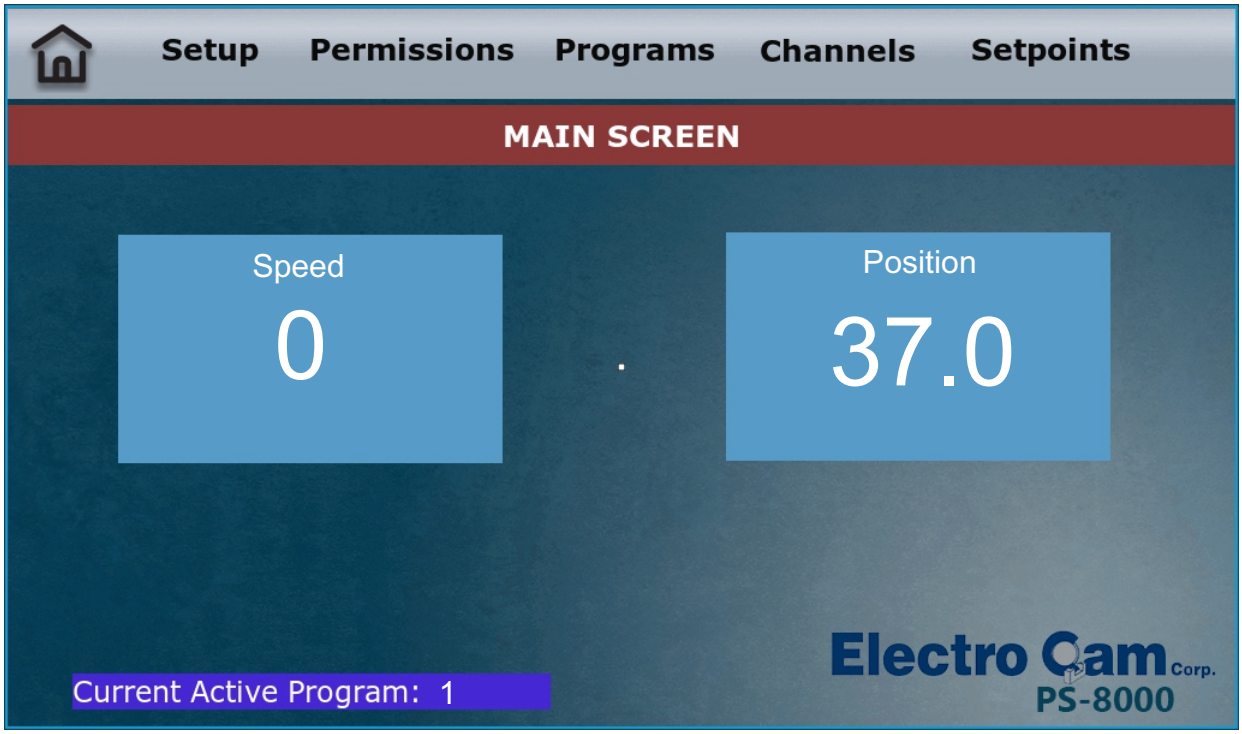
PLµS® PS-8000 Series

Programmable Limit Switch



Programming & Installation Manual

October 2025 Beta

Electro Cam Corp.
13647 Metric Rd • Roscoe, IL 61073 USA • 815/389-2620 • FAX 815/389-3304 • www.electrocam.com

PS-8000 Quick Start Guide

What the Controller Does

PLS - Programmable limit Switch: The PS-8000 turns outputs on and off based on machine position determined by the rotational position of a magnet as sensed by the Hall Effect sensor.

Wiring the Controller

1. Connect a 12 to 24 VDC power source to the power input connector. (TB1)
2. Connect the control and the hall effect sensor using cable PS-8300-01-XXX. (where XXX = length in feet)
3. Wire outputs as needed.

Programming the PS-8000 to Turn on Outputs Based on Position

The six steps below are all that is needed to get the PS-8000 operating in a basic programmable limit switch setup. More advanced features can then be added as needed.

Enter the Master ID

To change settings in the PS-8000, you will need to press 'Enter Master ID' in the Permissions screen. Enter 9992. This enables you to change any of the settings in the controller. You can, at this time, set up ID numbers for the Operator and Setup access levels. You may also want to change the default Master ID since it is the same on all controllers shipped from the factory.

Calibrate the Hall Effect Sensor

Calibration should probably be done before the shaft sensor is attached to the machine. In the Permissions screen, enter the Master ID number. Next, go to the Setup screen and press the Shaft Sensor Calibration button. Once in the Calibration screen, slowly rotate the shaft sensor until all four capture points turn green. When all four capture points turn green, the message "Saving Calibration" will appear. When the calibration has been saved, the message "Calibration Complete" will appear. During calibration, if a capture point, you may try turning it in the opposite direction to complete the calibration. The shaft sensor can now be attached to the machine.

Set the Direction of Increasing rotation

Verify that the PS-8000 position counts in an increasing direction when the machine is in motion. If not, you will need to change the Direction of Rotation setting in the Setup screen.

Set the Scale Factor

This will determine the number of counts per revolution of the shaft sensor. The factory default is 360 which gives position in degrees. A higher scale factor allows ON/OFF setpoints to be programmed more accurately if necessary. Scale Factor is set through the Setup screen.

Synchronize the PS-8000 with mechanical machine position

Stop the machine at its zero position. In the Setup screen, press the Zero Position button to set the controller position to zero.

Program the ON / OFF setpoints

This will determine the positions where the outputs will turn on and off. Each output or channel can be set to have multiple ON/OFF pulses within each machine cycle. Programming of setpoints is done through the Setpoints screen.

Press "Setpoints" in the top bar to enter the Setpoint screen.

Press "Add Setpoint".

Press "Edit On Angle". Use the on screen keypad to enter the setpoint on position. Press "Enter".

Press "Edit off angle" Use the on screen keypad to enter the setpoint off position. Press "Enter".

Press "Save Changes".

The output will now turn on and off at the programmed setpoints. To add additional setpoints in the same output, press "Add Setpoint" and repeat the steps above. To add setpoints to other output channels, use the channel arrow buttons in the upper right to navigate to the desired output and repeat the steps above. Note that multiple setpoints can be added in a channel, as well as in multiple channels and programs before pressing "save Changes".

PS-8000 Quick Start Guide (continued)

Add Advanced Features for Even More Precise Control of Output Devices

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

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

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

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

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

Table of Contents

WARRANTY

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

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

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

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

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

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

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

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

Mechanical Cam Switches

Mechanical Cams

The PS-8000 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.

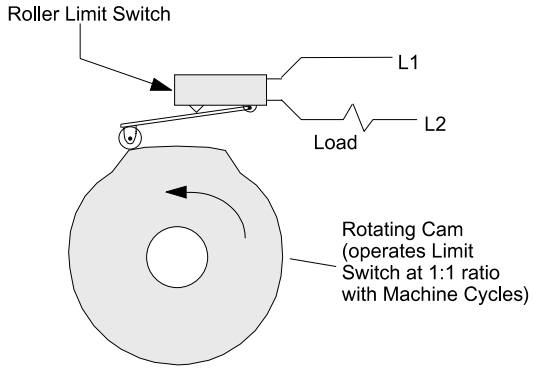


Figure 1—Basic Cam Switch

Programmable Limit Switches

PS-8000 & Hall Effect Sensors

The PS-8000 Programmable Limit Switch uses a Hall Effect sensor (see Figure 2 on Page 2) instead of a cam to indicate machine position. A Hall Effect sensor uses a magnet and an electric device that senses magnetic fields to generate an electronic signal that represents shaft position. The Hall Effect sensor is usually coupled to a machine shaft at a 1:1 ratio so that one sensor shaft revolution corresponds to one machine cycle. Hall Effect sensors have no brushes, contacts, or any frictional moving parts to wear out.

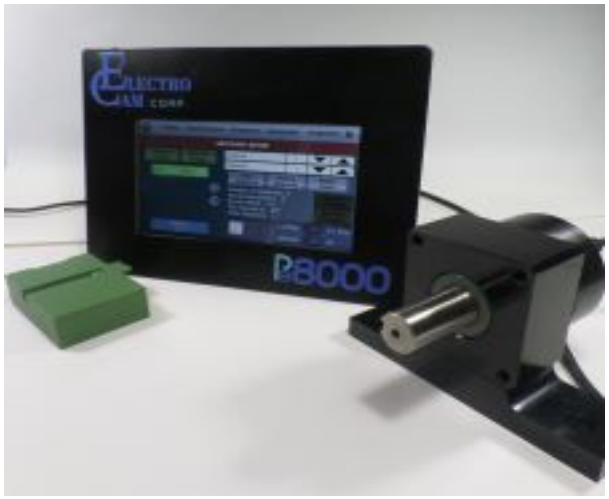
Based on the Hall Effect sensor signal, the PS-8000 Programmable Limit Switch turns electrical circuits, or "Outputs," on and off, simulating the mechanical roller limit switch. Because the combination PS-8000 and the hall effect sensor is completely electronic and has no frictional parts, it offers 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 display; 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.

Programmable Limit Switches

PS-8000
Controller

Output Module



Electro Cam Corp.
Foot Mount Hall Effect Sensor

Figure 2—PS-8000 Programmable Limit Switch and Hall Effect Sensor

PS-8000 Description

Controller

PS-8000 Series Programmable Limit Switches consist of the main touchscreen controller and the removable output modules. The piggyback output modules and integrated inputs remove the need for external I/O racks, simplifying installation and wiring. The touchscreen display provides a complete user interface from which every aspect of the controller's operation can be monitored and programmed.

The PS-8000 has been further ruggedized against transients and miswiring on the input power to meet the needs of especially demanding applications.

PS-8000 Low Level DC Output Module

The PS-8000 Low Power Output Module has 4 outputs.

PS-8000 High Level Output Module

The PS-8000 High Level Output Module has 2 outputs.

There are eight slots for output modules. The modules can be installed in any order or any combination to fit your exact application resulting in maximum flexibility.

Basic Terminology

The following terms will be used throughout this manual to explain PS-8000 installation, programming and operation:

Channels

Each Channel (CHN) in the PS-8000 controller contains "on" and "off" setpoints for one 360° revolution of the resolver shaft. Channels are one of two types:

Output Channels—These channels use an output module to turn an external circuit on or off. There are also two analog outputs that may be used to generate a control signal that is proportional to RPM.

Group Channels—These channels control the interaction between groups of outputs and an input received from a sensor or other controlling device. See Section 5 for details on Group Channels.

Setpoints

"Setpoints" are the points within one rotation of the shaft sensor at which a channel turns on or off. Setpoints can be programmed into a channel through the touchscreen display. The PS-8000 can turn any given channel on and off multiple times within one rotation. A setpoint consists of an "on" edge and an "off" edge.

Pulses

A "pulse" is the "on" period between the time a channel is turned on and off. 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.

Programs

Suppose that 15 output channels on a cartoner are programmed with setpoints to fold and glue a certain size carton. These settings could be stored as a "program." The 15 output channels could then be re-programmed with different setpoints for a different size carton. This second set of setpoints could also be stored as a program. To change carton sizes, an operator could simply activate the correct program, and the corresponding setpoints would take effect.

Standard PS-8000's can store up to 128 programs. The active program can be selected through the display, mechanical switches, or direct PLC interface.

Inputs

In addition to accepting a signal from the hall effect sensor, the PS-8000 can accept up to 16 input signals from mechanical switches, relay contacts, DC two- or three-wire sensors, solid state DC output modules, or PLC DC outputs. The PS-8000 hardware inputs are dedicated to specific functions involving program selection and controlling output channels based on sensor signals.

Groups and Modes

Output channels can be combined into "groups", and each group can be associated with an input terminal in any of five different "modes" of operation. For example, some modes activate the group only when the corresponding input has signaled that product is present. Glue control is a typical application where outputs are disabled until product is sensed. See Section 5 for details.

PS-8000 Standard Features

Scale Factor

The user can program the number of increments per revolution, or "Scale Factor." For example, to make the controller display position in degrees, a Scale Factor of 360 is used. For some applications, Scale Factor may be set to define increments in terms of linear distance, such as one increment equals 0.1" of travel. Standard controls have a maximum of 4096 increments per revolution.

Programming Access

Three levels of programming access are provided: Operator, Setup, and Master. Each level can be assigned a password that must be entered to allow programming at that level. Careful use of programming access levels can provide key personnel the flexibility they need in programming the controller, while protecting settings against accidental or unauthorized changes.

Speed Compensation

Speed compensation advances the 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.

Motion ANDing

Two speed ranges can be programmed into the controller, and outputs can be ANDed with either speed range so that they will be disabled unless the machine speed is within the range. A common use for this feature is disabling outputs to glue valves to turn off glue flow if the machine stops.

Timed Outputs

Timed outputs are programmed like standard outputs to turn on and off at specific points of the shaft sensor 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-8000 controllers have two dedicated analog outputs 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-8000.

Backup/Restoration of Settings

Saving your machine configuration is easy with the PS-8000. All you need is a USB storage device. Nothing else is required.

PS-8000 Optional Features

(-W) Washdown Gasket

Controllers with the "-W" option are rated NEMA 4X and are shipped with a silicone rubber gasket in place on the standard foam gasket. In addition to preventing contamination from harsh washdown chemicals, the upgraded gasket prevents any liquid from penetrating the front of the controller.

General Mounting and Wiring

Controller

The controller body mounts on a panel via the six 10-32 stud mounts as shown on 2-3. The Controller must be mounted in a grounded metal enclosure in order to minimize EMI.

Environment

1. Allow space on all sides and the top of the controller to allow for terminal blocks to be unplugged.
2. Ambient temperature range is 0° to 55°C (32° to 130°F).
3. Locate the controller away from devices that generate electrical noise, such as contactors and drives.
4. Use the 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 labeled 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 the hall effect sensor, input, low level DC outputs, and communication circuits. Also shield module output circuits that are driving low current electronic input circuits.
3. Ground shielded cables at the PS-8000 end only (except for hall effect sensor). Use any of the screw on the controller back for grounding.
4. Use appropriate suppression devices where module outputs are directly driving inductive loads.

Power Supply Wiring

Connect a 12 to 28 VDC power supply to the two-pin power terminal block. (TB1, Fig. 5). The PS-8000 is protected from switched polarity due to miswiring.

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

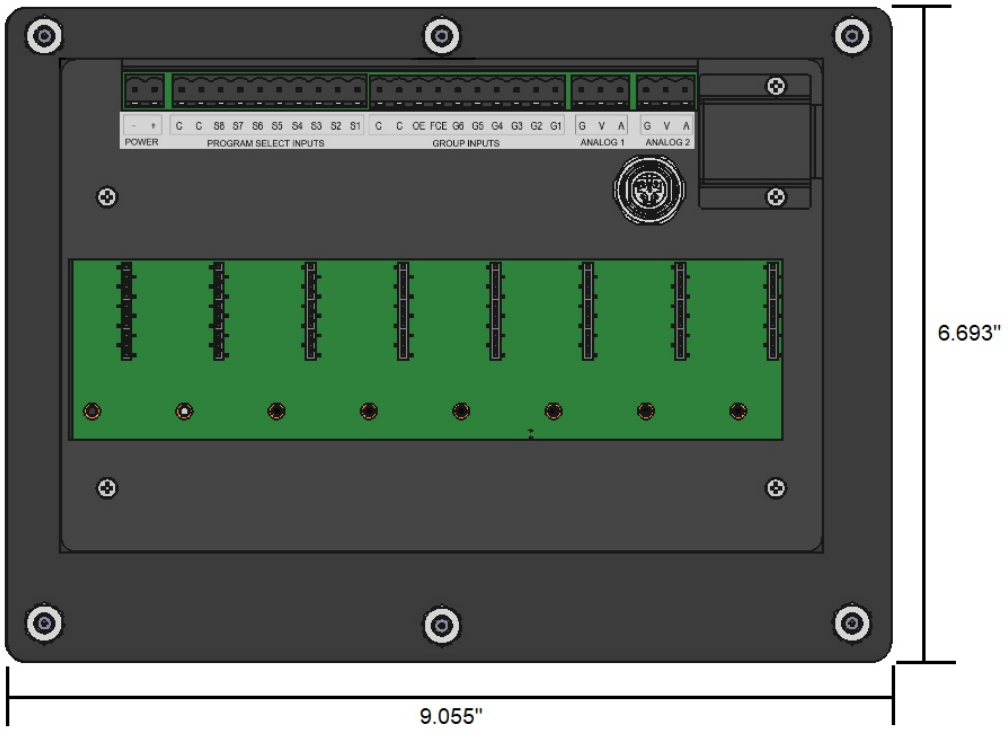
Module Mounting

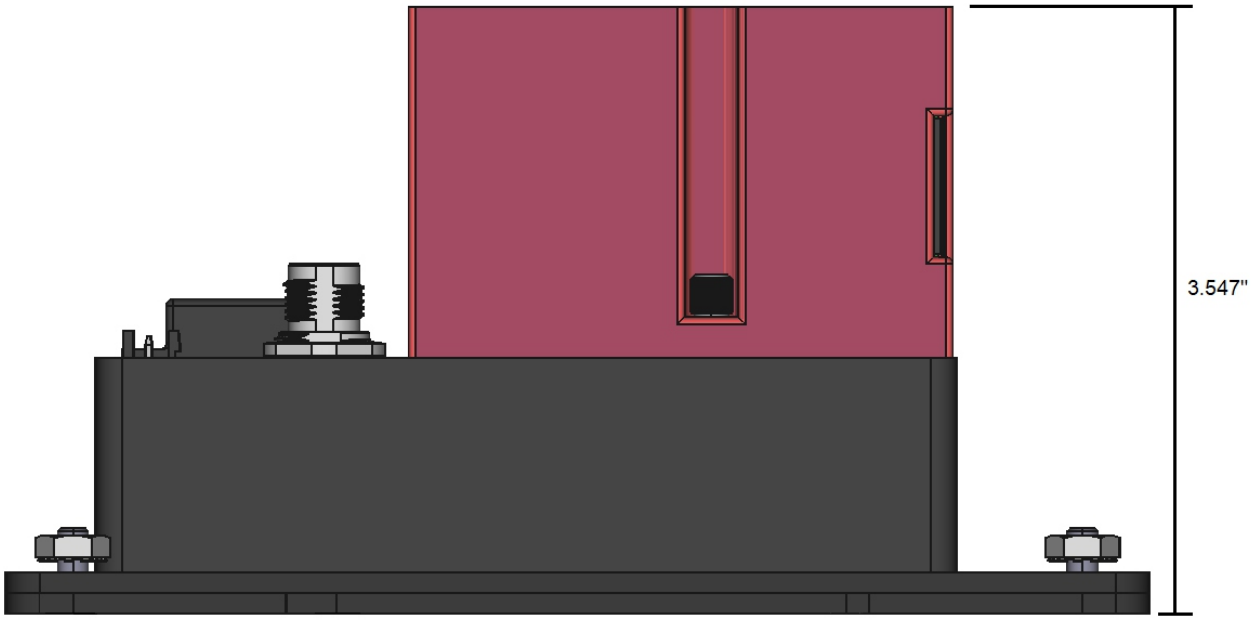
Modules are held in place with the screw in the middle. Make sure the connector is properly aligned before tightening the screw.

! WARNING

Disconnect power to the controller before installing or removing modules.

Mounting Dimensions





Panel Cutout Dimensions

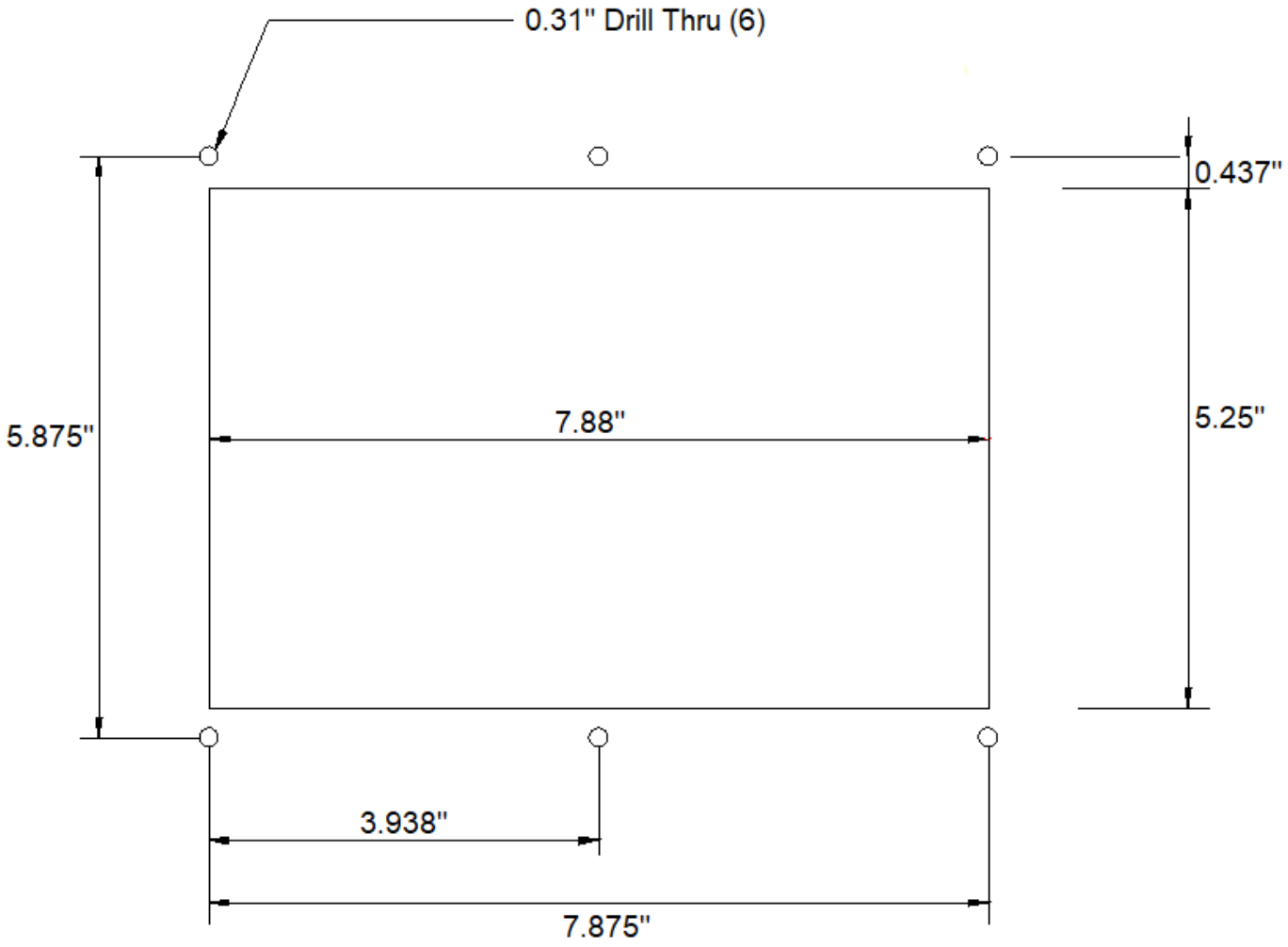
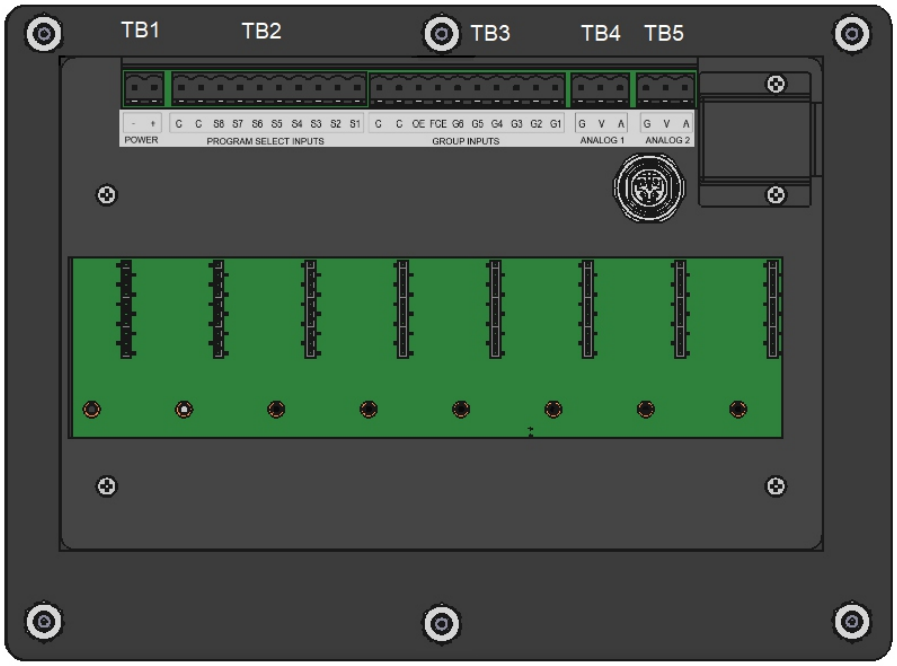
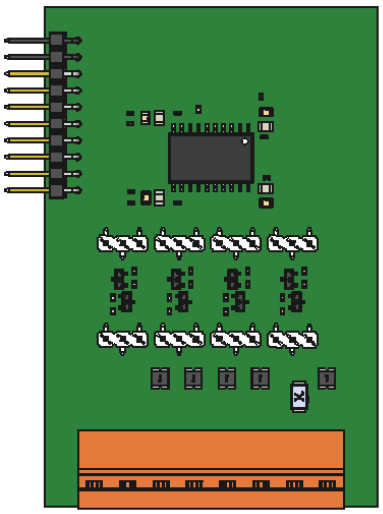


Figure 5 - PS-8000 Terminals & Components

PS-8000

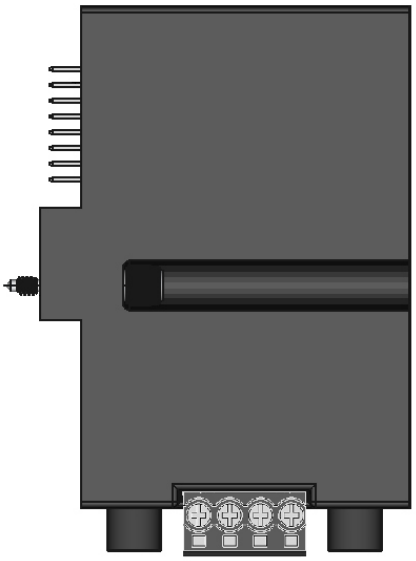


Low Power Output Module



TB6

High Power Output Module



TB7

Terminal Block Details

Terminal Block	Function	ECC Part #[1]
TB 1	Power Connector	PS-9008-001
TB 2	Inputs 1-8	PS-9008-002
TB 3	Inputs 9-16	PS-9008-003
TB 4	Analog Output #1	PS-9008-004
TB 5	Analog Output #2	PS-9008-005
TB 6	Low Power Output	PS-9008-006
TB 7	High Power Output	PS-9008-007

[1] Keyed to prevent accidental insertion into the 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 the mode logic as described in Section 5.

The 16 inputs on the PS-8000 are arranged on two terminal strips, TB 2 and TB 3, as show in Figure 7. Each input is optically isolated and can be powered from an external DC power source.

Sinking or Sourcing

Each terminal strip TB2 and TB3 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, sold 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 (Terminals 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.

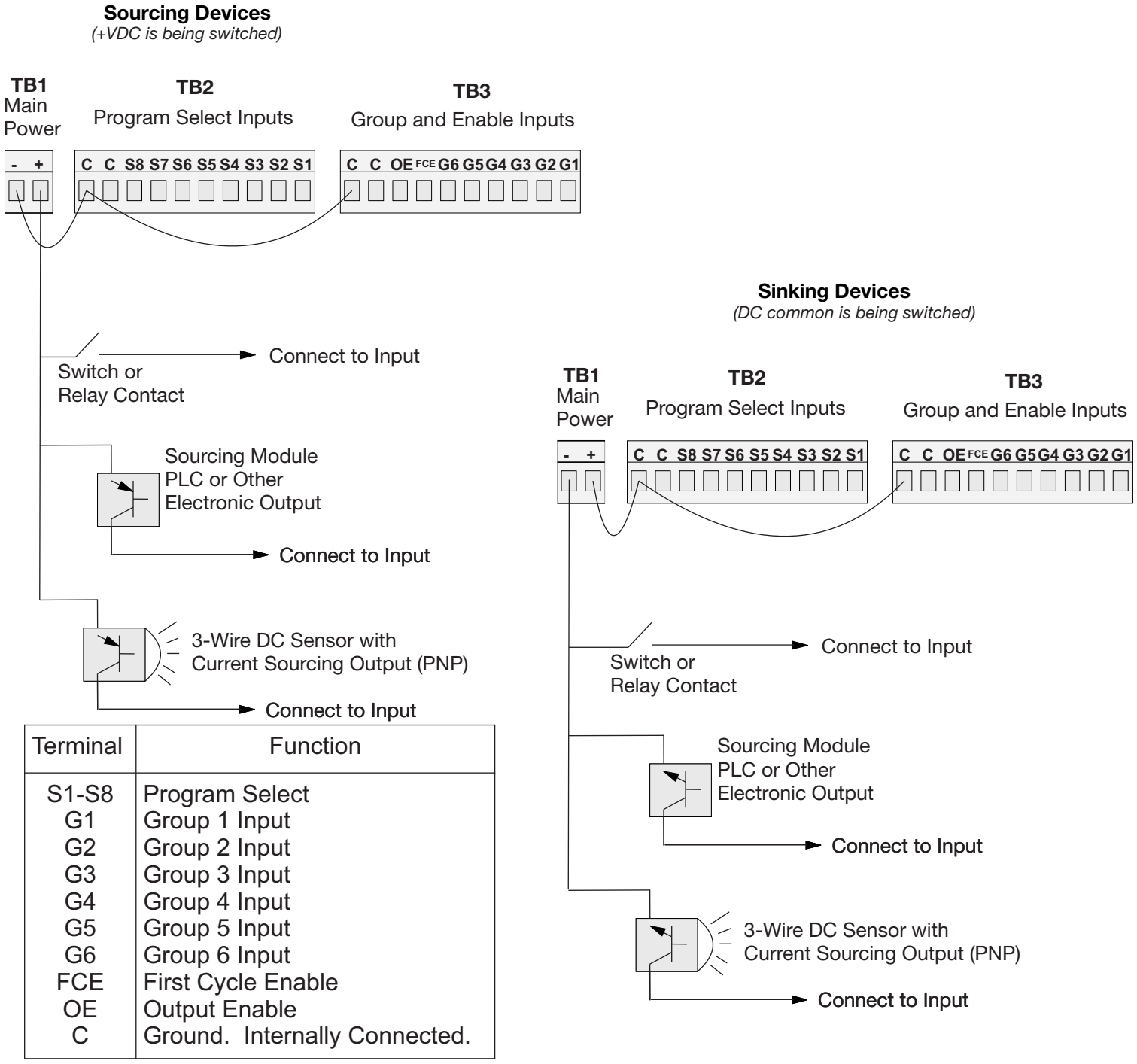
When all program select inputs are off, the “Default” program will become active as programmed through the DEFAULT PROGRAM function.

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

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

Output Enable (Terminal 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 outputs modes.

Figure 7 - Controller Input Wiring (See Figure 5 for Terminal Block Locations)



Terminal	Function
S1-S8	Program Select
G1	Group 1 Input
G2	Group 2 Input
G3	Group 3 Input
G4	Group 4 Input
G5	Group 5 Input
G6	Group 6 Input
FCE	First Cycle Enable
OE	Output Enable
C	Ground. Internally Connected.

Input Wiring Guidelines

- Each input powered from TB 2 will draw 11 mA at 24 VDC.
- Inputs will operate with voltages from 10 to 30 VDC.
- An external power supply can be used instead of TB1 to power inputs.
- A combination of mechanical and solid state devices can be used.
- TB2 can be wired for sourcing while TB3 is wired for sinking, and vice versa.

Controller Output Wiring

Output Types

The following output types are available on the PS-8000:

Output
Low Power
High Power
Analog Outputs

The PS-8000 has eight output module slots. Either a Low Power or High Power output module may be plugged into each slot to fulfill output requirements. There are two analog outputs. The number of analog outputs is not expandable.

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

Low Power

The Low Power Output Modules features four outputs. Using the internal power supply, each output is capable of driving 5 mA at 5 VDC. If configured to use an external power supply, each output is capable of 12 - 30 VDC at 50 mA. Each of the four outputs can be individually configured for either sinking or sourcing operation. Diagrams for sinking/sourcing and power supply jumper configuration is shown on Page 2-8 through 2-10.

High Power

High Power Output Modules can directly switch inductive loads and resistive loads that require more current or voltage than the Low Power Output Modules can supply. **The modules do not supply the power for the load; they simply switch it.** Each output on the high power modules can switch either 350 VDC or 350 VAC, both at up to 4A. DC outputs can be wired to sink or source as shown as shown on pages 2-12 and 2-13.

Analog Outputs

The two Analog Outputs generate signals that are proportional to the shaft sensor RPM. Each output produce both a 0 - 10 VDC and a 4- 20 mA output signal. An external power supply is not needed because the analog outputs get the power they source directly from the controller. The analog output signals are completely isolated. Terminal 1 is the output pin for the 4-20mA analog output. Terminal 2 is the output pin for the 0-10VDC analog output. Pin 3 on the terminal block is the ground for both types of analog outputs.

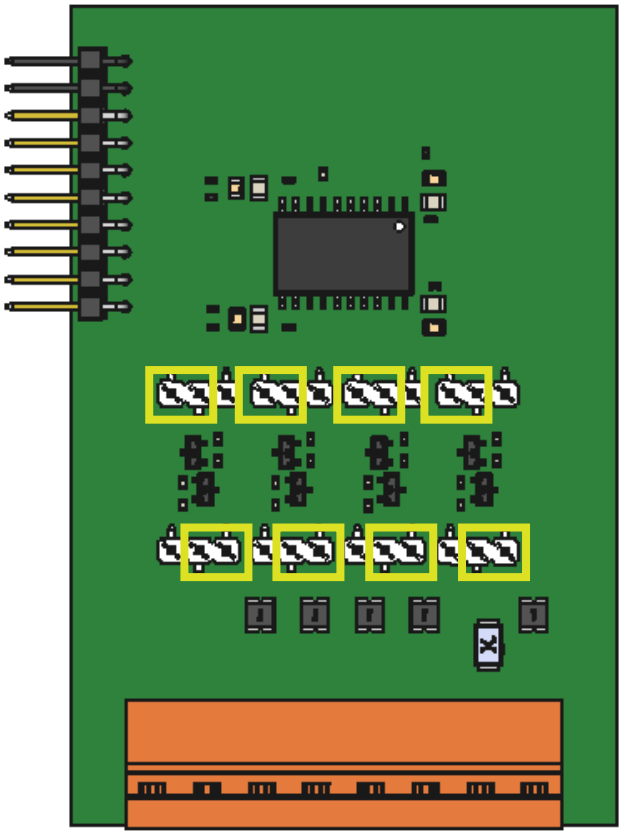
Sinking/Sourcing Defined

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

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

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

Wiring for Low Power Module (Sourcing, Internal Power)

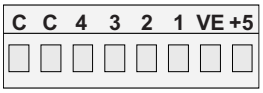


Jumpers as shown

Jumpers as shown

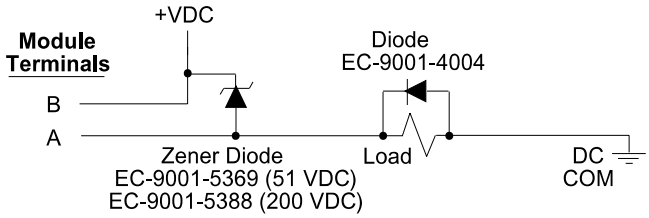
Using Internal Power Supply

Both C terminals are internally connected.
You may use either or both.



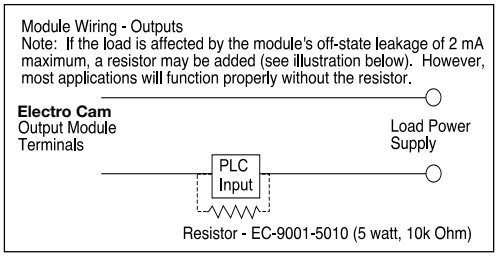
Connect load between the output terminals and C.

Sourcing



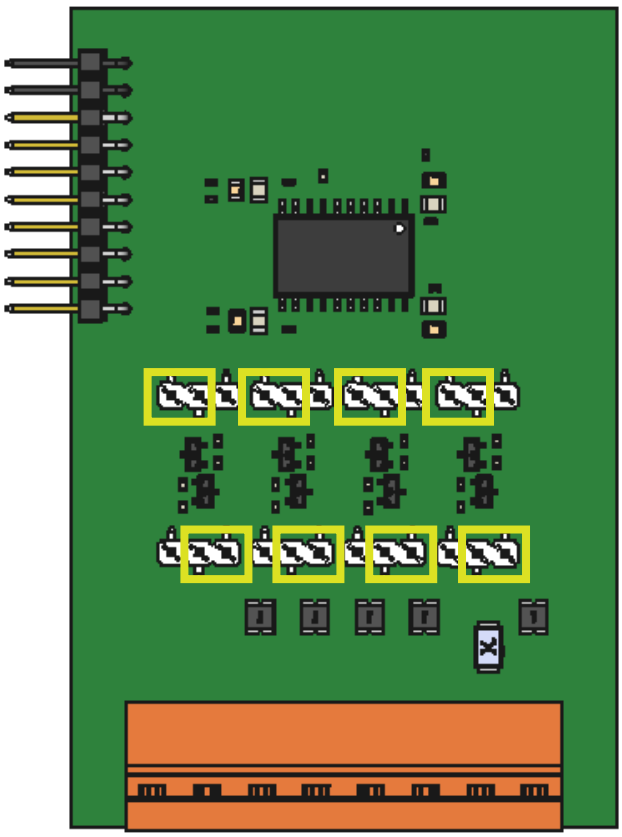
Most applications will not need the diodes shown above. However, highly inductive DC loads may damage modules by generating voltage spikes when switched off. Suppress these voltage spikes using one of these two methods:

- 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.



DC Output

Wiring for Low Power Module (Sourcing, External Power)



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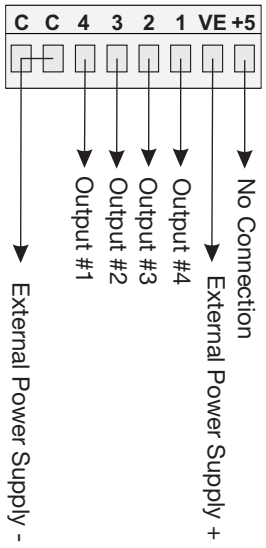

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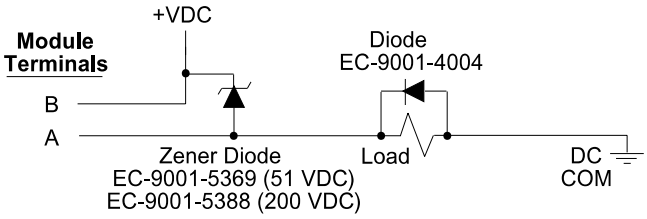

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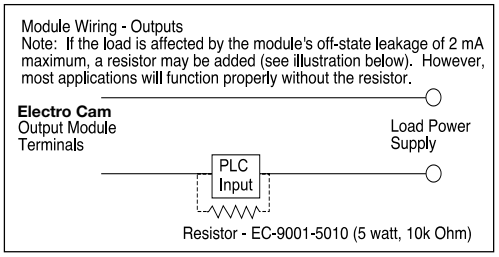
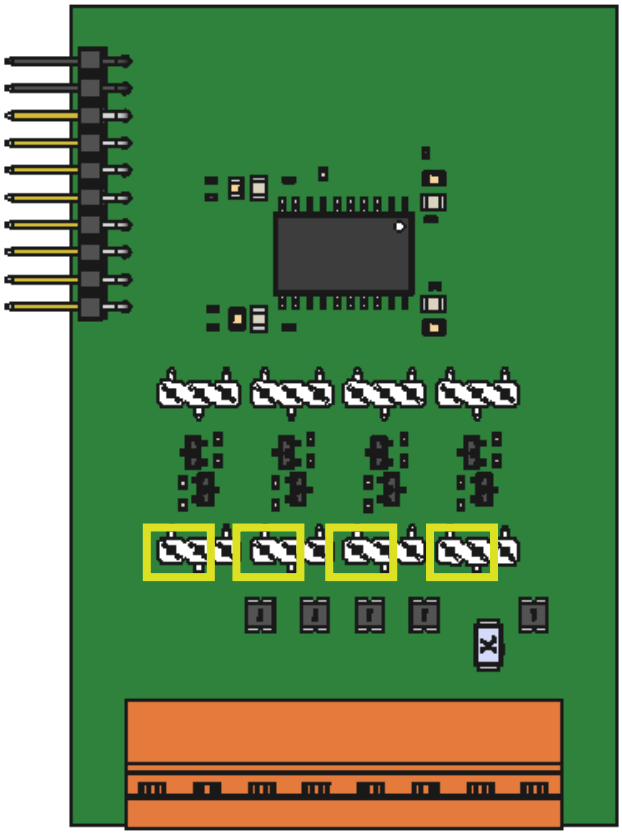


DC Output

Wiring for Low Power Module (Sinking, Internal and External Power))

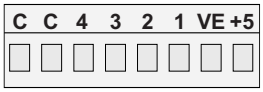


No Jumpers

Jumpers as shown

Using Internal Power Supply

Both C terminals are internally connected.
You may use either or both.

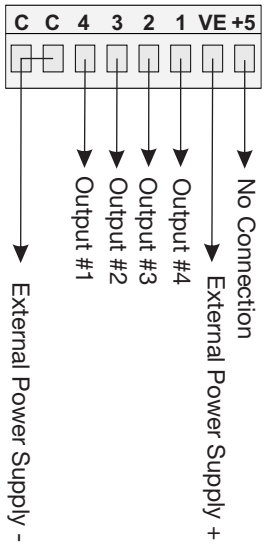


Connect load between +5 and the output terminals.

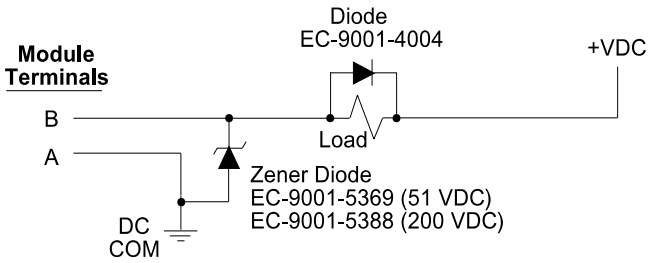
Using External Power Supply

Both C terminals are internally connected.
You may use either or both.

Connect load between VE and the output terminals.

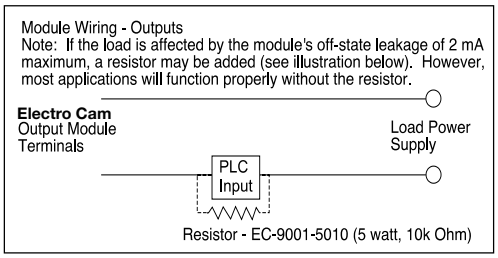


Sinking



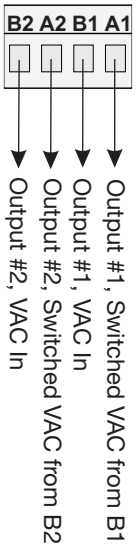
Most applications will not need the diodes shown above. However, highly inductive DC loads may damage modules by generating voltage spikes when switched off. Suppress these voltage spikes using one of these two methods:

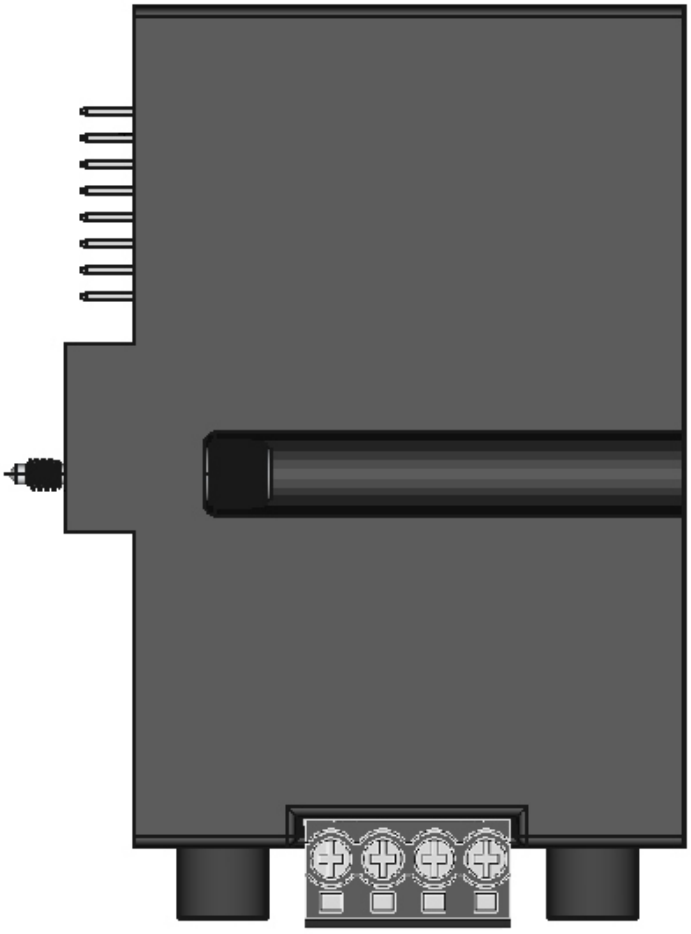
- Connect a Zener diode across the terminals. This will not significantly increase the load turn off time. Voltage rating of the diode must be greater than the normal circuit voltage.
- Connect a reverse-biased diode across the load. This may increase the load turn off time.



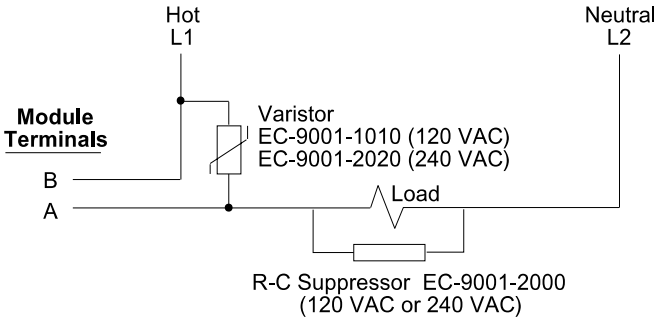
DC Output

Wiring for High Power Module (VAC)



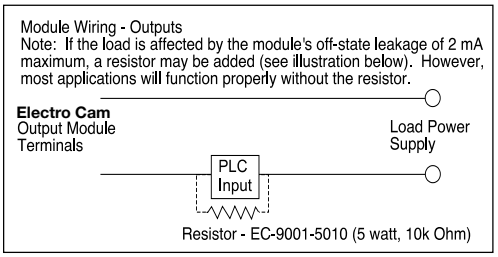


AC Output

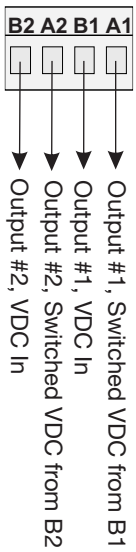


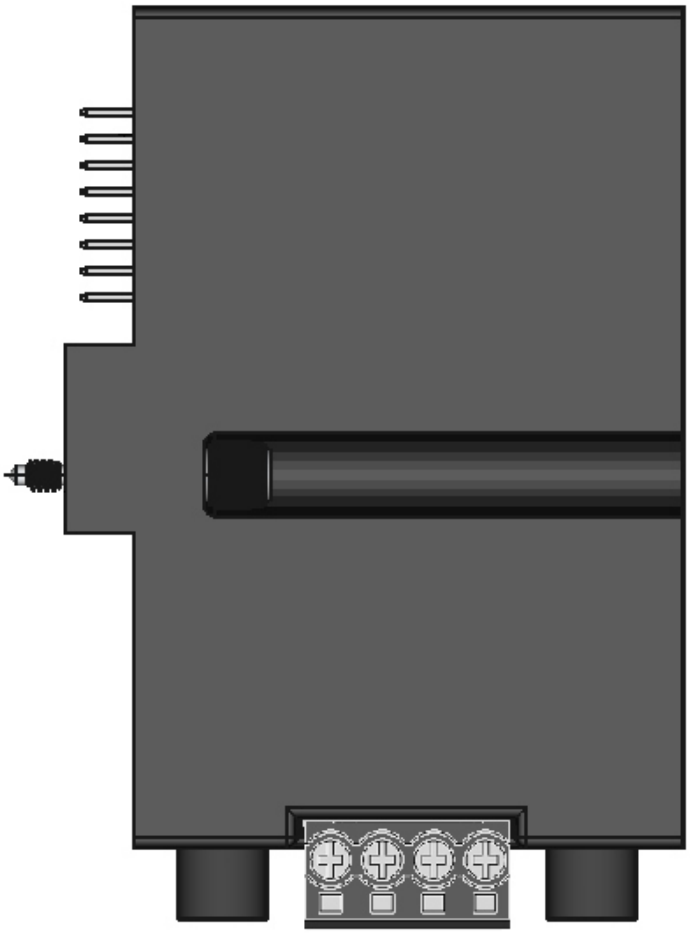
Most applications will not need the varistor or R-C suppressor shown above. However, when other switching devices are in series or parallel with the AC module, voltage spikes may damage the module. Use one of the following two methods to suppress voltage spikes.

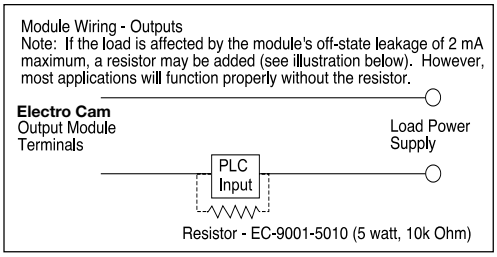
- For infrequent switching, connect a varistor (MOV) across the terminals.
- For continuous switching, wire an R-C suppressor in parallel with the load.



Wiring for High Power Module (VDC Sourcing)

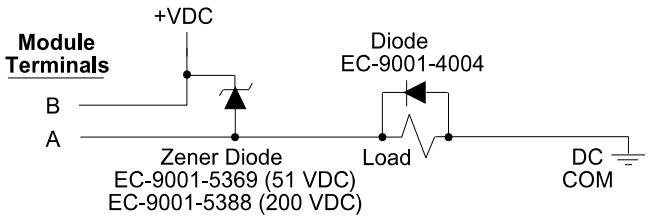






DC Output

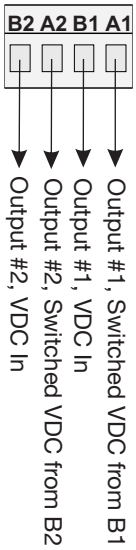
Sourcing

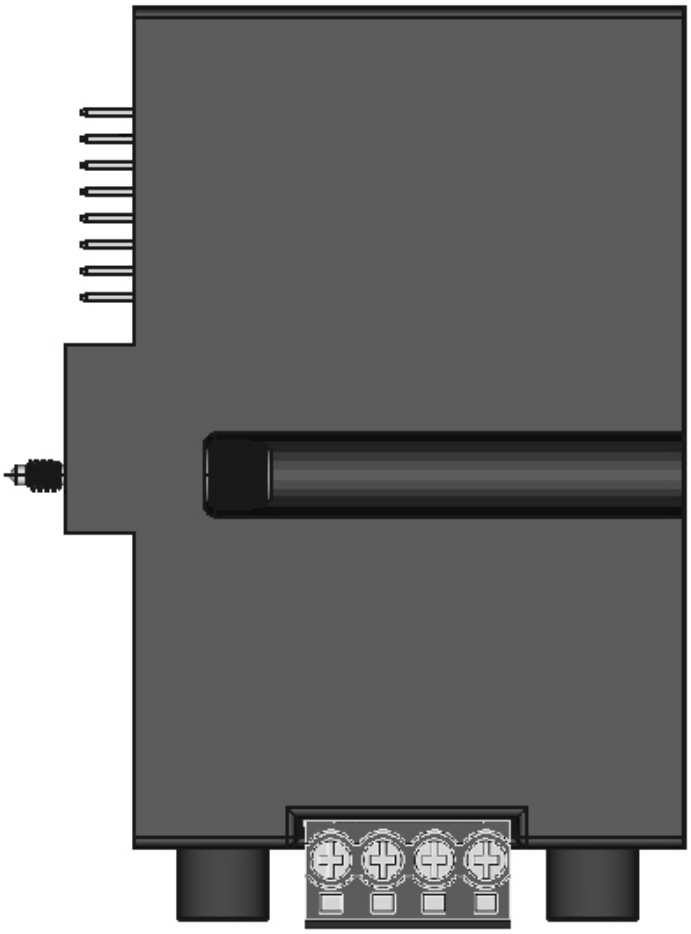


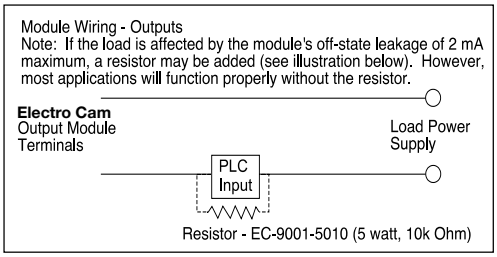
Most applications will not need the diodes shown above. However, highly inductive DC loads may damage modules by generating voltage spikes when switched off. Suppress these voltage spikes using one of these two methods:

- 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.

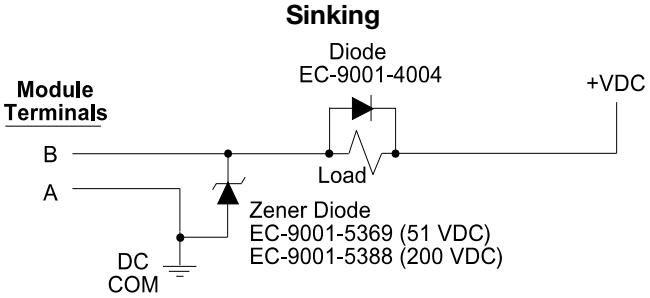
Wiring for High Power Module (VDC Sinking)







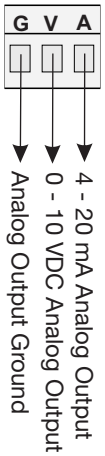
DC Output



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:

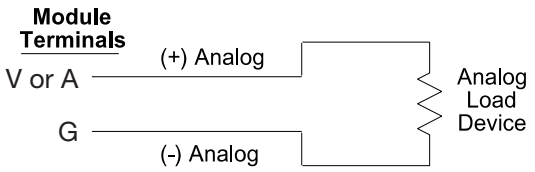
- Connect a Zener diode across the terminals. This will not significantly increase the load turn off time. Voltage rating of the diode must be greater than the normal circuit voltage.
- Connect a reverse-biased diode across the load. This may increase the load turn off time.

Wiring for Analog Outputs



Analog outputs can either be connected to the 0 - 10 VDC (V) terminal, the 4 - 20 mA terminal (A), or both can be used simultaneously.

Analog Output



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

Hall Effect Sensor Installation

General Information

Choose a mounting location for the shaft sensor that allows convenient mechanical connection of the hall effect sensor shaft to the machine. The shaft sensor is normally driven at a 1:1 ratio to machine cycles, but this is not true in every application. The shaft can be coupled to the machine using a chain and sprocket, timing pulley and belt, or a direct-to-shaft coupling. If a shaft-to-shaft coupling is used, Electro Cam Corp. recommends the use of a flexible coupling. Flexible couplings are available through Electro Cam Corp. and are included on the price list.

! WARNING

Turn power to the machine OFF prior to installation!

No provision need be made for physically rotating the shaft sensor shaft with respect to the machine shaft. The PS-8000 can be easily programmed to set any shaft sensor position as the 0° position.

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

Figure 16 shows the shaft sensor and its mechanical dimensions.

Ambient Temperature

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

Shaft Sensor Wiring

Shaft sensor cables have one end for mating with the hall effect sensor and one end for connecting with the PS-8000 controller.

The shaft sensor cables supplied by Electro Cam Corp. are a special type consisting of individually twisted-shield wire pairs. This ensures that reliable position information is being received by the controller. The use of other cable types could degrade the accuracy of the position signals and make them more susceptible to electrical noise. For these reasons, it is recommended that the customer does not make their own shaft sensor cables. Electro Cam will make shaft sensor cable any length up to 1000' and can expedite shipment as required.

Calibration

The shaft sensor will need to be calibrated once it is connected to a controller. To do this, navigate to from the Main screen to the Setup screen. Tap the 'Shaft Sensor Calibration' button. Once in the calibration screen, slowly rotate the shaft sensor through a few revolutions. You will see the four point capture markers turn green. Once all four point capture markers are green, the Calibration Status will also turn green and calibration is complete.

If some of the markers are not turning green after a few revolutions, you may try turning the shaft sensor in the opposite direction to capture those points.

Please note that this **must** be done again if the shaft sensor is replaced for any reason. You can do this by tapping the Reset button in the 'Shaft Sensor Calibration' screen and following the steps above.

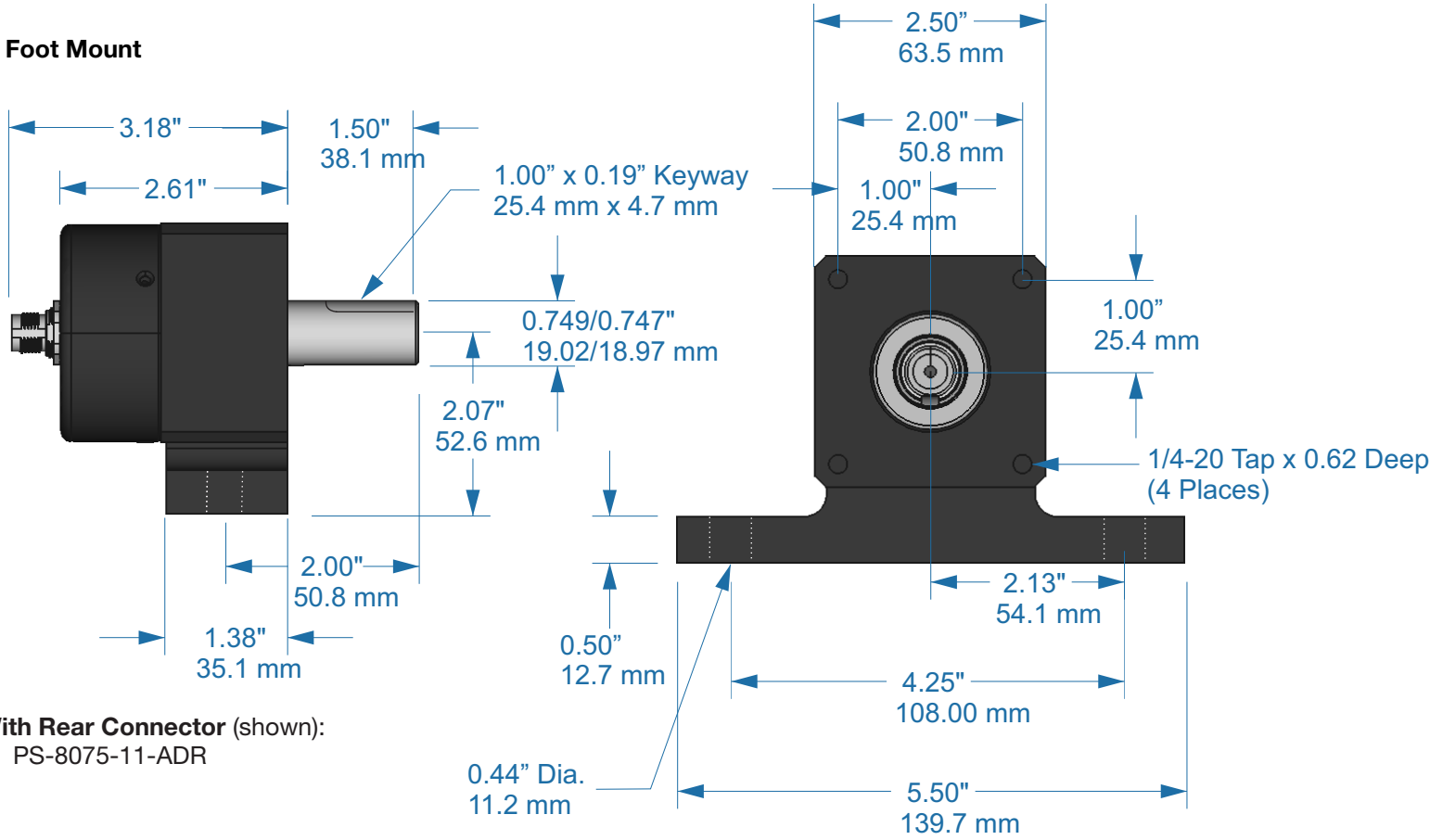
NOTE: You will see the message 'Default Calibration being used' on the main screen until you run the calibration routine or if the calibration needs to be reset.

Shaft sensor calibration requires Master level access to be activated.

Hall Effect Sensor Dimensions

Figure 16 - Electro Cam Corp. Hall Effect Sensors

Foot Mount



With Rear Connector (shown):
PS-8075-11-ADR

Flange Mount

With Rear Connector (shown):
PS-8038-11-ADR

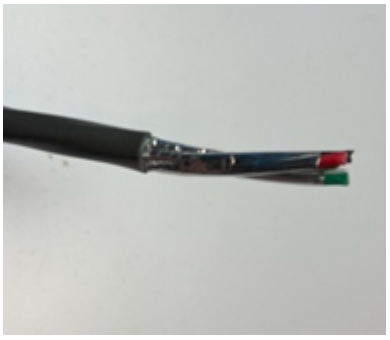
Cable for the Hall Effect Sensor

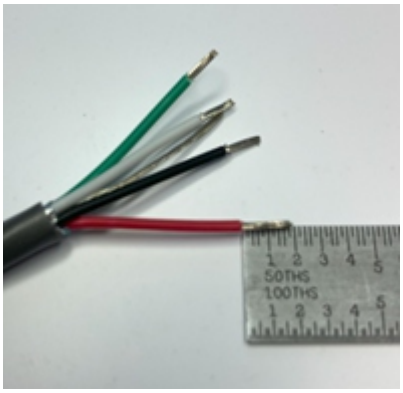
P/N PS-8300-01-XXX (XXX = Length in Feet)

The shaft sensor connector comes in two parts as shown in the image to the left. After the shaft sensor cable has been installed between the shaft sensor and the enclosure where the PS-8000 controller is mounted, the cable can be cut to the appropriate length and terminated with the supplied connector.

The following instructions detail the steps required to terminate the controller end of the cable.

First, remove 3/4” of the outer jacket at the end of the cable to be terminated. Be careful to not nick or cut the insulation on any of the inner conductors. This will expose two pairs of wires with each pair wrapped in a thin metal foil. There is also a single wire with no insulation.





Remove the foil from each pair of wires. This will expose a green wire, a white wire, a black wire, and a red wire as well as the wire with no insulation.

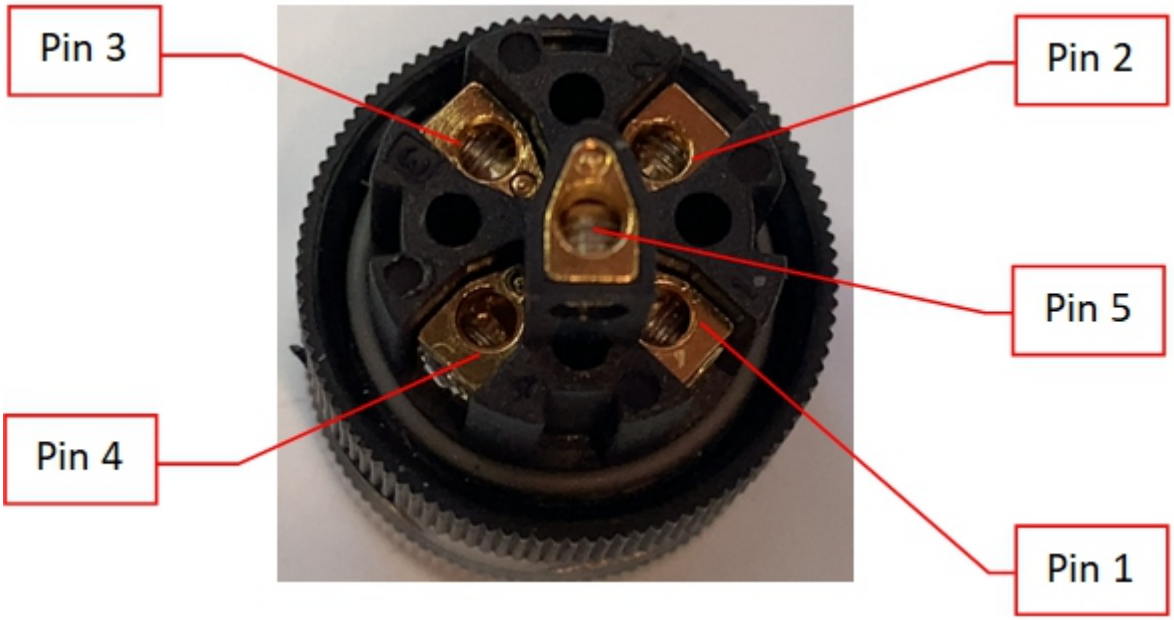
Remove roughly 0.2 inches of insulation from each of the insulated wires.

The rear housing of the connector usually comes pre-assembled. Disassemble the rear housing by unscrewing the “Pressing Screw”. You should end up with the four components shown below. From left to right they are the “Straight Housing”, “Seal”, “Pinch Ring” and “Pressing Screw”.

Hall Effect Sensor Cables (continued)

Being careful not to bend any strands at the end of the stripped wires away from the other strands, insert the cable through each of the rear housing components as shown below. The Pressing Screw goes first followed by the Pinch Ring, then the Seal and finally the straight housing. Be sure to insert the cable through the smaller diameter ends of the Pinch Ring and Seal first. Note that the Pinch Ring and Seal will have to expand slightly to accommodate the cable. This is normal.

The pin layout on the connector housing is shown below. It is very important to make sure that the correct wire is attached to the appropriate pin. Incorrect connections may damage either the shaft sensor, the PS-8000 controller, or both.



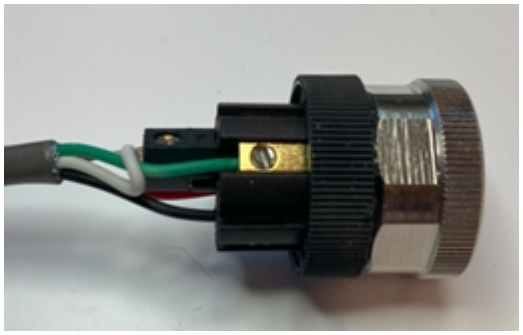
Connecting the cable wires to each of the connector pin requires a 2 mm, flat screwdriver. The terminating screws should not be tightened more than two newton-meters of torque. First, loosen the screws in each connector pin. Be careful to not loosen the screws so much that they fall out of the terminal and get lost. Three complete turns will be sufficient.

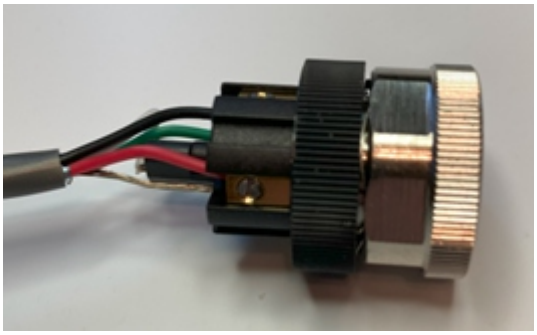
For each wire in the cable, insert the wire into the indicated pin terminal as defined in the table to the right and tighten the screw.

Wire	Terminal
Bare	Pin 1
Red	Pin 2
Black	Pin 3
Green	Pin 4
White	Pin 5

Hall Effect Sensor Cables (continued)

When complete, the connections will appear similar to the following images. Note that the white wire will have to be doubled around to get it inserted into the pin terminal.



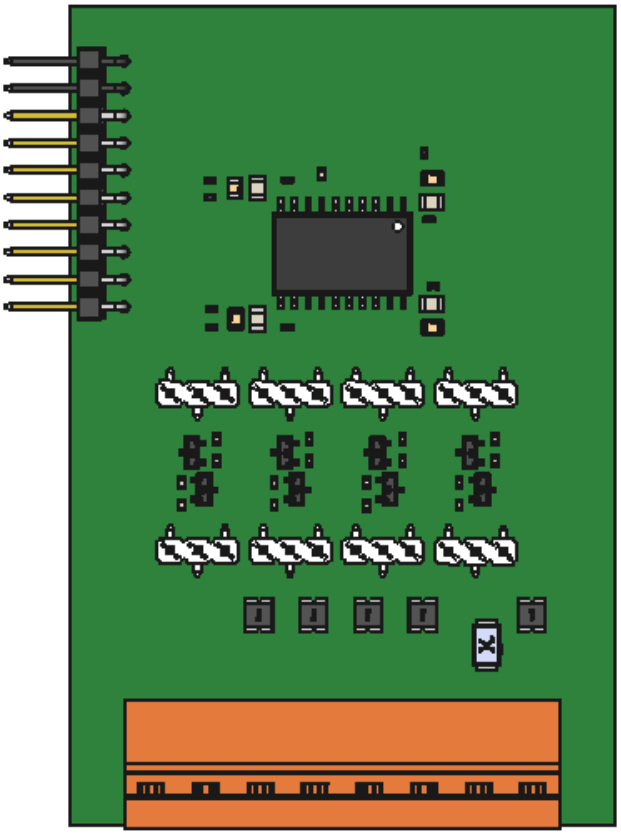


Next, align the key in the Straight Housing with one of the slots between the pin terminals on the connector housing and firmly press it against the plastic ring on the connector housing. Turn the ring while pushing on the straight housing until the threads are engaged and continue tightening until the Straight Housing is secure.

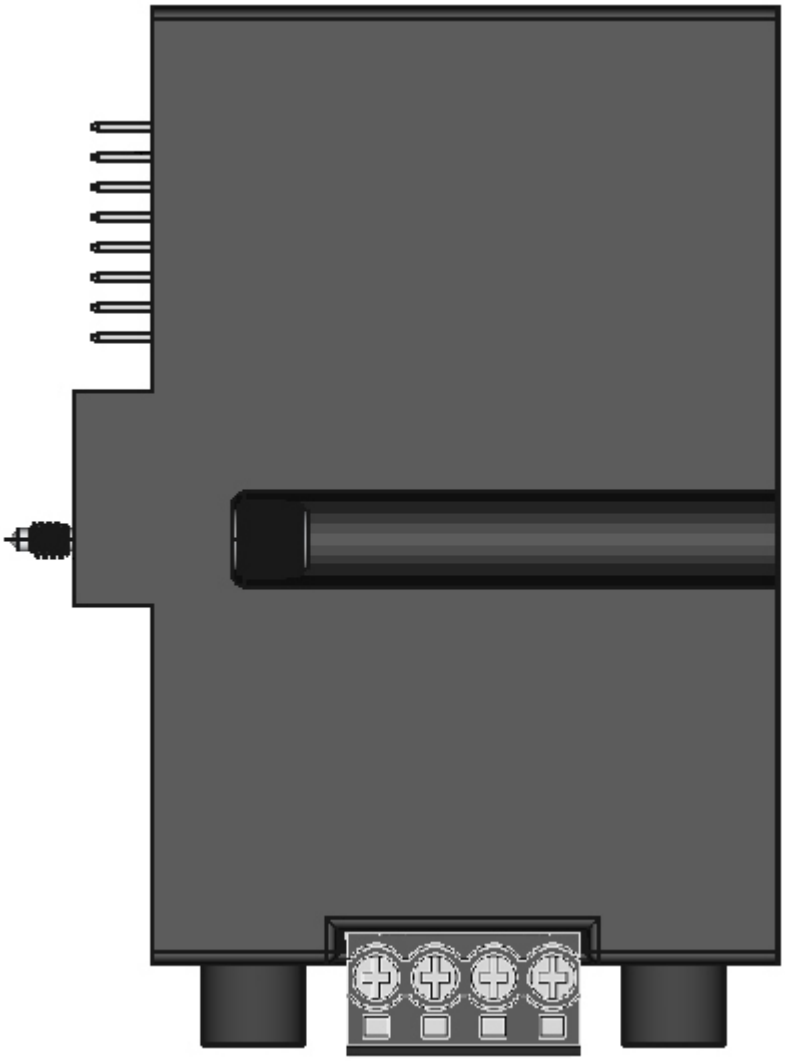
Finally, push the Seal and the Pinch Ring into the back end of the Straight Housing and secure them in place using the Pressing Screw. Tighten the Pressing Screw to one newton-meter.

Output Module Installation

Low Power Output Module
P/N PS-LPO



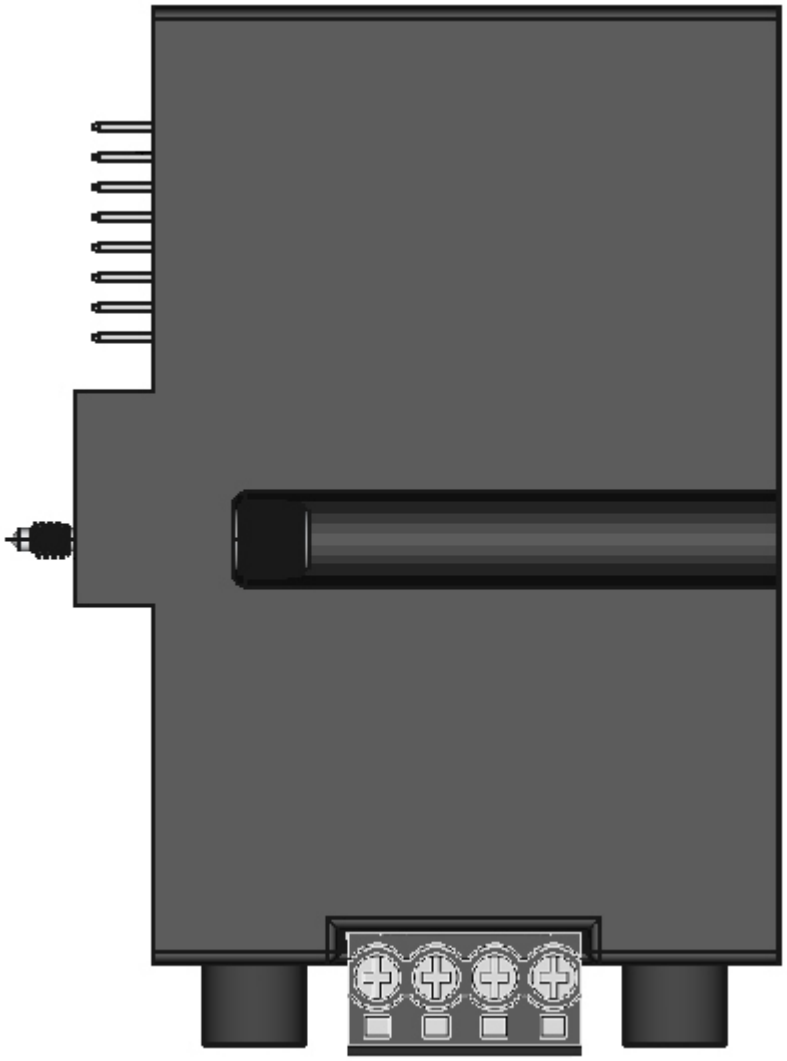
High Power Output Module
P/N PS-HPO



Align the module hold down screw with the nut in the circuit board for the output module slot you want to install it in. Make sure the connector is lined up as well. Push the module into place and then tighten the screw to hold it in place.

Fuse Listing and Fuse Replacement

All fuses on the PS-8000 are PTC fuses meaning that if they are tripped they will reset themselves after a short cooling off time. The lone exception to this is the High Power Output Module which does require its own one time use replaceable fuse.



Fuse 1 Fuse 2

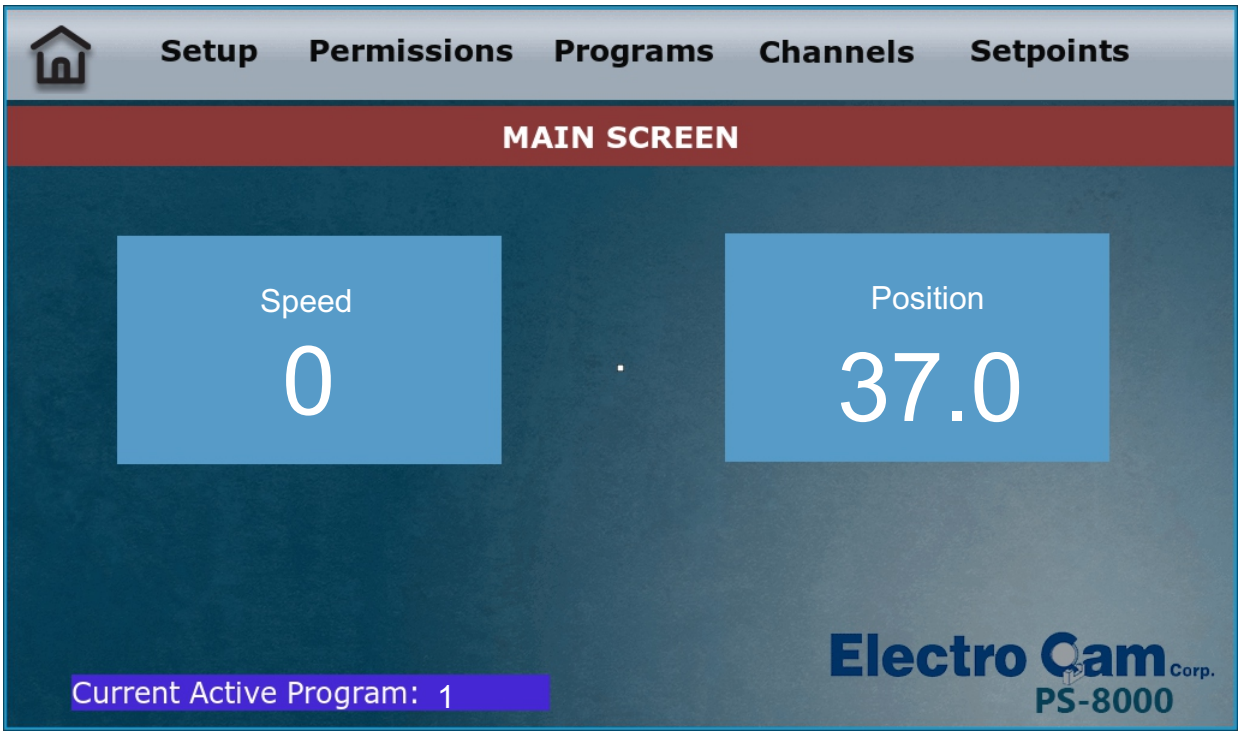
The High Power Output Modules uses a fuse for each output channel on the module. The replacement fuse part number is :PS-9005-0004.

Touch Screen Overview

Main Screen

On this screen, you can:

• View Active Program, RPM, Position, and Group # if applicable. Navigate to other screens using the menu at the top.



Below are brief descriptions of the functions and operations available in each sub-screen.

Setup From here you can zero the machine position, access Output Groups, Machine Setup information, Hall Effect Sensor Calibration, Analog Output Setup, and I/O status. Details for these features are listed alphabetically on the following pages.

Permissions Enter or change passwords. The operator edit enables are turned on and off from this screen.

Programs In this screen, you can change the currently running program (called the default program), and add, delete, or copy programs. The program select input format is also set here as well as the gray code compensation level. Details are on Page 3-?.

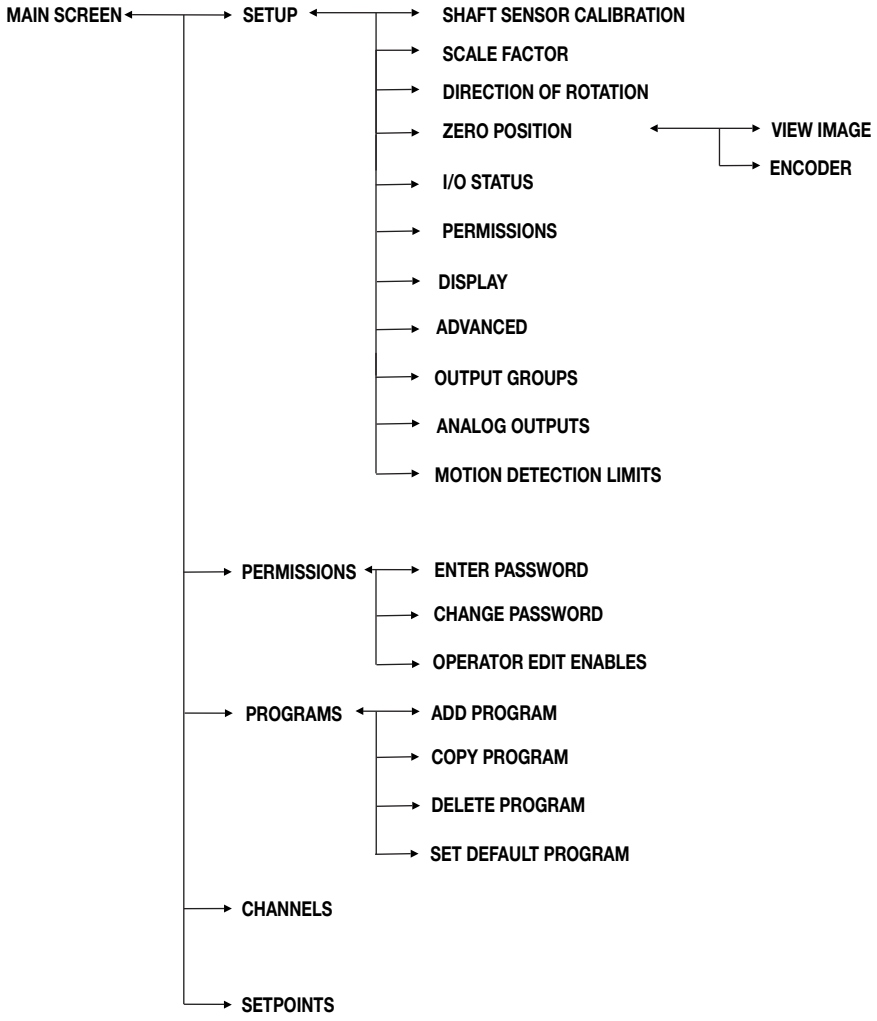
Channels In the Channel Screen, you will be able to set Speed Compensation, Timed Output Values, Motion Anding, Enable Anding, and set Operator Security Setting for individual channels. You can assign output to groups from this screen. Details are on Page 3-?.

Setpoints This is where you will set the turn on and turn off times for your setpoints. Details are on Page 3-14.

The rest of the sub-screens (Modules, Tests, Faults, CRC, Image, and Encoder) are test and troubleshooting screens and are discussed in 7-2 and 7-3. These screens are only visible in the menu in Master Level.

Figure 20—PS-8000 Menu Tree

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



Initial Programming

Bench Test

To test the PS-8000 prior to installing it, do the following:

1. Plug the output modules into the controller. See Figure 9.

2. Connect a shaft sensor. See Figure 16.

3. Connect DC input power.

4. Calibrate the shaft sensor by pressing the 'Shaft Sensor Calibration' button in the Setup Screen. Follow the instructions in the lower left once the 'Initiating Calibration' turns off.

After installing the unit, program the following set-up information into the controller before attempting any other programming:

Machine Setup

Information		Page
Direction of Rotation	Setup Screen	3-8
Scale Factor	Setup Screen	3-14
No. of Output Groups	Setup Screen -> Output Groups	3-11
Modes of Output Groups	Setup Screen -> Output Groups	3-11

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.

General Programming Notes

On each screen as changes are made, you will need to press the 'Save Changes' button to commit the changes to memory. Multiple changes and channel information can be programmed before hitting the button. It does not need to be pressed after each change, however you must press 'Save Changes' before leaving the screen or the changes will be lost.

If you do not press 'Save Changes', or if the 'Discard Changes' button is pressed, the controller settings will not be saved to the controller's memory. On some screens, functional changes can be made for ease of machine adjustment purposes, but they will be lost unless the 'Save Changes' button is pressed.

The 'Save Changes' and 'Discard Changes' buttons will be disabled if no changes have been made. If changes have been made, both button will become brighter and the 'Save Changes' button will have a small flashing red circle to remind the user there are changes that have yet to be save to the controller.

Analog Outputs

Accessed via: SETUP ⇨ ANALOG OUTPUTS

This page details how to setup and program the two dedicated analog outputs that are available on the PS-8000 controller.

There are four settings that apply to each of the two analog outputs:

Minimum Output Percentage
Maximum Output Percentage
Minimum RPM
Maximum RPM

Analog output signals are linearly proportional to the hall effect sensor RPM. Both analog outputs will continuously update both the 0-10 VDC and 0-25mA analog outputs, enabling the use of one or both at the same time.

Minimum Output Percentage A Minimum Output Percentage greater than zero will put an offset voltage or current on the analog outputs. For instance, if Minimum Output Percentage is set to 50, the analog output will have a 5VDC and 10mA signal representing exactly half of the full-scale values. This value is present even at zero RPM.

Maximum Output Percentage The value set here will dictate what RPM the analog outputs reach full scale. If Maximum RPM is set to 200, then at 200 RPM the analog outputs will be at their maximum levels and cannot increase any further even in the case of faster RPM.

Minimum RPM Minimum RPM will dictate when the analog output module starts converting speed into voltage or current. An RPM below this number the output will be result in the output being the same as the setting in Minimum Output Percentage.

Maximum RPM The value set here will dictate what RPM the analog outputs reach full scale. If Maximum RPM is set to 200, then at 200 RPM the analog outputs will be at their maximum levels and cannot increase any further even in the case of faster RPM. Increasing speed beyond the High RPM will **not** increase the analog output beyond full scale.

Default Program

Accessed via: PROGRAMS

The PS-8000 can store up to 128 programs in its memory. The **Default Program** is the program that is currently being executed on the controller. The default program may be changed in this screen or via the program select inputs on TB2.

To set a Default Program, navigate to the program number you would like to make the default by using the arrow buttons. Push the 'Set As Default' button. This is now the program the controller will run.

You may also tap the number to the right of Program and enter a number directly via the pop-up keypad. This may be more convenient when there are a larger number of programs. You still must tap the 'Set As Default' button to set it as the currently running program.

Enable Codes

Accessed via: PERMISSIONS

The PS-8000 has four levels of programming access: Normal, Operator, Setup, and Master in order of increasing capabilities. Figure 21 on the next page list the functions that can be programmed under the various levels of access.

Normal Mode is the default on start up and requires no password. All settings are read only and cannot be changed at this level.

The other three programming levels can be activated, or "enabled", by entering a password through the touchscreen in the appropriate box. The default passwords for the various levels are listed at the bottom of this page. To 'log out' or return access to the default no password level, press 'Access Level Normal'.

To change the password for either the Operator, Setup, or Master access levels, tap the 'Change ID #s' so the dot becomes green. At this point, you can tap on the ID Password box you wish to change. Enter the new password (up to four digits) and tap enter. It is a good security practice to change these passwords from their default as the default values are listed below and considered public knowledge.

TIP: Password are only able to be set when the PS-8000 is in the master access level and the 'Change ID #s' circle is green.

To change the functions that are available at the operator level, simply tap the button next to the appropriate feature on the left-hand side of the screen to enable or disable it.

The functions available at the setup access level are not individually configurable. The available functions are listed in Figure 21.

Individual channels can be turned on or off for editing in the operator mode. This is done in the Channel screen by tapping the "Opr Accs" until it shows the desired value. Please note that if a channel is turned off for editing, this effects setpoint programming as well as any channel specific functions, such as speed compensation and timed outputs even if they are enabled in the Operator Edit Enables.

Default Password Values:

Master Level	9992
Setup Level	9991
Operator Level	9990

Figure 21—Programming Access Levels for Various Menu Items

	Programming Level			
	Normal (No Password)	**Operator**	**Setup**	**Master**
Accessible by Password	N/A	Yes	Yes	Yes
Password	Enter	Enter	Enter	Program
Channels Screen				
Output Enable Anding	View Only	View Only	View Only	Program
Group Assignment	View Only	View Only	View Only	Program
Leading / Trailing Speed Comp.	View Only	Program[1]	Program	Program
Motion Anding	View Only	Program[1]	Program	Program
Operator Access	Hidden	View Only	View Only	Program
Timed Output Value	View Only	Program[1]	Program	Program
Program Screen				
Add Program	Hidden	Program[1]	Program	Program
Copy Program	Hidden	Program[1]	Program	Program
Delete Program	Hidden	Hidden	Hidden	Program
Program Select Mode	Hidden	Program[1]	Program	Program
Set Default Program	View Only	Program[1]	Program	Program
Setpoints Screen				
Add / Delete Setpoint	Hidden	Program[1]	Program	Program
Edit Setpoint	View Only	Program[1]	Program	Program
Make Train	Hidden	Program[1]	Program	Program
Setup Screen				
Analog Outputs	View Only	Program[1]	Program	Program
Direction of Rotation	View Only	View Only	View Only	Program
Scale Factor	Hidden	View Only	View Only	Program
Sensor Calibration	Hidden	Hidden	Hidden	Program
Zero Position	Hidden	Program[1]	Program	Program
Advanced Setup	Hidden	Hidden	Hidden	
Default Config	Hidden	Hidden	Hidden	Program
Clear Setpoints	Hidden	Hidden	Hidden	Program
Clear Group Windows	Hidden	Hidden	Hidden	Program
Display Functions				
Backlight Brightness	Program	Program	Program	Program
Hide Angle RPM	View Only	Program	Program	Program
Motion Detection	View Only	Program[1]	Program	Program
Output Groups				
Group Window	View Only	Program[1]	Program	Program
Offset / Preset	View Only	Program[1]	Program	Program
Operating Mode	View Only	View Only	View Only	Program
Permissions	Hidden	Hidden	Hidden	Program
Operator Edit Enables	Hidden	Hidden	Hidden	Program
Passwords	Hidden	Hidden	Hidden	Program

Hidden indicates that the option or button will not be visible at that access level.

[1] Can be programmed only if specified through Operator Edit Enables in the Permission screen or the Operator Accessible button in the Channels screen.

Increasing Direction

Accessed via: SETUP

The Increasing Direction button displays the direction of shaft sensor rotation (CW or CCW as viewed from the shaft end) that will cause the position display to increase in value.

This is normally set so the position value increases as the machine turns in its forward direction.

To set the **Increasing Direction,** tap the **Rotation** button to toggle between CW (clockwise) or CCW (counterclockwise).

Input Status

Accessed via: TEST

The input status for the Program Select Inputs (TB2) and the Group Enable Inputs (TB3) are shown on this screen. The on/off status for all the outputs are also shown here. Please note the values are shown in hexadecimal.

Reference Output Test later in this section for further details of the Test screen

Note: You must be in master mode to access this screen.

Motion ANDing

Accessed via: CHANNELS

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 shaft sensor 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.

To turn on motion detection for individual channels, navigate to the “Channels” screen. Select the channel by tapping the up and down arrows. Tap the “MOT AND” button. Every time you press the “MOT AND” button, it changes from the current selection to the next selection. The available selections are L1 (Level 1), L2 (Level 2), and NONE. Selecting NONE will turn off Motion ANDing for this channel. Press the ‘Save Changes’ button to save your selection.

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

Accessed via: SETUP

Motion Detection establishes one or two “Motion Levels”, or speed ranges, with low and high RPM values. These two ranges are independent of each other.

Each output channel can be ANDed with either Motion Level. ANDed outputs will be enabled only when the hall effect sensor speed is within the specified range. Output channels that are not ANDed will be “on” whenever the machine position is within their programmed setpoints, regardless of machine speed. One use of Motion Levels and Motion ANDing is to turn off devices such as glue guns if the machine stops or jams.

The MOTION DETECTION function is used to establish one or two motion levels. Once the Motion Levels are programmed, use MOTION ANDING to tie individual output channels to the Motion Levels.

To set the motion detection high or low ranges, tap on the number next to the level you want to change.

Note that the Motion Detection Levels only define the ranges. To enable Motion ANDing for individual channels, please see the Motion ANDing section above.

Offset

Accessed via: SETUP ⇨ OUTPUT GROUPS

Because the PS-8000 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 position is zeroed via the "Zero Position" button in the Setup screen.

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 set in the Output Group screen in Preset Angle. Because the reset can occur at any shaft sensor position, the relationship between the position of a group operating in Mode 1 or 2 and the mechanical position varies.

For Modes 1 and 2:
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 the mechanical position. When the group's input terminal is energized, then the group position will reset to the preset values.

Output Enable ANDing

Accessed via: CHANNELS

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

To turn on Output Enable ANDing for a particular channel, navigate to the “Channels” screen. Select the channel by tapping the up and down arrows. Tap the “Enbl AND” button. This will toggle it to ‘YES’. Tap again to change it back to ‘NO’ to turn Output Enable ANDing off. Press the ‘Save Changes’ button to save your selection.

Output Groups

Accessed via: SETUP ⇨ OUTPUT GROUPS

The Groups screen allows you to divide output channels into groups and assign operating modes to these groups. Operating modes provide a powerful tool for relating output channel operation to sensor signal 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.

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

Any output channel can be assigned to any group.

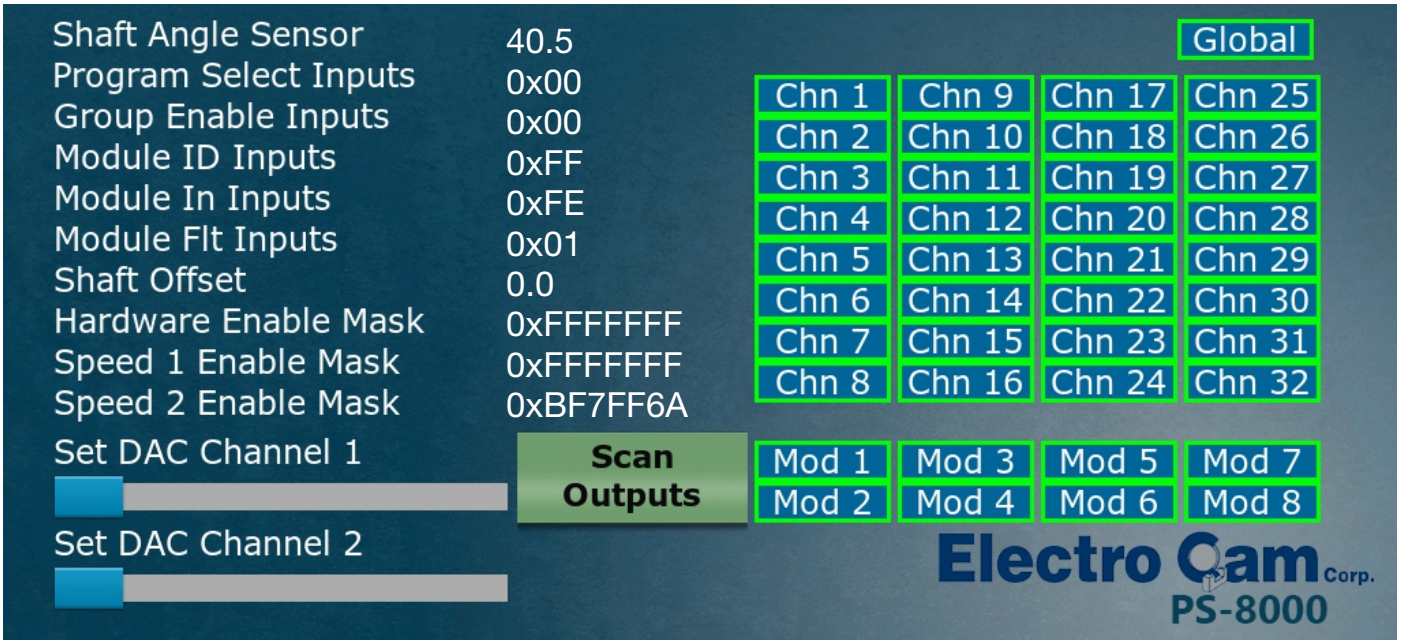
The PS-8000 controller has six groups that can be used.

More than one group can be assigned the same operating mode.

Programming
- Select your group and assign it a operating mode in the Output Groups Screen.
- Assign channels to the group through the Channel Screen. The Group assignment is listed under the channel number.
- You may need to also set the group window in the Group Outputs screen, depending on the mode being used.

Output Test

Accessed via: TEST



The test screen allows an operator who is knowledgeable in the mechanical and electrical properties of the machine to inspect the current status of the hardware inputs and force the on/off state of the outputs for diagnostic purposes.

Extreme caution must be observed when using this screen as significant damage to the machine or bodily injury could result from misuse.

Note that the screen cannot be entered if the shaft sensor has detected any motion. Additionally, the screen will automatically exit to the Main screen if the shaft sensor should detect any motion.

The left side of the screen shows a list of values obtained from various input sources. Most of the values are displayed in hexadecimal. The only two values shown as standard numbers are the current shaft sensor position and the current shaft offset value.

Below the list of values are two sliders that can be used to manually adjust the level at the analog output channels. The sliders set the output level as a hexadecimal value which is shown to the right of the slider title.

On the right side of the screen are a number of buttons that allow manual control of each of the output channels as well as the Global enable signal and each module enable signal. The Global enable signal is designed to keep the module outputs from “glitching” on when the controller is powered on or off. The module enable signals are designed to turn off all outputs on a particular module in the event a hardware fault with that module is detected. In order to force a particular output channel on, the Global button and the module button for the module with the desired output must be turned on. With both of the enable buttons active, the output channel can then be manually turned on and off by pressing the appropriate button. Once activated, the text will turn red and the outline of the box will be blue.

There is also a button marked “Scan Outputs”. Pressing this button turns on all of the enable signals and then turns each output on, one at a time, for a short period of time.

The On/Off state of individual outputs is shown in the setpoints screen.

NOTE: When leaving the Test screen, either intentionally or when some motion of the shaft sensor is detected, keep in mind that any outputs that have been forced will return to their originally programmed state.

NOTE: The Test button on the top-level menu is only visible in Master Password Mode.

Password

Accessed via: PERMISSIONS

See Enable Codes.

Program Copy

Accessed via: PROGRAMS

The PS-8000 allows the user to copy the contents of an entire program. Push the “Copy Program” button to make a copy of the currently displayed program. The copy created will become the last program in the list.

Example: If there are two programs in the controller, copying program 1 will create a new program in the next available number which in this case is program 3.

Program Select Mode

Accessed via: PROGRAMS

The ‘PGM SEL’ button in the Programs screen allows you to specify the format for the hardware Program Select inputs on Terminals 1 through 8 of Terminal Block 2, Figure 7, page 2-6. The Program Select inputs can operate in Binary, BCD, or Gray Code formats.

To configure the format for these inputs tap the ‘PGM SEL’ button on the setup screen, and select the appropriate checkbox.

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. Give the Default Program settings that will eliminate this hazard in the event of sudden activation.

Resets Menu

Accessed via: SETUP ⇨ ADVANCED

These three buttons provide functions that allow you to easily clear programmed values from the controller.

NOTE: There is no undo function for these buttons. The information is deleted **permanently**.

To clear configuration information:
Tap the “Default Config” button. The controller will ask for confirmation. If you wish to delete all configuration information that has been programmed into the controller other than setpoint values, tap “YES” to confirm.
NOTE: This does not clear the shaft sensor configuration settings.

To clear the setpoint information:
Tap the “Clear Setpoint” button. The controller will ask for confirmation. If you wish to delete all of the programmed setpoints in the controller, tap “YES” to confirm.

To clear the group windows:
Tap the “Clear Grp Windows” button. The controller will ask for confirmation. If you wish to delete all of the programmed group windows, tap “YES” to confirm.

NOTE: The Advanced button is only viewable is Master Password Mode.

Scale Factor

Accessed via: **SETUP**

Scale Factor controls the number of increments into which one hall effect sensor revolution is divided. A scale factor of 360 (0 to 359) allows the controller to operate in degrees. A scale factor of 4095 (0 to 4095) allows positions to be programmed more accurately. In some applications the scale factor can be set so each increment equals a unit of linear travel.

When the scale factor is changed, all values related to angles will be displayed in the new scale factor.

Limits
Allowable scale factors range from 10 to 4095.

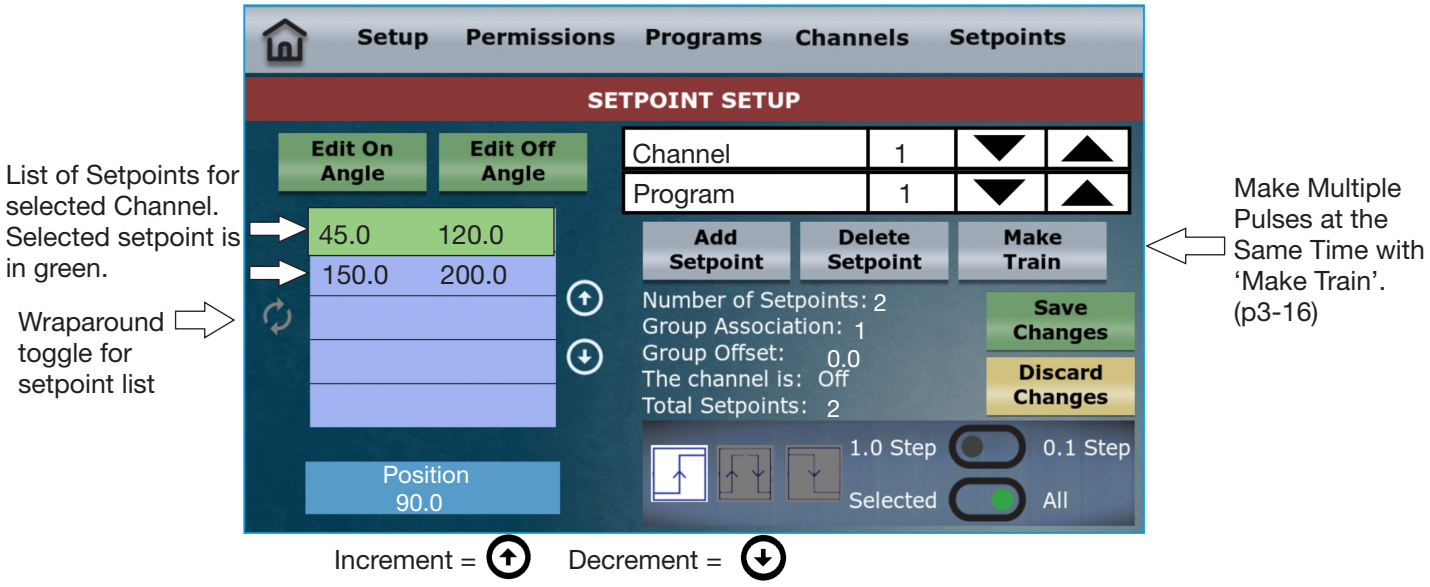
Setpoint Use

Accessed via: **SETPOINTS**

The total number of setpoints used is shown on the Setpoints screen next to Total Setpoints. The number of setpoints in the currently selected channel is shown next to Number of Setpoints. The amount of setpoints in each program can be viewed in the Program screen. Each 8000 controller is capable of holding 6000 setpoints.

Setpoints

Accessed via: **SETPOINTS**



Number of setpoints = Number of setpoints in the currently selected channel
Group Association = The group number the currently selected channel is assigned to. Editable in 'Channels' screen.
Group Offset = Number of increments the group position is leading the machine position.
On/Off status of the channel is show below Group Offset.
Total setpoints = Total number of setpoints programmed into the controller. Each controller holds 6000 setpoints max. The amount of setpoints in each program can be viewed in the 'Program' screen.

Setpoints (cont'd)

To Program a Setpoint:

Enter the acces code in the Permissions screen if you haven't already.
Press "Setpoints" in the top bar to enter the Setpoint screen.
Press "Add Setpoint".
Press "Edit On Angle" Use the on-screen keypad to enter the on position.
Press "Enter".
Press "Edit Off angle" Use the on-screen keypad to enter the off position.
Press "Enter".
Press "Save Changes".
The output will now turn on and off at the programmed setpoints.

To add additional setpoints in the same output press "Add Setpoint" and repeat.
To add setpoints to other output channels, use the channel arrow buttons in the upper right to navigate to the desired output and repeat.

To delete a setpoint, tap on the setpoint (it will turn green), and tap 'Delete Setpoint'.

To perform minor adjustments on already programmed setpoints, you may use the increment function on the setpoint screen.

To adjust one setpoint at a time, tap on it on the left of the screen. Make sure the toggle switch is set to 'Selected'. If you want to adjust all the setpoints at the same time, set the toggle switch to 'All'.

To adjust the On edges of the setpoint(s) only, press 

To adjust the Off edges of the setpoint(s) only, press 

To adjust both On and Off edges of the setpoint(s) simultaneously, press 

You may adjust the edges by either 1.0 degree at a time or 0.1 degree at a time. You can set the 1.0 Step / 0.1 Step toggle switch in the lower right hand corner of the setpoints screen.

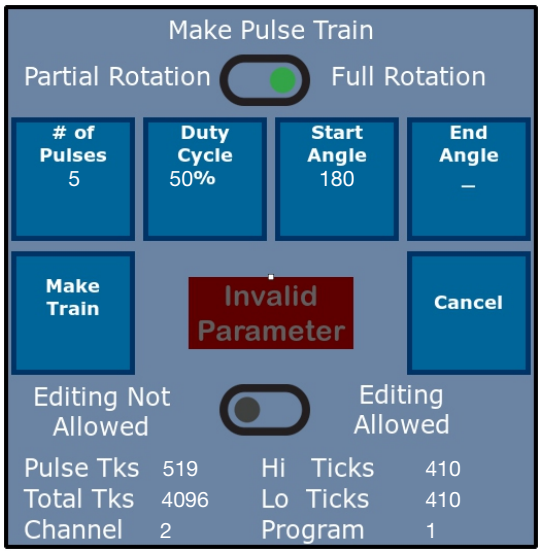
After setting the above options, press one of the white arrows in center of the screen to either increment or decrement the pulse edge(s).

SETTING A CHANNEL TO ALWAYS ON

You can set a channel to be on all the time by setting the On edge to "1" and the Off edge to "1". One application of this is for use as a motion detector. See Motion ANDing for details.

Setpoints (cont'd)

The 'Make Train' button can be used to easily make a pulse train containing multiple, evenly spaced pulses.



To make a Pulse Train:

- Select Either Partial Rotation or Full Rotation.
- Enter the Start Angle and End Angle of the Pulses.
  Note: End Angle is not used if Full Rotation is selected.
- Enter the number of desired pulses and Duty Cycle. Duty Cycle is defined as the percentage of the pulse width that the pulse is on.
- Press Make Train to create the custom pulse train.

Selecting 'Editing Not Allowed' will make the created pulses unchangeable after creating the pulse train.

Pulse Tks = Total length of one pulse.
Total Tks = Total length of all pulses to be created.
Hi Ticks = Total length that one pulse is on.
Lo Ticks = Total length that one pulse is off.
One revolution is 4096 ticks. This is independent of scale factor.

Software Version

Accessed via: SETUP

The software revision that your controller is operating on is located in the bottom left corner of the Setup screen.

The serial number is also located here.

Speed Compensation

Accessed via: CHANNELS

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.

Depending on the users needs, values for leading and trailing speed compensation can either be adjusted individually or be automatically set to the same value.

Speed Compensation Units
Speed compensation is programmed by entering the response time of the output device in milliseconds. (millisecond = 0.001 second). The output will always turn on this number of milliseconds before the programmed ON position is reached and turn off this number of milliseconds before the OFF position is reached. As speed increases, the number of degrees of advance will automatically increase to maintain the number of milliseconds of advance.

Programming
Speed compensation values are programmed in the Channels screen. Simply tap "Leading Comp" or "Trailing Comp" and enter the desired amount of speed compensation in milliseconds.

Negative Speed Compensation
Negative values of speed compensation cause an output channel to lag its programmed machine position by the specified number of milliseconds. See Section 4 for details on applying negative speed compensation.

Timed Outputs

Accessed via: CHANNELS

Any output 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 on one millisecond increments up to a maximum of 9999 milliseconds (9.999 seconds).

Pulse Required
A timed output must be programmed with ON and OFF position setpoints in order for output timing to take effect. It cannot be configured as a simple timer.

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

Programming
To program a timed output, navigate to the Channel screen. Select the channel that you want to put the timed output in by tapping the up or down arrows to the right of Channel. You can now tap the box marked “Time Value” and enter the timed output value in milliseconds.

Note: Programming more than 16 channels with timed outputs may result in reduced performance.

Introduction To Speed Compensation

What Is It?

"Speed compensation" refers to the ability of the PS-8000 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-8000 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-8000, 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: @ 1000 RPM, the transducer will rotate 0.6°/msec
@ 1000 RPM, the transducer will rotate 6.0°/msec

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

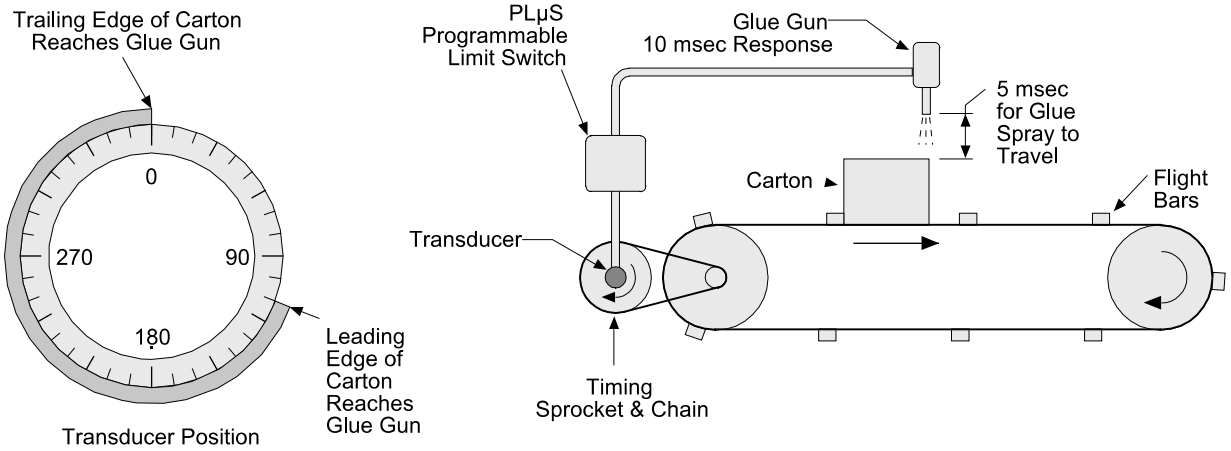
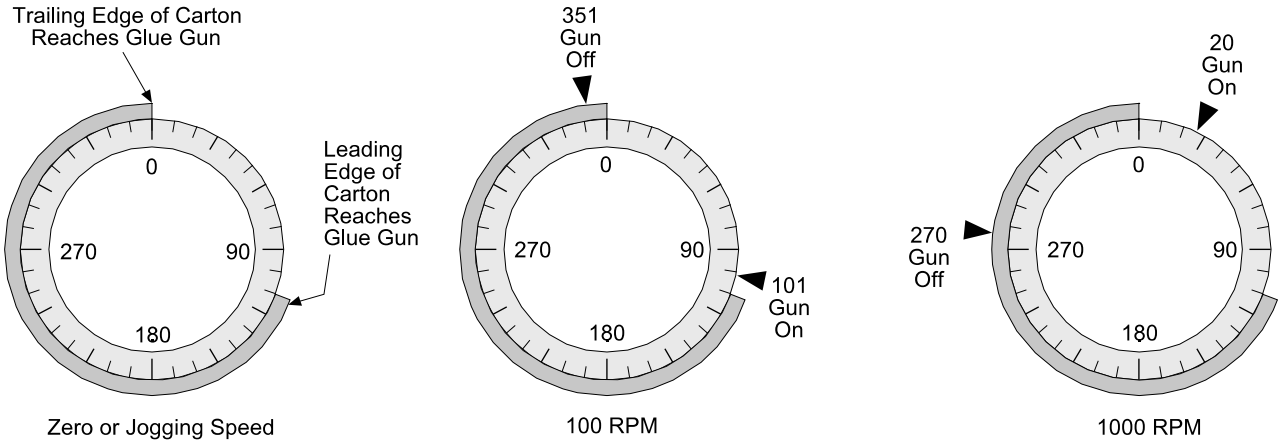


Figure 23—Speed Compensation at Various Speeds



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-8000 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.

(continued)

Standard Speed Comp (cont'd)

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.

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-8000 controllers 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 in the "Leading Comp" box, and the trailing edge, or OFF response time in "Trailing Comp".

⚠ 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 via the Channels screen. The leading edge, or "Leading Comp" value will control the ON timing, while the trailing edge, or "Trailing Comp" 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 tine the SPEED COMP values if neccessary.

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 shaft sensor position, thus maintaining output accuracy.

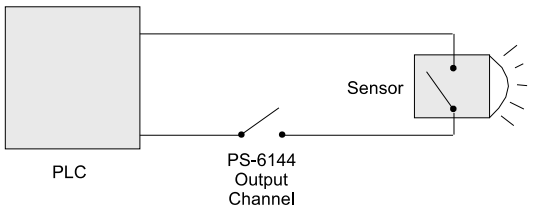
Sensor Lag

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 shaft sensor so much that its signal fails to appear during the window programmed into the PS-8000'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.

Figure 26—Simple Sensor Gating Scheme



Speed Comp Guidelines

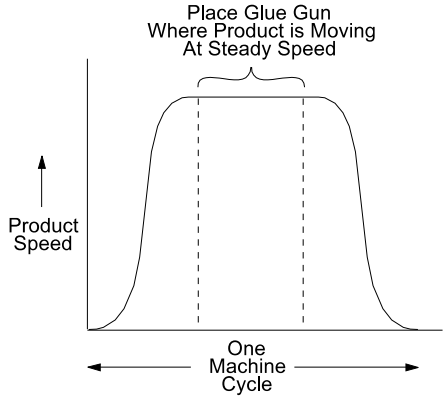
Device Placement

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 realationship between the setpoints, the Group Input signal, and the values programmed into the Group Window. **Speed compensation will not affect Group Windows.**

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-8000 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 TB3, 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-8000 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 shaft sensor 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-8000 output channels are divided into groups through OUTPUT GROUP programming. Each group is automatically associated with one of the input terminals on TB3, Figure 7, as well as a special "Group Window". The Group Windows are programmable through the Group Screen. The relationship between groups and input terminals is summarized in Fig. 28.

Figure 28—Groups, Input Terminals, & Group Channels

Output Group	Group Input Terminal TB 3, Fig. 7
1	G1
2	G2
3	G3
4	G4
5	G5
6	G6

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

- Output channels are can be assigned to any group. They do not need to be sequential. You may not assign a channel to more than one group.
- You can establish as many as six groups or as few as one.
- More than one group can be assigned to the same mode.
- There can be only one pulse in the group window for each group. There can be a different pulse for each group window in each program.

Grouping Example 1—All Outputs in One Group

Output Group	Includes Output Channels	Group Input Terminal TB 3, Fig. 7	Mode
1	1 thru 32	G1	0

Grouping Example 2—Two Groups

Output Group	Includes Output Channels	Group Input Terminal TB 3, Fig. 7	Mode
1	1 thru 4	G1	2
2	5 thru 32	G2	0

Grouping Example 3—Three Groups

Output Group	Includes Output Channels	Group Input Terminal TB 3, Fig. 7	Mode
1	1 & 2	G1	0
2	3 & 4	G2	4
3	5 thru 32	G3	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 window. Detailed discussions of each operating mode follow.

Mode 0 - Straight Cam Logic

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.

Mode 0 Programming

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

Mode 1 - Reset to Preset Position

Description

Outputs in a group assigned to Mode 1 are always enabled to turn on at their programmed setpoints. However, when the corresponding input terminal is energized, the machine position for the group immediately resets to the "Preset" value programmed into the Preset Angle in the Group Setup screen. Once the position is reset, the input terminal will have no effect until it is turned off and the shaft sensor reaches the leading edge of a pulse programmed into the corresponding group window.
See Figure 28 for input terminal and group channel assignments.

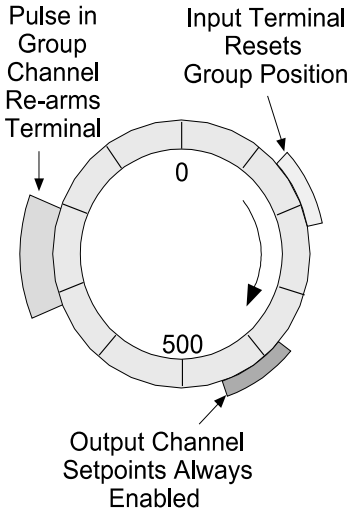
Applications

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 window re-arms the terminal.
- When the position of a group resets, the position of the corresponding group window 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 window can re-arm the input terminal. If the shaft sensor 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.

Mode 1 Typical Setup



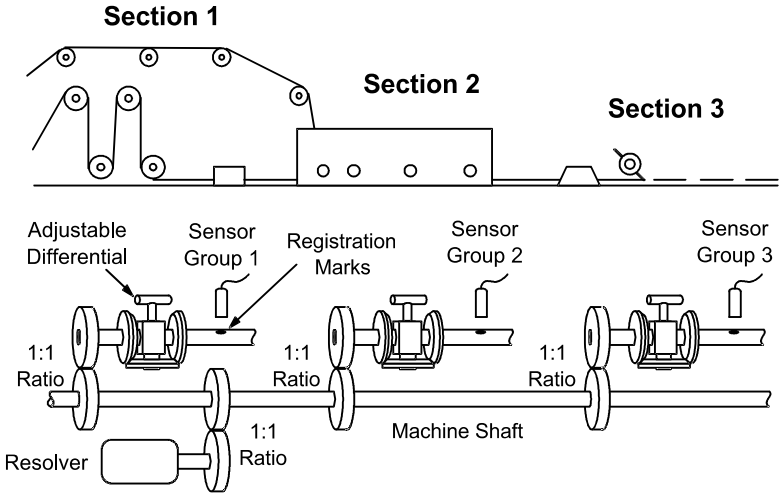
- Each program in the controller can have different setpoints for output channels and the corresponding group window.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a Mode 1 group.

(continued)

Figure 29—Mode 1 Example Application

Three sections of an adjustable phase converting machine are controlled by a single PLuS controller and shaft sensor. 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 shaft sensor provides the position information needed for all sections of the machine, regardless of their phase relationship.



Mode 1 Programming

See Figure 28 for input terminal and group channel assignments.

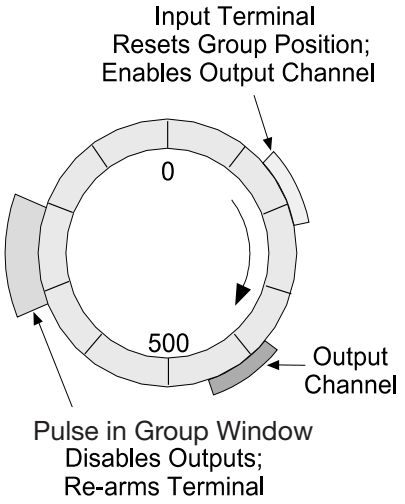
1. Use Channel and Group Setup screens to establish groups and modes.
2. Program the "Preset" value for each Mode 1 group using the Preset Angle in the Group Setup screen.
3. Jog the machine to the point where the group input terminal will energize. Using this point as a reference, program setpoints into the output channels in the group.
4. Program a pulse in the group channel to re-arm the input terminal.

Mode 2 - Reset to Preset with One Cycle Enable

Description

Outputs in a Mode 2 group are disabled until the corresponding input terminal is energized. The outputs are then enabled to turn on at their programmed setpoints, and the group position immediately resets to the value programmed in the 'Preset Angle' in the Group Setup screen. The leading edge of a pulse in the corresponding group window 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 window re-arms the terminal.
- When the position of a group resets, the position of the corresponding group window also resets.
- On power-up, outputs are disabled, the input terminal is armed, and the group position is the same value as the machine position.

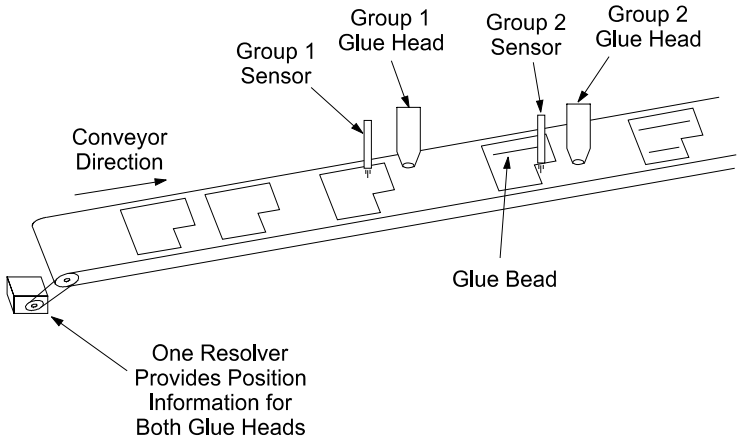
- Either edge of a pulse in the group channel can re-arm the input terminal. If the shaft sensor shaft is rotating in the forward direction (position is increasing as shaft rotates) the "on" edge of the pulse will re-arm the terminal. If the shaft is rotating in the reverse direction (position decreasing 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 window.
- MOTION ANDING and OUTPUT ENABLE ANDING can be used with outputs in a Mode 2 group.

Figure 30—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.



Mode 2 Programming

See Figure 28 for input terminal and group channel assignments.

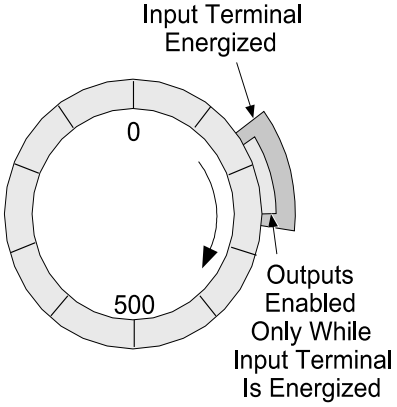
1. Program OUTPUT GROUPS to establish groups and modes.
2. Use Preset Angle in the Group Setup Screen to program the "Preset" value for any Mode 2 groups.
3. Jog the machine to the point where the group input terminal will energize. Using this point as a reference, program setpoints into the output channels in the group.
4. Program a pulse in the group window 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 - Outputs Gated by Group Inputs

Description

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

(continued)

Mode 3 (Cont'd)

Mode 3 Programming

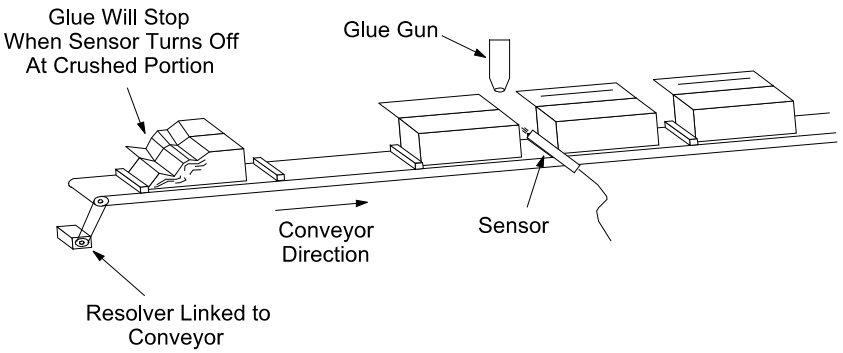
See Figure 28 for input terminal assignments.

1. Program OUTPUT GROUPS to establish groups and modes.
2. 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 31—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 hardwire photoeyes and other sensors in series with the corresponding controller outputs. Instead, the sensor is "ANDed" with the output through Mode 3 programming.



Mode 4 - One Cycle Enable with Edge-Triggered Input

Description

For a group in Mode 4, outputs will be enabled to turn on at their programmed setpoints for one machine cycle if the corresponding input terminal turns on within a pulse programmed into the group channel. Outputs will be disabled at the start of the next pulse in the group window. See Figure 28 for input terminal and group channel assignments.

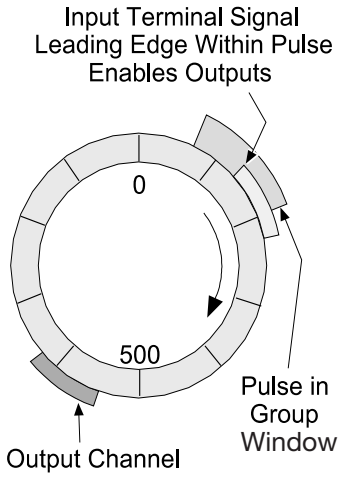
Applications

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 window. 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 window.
- Either edge of a pulse in the group window can disable the outputs. If the shaft sensor 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.

Mode 4 Typical Setup



Mode 4 (Cont'd)

Mode 4 Programming

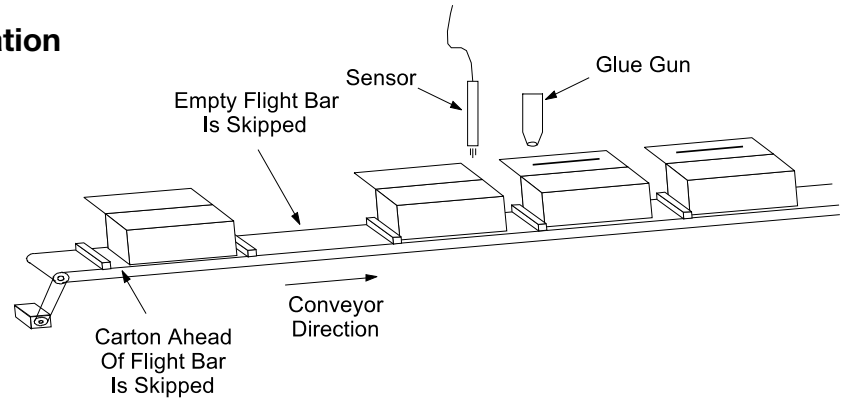
See Figure 28 for input terminal and group channel assignments.

1. Use the Outputs Group screen to establish groups and modes.
2. Jog the machine to the point where the group input terminal will energize. Program a pulse in the group window 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.
3. Program setpoints into the output channels in the group. Remember that the leading edge of the pulse in the group window will disable the output channels in the group.

Figure 32—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 window. 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.



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

Description

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

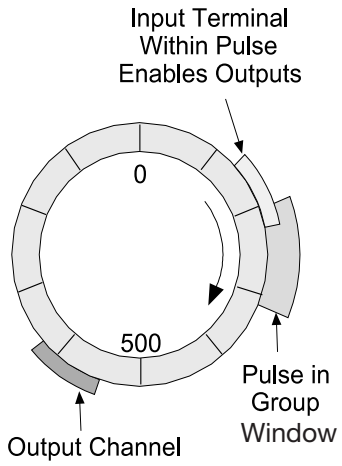
- In Mode 4, the **leading edge** of the input terminal signal must occur within the pulse programmed into the group window.

  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 TB3, 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.

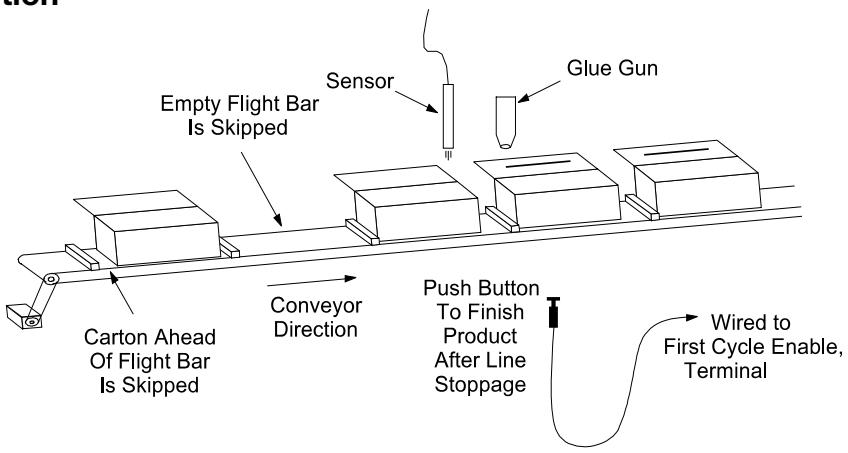
- Regardless of its programmed "off" point, the pulse in the group window will end as soon as any of the outputs in the group turn on.
- Each program in the controller can have different setpoints for output channels and the corresponding group window.
- MOTION ANDING and OUTPUT ENABLE ANDING can be 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.

Figure 33—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."

Note: Sensor must be active after stopping.



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.

Backup and Restoration of Settings in the PS-8000 Controller

Backup and restoration of settings with the 8000 controller is easy. Simply insert a USB drive into the controller's USB slot located in the upper right on the backside. In the Setup menu, press the Advanced Settings button. In that screen you will see a button marked USB. Pressing this button brings up a screen where you can backup or restore your controller's settings. It should show that the USB is ready and currently idle. The controller's setpoints and configuration is stored in a .csv (comma sperated value) file.

Backup

Simply press the Write Configuration button. The display will change to show Configuration Saved. All the controller programming is now backed up to the USB drive.

Note: The filename is not changeable.

Restoration

Simply press the Read Configuration button. The display will change to show Configuration Read and display a line number. The actual value here is not critical and will vary depending on how the controller is programmed. Press Save Changes to save the data read from the USB drive to the controller.

Note 1: You must power cycle the controller before the settings will take effect.
Note 2: The filename is not changeable.

Controller Diagnostics

Listing of Controller Faults

You can clear the fault using the 'ACK' button. You may press the 'Fault' button to see which faults have been trigger. You can press the 'Clear All' to acknowledge all faults. Descriptions of individual faults are below.

ADC1 Cal Fail - Analog to Digital Converter #1 Failed Calibration
Contact Factory if fault persists.

ADC3 Cal Fail - Analog to Digital Converter #2 Failed Calibration
Contact Factory if fault persists.

ADC1 Start Fail - Analog to Digital Converter #1 Failed to Start
Contact Factory if fault persists.

ADC3 Start Fail - Analog to Digital Converter #2 Failed to Start
Contact factory if fault persists.

TIM1 Start Fail - Timer #1 Failed to Start
Contact factory if fault persists.

HAL Init Fail - HAL Initialization Failure
Contact factory if fault persists.

ADC Init Fail - Analog to Digital Initialization Failure
Contact factory if fault persists.

Shaft Sensor Sine Signal Too Low - Sine wave voltage for the Hall Effect Sensor is too low.
Shaft sensor may not be calibrated correctly. Re-calibrate sensor in the calibration screen.

Shaft Sensor Sine Signal Too High - Sine wave voltage for the Hall Effect Sensor is too high.
Shaft sensor may not be calibrated correctly. Re-calibrate sensor in the calibration screen.

Shaft Sensor Cosine Signal Too Low - Cosine wave voltage for the Hall Effect Sensor is too low.
Shaft sensor may not be calibrated correctly. Re-calibrate sensor in the calibration screen.

Shaft Sensor Cosine Signal Too High - Cosine wave voltage for the Hall Effect Sensor is too high.
Shaft sensor may not be calibrated correctly. Re-calibrate sensor in the calibration screen.

Output Setpoint Out of Range Error - Output setpoint On/Off settings are out of range.
Number of On/Off setpoint was higher than the set Scale Factor. Either decrease value or adjust Scale Factor.

Group Setpoint Out of Range Error - The Group Window On/Off settings are out of range.
Number of On/Off setpoint was higher than the set Scale Factor. Either decrease value or adjust Scale Factor.

M4 Program Memory CRC Error - M4 Program Memory Checksum does not match last known good value.
Possible memory corruption. Core controller functions may be affected. Contact factory if problem persists.

M7 Program Memory CRC Error - M7 Program Memory Checksum does not match last known good value.
Possible memory corruption. Touchscreen may not work properly. Contact factory if problem persists.

Display Image Memory CRC Error - Display Image Memory Checksum does not match last good known value.
Possible memory corruption. Screens may not display correctly. Contact factory if problem persists.

Configuration Memory CRC Error - Configuration Memory Checksum does not match last good know value.
Possible memory corruption of the user settings. Verify controller configuration settings before operating. Contact factory if problem persists.

Setpoint Memory CRC Error - Setpoint Memory Checksum does not match last good known value.
Possible memory corruption of setpoints. Verify controller setpoints before operating. Contact factory if problem persists.

Hall Effect Sensor Troubleshooting

Whenever the controller or the Hall effect sensor is replaced, calibration of the sensor must be redone. If one of them has been replaced that is likely the cause of the problem. The calibration screen can be found under the Setup screen.

Recalibration is also recommended if the sensor seems to not be displaying the position correctly.

General Troubleshooting

Most of the fuses on the PS-8000 are PTC fuses meaning that if they are tripped they will reset themselves after a short cooling off time. The lone exception to this is the High Power Output Module which does require its own one time use replaceable fuse. See Page 2-21 for fuse placement and replacement part numbers.

If you are not seeing any outputs activating on your output modules, the following steps may help you determine the cause of the problem.

- If using the low power module, check the jumpers and make sure it is wired correctly. Reference Section 2-8 through 2-10 for wiring instructions and jumper settings.
- If using the high power module, check the fuses and make sure it is wired correctly. Reference Section 2-11 through 2-13 for wiring.
- Check to see if the controller thinks it is turning on the output. In the setpoints screen, you can see the status of individual outputs. It will be listed as either 'On' or 'Off'. If the ouput is not turning on and off as expected, make sure your setpoint settings are programmed correctly. Other settings that can keep outputs from turning on even if the position is in between the programmed on/off setpoint are: motion ANDing, output enable ANDing, and timed outputs. The settings for these functions can be viewed in the Channels screen.
- Navigate to the Module screen. Each physically installed module should show a 'Yes' next to it and show the module type (Either Lo PWR or Hi PWR). If a module is installed but the controller is not recognizing it, try reinserting the module while making sure the pins are mating correctly with the module socket. After reinstalling, check the module screen again.

If none of these solve the issue, contact Electro Cam either at 815-389-2620 or at www.electrocam.com.

PS-8000 Controller Specs

Electrical	
Input Power:	10-30 VDC
Input Current:	Less than 550 mA maximum (modules not included)
Power Consumption:	35W
Permanent Memory:	EEPROM (no battery required)
Internal Power Supply to Low Power Modules:	+5VDC, ???A max
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:	Touchscreen Display: NEMA 4?
Physical	
Overall Dimensions:	9.055”W x 6.693”H x 3.547”D
Panel Cutout Size:	7.88” x 5.25”
Weight:	Controller: ??? lbs. High Output Module: ??? lbs. Low Output Module: ??? lbs.
Mounting	
Controller:	(6) 10-32 studs
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 number of setpoints.
Response of All Other Inputs:	1-2 scans
Real World Outputs:	The PS-8000 has 8 sockets for output modules. Any combination of Low or High Power Output modules may be mounted to the controller. The Low Power Output Module has 4 outputs available per module, while the High Power Output Module has 2 outputs per module.
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:	50 µs
Position Resolution:	12 bits (4096 increments)
Speed Compensation:	Programmed in 1.0 ms steps. Updated ten times per second. Separate leading/trailing edge compensation.
Output Timeout:	1.0 ms time base (accuracy: +1, -0 ms)
Number of Timed Outputs:	Max of 16 Total
Multiple Programs:	128 programs standard
Total Pulse Memory:	1258 pulses standard
Pulses per Program:	512 maximum standard
Pulses per Output:	512 maximum standard
Maximum Speed:	3500 RPM

Low Power Output Module Specifications

Internally Supplied Power	
Output Voltage	5 VDC
Output Current	10 mA each, 40 mA total
Input Voltage	5 VDC (supplied by controller)
Turn On Time	??? µS
Turn Off Time	??? µS
Off State Leakage	??? mA
Operating Temp.	-30°C to +70°C (-22°F to +158°F)
Externally Supplied Power	
Output Voltage	0-60 VDC
Output Current	50mA each, 200 mA total
Input Voltage	0-60 VDC
Turn On Time	??? µS
Turn Off Time	??? µS
Off State Leakage	??? mA
Operating Temp.	-30°C to +70°C (-22°F to +158°F)

High Power Output Module Specifications

Output Voltage	350 VAC or 350 VDC
Output Current	4A each
Input Voltage	350 VAC or 350 VDC (user supplied)
Turn On Time	??? µS
Turn Off Time	??? µS
Off State Leakage	??? mA
Operating Temp.	-30°C to +70°C (-22°F to +158°F)

Analog Output Specifications

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)

Hall Effect Sensor Specifications

Operating Temp:	-40° to 125°C (-40° to 257°F)
Storage Temp:	-40° to 125°C (-40° to 257°F)
Operating Humidity:	95% Relative non-condensing
NEMA Rating:	NEMA 4
	NEMA 4X
Maximum RPM:	3500 RPM
Max Cable Length:	1000 feet
Type:	Hall Effect Sensor
Resolution:	12 Bits (4096 increments)
Linearity:	???

Note: Hall effect sensor linearity errors are repeatable at all positions of its 360 degree rotation. Therefore, once appropriate setpoints are established, machine performance is consistent every cycle.

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
Increasing Direction:	CCW
Input ANDing:	OFF
Keyboard Quantity:	1
Motion ANDing:	OFF
Motion Detection:	Lo 10 RPM, Hi 3000 RPM both levels
Offset:	0
Per Channel Enable:	All channels ON
Program Select Mode:	BIN (Binary)
Rate:	1X, RPM
RPM Update:	1/S
Output Enable ANDing:	OFF
Speed Comp:	All channels 0
Toggle RPM:	20 RPM

PLuS 8000 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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