



## INSTALLATION MANUAL

High-Speed Programmable Limit Switch

# 2500

## High-Speed PLS



**ABSOLUTE PROCESS CONTROL  
KNOW WHERE YOU ARE... REGARDLESS**

## Preface

This manual is for the Installation and Maintenance of the Gemco 2500 Programmable Limit Switch.

AMETEK has checked the accuracy of this manual at the time it was printed. Any comments you may have for the improvement of this manual are welcomed.

AMETEK reserves the right to revise and redistribute the entire contents or selected pages of this manual. All rights to the contents of this manual are reserved by AMETEK.



**WARNING:** Caution must be taken when adjusting limit outputs!

Disconnect power before servicing. The Gemco 2500 PLS contains no serviceable components other than relays and fuses. Consult factory for repair or replacement.

## Contents

<b>Chapter 1: Introduction</b> .....	4	<b>Chapter 6: Limit Switch Outputs</b> .....	53
1.1 Mechanical Cams .....	5	6.1 Setpoint Data.....	54
1.2 Description.....	5	<b>Chapter 7: Multiple Program</b> .....	56
1.3 Standard Features.....	7	7.1 Naming A Program .....	57
<b>Chapter 2: Hardware Overview</b> .....	9	7.2 Editing A Program.....	58
2.1 PLS Module .....	9	7.3 Copying A Program.....	59
2.2 Remote Operator Interface.....	11	7.4 Accessing A Program.....	60
2.3 Expansion Modules .....	11	7.5 Initialize Program.....	61
2.4 Resolver Assembly .....	12	<b>Chapter 8: Linear Speed Compensation</b> .....	62
2.5 Status Display/Programming Keys .....	14	8.1 Linear Speed Compensation .....	64
2.6 Dimension Drawings.....	16	8.2 Minimum Speed Disable.....	65
<b>Chapter 3: Mounting and Wiring</b> .....	20	<b>Chapter 9: Time Based Outputs</b> .....	66
3.1 Mechanical Installation .....	20	<b>Chapter 10: Inputs</b> .....	67
3.2 Electrical Installation.....	21	10.1 Input Configuration .....	71
3.3 Wiring Instructions.....	21	10.2 Input Configuration for No Input .....	73
<b>Chapter 4: Programming</b> .....	30	10.3 Input Configuration for Reset to Preset Continuous.....	74
4.1 Main Controller Keypad .....	30	10.4 Input Configuration for Reset to Preset Single.....	75
4.2 Programming Keys Defined.....	31	10.5 Input Configuration for Output Enable One Shot .....	76
4.3 Before You Start .....	32	10.6 Input Configuration for Output Enable Level.....	77
4.4 Menu Tree .....	33	10.7 Enable Brake Input .....	78
4.5 User and Supervisor Mode Access .....	33	<b>Chapter 11: Die Protection Inputs</b> .....	79
<b>Chapter 5: Global Parameters</b> .....	35	11.1 Applications for Die Protection Inputs .....	79
5.1 Quick Start.....	35	11.2 Input Configuration for Die Protect Momentary.....	82
5.2 Initialize System.....	36	11.3 Input Configuration for Die Protect Maintain .....	83
5.3 Expansion Boards .....	37	11.4 Input Configuration for Die Protect Partial.....	84
5.4 Lockout Functions .....	38	<b>Chapter 12: Faults</b> .....	85
5.5 Scale Factor .....	39	<b>Appendix A: Ordering Information</b> .....	89
5.6 Customize Decimal Pt. (Decimal Location).....	40	<b>Appendix B: Specifications</b> .....	90
5.7 Electronic Offset .....	41	B.1: Main Controller Specifications.....	90
5.8 Motion Detect .....	42	B.2: Expansion Module Specifications .....	91
5.9 Enable Brake Input.....	43	B.3: Remote Operator Interface Specifications .....	91
5.10 Brake Monitor .....	43		
5.11 Set Fault Clear Option .....	45		
5.12 Customize Display.....	46		
5.13 Define Title Screen .....	47		
5.14 Label Outputs .....	48		
5.15 Label Inputs.....	49		
5.16 Define User Password.....	50		
5.17 Define Supervisor Password.....	51		
5.18 Software Version .....	52		

## Chapter 1: Introduction

The 2500 PLS is a high speed resolver based Programmable Limit Switch that monitors rotary machine position and provides discrete limit switch outputs. These outputs are updated at a much faster rate than can be accomplished using any conventional PLC.

The single turn resolver is usually coupled to the machine shaft at a 1:1 ratio so that one resolver shaft rotation corresponds to one machine cycle. As the resolver rotates it generates a ratiometric analog signal representing an absolute rotary position. The ratiometric signal is converted to a digital signal at the 2500 PLS. Resolvers have no brushes, contacts, or any frictional parts to wear out.

As the resolver passes through the user programmed dwell settings, the 2500 PLS turns electrical switches, known as outputs, on and off. Outputs can energize solenoids, relays, or solid-state circuitry to control external devices. Because the 2500 PLS is completely electronic and has no frictional parts, it offers several advantages over mechanical cam switches:

- Long life with no parts to wear out.
- Easy to use menu driven displays.
- Setpoints can be adjusted instantly from the controller.
- Adjustments can be made while the machine is running.
- Programmable inputs allow for complex output functions that are impossible with mechanical cams.
- Operating speeds up to 2,000 RPM.



## 1.1 Mechanical Cams

The 2500 Programmable Limit Switch electronically simulates mechanical cam switches. A mechanical cam consists of a mechanical limit switch and a roller follower whose roller follower rides on the cam assembly as shown in Figure 1. The camshaft is driven by the machine at a 1:1 ratio so that the cam limit switch turns ON and OFF at specific positions in the machine cycle. Cam limit switches have the following disadvantages:

- The roller follower and limit switches wear out.
- The machine must be stopped during adjustment.
- On/off patterns are limited to typically one on and one off per cam. Multiple on and off points require custom cams.
- The mechanical cam switches are typically not installed in an easily accessible location.
- They cannot run at high speeds because of contact bounce and mechanical wear.

## 1.2 Description

The 2500 is a family of PLS's that offer unparalleled flexibility. The main controller is a resolver-based controller that consists of 8 input and 8 output relays, one fault check output relay and one optional brake monitor input relay.

The optional expansion module will provide 8 additional inputs and outputs per module. Up to 7 expansion modules can be driven by the controller for a total of 64 inputs and 64 outputs.

The 2500 PLS uses a unique, easy to understand programming sequence. The traditional number buttons have been

replaced with a rotary knob and the main controller has a 2x24 vacuum fluorescent display along with 4 pushbutton keys for programming.

The keys have been defined as MENU,  $\leftrightarrow$  and  $\leftarrow$ . The rotary knob scrolls you easily through the menu drive alphanumeric display. On-line help screens have been added to aid in the setup and troubleshooting of the unit.

System parameters are entered through a scrolling menu, which is accessed through the main display. The rotary knob is used to scroll through the selections and the  $\leftarrow$  key is used to select the menu item. The user can view any system value without entering a password. However, if the user wants to change a value, a password is required.

All the parameters are password protected. Once the password is entered, the user will be allowed to edit any value as long as the user does not return to the main display and the program input is in the correct state.

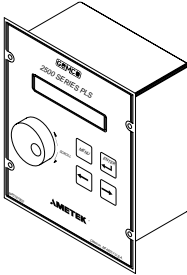
System data such as position, RPM, and brake monitor status will be shown on the main display. This data can be toggled through using the rotary knob.



Figure 1-1:  
1980 Rotating Cam Limit Switch

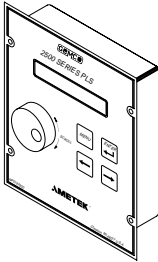
## 2500 PLS configurations include:

### 2500 Stand Alone Main Controller



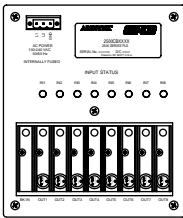
- 8 Isolated DC Inputs and 8 Solid-State AC or DC Outputs, Expandable to 64 (in groups of 8) using 2500E Expansion Modules
- Rotary Knob with Simple, Menu Driven Programming and Help Menus
- Brake Monitor
- 2 x 24 Vacuum Fluorescent Display
- Panel Mountable

### 2500R Remote Operator Interface



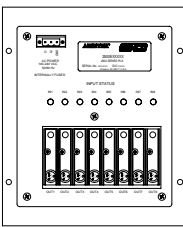
- Keypad only, used with 2500C Blind Main Controller Units
- 2 x 24 Vacuum Fluorescent Display
- Panel Mountable, up to 25 feet from Main Controller
- Simple RJ45 Connections to Main Controller
- Rotary Knob, with Scrolling, Menu Driven Programming

### 2500C Blind Main Controller Units



- 8 Isolated DC Inputs and 8 Solid-State AC or DC Outputs, Expandable to 64 (in groups of 8) using 2500E Expansion Modules
- Brake Monitor
- Panel or DIN Rail Mountable

### 2500E Expansion Modules



- 8 Isolated DC Inputs and 8 Solid-State AC or DC Outputs
- Panel or DIN Rail Mountable
- Up to 7 Expansion Modules can be Driven From the Main Controller
- Simple Depluggable Connections

## 1.3 Standard Features

### Scale Factor

The Scale Factor is the number of increments that the PLS counts through over one rotation of the resolver. For example, a PLS with a Scale Factor of 360 will count from 0 to 359 over one revolution.

### Offset

The Offset feature is used to electronically synchronize the PLS displayed position with the actual machine position. Valid values are 0 to (one less than the programmed Scale Factor).

### Supervisor Menu

Two levels of programming access are provided: User and Supervisor. In the Supervisor Menu, display screens can be customized and outputs and functions can be locked out. Each level can be assigned a password that must be entered to program the locked out functions. This can provide key personnel the flexibility they need while protecting settings against accidental or unauthorized changes.

### Onboard Help

Onboard Help is available from the 2500 PLS 2x24 alphanumeric vacuum fluorescent display. Each programming screen has easy to follow English programming screens.

### Multi-program

The Multi-program feature allows the storage of multiple sets of output sequences that are pre-programmed based on various requirements of different jobs. When jobs are changed, the new program is simply called up from the Interface or remote inputs and all outputs

and inputs are automatically set to the new output sequences. The 2500 PLS is capable of storing 15 different programs.

### Program Name

The Program Name feature allows the user to assign a name to each program.

### Program Copy

The Program Copy feature copies all parameters from one program to another. This is useful when inputting data from one program to another where only minor changes are needed.

### Brake Monitor

The Brake Monitor checks the stopping time of the machine against a selected preset stopping time in milliseconds. A user defined output remains energized when the stop time parameters are within tolerance. An excessive stop time will cause the relay to de-energize, which could be used to stop further machine operation.

### Motion Detector

A programmable Motion Detector output will energize a user selected relay when the transducer speed meets or exceeds the user programmed RPM value.

### Fault Check

The 2500 PLS offers an on-line Fault Check which provides an automatic, in-process mechanism to verify that all major programmable limit switch functions are operating properly. The fault check output can be energized by activating the fault check enable input. The output is a mechanical relay, which remains energized during normal operation.

## Input

Each Input can be configured as either a reset to preset input, an output configuration enable input, or a die protection input.

## Output Enabler

The output enable input will enable the setpoints for one revolution when the input is activated in a programmed window. The user can program the window.

## Reset to Preset

The Reset to Preset feature allows the user to reset a pre-defined output to any preprogrammed position. This feature can be used to compensate for mechanical slippage. NOTE: Each output has its own independent reset input.

## Reset Single Shot

The Reset Single Shot feature allows the user to reset a pre-defined output to any pre-programmed position. However, with this feature the output associated with this input waits for the input signal before it allows the output to fire. Once the input is made, the output will only fire one time and wait for the next input signal.

## Die Protection

Die Protection is used in stamping applications where it is necessary to monitor a part as it is progressing through the die. If the part is not detected in the location, an output will signal the press to stop.

## Output Enable

Output Enable is used in conjunction with an input. If the input is not seen within a programmed range, the output associated with that input will not fire. Output enables are typically used in gluing applications where if a product is not present, the gluing output does not fire.

## Setpoint Data

There are up to eight setpoint pairs available per revolution for each output. The user can add, delete, or change a setpoint in the list. Valid setpoints range from 0 to a value (one less than the current scale factor). For example, if the scale factor is set at 1000, then valid setpoint values range from 0 to 999.

## Timed Outputs

Time Based outputs are programmed like standard outputs to turn on at a specific resolver position and stay on for a programmable amount of time.

## Minimum Speed

The Minimum Speed Disable will disable the selected outputs when the Disable actual RPM falls below the minimum speed programmed by the user. Valid minimum speed values range from 0 to 2048. A value of zero will disable this feature. The default value is zero.

## Linear Speed

Linear Speed Compensation allows for setpoints to be adjusted to compensate for mechanical lag at higher speeds. Each output can be programmed with its own adjusted values. The user will program an on offset and an off offset and the RPM that is associated with that offset. The unit will linearize the offset values and adjust the setpoints for that output based on the actual RPM value.

## Software Version

The software version can be viewed through the Software Version menu item. The version number will follow our standard numbering system with two digits before the decimal indicating major releases and the two digits after the decimal indicating minor releases.



## Chapter 2: Hardware Overview

This section contains mechanical and electrical information on the 2500 PLS main controller, expansion modules, remote operator interface, and resolver assembly. For specifications, see Appendix B.

### 2.1 PLS Module

The 2500 PLS module is an electronic assembly that can be configured many different ways. The three main parts are described in Chapter 1. The following are features found on the module:

- A rotary knob replaces the standard number buttons. As the knob is rotated, it helps guide you through the programming process. Convenient help screens guide you through the entire programming process.
- A 2 line x 24 character vacuum fluorescent display indicates all PLS functions.
- Eight depluggable solid-state output relays are located on the back of the controller. Each output has its own input located on the opposite side of the controller.
- An optional depluggable Brake monitor input relay is located on the back of the controller. This input can be used to determine stopping time of the machine.
- The auxiliary communication port currently supports Modbus ASCII protocol.
- Resolver input terminals allow connection to a Gemco resolver or compatible equipment.
- Expansion ports allow for further relay expansion. The main controller is capable of driving 64 outputs and inputs.
- Fault check. A mechanical relay output is held closed as long as the PLS is working properly. If the PLS resolver circuitry or microprocessor fails, the relay will open.
- Universal input power. The 2500 PLS can operate over a wide input range, 100 - 240 VAC, 50/60 Hz.

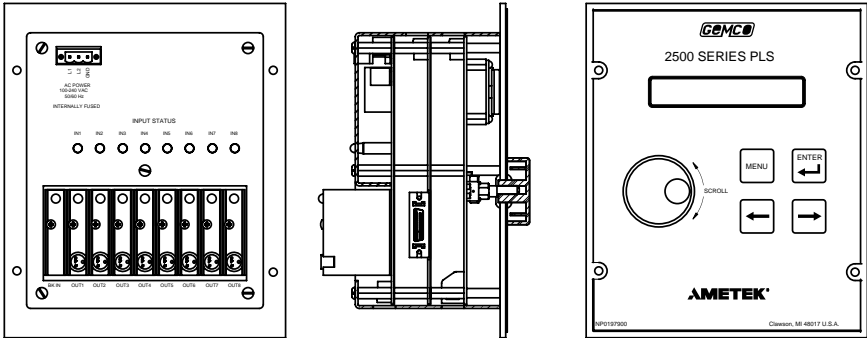


Figure 2-1: 2500CF Main Controller

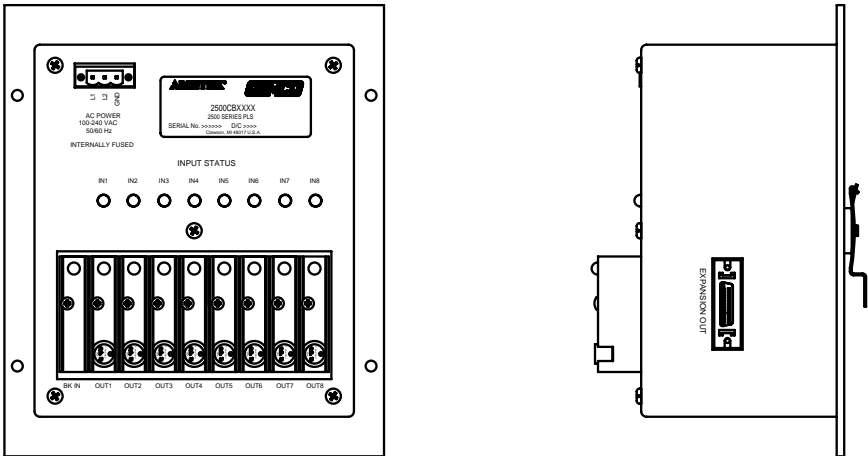


Figure 2-2: 2500CB Blind Main Controller

## 2.2 Remote Operator Interface

The Remote Operator Interface connects to the main controller through an 8-pin Ethernet cable commonly known as an RJ45. Full duplex RS-485 is used to communicate to the main controller. The remote operator interface is made up of a 2x24 vacuum fluorescent display, along

with four pushbutton keys and a rotary knob for programming. The keys have been defined as MENU, ←, → and ↵. The 2500R Remote Operator Interface can be used with the 2500CB main controller unit. This allows a means of mounting the main controller unit remotely.

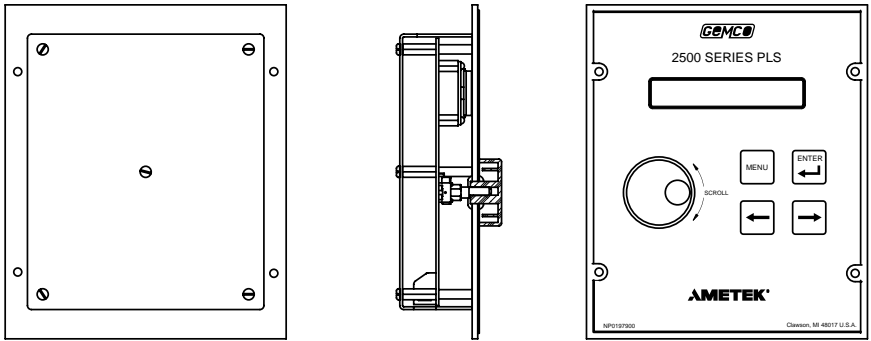


Figure 2-3: 2500R Remote Operator Interface

## 2.3 Expansion Modules

The standard 2500 PLS is supplied with 8 inputs and 8 outputs. The system is expandable to 64 inputs and 64 outputs by adding the 2500E Expansion Module. Each expansion module consists of 8 output modules and 8 inputs. These solid-state outputs are an optically isolated barrier between the PLS and the field devices they control. These output modules are also pluggable and either AC or DC relays can be used.

- Panel mount or DIN rail mountable.
- Plug and play cable design.
- Pluggable output relays.
- No increase in update time regardless of number of Expansion Modules.
- LED's are located next to each input and output. These LED's specify the state of each input and output.

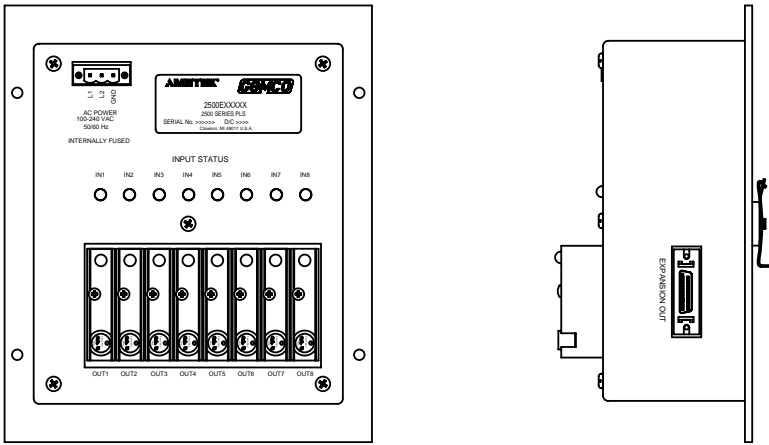


Figure 2-4: 2500E Expansion Module

## 2.4 Resolver Assembly

The resolver assembly consists of a highly accurate and repeatable brushless resolver, housed in an industrial-grade enclosure. Rotary shaft position is calculated from two analog signals that vary as a function of the angular rotation of the input shaft.

The resolver works on the same principle as a rotary transformer to couple power into the rotor. The resolver consists of a two-phase stator and a single-phase rotor. Each stator is positioned 90° apart from each other. The two stators continually provide two different output voltages. Using these two outputs, the PLS performs a ratiometric conversion which factors out electro-magnetic

interference (EMI) and provides an absolute position. See Figure 2-5. This results in a highly accurate and repeatable unit with excellent reliability and infinite resolution.

The resolver assembly is contained in a rugged NEMA 4 enclosure with a plug-in connector. The input shaft is a 3/4 inch diameter and is made of stainless steel. It is mounted in sealed ball bearings with a radial load rating of 150 lbs. This results in the most rugged duty transducer available for industrial applications. The operating temperature range is -40° C to 125° C. See Figure 2-7 or 2-8 for the resolver dimensions.

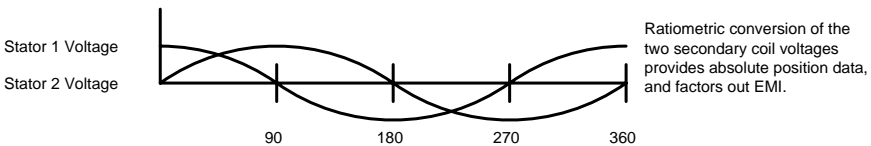


Figure 2-5: Voltages of Stator Coils



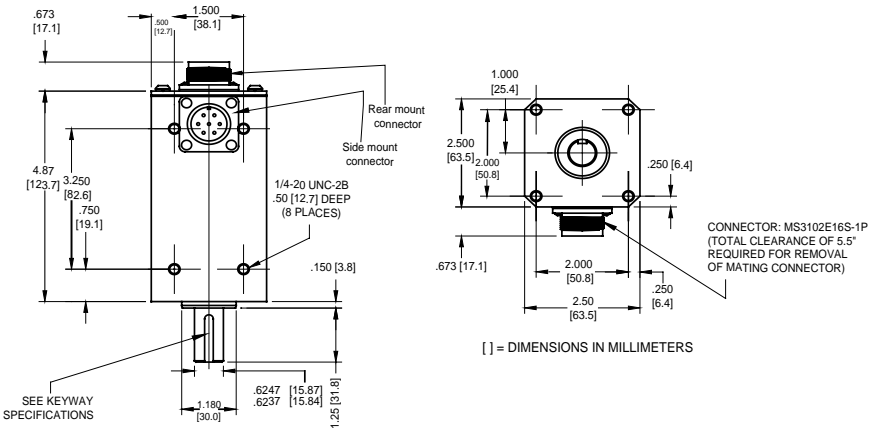


Figure 2-8: 1986 "F" Style Brushless Resolver

## 2.5 Status Display/Programming Keys

The 2500 PLS has a 2 line by 24 character vacuum fluorescent display (VFD), four programming buttons and a rotary knob. The VFD provides

programming and status information. The programming keys and rotary knob are used to program functions and perform basic operations.

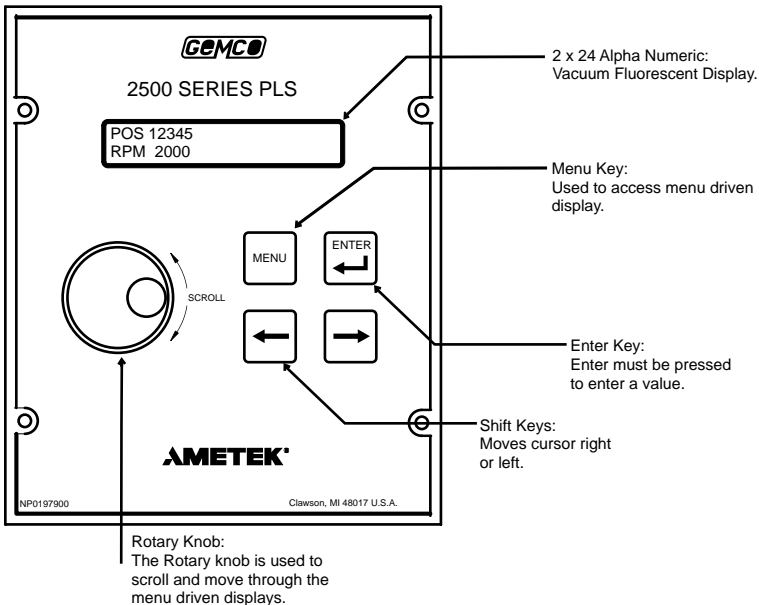


Figure 2-9: Main Controller (Front View)

The scrolling menu is accessed through the main display by pressing the MENU button. The rotary knob is used to scroll through the selections and the ← key is used to select the menu item.

Any system value can be viewed without entering a password. However, if the user wants to change a value he must enter a password into the system. All the parameters are password protected.

Once the password is entered, the user will be allowed to edit any value as long as the user does not return to the main display and the program input is in the correct state. On-board help is offered for each menu item.

System data such as position, RPM, and brake monitor status will be shown on the main display.

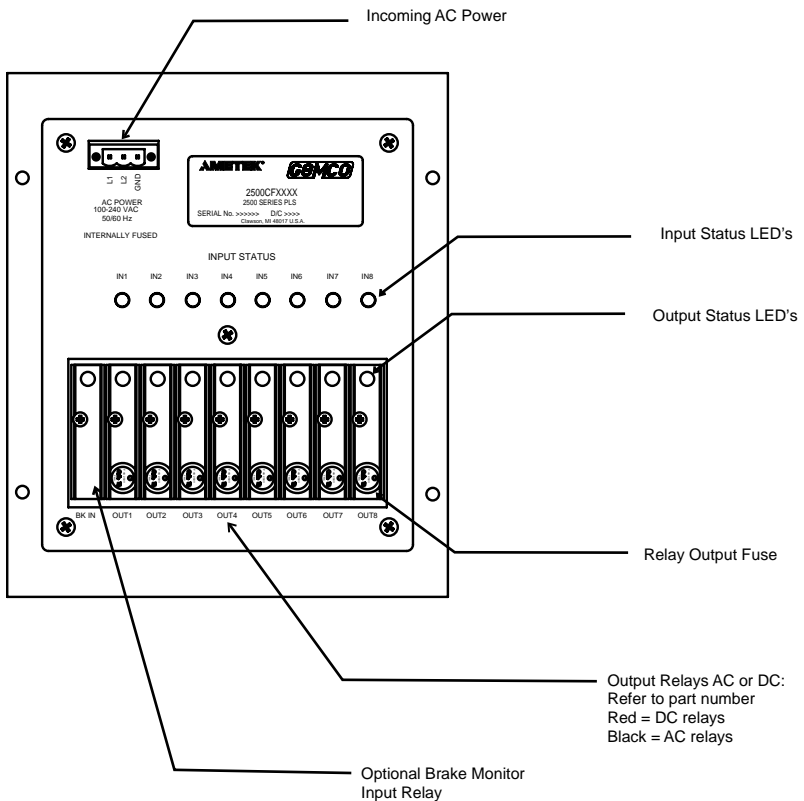


Figure 2-10: Main Controller (Rear View)

## 2.6 Dimension Drawings

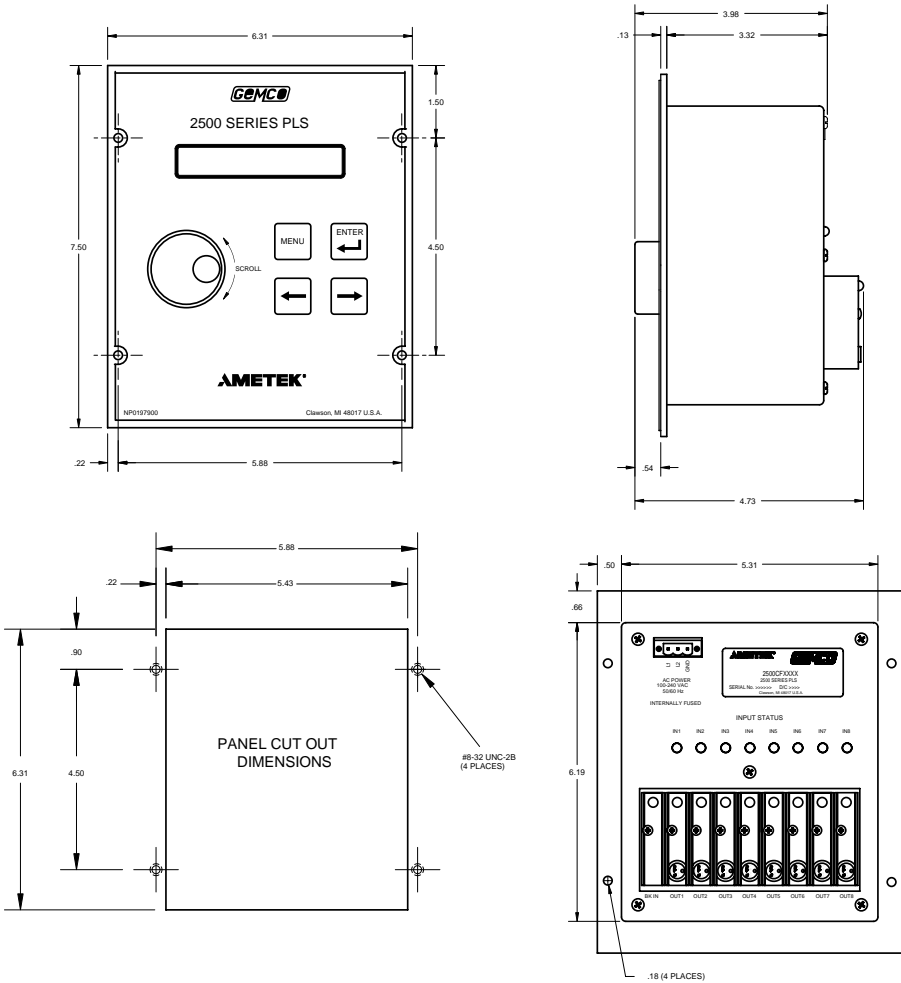


Figure 2-11: 2500CF Main Controller Dimensions



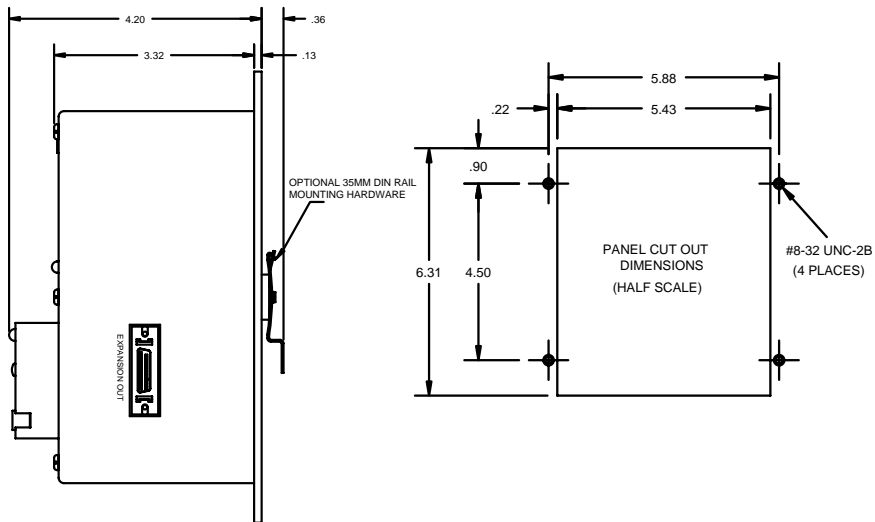
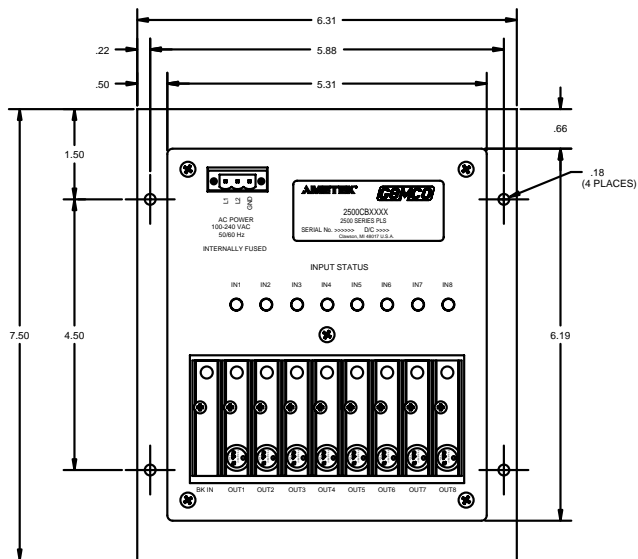


Figure 2-12: 2500CB Blind Main Controller Dimensions

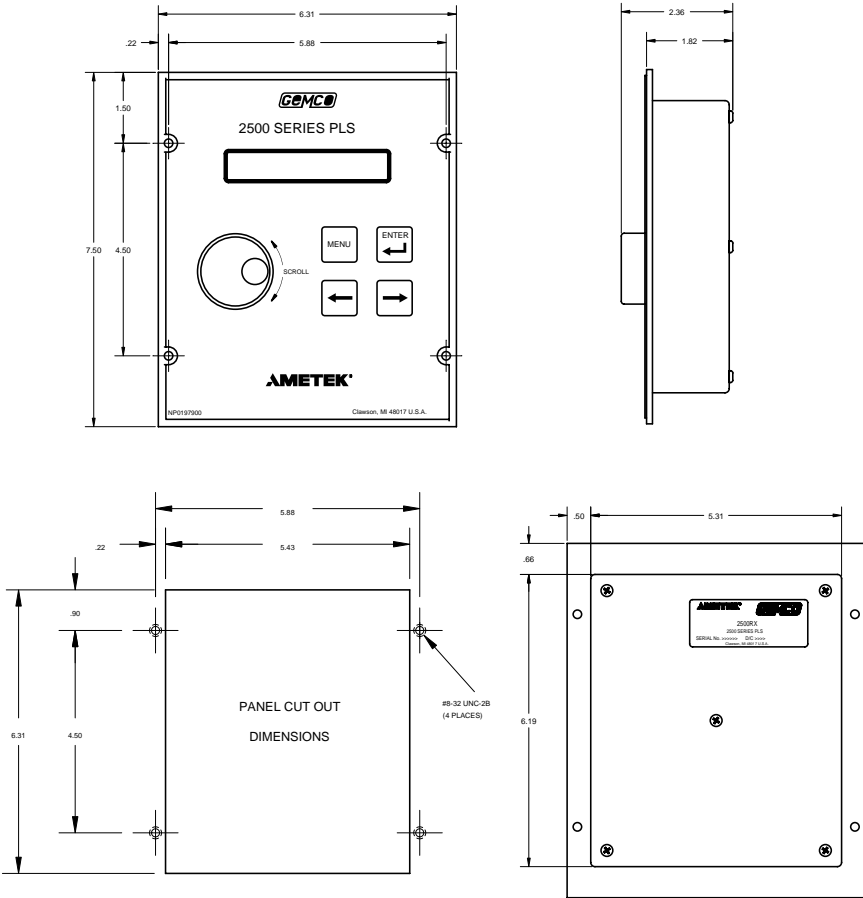


Figure 2-13: 2500R Remote Operator Interface

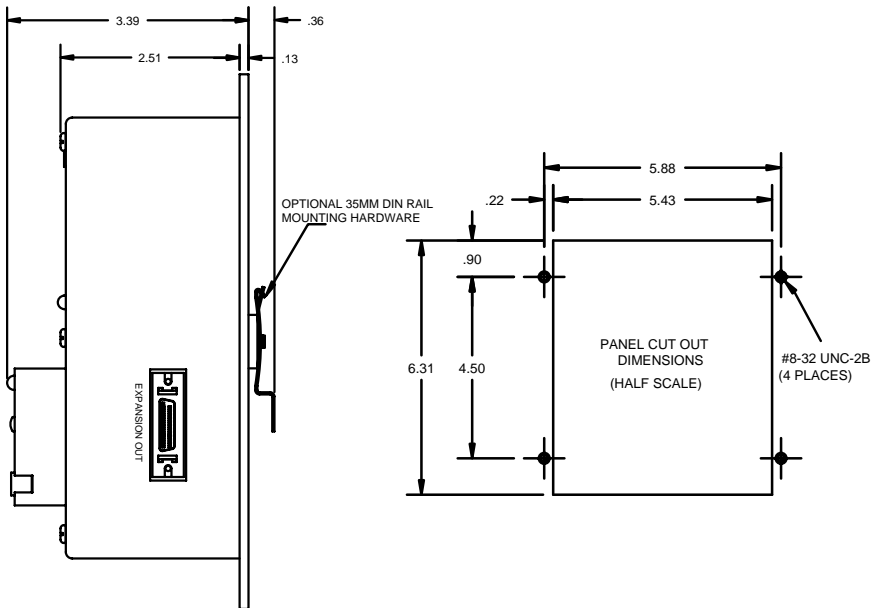
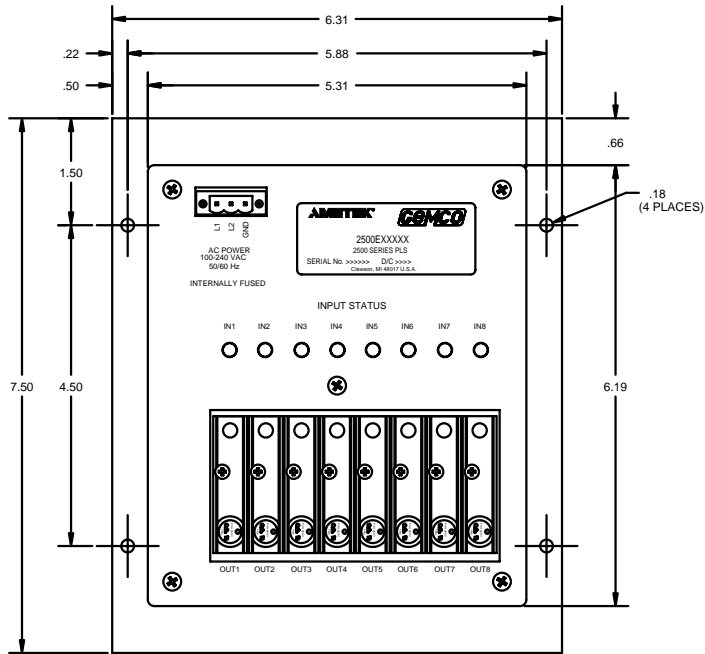


Figure 2-14: 2500E Expansion Module

## Chapter 3: Mounting and Wiring

This section describes the installation and wiring of the 2500 PLS family. Changes to these instructions should be made as necessary if special options and/or equipment are used.

The 2500 PLS should be installed in an area free of water spray, corrosive gases, flying chips or other foreign matter. The operating temperature should be between 32 and 125 degrees Fahrenheit, with less than 95% relative humidity.

### 3.1 Mechanical Installation

#### Mounting the 2500 PLS

The 2500 PLS is designed to be panel or DIN-rail mounted. The face of the 2500 can be affected by water and/or oil spray. Provisions should be made to

protect the face of the unit from spraying or splashing.

Panel cutouts, mounting holes and sizes for each component are shown in Chapter 2.

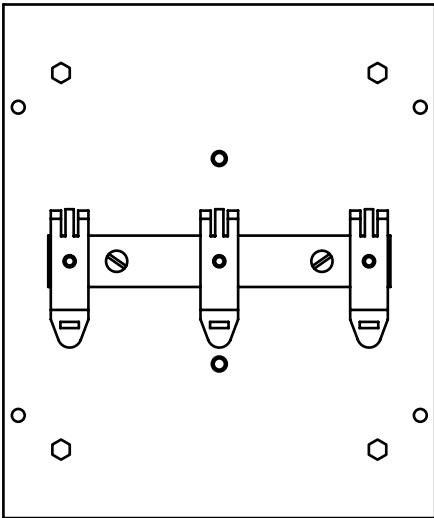
The controller should be mounted in the appropriate panel cutout and securely bolted into place using the four (4) 3/6" diameter mounting holes. A DIN-rail mounting kit is supplied with all blind main controller units and expansion modules for an optional means of mounting. See Fig. 3-1.

**NOTE:** In instances where the 2500 is being mounted directly on high vibration machinery, care should be taken to isolate the controller from shock load and vibration.

It is always good design practice to mount the controller in the enclosure as far away from the motor starters and control relays as possible to minimize the effects of electromagnetic interference (EMI).

Interconnecting wiring should also be routed to minimize EMI coupling.

To attach DIN-rail to the Expansion Module or Blind Main Controller unit, place the two supplied 8-32 x 5/8" lg. screws through the DIN-rail bracket and firmly attach to aluminum plate.



## Mounting the Resolver

The proper mounting of the resolver is critical to ensure the system's accuracy. There are many resolvers available. See our full line 1986 Reslover Catalog.

- A. Standard foot mounted resolvers.  
The foot mount resolver should be mounted in an area free of excessive shock and vibration. The resolver should be connected in a 1:1 ratio with the machine.
- B. Combination mechanical cam/resolver systems. Intended as bolt-in replacements to existing switches. The cam/resolver combination unit should be coupled where the existing limit switch is located. Wire and adjust the mechanical cams in accordance with the original manufacturer's specifications and wire the resolver cable to the controller.

**NOTE:** The 2500 programmable limits are not control reliable for the clutch/brake circuits. Mechanical cam limits must be used for these circuits.

## 3.2 Electrical Installation

The 2500 PLS is designed for use in an industrial environment and incorporates extensive transient suppression circuitry. However, the same general installation rules should be followed that are used on all microprocessor-based equipment.

Incoming AC lines should be from a clean power source and lines carrying computer level signals should not be routed in the same conduit as high voltage, transient-producing circuits such

as variable speed drives, welders or DC switching circuits.

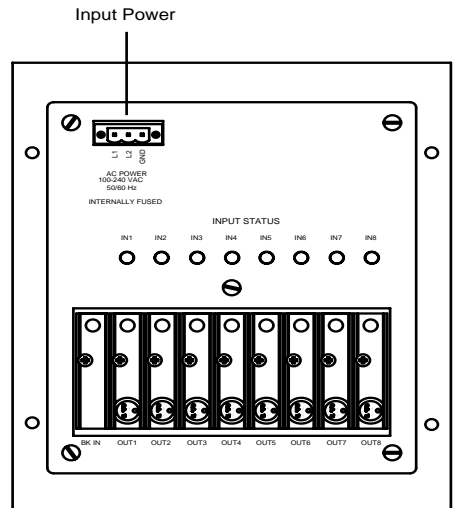
The 2500 PLS is only used with a single-turn resolver. Wiring for this system is shown in Figures 3-1 through 3-9. These wiring diagrams are applicable for all standard 2500 PLS's.

## 3.3 Wiring Instructions

This section contains pinout diagrams for each connector. The terminal wire size for all connectors is No. 22-12 AWG. For system wiring refer to wiring diagram [E0238000].

### Input Power

The 2500 Main Controller and Expansion Modules have a universal input power supply. Input power is 100-240 VAC 50/60 Hz @ 7 watts. This input is internally fused.



## Resolver Input

The resolver input has a six position connector (see figure 3-3). Attach the pre-wired plug on the resolver cable to the resolver and route the shielded cable through a separate grounded (earth ground) metal conduit to the panel. Connect the mating half terminal block to the 2500 PLS. To change count direction switch green (pin 5) and black of green (pin 6).

**NOTE:** When extensions to the factory supplied resolver cable are necessary, a junction box should be used to connect the wire leads and cable shields from one cable to the other. The junction box is used to isolate the splices of the connecting wires from outside electrical noises. Ground the cable shields at the controller case only.

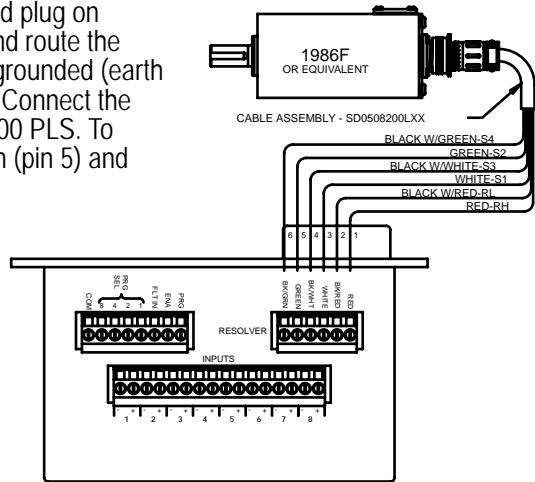


Figure 3-3

When using a cable other than the standard SD0508200, the shield must be tied to Pin 2 (black of red) and must not be tied at the resolver end.

## Program, Fault Clear, Enable and Multi-Program Inputs

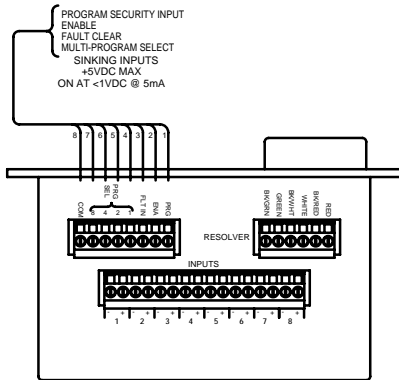


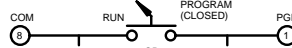
Figure 3-4

2500 P.L.S. CANNOT BE PROGRAMMED UNTIL THE PGM INPUT HAS BEEN ACTUATED - CONTINUITY - BETWEEN COM & PGM INPUT.

### PROGRAM SECURITY INPUT

TYPICAL WIRING FOR CUSTOMER SUPPLIED PROGRAM SECURITY SWITCH. WHEN SWITCH IS CLOSED, PLS CAN BE PLACED IN PROGRAM MODE. WHEN SWITCH IS OPEN, PLS WILL BE IN RUN MODE. (ALL FUNCTIONS CAN BE VIEWED BUT DATA CANNOT BE CHANGED.)

### TWO METHODS OF WIRING SECURITY SWITCH



IF NO RUN/SECURITY PROGRAM IS NEEDED (ALWAYS IN PROGRAM MODE) INSTALL A JUMPER WIRE BETWEEN COM & PGM.

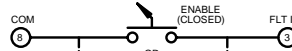
### ENABLE

THE USE OF THE ENABLE FEATURE IS OPTIONAL AND SHOULD BE WIRED TO THE PLS CIRCUITRY AS SHOWN BELOW ONLY IF IT IS REQUIRED. TYPICAL WIRING FOR CUSTOMER SUPPLIED ENABLE INPUT. WHEN SWITCH IS OPEN, PLS OUTPUTS WILL BE ENABLED. WHEN SWITCH IS CLOSED OUTPUTS WILL BE DISABLED.



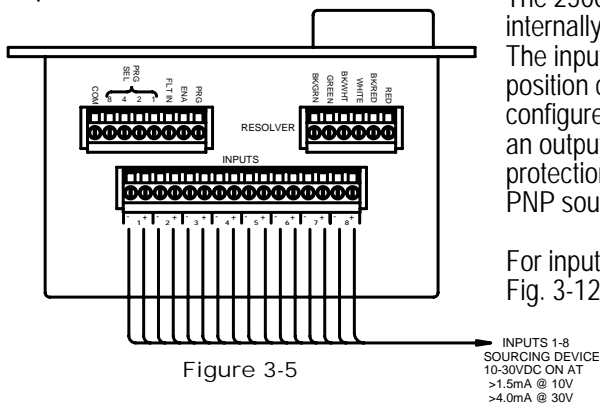
### FAULT CHECK CIRCUIT

THE USE OF THE FAULT CHECK FEATURE IS OPTIONAL AND SHOULD BE WIRED TO THE PLS CIRCUITRY AS SHOWN BELOW ONLY IF IT IS REQUIRED. IF A CUSTOMER SUPPLIED FAULT CHECK RESET SWITCH IS WIRED AS BELOW, AFTER A FAULT OCCURS, THE FAULT CHECK RELAY DE-ENERGIZES AND ALL OUTPUT RELAYS DE-ENERGIZE. AFTER THE FAULT IS CORRECTED AND THE CUSTOMER SUPPLIED RESET SWITCH IS OPENED (DISABLED) AND RECLOSURED (NORMAL OPERATION), THE FAULT CHECK RELAY WILL RE-ENERGIZE AND THE OUTPUTS WILL RESUME NORMAL OPERATION.



NOTE: ALL SWITCHES CAN BE REPLACED BY AN OPEN COLLECTOR (CURRENT SINKING) DEVICE, CONNECTED SIMILAR TO ABOVE.

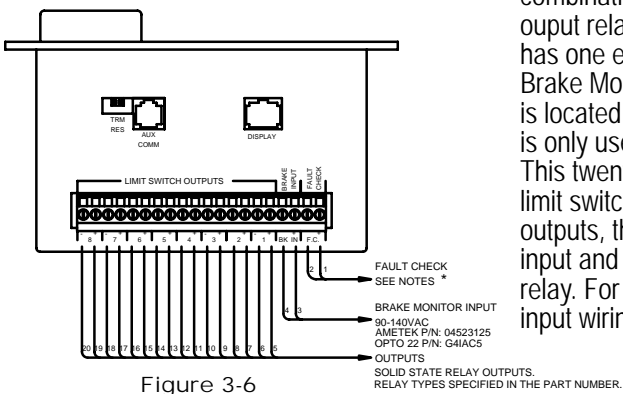
## Inputs 1-8



The 2500 has eight inputs that are internally tied to the eight outputs. The input connector is a sixteen position connector. Each input can be configured as either a reset-to-preset, an output enabler input or a die protection input. Inputs 1 - 8 require a PNP sourcing device type input signal.

For input wiring examples, see Fig. 3-12.

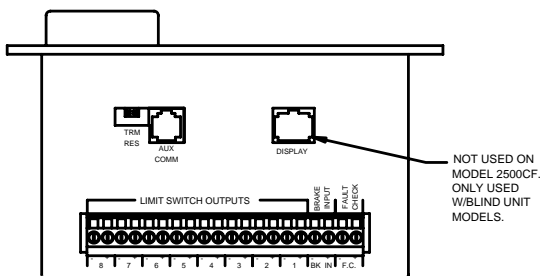
## Output Relays & Optional Brake Monitor Input



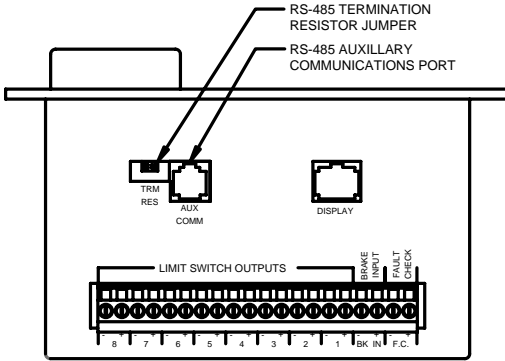
The Main Controller and Expansion Modules are available with any combination of solid-state AC or DC output relays. The Main Controller has one extra optional solid-state Brake Monitor input relay. This relay is located in the far left relay slot and is only used for brake monitoring. This twenty-place connector contains limit switch 1 - 8 solid-state relay outputs, the optional Brake Monitor input and the Fault Check output relay. For output or brake monitor input wiring, see Fig. 3-13 & 3-14.

## Remote Operator Interface

The remote operator interface connects to the Main Controller through an 8-pin Ethernet cable (part# SD0530100), commonly known as an RJ45. A full duplex RS485 is used to communicate to the Main Controller.



## Auxiliary Com Port



The auxiliary RS485 communication port uses a standard RJ11 connector. The communication port has not been defined at this time, consult factory.

Figure 3-8

## Expansion Connections

The standard 2500 PLS is supplied with 8 inputs and 8 outputs. The system is expandable to 64 inputs and 64 outputs by adding the 2500E Expansion Module. Each expansion module consists of 8 output modules and 8 inputs. Simple depluggable cable assemblies

connect from expansion to expansion or the Main Controller.

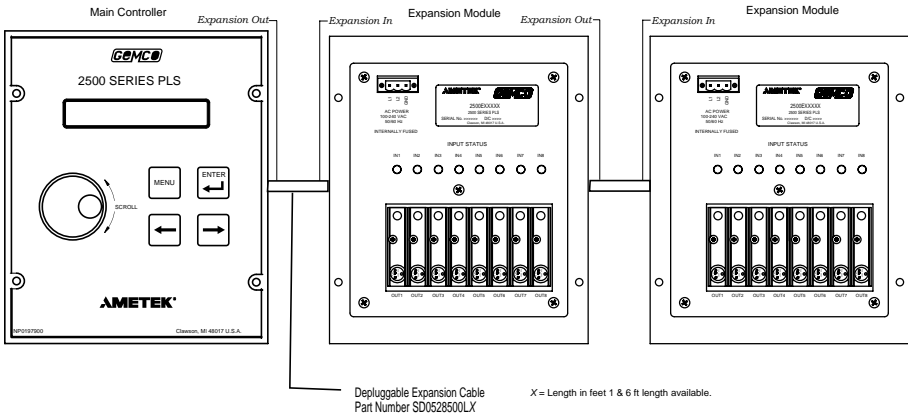


Figure 3 - 9

**NOTE:** Connect from Expansion Out of main controller to Expansion In on expansion module.



## Main Wiring Diagram

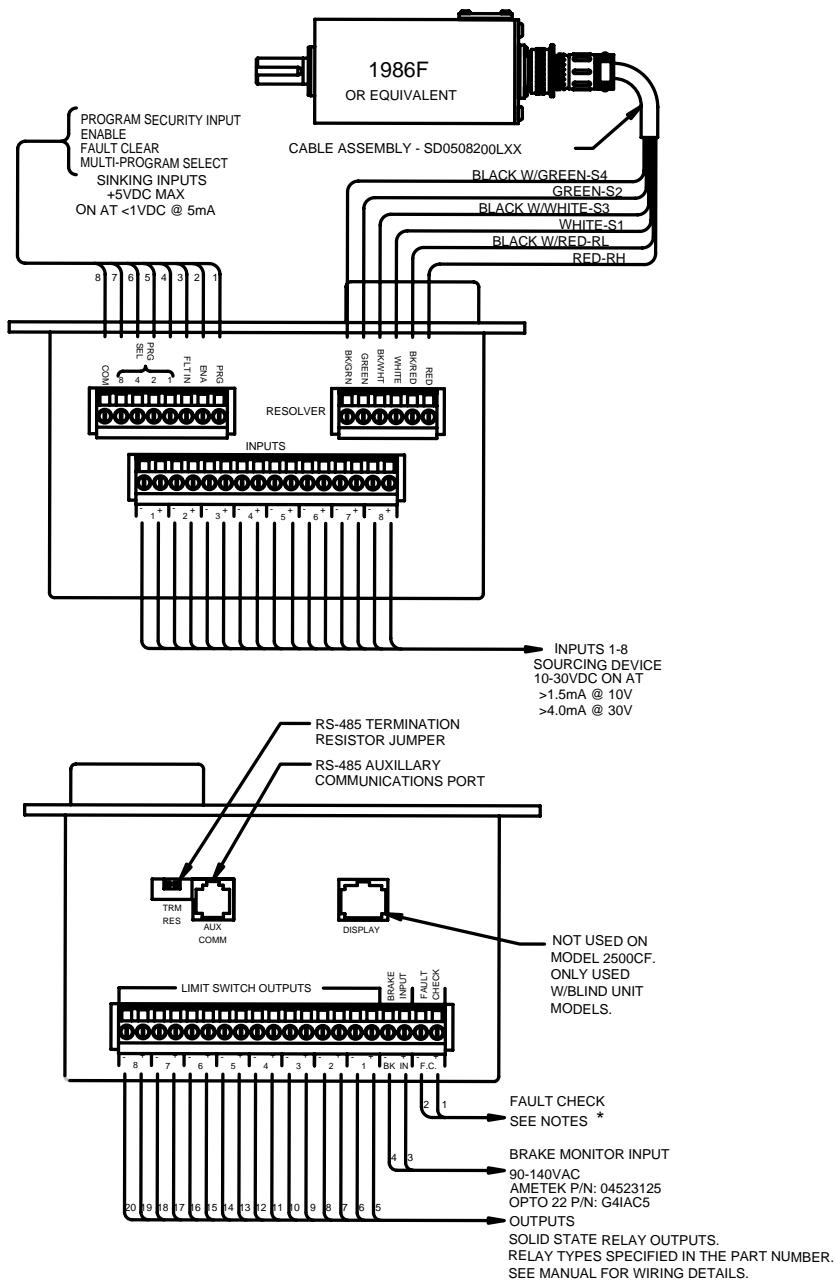
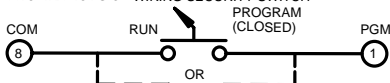


Figure 3-9

2500 PLS CANNOT BE PROGRAMMED UNTIL THE PGM INPUT HAS BEEN ACTUATED - CONTINUITY - BETWEEN COM & PGM INPUT

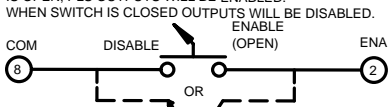
**PROGRAM SECURITY INPUT**

TYPICAL WIRING FOR CUSTOMER SUPPLIED PROGRAM SECURITY SWITCH WHEN SWITCH IS CLOSED, PLS CAN BE PLACED IN PROGRAM MODE. WHEN SWITCH IS OPEN, PLS WILL BE IN RUN MODE. (ALL FUNCTIONS CAN BE VIEWED BUT DATA CANNOT BE CHANGED.) TWO METHODS OF WIRING SECURITY SWITCH



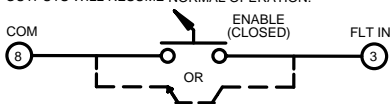
IF NO RUN/SECURITY PROGRAM IS NEEDED (ALWAYS IN PROGRAM MODE) INSTALL A JUMPER WIRE BETWEEN COM & PGM.

ENABLE THE USE OF THE ENABLE FEATURE IS OPTIONAL AND SHOULD BE WIRED TO THE PLS CIRCUITRY AS SHOWN BELOW ONLY IF IT IS REQUIRED. TYPICAL WIRING FOR CUSTOMER SUPPLIED ENABLE INPUT. WHEN SWITCH IS OPEN, PLS OUTPUTS WILL BE ENABLED.



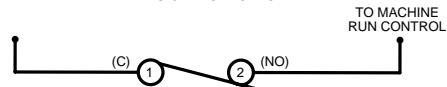
**FAULT CHECK CIRCUIT**

THE USE OF THE FAULT CHECK FEATURE IS OPTIONAL AND SHOULD BE WIRED TO THE PLS CIRCUITRY AS SHOWN BELOW ONLY IF IT IS REQUIRED. IF A CUSTOMER SUPPLIED FAULT CHECK RESET SWITCH IS WIRED AS BELOW, AFTER A FAULT OCCURS, THE FAULT CHECK RELAY DE-ENERGIZES AND ALL OUTPUT RELAYS DE-ENERGIZE. AFTER THE FAULT IS CORRECTED AND THE CUSTOMER SUPPLIED RESET SWITCH IS OPENED (DISABLED) AND RECLOSED (ENABLED), THE FAULT CHECK RELAY WILL RE-ENERGIZE AND THE OUTPUTS WILL RESUME NORMAL OPERATION.



NOTE: ALL SWITCHES CAN BE REPLACED BY AN OPEN COLLECTOR (CURRENT SINKING) DEVICE, CONNECTED SIMILAR TO ABOVE.

**RECOMMENDED WIRING OF FAULT CHECK RELAY**



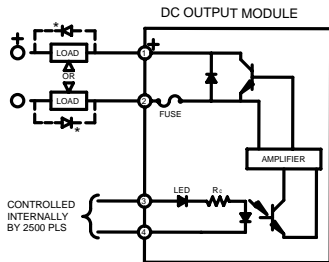
MACHINE SHOULD BE WIRED SO THAT DE-ENERGIZING FAULT CHECK RELAY WILL IMMEDIATELY STOP MACHINE.

IF NO FAULT CHECK NEEDED-DO NOT CONNECT ANY WIRING TO FAULT CHECK INPUT (FLT IN) AND DO NOT WIRE FAULT CHECK RELAY INTO MACHINE RUN CIRCUIT.

**INPUT POWER**

SEE MANUAL FOR INPUT POWER WIRING DETAILS.

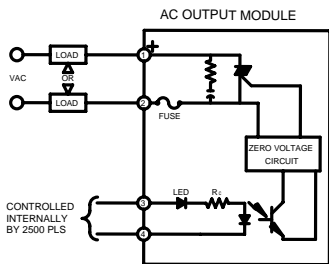
**CONNECTIONS TO P.C. OUTPUT MODULES**



AMETEK P/N: 04523126

OPTO 22 P/N: G4ODC5

\* COMMUTATION DIODE MUST BE USED ON INDUCTIVE LOADS. TYPICALLY, USE DIODE IN4005.



AMETEK P/N: 04523127

OPTO 22 P/N: G4OAC5A

THIS DEVICE CAN BE SUPPLIED WITH THESE OUTPUT DEVICES:

- A) I/O MODULE DC OUTPUT 5-60 VDC  
PART No. 04523126
- B) I/O MODULE AC OUTPUT 24-280 VAC  
PART No. 04523127

Drawing # E0238000

## Enable / Disable Outputs

The use of the enable feature is optional and should be wired to the PLS circuitry as shown below only if it is required. Typical wiring for customer supplied

enable input. When the switch is open, PLS outputs will be enabled. When the switch is closed, outputs will be disabled.

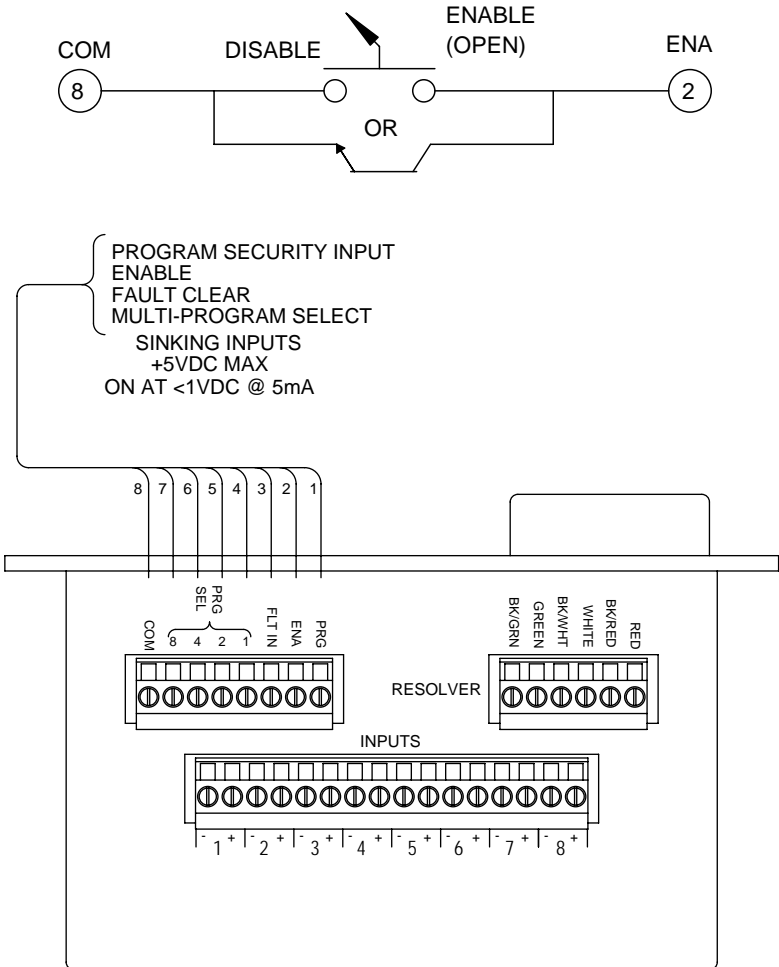


Figure 3 - 11

# Control Input Wiring

Sourcing PNP Devices + VDC is being switched

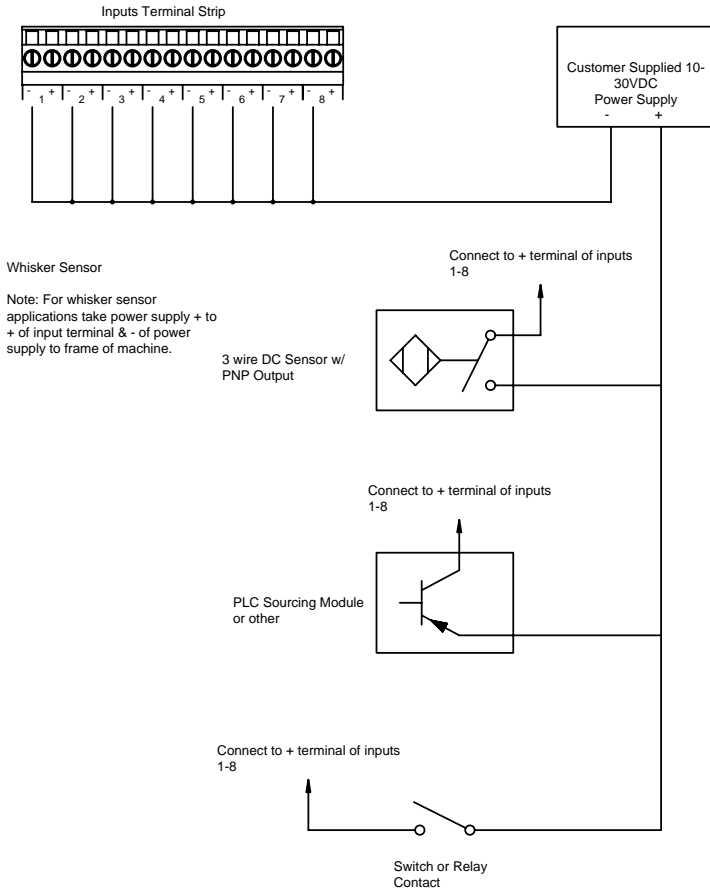


Figure 3 - 12

## Input Wiring Guidelines

- An external power supply must be used to power inputs.
- Inputs will operate with voltages from 10 - 30VDC.
- Each input will draw 4.0mA max.
- A combination of mechanical and solid state devices can be used.
- Each input is optically isolated.
- With mechanical switches, you can either break to + or - input.
- Each input is optically isolated and does not share a common.
- Voltage must be present across + and - terminals for input to turn on.

## Control Output Wiring

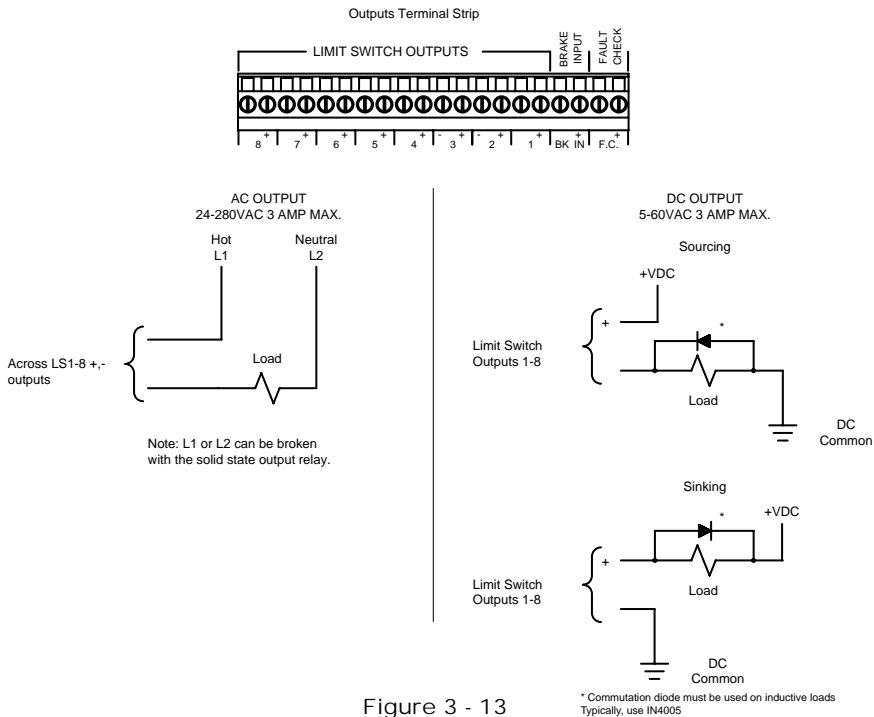


Figure 3 - 13

## Brake Monitor Input Wiring

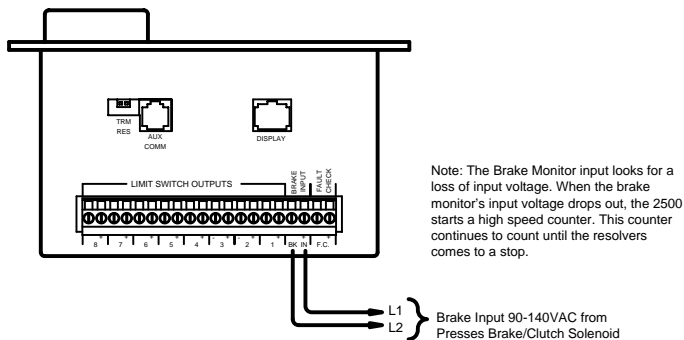


Figure 3 - 14

## Chapter 4: Programming

This chapter provides detailed descriptions and instructions for programming all 2500 PLS functions. A complete list of functions, with a brief explanation, can be found in Chapter One: Standard Features.

## 4.1 Main Controller Keypad

Figure 4-1 calls out the 2500's display, rotary knob and programming keys. Following this figure are descriptions of these keys and how they work, as well as a short tutorial on how to use the keys and rotary knob.

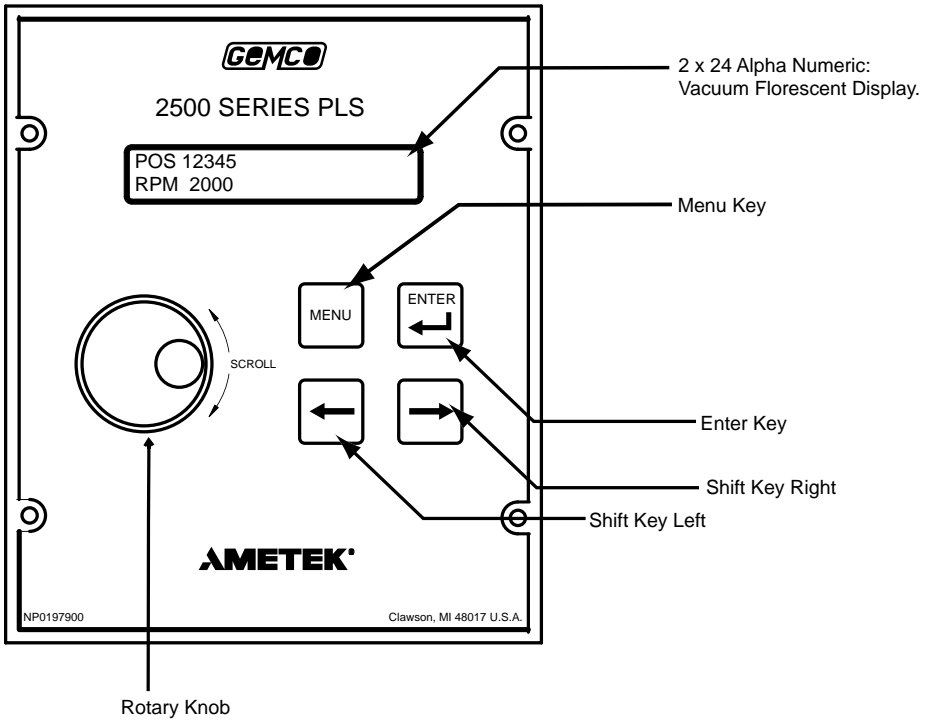
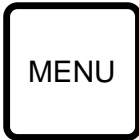


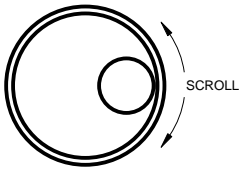
Figure 4-1: Programming Keys

## 4.2 Programming Keys Defined

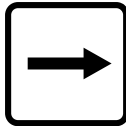
The 2500 PLS has four keys and a rotary knob located on the front panel. These keys are used to program functions and perform basic operations.



The Menu key is used to begin a process for programming a function. When this key is pressed, the 2500 prepares itself for entry of a specific function using the rotary knob.



The rotary knob is used to scroll through the 2500's list of functions, as well as other lists. To scroll to a particular function, continue to turn the rotary knob (after selecting the Menu key) until the arrow in the upper left hand corner of the display is at the desired function. The rotary knob is also used to increment/decrement selected digits on the 2500's display. Incrementing/decrementing digits can be done to select a value for a function. To move to a specified digit on the display, use either the shift right or shift left keys. A cursor under the digit indicates it is activated to be incremented/decremented.



The shift left or right keys are used to move to a specific digit shown on the 2500's display. To move to a specific digit on the display, press either shift left or shift right. A cursor under the digit indicates that digit is selected. (To increment/decrement that digit, turn the rotary knob). Continue with this process until the proper value is displayed.

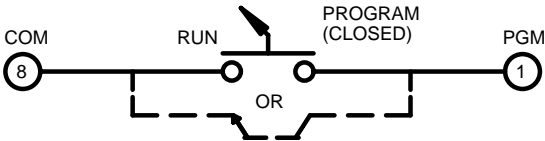


The ENTER key is used for several purposes. For example, it is selected after a function number is displayed. This begins the programming process for the selected function. The ENTER key is also used to program a value in a function. This is done by selecting the enter key after the desired value is displayed on the screen.

## 4.3 Before You Start

Before configuring or programming the 2500 PLS, the following must be done.

### TWO METHODS OF WIRING SECURITY SWITCH



IF NO RUN/SECURITY PROGRAM IS NEEDED (ALWAYS IN PROGRAM MODE) INSTALL A JUMPER WIRE BETWEEN COM & PGM.

(See Figure 3-3 for connector location.)

The 2500 PLS cannot be programmed until the PGM input has been actuated and continuity is between COM and PGM inputs.

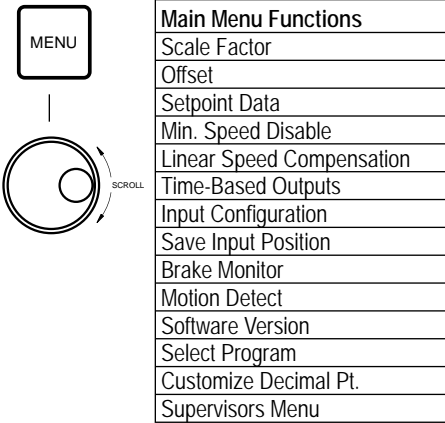
### Program Security Input

Typical wiring for customer supplied program security switch. When switch is closed, the PLS can be placed in program mode. When switch is open, the PLS will be in run mode (all functions can be viewed but data cannot be changed).

Once the mechanical security input has been made, you will need to enter the user password before programming. The default user password is 2500. See Program mode access in Section 4.4 : Programming and Supervisory Mode Functions.



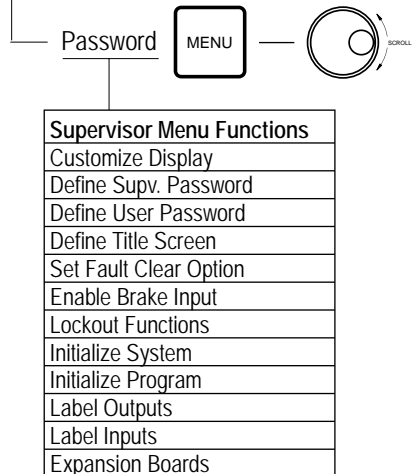
## 4.4 Menu Tree



**NOTE:** The programming examples listed throughout this manual will show where the function is located in the Menu Tree.

## 4.5 User and Supervisor Mode Access

This section provides descriptions and instructions for user and supervision mode functions. These functions are used to put the controller in either user or supervisor mode. Before a function can be programmed, the controller must be in the program mode. This is done through the User Mode Access Function, which is the first function described in this section. The controller can also be put in the Supervisor Menu. Putting the controller in this mode allows supervisor functions to be programmed. Putting the controller in this mode is described in Supervisor Mode Access Functions. The following is a list of the program and supervisor functions.



Main Menu Functions
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
Input Configuration
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu

Supervisor Menu Functions
Customize Display
Define Supv. Password
Define User Password
Define Title Screen
Set Fault Clear Option
Enable Brake Input
Lockout Functions
Initialize System
Initialize Program
Label Outputs
Label Inputs
Expansion Boards

### User Mode Access

The User Mode Access function is used to put the controller in the program mode. Only when the controller is in the program mode can functions be programmed.

A user mode access code must be entered in order to put the controller in the program mode. The factory default user password is 2500, this value can be changed via the supervisor menu. See Define User Password.

When programming functions, the controller will prompt you for the password. This is done in two parts. First the Program Security Input must have continuity from pin 8 (com) to pin 1 (prg) as shown in Section 4.3. If there is not continuity, the display will show KEY NOT IN THE PROGRAM MODE. The second step entering the user password, is done through the keypad and rotary knob, as described in Section 4.2.

The display will show:

- PASSWORD PROTECTED
- ENTER PASSWORD: 0000

### Supervisor Mode Access

The Supervisor Mode Access function is used to put the controller in the supervisor mode. Only when the controller is in the program or supervisor mode can the supervisor functions be programmed.

A supervisor mode password must be entered in order to put the controller in the supervisor mode. The factory default supervisor password is 9999, this value can be changed via the supervisor menu (see Define Supervisor Password).

When accessing supervisor functions, the controller will prompt you to enter your supervisor password. (See Section 4.2 for a description. Again, the Program Security Input must be connected properly. See Section 4.3 for specifics.)

The display will show:

- LIMITED ACCESS
- ENTER SUPV. CODE: 0000

## Chapter 5: Global Parameters

Global parameters are those variables that are normally programmed only when the system is initially installed. This chapter contains instructions for programming these parameters. You may find that some of these parameters are not necessary or are already defaulted to your desired setting. In these cases, you will not need to make any adjustments.

The following settings are detailed in this chapter:

- Initialize System
- Expansion Boards
- Lockout Functions
- Scale Factor
- Decimal Location
- Offset
- Motion Detect
- Brake Monitor
- Set Fault Clear Option
- Customizing Display
- Define Title Screen
- Label Outputs
- Label Inputs
- Define User Password
- Define Supervisor Password
- Software Version

**NOTE:** The controller can only be programmed when the security input is closed and either the user or supervisor access code has been entered. See Chapter 4 Programming for details.

### 5.1 Quick Start

In many simple applications it is not necessary to program all of the 2500 functions. For a quick start, or to become familiar with the programming process, attach the incoming power, wire the pre-assembled resolver cable, and jumper the program input to the appropriate terminals on the controller. See Chapter 3 for wiring details. Then program the following functions in this order:

1. Scale Factor - See Section 5.5
2. Offset - See Section 5.7
3. Setpoint Data - See Section 6.1

This completes the quick start programming process.

## 5.2 Initialize System

The Initialize System function presets all of the controller's calibration setting to factory defaults and deletes any programming that may be stored in the controller, except for the user and supervisor passwords.

Due to factory testing, there may be some data programmed into your controller. Because of this, it is recommended that you initialize the controller upon receiving it from the factory. To initialize the controller, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of Supervisor Menu. Press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4, Programming for password details).

Rotate knob until the ⇨ is in front of INITIALIZE SYSTEM, then press ENTER. The display will show INITIALIZING WILL DELETE ALL DATA. CONTINUE?. Rotate knob to YES, then press ENTER.

### Step 2

If you answer YES to reinitialize, the unit will ask you to re-verify your password, once you enter your supervisor password the display will show, SYSTEM INITIALIZATION IN PROCESS... PLEASE WAIT.

This procedure will take a few minutes to complete.

### Step 3

To escape Initialize System programming screen, either press ENTER to accept or MENU to back up one screen.

<b>Main Display</b> Position: 1.234 RPM: 0
--

Supervisor Menu Functions
Customize Display
Define Supv. Password
Define User Password
Define Title Screen
Set Fault Clear Option
Enable Brake Input
Lockout Functions
<b>Initialize System</b>
Initialize Program
Label Outputs
Label Inputs
Expansion Boards

## 5.3 Expansion Boards

The standard 2500 PLS is supplied with 8 inputs and 8 outputs, the system is expandable to 64 inputs and 64 outputs by adding 2500 E Expansion modules. Each expansion module consists of 8 inputs and 8 outputs.

The Expansion Board function is used to tell the main controller how many expansion boards are connected to the system. Valid selections are NONE, 1, 2, 3, 4, 5, 6, or 7. Any one of these items can be selected using the rotary knob. To select the number of expansion modules, perform the following steps:

### Step 1

Press the MENU button, then rotate the rotary knob until the ⇨ is in front of Supervisor Menu, then press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details).

Rotate knob until the ⇨ is in front of EXPANSION BOARDS. Press ENTER. Rotate knob until the desired setting and press ENTER.

### Step 2

To escape the EXPANSION BOARDS programming screen, press ENTER or MENU to back up one screen.

**NOTE:** This is only the software portion of enabling the expansion boards, the hardware must be ordered separately and connected using cable number SD0528500LX. See Section 3:2 wiring expansion connectors.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Supervisor Menu Functions</b>
Customize Display
Define Supv. Password
Define User Password
Define Title Screen
Set Fault Clear Option
Enable Brake Input
Lockout Functions
Initialize System
Initialize Program
Label Outputs
Label Inputs
Expansion Boards

## 5.4 Lockout Functions

The Lockout function allows you to program a four digit password into the 2500 PLS so that, without entering the supervisors password, certain programmed parameters such as Scale Factor, Output Channels, Offset, Minimum Speed, Linear Speed Compensation, Inputs, Brake Monitor, Brake Relay, Motion Detect, Program Select, and Decimal Point, cannot be accessed. This provides additional security when used with the user password. To program this additional security, first select and lock the parameters you wish to protect. Once these parameters are locked they cannot be changed without first entering the supervisors access code. To access the lockout functions, perform the following steps:

### Step 1

Press the MENU button, then rotate the rotary knob until the ⇨ is in front of Supervisor Menu. Press ENTER. Enter the supervisor password. (See Chapter 4 Programming: for password details).

Rotate knob until the ⇨ is in front of LOCKOUT FUNCTIONS. Press ENTER. Rotate knob until the ⇨ is in front of the desired lockout setting and press ENTER. The display will change from unlocked to locked, or locked to unlocked. Rotate knob until the ⇨ is in front of the next desired lockout setting and press ENTER. Continue until all desired setting are locked or unlocked, then press MENU to escape.

### Step 2

To escape the LOCKOUT FUNCTIONS programming screen, press ENTER or MENU to back up one screen.

NOTE: Any individual Input or Output Channel can be locked.

If a function has been locked and the user tries to access it, the display will show LIMITED ACCESS/FUNCTION HAS BEEN LOCKED. If this message is displayed, simply press MENU to back up one screen and enter the supervisors access code. (See Chapter 4: Users and Supervisors Mode Access)

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Supervisor Menu Functions</b>
Customize Display
Define Supv. Password
Define User Password
Define Title Screen
Set Fault Clear Option
Enable Brake Input
<b>Lockout Functions</b>
Initialize System
Initialize Program
Label Outputs
Label Inputs
Expansion Boards

## 5.5 Scale Factor

The scale factor can be programmed to display any engineering unit. For example, one rotation of the resolver could represent one product moving through the machine. The length of the product could then be programmed as the scale factor and setpoints can then be programmed in the length units that represent where they occur along the product. Valid scale factors can be from 2 - 65535. The 2500 has a 12 bit resolver to digital converter, which means it can count by ones, up to a scale factor value of 4096. For scale factors above 4096, the 2500 will not count by ones. Setting the scale factor will erase any existing setpoint data. For this reason, programming the scale factor should be done before any other programming. To program the scale factor, perform the following steps:

### Step 1

Press the MENU button, then rotate the rotary knob until the  $\Rightarrow$  is in front of scale factor, then press ENTER.

### Step 2

Rotate knob to EDIT and press ENTER. The controller will prompt you to enter the users password. See Chapter 4 Programming: for password details.

Rotate knob to increase / decrease numerical values. Use  $\Leftarrow \Rightarrow$  keys to move cursor to next digit, until the displayed value is the desired new Scale Factor, press ENTER.

### Step 3

To escape the Scale Factor programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screens. To exit HELP screens, press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
--

Main Menu Functions
---------------------

Scale Factor
--------------

Offset
--------

Setpoint Data
---------------

Min. Speed Disable
--------------------

Linear Speed Compensation
---------------------------

Time-Based Outputs
--------------------

Input Configuration
---------------------

Save Input Position
---------------------

Brake Monitor
---------------

Motion Detect
---------------

Software Version
------------------

Select Program
----------------

Customize Decimal Pt.
-----------------------

Supervisors Menu
------------------

## 5.6 Customize Decimal Pt. (Decimal Location)

The Customize Decimal Point function is used to program the resolution of the 2500 PLS and all positional data shown on the display. Resolution can either be displayed in whole units, tenths, hundredths, or thousandths. For programming see example below.

### Step 1

Press the MENU button, then rotate the rotary knob until the ⇌ is in front of Customize Decimal Point, then press ENTER.

### Step 2

Rotate knob to EDIT and press ENTER. The controller will prompt you to enter the users password (See Chapter 4 Programming: for password details). Rotate knob to increase / decrease decimal location or use ⇐⇒ keys to move decimal to next digit, until the displayed value is the desired new Decimal Position, then press ENTER.

### Step 3

To escape the Decimal Point programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER, Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
Input Configuration
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu



## 5.7 Electronic Offset

The offset feature is used to synchronize the digital display with the actual machine position. The 2500 PLS has full scale factor offset capabilities, and the offset is held in nonvolatile memory. However, to eliminate possible problems in the event that a replacement PLS is required, it is good practice to mechanically synchronize the resolver with the machine and then use the offset feature to make final, fine tune adjustments. Valid offset ranges are 0 to [1 less than the programmed scale factor]. To offset the controller, perform the following steps:

### Step 1

Press the MENU button, then rotate the rotary knob until the ⇨ is in front of Offset, then press ENTER.

### Step 2

Rotate knob to EDIT and press ENTER. The controller will prompt you to enter the users password. See Chapter 4 Programming: for password details. Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Position Value, press ENTER.

### Step 3

To escape the Offset programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Main Menu Functions</b>
----------------------------

Scale Factor
--------------

Offset
--------

Setpoint Data
---------------

Min. Speed Disable
--------------------

Linear Speed Compensation
---------------------------

Time-Based Outputs
--------------------

Input Configuration
---------------------

Save Input Position
---------------------

Brake Monitor
---------------

Motion Detect
---------------

Software Version
------------------

Select Program
----------------

Customize Decimal Pt.
-----------------------

Supervisors Menu
------------------

## 5.8 Motion Detect

Any one of the 64 limit switch output channels can be configured to operate as a motion detect output. This output will energize upon reaching a programmed RPM value and will de-energize as RPM drops below the selected RPM value. Typical uses for this feature include latching in a machine operation when a desired operating speed is reached or for detecting a broken coupling or chain driving the resolver. To select a circuit for motion detect, perform the following steps:

### Step 1

Press the MENU button, then rotate the rotary knob until the ⇨ is in front of Motion Detect, then press ENTER.

### Step 2

Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) Rotate knob to increase / decrease New Motion Detect Relay, press ENTER. The controller will prompt you to enter the New Motion Detect Value. Rotate knob to increase / decrease numerical values. Use ⇐⇨ keys to move cursor to next digit, until the displayed value is the desired New Motion Detect RPM Value, press ENTER.

### Step 3

To escape Motion Detect programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
Input Configuration
Save Input Position
Brake Monitor
<b>Motion Detect</b>
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu

## 5.9 Enable Brake Input

The Enable Brake Input function is used to enable or disable the Brake monitor. Valid selections are enabled or disabled. Using the rotary knob you can scroll through the displayed settings. For Brake monitoring details see Section 5.10 and Section 12. To enable or disable the brake monitor, perform the following steps:

### Step 1

Press the MENU button, then rotate the rotary knob until the ⇨ is in front of Supervisor Menu, press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.) Rotate knob until the ⇨ is in front of ENABLE BRAKE INPUT, press ENTER. Rotate knob until desired setting is displayed, press ENTER.

### Step 2

To escape ENABLE BRAKE INPUT programming screen, press ENTER or MENU to back up one screen.

**NOTE:** This feature is typically only used in the stamping industry to measure the stopping time of a stamping press.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Supervisor Menu Functions</b>
----------------------------------

Customize Display
-------------------

Define Supv. Password
-----------------------

Define User Password
----------------------

Define Title Screen
---------------------

Set Fault Clear Option
------------------------

Enable Brake Input
--------------------

Lockout Functions
-------------------

Initialize System
-------------------

Initialize Program
--------------------

Label Outputs
---------------

Label Inputs
--------------

Expansion Boards
------------------

## 5.10 Brake Monitor

Any one of the 64 limit switch output channels can be configured to operate as a Brake Monitor output. The Brake monitor offers an on-line monitor which checks the stopping time of the machine against a customer selected preset stopping time in milli-seconds, and can be used to check the stopping distance at any point during the machine's operation.

The stopping time and stopping degrees can be viewed from the main display by rotating the rotary dial. The Brake monitor calculates stopping time by monitoring the time span between the clutch disengagement and the press coming to a complete stop.

The system begins this timing sequence when it sees the loss of voltage from the brake monitor's input, wired between input terminals 3 and 4 (See Fig. 3-14 for wiring details).



The input of the Brake monitor input relay must be off when the clutch disengages. In efforts to make the brake monitor fail safe, if the controller sees motion without seeing the brake input, a break input error will occur. For brake monitor programming, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of Brake Monitor, then press ENTER.

### Step 2

The brake monitor feature is disabled when shipped from the factory. To enable the brake monitor feature, go to the Supervisor Menu and enable the Brake monitor feature, press MENU button twice to return to the main programming Brake Monitoring screen. The display will show Brake Time / Brake Relay. Rotate knob until ⇨ is in front of desired setting, press ENTER. Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.)

### Brake Time

The controller will prompt you to enter New Brake Warning Time. Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Brake Warning Time, press ENTER. The controller will prompt you to enter New Brake Error Time. Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor

to next digit, until the displayed value is the desired New Brake Error Time, press ENTER.

### Brake Relay

Rotate knob until ⇨ is in front of Brake Relay, press ENTER. Rotate knob to EDIT, press ENTER.

The controller will prompt you to enter New Brake Relay Channel Rotate knob to increase / decrease numerical values, until the displayed value is the desired New Brake Relay Channel, press ENTER.

### Step 3

To escape Brake Monitor programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

#### Main Display

Position: 1.234

RPM: 0

#### Main Menu Functions

Scale Factor

Offset

Setpoint Data

Min. Speed Disable

Linear Speed Compensation

Time-Based Outputs

Input Configuration

Save Input Position

Brake Monitor

Motion Detect

Software Version

Select Program

Customize Decimal Pt.

Supervisors Menu

## 5.11 Set Fault Clear Option

The SET FAULT CLEAR OPTION feature is used to select how faults are to be cleared from the controller. The factory default setting is that pressing the ENTER key will clear faults. The three choices are 1) only from the keypad, 2) only from the fault reset input, or 3) either the keypad or fault reset input (see figure 3-4 for wiring details). See Chapter 12 for a complete explanation on faults.

- **FAULTS CLEARED WITH ENTER KEY** = when a fault is detected the display will show you the type of error, press the ENTER key to clear the fault.
- **FAULTS CLEARED WITH INPUT PIN** = when a fault is detected the display will show you the type of error, cycle the fault reset input to clear the fault.
- **FAULTS CLEARED WITH ENTER KEY or INPUT PIN** = when a fault is detected the display will show you the type of error, either press the ENTER key or cycle the fault reset input to clear the fault.

To set the fault clear option, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇒ is in front of Supervisor

Menu, press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.)

Rotate knob until the ⇒ is in front of SET FAULT CLEAR OPTION, press ENTER Using the rotary knob to scroll through the selections, until the desired method is displayed, press ENTER.

### Step 2

To escape SET FAULT CLEAR OPTION programming screen, press ENTER or MENU to back up one screen.

<b>Main Display</b> Position: 1.234 RPM: 0
--

Supervisor Menu Functions
Customize Display
Define Supv. Password
Define User Password
Define Title Screen
<b>Set Fault Clear Option</b>
Enable Brake Input
Lockout Functions
Initialize System
Initialize Program
Label Outputs
Label Inputs
Expansion Boards

## 5.12 Customize Display

The customize display function is used to determine what will be shown on the display during machine operation. Valid selections are position data (this selection will display both position and RPM), brake data (this selection will show both stopping time and stopping degrees), and program data (this selection will show you the active running program). Any one or all three of the items can be selected. Using the rotary knob you can scroll through the displayed settings. To customize the display, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of Supervisor Menu, press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.)

Rotate knob until the ⇨ is in front of CUSTOMIZE DISPLAY, press ENTER. Rotate knob until the ⇨ is in front of the desired setting and press ENTER to show or hide this data.

### Step 2

To escape the Customize Display programming screen, press MENU to back up one screen.

**NOTE:** If all three settings are hidden, the display will continuously show what message is set in DEFINE TITLE SCREENS.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Supervisor Menu Functions</b>
Customize Display
Define Supv. Password
Define User Password
Define Title Screen
Set Fault Clear Option
Enable Brake Input
Lockout Functions
Initialize System
Initialize Program
Label Outputs
Label Inputs
Expansion Boards

## 5.13 Define Title Screen

The Define Title Screen function is used to determine what will be displayed on the controllers display during power up. Two lines of alpha numerical data can be selected. The factory default value is AMETEK APT / SERIES 2500 PLS. To create a new title screen, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇒ is in front of Supervisor Menu, press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.)

Rotate knob until the ⇒ is in front of DEFINE TITLE SCREEN, press ENTER.

Using the rotary knob to scroll through the alpha numerical selections and the arrow keys to move the cursor left or right, until the desired message is displayed, press ENTER to continue on with the second line, press ENTER when completed to return to the supervisor main menu.

### Step 2

To escape the DEFINE TITLE SCREEN programming screen, press ENTER or MENU to back up one screen.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Supervisor Menu Functions</b>
----------------------------------

Customize Display
-------------------

Define Supv. Password
-----------------------

Define User Password
----------------------

Define Title Screen
---------------------

Set Fault Clear Option
------------------------

Enable Brake Input
--------------------

Lockout Functions
-------------------

Initialize System
-------------------

Initialize Program
--------------------

Label Outputs
---------------

Label Inputs
--------------

Expansion Boards
------------------

## 5.14 Label Outputs

The Label Outputs function is used to customize the limit switch outputs to have alpha numeric names instead of the standard LS1- LS64 name. These names are a global parameter and will be the same for all programs. This feature allows the naming of individual outputs. For example, if output #5 is firing an adhesive gun, that output can be named 'Upper Glue Gun' or anything else that helps users understand the PLS and it's processes. To label outputs, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of Supervisor Menu, press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.)

Rotate knob until the ⇨ is in front of LABEL OUTPUTS, press ENTER. Using the rotary knob to scroll to the output channel you wish to name, press ENTER, the display will show ENTER NEW OUTPUT NAME.

Using the rotary knob to scroll through the alpha numerical selections and the arrow keys to move the cursor left or right, until the desired output name is displayed, press ENTER. Follow the same procedure to name all of the available outputs.

### Step 2

To escape the LABEL OUTPUTS programming screen, press ENTER or MENU to back up one screen.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Supervisor Menu Functions</b>
----------------------------------

Customize Display
-------------------

Define Supv. Password
-----------------------

Define User Password
----------------------

Define Title Screen
---------------------

Set Fault Clear Option
------------------------

Enable Brake Input
--------------------

Lockout Functions
-------------------

Initialize System
-------------------

Initialize Program
--------------------

<b>Label Outputs</b>
----------------------

Label Inputs
--------------

Expansion Boards
------------------



## 5.15 Label Inputs

The Label Inputs function is used to customize the limit switch inputs to have alpha numeric names instead of the standard Input 1 - Input 64 name. These names are a global parameter and will be the same for all programs. This feature allows inputs to be named in the same fashion as outputs. See Section 5.14 for further details. To label inputs, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of Supervisor Menu, press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.)

Rotate knob until the ⇨ is in front of LABEL INPUTS, press ENTER  
Using the rotary knob to scroll to the input channel you wish to name, press ENTER, the display will show ENTER NEW INPUT NAME.

Using the rotary knob to scroll through the alpha numerical selections and the arrow keys to move the cursor left or right, until the desired input name is displayed, press ENTER. Follow the same procedure to name all of the available inputs.

### Step 2

To escape the LABEL INPUTS programming screen, press ENTER or MENU to back up one screen.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Supervisor Menu Functions</b>
Customize Display
Define Supv. Password
Define User Password
Define Title Screen
Set Fault Clear Option
Enable Brake Input
Lockout Functions
Initialize System
Initialize Program
Label Outputs
<b>Label Inputs</b>
Expansion Boards

## 5.16 Define User Password

The Define User Password function is used to change the current users mode access code. The factory default access code is 2500. Values from 0000 to 9999 can be used for an access code. To program this function, the controller must be in the supervisor mode. (For more information, see User Mode Access.) To create a new user access code, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of Supervisor Menu, press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.)

Rotate knob until the ⇨ is in front of DEFINE USER PASSWORD, press ENTER .

Using the rotary knob to scroll through the numerical selections and the arrow keys to move the cursor left or right, until the desired password is displayed, press ENTER. The controller will now prompt you to VERIFY YOUR NEW USER ACCESS CODE. Re-enter the same value as above, then press ENTER.

### Step 2

To escape the DEFINE USER PASSWORD programming screen, press ENTER or MENU to back up one screen.

<b>Main Display</b>
Position: 1.234
RPM: 0

<b>Supervisor Menu Functions</b>
Customize Display
Define Supv. Password
Define User Password
Define Title Screen
Set Fault Clear Option
Enable Brake Input
Lockout Functions
Initialize System
Initialize Program
Label Outputs
Label Inputs
Expansion Boards

## 5.17 Define Supervisor Password

The Define Supervisor Password function is used to change the current supervisor mode access code. The factory default access code is 9999. Values from 0000 to 9999 can be used for an access code. To program this function, the controller must be in the supervisor mode. For more information, see Supervisor Mode Access. To create a new supervisor access code, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of Supervisor Menu, press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.)

Rotate knob until the ⇨ is in front of DEFINE SUPV. PASSWORD, press ENTER

Using the rotary knob to scroll through the numerical selections and the arrow keys to move the cursor left or right, until the desired password is displayed, press ENTER. The controller will now prompt you to VERIFY YOUR NEW SUPV. ACCESS CODE. Re-enter the same value as above, then press ENTER.

### Step 2

To escape the DEFINE SUPV. PASSWORD programming screen, press ENTER or MENU to back up one screen.

<b>Main Display</b> Position: 1.234 RPM: 0
--

Supervisor Menu Functions
---------------------------

Customize Display
-------------------

Define Supv. Password
-----------------------

Define User Password
----------------------

Define Title Screen
---------------------

Set Fault Clear Option
------------------------

Enable Brake Input
--------------------

Lockout Functions
-------------------

Initialize System
-------------------

Initialize Program
--------------------

Label Outputs
---------------

Label Inputs
--------------

Expansion Boards
------------------

## 5.18 Software Version

The Software Version screen displays the version number of the firmware contained within the controller. This information may be useful if the unit needs to be returned for service. There are no values that can be programmed for this function.

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of function desired, press ENTER.

Display shows: AMETEK APT SOFTWARE VERSION PX.XX
--

### Step 2

To escape Software Version screen, press MENU to back up one screen.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Main Menu Functions</b>
----------------------------

Scale Factor
--------------

Offset
--------

Setpoint Data
---------------

Min. Speed Disable
--------------------

Linear Speed Compensation
---------------------------

Time-Based Outputs
--------------------

Input Configuration
---------------------

Save Input Position
---------------------

Brake Monitor
---------------

Motion Detect
---------------

Software Version
------------------

Select Program
----------------

Customize Decimal Pt.
-----------------------

Supervisors Menu
------------------

## Chapter 6: Limit Switch Outputs

There are eight limit switch outputs installed on the main controller and eight limit switch outputs on each and every expansion module. Setpoints are the on/off position at which the limit switch outputs operate as the resolver turns through one rotation.

All 64 channels can be programmed for up to six on/off dwells each (referred to as Setpoint pairs), over each rotation of the resolver. Each limit can be configured as either a Standard Channel, Time-Based Channel or Linear Speed Channel. To select output for Linear Speed or Time Based, refer to Linear Speed or Time Based instructions.

### Programming Based on the Resolver's Scale Factor

Programming a limit switch is based on the resolver's scale factor. For example, assume the 2500 PLS is set for a 360° scale factor. If you programmed limit switch 1 to energize at 180° and de-energize at 270°, limit switch 1 would energize as shown in figure 6-1. The shaded area represents the area of the machine cycle where the limit switch is energized.

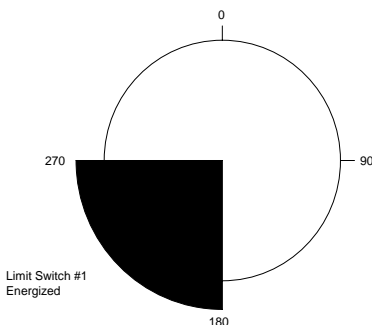


Figure 6-1: Programmed Limit Switch Based on a 360° Scale Factor

### Multiple Dwells

Programmable limit switch outputs offer a unique function, which normal rotation cam limits cannot. Namely, the ability to turn a limit on and off more than once in a 360° cycle.

The 2500 PLS has the ability to store up to six dwells (dwell on and dwell off positions) per limit switch output. As a result, a limit switch can become energized and de-energized more than once in one rotation of the resolver. Figure 6-2 illustrates a limit switch becoming energized from 20-80°, 100-180°, and 200-270°.

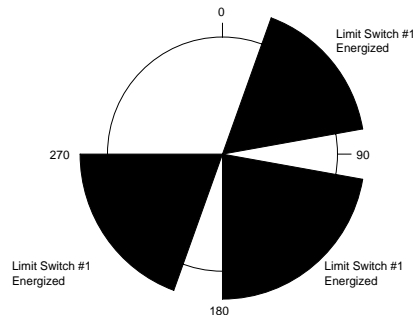


Figure 6-2: Multiple Dwells

## 6.1 Setpoint Data

Setpoints are the on/off positions at which the limit switch outputs operate as the resolver turns through one rotation. All 64 channels can be programmed for up to 6 on/off dwells each (referred to as Setpoint pairs), over each rotation of the resolver. Each limit can be configured as either a Standard Channel, Time-Based Channel or Linear Speed Channel. To select an output for Linear Speed or Time Based refer to Linear Speed or Time Based instructions. To program an output channel, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the  $\Rightarrow$  is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Output Channel, press ENTER.  
Rotate knob to EDIT or ADD, press ENTER.

The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.)  
The controller will prompt you to enter New On Position Value.

Rotate knob to increase / decrease numerical values. Use  $\Leftarrow\Rightarrow$  keys to move cursor to next digit until the displayed value is the desired New On Position Value, press ENTER.

The controller will prompt you to enter New Off Position Value.

Rotate knob to increase / decrease numerical values. Use  $\Leftarrow\Rightarrow$  keys to move cursor to next digit until the displayed value is the desired New Off Position Value, press ENTER.

### Step 3

To escape Setpoint programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Valid Setpoint programming selections are:

ADD = Add will add additional setpoint pairs to the output channel.

EDIT = Edit is used to edit an existing setpoint pair.

DEL = Delete is used to remove a setpoint pair from the output channel.

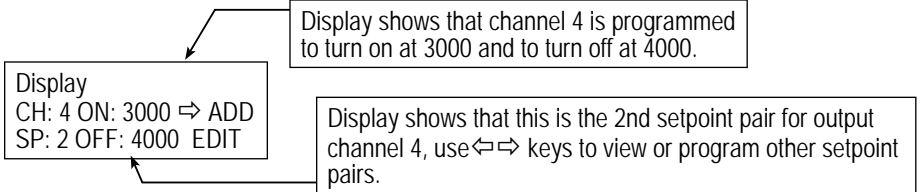
EXIT = Exit is used to exit programming screen.

HELP = Help will guide you through the programming process.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens, press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
Input Configuration
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu



## Chapter 7: Multiple Program

The 2500 PLS controller is designed to hold up to 15 different programs in its memory at one time. This allows you to program different limit switch dwell on and dwell off positions, as well as other programmed settings, for each program. A program's particular data can be accessed at any time via the keypad. Unique 15 digit alpha / numerical program names can be assigned to each program.

The following is a list of all of the settings in this chapter:

- Naming a Program
- Editing a Program
- Copying a Program
- Accessing a Program
- Clearing a Program / Initialize Program
- Clearing all Programs / Initialize System

**NOTE:** The controller can only be programmed when the security input is closed and either the user or supervisor access code has been entered. (See Chapter 4 Programming)

All multiple program features can be accessed from the main menu under SELECT PROGRAM.



## 7.1 Naming A Program

Each of the fifteen available programs in the 2500 PLS can be assigned a unique name. This can help when changing the programs because you no longer need to remember that program 1 is Job XYZ. A 15 digit alpha / numerical value can be assigned to each program. To assign a name, perform the steps below:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇒ is in front of SELECT PROGRAM, press ENTER.

### Step 2

Rotate knob to NAME, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) Rotate knob to EDIT, press ENTER. Rotate knob to scroll through the programs 1 - 15, press ENTER. Rotate knob to scroll through the alpha / numerical values.

Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Program Name, press ENTER.

Repeat above procedure, starting with EDIT, to assign names to each program.

### Step 3

To escape the select program programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Main Menu Functions</b>
----------------------------

Scale Factor
--------------

Offset
--------

Setpoint Data
---------------

Min. Speed Disable
--------------------

Linear Speed Compensation
---------------------------

Time-Based Outputs
--------------------

Input Configuration
---------------------

Save Input Position
---------------------

Brake Monitor
---------------

Motion Detect
---------------

Software Version
------------------

Select Program
----------------

Customize Decimal Pt.
-----------------------

Supervisors Menu
------------------

## 7.2 Editing A Program

Each of the fifteen available programs in the 2500 PLS can be recalled and edited at anytime. To edit a program, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of SELECT PROGRAM, press ENTER.

### Step 2

Rotate knob to EDIT, press ENTER.

The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) Rotate knob to scroll through the programs 1 - 15. (The second line of the display will show you the name of the program) press ENTER.

Rotate knob to scroll through available selections, until the value displayed is the desired program, press ENTER. The display will now show you the current program, rotate knob to EXIT, press ENTER.

### Step 3

To escape Select Program programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b>
---------------------

Position: 1.234
RPM: 0

<b>Main Menu Functions</b>
----------------------------

Scale Factor
--------------

Offset
--------

Setpoint Data
---------------

Min. Speed Disable
--------------------

Linear Speed Compensation
---------------------------

Time-Based Outputs
--------------------

Input Configuration
---------------------

Save Input Position
---------------------

Brake Monitor
---------------

Motion Detect
---------------

Software Version
------------------

Select Program
----------------

Customize Decimal Pt.
-----------------------

Supervisors Menu
------------------

## 7.3 Copying A Program

You can copy data from one program to another. This can save time from having to reprogram similar data, such as limit switch settings, that were already created in a previous program. To copy a program's data to another program, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of SELECT PROGRAM, press ENTER.

### Step 2

Rotate knob to COPY, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) The display will show, COPY DATA FROM PROGRAM : X

Rotate knob to scroll through the programs 1 - 15. (The second line of the display will show you the name of the program) press ENTER.

The display will show, COPY DATA TO PROGRAM : X

Rotate knob to scroll through the programs 1 - 15. (The second line of the display will show you the name of the program) press ENTER.

The display will now show you the current program, rotate knob to EXIT, press ENTER.

### Step 3

To escape Select Program programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

**NOTE:** When copying programs, the user assigned program name is also transferred. See: Naming a program to change program name.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens, press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
Input Configuration
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu



## 7.4 Accessing A Program

A specific program can be accessed from the controller's memory at anytime. To access a program, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of SELECT PROGRAM, press ENTER.

### Step 2

Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.)

Rotate knob to scroll through the programs 1 - 15. (The second line of the display will show you the name of the program) press ENTER.

Rotate knob to scroll through available selections, until the value displayed is the desired program, press ENTER. The display will now show you the current program, rotate knob to EXIT, press ENTER.

### Step 3

To escape Select Program programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
Input Configuration
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu

## 7.5 Initialize Program

The Initialize Program function will erase all programmed values for a selected program. You can clear a program and its data at any time. After clearing a program, the program number name will default back to factory default. To initialize a program, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of Supervisor Menu, press ENTER.

The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.)

Rotate knob until the ⇨ is in front of INITIALIZE SYSTEM, press ENTER. The display will show SELECT PROGRAM. Rotate knob to the desired program that you wish to erase, press ENTER. The display will show REINITIALIZE ALL DATA IN PROGRAM X ?. Rotate knob to either YES or NO, press ENTER.

### Step 2

If you answered YES to reinitialize the unit, it will ask you to re-verify your password, once you enter your supervisor password the display will show, PROGRAM INITIALIZATION IN PROCESS... PLEASE WAIT. This procedure will take a few minutes to complete.

### Step 3

To escape Initialize Program programming screen, either press ENTER to accept or MENU to back up one screen.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Supervisor Menu Functions</b>
Customize Display
Define Supv. Password
Define User Password
Define Title Screen
Set Fault Clear Option
Enable Brake Input
Lockout Functions
Initialize System
<b>Initialize Program</b>
Label Outputs
Label Inputs
Expansion Boards

## Chapter 8: Linear Speed Compensation

Linear Speed Compensation refers to the ability for the 2500 controller to allow channels to be individually selected and programmed to advance or retard setpoints depending on the speed of the machine. Linear speed compensation is used to compensate for mechanical lag in glue guns and actuators that must be precisely synchronized with the position of the product moving through a process. 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 speed.

The values assigned in the Linear Speed Compensation Channel establish the rate (counts per RPM) for the specified output. A different rate of change can be programmed for the leading edge (ON offset) and the trailing edge (OFF offset) of the ON/OFF dwells on the selected output channel.

For example, Fig. 8-1 shows a simple gluing application. A conveyor moves cartons under a glue gun which dispenses glue onto the flaps. The resolver is connected in a 1:1 relationship so that one revolution is equal to one carton.

Let's say we programmed output channel one to come on at 90 degrees and go off at 270 degrees, with an ON offset value of 20 degrees for every 100 RPM and an OFF offset of 10 degrees for every 100 RPM. This will advance the leading edge of all setpoints on output channel 1 by 20 counts and their trailing edge by 10 counts for every 100 RPM increase in resolver velocity. This rate of advance is applied linearly as speed increases from zero and will continue as speeds increase beyond 100 RPM. In other words, if the resolver increased to 50 RPM, the setpoint's leading edge would advance by 10 counts and its trailing edge would advance by 5 counts. This is illustrated in Fig. 8-2.

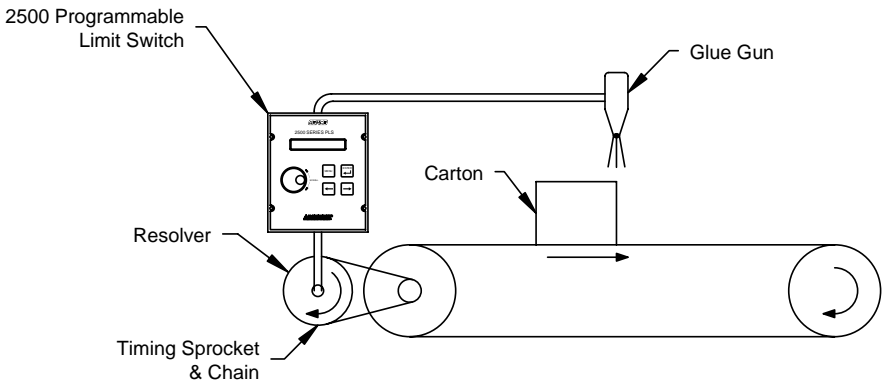


Figure 8-1

At very slow, or essentially zero speed, the glue gun would be energized at resolver position of 90 degrees and de-energized at 270 degrees. As the line speed increases, the glue guns need to

be energized before 90 degrees to allow the glue to hit the carton in the correct spot. The faster the line speed, the sooner in the resolver's cycle the glue gun must be triggered.

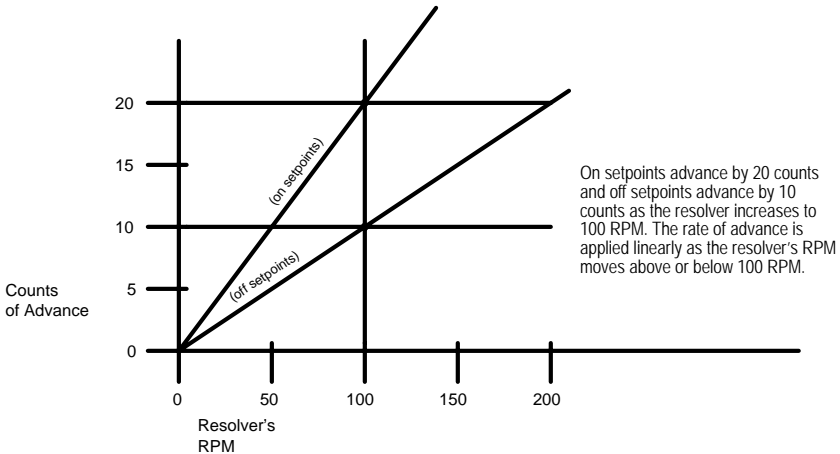


Figure 8-2:

## Linear Speed Compensation at Various Speeds

The examples below show the Linear Speed Offset using the previously stated parameters.

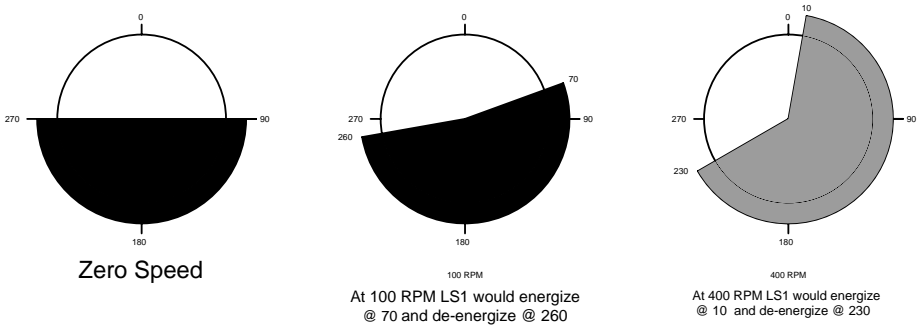


Figure 8-3:



## 8.1 Linear Speed Compensation

This feature allows any of the 64 outputs to automatically advance or retard as machine velocity varies. The number of circuits affected by linear speed compensation, the amount of on and off offset, and the RPM range over which the offset develops, are all programmable. The amount to offset per RPM change can be different for each output. This feature can be used to compensate for the mechanical lag in machine controls. To program a circuit for linear speed compensation, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Linear Speed Channel, press ENTER. Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. See Chapter 4 Programming; for password details. The controller will prompt you to enter New Linear Speed RPM Value.

Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Linear Speed RPM Value, press ENTER. The controller will prompt you to enter New Linear Speed On Count Value.

Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Linear Speed On

Count Value, press ENTER. The controller will prompt you to enter New Linear Speed Off Count Value. Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Linear Speed Off Count Value, press ENTER.

### Step 3

To escape the Speed Compensation programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

<b>Main Display</b>
Position: 1.234
RPM: 0

<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
<b>Linear Speed Compensation</b>
Time-Based Outputs
Input Configuration
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu

RPM = The RPM value at which the ON or OFF will move the specified amount of counts.

Display  
RPM 500 ON:100 ⇨ EDIT  
OFF:50 EXIT

ON = The amount of counts that the ON point will move at the selected RPM.

OFF = The amount of counts that the OFF point will move at the selected RPM.



## 8.2 Minimum Speed Disable

This feature allows limit switch output channels that have been programmed as linear speed channels to be automatically turned off if machine speed drops below a programmed RPM value. It can also be used to prevent output channels from turning on until a desired operating speed is reached. Typical uses include turning off glue guns or retracting actuators to a safe position under emergency stop conditions. To program a linear speed compensation channel for minimum speed offset, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of function desired, press ENTER.

### Step 2

Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) Rotate knob to increase / decrease numerical values.

Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Minimum Speed Disable Value, press ENTER.

### Step 3

To escape Min. Speed Disable programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

**NOTE:** Only outputs that are programmed with linear speed compensation can have a minimum speed disable setting.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
<b>Min. Speed Disable</b>
Linear Speed Compensation
Time-Based Outputs
Input Configuration
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu

## Chapter 9: Time Based Outputs

In instances where it is desirable to have outputs actuate based on resolver position and turn off based on time, we offer time-based outputs. Examples of where time-based limits are applicable include lubricators, air blow-off limits and pneumatic cylinders which require a fixed amount of time to perform a task. Valid selections are 0.01 to 9.99 seconds. Any or all of the 2500 PLS outputs can be programmed for Time-Based outputs. However, limit switches cannot be programmed for both Linear Speed Compensation and Time-Based outputs at the same time. To program an output for time based operation, perform the following steps:

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Time Based Channel, press ENTER.  
Rotate knob to EDIT, press ENTER.

The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.)  
The controller will prompt you to enter New On Position Value.

Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New On Position Value, press ENTER.

The controller will prompt you to enter New Time Duration Value. Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Time Duration Value, press ENTER.

### Step 3

To escape Time Based programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Main Menu Functions</b>
----------------------------

Scale Factor
--------------

Offset
--------

Setpoint Data
---------------

Min. Speed Disable
--------------------

Linear Speed Compensation
---------------------------

<b>Time-Based Outputs</b>
---------------------------

Input Configuration
---------------------

Save Input Position
---------------------

Brake Monitor
---------------

Motion Detect
---------------

Software Version
------------------

Select Program
----------------

Customize Decimal Pt.
-----------------------

Supervisors Menu
------------------

## Chapter 10: Inputs

This section describes the eight inputs that are on every main controller and expansion module, each input is internally tied to its corresponding output. Each input can be configured as a reset-to-preset, output enabler input, or a die protection input. Inputs 1 - 8 require a PNP sourcing device type input signal. A status LED for each input is conveniently located on the back of the controller.

The eight inputs are arranged on a 16 place terminal strip, as shown in figure 3-5. Each input is optically isolated and can be powered from an external DC power source. Many types of hardware can drive these inputs, including mechanical switches, relay contacts, DC 3 wire sensors, 3 wire proximity sensors, solid-state DC output modules, and PLC DC outputs. See figure 3-12 for wiring diagram.

### Input Functions

- No Input
- Reset to Preset Continuous
- Reset to Preset Single
- Die Protection Momentary
- Die Protection Maintain
- Die Protection Partial
- Output Enable One Shot
- Output Enable Level
- Save Input Position

### No Input

No input type has been configured for this input. The controller will ignore any activity on this input when it is in the No Input mode.

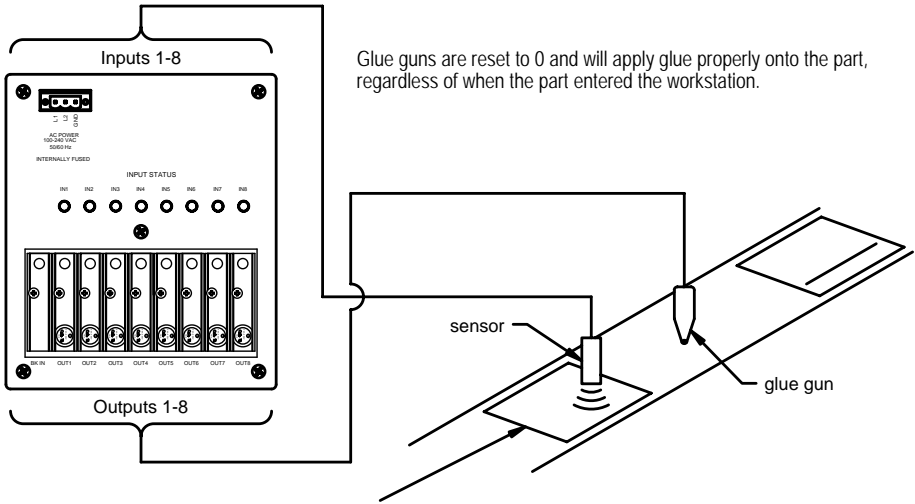
### Reset to Preset

The reset to preset input allows selected output channels to be reset to a programmed position value upon seeing an input from a remote sensor. This type of input is typically used in applications where parts are randomly spaced as they enter the workstation.

A photoelectric or proximity switch is used to sense the leading edge of the product. Upon seeing the leading edge of the part entering the workstation, output channels can be reset to a preset position value. The output channels will then begin to operate based on their on/off setpoints relative to a preset value which has been synchronized with the leading edge of the product.

Because the reset to preset input resets the output channels positions when it senses a part entering the workstation, it doesn't matter at what position on the resolver a part enters the workstation. In figure 10-1, output channel 1 has been programmed to have a reset to preset value of zero. During machine operation, input channel 1 becomes energized at machine position 180°. Because output channel 1 is linked to input channel 1, it resets to 0°. In this way, the outputs energize at the proper position, according to their on/off setpoints relative to the position at which the input was energized.

**NOTE:** Each input is internally tied to its corresponding output and cannot be changed. In cases where one input is used to control more than one output, simply daisy chain the inputs together.



Glue guns are reset to 0 and will apply glue properly onto the part, regardless of when the part entered the workstation.

Although the part was positioned at 180 according to the resolver, the output channels' position linked to the input are reset to 0.

Figure 10 - 1:

There are two modes of operation for the reset inputs. They are as follows:

### Continuous Mode

The selected output channel resets to the preset position value upon seeing the input. The setpoint will operate over its programmed value continuously. As the resolver continues to rotate through zero, the output channel will continue to track the reset resolver position and the setpoints will operate at the programmed values. For instructions on how to program the inputs to operate in the continuous mode, see Reset to Preset Continuous.

### Reset to Preset Single

The reset to preset single shot input can be programmed to reset its associated output channel to zero or some other value upon activation of the input. The setpoints will operate over their programmed values through one revolution of the resolver. After one complete revolution, the output channel will remain de-energized until the next reset input is sensed. See figure 10-2.

For instruction on how to program the inputs to operate in the single shot mode, see Reset to Preset Single.

Figure 10-2 shows three different glue heads in different locations on the conveyor being controlled by a single controller and resolver. Any or all of the available 64 outputs can be configured as a reset to preset without compromising the update time of the controller. The spacing between the parts being glued is random. Each output on the controller is capable of keeping track of its own position.

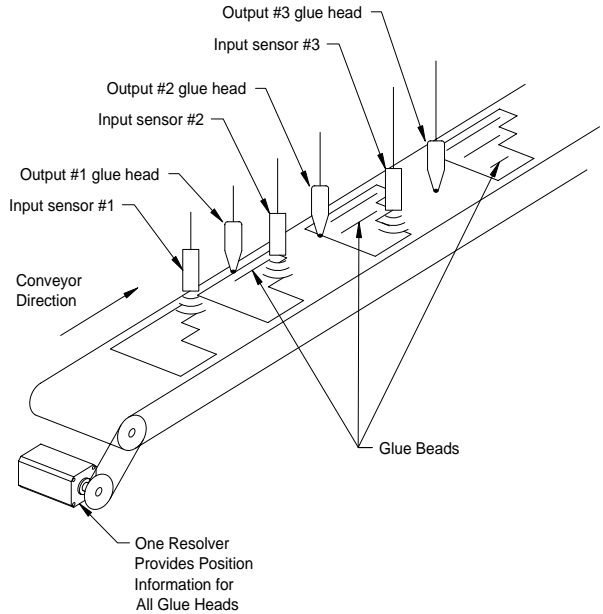


Figure 10 - 2: Example Application

The PNP type sensors are connected to the input terminals. When a sensor detects a product, it resets its corresponding output's position to the preset value and enables that output to turn on at the programmed positions through one revolution of the resolver. After one complete revolution, the output channel will remain de-energized until the next reset input is detected.

### Die Protection

Die Protection is typically used in the stamping industry to protect the dies from damage as a part progresses through the die. For a more detailed explanation and programming see Chapter 11.

### Output Enabler

Output enabler inputs are used to enable or disable output channels based upon sensing a critical event prior to or during each rotation of the resolver. Typically used to verify that a product is present at a glue station prior to allowing the glue guns to operate. There are two modes of operation for the output enabler inputs. They are:

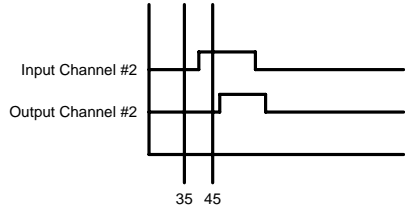
#### Output Enabler One Shot

In one-shot mode, you program a window in which the input must change state in order to allow the linked output channel to operate

over the current rotation of the resolver. If the input does not change states within the programmed window, the linked output will not operate. In figure 10:3, the output enable input 2 is linked to output channel 2. When the input senses the part, the glue guns controlled by the output channel are enabled, and will apply glue onto the part according to the on/off setpoints. However, if a part is not sensed within the programmed window, the linked output channel will be disabled through that rotation of the resolver. For instructions on how to program the inputs to operate in the output enable one-shot mode, see Output Enable One Shot.

**NOTE:** In order for an output enable input (one-shot mode) to enable the output channel, the input must transition sometime between the resolver's zero position and the first on setpoint position of the output channel. The output enabler input can remain energized for any duration - as long as it de-energizes before it transitions again within its window.

Chart represents the input channel #2's window of detection (35 to 45) and the input's actual transition. Notice that the input detection window closes before the output channels' first on/off dwell.



Sensor must detect part between 35 and 45 in order to enable glue gun.

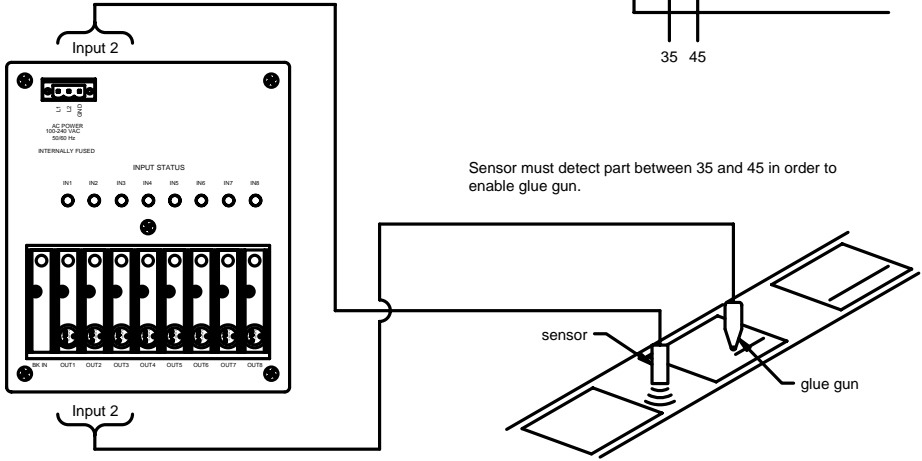


Figure 10 - 3:

### Output Enable Level

The output enable level mode will operate like a simple AND input. The output pattern will only operate as long as the output enabler input is energized or de-energized. Therefore, the product presence sensor must provide an input during the full duration of the limit switch output pattern. If the input goes to the wrong state, the output channel will de-energize. For instruction on how to program the inputs to operate in the output enable level mode, see Output Enable Level Mode.

### Save Input Position

The save input position feature can be used at any time to save the resolver position to any or all of the output channels that have been configured with a Reset-to-Preset input. When setting up an input for reset-to-preset, the controller will ask a series of questions. One of the questions is when to save the reset position to memory. The selections are EVERYTIME, NEVER, or THRU INPUT SAVE. The electronic part which saves the resolver position has an infinite life, which means that it is guaranteed to save the position 100,000 times before the part is worn out. This is why during the setup of the reset inputs you must select how and when the position is stored.

- **Every time:** Every time the input sees a transition it saves the resolver position to memory. With this option, if power is lost, the position associated with that output will be retained. This option should not be used in applications where each time a product is produced, the input is reset, as shown in figures 10-1 or 10-2.
- **Never:** Never, is typically used in a high speed packaging application where it is necessary to reset an output position to zero each time a product passes under the input sensor. Since every time a product appears under the sensor the output resets to zero, it is not necessary to store this value. With this option, if power is lost, the position associated with that output will not be retained.
- **Save Input Position:** The save input position feature can be used at any time to save the resolver position to any or all of the output channels that have been configured for a Reset-to-Preset input.

## 10.1 Input Configuration

Any one or all of the 64 available limit switch outputs can be configured with an input. These inputs can enhance the way the output will function. The introduction of inputs in Chapter 10 will give you a clear explanation on how and where such inputs can be used. Valid selections for inputs are: No Input Type, Reset to Preset Continuous, Reset to Preset Single, Die Protect Momentary, Die Protect Maintain, Die Protect Partial, Output Enable One Shot, and Output Enable Level. The programming sequence for each option is different. Please refer to subsequent pages for programming details.

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of function desired, press ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
<b>Input Configuration</b>
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu

## Step 2

Rotate knob to select desired Input Configuration Channel, press ENTER.

Rotate knob to EDIT, press ENTER.

The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.)

The controller will prompt you to enter New Input Type.

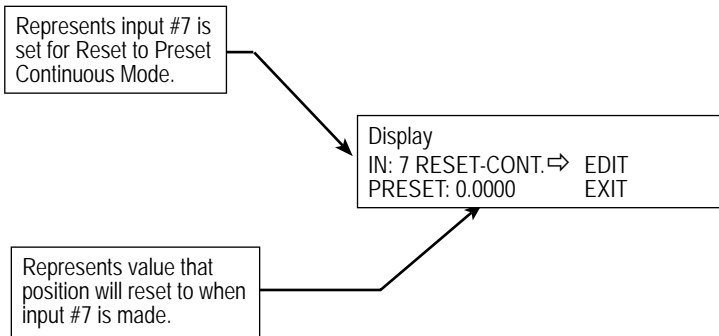
Rotate knob to scroll through selections.

Valid selections are:

NO INPUT TYPE  
RESET TO PRESET CONTINUOUS  
RESET TO PRESET SINGLE  
DIE PROTECT MOMENTARY  
DIE PROTECT MAINTAIN  
DIE PROTECT PARTIAL  
OUTPUT ENABLE ONE SHOT  
OUTPUT ENABLE LEVEL

Use the rotary knob until the displayed value is the desired New Input Type, press ENTER.

The remaining programming steps are different for each input type. Refer to programming section for option selected to complete the programming process.





## 10.2 Input Configuration for No Input

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the → is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Input Configuration Channel (the second line of the display will show you how the input is presently configured), press ENTER.

Rotate knob to EDIT, press ENTER.

The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) The controller will prompt you to enter New Input Type.

Rotate knob to scroll through selections until NO INPUT TYPE is displayed, press ENTER.

**NOTE:** When set to No Input Type the controller will ignore any activity on that selected input.

### Step 3

To escape Input Configuration programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
<b>Input Configuration</b>
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu

## 10.3 Input Configuration for Reset to Preset Continuous

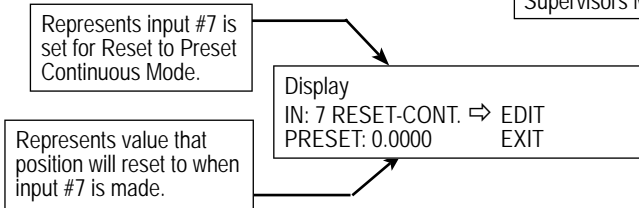
### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇐ is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Input Configuration Channel (the second line of the display will show you how the input is presently configured), press ENTER. Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) The controller will prompt you to enter New Input Type. Rotate knob to scroll through selections until RESET TO PRESET CONT. is displayed, press ENTER. The controller will prompt you to enter the Active Input State. Valid selections are active low or active high. (This determines the state that the input must be in to be considered active).

Rotate knob to scroll through selections until desired selection is displayed, press ENTER. The controller will prompt you to enter the New Reset to Preset Position, Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Reset to Preset Position, press ENTER. The controller will prompt you to Save the Reset Position to Memory. Valid selections are Everytime, Never, or Thru Input Save.



Rotate knob to scroll through selections until desired selection is displayed, press ENTER. Warning see Chapter 10: Save Input Position section before setting.

### Step 3

To escape Input Configuration programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
<b>Input Configuration</b>
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu

## 10.4 Input Configuration for Reset to Preset Single

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Input Configuration Channel (the second line of the display will show you how the input is presently configured), press ENTER. Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) The controller will prompt you to enter New Input Type. Rotate knob to scroll through selections until RESET TO PRESET SINGLE is displayed, press ENTER. The controller will prompt you to enter the Active Input State.

Valid selections are active low or active high. (This determines the state that the input must be in to be considered active). Rotate knob to scroll through selections until desired selection is displayed, press ENTER. The controller will prompt you to enter the New Reset to Preset Position, Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Reset to Preset Position, press ENTER. The controller will prompt you to Save the Reset Position to Memory. Valid selections are Everytime, Never, or Thru Input Save.

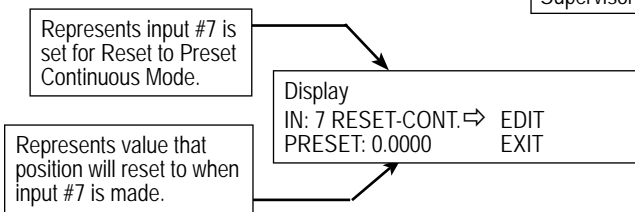
Rotate knob to scroll through selections until desired selection is displayed, press ENTER. Warning see Chapter 10: Save Input Position section before setting.

### Step 3

To escape Input Configuration programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
<b>Main Menu Functions</b>
Scale Factor
Offset
Setpoint Data
Min. Speed Disable
Linear Speed Compensation
Time-Based Outputs
<b>Input Configuration</b>
Save Input Position
Brake Monitor
Motion Detect
Software Version
Select Program
Customize Decimal Pt.
Supervisors Menu



## 10.5 Input Configuration for Output Enable One Shot

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇄ is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Input Configuration Channel (the second line of the display will show you how the input is presently configured), press ENTER. Rotate knob to EDIT, press ENTER.

The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) The controller will prompt you to enter New Input Type.

Rotate knob to scroll through selections until OUTPUT ENABLE ONE SHOT is displayed, press ENTER. The controller will prompt you to enter the Active Input State. Valid selections are active low or active high. (This determines the state that the input must be in to be considered active). Rotate knob to scroll through selections until desired selection is displayed, press ENTER.

The controller will prompt you to enter the New Window On Position. Rotate knob to increase / decrease numerical values. Use ⇄ keys to move cursor to next digit, until the displayed value is the desired New Window On Position, press ENTER. The controller will prompt you to enter the New Window Off Position. Rotate knob

to increase / decrease numerical values. Use ⇄ keys to move cursor to next digit, until the displayed value is the desired New Window Off Position, press ENTER.

### Step 3

To escape Input Configuration programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Main Menu Functions</b>
----------------------------

Scale Factor
--------------

Offset
--------

Setpoint Data
---------------

Min. Speed Disable
--------------------

Linear Speed Compensation
---------------------------

Time-Based Outputs
--------------------

<b>Input Configuration</b>
----------------------------

Save Input Position
---------------------

Brake Monitor
---------------

Motion Detect
---------------

Software Version
------------------

Select Program
----------------

Customize Decimal Pt.
-----------------------

Supervisors Menu
------------------

Represents input #7 is set for Reset to Preset Single Mode.

Represents value that position will reset to when input #7 is made.

Display IN: 7 RESET-SINGLE ⇄ EDIT PRESET: 0.0000      EXIT
--

## 10.6 Input Configuration for Output Enable Level

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇒ is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Input Configuration Channel (the second line of the display will show you how the input is presently configured), press ENTER.

Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) The controller will prompt you to enter New Input Type.

Rotate knob to scroll through selections until OUTPUT ENABLE LEVEL is displayed, press ENTER.

The controller will prompt you to enter the Active Input State. Valid selections are active low or active high. (This determines the state that the input must be in to be considered active).

Rotate knob to scroll through selections until desired selection is displayed, press ENTER.

### Step 3

To escape Input Configuration programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Main Menu Functions</b>
----------------------------

Scale Factor
--------------

Offset
--------

Setpoint Data
---------------

Min. Speed Disable
--------------------

Linear Speed Compensation
---------------------------

Time-Based Outputs
--------------------

<b>Input Configuration</b>
----------------------------

Save Input Position
---------------------

Brake Monitor
---------------

Motion Detect
---------------

Software Version
------------------

Select Program
----------------

Customize Decimal Pt.
-----------------------

Supervisors Menu
------------------

Represents input #7 is set for Output Enabler Level Mode.

Represents the state the input must be in to activate the output.

Display IN: 7 OE-LEVEL ⇒ EDIT ACTIVE STATE: LOW EXIT
--

## Chapter 10.7: Enable Brake Input

The Enable Brake Input function is used to enable or disable the Brake input relay. Valid selections are DISABLED, ENABLED AS BRAKE MONITOR, or ENABLED AS GLOBAL R-TO-P. This input relay is optional and if ordered, it will be installed in the lower left hand relay slot located next to output number 1.

Using the rotary knob you can scroll through the displayed settings. For Brake monitoring details see Section 5.10 Section 12. For Global Reset to Preset see addendum. For programming see example below.

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇨ is in front of Supervisor Menu, press ENTER. The controller will prompt you to enter the supervisor password. (See Chapter 4 Programming: for password details.)

Rotate knob until the ⇨ is in front of ENABLE BRAKE INPUT, press ENTER. Rotate knob until desired setting is displayed, press ENTER.

To escape Enable Brake Input programming screen, press MENU to back up one screen.

**NOTE:** This feature is only used to activate the Brake input relay. To program the Brake Monitor or Global Reset to Preset options refer to programming sections.

<b>Main Display</b>
---------------------

Position: 1.234
-----------------

RPM: 0
--------

<b>Supervisor Menu Functions</b>
----------------------------------

Customize Display
-------------------

Define Supv. Password
-----------------------

Define User Password
----------------------

Define Title Screen
---------------------

Set Fault Clear Option
------------------------

Enable Brake Input
--------------------

Lockout Functions
-------------------

Initialize System
-------------------

Initialize Program
--------------------

Label Outputs
---------------

Label Inputs
--------------

Expansion Boards
------------------

## Chapter 11: Die Protection Inputs

Die protection inputs are used to protect dies from damage due to mis-sequence or buildup of material. This is accomplished by comparing inputs from sensors mounted on or near the dies to dwells programmed into the controller. If the sensors do not change states within the programmed dwell area, a fault can occur depending on how the inputs are programmed.

The 2500 is capable of 8 programmable die protection inputs and is expandable to 64 by using the expansion modules. They are found on the bottom of the controller. See Figure 3-5 for the location of these inputs.

Programming a die protection input is like programming a limit switch; it needs a dwell on position and a dwell off position. Within this window, a sensing device is used to determine if a process has occurred during a stroke. For example, after the press has formed a part, the part has to be expelled from the die before a new stroke occurs. This is typically accomplished through an air blow off valve, which blows the part out of the die area.

If the part is not ejected (due to material buildup or some other fault in the process), a sensor such as a photo switch or light curtain would not detect the ejection. As a result, a fault would occur. The output associated with the die protection's input will come on, which could stop the press.

### 11.1 Applications for Die Protection Inputs

This section describes how the die protection inputs can be programmed for the following three modes:

- Momentary
- Partial Revolution Constant Monitor
- Maintain

#### Momentary

A die protection input programmed in momentary mode only needs to sense something once while the resolver is in the input's programmed dwell window. For example, a N.O. light curtain could be used to detect a part being ejected from a press. When the part is ejected between a programmed dwell window, the light

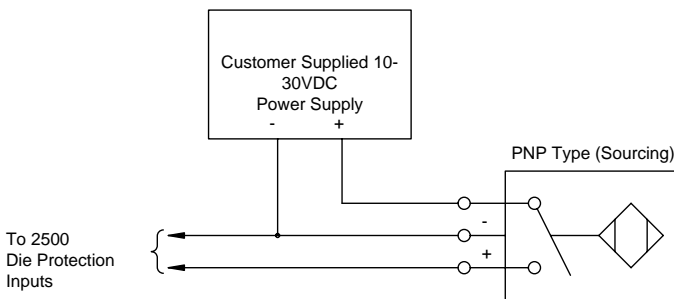
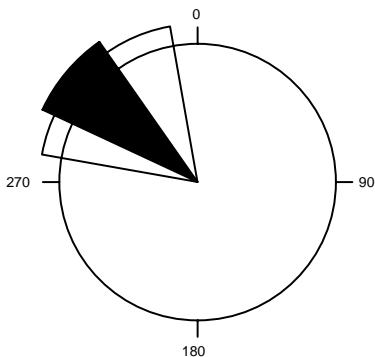


Figure 11-1: Open Collector Device, Photo Switches, Proximity Switches, etc.

curtain's N.O. circuit would close. If a part is not detected within the programmed dwell window, the limit switch's output will come on. This could top stop or E-STOP the press, if properly wired (see Figure 11-1). To make this possible, the sensor needs to be connected to one of the die protection inputs. This input would then need to be programmed with a dwell on and dwell off position.

## Partial Revolution Constant Monitor

An input programmed in partial revolution constant monitor mode monitors only during a part of the revolution (the dwell window the user programs), the input must be made during the entire programmed window or a die protection fault will occur, as shown in Figure 11-2.



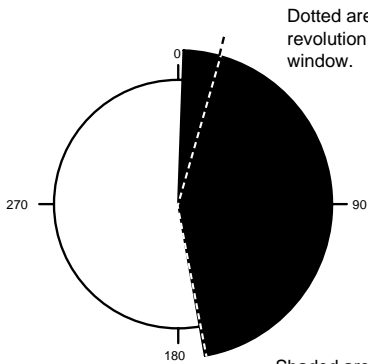
Dotted area represents the momentary dwell window; the period in which a part must be sensed.

Shaded area represents the period the part passes through the light curtain. Fault does not occur because input is detected at sometime within the momentary window

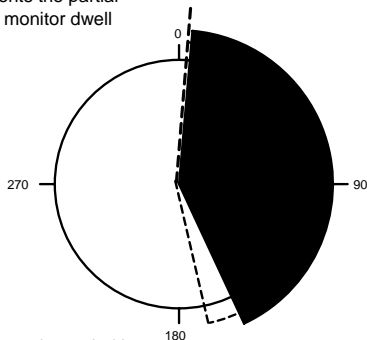
Figure 11-2: Light Curtain Detecting and Ejected Part

Fault does not occur because input is detected throughout the partial revolution constant monitor dwell window.

Fault occurs because input is not detected throughout the partial revolution constant monitor dwell window.



Dotted area represents the partial revolution constant monitor dwell window.



Shaded area represents the period in which an input is detected.

Figure 11-2 Buckle, Metal Bounces When Hit



## Maintain

An Input programmed in maintain mode can be used to detect a short feed of material into the press. After material is fed into the press, a device usually is used to clamp onto the material. This prevents the material from moving before the die is engaged. But sometimes the material can be pulled back just before the clamps are engaged. A sensor programmed with the maintain mode is able to sense this type of fault. It will monitor the material until the end of the revolution it was programmed to monitor, as shown in Figure 11-3.

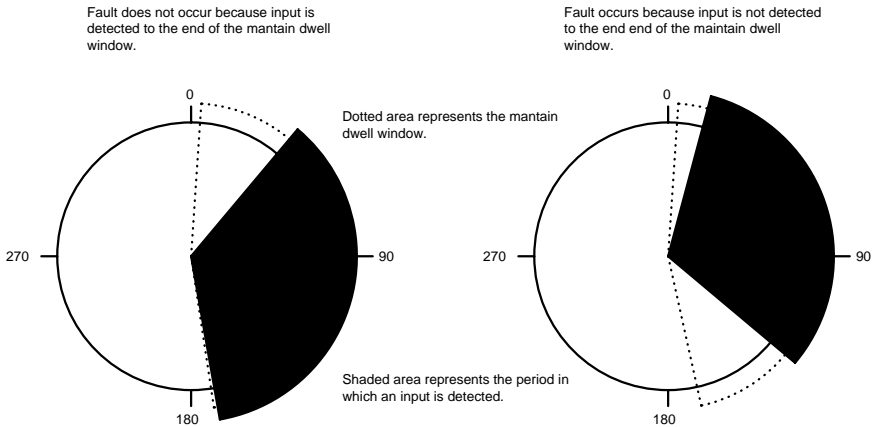


Figure 11-3 Proximity Switch Monitoring for Short Feeds

## 11.2 Input Configuration for Die Protect Momentary

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇐ is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Input Configuration Channel (the second line of the display will show you how the input is presently configured), press ENTER. Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.) The controller will prompt you to enter New Input Type. Rotate knob to scroll through selections until DIE PROTECT MOMENTARY is displayed, press ENTER.

The controller will prompt you to enter the Active Input State. Valid selections are normally open or normally closed. (This determines the state that the input must be in to be considered active). Rotate knob to scroll through selections until desired selection is displayed, press ENTER. The controller will prompt you to enter the New Window On Position, Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Window On Position, press ENTER. The controller will prompt you to enter the New Window Off Position,

Rotate knob to increase / decrease numerical values. Use ⇐⇒ keys to move cursor to next digit, until the displayed value is the desired New Window Off Position, press ENTER.

### Step 3

To escape Input Configuration programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

#### Main Display

Position: 1.234

RPM: 0

#### Main Menu Functions

Scale Factor

Offset

Setpoint Data

Min. Speed Disable

Linear Speed Compensation

Time-Based Outputs

Input Configuration

Save Input Position

Brake Monitor

Motion Detect

Software Version

Select Program

Customize Decimal Pt.

Supervisors Menu

Represents input #7 is set for Die Protection Momentary.

Represents Die Protect window ON at 0.0000 and OFF at 1.000.

Display

IN: 7 DP-MOMENTARY ⇐ EDIT  
WIN: 0.0000 - 1.000 EXIT

## 11.3 Input Configuration for Die Protect Maintain

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇌ is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Input Configuration Channel (the second line of the display will show you how the input is presently configured), press ENTER. Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.)

The controller will prompt you to enter New Input Type. Rotate knob to scroll through selections until DIE PROTECT MAINTAIN is displayed, press ENTER. The controller will prompt you to enter the Active Input State. Valid selections are normally open or normally closed. (This determines the state that the input must be in to be considered active). Rotate knob to scroll through selections until desired selection is displayed, press ENTER. The controller will prompt you to enter the New Window On Position, Rotate knob to increase / decrease numerical values. Use ⇌⇌ keys to move cursor to next digit, until the displayed value is the desired New Window On Position, press ENTER. The controller will prompt you to enter the New Window Off Position, Rotate knob to increase / decrease

numerical values. Use ⇌⇌ keys to move cursor to next digit, until the displayed value is the desired New Window Off Position, press ENTER.

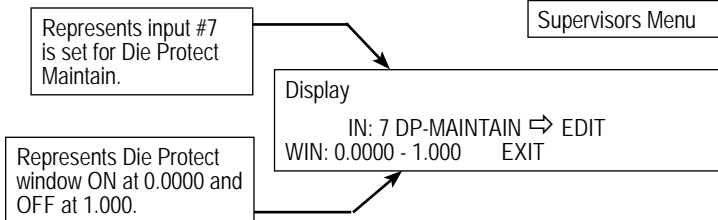
### Step 3

To escape Input Configuration programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

<b>Main Display</b> Position: 1.234 RPM: 0
--

<b>Main Menu Functions</b> Scale Factor Offset Setpoint Data Min. Speed Disable Linear Speed Compensation Time-Based Outputs <b>Input Configuration</b> Save Input Position Brake Monitor Motion Detect Software Version Select Program Customize Decimal Pt. Supervisors Menu
--



## 11.4 Input Configuration for Die Protect Partial

### Step 1

To program the 2500 PLS, press the MENU button then rotate the rotary knob to scroll through the menu driven display until the ⇔ is in front of function desired, press ENTER.

### Step 2

Rotate knob to select desired Input Configuration Channel (the second line of the display will show you how the input is presently configured), press ENTER. Rotate knob to EDIT, press ENTER. The controller will prompt you to enter the users password. (See Chapter 4 Programming: for password details.)

The controller will prompt you to enter New Input Type. Rotate knob to scroll through selections until DIE PROTECT PARTIAL is displayed, press ENTER. The controller will prompt you to enter the Active Input State. Valid selections are normally open or normally closed. (This determines the state that the input must be in to be considered active). Rotate knob to scroll through selections until desired selection is displayed, press ENTER.

The controller will prompt you to enter the New Window On Position, Rotate knob to increase / decrease numerical values. Use ⇔ keys to move cursor to next digit, until the displayed value is the desired New Window On Position, press ENTER. The controller will prompt you to enter the New Window Off Position, Rotate knob to increase

/ decrease numerical values. Use ⇔ keys to move cursor to next digit, until the displayed value is the desired New Window Off Position, press ENTER.

### Step 3

To escape Input Configuration programming screen, either press MENU to back up one screen or rotate knob to EXIT and then press ENTER.

Help Screens are located in each menu. To access, rotate rotary knob to HELP and press ENTER. Use rotary knob to scroll through help screen. To exit HELP screens press MENU or ENTER.

#### Main Display

Position: 1.234  
RPM: 0

#### Main Menu Functions

Scale Factor

Offset

Setpoint Data

Min. Speed Disable

Linear Speed Compensation

Time-Based Outputs

**Input Configuration**

Save Input Position

Brake Monitor

Motion Detect

Software Version

Select Program

Customize Decimal Pt.

Supervisors Menu

Represents input #7 is set for Die Protect Partial.

Represents Die Protect window ON at 0.0000 and OFF at 1.000.

Display

IN: 7 DP- PARTIAL ⇔ EDIT  
WIN: 0.0000 - 1.000 EXIT

## Chapter 12: Faults

This section describes possible faults that may occur and how to clear them.

### Fault Check

The fault check option provides a automatic in-process self-diagnostic mechanism to verify that all PLS functions are operating properly.

The fault check option will detect and disable system operations in event of any of the following problems:

- Disconnected or severed resolver cables
- Open or shorted resolver signals
- Resolver excitation failure
- Resolver-to-digital converter or associated electronic failure
- Microprocessor failure

Non system type faults, such as individual output failures, will not be sensed. It is recommended that the fault check output be used as an “operate enable” type signal. Loss of this output should immediately stop the process which is being controlled.

The fault check input may be operated by an isolated contact, or current sinking device 5VDC @ 5mA.

A pushbutton, wired per Figure 3-4, will provide a method of resetting the fault output after a fault condition has been sensed.

**NOTE:** If the fault check input is not wired, the display and fault check relay will still function. However, to reset and clear the fault, the fault reset input must be cycled.

### PLS Output Status On Fault Conditions

If a fault condition is detected, ALL limit switch outputs will turn off and the display will show the following:

- RESOLVER FAULT CHECK CABLING - A resolver fault has occurred, check cabling.
- No Message - Microprocessor or power supply failure.

This message will remain on the display and the outputs will be off until the problem is corrected and the fault reset button is cycled to reactivate the fault check output and return the display and outputs to their normal operation.

If the fault condition is the result of a microprocessor failure or lockup, the state of the limit switch outputs cannot be predicted. However, the fault check output will turn off until the fault is cleared and the fault reset button is cycled. Removal and reapplication of power to the PLS system may clear a locked-up condition.

### Brake Monitor Fault

The brake monitor receives 120VAC from the press's brake clutch solenoid valve. When the controller senses a loss in voltage from the brake clutch solenoid valve, a timer within the controller is activated. This timer stops when the resolver senses no movement (the press's ram is no longer moving). If the internal timer has a greater time than the programmed time, a brake monitor fault will occur.

- A loss of 120VAC from the brake clutch valve, but the resolver (crank) moves more than 20°. This could be caused by a defective press circuit (consult the press manufacture for details), or that the brake monitor input relay (see figure 2-1) is defective.
- A loose wire to the brake input relay could cause sporadic operation of the brake monitor.
- If the wire connected to the brake input becomes disconnected, or if the connection was never made, the controller will drop out the brake monitor output relay and display BRAKE INPUT ERROR / BRAKE FAILURE DETECTED. If you are not using the 2500 brake monitor feature, you must continuously supply 120VAC to the brake input or disable the brake monitor feature via the supervisor menu. The factory default is brake monitor disabled.

## Die Protection Faults

Any fault in the die protection circuitry will cause a die protection fault to occur. The fault will specify the specific faulted input.

- If the input does not change state within the programmed die protection dwell window, a fault will occur.
- If the input, when a normally open sensor is selected, is closed when reaching the dwell window, a fault will occur.
- If the input, when a normally closed sensor is selected, is open when reaching the dwell window, a fault will occur.

- Transition in a window, if the die protection input is programmed for part revolution constant monitor (see Chapter 11 Applications for die protection inputs), will cause a fault.
- Exiting a dwell window in the wrong state when the die protection input is programmed in the maintain mode (see Chapter 11 Applications for Die Protection Inputs) will cause a fault.

## Resolver Faults

The resolver's coil receives an AC voltage from the 2500 PLS. The rotor coil then feeds the stator coils, which give a ratiometric feedback used to calculate position.

- Confirm resolver wire connections are secure and properly connected. See figure 3-3 for wiring details.
- With a digital voltmeter set to AC, measure the voltage across the pins 2 (black or red) and 1 (red) on position input connector. The voltage level should be between 2.0 and 2.5 VAC. If the voltage is present and is between 2.0 and 2.5 VAC continue to step 5. If the voltage is not present, continue to next step.
- Remove the red and black of red wires from their terminal strip. With the voltmeter still set to AC, check the voltage across the terminals that the red and black of red wires were previously connected to. If no voltage is present, the resolver drive circuit has been damaged. Contact the factory for further assistance. However, if the voltage is present, continue on to the next step.

- Set the digital voltmeter to resistance (ohms). With the red and black of red wires still removed from their terminals, check the resistance across the red and black wires. Normal readings will be 15- 50 ohms. If the reading is low, check the resolver cable for shorts. Remove the connector at the resolver end and check for a low resistance between the red and black of red wires. For pin out detail, see Figure 2-6. If the resolver cable check proves to be correct yet a low resistance is seen when connected to a resolver, it is likely that the resolver rotor coil has been shorted. Contact the factory for further assistance.
- If the voltage in step 2 is present and is between the stated values, the 2500 PLS resolver drive circuitry is working properly. Next, with a digital voltmeter set to AC, check the voltages across the white (pin 3) and black of white (pin 4) on the position input connector. The voltage level should be between 0 and 3.2 VAC, depending on the resolver's position. Slowly rotate the resolver while monitoring the voltage levels. Within one revolution of the resolver, the voltage should make a cycle from approximately 0 to 3.2 VAC. If the voltage levels are present and are between the stated voltages continue to step 7. If no voltage is present continue to next step.
- Remove the white and black of white wires from their terminal strip. With the digital voltmeter set to resistance (ohms) check the resistance between the white and black of white wires. Normal readings will be between 50- 150 ohms. If the reading is low or infinite, check the resolver cable for open/shorts. Remove the connector at the resolver end and check for open/shorts between the white and black of white wires. For pin out detail, see Figure 2-6. If the resolver cable check proves to be correct, yet a low or infinite resistance is seen when connected to a resolver, it is likely that the resolver stator is open or shorted. Contact the factory for replacement of the resolver.
- With a digital voltmeter set to AC, check the voltages across the green (pin 5) and black of green (pin 6) on the position input connector. The voltage level should be between 0 and 3.2 VAC, depending on the resolver's position. Slowly rotate the resolver while monitoring the voltage levels. Within one revolution of the resolver, the voltage should make a cycle from approximately 0 to 3.2 VAC. If the voltage levels are present and are between the stated voltages contact the factory for further assistance. If no voltage is present continue to the next step.
- Remove the green and black of green wires from their terminal strip. With the digital voltmeter set to resistance (ohms) check the resistance between the green and black of green wires. Normal readings will be between 50- 150 ohms. If the reading is low or infinite, check the resolver cable for open/shorts. Remove the connector at the resolver end and check for open/shorts between the green and black of green wires. For pin out detail, see Figure 2-6. If the resolver cable check proves to be correct yet a low or infinite resistance is seen when connected to a resolver, it is likely that the resolver stator is open or shorted. Contact the factory for replacement of the resolver.

## Three Methods for Resetting Faults

During the setup process of the unit there are three choices on how you would like to reset faults, including: Only from the keypad; only from the fault reset input, and; either the keypad or fault reset input. See Figure 3-4 for wiring details. The option for selecting how a fault is to be cleared is in the supervisor menu under SET FAULT CLEAR OPTION.

- **FAULTS CLEARED WITH ENTER KEY**  
= when a fault is detected the display will show the type of error. Press the ENTER key to reset the fault.
- **FAULTS CLEARED WITH INPUT PIN**  
= when a fault is detected the display will show the type of error. Cycle the fault reset input to reset the fault.
- **FAULTS CLEARED WITH ENTER KEY or INPUT PIN** = when a fault is detected the display will show the type of error. Either press the ENTER key or cycle the fault reset input to reset the fault.

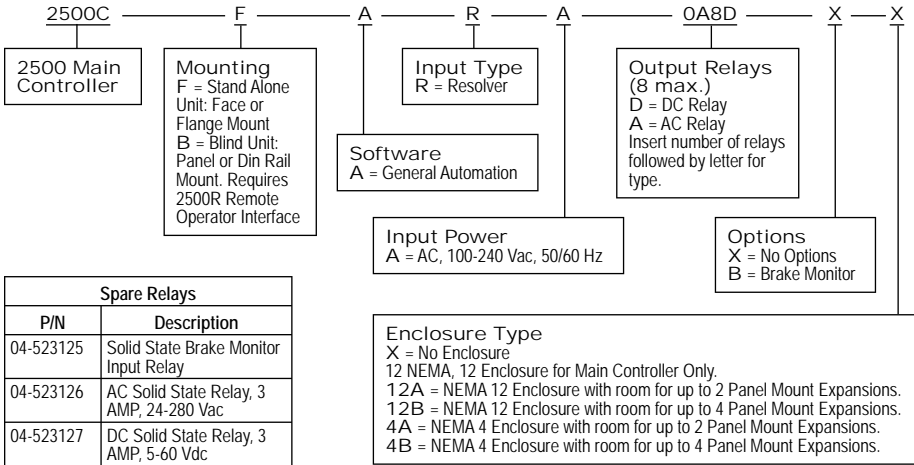




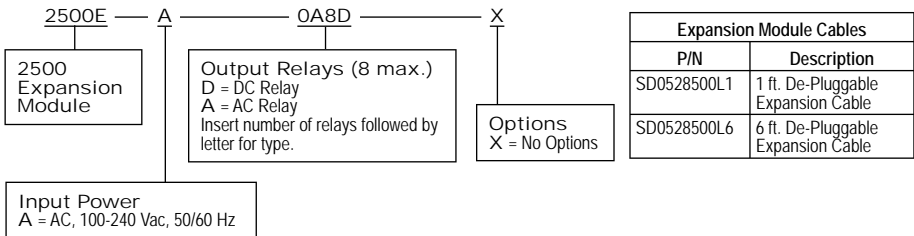
## Appendix A: Ordering Information

Catalog numbers can be found on the back of the controller.

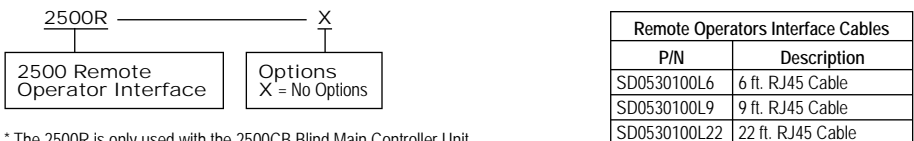
### 2500 Main Controller



### 2500 Expansion Module



### 2500 Remote Operator Interface



\* The 2500R is only used with the 2500CB Blind Main Controller Unit.



## Appendix B: Specifications

### B.1: Main Controller Specifications

Resolution	12 Bit (4096)
Scale Factor	2 - 65535
Scan Time	100 Microseconds, Regardless of Number of Output Channels
Input Voltage	100 - 240VAC 50/60Hz
Power Consumption	7 Watts Max.
Max. Speed	2048 RPM
Job Storage	Up to 15 Programs
Temperature Range	
Operating	32 - 131°F (0 - 55°C)
Storage	0 - 150°F (-17 - 65°C)
Resolver Cable Length	1000 ft. max.
Enclosure Rating	IP50
Output Relays	
DC Relay	Output relay type G4ODC5 5-60VDC, 3 amp max. load 1mA leakage current @ 60VDC 50 microsecond turn-on and turn-off time
AC Relays	Output relay type G4OAC5A 24-280VAC, 3 amp max. load 1.25mA leakage current @ 120VAC 2.5mA leakage current @ 240VAC 8.3 millisecond turn-on and turn-off time, one-half cycle maximum. Relay turns on at zero volt crossing of the AC sine wave.
Inputs 1 - 8	8 Isolated Inputs 10 - 30 VDC, Sourcing Device ON @ >1.5mA @ 10V >4.0mA @ 30V
Program, Fault Clear, Multi-Program Inputs	Sinking Inputs +5VDC max. On @ <1VDC @ 5mA



## B.2: Expansion Module Specifications

Scan Time	100 Microseconds, Regardless of Number of Output Channels
Input Voltage	100 - 240VAC 50/60Hz
Power Consumption	7 Watts Max.
Max. Speed	2048 RPM
Temperature Range	
Operating	32 - 131°F (0 - 55°C)
Storage	0 - 150°F (-17 - 65°C)
Expansion Cable Length	6 ft. max. between each expansion module
Enclosure Rating	IP50
Output Relays	
DC Relay	Output relay type G4ODC5 5-60VDC, 3 amp max. load 1mA leakage current @ 60VDC 50 microsecond turn-on and turn-off time
AC Relays	Output relay type G4OAC5A 24-280VAC, 3 amp max. load 1.25mA leakage current @ 120VAC 2.5mA leakage current @ 240VAC 8.3 millisecond turn-on and turn-off time, one-half cycle maximum. Relay turns on at zero volt crossing of the AC sine wave.
Inputs 1 - 8	8 Isolated Inputs 10 - 30 VDC, Sourcing Device ON @ >1.5mA @ 10V >4.0mA @ 30V
Program, Fault Clear, Multi-Program Inputs	Sinking Inputs +5VDC max. On @ <1VDC @ 5mA

## B.3: Remote Operator Interface Specifications

Scan Time	100 Microseconds, Regardless of Number of Output Channels
Input Voltage	5VDC Supplied Through RJ45 Cable
Power Consumption	7 Watts Max.
Temperature Range	
Operating	32 - 131°F (0 - 55°C)
Storage	0 - 150°F (-17 - 65°C)
RJ45 Interface Cable Length	25 ft. max.
Enclosure Rating	IP50



Other Products



- GEMCO**
- LINEAR DISPLACEMENT TRANSDUCERS
- PLC INTERFACE PRODUCTS
- ROTARY POSITION PRODUCTS
- PROGRAMMABLE LIMIT SWITCHES
- EXTREME DUTY CABLE REEL PRODUCTS
- ROTARY LIMIT SWITCHES
- RESOLVERS
- MILL DUTY ENCLOSURES
- ULTRA HIGH SPEED PLS
- SAFETY PRODUCTS



Copyright 2005 by AMETEK AUTOMATION & PROCESS TECHNOLOGIES.  
All Rights Reserved. Made in the USA.



1080 N. Crooks Road, Clawson, MI 48017-1097  
Phone 248-435-0700 Toll Free 800-635-0289  
Fax 248-435-8120 [www.AMETEKAPT.com](http://www.AMETEKAPT.com)

2500.M2R  
4/05.Z146  
5C