command/Status custom data monitor.
4. Clear the TransferDirection bit.
5. Set the Start bit. When all data has been transferred, the Done bit is set.

Write Instructions
1. Download the ladder program into the SLC processor.
2. Run the ladder program.
3. Open the Command/Status custom data monitor.
4. Clear all pulse data from the C02/C03. (This is easily accomplished by using Memory Test Function 7002 if a PS-6400 keypad/display is available. If a keypad/display is not available, each channel must be cleared individually; see Pulse Edit for instructions.)
5. Set the TransferDirection bit.
6. Set the Start bit. When all data has been transferred, the Done bit is set.

Notes
1. If pulses are to be downloaded as well as configuration data, the pulses should be downloaded after the configuration data has been downloaded as described above.
2. This program is intended for use with the C02 installed in slot 1 of the SLC rack. If that slot is unavailable, all references to slot 1 will have to be changed to the appropriate slot number.
3. Index Across Data Files (S:2/3) must be set to “Yes” for proper operation of this program.
4. See the documentation contained within the program for further details on its operation
5. See the chapter 3 of this manual for further details on errors.

Errors
Errors are indicated in the Command/Status Custom Data Monitor. If an error occurs, correct the problem, toggle the O:S.0/8 Clear Error bit (if necessary), and start the transfer again.

Hardware Status/Error Register This word indicates hardware status/errors in the C02.

Error Number Register	This word provides the Mapping Index Number of the register associated with the error indicated by the Module Status Register.
Programming Error Register	This word indicates programming errors.
Clear Error	This bit may be used to clear errors in either the Hardware Status Register or the Module Status Register.

C02 & C03 Example.rss

This program provides examples of ladder programming for modifying PL-1746 configuration and pulse data while in run mode. These examples can be followed, for example, when making HMIs operate with the PL-1746.

C02 & C03 -S Configuration.rss

See instructions for the C02 & C03 Configuration.rss ladder program.

C02 & C03 -S Pulses.rss

See instructions for the C02 & C03 Pulses.rss ladder program.

C02 & C03 -S Example.rss

See instructions for the C02 & C03 Example.rss ladder program.

Resolver Installation

General Information

Choose a mounting location for the resolver that allows convenient mechanical connection of the resolver shaft to the machine. The resolver is normally driven at a 1:1 ratio to machine cycles, but this is not true in all applications. Commonly used methods for driving the resolver shaft include flexible couplings, timing belts and pulleys, and chains and sprockets. Insure that the coupling method used is tight enough to minimize backlash without placing excessive side load on the resolver shaft.

No provision need be made for physically rotating the resolver shaft with respect to the machine shaft. The PL-1746 can be easily programmed to set any resolver position as the 0° position.

If possible, select a location that shelters the resolver from accidental mechanical abuse, lubricants, washdown chemicals or any other liquids. Most Electro Cam resolvers have a NEMA 4 rating or better, but avoiding contaminants will maximize their reliability and service life.

Ambient Temperature

Electro Cam resolvers have an ambient temperature range of -40° to +125°C (-40° to +257°F).

Resolver Wiring

Cables for non-stainless Electro Cam resolvers are shipped with one end soldered to the resolver connector. The connector for the other end is mounted on the Plug-In Module.

The shield is connected at both ends of the cable to prevent damage due to electrostatic discharge. If electrical noise problems are suspected when the control is in operation, call Electro Cam Corp. for advice regarding shielding.

The resolver cable used with the stainless steel resolvers (PS-5300-02-XXX) does not have a connector at the resolver end because screw terminals are used inside that resolver. When properly connected, both ends of the cable shield will be connected. If electrical noise problems are suspected when the control is in operation, call Electro Cam Corp. for advice regarding shielding.

Resolver cables supplied by Electro Cam are a special type consisting of three individually twisted/shielded pairs with a common braid shield. This insures that reliable position information is being received by the controller. The use of other cable types could degrade the accuracy of the position signals and make them more susceptible to electrical noise. For these reasons, it is recommended that customers do not make their own resolver cables. Electro Cam will make resolver cables any length up to 1000' and can expedite shipment as required.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank

PL-1746-C01 Module Specifications

Electrical (The PL-1746 controller and PS-4108 rack are both UL and UL-C listed)

Input Power:	20-30 VDC. Keypad/display is powered from controller.
Backplane Power:	5VDC @ 500 mA max.
I/O Power:	20-30 VDC, 80 mA +150 mA per keyboard + 230 mA per rack.
	Example: Total = 840 mA with 2 keyboards and 2 racks.
	Certain types of power supplies employ a self protection feature called current fold back limiting. The inrush currents of the high efficiency switching regulators may cause power supplies to enter current limit mode. Power supplies with current fold back limiting should be sufficient to supply three times the steady state current of the system.
	Inrush current @ 30v, 40 amps max. for 600 µs (2 keyboards, 2 racks).
Permanent Memory:	EEPROM (no battery required).

Environment

Operating Temp:	0° to 55°C (32° to 131°F).
Storage Temp:	-40° to 70°C (-40° to 160°F).
Humidity:	95% maximum relative non-condensing.
NEMA Rating:	Keypad/Display: NEMA 4.

Physical

Weight:	PLS Module: 0.5 lbs (0.2 kg). Keypad/Display: 0.5 lbs. (0.2 kg).

Mounting

Controller:	Mounts in SLC-500 chassis.
Rack:	Brackets accept EN-50035 (“G” profile) or EN-50022 (“Top Hat” profile) DIN rail.
Keypad/Display:	Mounts up to 1000' from controller. Multiple keypads may be connected to one controller.

Inputs On Rack

DC Inputs:	8 sinking or sourcing DC inputs, optically isolated (first rack only).
Input ON State Voltage:	10-30 VDC.
Input Current:	11 mA @ 24 VDC.
Response:	2 µs max.

Outputs On Rack

Real World Outputs:	Up to sixteen Slimline modules may be mounted on the rack. Modules may be any mix of AC, DC, and reed relay. All modules (except reed relay) are optically isolated.
Analog Output:	Up to two Slimline analog output modules may be mounted on the rack in addition to the sixteen digital modules.
Output Types:	4-20 mA or 0-10 VDC, proportional to RPM.
Resolution:	12 bit.
Update Frequency:	10 ms.
Linearity:	±0.3% of full scale @ 25°C (77°F).
Set-up:	Offset and full scale RPM are programmable.

Operation

Scan Time:	Less than 1000 µs typical (exact time determined by programming).
Position Resolution:	12 bits (4096 increments).
Speed Compensation:	Programmed in 0.1 msec steps. 16 individually compensated outputs max. Updated five times per second. Separate leading/trailing edge compensation standard.
Output Timeout:	1.0 ms time base (accuracy: +1, -0 ms).
Number of Timed Outputs:	Four maximum.
Multiple Programs:	48 programs standard.
Total Pulse Memory:	1252 pulses standard.
Pulses per Program:	512 maximum standard.
Pulses per Output:	512 maximum standard.
Maximum Speed:	3000 RPM, Note: Pulses generated with Pulse Train command are not included in pulses per program or pulses per output counts.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746-C02/C03 Module Specifications

Electrical (The PL-1746 controller is UL and UL-C listed)

Input Power:	20-30 VDC. Keypad/display is powered from controller.
Backplane Power:	5 VDC @ 500 mA max.
I/O Power:	20-30 VDC @ 90 mA max. plus 150 mA per PS-6400 keypad. Certain types of power supplies employ a self protection feature called current fold back limiting. The inrush currents of the high efficiency switching regulators may cause power supplies to enter current limit mode. Power supplies with current fold back limiting should be sufficient to supply three times the steady state current of the system.
Permanent Memory:	EEPROM (no battery required).

Environment

Operating Temp:	0° to 55°C (32° to 131°F).
Storage Temp:	-40° to 70°C (-40° to 160°F).
Humidity:	95% maximum relative non-condensing.
NEMA Rating:	Keypad/Display: NEMA 4

Physical

Weight:	PLS Module: 0.5 lbs (0.2 kg). Keypad/Display: 0.5 lbs. (0.2 kg).

Mounting

Controller:	Mounts in SLC-500 chassis.
Keypad/Display:	Mounts up to 1000' from controller. Multiple keypads may be connected to one controller.

Inputs On Module

DC Inputs:	8 DC inputs, optically isolated, sinking or sourcing in banks of 4.
Input ON State Voltage:	20-30 VDC.
Input Current:	11 mA @ 24 VDC.
Response:	2 μs max.

Outputs On Module

Real World Outputs:	6 DC outputs @ 1.5A each, 20-30 volts. **On the -C02 ALL outputs are SOURCING, on the -C03 ALL outputs are SINKING.**
Analog Output:	Analog outputs accessible through backplane only; they are proportional to RPM.
Resolution:	12 bit.
Update Frequency:	10 ms.
Set-up:	Offset and full scale RPM are programmable.

Operation

Scan Time:	Less than 1000 μs typical (exact time determined by programming).
Position Resolution:	12 bits (4096 increments).
Speed Compensation:	Programmed in 0.1 msec steps. 16 individually compensated outputs max. Separate leading/trailing edge compensation standard.
Timed Outputs:	1.0 ms time base (accuracy: +1, -0 ms).
Number of Timed Outputs:	4 maximum.
Multiple Programs:	48 programs standard.
Total Pulse Memory:	1252 pulses standard.
Pulses per Program:	512 maximum standard.
Pulses per Output:	512 maximum standard.
Maximum Speed:	3000 RPM.

PL-1746-C02/C03 Module

Outputs

32 outputs are accessible through the backplane. 6 (of the 32) optically isolated outputs are provided on the pluggable output header on the front panel for high speed, real world outputs. The outputs are either all sinking or all sourcing, depending on the part number ordered. The outputs are over-current protected by standard fast-acting 2A, 250V, TR5 fuses. They are over-voltage and reverse-voltage protected by zener diodes.

Note: Both positive and negative terminals must be connected to power supply for outputs to function.

Pluggable Output Header

Terminal Label	Function
+	Supply positive for outputs 0-2
-	Supply negative for outputs 0-2
00	Output 0
01	Output 1
02	Output 2
+	Supply positive for outputs 3-5
-	Supply negative for outputs 3-5
03	Output 3
04	Output 4
05	Output 5

Inputs

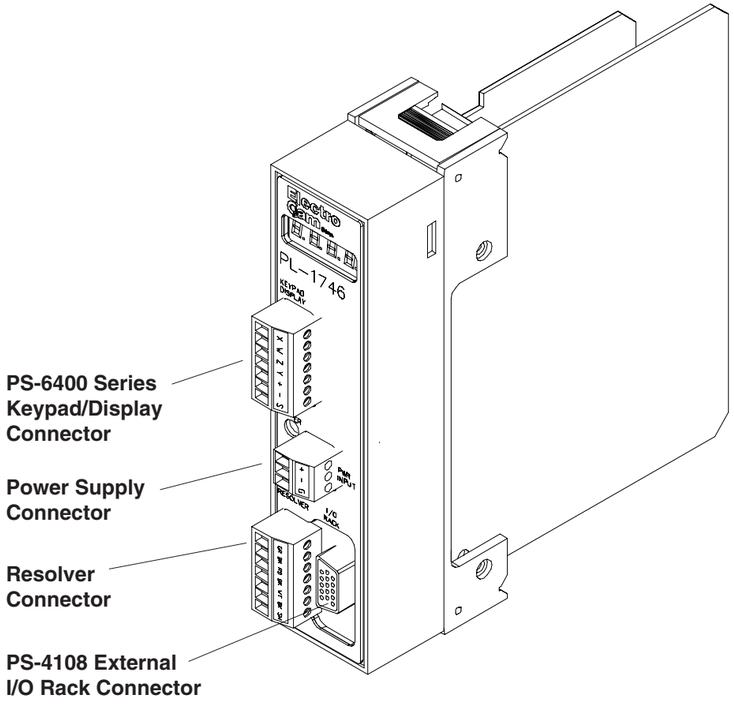
8 dc inputs are provided on the pluggable input header on the front panel: 6 group inputs, 1 First Cycle Enable input, and 1 Output Enable input. Each input is optically isolated. The 8 inputs are separated into two groups of four inputs; each group shares a common terminal. An input's state is a logic one when current is flowing through its terminal on the connector, and it's state is a logic zero when current is not flowing. The inputs are not fused. To source current to the inputs, wire the group's common terminal to the negative terminal of an external power supply. To sink current from the inputs, wire the group's common terminal to the positive terminal of an external power supply.

Pluggable Input Header

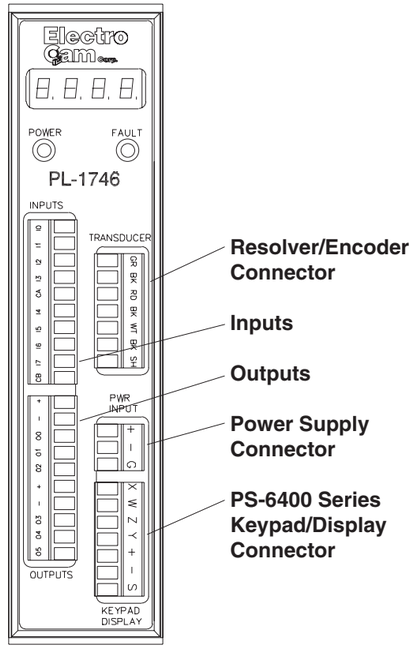
Terminal Label	Function
I0	Input 0 (Group 0)
I1	Input 1 (Group 1)
I2	Input 2 (Group 2)
I3	Input 3 (Group 3)
CA	Common for inputs 0-3
I4	Input 4 (Group 4)
I5	Input 5 (Group 5)
I6	Input 6 (FCE)
I7	Input 7 (OE)
CB	Common for inputs 4-7

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746-C01 Module



PL-1746-C02/C03 Module



PL-1746-C02/C03 Module Specifications (Cont'd)

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

Output Specifications

	Minimum	Typical	Maximum
Operating Voltage	20 V dc	24 V dc	30 V dc
Carry Current			1.5A dc
Leakage Current			150 μA dc
Turn-On Time		10 μs	50 μs
Turn-Off Time		20 μs	50 μs

Input Specifications

	Minimum	Typical	Maximum
Absolute Maximum Voltage			30 V dc
Pickup Voltage		9.2 V dc	11.0 V dc
Dropout Voltage	7.0 V dc	9.2 V dc	
Current Draw		3.5 mA dc	20 mA dc

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Solid State Relay Specifications

Note: The maximum current rating for each module installed in the PS-4108 rack is as stated in the module's specifications, OR 1.5 amps, whichever is less.

AC Outputs — **Part # EC-OAC240-3**

Output Voltage:	24 VAC rms minimum 280 VAC rms maximum
Output Current:	30 mA rms minimum 3 amps rms maximum @/below 35°C (95°F). Above 35°C derate 50 mA/°C (27.8 mA/°F)
Input Voltage:	5 VDC nominal 8 VDC maximum
Turn On Time:	100 µs maximum @ 60 Hz
Turn Off Time:	8.3 ms maximum @ 60 Hz
Off State Leakage:	2 mA AC rms @ 120 VAC rms, 60 Hz
Operating Temp.	-30°C to +70°C (–22° to +158°F)

DC Output, 60 VDC — **Part # EC-ODC060-3**

Output Voltage:	0 to 60 VDC
Output Current:	3 amps DC @/below 35°C (95°F) Above 35°C derate 35.7 mA/°C (19.8 mA/°F)
Turn On Time:	50 µs maximum
Turn Off Time:	50 µs maximum
Off State Leakage:	1 µA DC maximum @ 24 VDC
Operating Temp.	-30°C to +70°C (–22° to +158°F)

DC Outputs, 200 VDC — **Part # EC-ODC200-1 (Slimline)**

Output Voltage:	0 to 200 VDC
Output Current:	1 amp DC @/below 45°C (113°F). Above 45°C derate 18 mA/°C (10 mA/°F)
Turn On:	50 µs maximum
Turn Off:	50 µs maximum
Off State Leakage:	1 µA maximum
Operating Temp.	-30°C to +70°C (–22° to +158°F)

Analog Output, 0-10 VDC — **Part # EC-SANL-010V**

Resolution:	12 Bits (4096 Increments)
Output Voltage:	0 to 10 VDC
Output Current:	10 mA maximum
Load Resistance:	1 K Ohm minimum
Linearity:	±0.3% full scale @ 25°C (77°F)

Analog Output, 4-20 mA — **Part # EC-SANL-420M**

Resolution:	12 Bits (4096 Increments)
Output Current:	4 to 20 mA DC
Load Resistance:	450 Ohm maximum
Linearity:	±0.3% full scale @ 25°C (77°F)

Reed Relays — **EC-ORR000-0 (SLIMLINE)**

Output Type:	N/O Reed Relay Contacts
Contact Rating:	10 VA maximum
Switching Voltage:	100 VDC or 130 VAC maximum
Switching Current:	0.5 A maximum
Carry Current:	1.5 A maximum
Turn On Time:	500 ms
Turn Off Time:	500 µs
Mechanical Life:	5 x 10^6 cycles
Operating Temp:	-30 to +70°C (-22° to +158°F)

General Installation

⚠ CAUTION **If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.**

Keypad/Display

Mount the keypad/display to a panel using the four studs on the back of the keyboard. Enclosures are available from Electro Cam if an appropriate mounting location does not exist.

DIP Switches

For convenience, set the DIP switches to their proper positions before mounting the keypads and the module.

Environment

1. Ambient temperature range is 0° to 55°C (32° to 130°F).
2. Locate the chassis and keypad away from devices that generate electrical noise, such as contactors and drives.
3. Use the keypad/display gasket provided to prevent contaminants from getting into the cabinet.

Terminal Blocks

All terminal blocks can be unplugged from the PLS module and rack (PL-1746-C01). Each block is keyed so it cannot be plugged into the wrong socket. All terminals are labeled on each block.

Wiring Guidelines

Follow normal wiring practices associated with the installation of electronic controls. Some guidelines are:

1. Route input and output wiring away from high voltage, motor drive, and other high level control signals.
2. Use shielded cables for resolver and input circuits. Also shield module output circuits that are driving low current electronic input circuits.
3. Ground shielded cables at the PL-1746 end **only** (except for resolver cable).
4. Use appropriate suppression devices where module outputs are directly driving inductive loads.

CE Installations

For installations that must comply with CE requirements the PL-1746 module and PS-4108 rack must be mounted inside a metal enclosure. In addition, a CoreCom 20VK6 or equivalent single stage PI filter must be connected across the AC input to the SLC power supply. A Steward 28A2025-0A0 or equivalent ferrite bead must be snapped onto the resolver cable as close to the enclosure wall (inside) as possible.

! IMPORTANT **CE Installations must comply with all other manufacturer's requirements.**

Power Supply Wiring

Connect a 20 to 30 VDC power supply to the PLS module's power supply terminal block. Reversing the polarity will cause the power supply circuit to shut down. The PLS module will not be damaged, but you must correct the polarity for correct operation to resume.

To insure electrical noise immunity, connect a good electrical ground to the ground terminal on the power supply terminal block.

Solid State Relay Mounting

(PL-1746-C01 only) A phillips head screw holds each SSR in place. Individual SSR's can be removed and installed without affecting other modules. **Be sure to disconnect power to the rack before changing SSR's.**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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

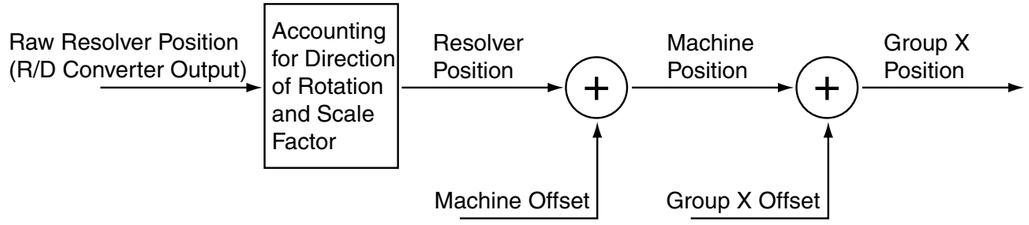
Timed outputs are programmed like standard channels to turn on and off at specific points of resolver rotation. However, once a timed output is on, it will remain on for a specified time period, regardless of RPM. If the programmed “off” position is reached before the time period passes, the output will 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.



Module Factory Defaults

Analog Outputs	
Quantity:	0
Offset:	0
High RPM:	2000
Default Program:	0
Enable Codes	
Operator:	1
Setup:	2
Master:	3
Enable Options:	ON for all functions
Increasing Direction:	CCW
Input ANDing:	OFF
Keyboard Quantity:	1
Motion ANDing:	OFF
Motion Detection:	Lo 10 RPM, Hi 3000 RPM both levels
Machine Offset:	0
Per Channel Enable:	All channels ON
RPM Update:	1/s
Output Enable ANDing:	OFF
Speed Comp:	All channels 0
Toggle RPM:	20 RPM
Scale Factor	360
Speed Comp Mode:	L/T
Group Qty:	1
Group 0 Channel Qty:	32
Group 0 Mode:	1
Group Position Display:	Each
Group 0 Offset:	0
Rate Multiplier:	1
Rate Divisor:	1
Decimal Point Location:	0
Display Units:	RPM
Pulses Used:	0
Input File Mapping Registers:	Unmapped
Output File Mapping Registers:	Unmapped
Interrupt Levels:	Zero to one transition
Interrupt Enables:	Disabled

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Resolver Specifications

Operating Temp:	-40° to 125°C (-40° to 257°F)
Storage Temp:	-40° to 125°C (-40° to 257°F)
Operating Humidity:	95% Relative non-condensing
NEMA Rating:	NEMA 4 NEMA 4X
Maximum RPM:	3000 RPM
Max Cable Length:	1000 Ft.
Type:	Single Turn - Brushless
Resolution (all):	12 Bits (4096 increments)
Linearity (standard):	+/-20 arc minutes (resolver only) (+/-30 arc minutes combined with R/D converter in controller)
Linearity (specials):	+/-3 to +/-10 arc minutes (resolver only) (+/-7 to +/-14 arc minutes combined with R/D converter in controller)

Note: A resolver's linearity errors are repeatable at all positions of its 360 degree rotation. Therefore, once appropriate setpoints are established, machine performance is consistent every cycle.

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

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.

Output Pulse Programming

This section will explain how to program ON/OFF pulses or “dwells” in the PL-1746 card via the SLC 500 backplane M0 files, using a ladder program or a touch screen interface.

Monitoring The Error Registers & Execute Busy Bit
It is recommended that the following error registers be monitored when writing information to the PL-1746.
If a command is written and no result is seen, check these error registers to see what type of error has occurred.

1. Module Status register I:S.7 (Clear errors with bit O:S.0/8). *Note: Errors in this register must be cleared or no further commands will be accepted.*
2. The error bits 10 through 15 in Pulse Edit Command Status register M0:S.902.
3. It is also recommended to monitor the execute/busy bit in the Pulse Edit Command Status register M0:S.902 bit 0. This bit is required to execute commands,and will stay high until a pulse edit command has been completed. Writing subsequent commands before this bit goes low will result in errors.

Programming ON/OFF Pulses to the PL-1746 Memory
There are 2 steps in this process as follows:
1. Enter the data to be written in the Pulse Edit M0 files (M0:S.896 – M0:S.901).
2. Enter the proper read or write command in the Command Status register (M0:S.902) to execute the M0 file data.

Example 1: Program a pulse in Program 0, Channel 1, of ON = 90, OFF = 180.

1. Since this is a write command, it requires (see table 1) that we enter the program, channel and on/off data in the M0 files (see table 2).

Data to enter	M0 file	Purpose
0	M0:S.896	Program number
1	M0:S.897	Channel number
90	M0:S.898	On: Start position of pulse
180	M0:S.899	Off: End position of pulse

1. After entering the proper information above, a command is now required in the Command Status register M0:S.902 (see tables 3 & 4).

Command	bit 4	bit 3	bit 2	bit 1	bit 0	(decimal)
Write	0	0	0	1	1	3

Once the command bits are entered, the data in the M0 files will be written to the PL-1746 memory. The execute/busy bit 0 will stay a “1” until the write is completed when it will return to “0”.

Example 2: Read the ON 90, OFF 180 pulse programmed in Program 0, Channel 1 in Example 1 above.

1. Since this is a Read command, it requires (see table 1) that we enter the program & channel data in the M0 files (see table 2). Note: If there were more that one pulse in the channel being read, we would also need to specify the Pulse number. First pulse in channel is considered pulse #0, second pulse #1, etc.

Data to enter	M0 file	Purpose
0	M0:S.896	Program number
1	M0:S.897	Channel number

1. After entering the proper information above, the command for a read is now required in the command status register M0:S.902 (see tables 3 & 4).

Command	bit 4	bit 3	bit 2	bit 1	bit 0	(decimal)
Read	0	0	0	0	1	1

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Pulse Programming

Once the Read command is sent, the information requested will be written to the M0 files (see table 2).
In this example you would see the following information returned:

Info returned	M0 file	Purpose
90	M0:S.898	On: start position of pulse
180	M0:S.899	Off: end position of pulse
0	M0:S.900	Number of the pulse being read
1	M0:S.901	Quantity of pulses in the channel

Where to monitor outputs for use in a ladder program:
The ON/OFF status for each of the 32 outputs (or channels) can be monitored in the first two 16 bit input words.
I:S.0 Outputs 0-15
I:S.1 Outputs 16-31

Special pulse edits:
To clear all pulses in a channel write a pulse of ON = 0, OFF = 0.
To delete one of the pulses in a channel containing multiple pulses change the OFF value to equal the ON value.
To turn a channel on all the time write a pulse of ON = 1, OFF = 1.

Table 1: Data requirements in M0 files before executing specific commands.

Command	Program	Channel	On/off	*Pulse #
Read	x	x		x*
Write	x	x	x	
Inc ON	x	x		x*
Dec ON	x	x		x*
Inc OFF	x	x		x*
Dec OFF	x	x		x*
Inc both ON/OFF	x	x		x*
Dec both ON/OFF	x	x		x*
Inc all in channel	x	x		
Dec all in channel	x	x		
Change ON	x	x	x (ON)	x*
Change OFF	x	x	x (OFF)	x*

*Pulse number only required if there is more than one pulse in a channel.

Table 2: Where to write (& read) pulse edit data.

M0:S.896	Program number
M0:S.897	Channel number
M0:S.898	On: Start position of pulse
M0:S.899	Off: End position of pulse
M0:S.900	Number of the pulse being read
M0:S.901	Quantity of pulses in the channel (read only)

Table 3: Command Status Register M0:S.902.

Bit #	Purpose
0	command (execute / busy)
1	command bit
2	command bit
3	command bit
4	command bit
5 - 9	not used
10	error: incorrect pulse number entered
11	error: ON pulse out of scale factor range
12	error: OFF pulse out of scale factor range
13	error: channel number out of range
14	error: program number out of range
15	error: any above error causes this bit to go high

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.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746 Quick Start & Setup

Programming the PL-1746 to Turn on Outputs Based on Position

The four steps below are all that is needed to get the PL-1746 operating in a basic programmable limit switch setup. More advanced features can then be added as needed.

1. ***Set the Direction of Increasing Rotation:*** Verify that the PL-1746 position counts in an increasing direction when the machine is in motion. If not, you will need to change the Direction Of Rotation setting through the PS-6400 keypad or in M0:S.34. In this M0 file, a value of "0" = Counter Clockwise. A value of "1" = Clockwise.

2. ***Set the Scale Factor:*** This will determine the number of counts per revolution of the resolver. The factory default is 360 which gives position in degrees. A higher scale factor (4096 max) allows ON/OFF positions to be programmed more accurately. This can be set either through the PL-6400 keypad "Scale Factor" menu or in M0:S.32

3. ***Synchronize the PL-1746 with mechanical machine position:*** Stop the machine in a known position such as zero. Enter this value in the "Machine Position" setting either through the PS-6400 keypad or in M0:S.24.

4. ***Program the ON / OFF setpoints:*** This will determine the positions where the outputs will turn on and off. Each output or channel can be set to have multiple ON/OFF pulses within each machine cycle. Programming can be done either through the "Pulses" menu in the PL-6400 keypad or through the "Pulse Edit" M0 files. Refer to the "Pulse Edit" section and "Output Pulse Programming" Apendix-1 in the PL-1746 manual.

Where to Read PL-1746 Outputs in the Ladder

All 32 PL-1746 outputs are available in two 16 bit words. Each output is represented by a single bit that will reflect that outputs ON/OFF status by a "1" or "0" respectively.
I:S.0 Outputs 0 through 15
I:S.1 Outputs 16 through 31
With the above steps completed, you are now ready to run the card with the outputs turning On and OFF at the specified positions.

Add Advanced Features for Even More Precise Control of Output Devices

Motion Anding
Select outputs to turn on only when machine speed is within user specified speed ranges. A common use of this feature is to disable glue valves when the machine stops.

Speed Compensation
Select outputs to be advanced in proportion to machine speed to compensate for devices with fixed response times. This prevents "drift" of such devices as glue guns as machine speed increases and insures accuracy over the full range of machine speeds.

Timed Outputs
Select a time value in milliseconds for the ON duration of an output rather than a position range. This feature is useful for devices that require a fixed time to perform a task regardless of machine speed. Note: You will still need to program an ON and OFF setpoint to use this feature.

Input logic / Groups and Modes
Gate specified outputs with sensor inputs for "product present" requirements. Glue control is a typical application where outputs are disabled until product is sensed. Outputs can be divided into groups and each group can be triggered by one of six available inputs.

Refer to the appropriate section of this manual for programming details on these features.

Output Pulse Programming

Table 4: Commands entered in Command Status Register M0:S.902 bits 0 through 4.

Command	bit 4	bit 3	bit 2	bit 1	bit 0	(decimal)
Read	0	0	0	0	1	1
Write	0	0	0	1	1	3
Increment ON	0	0	1	0	1	5
Decrement ON	0	0	1	1	1	7
Increment OFF	0	1	0	0	1	9
Decrement OFF	0	1	0	1	1	11
Inc both ON/OFF	0	1	1	0	1	13
Dec both ON/OFF	0	1	1	1	1	15
Inc all in channel	1	0	0	0	1	17
Dec all in channel	1	0	0	1	1	19
Change ON	1	0	1	0	1	21
Change OFF	1	0	1	1	1	23

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746 Quick Start & Setup

What the Card Does

PLS - Programmable Limit Switch: The PL-1746 Card turns outputs on and off based on machine position determined by the rotation of the resolver. All 32 outputs are available to the SLC-500 backplane and can be used in ladder logic. Most models also provide additional high speed real world outputs. Outputs can also be gated by inputs from sensors or photo eyes.

Use it as a Resolver Card for Machine Position in Ladder Logic: While the PL-1746 provides outputs based on its own internal high speed logic, it also supplies real time machine position to the SLC-500 backplane. The position can be used in ladder logic for position dependant functions.

Wiring the Card

1. Wire 24 Volts DC to the Power input connector on the front of the card.
2. Wire the resolver to the resolver input connector on the front of the card.
3. Wire the PL-6400-24-001 keypad / Display (optional - not required for operation).

Installing the PL-1746 in the SLC-500 PLC

1. After performing a “Read I/O” in Rockwell software, the card type will be automatically set to “OTHER” and the ID Code will be set to 13235.
2. In “advanced Config” you must set the “MO Length” to 16320
3. In “advanced Config” you must set the “M1 Length” to 16380

DIP Switch Settings

This is set at the factory and normally will not need to be changed unless special functions are required. The DIP Switch is located on the back of the card. See the manual for settings if needed.

Monitoring the Error Registers

It is recommended to monitor the following error registers in the PL-1746.

1. *Programming Errors*: It is recommended to monitor the “Any Error Bit” I:S.7/15. This will let you know a programming error has occurred while writing to the M0 files. Bits 0 through 14 in the Module Status register I:S.7 will signify what type of error it is. Clear these errors by toggling the Clear Error bit O:S.0/8 from a “0” to a “1”. **Note: Errors in this register must be cleared or no further programming will be accepted on some models.**

2. *Hardware Errors:* (PL-1746-C02 / C03 models only) It is recommended to monitor the “Any Fault Bit” I:S.5/15. This will let you know a hardware error has occurred. Bits 0 through 14 in the Hardware Status / Error Register: I:S.5 will signify what type of error it is. After correcting the fault, the user must clear the errors by toggling the Clear Error bit O:S.0/8 from a “0” to a “1”

How To Program PL-1746 Settings

All settings such as “Machine Zero” and “Setpoint ON/OFF positions” are retained in permanent memory and can be programmed via two different methods:
1. Through the optional Electro Cam Keypad - model PS-6400-24-001.
2. Through the M0 files in the SLC-500

Programming Settings Via M0 Files

Writing a value to the M0 files is typically done by a move command. Once the value is written to an M0 file, it resides in permanent memory within the PL-1746 card. **Note:** Setup parameters only need to be written to the M0 files once upon initial programming. Writing to the M0 files every ladder scan will cause faults and possibly damage the memory.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank

Index

Symbols

1746 Description 1-3
4108-13-L08 I/O Rack 2-13
4108-13-L16 I/O Rack 2-8

A

Active Program 3-13
Adding a Pulse 4-32
Adding Multiple Pulses 4-32
Analog Offset 4-1
Analog Output 4-1
Analog Outputs 1-6, 2-10, 2-15, 3-5
Analog Quantity 4-2

B

Backplane Interlock 3-13
Backplane Programming 3-1
Base Revision 3-13

C

C01 Configuration.rss 8-2, 8-3
C01 Example.rss 8-6
C01 Pulses.rss 8-4, 8-5
C02 & C03 Configuration.rss 8-19
C02 & C03 Pluses.rss 8-20
CE Installations 2-1
Changing Setpoints 4-33
Channel Always ON 4-33
Channel Copy 3-5, 4-2
Channel Not Enabled 7-7
Channel to Edit 4-33
Channels 1-5
Clear Error 3-3
Comm Failure 7-7
Configuration Checksum Error 7-7
Configuration.rss 8-2, 8-3, 8-19
Cursor Keys 3-14

D

Decimal Point Location 3-10
Default Program 3-13, 4-4
Defaults 9-5
Deleting a Pulse 4-33
DIP Switch Settings 2-19, 2-20
DIP Switches 2-1
Direction of Rotation 3-10, 4-4
Displayed Units 3-10
Downloading PLC Program 8-9

E

EEPROM Checksum 3-13, 4-5
EEPROM memory 4-29
Enable Codes 4-5
Enable Options 4-7
Encoder 1-3
Encoder cable 2-7
Environment 2-1
Error Index Number Register 3-2
Error Messages: Keypad 7-7
Error Messages: PL-1746-C01 Module 7-6
Error Messages: PL-1746-C02/C03 Module 7-6
Error Number Register 3-6
ESC, SEL, HLP Keys 3-14
Example.rss 8-6

F

Fixed Response Times 5-1
Force Outputs 3-8
Function 7000 4-16
Function 7001 4-16
Function 7002 4-16
Function 7998 4-16

G

General Mounting & Wiring 2-1
General Troubleshooting 7-1, 7-2
Group Channels 1-5
Group Offset 4-8
Group Programming 6-2
Groups 3-7
Groups & Modes 1-5
Groups & Modes Introduction 6-1

H

Hardware Status/Error Register 3-6

I

INC, DEC Keys 3-14
Input File 3-1, 3-5
Input Mapping Registers 3-6
Input Status 4-11, 4-12
Input Word 3-1
Inputs 1-5
Internal High Speed Logic 6-1
Interrupt Enable 4-12
Interrupts 3-6

K

Keyboard Diagnostics 7-2
Keyboard Quantity 3-13, 4-13
Keypad Display 2-1
Keypad Overview 3-14
Keypad Wiring 2-18
Keypad/Display, Mounting 2-1

L

Ladder Program 3-1
Leading Edge 3-12
Leading Trailing Speed Comp 5-4
Logic Inputs 3-7
Logic Inputs Status 3-7, 4-8, 4-20

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Index

M

M0 File 3-1
M1 File 3-1
Machine Offset 3-10, 4-14
Machine Position 3-10
Machine Speed 4-15
Main Screen 4-15
Major Revision 3-13
Master Password 3-9
Memory Tests 4-16
Menu Tree 3-15
Mode 0 Operation 6-2
Mode 1 Operation 6-3
Mode 2 Operation 6-4
Mode 3 Operation 6-5
Mode 4 Operation 6-6
Mode 5 Operation 6-7
Mode Assignments 6-2
Model 3-13
Model & Options 4-17
Module 1-5
Module Connections 2-2
Module Defaults 9-5
Module Installation 2-2
Motion ANDing 1-6, 4-17
Motion ANDing/Detection 3-8
Motion Detector 4-17
Motion Level Band 4-18

N

Negative Speed Comp 4-44, 5-6
Numeric Keys 3-14

O

Offset 4-1
Operator Enable Options 3-9
Operator Password 3-9
Options 3-13
Output Assignment Screen 4-19
Output Assignments 3-7
Output Channels 1-5
Output Enable 3-3
Output Enable ANDing 3-7, 4-19
Output File 3-1
Output Groups 4-20, 4-21
Output Mapping Registers 3-8
Output Pulse Programming Appendix-1
Output Status 3-8, 4-23
Output Word 3-1

P

Password 4-24
Per Channel Enable 4-25
Per-Channel Operator Access 3-9
Phase Adjustment 6-1
Pluses.rss 8-20
Power Supply Wiring 2-1
Processor 1-5
Program Copy 3-8, 4-25
Program Copy Command/Status 3-8
Program Copy Destination Program 3-8
Program Copy Source Program 3-8
Program Enable 3-9
Program Initialization 8-6
Programmable Limit Switch 1-2
Programming Access 1-6, 4-5
Programming Access Levels 4-6
Programming Error Register 3-6
Programming Preset 4-9
Programs 1-5
PS-4108-13-L16 I/O Rack Description 2-14, 2-16, 2-17
Pulse Copy 3-9, 4-27
Pulse Copy Channel 3-9
Pulse Copy Count 3-9
Pulse Copy Duration 3-9
Pulse Copy Program 3-9
Pulse Edit 3-9
Pulse Edit Channel 3-9
Pulse Edit Command/Status 3-9
Pulse Edit Pulse Index 3-9
Pulse Edit Pulse Quantity 3-9
Pulse Modes 4-33
Pulses 1-5, 3-10, 4-30
Pulses Used 3-13, 4-29
Pulses.rss 8-4, 8-5

Q

Quick Reference 3-5

R

Rack 1-5
Rack Cable 2-9
rack cable 2-14
Rack Installation 2-8
Rack Quantity 3-13, 4-34
Rack Troubleshooting 7-4
Rate Divisor 3-10
Rate Multiplier 3-10
Rate Setup 4-35
Raw Resolver Position 3-1, 3-6
Relay Mounting 2-1
Resolver 1-3, 1-5
Resolver Cables 2-7
Resolver Dimensions 2-6
Resolver, Electrical Problems 7-3
Resolver Installation 2-5
Resolver, Mechanical Problems 7-3
Resolver Mode 3-10, 4-36
Resolver Position 3-10
Resolver Specifications 9-6
Resolver Speed 3-10
Resolver Troubleshooting 7-3
Resolver Wiring 2-5
Response Times 5-4
Reverse Rotation 4-45
RPM Update Rate 3-10, 4-36

WARRANTY

1. Electro Cam Corp. warrants that for a period of twelve (12) months from the date of shipment to the original purchaser, its new product will be free from defects in material and workmanship and that the product conforms to applicable drawings and specifications approved by the Manufacturer. This warranty period will be extended on Distributor or OEM orders to a maximum of eighteen months to take into consideration Distributor or OEM shelf time.

2. The remedy obligations of Electro Cam Corp. under this warranty are exclusive and are limited to the repair, or at its option, the replacement or refund of the original purchase price of any new apparatus which proves defective or not in conformity with the drawings and specifications. Shipment of the claimed defective product to Electro Cam Corp. shall be at the cost of the consumer. Shipment of the repaired or replacement product to the consumer shall be at the cost of Electro Cam Corp. All claims must be made in writing to Electro Cam Corp., 13647 Metric Road, Roscoe, IL 61073 USA.

3. In no event, and under no circumstances, shall Electro Cam Corp. be liable for:

   a. Any product damaged or lost in shipment. Inspection for damage should be made before acceptance or signing any delivery documents releasing responsibility of the delivering carrier.

   b. Product failure or damages due to misuse, abuse, improper installation or abnormal conditions of temperature, dirt or other contaminants as determined at the sole discretion of Electro Cam Corp.

   c. Product failures due to operation, intentional or otherwise, above rated capacities as determined at the sole discretion of Electro Cam Corp.

   d. Non-authorized expenses for removal, inspection, transportation, repair or rework. Nor shall the manufacturer ever be liable for consequential and incidental damages, or in any amount greater than the purchase price of the equipment.

4. There are no warranties which extend beyond the description on the face hereof. This warranty is in LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED INCLUDING (BUT NOT LIMITED TO) ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ALL OF WHICH ARE EXPRESSLY DISCLAIMED. Any legal proceeding arising out of the sale or use of this apparatus must be commenced within (18) months of the date of shipment from the manufacturer.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table of Contents (cont'd)

Chapter 4 - PLS Functions (cont'd)
Rate Setup ..... Configure Speed Display 4-35
Resolver Mode 4-36
RPM Update Rate ..... Set How Frequently the Speed Display is Updated 4-36
Scale Factor 4-37
Shift Count 4-38
Shift Position 4-41
Shift Register Display 4-41
Shift Window 4-42
Software Version 4-43
Speed Compensation ..... Compensating PLS Output Timing for Delays in External Devices 4-44
Speed Comp Mode ..... Select Whether Leading & Trailing Pulse Edges Have Unique Values 4-45
Timed Outputs ..... Assign Timeout Durations to Pulses 4-45
Toggle RPM ..... Set the Speed at which the Display Changes from Position to Speed 4-46

Chapter 5 - Speed Compensation - Compensating PLS Output Timing for Delays in External Devices
Introduction to Speed Compensation 5-1
Standard Speed Compensation 5-1
Leading/Trailing Edge Speed Compensation 5-4
Negative Speed Compensation 5-6
Speed Compensation Guidelines 5-6

Chapter 6 - Groups & Modes - Using External Inputs to Condition PLS Outputs
Introduction to Groups & Modes 6-1
Mode 0 ..... Straight Cam Logic 6-2
Mode 1 ..... Reset to Preset Position 6-3
Mode 2 ..... Reset to Preset Position with One Cycle Enable 6-4
Mode 3 ..... Outputs Gated by Group Inputs 6-5
Mode 4 ..... One Cycle Enable with Edge-Triggered Input 6-6
Mode 5 ..... One Cycle Enable with Level-Triggered Input and First Cycle Enable 6-7

Chapter 7 - Troubleshooting
General Troubleshooting 7-1
PS-6400 Keypad Troubleshooting 7-2
Resolver Troubleshooting 7-3
Rack Troubleshooting 7-4
Error Messages: PL-1746-C01 Module 7-6
Error Messages: PL-1746-C02/C03 Module 7-6
Error Messages: PS-6400 Keypad 7-7

Chapter 8 - Utility & Example Ladder Programs
Overview of Utility & Example Ladder Programs 8-1
C01 Configuration.rss 8-2
C01 Pulses.rss 8-4
C01 Example.rss 8-6
C02 & C03 Configuration.rss 8-19
C02 & C03 Pulses.rss 8-20
C02 & C03 Example.rss 8-20
C02 & C03-S Configuration.rss 8-20
C02 & C03-S Pulses.rss 8-20
C02 & C03-S Example.rss 8-20

Chapter 9 - Specifications & Factory Defaults
PL-1746-C01 Module Specifications 9-1
PL-1746-C02/C03 Module Specifications 9-2
Solid State Relay Specifications 9-4
Module Factory Defaults 9-5
Resolver Specifications 9-6

Appendix - Output Pulse Programming Information

Index

Index

S

Scale Factor 1-6, 3-10, 4-37
Sensor Lag 5-6
Setpoint Reading 8-4, 8-5
Setpoints 1-5
Setting Speed Comp 5-2
Setup Password 3-9
Shift Count 4-40
Shift Position 3-11, 4-38, 4-41
Shift Register 3-11
Shift Register Display 4-41
Shift Window 4-42
Sinking/Sourcing 2-11, 2-16, 2-18
Software Version 4-43
Solid State Relay 1-5
Solid State Relay Mounting 2-1
Specifications, Module 9-1, 9-2, 9-3
Specifications, Solid State Relay 9-4
Speed Comp Mode 3-12, 4-45
Speed Comp, Repsonse Times 5-4
Speed Comp, Sensor Lag 5-6
Speed Comp, Setting 5-2
Speed Compensation 1-6, 3-12, 4-44, 5-1
Standard Speed Comp 5-1
System M0 Interlock 3-1

T

Terminal Blocks 2-1
Timed Outputs 1-6, 3-13, 4-45
Toggle RPM 3-10, 4-46
Trailing Edge 3-12

U

Utility & Example Ladder Programs 8-1

W

Watchdog Timer Test 4-16
Wiring Guidelines 2-1
Wiring Inputs 2-16, 2-17

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Notes

Table of Contents

Chapter 1 - Introduction
Quick Start & Setup 1-1
Introduction to Programmable Limit Switches 1-3
Resolvers & Encoders 1-3
PL-1746-C01 Module Description 1-3
PL-1746-C02/C03 Module Description 1-4
Basic Terminology 1-5
PL-1746 Additional Features 1-6
Positions & Offsets 1-6

Chapter 2 - Installation
General Installation 2-1
PL-1746-C01 Module 2-2
PL-1746-C02/C03 Module 2-2
Resolver Installation 2-5
Resolver & Encoder Cables 2-7
PS-4108-13-L16 I/O Rack Installation 2-8
PS-4108-13-L08 I/O Rack Installation 2-13
PS-6400 Keypad Installation 2-18
DIP Switch Settings 2-19

Chapter 3 - How to Program the PLS
Backplane Programming 3-1
Remote I/O 3-4
Register Mapping 3-4
Quick Reference 3-5
PS-6400 Keypad Overview 3-14
Menu Tree 3-15

Chapter 4 - PLS Functions
Analog Output ..... Based on Speed 4-1
Analog Quantity 4-2
Channel Copy 4-2
Default Program/Active Program 4-4
Direction of Rotation 4-4
EEPROM Checksum 4-5
Enable Codes ..... Operator, Setup, & Master Passwords 4-5
Enable Options ..... Operator Access to PLS Features 4-7
Group Offset ..... Reset Group Electrical Zero to Mechanical Zero 4-8
Group Position Display 4-10
Input Maps ..... Map M File Data to Input File Registers 4-11
Input Status 4-11
Interrupt Enable ..... Enable a PLS Output to Interrupt the SLC Processor 4-12
Interrupt Level 4-12
Keyboard Quantity 4-13
Machine Offset ..... Reset Global Electrical Zero to Mechanical Zero 4-14
Main Screen ..... Shows Position, Speed, and Active Program 4-15
Memory Tests 4-16
Model & Options 4-17
Motion ANDing ..... Associate Channels with Motion Detection Levels 4-17
Motion Detection ..... Set Speed Levels to Enable Outputs 4-18
Output Assignment 4-19
Output Enable ANDing ..... Select PLS Outputs to be Gated by Output Enable Input 4-19
Output Groups ..... Divide Outputs into Groups 4-20
Output Maps ..... Map Output File Registers to M File Data 4-22
Output Status ..... View or Force PLS Outputs 4-23
Password 4-24
Per Channel Enable ..... Enable Operator-Level Programming of Selected Channels 4-25
Program Copy 4-25
Pulse Copy 4-27
Pulses Used ..... View Total Number of Currently Programmed Pulses 4-29
Pulse Edit ..... Create, Modify, or Delete Pulses 4-30
Pulses ..... Create, Modify, or Delete Pulses 4-32
Rack Quantity 4-34

(Continued)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Copyright © 2000
All Rights Reserved

Neither this document nor any part may be reproduced or transmitted in any form or by any means without permission in writing from the publisher.

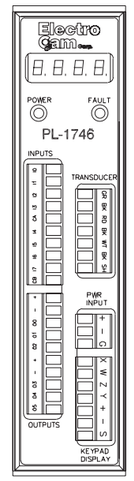
Electro Cam, PLµS, **SLIMLINE**, and PLµSNET are all registered trademarks of **Electro Cam** Corp.

This product incorporates technology which is licensed by Allen-Bradley Company, Inc. A-B has not technically approved, nor does it warrant or support this product. All warranty and support for this product and its application is provided solely by Electro Cam Corp.

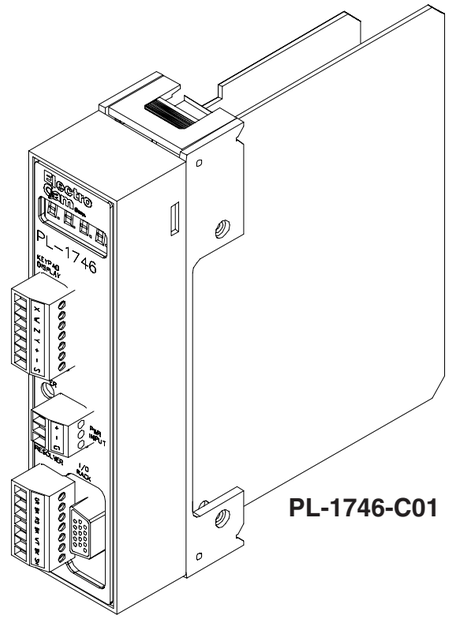
Notes

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PL-1746 PLμS® Plug-In Module
for the Allen-Bradley SLC 500 PLC



PL-1746-C02/C03



PL-1746-C01

c UL us

CE

Programming & Installation Manual

October 2006

ROCKWELL AUTOMATION
ENCOMPASS
AMERICAS PARTNER

Electro Cam Corp.
800-228-5487 (U.S.A. and Canada) • Web Site: www.electrocam.com • email: ecam@electrocam.com
PRINTED IN U.S.A
298 10/06

Electro Cam Corp.
13647 Metric Rd • Roscoe, IL 61073 USA • 815/389-2620 • FAX 815/389-3304 • 800-228-5487 (U.S.A. and Canada)

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP