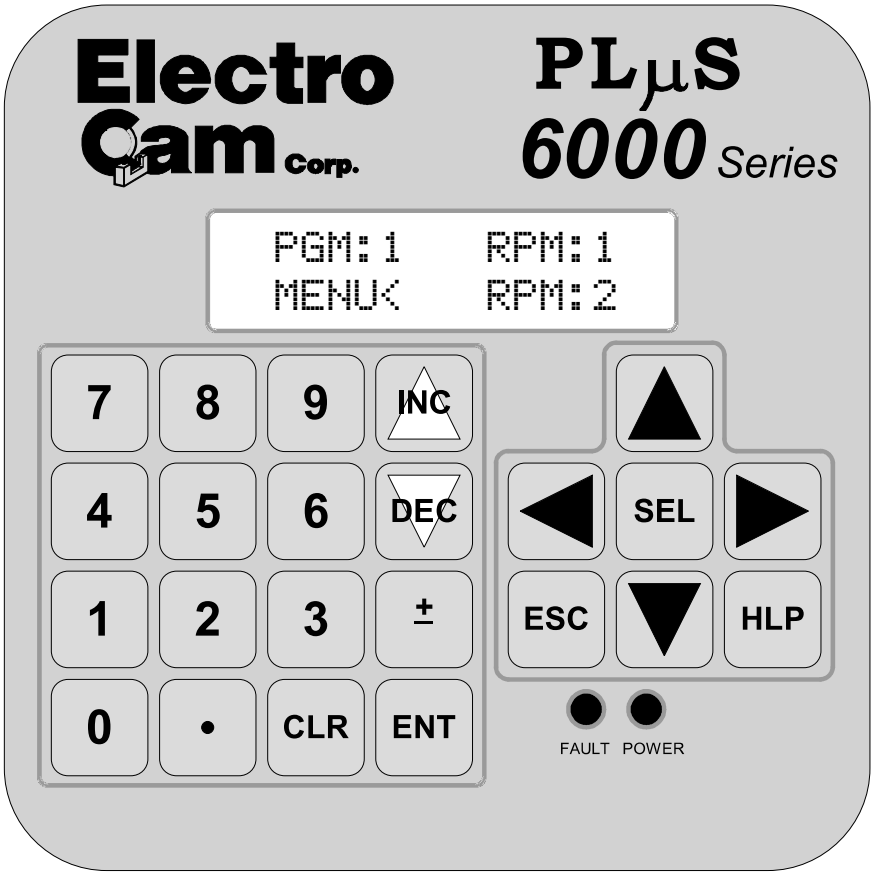
PLμS® PS-6344 Series

Programmable Limit Switch
Dual Resolver Model



Programming & Installation Manual

May 2000

Electro Cam Corp.

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

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    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.

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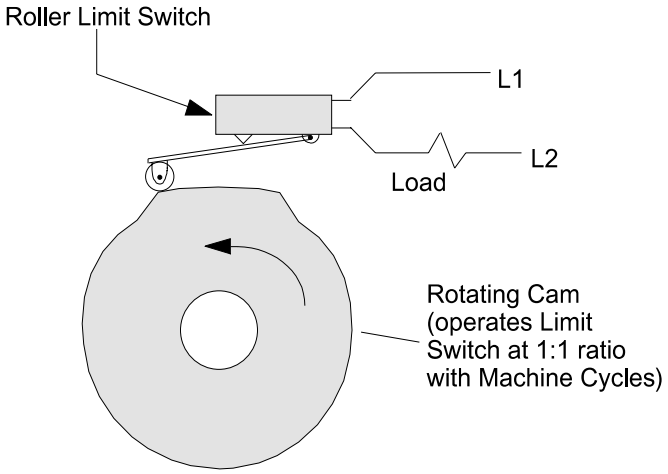
Mechanical Cam Switches

Mechanical Cams

The PS-6344 Programmable Limit Switch electronically simulates mechanical cam switches. A cam switch consists of a roller limit switch whose arm rides on a cam as shown in Figure 1. The cam shaft is driven by a machine at a 1:1 ratio, so that the cam switch turns on and off at specific positions in the machine cycle. Cam limit switches have the following disadvantages:

- The roller, the cam, and the limit switch wear out.
- The machine must be stopped during adjustment.
- On/off patterns are limited, and changing the pattern may require replacement of one cam with another. For example, a cam that switches on and off twice in one revolution would need to be replaced with a different cam if three on/off pulses per revolution were required.
- They cannot run at high speeds because of contact bounce and excessive mechanical wear.

Figure 1—Basic Cam Switch



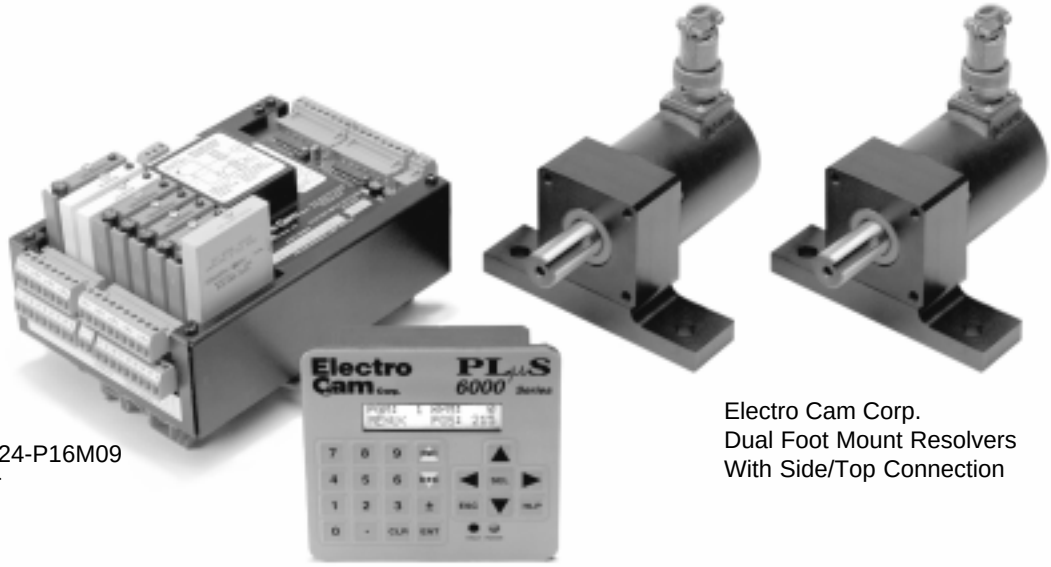
PS-6344's & Resolvers

The PS-6344 Programmable Limit Switch uses resolvers (Figure 2) instead of cams to indicate machine position. A resolver uses fixed and rotating coils of wire to generate an electronic signal that represents shaft position. The resolver is usually coupled to a machine shaft at a 1:1 ratio so that one resolver shaft rotation corresponds to one machine cycle. Resolvers have no brushes, contacts, or any frictional moving parts to wear out.

Based on the resolver signal, the PS-6344 Programmable Limit Switch turns electrical circuits, or "Outputs," on and off, simulating the mechanical roller limit switch. Because the combination PS-6344/resolver 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.

Figure 2—PS-6344 Controller, Keypad, and Resolvers



PS-6344-24-P16M09
Controller

Electro Cam Corp.
Dual Foot Mount Resolvers
With Side/Top Connection

PS-6000 Series
Keypad/Display

PS-6344 Description

Controller & Keypad

PS-6344 Series Programmable Limit Switches consist of three main components: the controller, the resolvers, and the keypad/displays. The controller houses the microprocessor, associated circuitry, and all of the I/O circuits. This eliminates the need for external I/O racks. The controller is capable of accepting rotary position input from one or two resolvers. Channels are assigned to either resolver 1 or resolver 2 through the output groups function.

A separate 1/4 DIN keypad/display provides a complete user interface from which every aspect of the controller's operation can be monitored and programmed. Multiple keypads can be connected to a single controller. In addition, when interfaced to a PLC or other computer, the controller can be used without a keypad/display. When properly mounted with the gasket provided, the keypad/display meets NEMA 4 standards. A clear silicon rubber boot assembly is available to provide NEMA 4X protection for installations where harsh washdown chemicals are used.

The PS-6344 Series is available in two models, the PS-6344-24-X16M09 and the PS-6344-24-M17. Both are described in Figure 3.

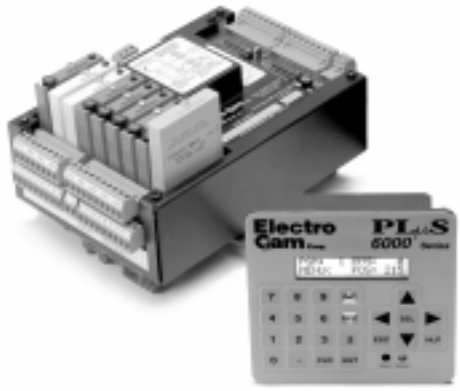
Figure 3—PS-6344 Models

PS-6344-24-M17 Controller—Up to 17 Outputs

The PS-6344-24-M17 has 17 total outputs:

- Outputs 1 through 17 can accept AC or DC output modules for driving "real world" devices such as solenoids, valves, or glue guns.
- Outputs 16 & 17 will also accept an analog module that generates a control signal proportional to RPM.

PS-6344-24-X16M09 Controller—Up to 25 Outputs



The PS-6344-24-X16M09 has 25 total outputs:

- 16 transistor outputs are built into the controller.
- Outputs 17 through 25 can accept AC or DC output modules for driving "real world" devices such as solenoids, valves, or glue guns.
- Outputs 24 & 25 will also accept an analog module that generates a control signal proportional to RPM.

Basic Terminology

Channels

Each Channel in the PLuS controller contains ON and OFF setpoints for one 360° revolution of the resolver/encoder 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.

Group Channel - These channels control the interaction between groups of outputs and an input received from a sensor or other controlling device.

Inputs

Signals from external sources accepted into the PLuS controller which can be sent from a position transducer (encoder/resolver) or other external sensor or switch.

Internal High Speed Logic

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

Program

Programs allow the user to store channel ON/OFF setpoints for specific machine set-ups. By selecting different programs, product changeovers can easily be made without reprogramming individual setpoints.

Pulses

A pulse begins at the ON setpoint and ends at the OFF setpoint. The ON setpoint is the leading edge of the pulse, and the OFF setpoint is the trailing edge. When multiple pairs of setpoints are programmed into one channel, the channel is said to have multiple pulses.

Setpoints

Setpoints are the points within one rotation of the resolver/encoder at which a channel turns ON or OFF. Setpoints can be programmed into a channel through the keypad/display. Any given channel can turn ON and OFF multiple times within one rotation.

PS-6344 Standard Features

Scale Factor with High Resolution

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. Standard controls have a maximum of 4096 increments per revolution. Note: Each resolver can have it's own scale factor setting.

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 with Leading/Trailing Edge Adjustment

Speed compensation advances the setpoints for an output as machine speed increases. This eliminates the need to manually adjust the setpoints for fixed-response devices when machine speeds are changed. Speed compensation provides greater accuracy, higher production speeds, and reduced downtime for machine adjustment.

Leading/Trailing Edge Adjustment allows the “on” and “off” edges of output pulses to be speed compensated by different amounts. This feature is used for devices whose “on” and “off” response times are significantly different. High speed gluing is a common application. See Section 4 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.

PS-6344 Standard Features (cont'd)

Timed Outputs

Timed outputs are programmed like standard outputs 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

PS-6344 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 PS-6344.

Serial Communication

Using Electro Cam Corp.’s PLuSNET software for IBM-PC compatible computers, the controller’s entire program can be saved to a disk file or loaded from a disk file to the controller. The program can be printed or edited using the computer. Individual commands may also be sent to the controller to change settings while running. See Section 6 for details.

PS-6344 Optional Features

“-W” Washdown

PS-6400 keypads with the “-W” option are rated NEMA 4X and are shipped with a clear silicon rubber boot fitted over and around the keyboard area. The back of this boot provides a good seal between the back of the keyboard and the panel. The boot is transparent and pliable, allowing the keyboard to be viewed and operated through it. In addition to preventing contamination from harsh chemicals, the boot also protects the keyboard from grease, oil, dirt and normal wear that could otherwise shorten the life of the keyboard.

These clear silicon rubber boots can be ordered separately and installed on existing controls in the field.

“-V” Vibration

This option offers extra conformal coating on PCB's for added protection against high shock and vibration.

General Mounting & Wiring

Controller

The controller body mounts on a DIN rail as shown in Figure 4.

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 on the side of the controller and keypad to their proper positions before mounting the units in a panel. See page 2-14 for DIP switch information.

Environment

1. Allow space at both sides and the top of controller for terminal blocks to be unplugged.
2. Ambient temperature range is 0° to 55°C (32° to 130°F).
3. Locate the controller and keypad away from devices that generate electrical noise, such as contactors and drives.
4. Use the keypad/display gasket provided to prevent contaminants from getting into the cabinet.

Terminal Blocks

All terminal blocks can be unplugged from the controller. Each block is keyed so it cannot be plugged into the wrong socket. All terminals are labelled on each block.

Wiring Guidelines

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

⚠ CAUTION

1. Route input and output wiring away from high voltage, motor drive, and other high level control signals.
2. Use shielded cables for resolver, input, transistor output, and communication circuits. Also shield module output circuits that are driving low current electronic input circuits.
3. Ground shielded cables at the PS-6344 end **only** (except for resolver cable). Use any of the screws on the controller back for grounding.
4. Use appropriate suppression devices where module outputs are directly driving inductive loads.

Power Supply Wiring

Connect a 20 to 30 VDC power supply to TB 8 (Fig. 5 or 6). Reversing the polarity will blow the 1-1/4 amp power fuse. The controller will not be damaged, but you must correct the polarity and replace the fuse before the controller will operate.

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

Module Mounting

A phillips head screw holds each module in place. Individual modules can be removed and installed without affecting the other modules on the unit.

⚠ WARNING

Disconnect power to the controller before changing modules.

Installation Instructions for
Compliance to the European EMC Directive

Special attention must be given to the installation of PluS controllers in order to meet the Electro Magnetic Compatibility requirements of EN-50082 and EN-50081. Specific attention must be given to the following three areas:

1. The controller and keypad must be mounted in a metal enclosure. A standard steel NEMA 12 electrical enclosure meets this requirement.

2. The frames of the controller and keypad must be grounded to the main frame ground of the enclosure with wide flat braided ground cable, preferably less than 8 inches long.

NOTE: It is important for the ground to go to the main enclosure ground by the shortest route possible and that it must be with wide flat braided cable. The door to the enclosure will not work as an effective EMC ground point. An EMC ground is NOT the same as an electrical ground.

3. Snap on ferrite cores (Fair-Rite 0443625006 or equivalent) need to be installed over the resolver cable and the communications cable as close as possible to the connector on the controller.

These simple modifications in installation will insure compliance with the European EMC Directive.

Figure 4—Mounting Dimensions

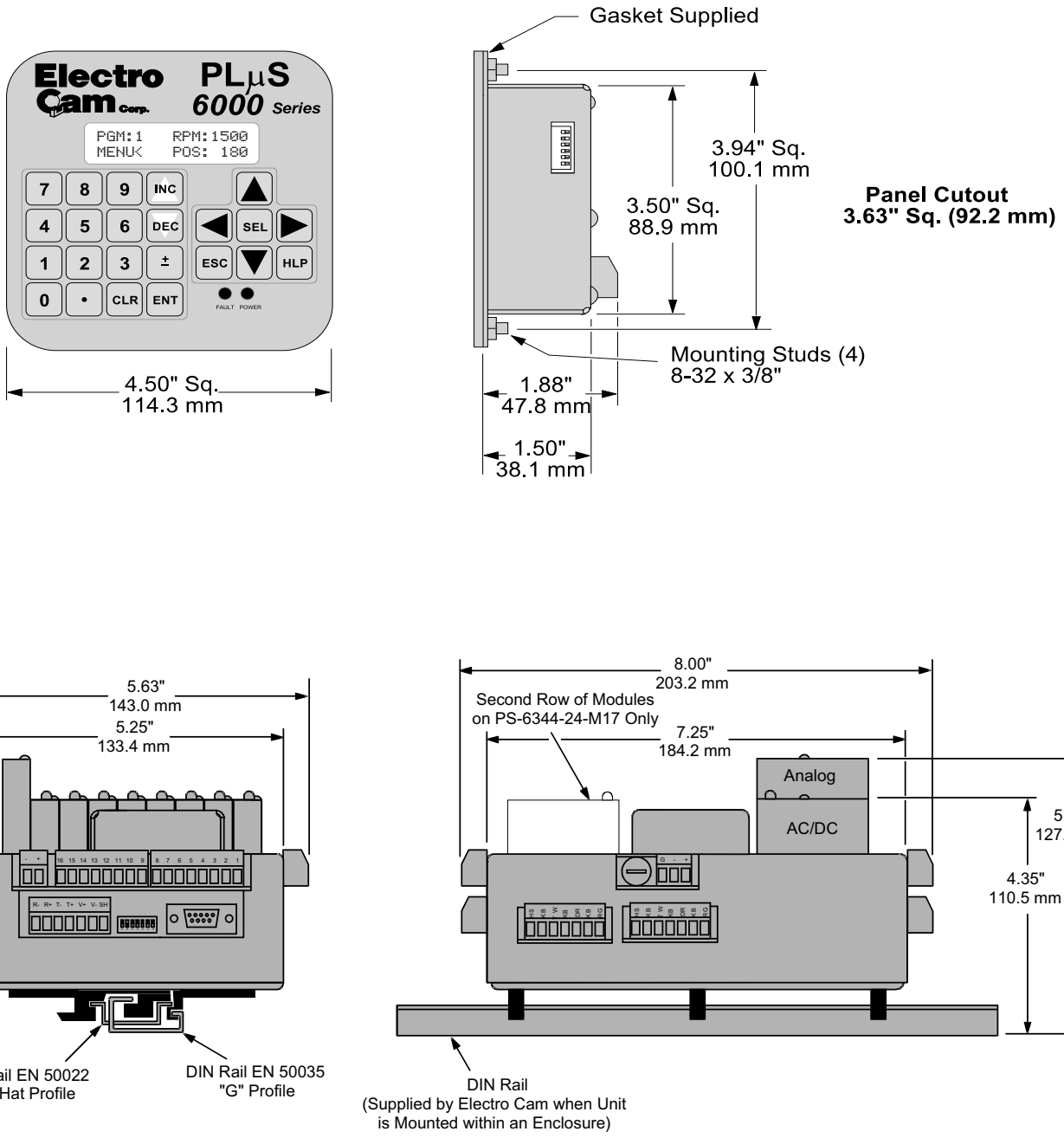
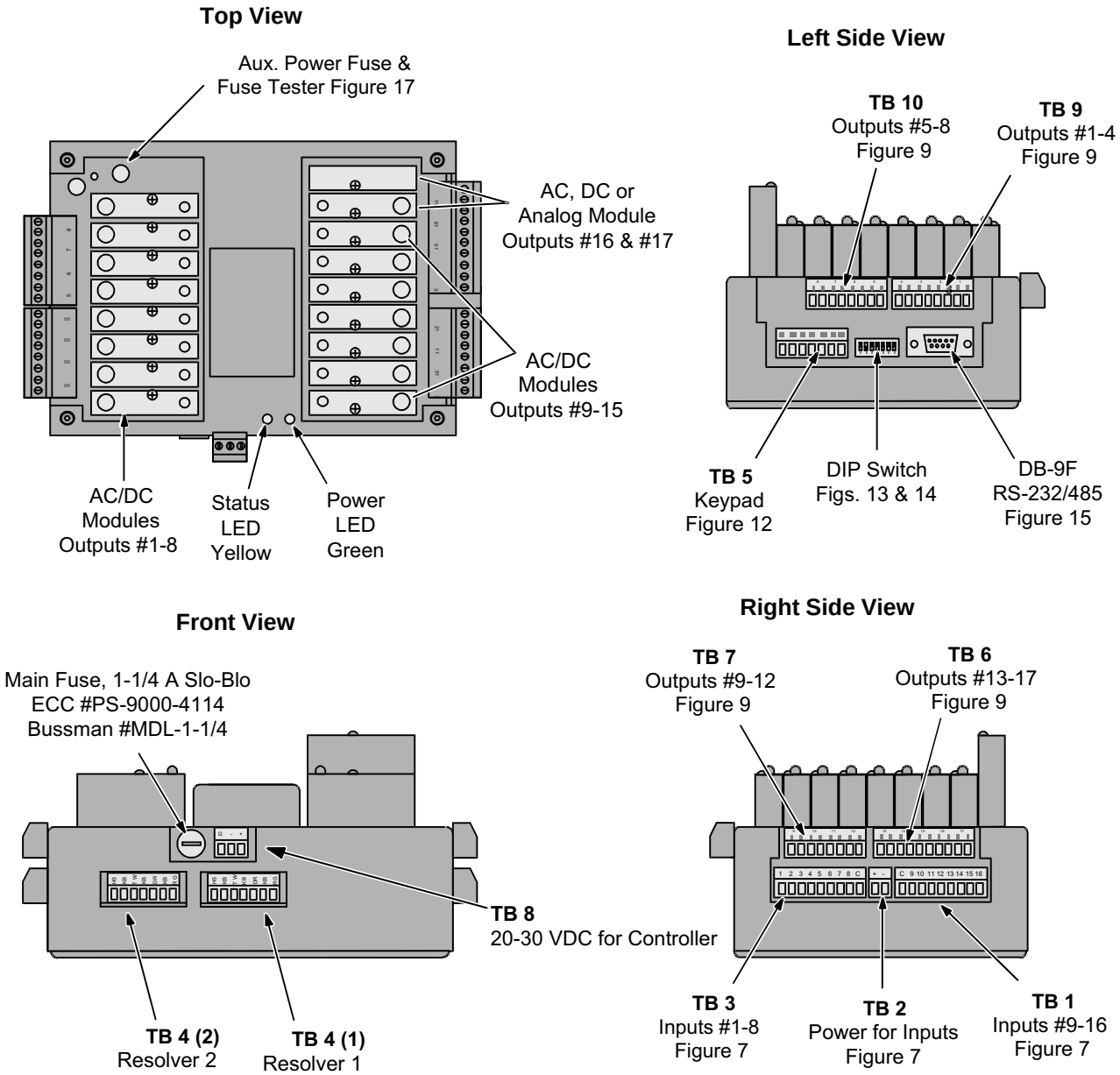


Figure 5—PS-6344-24-M17 Terminals & Components

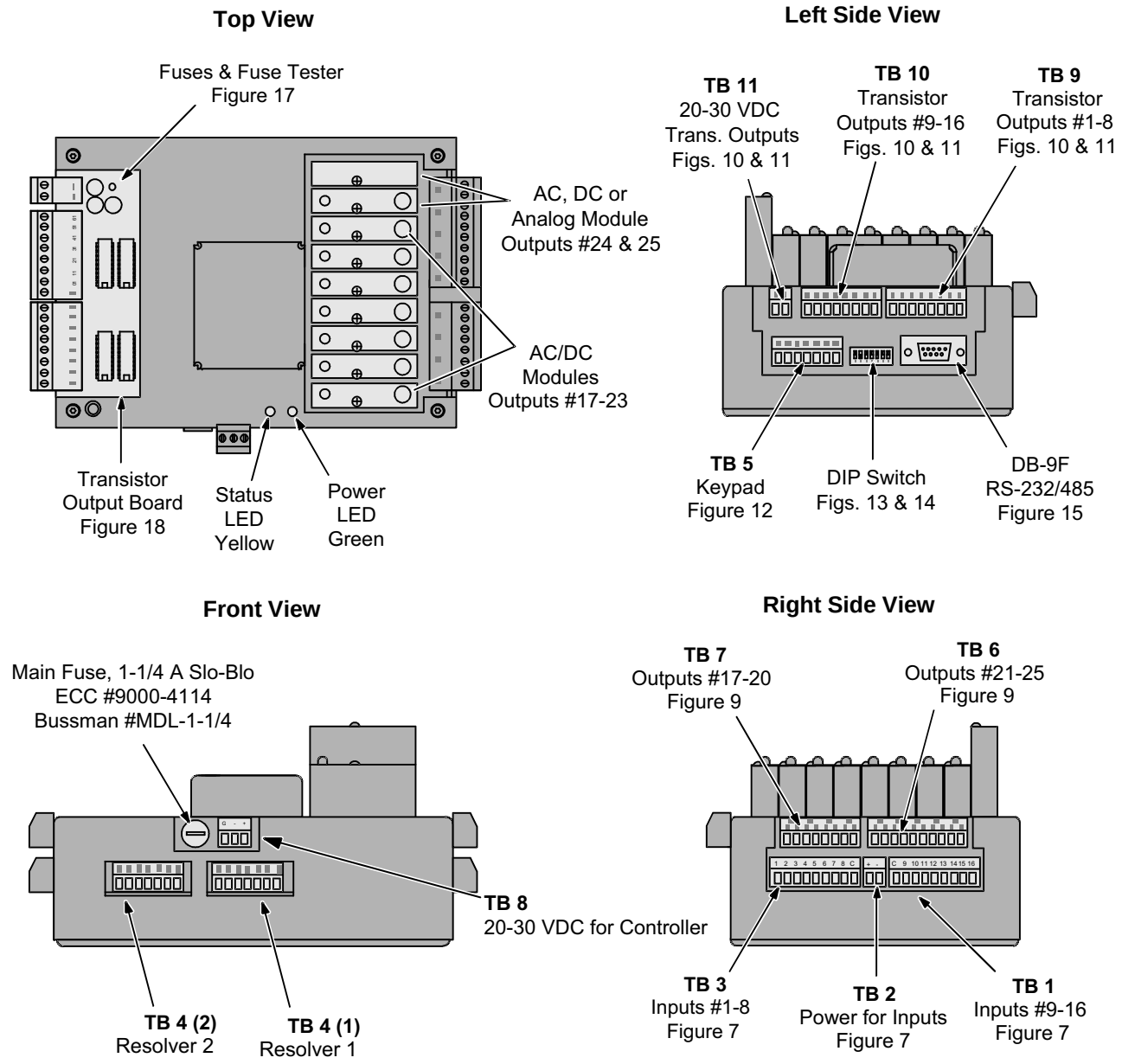


Terminal Block Details

Terminal Block	Function	ECC Part #[1]
TB 1	Inputs #9–16	PS-9006-0024
TB 2	Auxiliary power output	PS-9006-0018
TB 3	Inputs #1–8	PS-9006-0023
TB 4 (1)	Resolver 1 connector	PS-5300-01-TER
TB 4 (2)	Resolver 2 connector	PS-5300-01-TE2
TB 5	Keypad port connector	PS-9006-0029
TB 6	Module outputs #13-17	PS-9006-0031
TB 7	Module outputs #9-12	PS-9006-0030
TB 8	Power for controller	PS-9006-0026
TB 9	Module outputs #1-4	PS-9006-0033
TB 10	Module outputs #5-8	PS-9006-0034

[1] Keyed to prevent accidental insertion into wrong sockets.

Figure 6—PS-6344-24-X16M09 Terminals & Components



Terminal Block Details

Terminal Block	Function	ECC Part #[1]
TB 1	Inputs #9–16	PS-9006-0024
TB 2	Auxiliary power output	PS-9006-0018
TB 3	Inputs #1–8	PS-9006-0023
TB 4 (1)	Resolver 1 connector	PS-5300-01-TER
TB 4 (2)	Resolver 2 connector	PS-5300-01-TE2
TB 5	Keypad connector	PS-9006-0029
TB 6	Module outputs #21–25	PS-9006-0028
TB 7	Module outputs #17–20	PS-9006-0027
TB 8	Power for controller	PS-9006-0026
TB 9	Transistor outputs #1–8, sinking	PS-9006-0019
	Transistor outputs #1–8, sourcing	PS-9006-0021
TB 10	Transistor outputs #9–16, sinking	PS-9006-0020
	Transistor outputs #9–16, sourcing	PS-9006-0022
TB 11	Power for transistor outputs	PS-9006-0017

[1] Keyed to prevent accidental insertion into wrong sockets.

Controller Input Wiring

Input Terminals

Hardware inputs can be used to select a program of setpoints or activate groups of outputs based on sensor signals according to mode logic as described in Section 5.

The 16 inputs on the PS-6344 are arranged on two terminal strips, TB 1 and TB 3, as shown in Figure 7. Each input is optically isolated and can be powered from an external DC power source or the Auxiliary Power terminals located on TB 2.

Sinking or Sourcing

Each terminal strip TB 1 and TB 3 can be wired to accept sinking or sourcing input signals, but all eight inputs on that strip will require the same type of signal. Many types of hardware can drive these inputs, including mechanical switches, relay contacts, DC 3-wire sensors, solid state DC output modules, and PLC DC outputs. 2-wire DC sensors can also be used, but may require a load resistor in parallel with the input. Typical wiring diagrams are shown in Figure 7.

Input Functions

The following are the input terminals and their corresponding functions:

Program Select (1–8)
The on/off status of these terminals selects which program of setpoints is controlling the outputs. Binary, BCD, or Gray Code formats can drive these terminals as shown in Figure 8.

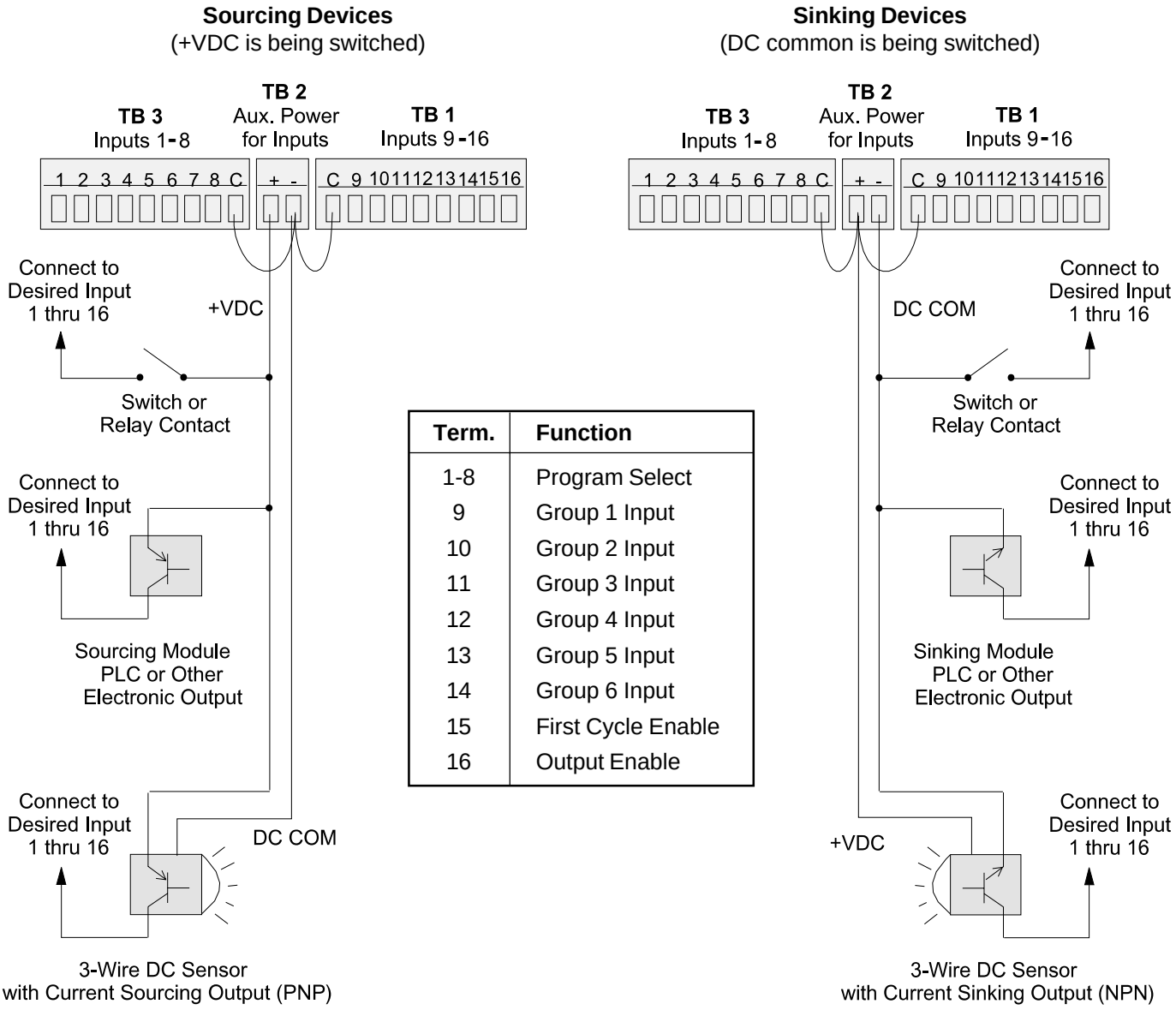
When all program select inputs are off, the “Default” program will become active as programmed through DEFAULT PROGRAM function.

Group Inputs (9–14)
These inputs work in conjunction with groups of outputs according to mode logic as discussed in Section 5. Typically, photo eyes and other sensors will operate these inputs.

First Cycle Enable (15)
Mode 5 uses this input to allow the first machine cycle to operate the corresponding outputs. See Section 5 for details.

Output Enable (16)
Any of the outputs (except analog) can be ANDed with this input through OUTPUT ENABLE ANDING. Outputs that are ANDed will operate only when this input is on. This can be used in conjunction with Motion ANDing and output modes.

Figure 7—Controller Input Wiring (See Figures 5 & 6 for Terminal Block Locations)



Term.	Function
1-8	Program Select
9	Group 1 Input
10	Group 2 Input
11	Group 3 Input
12	Group 4 Input
13	Group 5 Input
14	Group 6 Input
15	First Cycle Enable
16	Output Enable

Input Wiring Guidelines

- Voltage from TB 2 will be the same as the voltage supplied to the controller.
- Each input powered from TB 2 will draw 11 mA at 24 VDC. TB 2 is fused at 1/4 amp.
- Inputs will operate with voltages from 10 to 30 VDC.
- An external power supply can be used instead of TB 2 to power inputs.
- A combination of mechanical and solid state devices can be used.
- TB 1 can be wired for sourcing while TB 3 is wired for sinking, and vice versa.

Figure 8—Program Select Terminals for Various Formats

BCD Format

		10's			Units			
Input Terminal:		**7**	**6**	**5**	**4**	**3**	**2**	**1**
Value:		40	20	10	8	4	2	1
Program: Default		0	0	0	0	0	0	0
⑨	**1**	0	0	0	0	0	0	1
	2	0	0	0	0	0	1	0
	3	0	0	0	0	0	1	1
	4	0	0	0	0	1	0	0
	5	0	0	0	0	1	0	1
	6	0	0	0	0	1	1	0
	7	0	0	0	0	1	1	1
	8	0	0	0	1	0	0	0
	9	0	0	0	1	0	0	1
	10	0	0	1	0	0	0	0
	11	0	0	1	0	0	0	1
	12	0	0	1	0	0	1	0
	13	0	0	1	0	0	1	1
	14	0	0	1	0	1	0	0
	15	0	0	1	0	1	0	1
	16	0	0	1	0	1	1	0
	17	0	0	1	0	1	1	1
	18	0	0	1	1	0	0	0
	19	0	0	1	1	0	0	1
	20	0	1	0	0	0	0	0
	21	0	1	0	0	0	0	1
	22	0	1	0	0	0	1	0
	23	0	1	0	0	0	1	1
	24	0	1	0	0	1	0	0
	25	0	1	0	0	1	0	1
	26	0	1	0	0	1	1	0
	27	0	1	0	0	1	1	1
	28	0	1	0	1	0	0	0
	29	0	1	0	1	0	0	1
	30	0	1	1	0	0	0	0
	31	0	1	1	0	0	0	1
	32	0	1	1	0	0	1	0
	33	0	1	1	0	0	1	1
	34	0	1	1	0	1	0	0
	35	0	1	1	0	1	0	1
	36	0	1	1	0	1	1	0
	37	0	1	1	0	1	1	1
	38	0	1	1	1	0	0	0
	39	0	1	1	1	0	0	1
	40	1	0	0	0	0	0	0
	41	1	0	0	0	0	0	1
	42	1	0	0	0	0	1	0
	43	1	0	0	0	0	1	1
	44	1	0	0	0	1	0	0
	45	1	0	0	0	1	0	1
	46	1	0	0	0	1	1	0
	47	1	0	0	0	1	1	1
	48	1	0	0	1	0	0	0

For BCD, calculate the program selected by adding up the values for each of the inputs that are on. For example, if Inputs 5, 3, and 1 are on, Program #15 is active (10 + 4 + 1).

- Only three of the normal four BCD digits for 10's are used.
- **9 is the largest valid value for the units digit.** A units digit combination larger than 9 will set the units digit to 9.

Binary Format

		6	**5**	**4**	**3**	**2**	**1**
Input Terminal:							
Value:		32	16	8	4	2	1
Program: Default		0	0	0	0	0	0
⑨	**1**	0	0	0	0	0	1
	2	0	0	0	0	1	0
	3	0	0	0	0	1	1
	4	0	0	0	1	0	0
	5	0	0	0	1	0	1
	6	0	0	0	1	1	0
	7	0	0	0	1	1	1
	8	0	0	1	0	0	0
	9	0	0	1	0	0	1
	10	0	0	1	0	1	0
	11	0	0	1	0	1	1
	12	0	0	1	1	0	0
	13	0	0	1	1	0	1
	14	0	0	1	1	1	0
	15	0	0	1	1	1	1
	16	0	1	0	0	0	0
	17	0	1	0	0	0	1
	18	0	1	0	0	1	0
	19	0	1	0	0	1	1
	20	0	1	0	1	0	0
	21	0	1	0	1	0	1
	22	0	1	0	1	1	0
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	39	1	0	0	1	1	1
	40	1	0	1	0	0	0
	41	1	0	1	0	0	1
	42	1	0	1	0	1	0
	43	1	0	1	0	1	1
	44	1	0	1	1	0	0
	45	1	0	1	1	0	1
	46	1	0	1	1	1	0
	47	1	0	1	1	1	1
	48	1	1	0	0	0	0

For Binary, calculate the program selected by adding up the values for each of the inputs that are on. For example, if Inputs 5, 3 and 1 are on, Program #21 is active (16 + 4 + 1).

Gray Code Format

		6	**5**	**4**	**3**	**2**	**1**
Input Terminal:							
Value:		MSB					LSB
Program: Default		0	0	0	0	0	0
⑨	**1**	0	0	0	0	0	1
	2	0	0	0	0	1	1
	3	0	0	0	0	1	0
	4	0	0	0	1	1	0
	5	0	0	0	1	1	1
	6	0	0	0	1	0	1
	7	0	0	0	1	0	0
	8	0	0	1	1	0	0
	9	0	0	1	1	0	1
	10	0	0	1	1	1	1
	11	0	0	1	1	1	0
	12	0	0	1	0	1	0
	13	0	0	1	0	1	1
	14	0	0	1	0	0	1
	15	0	0	1	0	0	0
	16	0	1	1	0	0	0
	17	0	1	1	0	0	1
	18	0	1	1	0	1	1
	19	0	1	1	0	1	0
	20	0	1	1	1	1	0
	21	0	1	1	1	1	1
	22	0	1	1	1	0	1
	23	0	1	1	1	0	0
	24	0	1	0	1	0	0
	25	0	1	0	1	0	1
	26	0	1	0	1	1	1
	27	0	1	0	1	1	0
	28	0	1	0	0	1	0
	29	0	1	0	0	1	1
	30	0	1	0	0	0	1
	31	0	1	0	0	0	0
	32	1	1	0	0	0	0
	33	1	1	0	0	0	1
	34	1	1	0	0	1	1
	35	1	1	0	0	1	0
	36	1	1	0	1	1	0
	37	1	1	0	1	1	1
	38	1	1	0	1	0	1
	39	1	1	0	1	0	0
	40	1	1	1	1	0	0
	41	1	1	1	1	0	1
	42	1	1	1	1	1	1
	43	1	1	1	1	1	0
	44	1	1	1	0	1	0
	45	1	1	1	0	1	1
	46	1	1	1	0	0	1
	47	1	1	1	0	0	0
	48	1	0	1	0	0	0

Electro Cam 8-position Gray Code selector switches are available as accessories for PS-6344 and other PLuS controls.

Notes Common to All Three Formats

- Because the standard PS-6344 has 48 programs available, **any program select value larger than 48 selects program number 48.**
- The Default Program is determined by programming the DEFAULT PROGRAM function, Section 3.

Output Wiring

Output Types

The outputs available depend on the PS-6344 Model:

Output Type	Model 6344-24-M17	Model 6344-24-X16M09
Transistor	None	Outputs 1-16
AC/DC/RR Modules Only	Outputs 1-15	Outputs 17-23
AC/DC/RR or Analog Modules	Outputs 16 & 17	Outputs 24 & 25

The load device to be driven must match the output type.

Power Output Modules

Output modules can directly switch inductive loads and resistive loads that require more current or voltage than the transistor outputs can supply. **The modules do not supply the power for the load; they simply switch it.** Each output module has two dedicated terminals and therefore does not share any common signal with the other modules. This allows AC and DC modules to be mixed on the same control. DC modules can be wired to sink or source as shown in Figure 9.

Analog Output Modules

Analog output modules generate signals that are proportional to the resolver RPM. They can be used only in the output positions shown above. Either a 0-10 VDC or 4-20 mA analog module can be used in either module position. ANALOG QTY must be programmed for the number of analog modules installed. An external power supply is not needed because the analog modules get the power they source from the controller. The analog output signal is completely isolated.

Transistor Outputs

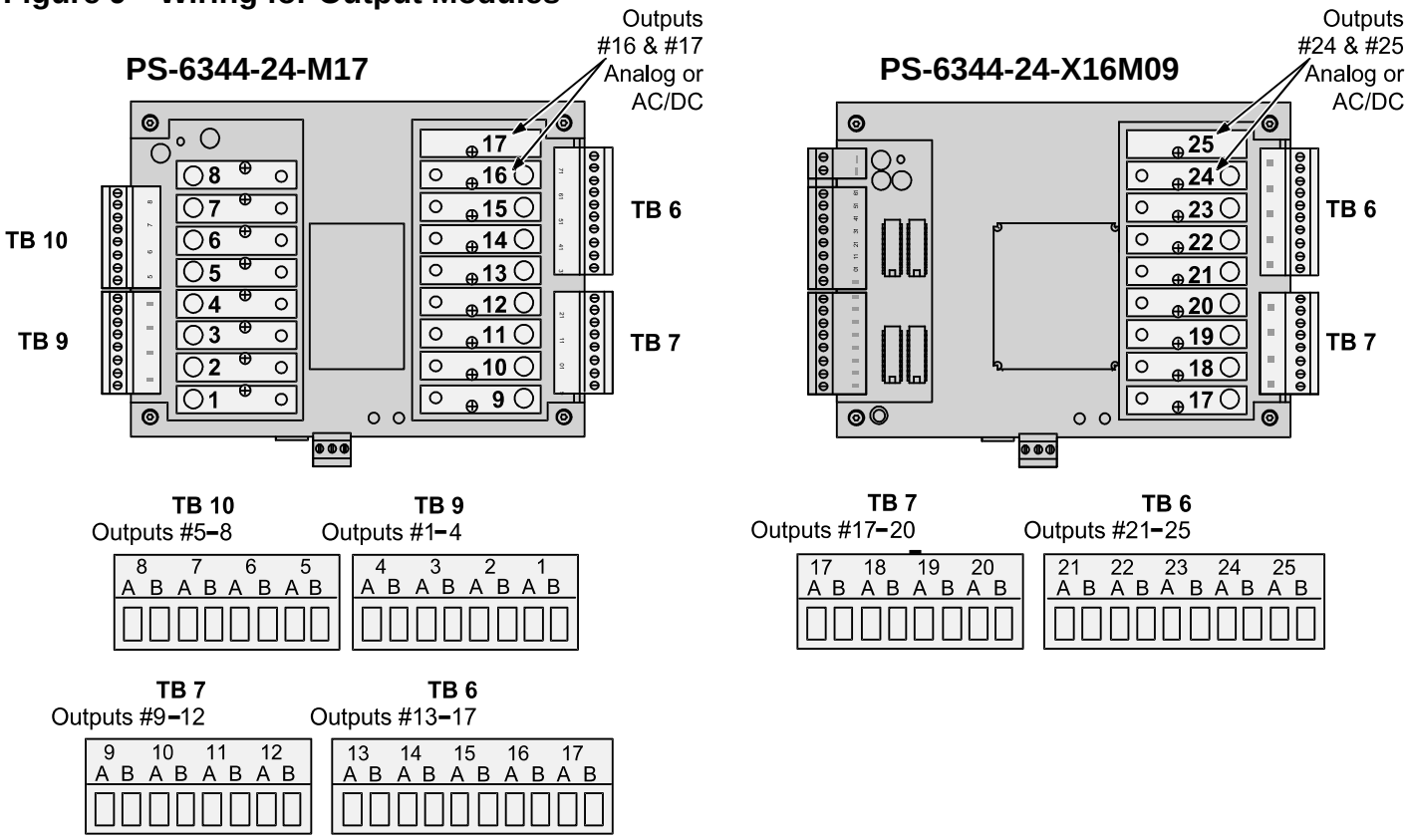
PS-6344-24-X16M09 models include 16 transistor outputs to drive the electronic input circuits of other control devices. The outputs are limited to 30 VDC, 50 mA each and should not be used to control inductive devices such as solenoids, solenoid valves or relays.

The control can be ordered with either sinking or sourcing transistor outputs. Both types require a 10-30 VDC power supply connected to TB 11 to drive the transistor output circuitry. The transistor output fuse will blow if the power supply polarity is incorrect, but the circuitry will not be damaged. See Figs. 17 & 18 for fuse and transistor chip replacement.

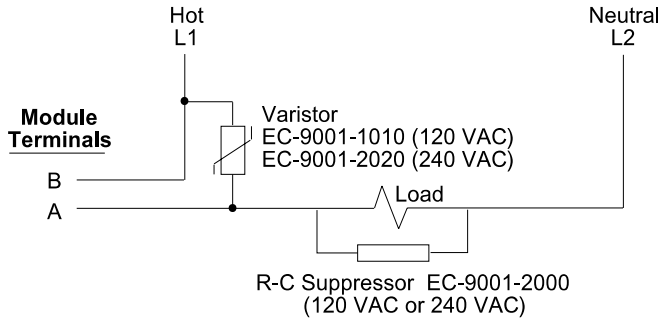
Sinking transistor outputs (N16 controls, Figure 10) conduct to the negative terminal of TB 11. Therefore the common for TB 11 and the load must be electrically the same. This may require connecting commons together if the power supplied to TB 11 is not also the load power supply. Electronic counters/ratemeters often fall into this category. The power supply that powers the load does not have to be the same voltage as the transistor power supplied to TB 11.

Sourcing transistor outputs (P16 controls, Figure 11) conduct to the positive power terminal of TB 11. The load is therefore powered from the same supply that is providing the transistor power.

Figure 9—Wiring for Output Modules



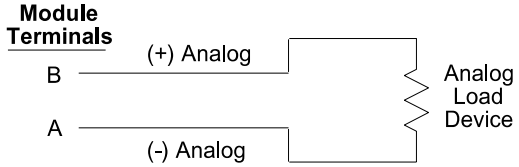
AC Output



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.

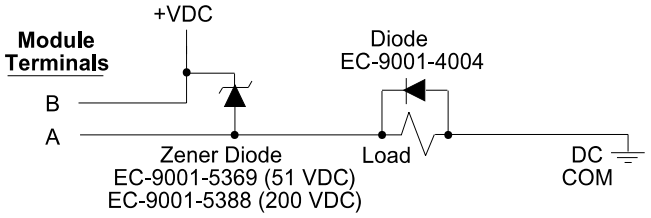
Analog Output



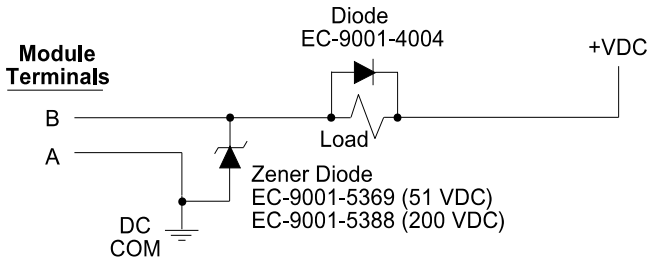
- Analog output modules source the analog signal.
- No external supply is required.
- Analog output signals are isolated.

DC Output

Sourcing



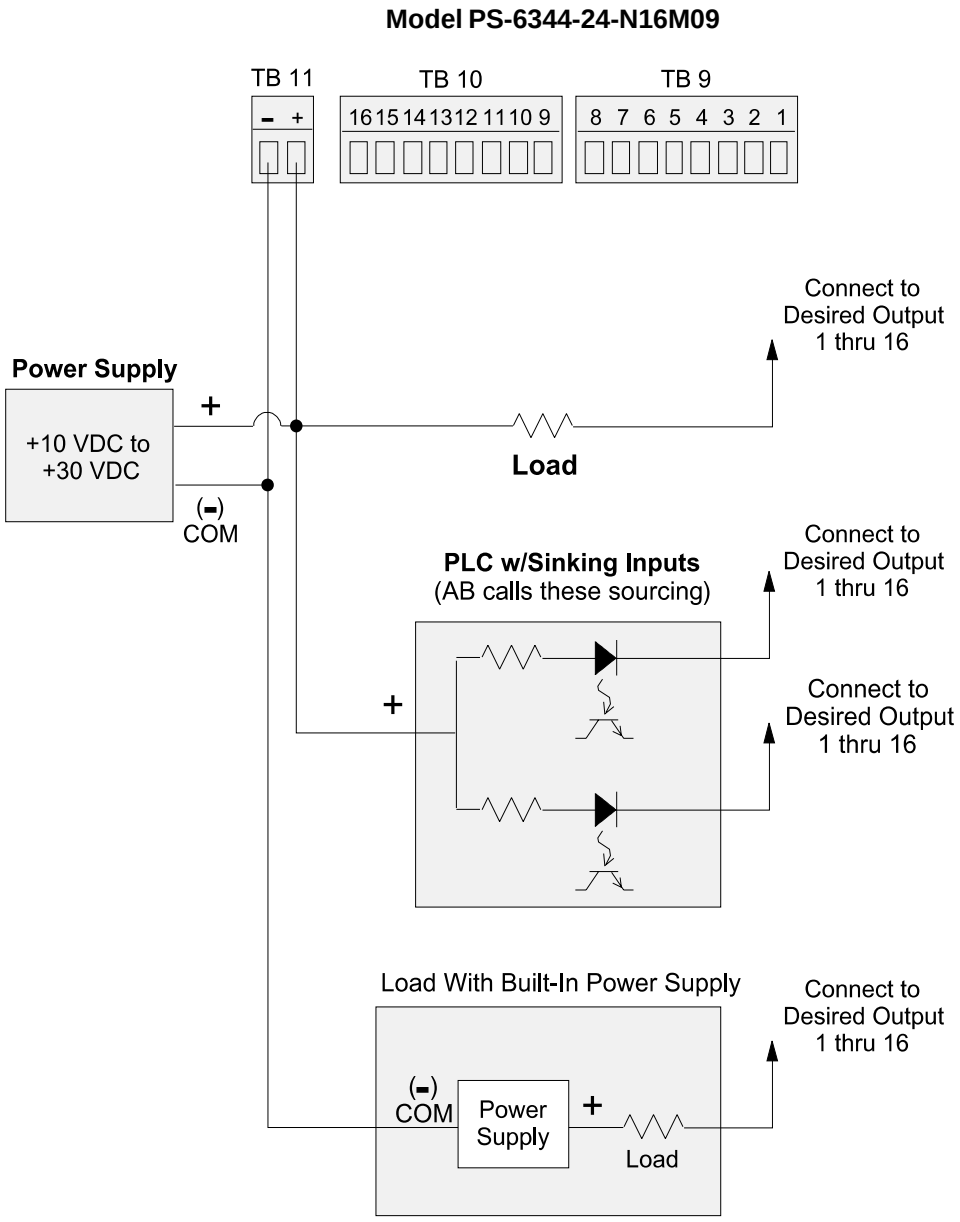
Sinking



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.

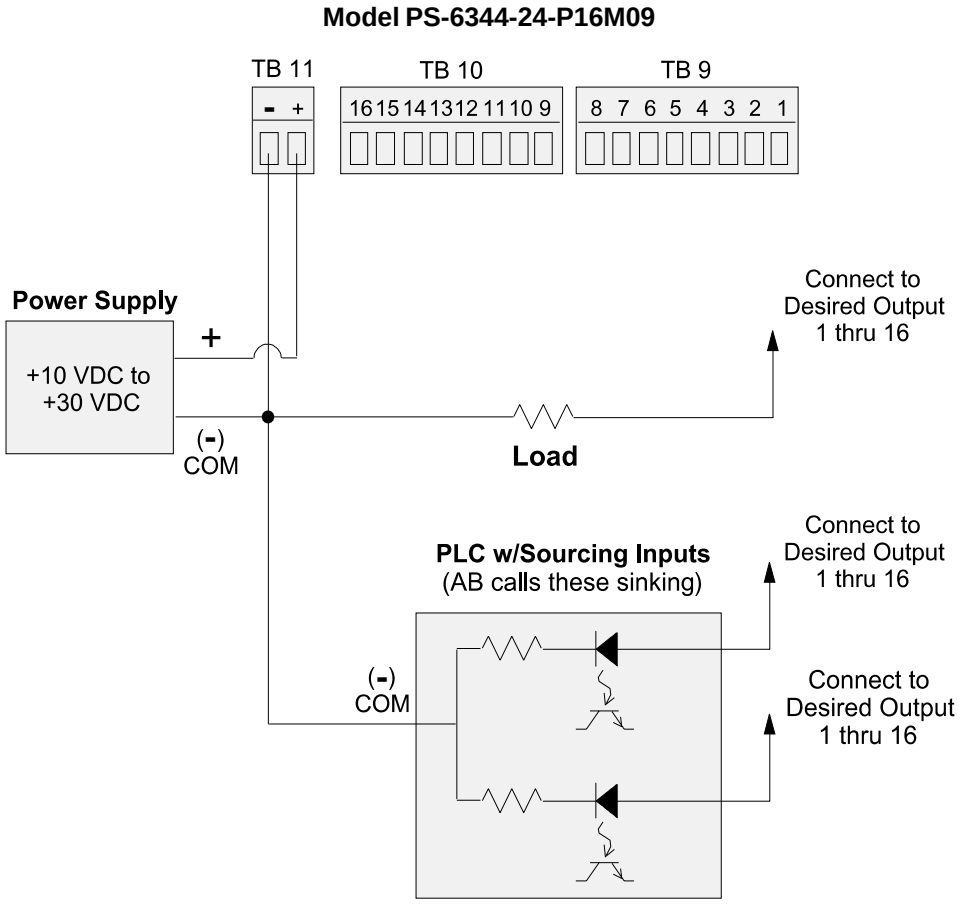
Figure 10—Wiring for Sinking Transistor Outputs (See Figure 6 for Terminal Block Locations)



Please Note:

- Outputs are rated at 30 VDC, 50 mA.
- Transistor outputs should not be used to switch inductive devices such as solenoids or relays.
- Sinking outputs conduct to the negative terminal of TB 11 when "on."
- The power supply shown in "Load with Built-In Power Supply" does not have to be the same voltage as the power supply connected to TB 11.

Figure 11—Wiring for Sourcing Transistor Outputs (See Figure 6 for Terminal Block Locations)



Please Note:

- Outputs are rated at 30 VDC, 50 mA.
- Transistor outputs should not be used to switch inductive devices such as solenoids or relays.
- Sourcing outputs conduct to the positive terminal of TB 11 when "on."

Keypad Wiring

Number of Keypads

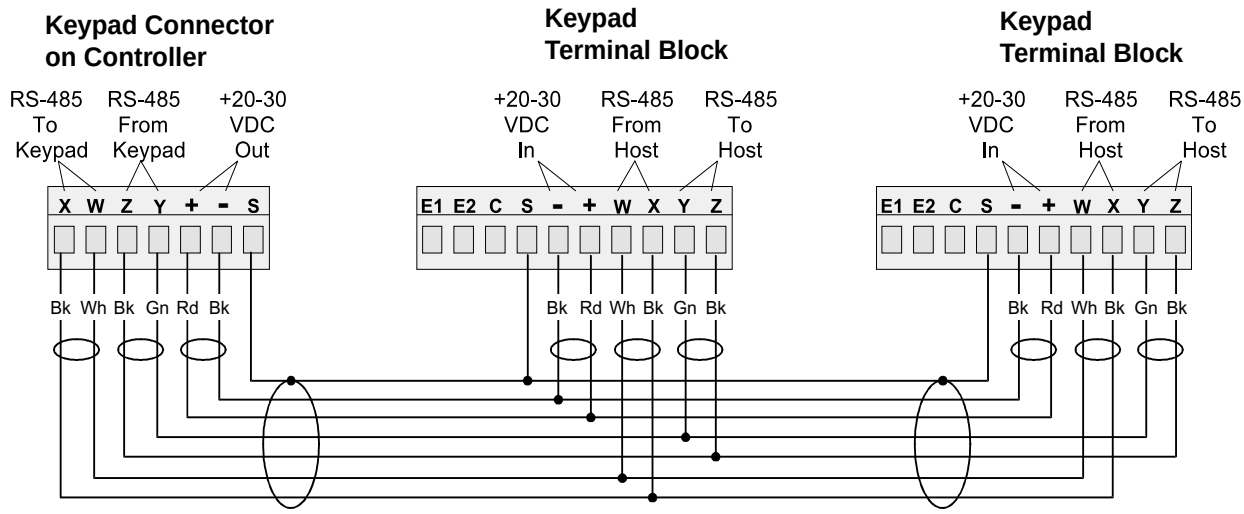
One or two keypads may be connected to a PS-6344 controller as shown in Figure 12. See Figure 14 for possible system configurations.

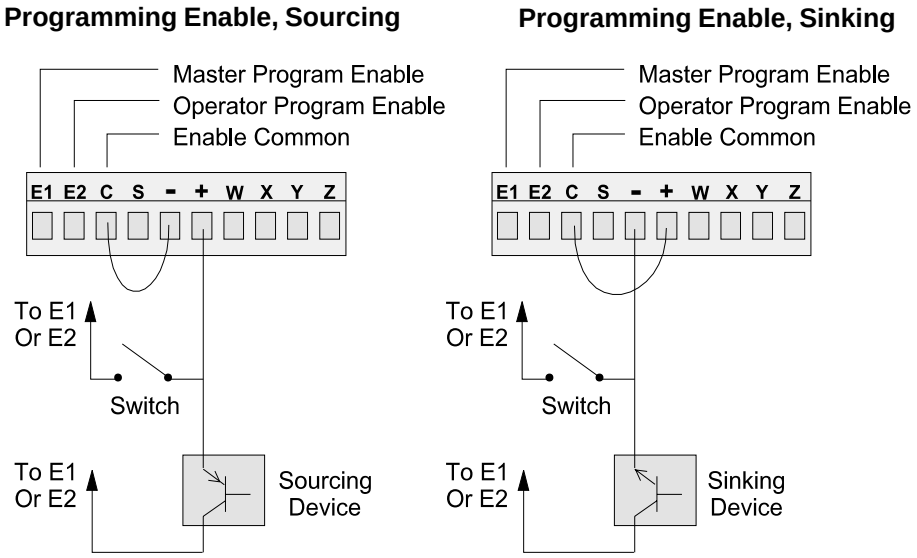
Programming Enable

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 set-up 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.

Figure 12—Keypad Wiring





DIP Switch Configurations

DIP Switches

Each keypad and controller has a DIP switch as shown in Figure 13. For convenience, set the DIP switches correctly before mounting the units in a panel.

Keypad Settings

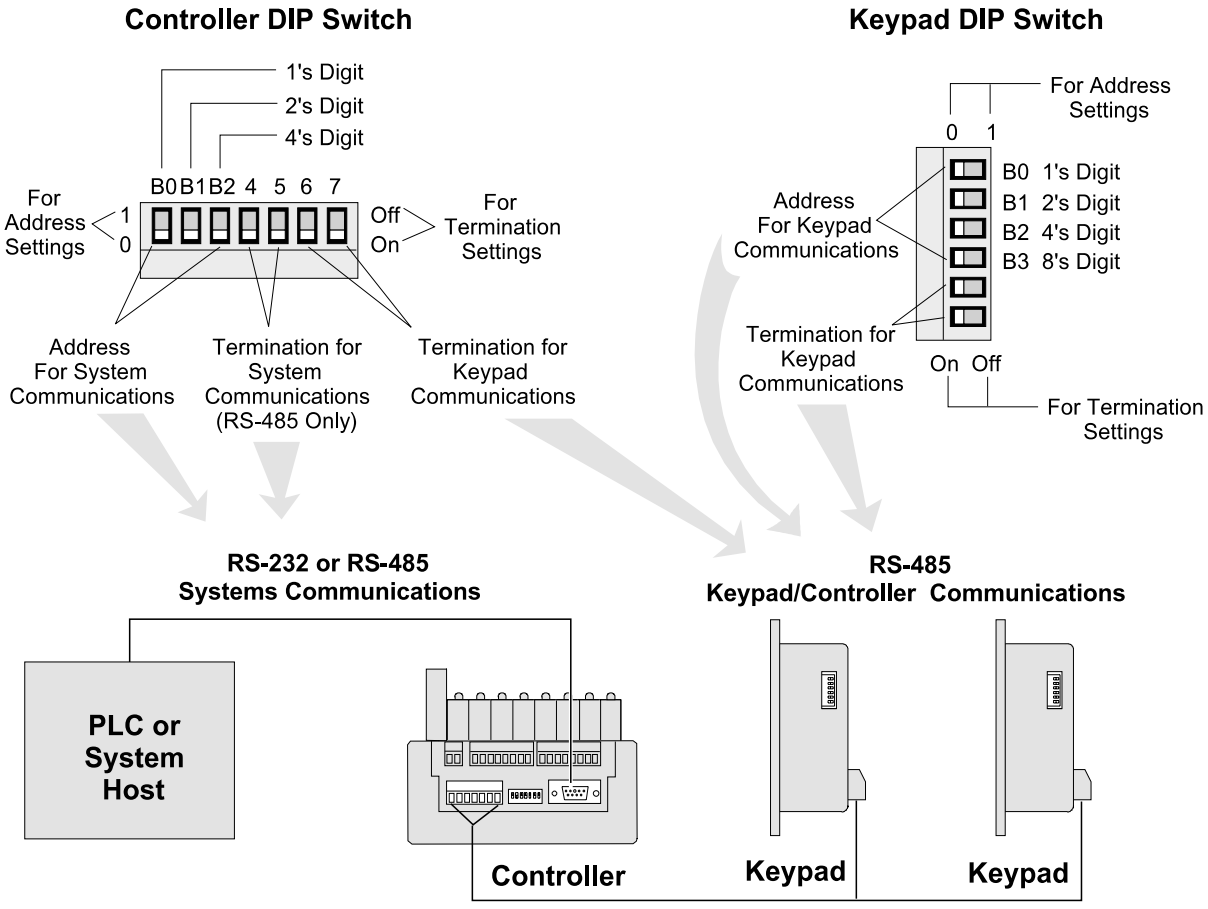
The address and termination settings on the **keypad** DIP switch apply to the RS-485 network that connects it to the controller. See Figure 14 for guidelines and sample settings.

Controller Settings

The address settings on the **controller** DIP switch apply to a network connecting the controller to a PLC or other system host. When the DIP switch is set to zero, the default address programmed through the COMMUNICATIONS function takes affect. Whereas the DIP switches can set a maximum address of "7", the COMMUNICATIONS function can establish much higher address numbers. **These settings are not related to communications with the keypads.**

Two sets of termination switches are included on the controller. One set establishes the termination value for an RS-485 network connecting the controller to a PLC or other system host. It does not apply to an RS-232 network. The other termination switches apply to the keypad network. See Figure 14 for guidelines and sample settings.

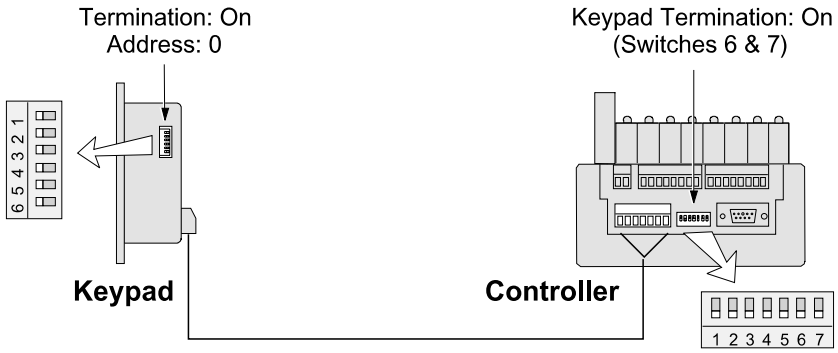
Figure 13—DIP Switches and Related Communications Networks



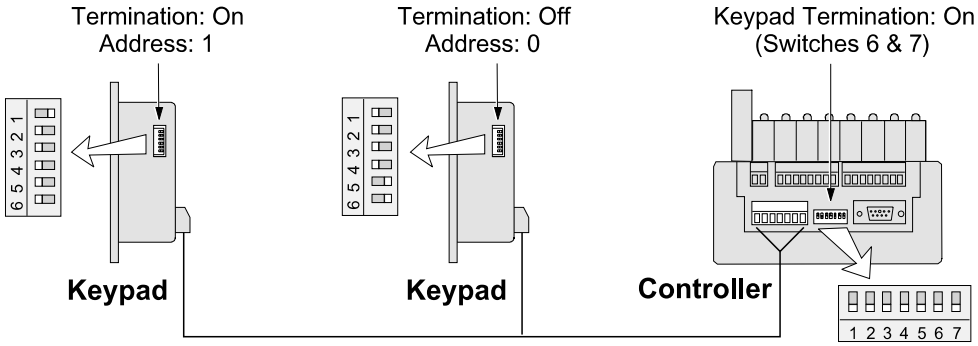
NOTE: Both termination switches in a pair must be in the same position.

Figure 14—DIP Switch Settings for Typical Systems

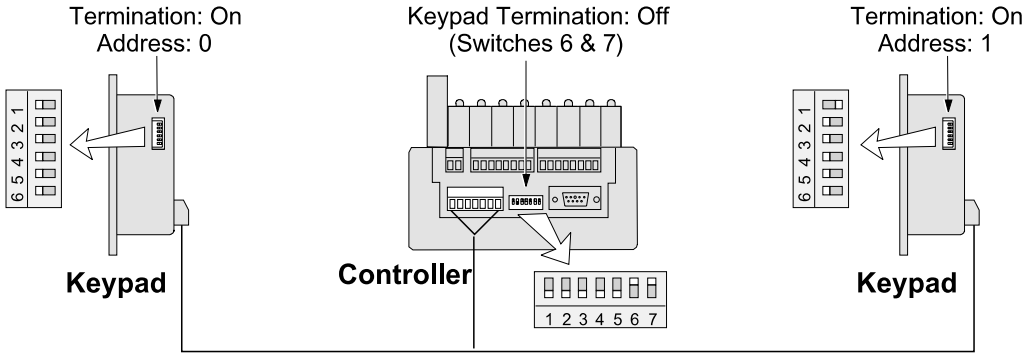
One Keypad



Two Keypads, Controller on End



Two Keypads, Controller in Middle



DIP Switch Guidelines

Termination:
- Termination must be "on" for devices on each end of the chain.
- Termination must be "off" for devices in the middle of the chain.
- Both termination switches in a pair must be in the same position.

Address:
- Keypad addresses must be assigned starting with "0" and increasing sequentially.
- The physical location of a keypad in the chain has no relationship to its address.
- During initial programming, the KEYBOARD QTY function must be used to enter the number of keypads in the chain. KEYBOARD QTY can be accessed only through the keypad whose address is "0."

Communications Wiring

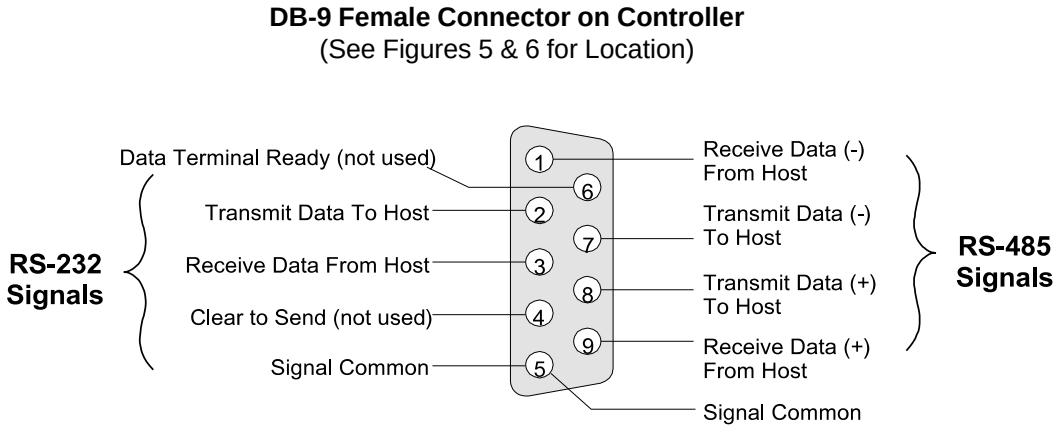
DB-9F Port — Serial communication to a PLC or other system host is provided through a DB-9 female connector as shown in Figure 6. This connector can be wired for RS-232 or RS-485 communications.

RS-485 — RS-485 can be used for "multi-drop" networks where more than one controller could be connected to the system host.

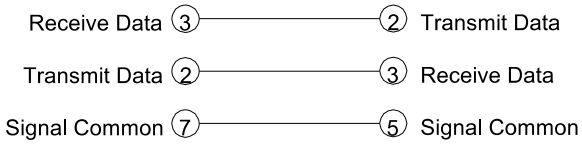
RS-232 — RS-232 can connect only a single PS-6344 to a system host.

RS-232/485 Selection — Use the COMMUNICATIONS function to select RS-232 or RS-485 communications.

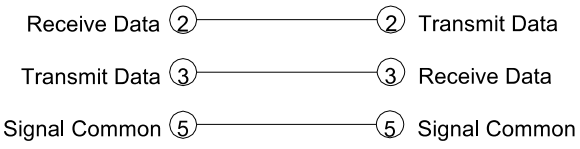
Figure 15—Communications Wiring



RS-232 Cable Wiring*
DB-25 (Host) **to DB-9F** (PS-6344)



RS-232 Cable Wiring*
DB-9 (Host) **to DB-9F** (PS-6344)



***IMPORTANT!**
Pins 1, 4, 6, 7 and 8 must NOT be connected.
Damage may result from using an off-the-shelf RS-232 communications cable.

Resolver Installation

General Information

Choose a mounting location for the resolvers that allows convenient mechanical connection of the resolver shafts to the machine. The resolvers are normally driven at a 1:1 ratio to machine cycles, but this is not true in all applications.

No provision need be made for physically rotating the resolver shafts with respect to the machine shaft. The PS-6344 can be easily programmed to set any resolver position as the 0° position.

If possible, select a location that shelters the resolvers 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.

Figure 16 shows three commonly used Electro Cam resolvers.

Shaft Couplings

The shaft can be coupled to the machine using a chain and sprocket, timing pulley and belt, or a direct in-line shaft-to-shaft coupling.
If a shaft-to-shaft coupling is used, Electro Cam Corp. recommends the use of a flexible coupling. Flexible couplings available through Electro Cam Corp. are listed on the Rotary Cam Price List.

⚠ CAUTION

Unit damage may occur when using a solid coupling with shaft misalignment greater than 0.005". Shimming of the individual unit to its mounting surface must take place because of tolerance stackups. Do not attempt to remove the shaft. Doing so will damage the unit and void the warranty.

⚠ WARNING

Turn power to the machine OFF prior to installation.

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 controller.

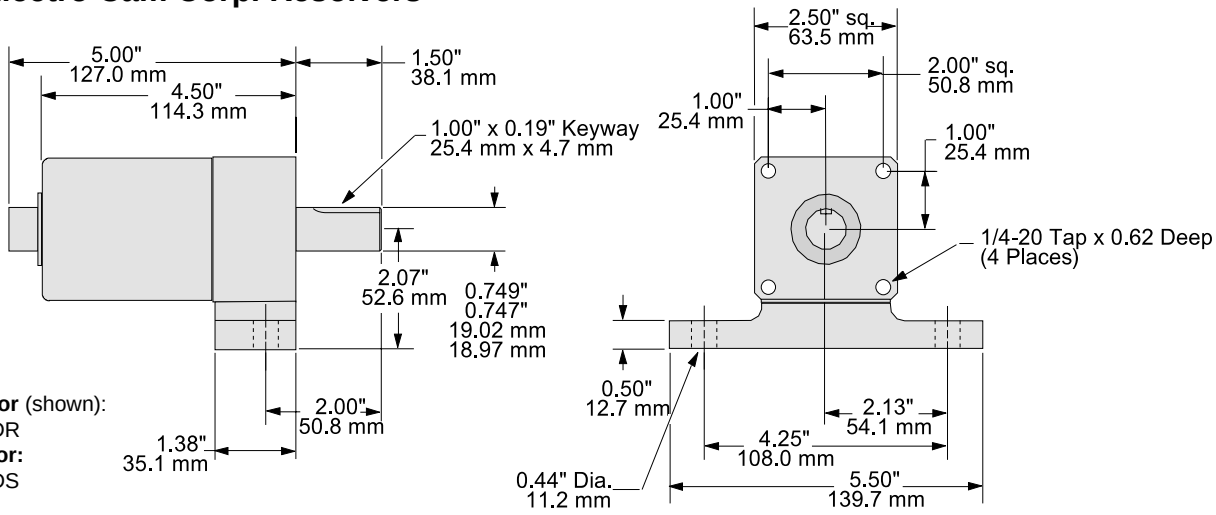
The shield is connected at both ends of the cable to prevent damage due to electrostatic discharge. If electrical noise problems are suspected when the control is in operation, call Electro Cam Corp. for advice regarding shielding.

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.

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. It is recommended that customers do not make their own resolver cables. Electro Cam will make resolver cables any length up to 1000'.

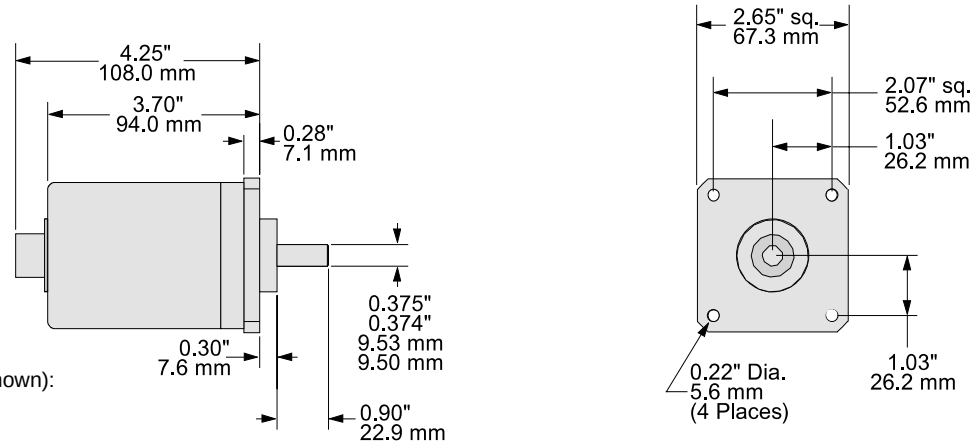
Figure 16—Electro Cam Corp. Resolvers

Foot Mount



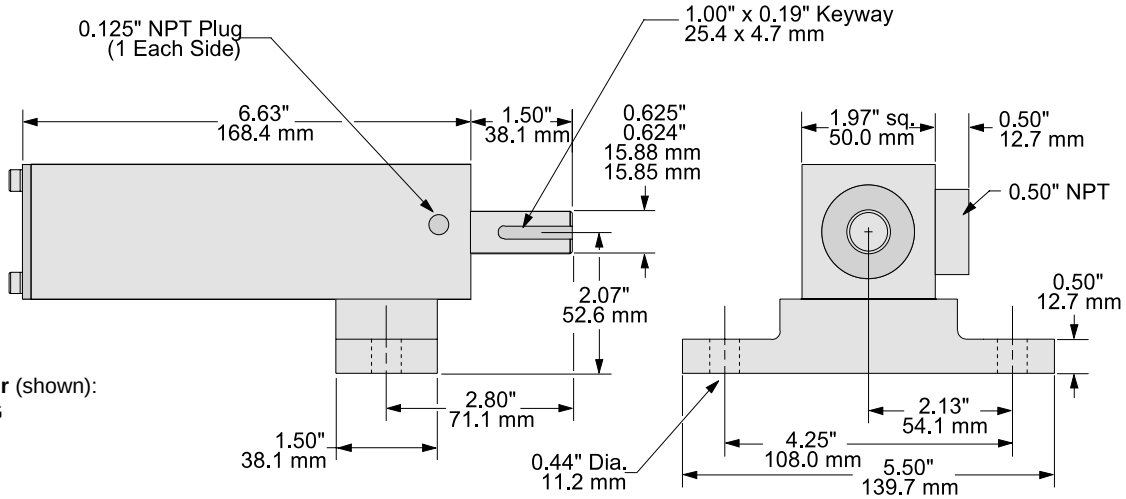
With Rear Connector (shown):
PS-5275-11-ADR
With Side Connector:
PS-5275-11-ADS
Cable:
PS-5300-01-XXX where "XXX" is length in feet.

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



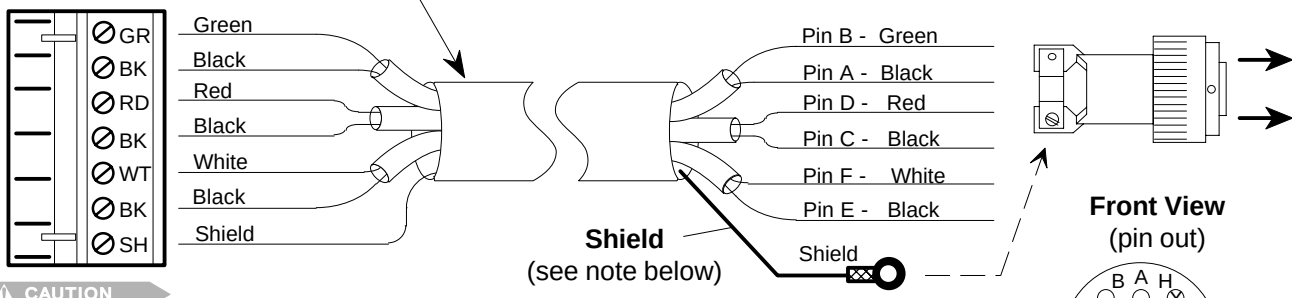
With Right Connector (shown):
PS-5262-11-CTG
With Left Connector:
PS-5262-11-CTL
Cable:
PS-5300-02-XXX where "XXX" is length in feet.

Cable for Resolver with Cannon Connector

PT# PS-5300-01-XXX (XXX = Length in Feet)

Connector - Controller End
PT# PS-5300-01-TER
(Weidmuller # BLA7 12822.6)

Cable Type:
3 individually shielded pairs, 22 gauge



⊗ = Not Used

CAUTION

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.

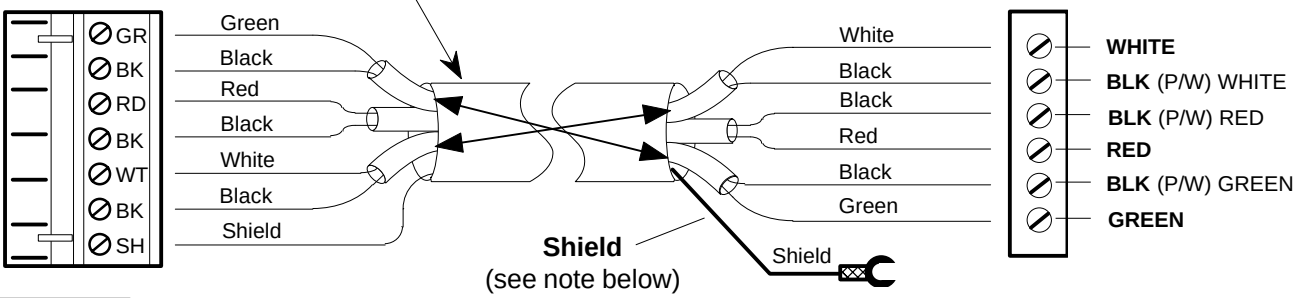
Cable for Stainless Steel Resolver with Terminal Strip Connections

PT# PS-5300-02-XXX (XXX = Length in Feet)

Connector - Controller End
PT# PS-5300-01-TER
(Weidmuller # BLA7 12822.6)

Cable Type:
3 individually shielded pairs, 22 guage

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



CAUTION

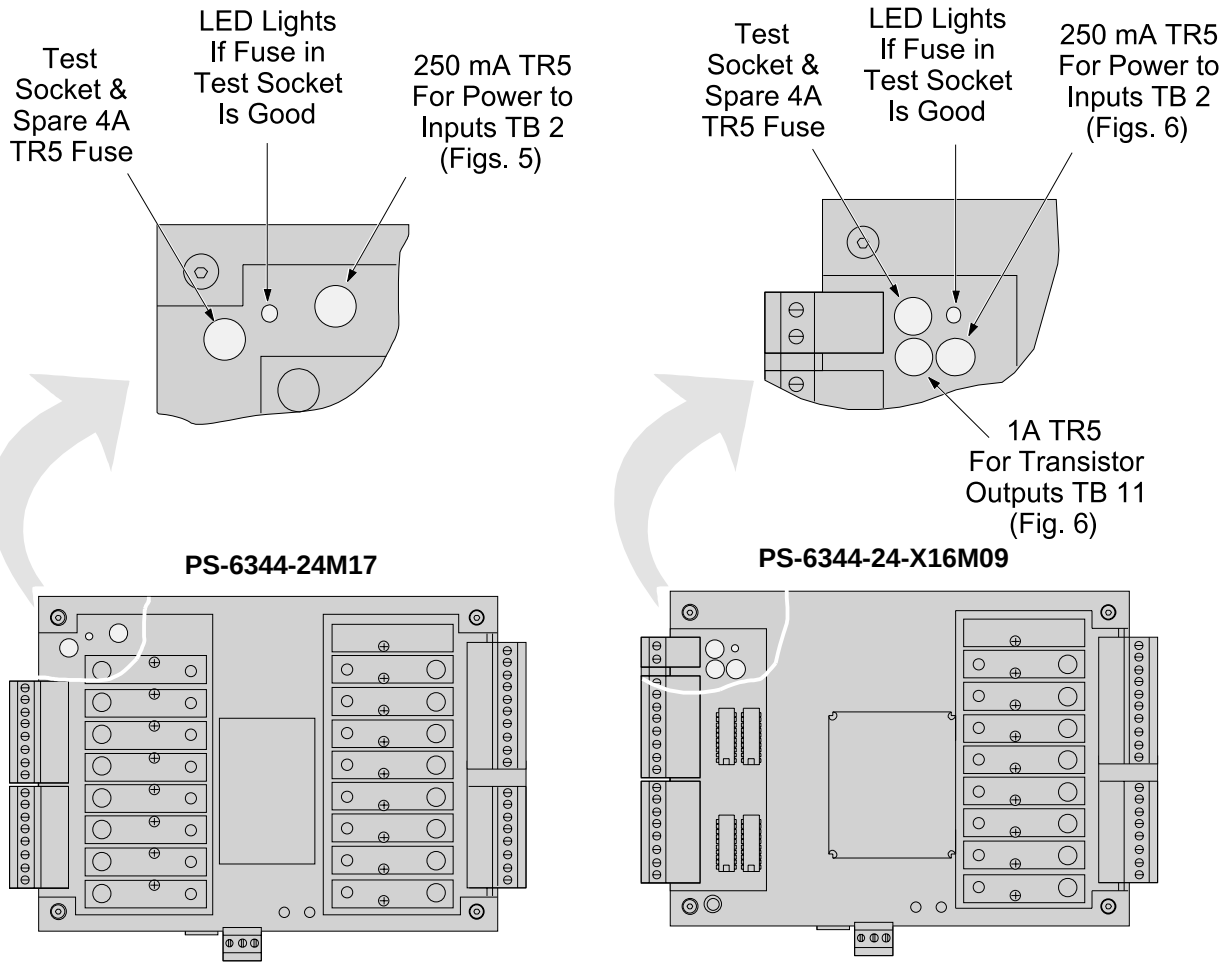
Shielding Note: This type of resolver cable will have a spade lug connected to the shield at the resolver end. The lug should be attached to the grounding stud on the cover plate of the resolver. In some installations, it may be advisable to disconnect the lug to prevent ground loops through the cable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

Fuse Tester & Fuse Replacement

Fuse Tester

Figure 17 shows the location of a fuse test socket and LED which can be used to test TR5 style fuses. PS-6344 controllers are shipped with a spare 4A fuse mounted in the test socket.

Figure 17—TR5 Fuse Tester and Fuse Locations



Replacement TR5 Fuse Part Numbers

Rating	Function	ECC Part #	Wickmann Part #
250 mA	Power for Inputs (TB 2)	PS-9005-0250	19374-035
1 A	Power for Transistor Outputs (TB 11)	PS-9005-0001	19370-048
4 A	Fuse for Output Modules	PS-9005-0004	19370-062

Output Transistor Replacement

Check Fuse First

If all of the transistor outputs fail to work, check the 1A fuse shown in Figures 17 & 18. Also check to be sure that a 10–30 VDC power supply is connected to TB 11, Figure 6.

Correct Problems

Chips will most likely be damaged by one of two events:

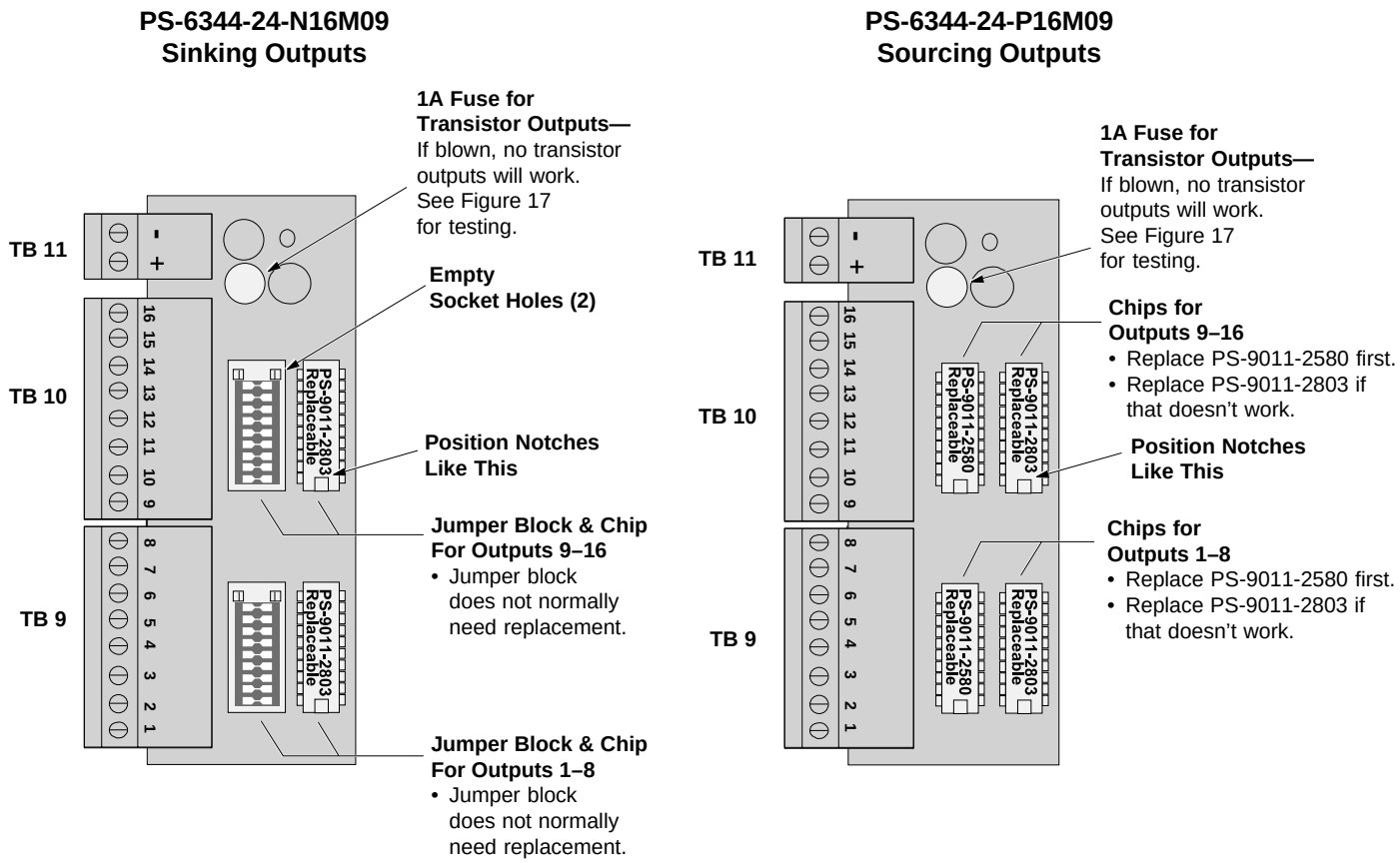
- A short circuit connected to one of the transistor outputs.
- A load exceeding 50 mA connected to one of the transistor outputs.

Before replacing a transistor output chip, fix the problem that damaged it.

Proper Placement

When replacing a chip, be sure that all of the pins are properly seated in the socket. Position the notch on the end of the chip as shown below.

Figure 18—Transistor Chip Replacement



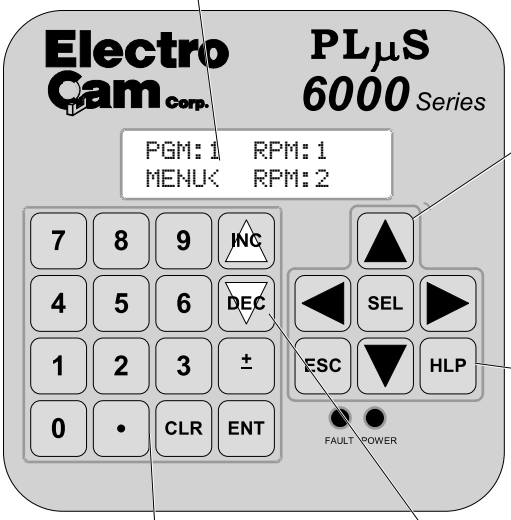
Replacement Part Numbers

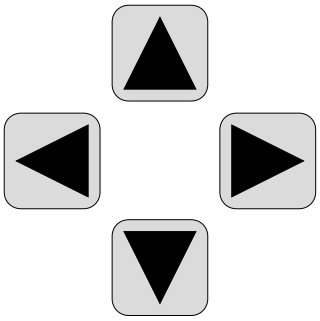
Description	ECC Part #
Replacement Chip-Sourcing	PS-9011-2580
Replacement Chip-Sinking	PS-9011-2803
DIP Jumper Block	PS-9006-0015

Figure 19—Keypad Keys and Corresponding Functions

Main Screen

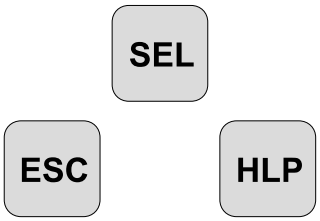
- Shows Active Program, RPM, Position, and Group # if applicable.
- **See MAIN SCREEN** in this Section for details.
- **Press SEL key when cursor is on "MENU"** to enter Menu Tree (Fig. 20) and initiate programming.





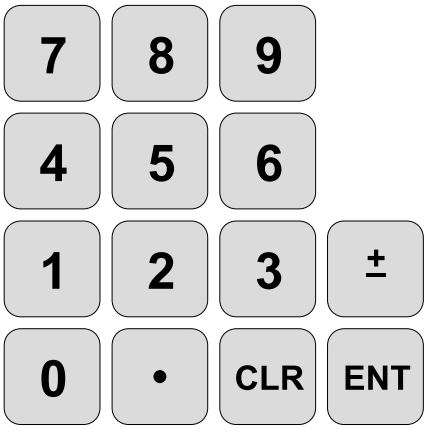
Cursor Keys

- Scroll through Menu Tree (Fig. 20).
- Move around **within a screen.**
- Scroll through setpoints.



ESC, SEL, HLP Keys

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



INC, DEC Keys

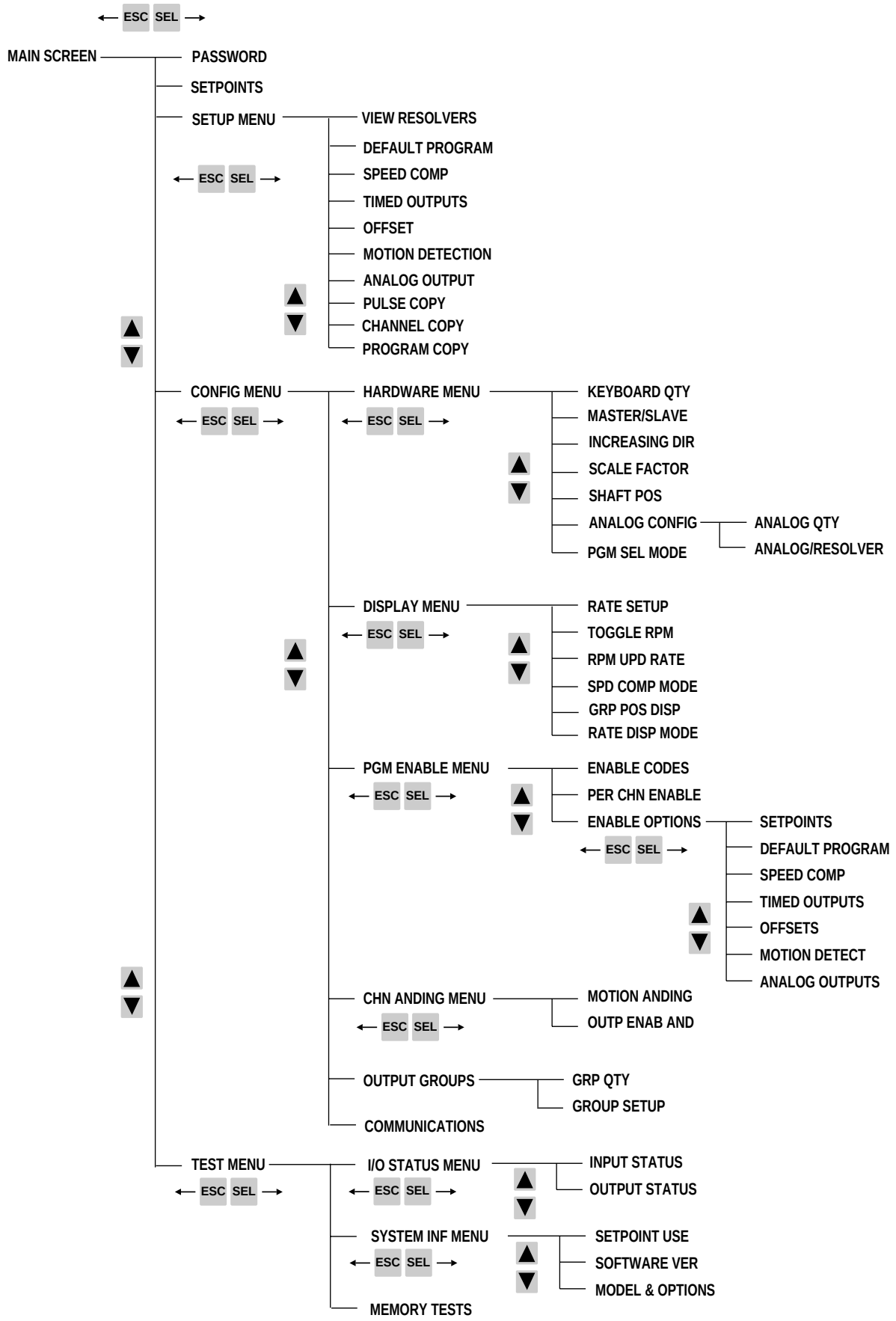
- Increment or decrement a value **within a field.**
- Hold for rapid scrolling of value.

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 prior to pressing ENT.
- ± will convert a positive number to a negative number, or vice versa.

Figure 20—PS-6344 Menu Tree

- **Functions are listed alphabetically in Section 3 of this manual starting on page 3-4.**



Bench Test

To test the PS-6344 prior to installing it, do the following:

1. Plug output modules into the controller beginning with Position 1 on the PS-6344-24-M17, or Position 17 on the 6344-24-X16M09. See Figure 9.
2. Connect a resolver. See Figure 16.
3. Connect the keypad/display to the controller. See Figure 12.
4. Set the keypad DIP switch to address “0” and termination “on,” as shown in Figure 13. Set switches 6 and 7 on the controller DIP switch to “on,” also shown in Figure 13.
5. Use two jumper wires to enable Master Level programming as shown in Figure 12. Connect one jumper from “+” of the keypad terminal block to “C.” Connect the other jumper from “–” to “E1.” These jumpers will permit access to the entire menu tree shown in Figure 20.
6. Connect DC input power.

When experimenting with the controller, note that the LED on an output module will light when that output channel is turned on. By hand-turning the resolver shaft and watching the module LED’s, you can observe the effects of programming setpoint values. Remember that on a PS-6344-24-X16M09, outputs 1-16 are transistor outputs. To activate the LED on a module installed in Position 17, enter the setpoint values into Output Channel 17.

Machine Setup

Before installing the PS-6344 on a machine, be sure the DIP switches are properly set as shown in Figures 13 & 14. After installing the unit, program the following set-up information into the controller before attempting any other programming:

Information	Menu Selection	Page
Direction of Rotation	INCREASING DIR	3-11
Scale Factor	SCALE FACTOR	3-26
Shaft Position	SHAFT POSITION	3-29
No. of Keypads	KEYBOARD QTY	3-12
No. of Analog Outputs	ANALOG QTY	3-5
No. of Output Groups	OUTPUT GROUPS	3-18
Modes for Output Groups	OUTPUT GROUPS	3-18
Group Display Mode	GRP POS DISP	3-10
Group Offsets	OFFSET	3-16

Once this information is entered, setpoints can be established and modified in the groups and output channels desired. Refer to Section 5 for information on using groups and modes.

Analog Output

Menu Path

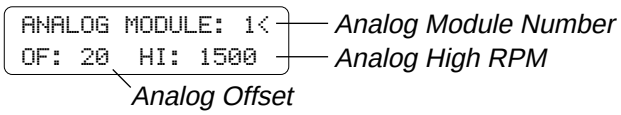
MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to ANALOG OUTPUT SEL

Purpose

Analog output signals are linearly proportional to the 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 output positions for analog modules.

Screen



Module Number

The following table shows the relationship between the analog module number on the screen and the module position on the controller back. See Figure 9 for an illustration of analog module positions.

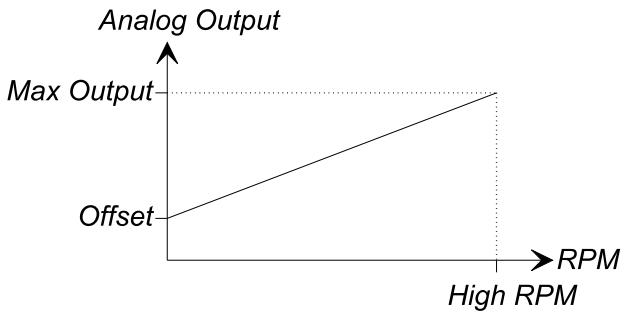
Model	Module #1 On Screen	Module #2 On Screen
PS-6344-24-M17	Output #17	Output #16
PS-6344-24-X16M09	Output #25	Output #24

Resolver Assignment

Analog 1 can be either resolver 1 or resolver 2.

- Analog characteristics can be programmed for Modules #1 and #2 even if no analog modules are physically mounted on the controller. Programming can be done first, and modules mounted later.
- To program Offset and High RPM for Module #2, be sure the ANALOG QTY function (next page) is set to “2.” If ANALOG QTY is set to “1,” programming for Module #2 will not be available.
- When two analog outputs are used, the two outputs can have different values for Offset and High RPM.

To program Module Number, move the cursor to “Module” and use the numeric keys and ENT.



(continued)

Analog Output (cont'd)

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.

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

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 zero volts or 4 mA. Because the analog output module 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 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

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

See Also

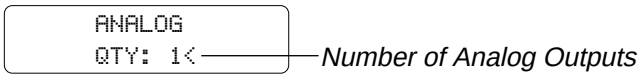
OUTPUT STATUS

Analog Quantity

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL HARDWARE MENU SEL ▼ to ANALOG CONFIG SEL to ANALOG QTY SEL

Screen



Purpose

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. See ANALOG OUTPUT for details.

Programming

Use the numeric keys or INC/DEC to enter "0," "1," or "2" analog channels. An analog output module is required to generate an analog output signal.

See Also

ANALOG OUTPUT
OUTPUT STATUS

Channel Copy

Menu Path

MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to CHN COPY SEL

Purpose

Channel Copy allows you to copy all setpoints to another channel in the specified program.

Screens

The Channel Copy function consists of four screens:

Programming

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.

```
SOURCE PGM:---<
```
Program containing channels

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

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

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

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

Communications

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL

▼ to COMMUNICATIONS SEL

Purpose

This function sets the communications type, **controller** address, and baud rate for communicating with a host computer.

Screen

Communications Type: RS-232 or RS-485

```
TYPE:485 ADR: 1<
   BAUD: 9600
```
Address: 0-255

Baud Rate: 4800, 9600, 19.2Kb, 38.4Kb

Type

Use SEL to toggle between RS-232 and RS-485 communications on units shipped with date code 9549 or newer (default setting is RS 485).

Address

The address must be unique for each controller installed on a network. This address is used by a host computer to identify and send information to a particular controller. A PLuS controller will ignore incoming information if the address field of the communication packet does not match the address of the controller.

The address set through COMMUNICATIONS programming takes effect only when the DIP switch shown in Figure 13 is set to an address value of zero. Whereas the DIP switch can set a maximum address of “7,” the COMMUNICATIONS function can set addresses ranging from 0-255.

Use the numeric keys and ENT to program the address.

Baud Rate

Use SEL to toggle between the available baud rates. The baud rate must match that of the host computer. Available baud rates are:

4,800; 9,600; 19,200; and 38,400.

Default Program

Menu Path

MAIN SCREEN SEL ▼ to SETUP MENU SEL DEFAULT PROGRAM SEL

Background

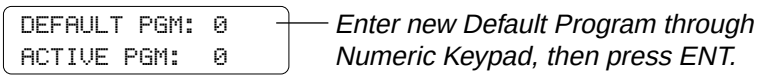
The PS-6344 controller can store up to 48 programs in its memory. The **Default Program** is the program that controls the output channels when terminals 1–8 of TB 3, Figure 7, are "off."

The **Active Program** is the program number that is currently controlling the output channels. If there are program select inputs on TB 3, those inputs will determine the Active Program, and the Default Program will be ignored. If no hardware inputs are "on," the Default Program will become the Active Program.

For installations where the program select inputs on TB 3 are not used, the Default Program will always be the Active Program.

This function displays the current Default Program and allows you to select a different one.

Screen



Programming

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

⚠ WARNING

Injury and property damage hazard may occur due to changes in machinery operation. Program the Default Program with settings that will eliminate this hazard in the event of sudden activation.

See Also

PGM SEL MODE

Enable Codes

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL

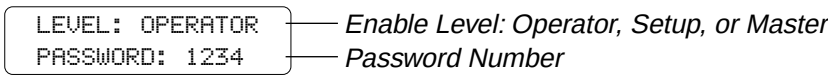
▼ to PGM ENABLE MENU SEL ENABLE CODES SEL

Background

The PS-6344 has three levels of programming access: Operator, Setup, and Master in order of increasing capabilities. Figure 21 lists the menu 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 as shown in Figure 12. The first two rows of Figure 21 show which methods can be used to enable the various levels of programming access.

Screen



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

Use the SEL key to toggle between enable levels.

Use the numeric keys, followed by ENT to assign codes.

Operation

- 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 one keypad in a two-keypad system is enabled, the other keypad will continue to operate in the “Normal Display” mode.
- 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.

See Also

PER CHN ENABLE

ENABLE OPTIONS

PASSWORD

Figure 21—Programming Access Levels for Various Menu Items

	Programming Level			
	Normal Display	**Operator**	**Setup**	**Master**
Can Be Enabled By…				
Keypad Terminal	---	Yes (E2)	No	Yes (E1)
Password	---	Yes	Yes	Yes
Menu Item Access				
Password	Enter	Enter	Enter	Program
Setpoints	View	Program[1]	Program	Program
Setup Menu				
Default Program	View	Program[1]	Program	Program
Timed Outputs	View	Program[1]	Program	Program
Speed Comp	View	Program[1]	Program	Program
Offset	View	Program[1]	Program	Program
Motion Detect	View	Program[1]	Program	Program
Analog Output	View	Program[1]	Program	Program
Pulse Copy	View	---	Program	Program
CHN Copy	View	---	Program	Program
PGM Copy	View	---	Program	Program
I/O Status Menu				
Input Status	View	View	View	View
Output Status	View	View	View	View
System Info Menu				
Setpoint Use	View	View	View	View
Software Version	View	View	View	View
Model & Options	View	View	View	View
Config Menu				
Hardware Menu				
Keyboard Qty	---	---	---	Program[2]
Increasing Dir	---	---	---	Program
Scale Factor	---	---	---	Program
Shaft Position	---	---	---	Program
Analog Qty	---	---	---	Program
Resolver Type	---	---	---	Program
Pgm Sel Mode	---	---	---	Program
Display Menu				
Rate Setup	---	---	---	Program
Toggle RPM	---	---	---	Program
RPM Update	---	---	---	Program
Spd Comp Mode	---	---	---	Program
Grp Pos Disp	---	---	---	Program
Pgm Enable Menu				
Enable Codes	---	---	---	Program
Per Chn Enable	---	---	---	Program
Enable Options				
Setpoints	---	---	---	Program
Default Program	---	---	---	Program
Speed Comp	---	---	---	Program
Timed Outputs	---	---	---	Program
Offsets	---	---	---	Program
Motion Detect	---	---	---	Program
Analog Output	---	---	---	Program
Chn ANDing Menu				
Motion ANDing	---	---	---	Program
Outp Enab AND	---	---	---	Program
Communications	---	---	---	Program
Test Menu				
Memory Tests	---	---	---	Run

[1] Can be programmed only if specified through PER CHN ENABLE and ENABLE OPTIONS.

[2] KEYBOARD QTY can be programmed only through the keypad whose address is "0." See Figure 14.

Enable Options

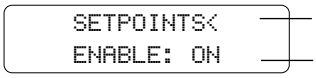
Menu Path

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

Purpose

The Enable Options screen controls Operator Level access to SETUP MENU programming as indicated in Figure 21, note 1.

Screen



SETPOINTS or SETUP MENU screen. Scroll through choices with UP and Down cursor keys.

OPERATOR ENABLE: ON/OFF (Toggle with SEL key)

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.

Programming

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.

Setup Menu Items

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

SETPOINTS, DEFAULT PROGRAM, SPEED COMP, OFFSET
MOTION DETECT, ANALOG OUTPUTS. TIMED OUTPUTS

See Also

PER CHN ENABLE

Group Position Display

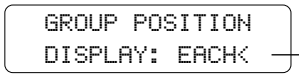
Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ DISPLAY MENU SEL
▼ to GRP POS DISP SEL

Purpose

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.**

Screen

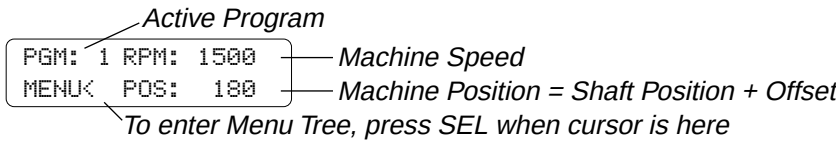


Group Position Display Mode: EACH = Each ouput group has its own offset value; ONE = One value of offset is shared by all output groups.

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

Main Screen—

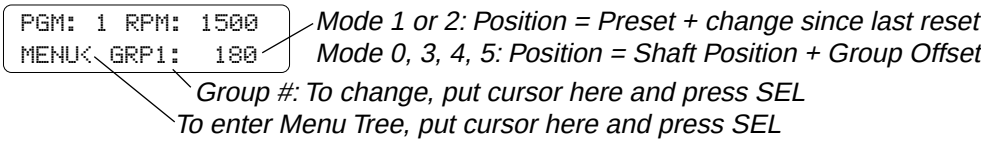
- **One Output Group, and GRP POS DISP Set to "One" or "Each"**
- **Multiple Output Groups, and GRP POS DISP set to "One"**



Group Position Display (Cont'd)

Main Screen—

- **Multiple Output Groups and GRP POS DISP Set to "Each"**



Programming

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

IMPORTANT

- 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 OFFSET programming, setting GRP POS DISP to "ONE" will immediately change the individual group offsets to the value of Group 1.

See Also

OFFSET, SHAFT POSITION, OUTPUT GROUPS, MAIN SCREEN

Increasing Direction

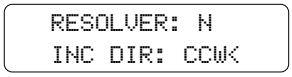
Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL HARDWARE SEL ▼ to INCREASING DIR SEL

Purpose

The Increasing Direction 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.

Screen



Choose Resolver

Arrow cursor to resolver number and numerically enter a 1 or 2.

Setting Direction

After selecting the resolver, cursor to INC DIR and press SEL to toggle the direction of increasing rotation between CCW and CW.

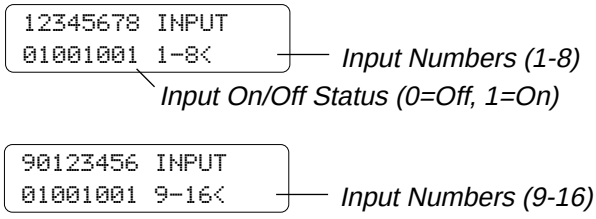
Input Status

Menu Path

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

The input status screen displays the On/Off status of the DC inputs on Terminal Blocks TB 1 and TB 3, Figure 7.

Screens



Inputs are numbered 1 through 16, but only 8 inputs are shown at one time. The On/Off status is shown under the input number; 0=Off, 1=On.

Selecting Inputs

You may view inputs 1-8 or 9-16. Press the SEL key to toggle between the two groups of inputs.

Keyboard Quantity

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL HARDWARE MENU SEL KEYBOARD QTY SEL

Purpose

The Keyboard Quantity screen shows the number of keypads the controller will communicate with.

Screen

```
KEYBOARD
 QTY: 1<
```

Number of keyboard/display units attached to 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" as shown in Fig. 14.

Keypad "0"

You can change the number of keypads shown in KEYBOARD QTY only from the keypad whose address is "0."

IMPORTANT

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.

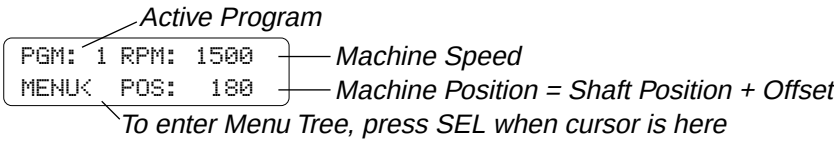
Main Screen

Two Screens

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

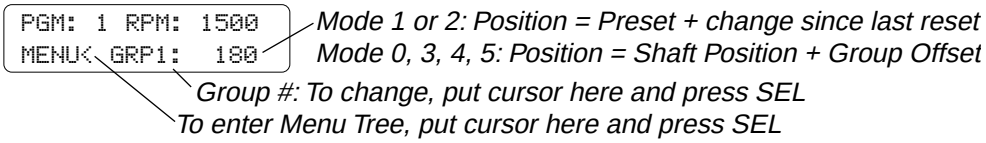
Main Screen—

- **One Output Group, and GRP POS DISP Set to "One" or "Each"**
- **Multiple Output Groups, and GRP POS DISP set to "One"**
- **Rate Display Mode set to "RPM-POS"**



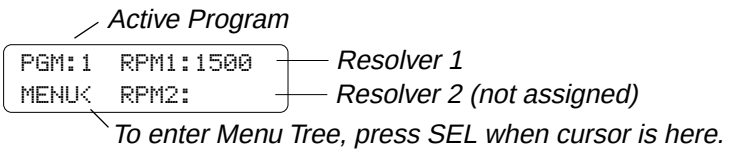
Main Screen—

- **Multiple Output Groups and GRP POS DISP set to "Each"**
- **Rate Display Mode set to "RPM-POS"**



Main Screen—

- **Rate Display Mode set to "RPM-RPM".**



Main Screen (Cont'd)

Active Program

The PS-6344 can store up to 48 programs of setpoints. The "Active program" is the program currently controlling the output channels.

If hardware inputs are being used to select the Active Program, the display will indicate the program selected by the inputs. If all hardware inputs are OFF, the Active program will be the Default Program specified through the DEFAULT PROGRAM function. For information on using hardware inputs to select the Active Program, see "Controller Input Wiring" in Section 2.

If hardware inputs are not used, the Active Program will be the program specified through the DEFAULT PROGRAM function.

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). Machine Speed is displayed as a value which is 1X, 2X, or 3X the resolver RPM. See RATE SETUP for details.

Entering Menu Tree

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

See Also

DEFAULT PROGRAM, RATE SETUP, RATE DISPLAY MODE, GRP POS DISP, OFFSET

Master/Slave

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL HARDWARE MENU SEL ▼ MASTER/SLAVE SEL

IMPORTANT

Do not slave a PS-6344 FROM a PS-5100 or PS-6100 controller. The PS-5100 or 6100 controllers may be slaved FROM the PS-6344 however.

WARNING

Switching to slave mode with no master connected will cause outputs to turn ON and OFF. This may cause erratic operation, resulting in injury and damage to equipment.

Purpose

This screen allows you to select the primary resolver interface to be in either MASTER or SLAVE mode. In Master mode the controller provides an internally generated reference signal for each of its resolvers. In SLAVE mode the reference signal for resolver 1 is generated by another controller (the master). The reference signal for resolver 2 is generated internally regardless of the mode.

Screen

```
MASTER/SLAVE
SELECT: MASTER<
```

Press SEL key to toggle between MASTER and SLAVE modes.

Press ENTER to verify choice.

Memory Tests

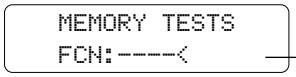
Menu Path

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

Purpose

This menu selection provides three functions that allow you to clear programmed values from the controller. An additional function tests the controller's watchdog timer.

Screen



Programming

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

Function 7000

Clears all setpoints and configuration settings from the controller's EEPROM. After clearing the setpoints, the controller will reload the factory default settings listed in the Appendix.

Function 7001

Clears all configuration settings from the controller's EEPROM. These include all of the programming performed through the Setup Menu and Config Menu on the menu tree, Figure 20. When finished, the controller will reload the factory default settings listed in the Appendix.

Function 7002

Clears all setpoints from the controller's EEPROM. These include any on/off setpoints programmed through SETPOINTS. All other settings will remain intact.

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. 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.

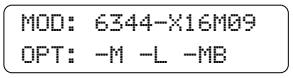
Model & Options

Menu Path

MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to SYSTEM INFO MENU SEL ▼ MODEL & OPTIONS SEL

Purpose

This screen displays the model number and specific options configured in the controller.



Motion ANDing

Menu Path

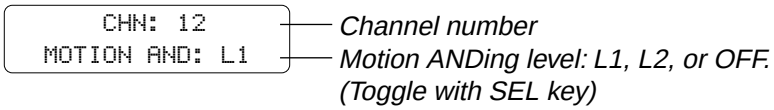
MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to CHN ANDING MENU SEL MOTION ANDING SEL

Purpose

This function is used to tie the operation of output channels to the Motion Detection levels programmed through MOTION DETECTION. Each output channel may be ANDed with either Motion Detection level. If an output is Motion ANDed, it will turn on only when the resolver RPM is in the range specified for that Motion Detection level, AND the setpoints programmed for that channel are "on."

Outputs that must always operate, regardless of machine speed, should **not** be ANDed with a Motion Detection level.

Screen



This screen displays the channel number and the Motion Detection level for Motion ANDing: L1, L2, or OFF. The channel will not be Motion ANDed if the enable is OFF.

Programming

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.

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.

See Also

MOTION DETECTION

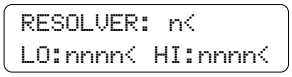
Motion Detection

Menu Path

MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to MOTION DETECT SEL

Motion Detection shows low and high RPM values for each resolver.

Screen



Programming

Use the numeric keys and ENT to change values for low and high RPM.

See Also

MOTION ANDING

Offset

Menu Path

MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to OFFSET SEL

Background

Because the PS-6344 is a programmable device, it can be set to display a position of "zero" at any point in the machine cycle. Usually, a machine is jogged to the beginning of a cycle, and the SHAFT POSITION function is set to zero at this point.

In addition, each output group operating in **Mode 0, 3, 4, or 5** can be individually "offset" from this SHAFT POSITION through OFFSET programming. This allows the output channels in a group to be set to "zero" at a different machine position than the one that corresponds to "zero" in SHAFT POSITION.

Note: GROUP POSITION DISPLAY must be set to "EACH" for individual offsets.

Note: Internal scaling may cause a position difference of one between shaft position, absolute offset, and group position.

Setting a group to its own zero position can simplify setpoint programming for output channels by clarifying the relationship between the setpoints and the machine component controlled by the group. For example, suppose that an output group controls a glue head on a cartoning machine. By jogging the machine and viewing POS on the PS-6344 display, you realize that the glue head must turn on at 347° and off at 22° when using the position set through SHAFT POSITION. Since other output channels correlate well with SHAFT POSITION, you don't want to change it. Instead, using the OFFSET function for this group, you could add 13° to the shaft position so that the glue head would turn on at a **group position** of 0° and off at 35°. Although the group position has been "offset" by 13°, the gun would still turn on at 347° and off at 22° in terms of **shaft position**.

For output groups operating in **Mode 1 or 2**, the group position is reset to a "preset" value whenever the group's input terminal is energized. This preset is defined through OFFSET programming. Because the reset can occur at any resolver position, the relationship between the position of a group operating in Mode 1 or 2 and the SHAFT POSITION varies.

Units with the gray code output option "-G" generate an 8-bit position signal across Outputs 1 through 8. This gray code position signal always corresponds to the position as programmed through SHAFT POSITION, and is not affected by group positions programmed through the OFFSET function.

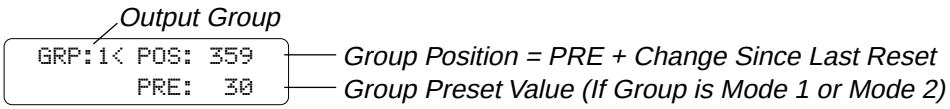
Screens

OFFSET Screen—Group Mode 0, 3, 4 or 5

(continued)

Screens (cont'd.)

OFFSET Screen—Group Mode 1 or 2



Offset Programming

To change the offset for an output group in Mode 0, 3, 4, or 5, first select the group by moving the cursor to GRP. Use INC or DEC, or the numeric keypad and ENT to select the group.

Offset can be programmed in two ways:

Direct Entry—Enter the offset directly by moving the cursor to ABS and entering the offset value on the numeric keypad, followed by ENT.

Group Position—Jog the machine to a position that corresponds to the desired group position, move the cursor to POS, and enter the group position using the numeric keypad, followed by ENT. For example, jog the machine to a point where the group position should be zero, then press "0" ENT while the cursor is at POS.

- For standard PS-6344 controllers using Electro Cam resolvers, the ABS value will directly show the relationship between the group position and machine 0 (shaft position) in scale factor increments. For example, suppose that SHAFT POSITION is set to machine 0 and SCALE FACTOR is set to 360. If the ABS of a group is 20, its position will always be 20 degrees ahead of the machine position.
- If groups have been programmed with their own offsets, changing SHAFT POSITION will change all of the group positions at once.
  It is usually best to set SHAFT POSITION to the desired zero position in the machine cycle before programming individual group offsets.
- For all groups assigned to a particular resolver: If groups have been programmed with their own offsets, changing GRP POS DISP to "ONE" will immediately change ABS for all groups to the value programmed for Group 1.

CAUTION

Programming Preset

To change the preset for an output group in Mode 1 or 2, first select the group by moving the cursor to GRP. Use INC or DEC, or the numeric keypad and ENT to select the group. Move the cursor to PRE and enter the preset value, followed by ENT. 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 SHAFT POSITION. When the group's input terminal is energized, then the group position will reset to the preset value.

See Also

SHAFT POSITION

GRP POS DISP

OUTPUT GROUPS

Output Enable ANDing

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to CHN ANDING MENU SEL ▼ to OUTPUT ENABLE ANDING SEL

Purpose

Output Enable ANDing allows you to AND any output channels with Input Terminal #16, Figure 7. A channel ANDed with this terminal will be enabled to turn on at its programmed setpoints only while the terminal is energized.

Screen

```
    CHN: 12<
OUTPUT AND: OFF
```

Channel number

Output Enable ANDing: ON or OFF. (Toggle with SEL key)

Programming

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.

Output Groups

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL

▼ to OUTPUT GROUPS SEL

Purpose

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 5 for a complete explanation of the uses and applications of operating modes.

Screens

```
    GROUP
QTY: n<
```

The screen above is used to program the total number of groups.

```
GRP:n<RESOLVR:n<
CHNS:nn< MODE:n<
```

This screen is used to program the resolver that is used by the group (RESOLVR), the number of channels in the group (CHNS), and the mode the group operates in (MODE).

Remember that the group 1 always uses resolver 1. Groups 2 through "n" may use resolver 1 or resolver 2, however, all groups after the first group which uses resolver 2 must also use resolver 2. All groups previous to the first group that uses resolver 2 must use resolver 1.

Establishing Groups

When dividing outputs into groups keep these rules in mind:

- Output channels are assigned to groups sequentially. Group 1 will begin with Output 1 and include the specified number of outputs; Group 2 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.
- More than one group can be assigned to the same mode.

Grouping Example 1—All Outputs in One Group

Output Group	Includes Outputs	Mode
1	1 thru 25	3

Grouping Example 2—Two Groups

Output Group	Includes Outputs	Mode
1	1 thru 4	2
2	5 thru 25	0

Grouping Example 3—Three Groups

Output Group	Includes Outputs	Mode
1	1 & 2	0
2	3 & 4	4
3	5 thru 25	0

Programming

Begin by moving the cursor to GRP QTY and pressing select.

Enter the number of groups desired (you may also use the INC/DEC key), then press ENT. If the desired number of groups is correct, press ESC and cursor down to GROUP SETUP.

When at GROUP SETUP press select to get to the group setup menu. There will be several options depending upon the previous setup of the machine. The following will describe the situation where the default settings must be changed:

Move the cursor to GRP and enter "1" followed by ENT.

Move the cursor to CHNS and enter the number of output channels to be included in Group 1, followed by ENT.

Move the cursor to MODE and enter the operating mode for the group from zero to five, followed by ENT. See Section 5 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.

If resolver 2 is used, the last group must be assigned to resolver 2. Preceeding adjacent groups may also be assigned to resolver 2. The machine will not allow improper group assignments.

Main Screen

When output channels are divided into groups, the appearance of the Main Screen will change slightly. See MAIN SCREEN for details.

Output Status

Menu Path

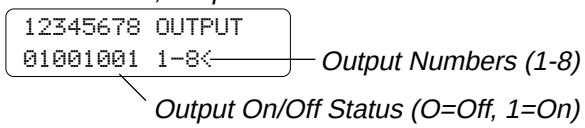
MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to I/O STATUS SEL ▼ to OUTPUT STATUS SEL

Purpose

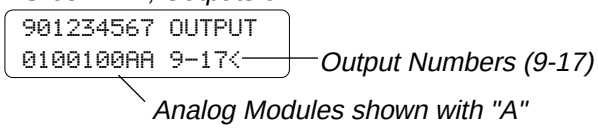
This screen shows the On/Off state of the output channels, and it allows the outputs to be forced.

Screens

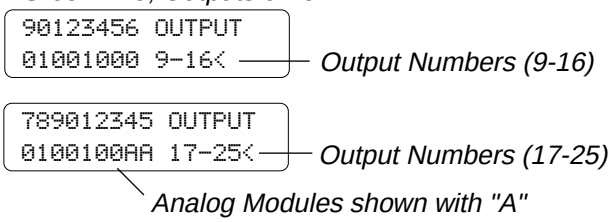
Both Models, Outputs 1-8



PS-6344-17, Outputs 9-17



PS-6344-25, Outputs 9-25



If any output positions have been programmed as analog outputs, the On/Off status will show “A” instead of “0” or “1.”

Selecting Outputs

Press the SEL key to change the set of outputs displayed.

Forcing Outputs

Forcing outputs allows you to force an output on or off for diagnostic purposes.

Note: When leaving the Output Status screen, keep in mind that any outputs that have been forced will return to their originally programmed state.

Programming

Press ◀ to access Output 1, 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. Press SEL to access Outputs 9-17 on the PS-6344-24-M17 and Outputs 9-16 or 17-25 on the PS-6344-24-X16M09

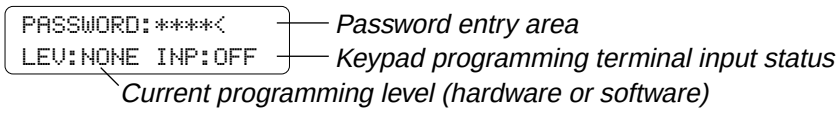
Password

Menu Path

MAIN SCREEN SEL PASSWORD SEL

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, Figure 12.

Screen



Enable Levels

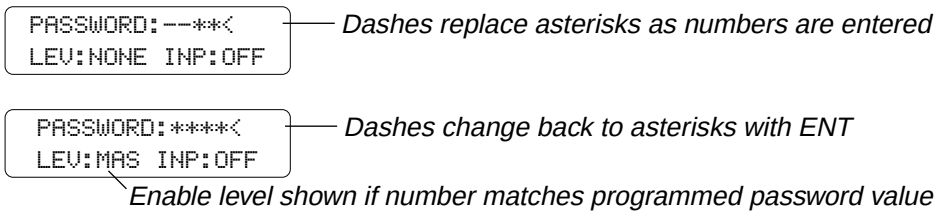
There are three programming access levels; OPERATOR, SETUP, and MASTER. See Figure 21 for a summary of the programming functions available to the different levels. The codes that correspond to each level are established in the ENABLE CODES screen.

Entering a Password

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.

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.



Clearing a Password

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 shown in Figure 21.

See Also

ENABLE CODES

Per Channel Enable

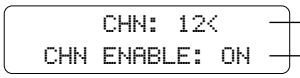
Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to PROGRAM ENABLE SEL ▼ to PER CHN ENABLE SEL

Purpose

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.

Screen



Channel number
Per channel enable: ON/OFF
(Toggle with SEL key)

Channel Select

Press the INC/DEC keys, or use the numeric keys and ENT.

Enable Toggle

Press the SEL key to toggle the enable ON or OFF.

See Also

ENABLE OPTIONS

Program Copy

Menu Path

MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to PROGRAM COPY SEL

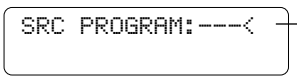
Purpose

Program Copy allows you to copy all of the channels and setpoints from one program to another. It is often easier to copy an existing program and modify it, than to enter a new program from scratch.

Screens
Programming

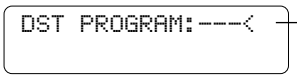
The Program Copy function consists of four screens:
Use the numeric keys and SEL to enter program numbers.

During programming, the cursor keys allow you to move between the Source and Destination screens to allow you to change values before selecting EXECUTE.



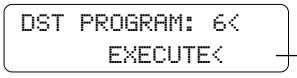
Program to be copied from

(Press SEL to enter)



Destination to be copied to

(Press SEL to enter)



Move cursor to EXECUTE, then press SEL to copy program

COMPLETE indicates program successfully copied

Program Select Mode

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL HARDWARE SEL ▼ to PGM SEL MODE SEL

Purpose

This screen allows you to specify the format for the hardware Program Select inputs on Terminals 1 through 8 of Terminal Block 3, Figure 7.

Screen

```
PROGRAM SELECT
  MODE: BIN<
```

Hardware Program Select Format: BIN = Binary, GRAY = Gray Code, BCD = Binary Coded Decimal

The Program Select inputs can operate in Binary, BCD, or Gray Code formats as shown in Figure 8.

Use the SEL key to toggle the input format.

⚠ WARNING

Injury and property damage hazard may occur due to changes in machinery operation. If the input signals controlling program selection are lost due to a malfunction, the Default Program will activate. Program the Default Program with settings that will eliminate this hazard in the event of sudden activation.

See Also

DEFAULT PROGRAM

Pulse Copy

Menu Path

MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to PULSE COPY SEL

Purpose

Pulse Copy allows you to program a series, or “train” of pulses into a channel without having to enter the On and Off setpoints for each pulse. The Pulse Copy function prompts you for the beginning and ending setpoints 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.

Screens

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

Pulse Copy (cont'd)

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.

Program PULSE COPY as follows:

```
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

Rate Display Mode

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to DISPLAY SEL ▼
RATE DISP MODE SEL

Purpose

The Rate Display Mode allows you to select whether the main screen will display position and rpm, or the rpm of both resolvers.

Screen

```
RATE DISPLAY
MODE: RPM-POS<
```
Rate Display Mode: RPM-POS or RPM-RPM

Pressing the SEL key will toggle the rate display mode between RPM-POS and RPM-RPM.

Rate Setup

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to DISPLAY SEL
RATE SETUP SEL

Purpose

The Rate Setup function allows you to configure the RPM display on the Main Screen. Three parameters can be programmed:

- **Units—**The Main Screen can label the resolver speed as (x)PM. The "x" is any capital letter, A through Z. Typical combinations are RPM (revolutions per minute), BPM (bags per minute), CPM (cartons per minute), or IPM (inches per minute). Other letters can be used depending on the product or unit desired.
- **Rate—**The ratio of actual resolver RPM to displayed RPM.
- **Decimal Points—**The controller divides the Rate by 1, 10, 100, or 1000 to display 0, 1, 2, or 3 decimal places, respectively.

Screen

```
XDUCER:n<DP:n<
MPY:n.nnnn XPM<
```

After selecting the XDUCER, cursor to the other windows to change the decimal point position (DP), the rate multiplier (MPY), or the rate mnemonic (XPM). Press the SEL key when pointing to the XPM window to scroll through the alphabet.

Following are a few examples of the relationships between multiplier (MPY), decimal points (DP), actual resolver speed, and displayed resolver speed:

If MPY Is…	And DP Is…	And a Resolver Speed Of…	Is Displayed As…
.5	0	100 RPM	50 RPM
.5	1	100 RPM	5.0 RPM
.5	2	100 RPM	.50 RPM
.5	3	100 RPM	.050 RPM
1	0	100 RPM	100 RPM
1	1	100 RPM	10.0 RPM
1	2	100 RPM	1.00 RPM
1	3	100 RPM	.100 RPM
2	0	100 RPM	200 RPM
2	1	100 RPM	20.0 RPM
2	2	100 RPM	2.00 RPM
2	3	100 RPM	.200 RPM

Programming

MPY—Move the cursor to MPY and use the numeric keys followed by ENT to enter a value.

DP—Move the cursor to DP and use numeric keys or INC/DEC to toggle between values.

RPM Update Rate

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to DISPLAY SEL ▼
RPM UPD RATE SEL

Purpose

The RPM Update Rate is how often the RPM display on the Main Screen is updated. This rate can be programmed to be 1/Sec, 2/Sec, or 10/Sec.

Screen

RPM Update Rate: How often RPM display on main screen is updated; 1/Sec, 2/Sec, or 10/Sec.

Press the SEL key to toggle the selection.

Scale Factor

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to HARDWARE MENU SEL SCALE FACTOR SEL

Purpose

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 scale factor of 1024 (0 to 1023) 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.

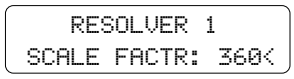
Use the INC/DEC keys to choose between Resolver 1 and Resolver 2.

Use the UP/DOWN arrow keys to cursor between Resolver and Scale Factor.

Use numeric entry to change scale factor.

Note: Resolvers 1 and 2 can have differing scale factors.

Screen



Limits

Scale factors range from two to 1024 on standard controllers. For controllers equipped with the “-H” option, scale factor can be as high as 4096.

Recalculations

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.

Setpoint Use

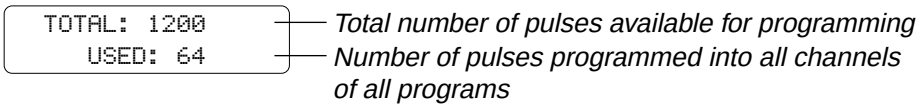
Menu Path

MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to SYSTEM INFO SEL SETPOINT USE SEL

Purpose

This function displays the total number of setpoint On/Off pairs, or “pulses” available for programming, and the number of pulses that have been programmed.

Screen



The number of setpoints 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.

Setpoints

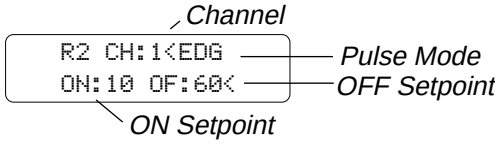
Menu Path

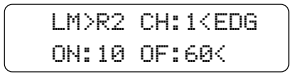
MAIN SCREEN SEL ▼ to SETPOINTS SEL

Screens

When SETPOINTS is selected, a preliminary screen specifies the program whose setpoints will be programmed.

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 setpoint programming.





Note: Choosing a program other than the current active program will edit the setpoints in an inactive program.

(continued)

Channel to Edit

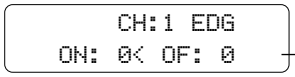
Use the numeric keypad and ENT to select the channel to program.

- **Channels 91 through 96 are special channels used for Output Grouping and Modes. See Section 5 for details.**

Setpoint Values

Use the left and right arrow keys to move between the ON and OFF setpoints.

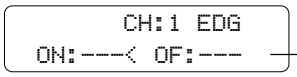
- If a channel has more than one pulse, you may view the other pulses by pressing the right cursor key when viewing the OFF setpoint, or by pressing the left cursor key when viewing the ON setpoint.
- If a channel contains no pulses, the ON and OFF setpoints will be "0."
- If a channel is always on, both the ON and OFF setpoints will be "1."



ON and OFF setpoints both 0 if no pulses in channel. Both 1 if channel always ON

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 setpoint.



Enter ON setpoint, then ENT or right cursor to OF. Enter OFF setpoint, then press ENT.

The display will change to show blank ON and OFF setpoints; the cursor will point to the ON setpoint. Enter the ON setpoint through the numeric keypad, and then press the ENT key or the right cursor to move to the OFF setpoint. Enter the OFF setpoint through the numeric keypad and then press the ENT key.

Adding Multiple Pulses

If ON and OFF setpoints 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 setpoints 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.

Changing Setpoints

Change a setpoint 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 setpoints. 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 setpoint only.

In **PUL** mode, both ON and OFF setpoints will be incremented or decremented simultaneously.

In **CHN** mode, **all** ON and OFF setpoints 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 setpoint area. If the channel has no more pulses, the ON and OFF setpoint will both be zero.

Clearing a Channel

To clear a channel of all pulses, enter a new pulse with ON and OFF setpoints 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 values equal to "1."

(continued)

Setpoints (cont'd)

Record Setpoints

Photocopy the form inside of the back cover and use it to write down setpoints for each program.

⚠ IMPORTANT

For most installations, before programming setpoints, it is best to set SHAFT 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 PS-6344 display, and enter them into setpoint programming. Setpoints programmed in this manner will relate directly to the machine position. If setpoints are programmed before SHAFT POSITION is set, and SHAFT POSITION is subsequently changed, the setpoints will no longer correlate with the machine zero position.

The same logic applies if OFFSET will be used for individual output groups. Program the offsets before establishing setpoints for the channels in the groups.

Shaft Position

Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL to HARDWARE MENU SEL ▼ to SHAFT POSITION SEL

Purpose

Because the PS-6344 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 SHAFT 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.

Screen

```
RESOLVER:n<
SHAFT POS:nnnn<
```

Programming

Use the INC/DEC keys, or the numeric keys followed by ENT to change shaft position.

- Set SHAFT POSITION before doing any SETPOINT or OFFSET programming.

Note: Internal scaling may cause a position difference of one between shaft position, absolute offset, and group position.

Software Version

Menu Path

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

Purpose

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.

Screen

```
REV XXXXXXXXXX
```

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

Speed Compensation

Menu Path

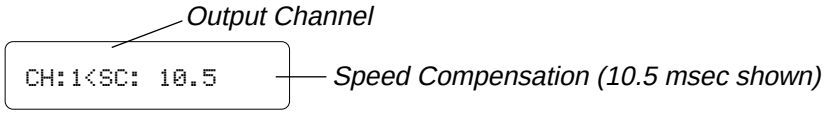
MAIN SCREEN SEL ▼ to SETUP MENU SEL ▼ to SPEED COMP SEL

Background

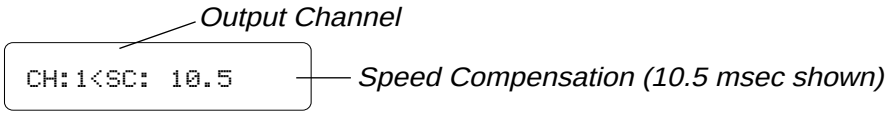
Some devices such as pneumatic cylinders and glue guns require a fixed amount of time to perform their function. As a machine speeds up, these devices need to be actuated earlier in the cycle in order to complete their action at the required time. Speed compensation automatically advances the On/Off setpoints of specified output channel(s) as the machine speeds up, maintaining proper synchronization at all speeds. See Section 4 for a detailed discussion of speed compensation.

Screens

For standard controllers, one value of speed compensation applies to both the ON and OFF setpoints in a channel The SPEED COMP screen for standard controllers looks like this:



For units with the "-L" option (Leading /Trailing edge), the ON and OFF edges in a channel can have different values of speed comp. If SPEED COMP MODE in these models is set to "One," the same value will apply to both ON and OFF edges, and the screen above will show. If SPEED COMP MODE is set to L/T, Leading/Trailing Edge speed comp is activated, and the following screen appears:



Speed Comp Units

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

Programming

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 even msec, the decimal point is not needed: "12 ENT" will result in a value of 12.0.

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 Section 4 for details on applying negative speed compensation.

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

Speed Comp Mode

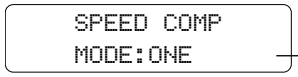
Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to DISPLAY MENU SEL ▼ to SPD COMP MODE SEL

Purpose

For units with the "-L" option (Leading/Trailing Edge Speed Comp), Speed Comp Mode determines whether standard or leading/trailing edge speed compensation is in effect.

Screen



Speed Comp Mode: ONE = Leading/Trailing edge have same speed comp; L/T = Each edge can have a different value of speed comp.

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.

Programming

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

See Also

SPEED COMPENSATION

Timed Outputs

Menu Path

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

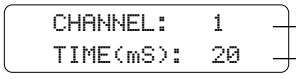
Purpose

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.

Outputs are timed in one msec increments up to a maximum of 9999 msec (9.999 seconds).

Screen



Channel

Time duration

Pulse Required

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

Reverse Rotation

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

Toggle RPM

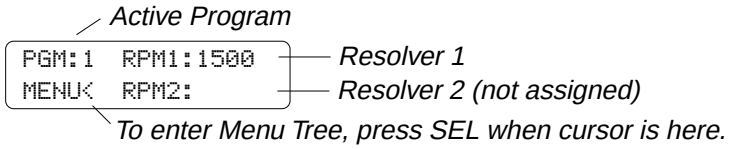
Menu Path

MAIN SCREEN SEL ▼ to CONFIG MENU SEL ▼ to DISPLAY MENU SEL ▼ to TOGGLE RPM SEL

Purpose

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.

Screen



Programming

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

View Resolvers

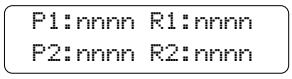
Menu Path

MAIN SCREEN SEL ▼ to SETUP MENU SEL to VIEW RESOLVERS SEL

Purpose

This screen displays the rpm and position of both resolvers. This position is raw resolver position.

Screen



Introduction To Speed Compensation

What Is It?

"Speed compensation" refers to the ability of the PS-6344 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 PS-6344 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 PS-6344, 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.

Example

Figure 22 illustrates 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.

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

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 Figure 23.

Figure 22—Simple Application Using Speed Compensation

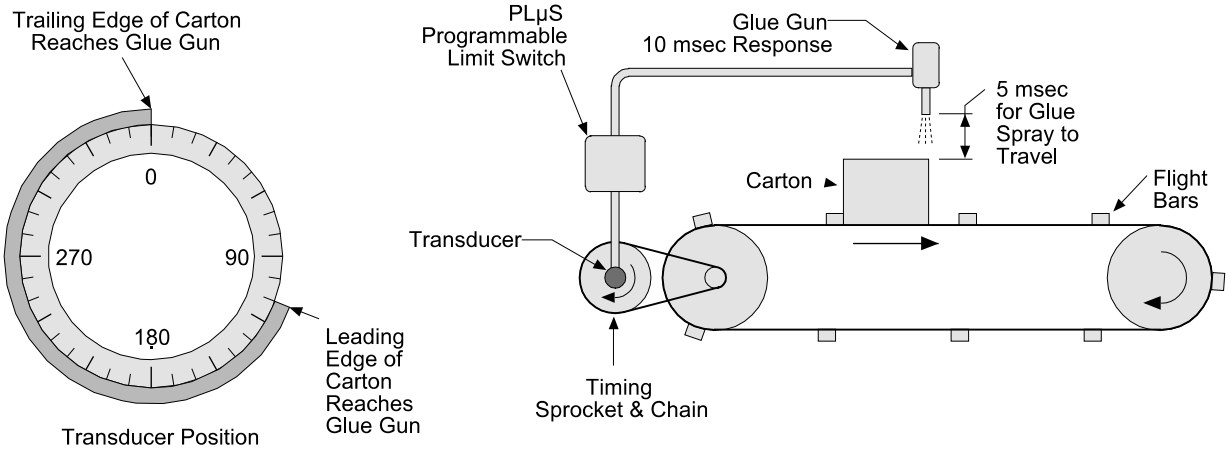
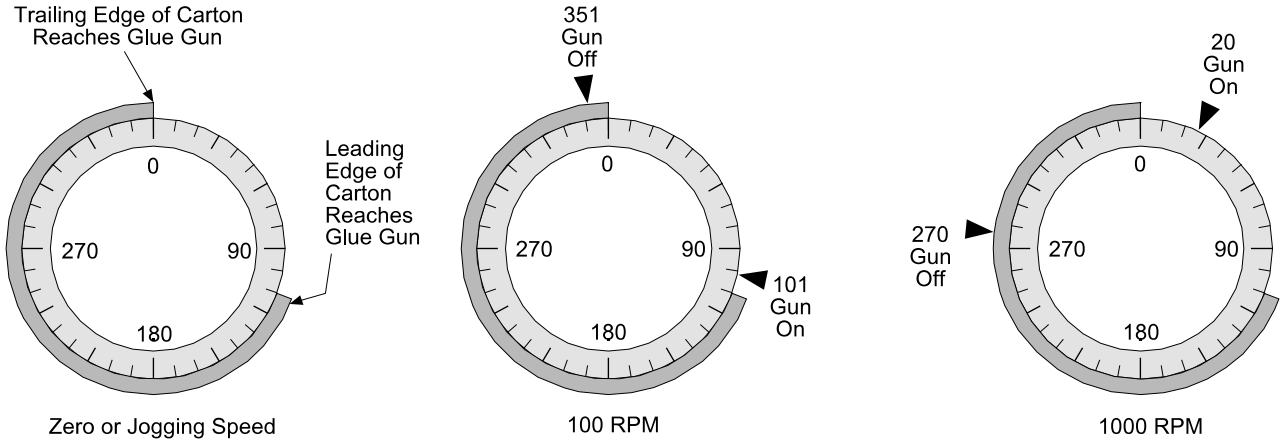


Figure 23—Speed Compensation at Various Speeds



Setting Speed Comp

In many applications, speed compensation can be set by jogging the line to determine ON and OFF setpoints 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 setpoints are entered, the glue system response time of 15 msec would be entered through SPEED COMP programming as described in Section 3. As line speed increases, the PS-6344 will automatically advance the setpoints to maintain the accuracy of the glue bead position.

⚠ CAUTION

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

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 setpoints as described earlier. Then, estimate a response time and enter it into the controller using the SPEED COMP function described in Section 3.

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 setpoints. To set up this type of equipment, start the line, run cartons through it at a fixed line speed, and set the ON and OFF setpoints as required for proper gluing. Write them down for reference in the next step. SPEED COMP should be set to zero.

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

Once the second pair of setpoints is established, compare them to the first pair that you wrote down. Establish a ratio of degrees the setpoints advance versus the speed as shown in Figure 24. 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 setpoints already programmed, you will need to start the line one more time and, at a constant speed, adjust the **ON and OFF setpoints** for proper gluing. Once set, vary the line speed to confirm that the speed compensation value is accurately adjusting the setpoints over the operating speed range.

Standard Speed Comp

Figure 24—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 (see page 4-2), this shaft would require (0.05/0.006), or 8.3 msec to rotate 0.05°. The speed compensation value is 8.3.

Leading Trailing Speed Comp

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, PS-6344 controllers with the "-L" option (Leading/Trailing Edge) provide 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 Section 3. 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 setpoints have been established, always adjust the speed compensation value. Do not adjust the individual output setpoints!

Response Times Unknown

If the response times are unknown, jog the line to determine ON and OFF setpoints 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 setpoints as required with SPEED COMP set to zero for both the leading and trailing edges. Write down the ON and OFF setpoints.

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

Once the second pair of setpoints is established, calculate separate leading and trailing edge speed comp values as shown in Figure 25.

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

Figure 25—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°. The speed compensation value 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 (see page 4-2), this shaft would require (0.025/0.006), or 4.2 msec to rotate 0.05°. The speed compensation value is 4.2.

Negative Speed Compensation

Negative Speed Comp

Normal speed compensation **advances** the setpoints 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 setpoints 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.

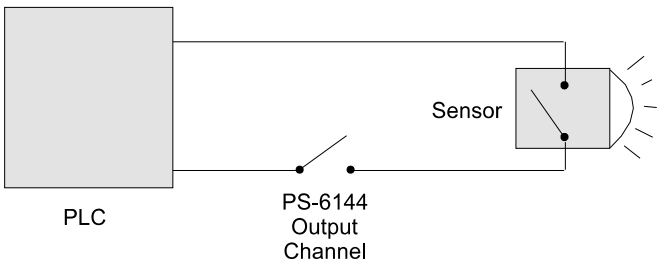
Sensor Lag

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. Figure 26 illustrates 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 PS-6344'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 Section 3 for details on programming negative speed comp.

Figure 26—Simple Sensor Gating Scheme



Speed Comp Guidelines

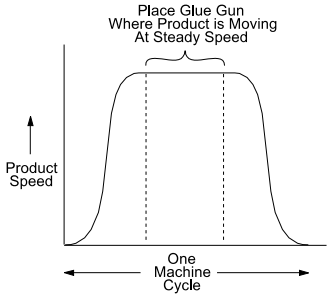
Device Placement

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. See Figure 27 for 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 Section 5, be aware of the effects of speed compensation on the relationship between the setpoints, the Group Input signal, and the pulse programmed into the Group Channel. **Speed compensation will not affect Group Channels 91 through 96.**

Figure 27—Product Speed Should be Constant Past Controlled Device



Introduction to Groups & Modes

Input Signals

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:

- **Conditional Operation**

  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.

- **Phase Adjustment**

  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.

Groups & Modes

The PS-6344 controller 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 one of the input terminals on TB 1, Figure 7. 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.

Benefits

Proper programming of output groups and modes can provide substantial benefits:

- **Reduced Waste & Cleanup—**By enabling devices such as glue guns to operate only when a product is present, operating modes conserve glue and reduce mess and cleanup.

- **Increased Productivity—**When used to compensate for phase adjustments between machine sections, operating modes can improve the high speed accuracy of machine functions, allowing higher machine speeds, better product quality, and reduced scrap.

Typical Applications

Details on each of the six PS-6344 operating modes are included later in this section. Following are a few types of industrial machinery which frequently benefit from the use of operating modes.

Web Converting Machines—Disposable diapers, medical pads, office folders, and similar products. Mode 1 can automatically change the timing of individual machine sections to compensate for changes in phase relationships between sections.

Cartoners & Case Packers—Vacuum, material handling, loading and other functions are usually controlled in Mode 0. Gluing functions are typically controlled in Modes 4 or 5 to prevent glue from being dispensed when containers are not present.

Vertical Form/Fill/Seal Machines—Package handling functions are controlled in Mode 0, while pump or fill functions are handled in Mode 1 to automatically correct for mechanical phase adjustments made between these two sections of the machine. This allows one resolver to do a job that would otherwise require two.

Machines with Multiple Cycle Ratios—Some machines have different sections that run at different cycle ratios per overall machine cycle. For example, one portion of a machine may complete several cycles while another section makes only one cycle. By using Mode 1 or 2, it is possible for some output groups to cycle multiple times while others cycle once.

Group Programming

PS-6344 output channels are divided into groups through OUTPUT GROUP programming. Each group is automatically associated with one of the input terminals on TB 1, Figure 7, as well as a special "Group Channel" ranging from Channel 91 to 96. The relationship between groups, input terminals, and group channels is summarized in Fig. 28.

Figure 28—Groups, Input Terminals, & Group Channels

Output Group	Group Input Terminal TB 1, Fig. 7	Group Channel
1	9	91
2	10	92
3	11	93
4	12	94
5	13	95
6	14	96

When dividing outputs into groups, keep these rules in mind:

- Output channels are assigned to groups sequentially. Group 1 will begin with Output Channel 1 and include the specified number of channels; Group 2 will begin with the next output channel and continue sequentially for its specified number of channels; and so on. The last group will automatically include all of the remaining output channels.
- You can establish as many as six groups or as few as one.
- More than one group can be assigned to the same mode.

Grouping Example 1—All Outputs in One Group

Output Group	Includes Output Channels	Group Input Terminal TB 1, Fig. 7	Group Channel	Mode
1	1 thru 25	9	91	0

Grouping Example 2—Two Groups

Output Group	Includes Output Channels	Group Input Terminal TB 1, Fig. 7	Group Channel	Mode
1	1 thru 4	9	91	2
2	5 thru 25	10	92	0

Grouping Example 3—Three Groups

Output Group	Includes Output Channels	Group Input Terminal TB 1, Fig. 7	Group Channel	Mode
1	1 & 2	9	91	0
2	3 & 4	10	92	4
3	5 thru 25	11	93	0

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 input terminal, and its group channel. Detailed discussions of each operating mode follow.

Mode 0 Operation

Description

Output channels in a group assigned to Mode 0 function normally and 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 OFFSET programming, Section 3.

Mode 0 Programming

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

Mode 1 Operation

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 OFFSET function, Section 3. 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. See Figure 28 for input terminal and group channel assignments.

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 position of the corresponding group channel also resets.
- On start-up, the input terminal is armed and the group position is the same as the value programmed in SHAFT POSITION, Section 3. On power-down, the group’s current position setting will be lost.
- Either edge of a pulse in the group channel can re-arm the input terminal. If the resolver shaft is rotating in the forward direction (position is increasing as shaft rotates) the “on” edge of the pulse will re-arm the terminal. If the shaft is rotating in the reverse direction (position decreasing as shaft rotates), the “off” edge of the pulse will re-arm the terminal.
- Each program in the controller can have different setpoints for output channels and the corresponding group channel.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a Mode 1 group.

Mode 1 Typical Setup

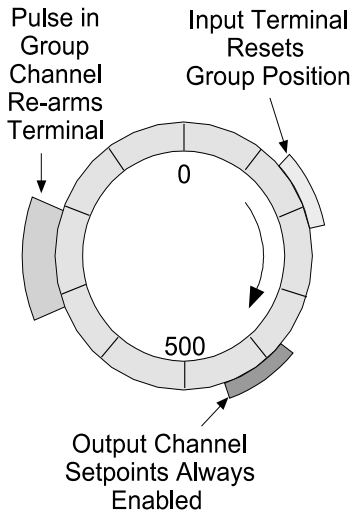


Figure 29—Mode 1 Example Application

Three sections of an adjustable phase converting machine are controlled by a single PLuS 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.

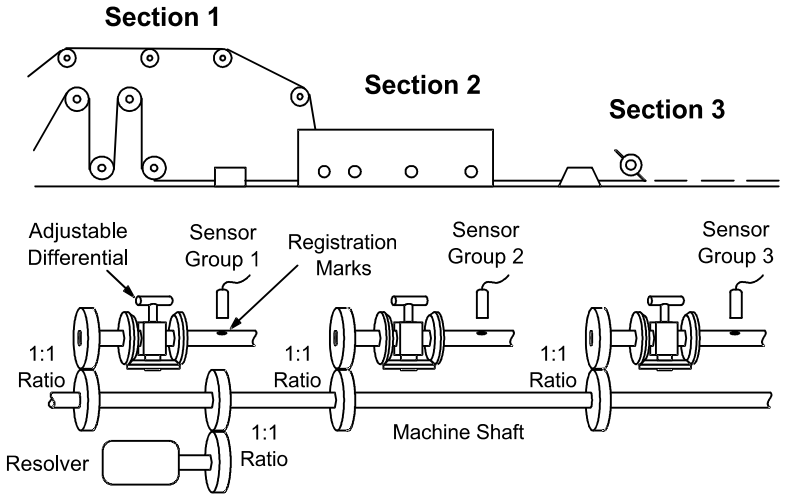
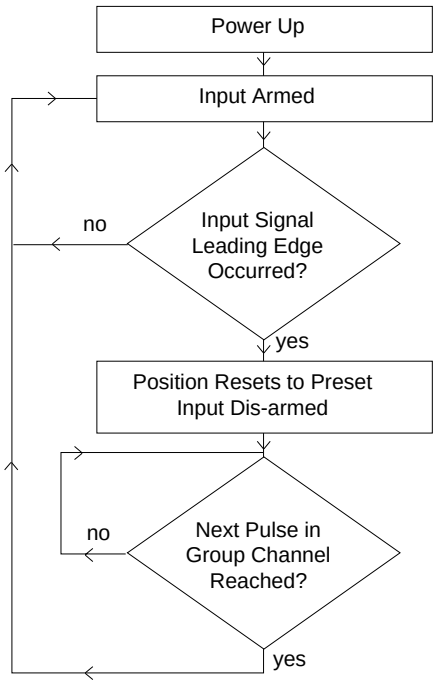


Figure 30—Mode 1 Logic Flow Chart



1. Control powers up. Initial group position is the value programmed through SHAFT POSITION, Section 3. Group outputs are always enabled in Mode 1.

2. Group input terminal, Fig. 28, is armed.

3. Check for leading edge of signal on group input terminal, Fig. 28. If it occurred, go to Step 4. If not, loop back to Step 2.

4. Reset group position to "Preset" value programmed through OFFSET, Section 3. Dis-arm group input terminal.

5. Check if group position has reached the pulse programmed into the group channel, Fig. 28. If "yes," go to Step 2. If "no," repeat this step.

Note: Pulse in group channel can re-arm input from forward or reverse direction.

Mode 1 Programming

See Figure 28 for input terminal and group channel assignments.

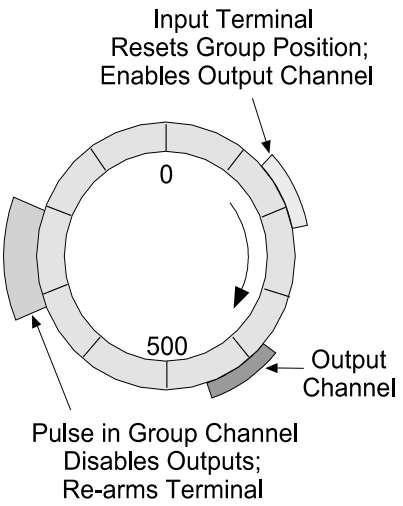
1. Program OUTPUT GROUPS, Sect. 3, to establish groups and modes.
2. Program the "Preset" value for each Mode 1 group using OFFSET, Section 3.
3. Jog the machine to the point where the group input terminal will energize. Using this point as a reference, program setpoints into the output channels in the group.
4. Program a pulse in the group channel to re-arm the input terminal.

Mode 2 Operation

Description

Outputs in a Mode 2 group are disabled until the corresponding input terminal is energized. The outputs are then enabled to turn on at their programmed setpoints, and the group position immediately resets to the value programmed through the OFFSET function, Section 3. 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, the position of the corresponding group channel also resets.
- On power-up, outputs are disabled, the input terminal is armed, and the group position is the same as the value programmed in SHAFT POSITION, Section 3.
- Either edge of a pulse in the group channel can re-arm the input terminal. If the resolver shaft is rotating in the forward direction (position is increasing as shaft rotates) the "on" edge of the pulse will re-arm the terminal. If the shaft is rotating in the reverse direction (position decreasing as shaft rotates), the "off" edge of the pulse will re-arm the terminal.
- Each program in the controller can have different setpoints for output channels and the corresponding group channel.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a Mode 2 group.

(continued)

Figure 31—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 position to the "preset" values and enables the group outputs to turn on the glue guns at the correct setpoints.

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

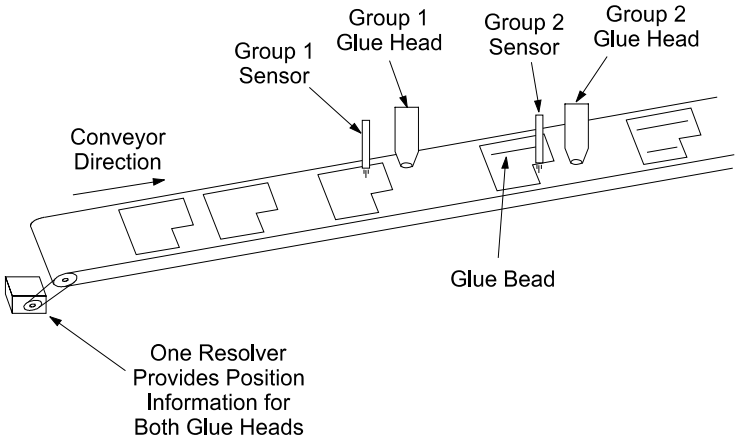
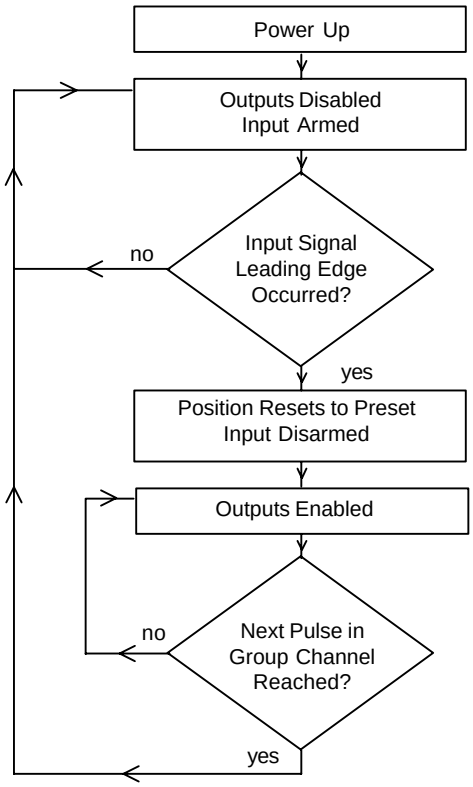


Figure 32—Mode 2 Logic Flow Chart



1. Control powers up. The initial group position is the value programmed through SHAFT POSITION, Section 3.

2. Outputs are disabled. Group input terminal, Fig. 28, is armed.

3. Check for leading edge of group input terminal signal. If it occurred, go to Step 4. If not, loop back to Step 2.

4. Reset group position to "Preset" value programmed through OFFSET, Section 3. Dis-arm group input terminal.

5. Enable the outputs to turn on at their programmed setpoints.

6. Check if group position has reached the edge of a pulse programmed into the group channel. If "yes," go to Step 2. If "no," loop back to Step 5.

Note: Pulse in group channel can re-arm input from forward or reverse direction.

Mode 2 Programming

See Figure 28 for input terminal and group channel assignments.

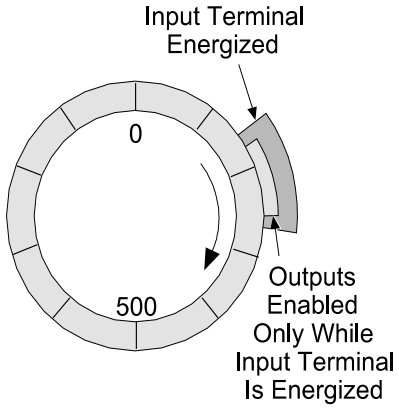
1. Program OUTPUT GROUPS to establish groups and modes.
2. Use OFFSET to program the "Preset" value for any Mode 2 groups.
3. Jog the machine to the point where the group input terminal will energize. Using this point as a reference, program setpoints into the output channels in the group.
4. Program 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.

Mode 3 Operation

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. See Figure 28 for input terminal channel assignments.

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 Mode 3 group.
- The machine position for a Mode 3 group can be set through OFFSET programming.

Mode 3 Programming

See Figure 28 for input terminal assignments.

1. Program OUTPUT GROUPS to establish groups and modes.
2. Use OFFSET to program the absolute offset value for any Mode 3 groups.
3. Program setpoints into the output channels in the group. Remember that the output channels in Mode 3 will be enabled only while a signal is applied to the group terminal.

Figure 33—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.

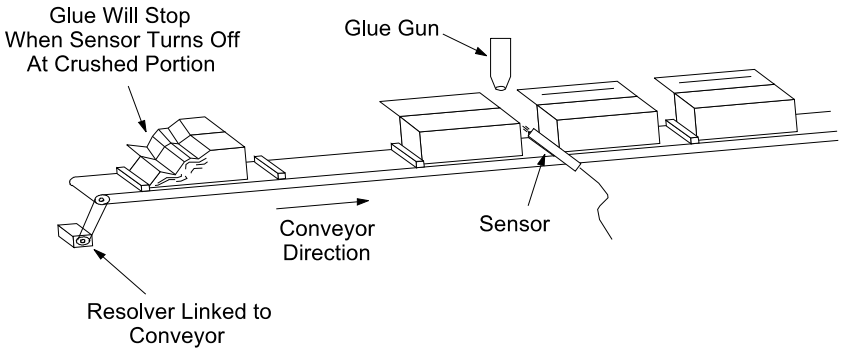
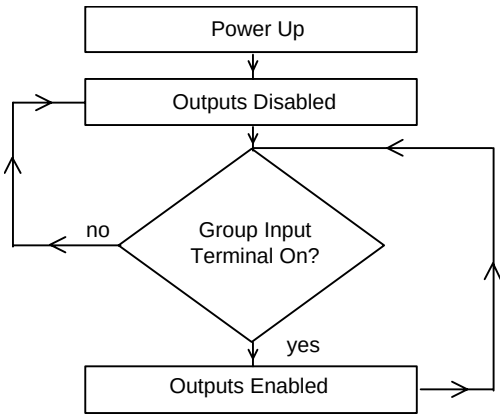


Figure 34—Mode 3 Logic Flow Chart



1. Control powers up. Group position is the value programmed through OFFSET, Section 3.

2. Outputs are disabled.

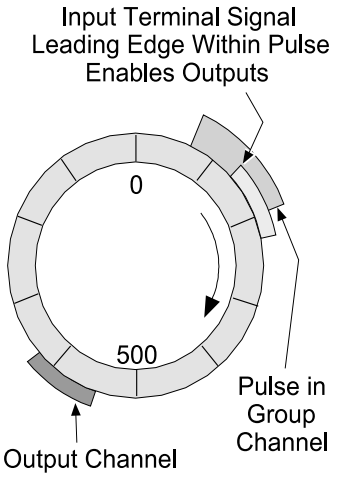
3. If the group input terminal is on, go to Step 4. If not, go back to Step 2.

4. Enable outputs to cycle on and off at their programmed position setpoints. Loop back to Step 3.

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. See Figure 28 for input terminal and group channel assignments.

Mode 4 Typical Setup



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 the pulse, the outputs will not be enabled.
- Each program in the controller can have different setpoints for output channels and the corresponding group channel.
- Either edge of a pulse in the group channel can disable the outputs. If the resolver shaft is rotating in the forward direction (position is increasing as shaft rotates) the “on” edge of the pulse will disable the outputs. If the shaft is rotating in the reverse direction (position 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 Mode 4 group.
- The machine position for a Mode 4 group can be set through OFFSET programming.

Mode 4 Programming

See Figure 28 for input terminal and group channel assignments.

1. Program OUTPUT GROUPS to establish groups and modes.
2. Use OFFSET to program the absolute offset value for any Mode 4 groups.
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 setpoints into the output channels in the group. Remember that the leading edge of the pulse in the group channel will disable the output channels in the group.

Figure 35—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.

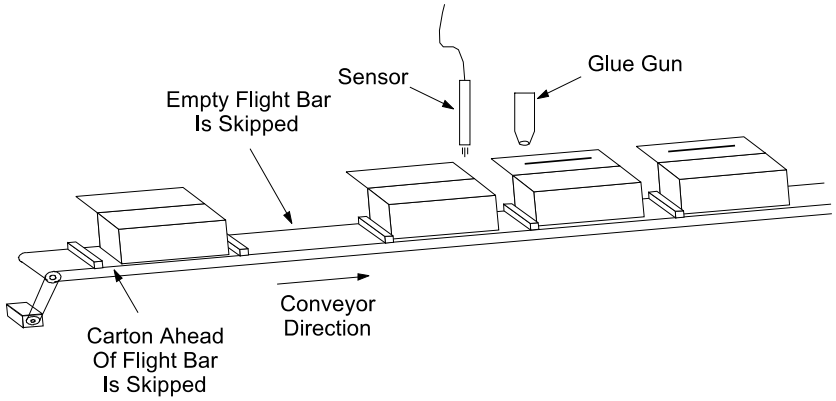
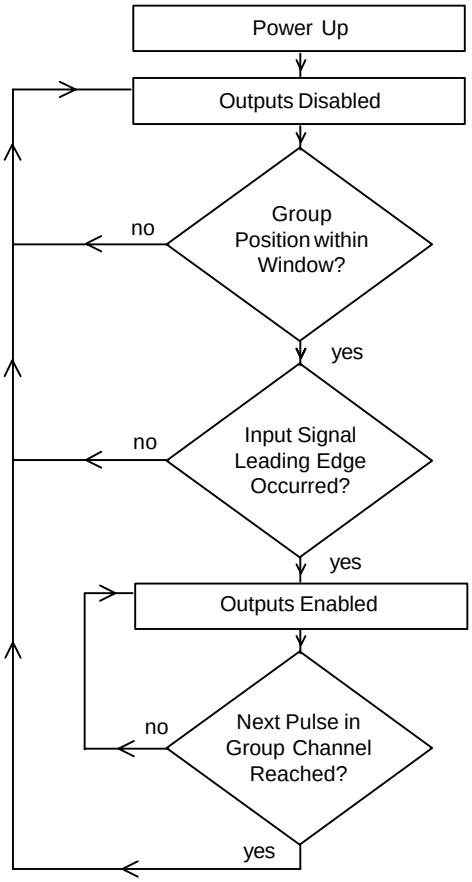


Figure 36—Mode 4 Logic Flow Chart



1. Control powers up. Initial group position is the value programmed through OFFSET, Section 3.

2. Group outputs are disabled.

3. If the group position is within the pulse programmed into the group channel, go to Step 4. If not, loop back to Step 2.

4. Check for leading edge of signal on the group input terminal, Figure 28. If it occurred, go to Step 5. If not, loop back to Step 2.

5. Enable the group outputs to cycle on and off at their programmed setpoints. Go to Step 6.

6. If the group position has reached the pulse programmed into the group channel, go to Step 2. If not, loop back to Step 5.

Note: Position can reach pulse from forward or reverse direction.

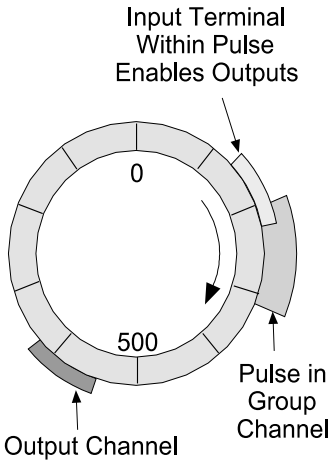
Description

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

- Mode 5 is only allowed on a Group associated with Resolver 1.
- 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 #15 on TB 1, Fig. 7, 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

See Figure 28 for input terminal and group channel assignments.

- 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 the corresponding group channel.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a Mode 5 group. 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 Mode 5 group can be set through OFFSET programming.

Figure 37—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."

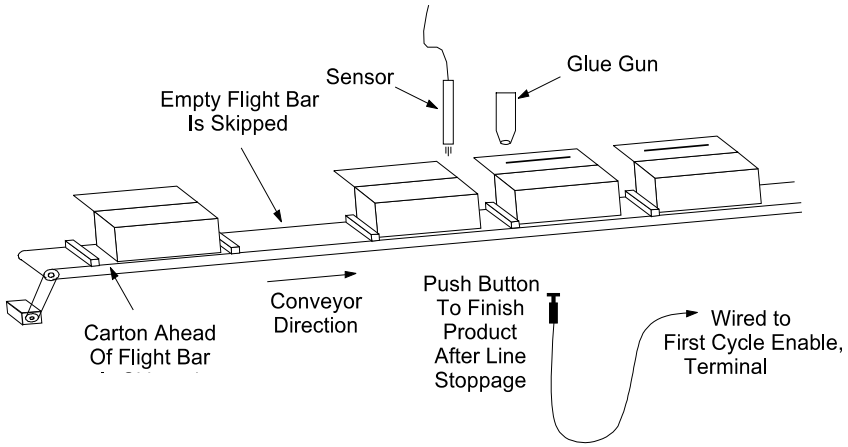
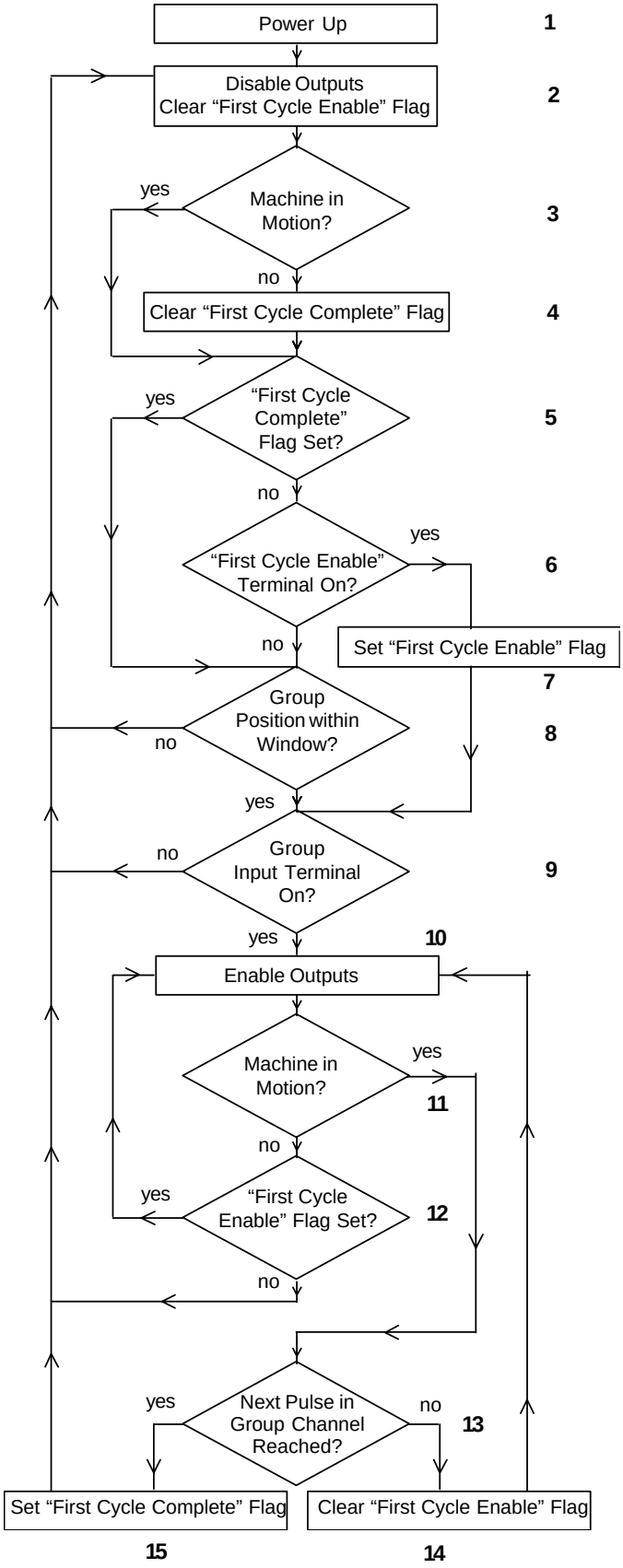


Figure 38—Mode 5 Logic Flow Chart



1. Control powers up. Group position is the value programmed through OFFSET, Section 3.
2. Outputs are disabled. "First Cycle Enable" flag is unlatched.
3. If the machine is moving, go to step 5. If not, go to step 4.
4. Clear "First Cycle Complete" flag because machine is stopped.
5. Check if "First Cycle Complete" flag is set. If it is, go to step 8. If not, go to step 6.
6. Check if "First Cycle Enable" terminal is on. If it is, go to step 7. If not, go to step 8.
7. Set "First Cycle Enable" flag. Go to step 9.
8. If the group position is within the pulse programmed into the group channel, go to step 9. If not, return to step 2.
9. Check if Group Input Terminal is on. If it is, go to step 10. If not, loop back to step 2.
10. Enable the outputs to cycle at their programmed on/off setpoints. Go to step 11.
11. If the machine is moving, go to step 13. If not, go to step 12.
12. If the "First Cycle Enable" flag is set, return to step 10. If not, go to step 2.
13. If the group position has reached the pulse programmed into the group channel, go to step 15. Otherwise, go to step 14.
14. Clear "First Cycle Enable" flag because machine is moving. Loop back to step 10.
15. Set "First Cycle Complete" flag because next pulse in Group Channel has been reached. Go to step 2 to start next cycle.

Mode 5 Programming

See Figure 28 for input terminal and group channel assignments.

1. Program OUTPUT GROUPS to establish groups and modes.
2. Use OFFSET to program the absolute offset value for any Mode 5 groups.
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 setpoints into the group output channels. Don't overlap the setpoints with the group channel pulse programmed in Step 3.

Speed Compensation & Modes

Speed Compensation

Speed compensation will affect individual channels in an output group as programmed through SPEED COMP. **However, speed compensation will not affect the group channels, 91 through 96.**

When using speed compensation and modes together, be aware that speed compensation may shift an output channel's setpoints into a pulse programmed in the group channel, or into the position in which an input signal will occur. Depending on the Mode and the arrangement of setpoints, speed compensation may produce unexpected results.

PLμSNet II Upload/Download Program (Must use version 2.57 or higher)

Description

PLμSNet II is a DOS program that will run on most IBM-PC compatible computers. When the serial port of the PC is connected to a PLμS Programmable Limit Switch, PLμSNet II can transfer programming values between the computer and the controller in either direction. PLμSNet II includes its own communications software with selection of baud rate, PLμS controller address, and the computer's COM port. No other communication software is needed.

Functions

PLμSNet II provides two main functions: **Uploading** a controller's complete set of programming values from the controller to an ASCII file on the PC; and **downloading** the contents of an ASCII from a computer to the PLμS controller. PLμSNet II also provides a text editor to view and change the contents of an ASCII file.

Applications

Hard Copy Reference—Using PLμSNet II, a PLμS controller's programming can be saved as an ASCII file and printed out for reference. The printout can be used to study line operation or to program other PLμS controllers in the plant.

Archival Storage—The ASCII file containing a PLμS controller's programming can be stored on a hard drive or floppy disk. In the event of accidental alteration or erasure of the controller's programming, PLμSNet II can be used to download the ASCII file to the controller to restore normal operation.

Programming Multiple Units—If several PLμS controllers will have the same values, one controller can be programmed correctly and its setpoints uploaded to a PC using PLμSNet II. The programming can then be downloaded to the other PLμS controllers, eliminating the need to manually re-enter setpoints for each controller.

Modify Programming—Once a program has been saved as an ASCII file, it can be studied and edited to create other versions of the program.

Contents

The PLμSNet II Communications Software Program includes these materials:

(1) Introduction sheet.

(1) One disk containing the PLUSNET.EXE file.

Cable

To use PLμSNet II, a serial communications cable is required to connect the PLμS controller to an IBM compatible personal computer. This cable can be purchased from Electro Cam Corp., or it can be built by the customer using the wiring information shown in the PLμS Programming and Installation Manual.

Installation

Copy the PLUSNET.EXE file to the desired directory on the PC.

Operation

Connect the PC and the PLμS controller with a communications cable and turn both units ON.

Start PLUSNET.EXE from the DOS command line, or from a DOS window within Microsoft Windows. The menus in the program are self-explanatory.

Figure 39—Sample ASCII Program Copied from PS-6344 Using PLuSNET II

```
;                                   Electro Cam Corp.
;                PLuSNet II Communications Software v2.57
;                     Upload Date: 3/10/1999
;
; Comments may be added to any line as long as they start with a ";" and do
; not contain a carriage return.  However, these comments will not be
; retained when the file is uploaded from a controller.
; Be careful to save and name files accordingly to archive information.
; NOTE: Plusnet will not report invalid data errors.
; ALSO: Plusnet does not use decimal points in decimal numbers.
;      Example: rate multiplier of 1000 is actually 1.000
;
; Communication settings : Type=RS-232, Baud=4800, Address=1
;
;Data              Line# Comments
;-------------------------------------------------------------------------
;                    SYSTEM INFORMATION
;-------------------------------------------------------------------------
2: 103              ;   1; Register map version
3: 6344             ;   2; Model
4: 136              ;   3; Firmware revision
5: 17               ;   4; Output quantity
6: 5,1              ;   5; Option: -H; High resolution
6: 6,1              ;   6; Option: -L; Leading/trailing speed comp
6: 7,1              ;   7; Option: -A; Analog output
;-------------------------------------------------------------------------
;                    SETUP CONFIGURATION
;-------------------------------------------------------------------------
9: 1                ;  8; Default Program
10: 0               ;  9; Analog quantity
12: 1,10,3000       ;  10; Motion detection: Resolver #, low rpm, high rpm
12: 2,10,3000       ;  11; Motion detection: Resolver #, low rpm, high rpm
16: 0               ;  12; Map limit
18: 2               ;  13; Keyboard quantity
21: 0               ;  14; Program select mode: 0=bin, 1=BCD, 2=Gray
25: 1               ;  15; Master/Slave of 1st resolver: 1=Master, 2=Slave
26: 1, 0            ;  16; Direction of rotation: Resolver #, 0=CCW/1=CW
26: 2, 0            ;  17; Direction of rotation: Resolver #, 0=CCW/1=CW
27: 1, 360          ;  18; Scale factor: Resolver #, Scale factor
27: 2, 360          ;  19; Scale factor: Resolver #, Scale factor
28: 1, 0            ;  20; Absolute offset: Resolver #, Offset
28: 2, 0            ;  21; Absolute offset: Resolver #, Offset
30: 1,1000,0,R      ;  22; Rate setup: resolver, mult, Dec pt, units
30: 2,1000,0,R      ;  23; Rate setup: resolver, mult, Dec pt, units
31: 0               ;  24; Rate mode: 0=RPM-POS, 1=RPM-RPM
32: 1,20            ;  25; Toggle rpm: Resolver #, RPM
32: 2,20            ;  26; Toggle rpm: Resolver #, RPM
33: 0               ;  27; Rpm update rate: 0=1/Sec, 1=2/Sec, 2=10/Sec
34: 1               ;  28; Speed comp mode: 0=Single, 1=L/T
35: 0               ;  29; Group pos display mode: 0=Each, 1=One
;-------------------------------------------------------------------------
;                    USER ENABLE CODES
;-------------------------------------------------------------------------
36: 1               ;  30; Operator ID number (P2)
37: 2               ;  31; Setup ID number (P1)
38: 3               ;  32; Master ID number
;-------------------------------------------------------------------------
;                    OPERATOR ENABLE ACCESS
;-------------------------------------------------------------------------
39: 1;1,1,1,1,1,1,1,1 ;  33; Per chn enable: chns 1-8; chn on/off
39: 2;1,1,1,1,1,1,1,1 ;  34; Per chn enable: chns 9-16; chn on/off
39: 3;1,0,0,0,0,0,0,0 ;  35; Per chn enable: chns 17-24; chn on/off
40: 1               ;  36; Operator enable: Setpoints
41: 1               ;  37; Operator enable: Default program
42: 1               ;  38; Operator enable: Speed comp
43: 1               ;  39; Operator enable: Timed outputs
44: 1               ;  40; Operator enable: Offsets
45: 1               ;  41; Operator enable: Motion detection
46: 1               ;  42; Operator enable: Analog values
;-------------------------------------------------------------------------
;                    MOTION ANDING
;-------------------------------------------------------------------------
47: 1;0,0,0,0,0,0,0,0 ;  43; Motion ANDing: chns 1-8; chn levels (0=none)
47: 2;0,0,0,0,0,0,0,0 ;  44; Motion ANDing: chns 9-16; chn levels (0=none)
47: 3;0,0,0,0,0,0,0,0 ;  45; Motion ANDing: chns 17-24; chn levels (0=none)
;-------------------------------------------------------------------------
;                    OUTPUT ENABLE ANDING
;-------------------------------------------------------------------------
48: 1;0,0,0,0,0,0,0,0 ;  46; Output enable ANDing: chns 1-8; chn on/off
48: 2;0,0,0,0,0,0,0,0 ;  47; Output enable ANDing: chns 9-16; chn on/off
48: 3;0,0,0,0,0,0,0,0 ;  48; Output enable ANDing: chns 17-24; chn on/off
;-------------------------------------------------------------------------
;                    GROUP & MODE SETUP
;-------------------------------------------------------------------------
49: 1               ;  49; Output group quantity
50: 1,0             ;  50; Offset: group#, offset
51: 1,1,17,0        ;  51; Group config: group, Xducer, #chns, mode
;-------------------------------------------------------------------------
; SETPOINTS
; Format: pgm, chn, on, off
;-------------------------------------------------------------------------
54: 1,1,10,45       ;  52;
54: 1,1,50,85       ;  53;
54: 1,1,182,192     ;  54;
54: 1,2,0,90        ;  55;
54: 1,2,180,270     ;  56;
54: 1,3,0,90        ;  57;
54: 1,4,0,90        ;  58;
54: 1,5,0,90        ;  59;
54: 1,6,0,90        ;  60;
54: 1,7,0,90        ;  61;
54: 1,8,0,90        ;  62;
54: 1,9,0,90        ;  63;
54: 1,9,180,270     ;  64;
54: 1,10,0,90       ;  65;
54: 1,10,180,270    ;  66;
54: 1,11,0,90       ;  67;
54: 1,12,0,90       ;  68;
54: 1,13,0,90       ;  69;
54: 1,13,220,350    ;  70;
54: 1,14,0,90       ;  71;
54: 1,14,220,320    ;  72;
54: 1,15,0,90       ;  73;
54: 1,16,0,90       ;  74;
54: 1,17,0,90       ;  75;
54: 1,17,100,110    ;  76;
54: 1,17,122,132    ;  77;
54: 1,17,143,153    ;  78;
54: 1,17,164,174    ;  79;
54: 1,17,185,195    ;  80;
54: 1,17,206,216    ;  81;
54: 1,17,227,237    ;  82;
54: 1,91,320,340    ;  83;
54: 1,94,300,310    ;  84;
54: 1,96,270,320    ;  85;
```

Data Organization

This section describes the internal data structure of PLuS controllers, and how this data may be accessed via serial communications. The data has been organized as a series of "Coils" and "Registers" compatible with PLC programming techniques. You access and/or change the data within a PLuS controller by forcing coils ON or OFF, and by reading and writing register data.

A PLuS Controller can be completely programmed via the serial interface. All controller data, such as pulses, speed compensation, timed output values, etc., are available as registers. Configuration data, such as the direction of rotation, number of keyboards, number of analog outputs, etc., is also available as register data. The controller is programmed by writing to these registers. Data is monitored within the controller by reading from these registers.

Mapping

In addition to accessing controller data via dedicated registers, specific indexed data items can be accessed through the 240 data display registers. This is done by "mapping" a specific indexed data element to a data display register; a data display register is assigned to represent a pulse, speed comp value, etc. Once an indexed data element is mapped it can be accessed either through the data display register or through the dedicated register.

Mapping is useful when displaying more than one instance of an indexed data element at once. For instance, speed compensation is accessed via three registers; 1) a channel index, 2) a leading edge value, and 3) a trailing edge value. This means that the values of speed compensation for all channels can be accessed, but only one at a time. To display more than one value of speed compensation at once, simply map the values to a series of data display registers.

You must define how many mappings are available through the Map Limit register.

Modbus

Modbus ASCII protocol is used for serial communications.

Set host controller communication parameters to 7 data bits, 2 stop bits, no parity.

Limit the number of consecutive registers or coils read to 32.

Discrete Elements

Inputs

10001 - 10016	DC Inputs

Outputs

00001 - 00100	Channel Outputs

ORing and ANDing

00101 - 00200	Channel ORing
00201 - 00300	Channel ANDing

Special Purpose

00301 - 00400	Special Purpose

00301	Global Unforce
00302	Pulse Register Enable
00303	Create New Pulse
00304	Move Both Edges of Pulse
00305	Move All Pulses in Channel
00314	NAK Bad Address Reads
00315	Execute Special Function

Registers

Special Purpose & Data Display

40001	Message and Special Function (16 registers)
40017	Data Display (255 registers)

RPM

40295	RPM Mapping
40257	RPM Index
40258	RPM

Position

40296	Position Mapping
40259	Position Index
40260	Position

Pulse Programming

40297	Pulse Mapping
40261	Total Pulse Count
40262	Channel Pulse Count
40263	Program Index
40264	Channel Index
40265	Pulse Index
40266	Pulse On
40267	Pulse Off
40268	New On
40269	New Off

Active & Default Program

40270	Active Program
40271	Default Program

Speed Compensation

40298	Speed Comp Mapping
40272	Channel Index
40273	Leading Edge Comp
40274	Trailing Edge Comp

Timed Outputs

40299	Timed Outputs Mapping
40275	Time Outputs Index
40276	Time Outputs

Group Offset Values

40300	Group Offset Mapping
40277	Group Offset Index
40278	Group Offset

Motion Detection

40301	Motion Detection Mapping
40279	Channel Index
40280	Low Motion Detection RPM
40281	High Motion Detection RPM

Analog Output

40302	Analog Output Mapping
40282	Analog Channel Index
40283	Analog Offset
40284	Analog High RPM
40347	Analog_Resolver

Gray Code Speed Comp

40285	Gray Comp

Mapping Registers

40291	Mapping Limit
40292	Mapping Quantity
40293	Mapping Store
40294	Mapping Recall

Model Information

40303	Model
40304	Revision
40305	Output Quantity

Transducer Setup

40308	Master/Slave
40309	Transducer Index
40310	Increment Direction
40311	Scale Factor
40312	Shaft Offset
40313	Shaft Position

Other Hardware Setup

40318	Keyboard Quantity
40319	Analog Quantity
40320	Program Select Mode
40321	Gray Level
40322	Time Base

Display Configuration

40323	Default Display
40314	Rate Multiplier
40315	Rate Decimal Point Position
40316	Rate Units
40317	Toggle RPM
40324	RPM Update Rate
40325	Speed Comp Display Mode
40326	Group Position Display Mode
40327	Rate Mode

Programming Enable Data

40328	Operator ID
40329	Setup ID
40330	Master ID
40331	Operator Program Enable Index
40332	Operator Program Enable
40333	Operator Function Enable

Motion Detection and Programming

40334	Motion Enable Level Index
40335	Motion Enable Level

Enable Input and Programming

40336	Enable ANDing Index
40337	Enable ANDing

Group Programming

40338	Group Quantity
40339	Group Index
40340	Group Channel Quantity
40341	Group Mode
40342	Group Transducer

Run Time Control

40343	Stop Control
40344	EEPROM Checksum
40345	EEPROM Changed

I/O Control

40350 - 40359	Input Status
40360 - 40369	Output Status
40370 - 40379	ORing Bits
40380 - 40389	ANDing Bits

Communications

40390	Type (RS485/RS232)
40391	Baud Rate
40392	Address

Inputs

10001 - 10016 **DC Inputs**
These points represent the status of the DC inputs.

Outputs

00001 - 00100 **Channel Outputs**
These coils represent the status of the channel outputs. Forcing these coils directly will set/clear the appropriate ORing and ANDing coils as required.
The Channel Output Coil status before OR/ANDing is determined by setpoints, group modes, speed compensation, motion ANDing, enable input ANDing, timed outputs, and resolver fault status.

ORing and ANDing

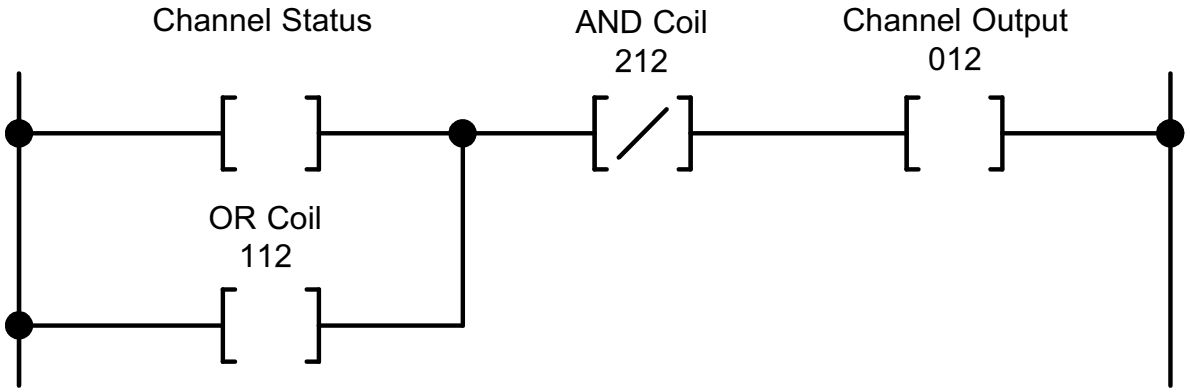
00101 - 00200 **Channel ORing**
Setting these coils to '1' will force the corresponding Channel Output Coil ON.

00201 - 00300 **Channel ANDing**
Setting these coils to '1' will force the corresponding Channel Output Coil OFF.

Special Purpose

00301 - 00400 **Special Purpose**

Ladder Diagram Example of ORing/ANDing Coils



301 Global Unforce
Clears all OR and AND coils when set from '0' to '1' (edge active).

302 Pulse Register Enable
When '1', this coil enables the creation of new pulses through writes to the New Off Register. When this coil is '0', writes to New Off Register do not create a new pulse.

303 Create New Pulse
Creates a new pulse defined by the New On and New Off registers when set from '0' to '1' (edge active). This coil is ignored if coil 302 is '1'.

304 Move Both Edges of Pulse
When '1', this coil will cause both edges of a pulse to move when either the leading or trailing edge is changed by '1' (incremented or decremented).

305 Move All Pulses in Channel
When '1', this coil will cause all edges of all pulses in a channel to move when either the leading or trailing edge is changed by '1' (incremented or decremented).

314 NAK Bad Address Reads
When '1', this coil will cause the controller to NAK attempted reads to non-existent registers. When this coil is '0', reads to non-existent registers return a value of zero.

315 Execute Special Function
Executes the special function defined by the contents of the Special Purpose Registers (40001-40017) when set from '0' to '1'.

Registers

Special Purpose & Data Display

40001 **Special Function (16 registers)**
The first 16 registers (001 - 016) are used for entering data used by the special functions.

40017 **Data Display (240 registers)**
These registers (017 - 256) are used by the Mapping functions to display individual instances of indexed data.

Continued

RPM

40295 **RPM Mapping**
Read/write
Values: 17 - 256
GP register mapping rpm.

40257 **RPM Index**
Read/write
Values: 1-2 (1 = resolver 1 and 2 = resolver 2)
Specifies the transducer in multiple transducer controllers.

40258 **RPM**
Read only
Returns the current RPM.

Position

40296 **Position Mapping**
Read/Write
Values: 17 - 255
Specifies the general purpose register used to display the position for the output group specified by the Group Index Register.

40259 **Position Index**
Read/Write
Values: 1 - 8
Specifies the output group whose position is displayed in the Position Register.

40260 **Position**
Read only
Values: 0 - (Scale Factor - 1)
Returns the current position for the output group specified by the Group Index Register.

Pulse Programming

40297 **Pulse Mapping**
Read/Write
Values: 17 - 255
General Purpose register used for mapping the On and Off values for the pulse specified by the index registers. Two registers will be used; the first will contain the On value, the second will contain the Off value.

40261 **Total Pulse Count**
Read/Write
Values: 0 - n
Returns the total number of pulses for all channels. Writing a value of '0' to this register will erase all pulses. Only write to this register when the Stop register is '1'.

40262 **Channel Pulse Count**
Read only
Values: 0 - n
Returns the number of pulses in the channel defined by the index registers below.

Pulse Programming (Cont'd)

40263 **Program Index**
Read/Write
Values: 0 - Max Program Number
Contains the current program number for pulse access. Writing to this register resets the Channel Index Register and the Pulse Index Register to '1'. When this register is '0', the current active program is used for setpoint access and for mapping (setpoints mapped with a program index of '0' will automatically change when the active program changes).

40264 **Channel Index**
Read/Write
Values: 1 - Max Channel Number
Contains the current channel number for pulse access. Writing to this register resets the Pulse Index Register to '1'. This register is reset to '1' when the Program Index Register is changed.

40265 **Pulse Index**
Read/Write
Values: 1 - n
Contains the current pulse number for pulse access. This register is reset to '1' when the Program Index Register or Channel Index Registers are changed.

40266 **Pulse On**
Read/Write
Values: 0 - (Scale Factor - 1)
Pulse On Value.

40267 **Pulse Off**
Read/Write
Values: 0 - (Scale Factor - 1)
Pulse Off Value.

40268 **New On**
Read/Write
Values: 0 - (Scale Factor - 1)
New Pulse On Value.
Writing to this register loads the On setpoint of a new pulse for the program and channel specified by the index registers above.

40269 **New Off**
Read/Write
Values: 0 - (Scale Factor - 1)
New Pulse Off Value.
Writing to this register loads the Off setpoint of a new pulse for the program and channel specified by the index registers above. The pulse is stored when the Off value is written if the Pulse Register Enable Coil is set to '1'; otherwise the pulse is stored when the Create New Pulse Coil is changed form '0' to '1' (edge active).

Active Program and Default Program

40270 **Active Program**
Read/Write.
Values: 1 - Max program number
Returns to program currently active; determined either by hardware inputs or by the value of the default program. If hardware inputs are active, writes to this register will change the default program, but the active program will not change.

40271 **Default Program**
Read/Write.
Values: 1 - Max program number
Defines the program that will be active if no hardware program select inputs are active.

Speed Compensation

40298 **Speed Comp Mapping**
Read/Write
Values: 17 - 255
General purpose register used for mapping speed compensation values. Two registers will be used; the first will contain the leading edge value, the second will contain the trailing edge value.

40272 **Channel Index**
Read/Write
Values: 1 - Max Channel Number
Channel index for speed comp values.

40273 **Leading Edge Comp**
Read/Write
Values: 0 - n (.1mS)
Specifies the leading edge speed comp value.

40274 **Trailing Edge Comp**
Read/Write
Values: 0 - n (.1mS)
Specifies the trailing edge speed comp value.

Timed Outputs

40299 **Time Outputs Mapping**
Read/Write
Values: 17 - 255
GP register mapping for timed output values.

40275 **Time Outputs Index**
Read/Write (INDEX)
Values: 1 - Max channel number.
Channel index for time delay values.

Continued

Timed Outputs (Cont'd)

40276 **Time Outputs**
Read/Write (Indexed by REG_TIME_DELAY_IDX)
Values: 0 - n.
Timed output value in milliseconds.

Group Offset Values

40300 **Group Offset Map**
Read/Write
Values: 17 - 255
GP register mapping for group offset values.

40277 **Group Offset Index**
Read/Write (INDEX)
Values: 1 - 6
Group index for offset values.

40278 **Group Offset**
Read/Write (Indexed by REG_GROUP_OFFSET_IDX)
Values: 0 - (Scale Factor - 1).
This value is a PRESET value for groups in modes 1 and 2.
Note: Could also be indexed by REG_GEN_PGM_IDX if unit stores offsets by program.

Motion Detection

40301 **Motion Detection Mapping**
Read/Write
Values: 17 - 255
General purpose register used for mapping low and high motion detection values. The first register will contain the low motion detection rpm value, the second will contain the high motion detection rpm value.

40279 **Channel Index**
Read/Write
Values: 1, 2
Motion detection level index for high and low motion detection values.

40280 **Low Motion Detection RPM**
Read/Write
Values: 0 - n
Motion detection low limit for the level specified by the index register.

40281 **High Motion Detection RPM**
Read/Write
Values: 0 - n
Motion detection high limit for level specified by index register.

Analog Output

40302 **Analog Output Mapping**
Read/Write
Values: 17 - 255
General purpose register used for mapping analog setpoints. Four registers will be used: analog channel, index, analog offset, analog high rpm, analog resolver.

40282 **Analog Channel Index**
Read/Write
Values: 1, 2
Analog channel index for line speed and output percentage.

40283 **Analog Offset**
Read/Write
Values: 0 - 4095
Analog output value at 0 rpm.

40284 **Analog High RPM**
Read/Write
Values: 0 - n.
RPM at which analog output is 4095.

40347 **Analog_Resolver**
Read/Write
Values: 1-2
1 = analog with 1st resolver
2 = analog with 2nd resolver

Gray Code Speed Comp

40285 **Gray Comp**
Read/Write
Values: 0 - n.
Gray code speed comp value.

Mapping Registers

40291 **Map Limit**
Read/Write
Values: 0 - 255
Sets the maximum number of data mappings.

40292 **Map Quantity**
Read/Write
Values: 0 - 255
Returns the number of data mappings active in the controller.
NOTE: Writing a '0' to this register will delete all data mappings!

40293 **Map Store**
This register is only for use by utility programs.

40294 **Map Recall**
This register is only for use by utility programs.

Model Information

40303 **Model**
Read only
Returns the PLuS model number (5144, 6144, etc.).

40304 **Revision**
Read only
Returns the major software revision.

40305 **Output Quantity**
Read only
Returns the number of output channels.

Transducer Setup

40308 **Master/Slave**
Read/Write
Values: 1-2: 1 = master, 2 = slave
When 2, the first resolver is the slave.

40309 **Transducer Index**
Read/Write
Values: 1,2
Specifies the transducer in multiple transducer controllers. Affects INC_DIRECTION, SHAFT_POS, and SHAFT_OFFSET.

40310 **Increment Direction**
Read/Write
Values: 0 = CCW, 1 = CW.
Specifies the direction of rotation of the resolver (viewed from the shaft end) that will result in an increasing numerical display of position.

40311 **Scale Factor**
Read/Write
Values: 2 -1024 (4096 with "-H" option)
Scale factor used for setpoint, position, and offset programming.

40313 **Shaft Position**
Read/Write
Values: 0 - (Scale Factor - 1).
Returns the current shaft position, including the shaft offset.

Other Hardware Setup

40318 **Keyboard Quantity**
Read/Write
Values: 1, 2.
6000 units only.

40319 **Analog Quantity**
Read/Write
Values: 0, 1, 2.

40320 **Program Select Mode**
Read/Write
Values: 0 = binary, 1 = BCD, 2 = gray code.

40321 **Gray Level**
Read/Write
Values: 0 = positive true, 1 = negative true.

40322 **Time Base**
Read only
Values: 0 = 1mSec, 1 = .5mSec, 2 = .2mSec.

Display Configuration

40323 **Def Display**
Read/Write
Values: 0 = RPM, 1 = Pos, 2 = Auto.
Only applicable on 5XXX units.

40314 **Rate Multiplier**
Read/Write
Values: 1000 - 9999
RPM rate multiplier, assumed decimal point at X.XXX.

40315 **Rate Decimal Point Position**
Read/Write
Values: 0 - 3
Rate decimal point position

40316 **Rate Units**
Read/Write
Values: A - Z (decimal 65 - 90)
Rate display units

40317 **Toggle RPM**
Read/Write
Values: 0 - n
Specifies RPM which will cause position display to blank (6000 series), or to change to rpm (5000 series).

40324 **RPM Update Rate**
Read/Write
Values: 0 = 1/Sec, 1 = 2/Sec, 2 = 10/Sec
Rate at which the RPM display is updated.

Continued

Display Configuration (Cont'd)

40325 **Speed Comp Display Mode**
Read/Write
Values: 0 = One, 1 = L/T
Specifies whether speed comp values are displayed as one value for both leading and trailing edges, or as a value for each.

40326 **Group Position Display Mode**
Read/Write
Values: 0 = Each, 1 = One.

40327 **Rate Mode**
Read/Write
Values: 0-1, 0 = RPM-POS mode, 1 = RPM-RPM mode
Display setup for main screen.

Programming Enable Data

40328 **Operator ID**
Read/Write
Values: Any integer
Contains the Operator ID number used to enable the operator access level for programming.

40329 **Setup ID**
Read/Write
Values: Any integer.
Contains the Setup ID number used to enable the setup access level for programming.

40330 **Master ID**
Read/Write
Values: Any integer.
Contains the Master ID number used to enable the master access level for programming.

40331 **Operator Program Enable Index**
Read/Write (INDEX)
Values: 1 - Max Channel.
Channel index for OPR_PGM_ENAB register.

40332 **Operator Program Enable**
Read/write (Indexed by REG_OPR_PGM_ENAB_IDX)
Values: 0/1
Value which specifies whether a channel can be modified under the Operator access level. Channel data such as speed comp and timed output values can be individually enabled per channel for operator access through this register.

Continued

Programming Enable Data (Cont.)

40333 **Operator Function Enable**
Read/Write
Values: 0 - OFFFFH
Bit mask which specifies which programming functions the operator may perform.
Bit 0: Pulse on/off values.
Bit 1: Default program
Bit 2: Speed compensation
Bit 3: Timed outputs
Bit 4: Offset
Bit 5: Motion detection
Bit 6: Analog offset and high rpm

Motion Detection and Programming

40334 **Motion Enable Level Index**
Read/Write (INDEX)
Values: 1 - Max channel number.

40335 **Motion Enable Level**
Read/Write
Values: 0 = Off, n = Motion detection level.
Specifies the motion detection level used for a channel.

Enable Input and Programming

40336 **Enable Anding Index**
Read/Write (INDEX)
Values: 1 - Max Channel.
Channel index for ENAB_ANDING register.

40337 **Enable Anding**
Read/Write (Indexed by REG_ENAB_ANDING_IDX)
Values: 0/1.
Value which specifies whether a channel is ANDed with the Enable Input.

Group Programming

40338 **Group Quantity**
Read/Write
Values: 1 - 6
Specifies the number of output groups.

40339 **Group Index**
Read/Write (INDEX)
Values: Group number 1 - 8.
Contains the current output group number.

Continued

Group Programming

40340 **Group Channel Quantity**
Read/Write (Indexed)
Values: 0 - Max channel number.

40341 **Group Mode**
Read/Write (Indexed)
Values: 0 - 5.
Groups in mode 0 don't need enable input.

40342 **Group Transducer**
Read/Write (Indexed)
Values: 0 - 5n.
Specifies group transducer in multiple transducer controllers.

Run Time Control

40343 **Stop Control**
Read/Write
Values: 0 = Running, 1 = Stopped
When PLuS is STOPPED, changes written to registers do not update the checksum in EEPROM memory. Changes are faster when unit is stopped, but you must read from the Checksum Register when changes are complete to establish a valid checksum. Writing a '1' value to this register will place the PLuS in STOPPED mode. Writing a '0' to this register will restart the PLuS via a watchdog timer reset.

40344 **EEPROM Checksum**
Read only
Returns the current checksum of EEPROM memory. If computed checksum of EEPROM memory does not match the current value (i.e. if changes were made while unit STOPPED), a new value will be written to EEPROM memory.

40345 **EEPROM Changed**
Read only
Values: 0 = no change, 1 = changed.
A value of '1' in this register means that the EEPROM has been changed (through the keyboard) since the last time this register was read. Reading this register sets it to '0'.

Controller Diagnostics

CAUTION

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

Status LED

The yellow Status LED on the controller, Figures 5 & 6, blinks in various patterns to indicate the controller status.

Normal Operation
The Status LED blinks on and off rapidly.

Keypad Not Connected
If the controller is powered without a keypad connected, the LED blinking pattern will be “off” for one second, followed by four quick “on” blinks.

Internal Errors
If the LED blinking pattern is “on” for a second, followed by one or more quick blinks “off,” the controller is experiencing internal errors. The specific error is indicated by the number of “off” blinks:

One “Off” Blink—Corrupt RAM

Two “Off” Blinks—Checksum error indicating EPROM corruption.

Three “Off” Blinks—System error.

Four “Off” Blinks—System error.

If any of the above four patterns occur, power cycle the control. If the pattern occurs again, remove the controller from service and return it to the factory.

Five “Off” Blinks—Internal error; possibly noise problems.

Six “Off” Blinks—Internal error; possibly noise problems.

If either of these two patterns occur, check for loose connections and fix any obvious noise problems. If the problem persists, remove the controller from service and return it to the factory.

Keypad Diagnostics

CAUTION **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 6400 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.

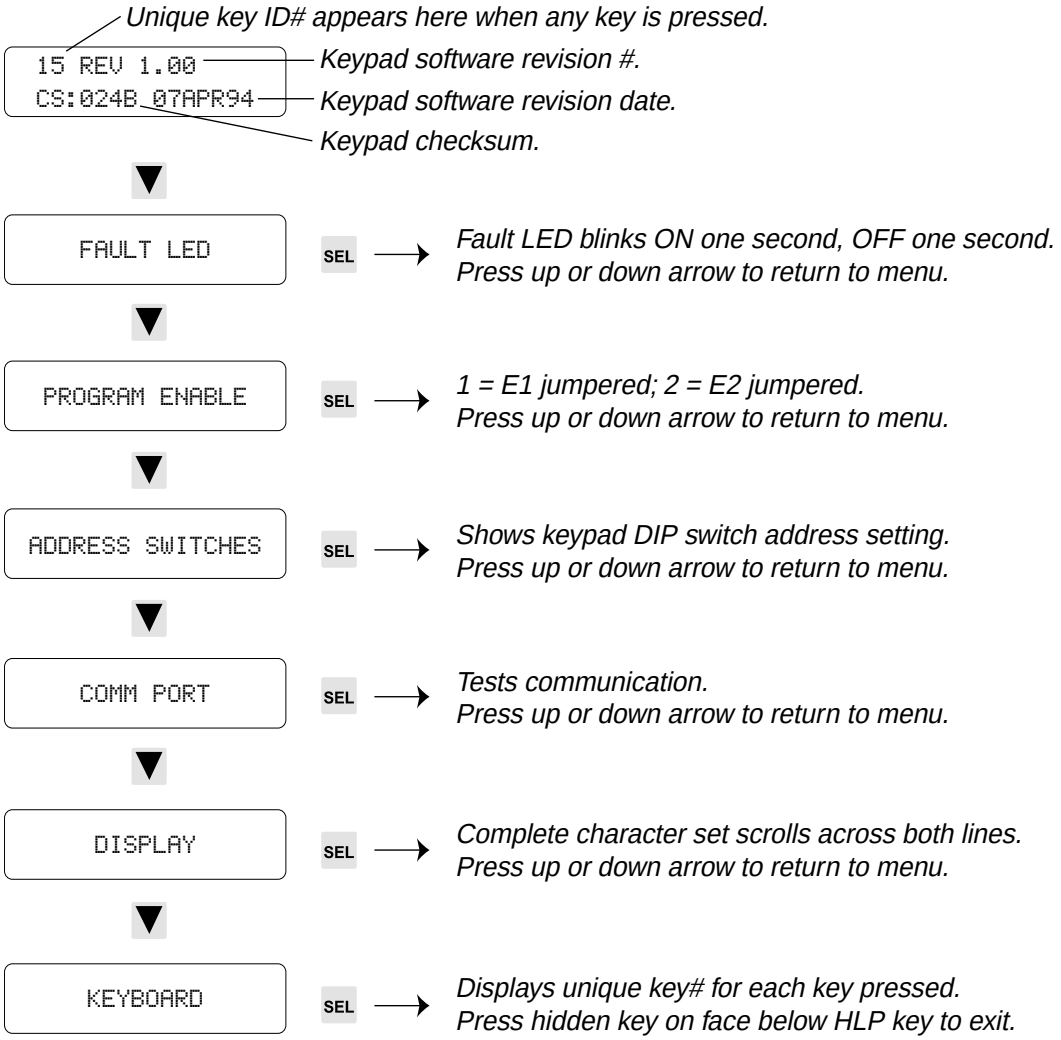
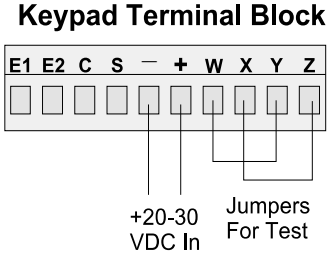


Figure 40—Keypad Communications Port Test Setup



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.

Keypad Error Messages

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 setpoint information has been removed. **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 he 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.*

Keypad Error Messages (Cont'd)

Error Message:	Description:
Too many Speed Compensated chns.	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	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.*

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

Page 2-18 shows the wiring diagrams for Electro Cam Corp. resolvers and cables. 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 re-connected. 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 re-connected.

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.

General Troubleshooting

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

Problem	Possible Solution
Controller & keypad dead.	1. Check main fuse shown in Figs. 5 & 6. 2. Check power supply to controller.
Keypad dead, but controller LED's are on.	1. Check wiring between keypad and controller, Figure 12.
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, return the keypad to the factory.
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, Figure 12. 3. Check DIP switch settings, Figures 13 & 14. 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 briefly lose contact 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 not enabled. See Figure 12, and also ENABLE CODES for details.
ERROR: RESOLVER NOT CONNECTED message	1. Resolver or resolver cable may have failed. See Resolver Troubleshooting, pg. 7-3.
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," page 7-3.
Serial communications not working	1. Check COMMUNICATIONS programming to be sure type, baud rate, and address are correctly set. 2. Be sure the DIP switches for the PLµS-to-host communications are set correctly as shown in Figure 13. 3. Check communication cable wiring, Figure 15.
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.

General Troubleshooting (cont'd)

Erratic Operation	1. Run the Watchdog Timer test described under MEMORY TESTS in the programming section of this manual. 2. See Resolver Troubleshooting page 7-5.
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. See Figure 5 or 6. 3. Check correct wiring of analog output. 4. Verify that analog load device is within specifications for the analog module. 5. Try a different analog output module.
Some transistor outputs not working	1. Check that the correct program number is active. 2. Use OUTPUT STATUS to see if the controller is activating the output(s) at the correct position in the resolver revolution. If not, verify that the SETPOINTS are correctly programmed. Other programming that may prevent an output from energizing includes MOTION ANDING and OUTPUT ENABLE ANDING. 3. If OUTPUT STATUS shows the output is on, use a meter to see if the output terminal is energized. If so, check the load device and its wiring. If not, go to Step 4. 4. Check the transistor array chips, Figure 17.
All transistor outputs not working	1. Check that the correct program number is active. 2. Use OUTPUT STATUS to see if the controller is activating the output(s) at the correct position in the resolver revolution. If not, verify that the SETPOINTS are correctly programmed. Other programming that may prevent an output from energizing includes MOTION ANDING and OUTPUT ENABLE ANDING. 3. If OUTPUT STATUS shows the output is on, use a meter to see if the output terminal is energized. If so, check the load device and its wiring. If not, check the transistor output fuse, Figure 18. Use the fuse tester built into the controller, Figure 17. 4. Check that 10-30 VDC power is connected to TB 11, Figure 10 & 11.
AC/DC module not working	1. Check that correct program number is active. 2. Use OUTPUT STATUS to see if the controller is activating the output(s) at the correct position in the resolver revolution. If not, verify that the SETPOINTS are correctly programmed. Remember that AC/DC output modules are controlled by Channels 17-25 (1-17 on M17). Other programming that may prevent an output from energizing includes MOTION ANDING and OUTPUT ENABLE ANDING and TIMED OUTPUTS. 3. If OUTPUT STATUS shows the output is on, but the LED on top of the module does not light, try replacing the module. 4. If the LED on the module lights but the output terminal does not energize, check the fuse built into the top of the module. Use the fuse tester built into the controller, Fig. 17. 5. Check that load power is present in the circuit and correctly wired. Remember that modules do not supply power to loads; they simply switch the load circuit on and off.

Fuse Part Numbers

Fuse	Description	Mfct. Part #	Electro Cam Part #
Main Fuse (Figs. 5 & 6)	1-1/4 Amp Slo-Blo Glass	Bussman MDL-1-1/4	PS-9000-4114
Module Fuse	4 Amp TR-5	Wickmann 19370-062	PS-9005-0004
Input Fuse (Fig. 17)	250 mA TR-5	Wickmann 19372-035	PS-9005-0250
Output Transistor Fuse (Fig. 17)	1 Amp TR-5	Wickmann 19370-048	PS-9005-0001

PS-6344 Controller Specs

Electrical (The PS-6344 is UL and UL-C listed)	
Input Power	20-30 VDC. Keypad/display is powered from controller.
Input Current	500 mA maximum (control only)
	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)
Power Consumption:	25 W
Permanent Memory:	EEPROM (no battery required)
Accessory Power Out:	20-30 VDC, 250 mA Max (same source and voltage as input power)
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	
Overall Dimensions:	See Figure 4
Weight:	Controller: 3.5 lbs (1.6 kg). Keypad/Display: 0.5 lbs. (0.2 kg)
Mounting	
Controller:	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	
DC Inputs:	16 sinking or sourcing DC inputs, optically isolated.
Input ON State Voltage:	10-30 VDC
Input Current:	11 mA @ 24 VDC
Program Select Response:	100 ms typical; may be longer with large numbers of setpoints.
Response of All Other Inputs:	1-2 scans
Outputs: PS-6344-24-(P16 or N16)M09	
Real World Outputs:	Up to nine Slimline modules may be mounted on controller. Modules may be any mix of AC, DC, reed relay, and up to two analog. All modules optically isolated.
DC (Transistor) Outputs:	16 sinking (N16) or sourcing (P16), optically isolated. Sinking or sourcing must be specified on order.
Outputs: PS-6344-24-M17	
Real World Outputs:	Up to 17 Slimline modules may be mounted on controller. Modules may be any mix of AC, DC, reed relay, and up to two analog. All modules optically isolated.
Analog Output	
Output Types:	4-20 mA or 0-10 VDC, proportional to RPM.
Resolution:	12 bit
Update Frequency:	10 times/sec minimum
Linearity:	±0.3% of full scale @ 25°C (77°F)
Set-up:	Offset and full scale RPM are programmable.
Operation	
Scan Time:	300-800 ms typical (exact time determined by programming) For higher speeds, interrupt-driven versions available—consult factory.
Position Resolution:	10 bits (1024 increments). 12 bits (4096 increments) available with “-H” option.
Speed Compensation:	Programmed in 0.1 msec steps. 16 individually compensated outputs max. Updated ten times per second. Separate leading/trailing edge compensation available with option “-L” (update time typically five times per second).
Output Timeout:	1.0 ms time base (accuracy: +1, -0 ms)
Number of Timed Outputs:	Four maximum
Multiple Programs:	48 programs
Total Pulse Memory:	1258 pulses
Pulses per Program:	512 maximum
Pulses per Output:	512 maximum
Maximum Speed:	3000 RPM
RS-232 Serial Communication	
Port Types:	1 RS-282 or 1 RS-422/485—R-485 can be configured as a “Multi-Drop” network.
Baud Rates:	4800, 9600, 19.2K, 38.4K

SLIMLINE Output Module Specifications

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 Relay — **Part # EC-ORR000-0**

Output Type:	N/O Reed Relay Contacts
Contact Rating:	10 VA maximum (DC resistive load)
Output Voltage:	0 to 24 VDC 0 to 120 VAC rms
Output Current:	100 mA AC maximum (resistive load only)
Turn On Time:	500 µs
Turn Off Time:	500 µs
Mechanical Life:	50 million cycles
Operating Temp:	0° to +70°C (32° to +158°F)

Transistor Output Specifications

Sinking Transistor Output **Part # PS-9011-2803**

Output Type:	Current Sinking (NPN)
Output Voltage:	5 to 30 VDC
Output Current:	50 milliamp cont. max (each output)

Sourcing Transistor Output **Part # PS-9011-2580**

Output Type:	Current Sourcing (PNP)
Output Voltage:	5 to 30 VDC
Output Current:	50 milliamp cont. max (each output)

Factory Defaults

Analog Outputs	
Quantity:	0
Offset:	0
High RPM:	2000
Communications	
Type:	RS-485
Baud Rate:	9600
Default Program:	1
Enable Codes	
Operator:	1
Setup:	2
Master:	3
Enable Options:	ON for all functions
Group Qty	1
Increasing Direction:	CCW (For both resolver 1 and 2)
Input ANDing:	OFF
Keyboard Quantity:	1
Master/Slave	Master
Motion ANDing:	OFF
Motion Detection:	Lo 10 RPM, Hi 3000 RPM both levels
Offset:	0
Output Enable ANDing:	OFF
Per Channel Enable:	All channels ON
Program Select Mode:	BIN (Binary)
Rate:	1X, RPM
Rate Display Mode:	RPM-POS
RPM Update:	1/S
Scale Factor:	300 (For both resolver 1 and 2)
Speed Comp:	All channels 0
Toggle RPM:	20 RPM

PLuS 6344 Setpoint Record

Date:

PLuS Program #:_____ **Description:**

CHN	Group	Mode	On	Off	ANDed With… Output Enable	ANDed With… Motion Level #	Timed Output	Speed Comp	Comments (multiple pulses, etc.)
1	____	____	____	____	____	____	____	____	_____
2	____	____	____	____	____	____	____	____	_____
3	____	____	____	____	____	____	____	____	_____
4	____	____	____	____	____	____	____	____	_____
5	____	____	____	____	____	____	____	____	_____
6	____	____	____	____	____	____	____	____	_____
7	____	____	____	____	____	____	____	____	_____
8	____	____	____	____	____	____	____	____	_____
9	____	____	____	____	____	____	____	____	_____
10	____	____	____	____	____	____	____	____	_____
11	____	____	____	____	____	____	____	____	_____
12	____	____	____	____	____	____	____	____	_____
13	____	____	____	____	____	____	____	____	_____
14	____	____	____	____	____	____	____	____	_____
15	____	____	____	____	____	____	____	____	_____
16	____	____	____	____	____	____	____	____	_____
17	____	____	____	____	____	____	____	____	_____
18	____	____	____	____	____	____	____	____	_____
19	____	____	____	____	____	____	____	____	_____
20	____	____	____	____	____	____	____	____	_____
21	____	____	____	____	____	____	____	____	_____
22	____	____	____	____	____	____	____	____	_____
23	____	____	____	____	____	____	____	____	_____
24	____	____	____	____	____	____	____	____	_____
25	____	____	____	____	____	____	____	____	_____
91	____	____	____	____	____	____	____	____	_____
92	____	____	____	____	____	____	____	____	_____
93	____	____	____	____	____	____	____	____	_____
94	____	____	____	____	____	____	____	____	_____
95	____	____	____	____	____	____	____	____	_____
96	____	____	____	____	____	____	____	____	_____

Analog Outputs

Output Channel #:_____ ✶ 4-20mA ✶ 0-10 VDC Offset: ____ High RPM: _____

Output Channel #:_____ ✶ 4-20mA ✶ 0-10 VDC Offset: ____ High RPM: _____

Global Settings

Motion Detection Levels

L1:___ RPM

L2:___ RPM

Group Offsets

Group #1 Offset/Preset: _____ Group #4 Offset/Preset: _____

Group #2 Offset/Preset: _____ Group #5 Offset/Preset: _____

Group #3 Offset/Preset: _____ Group #6 Offset/Preset: _____

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