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Servo Roll Feed

SRF-125 (5) through SRF-900 (36)

Operation Manual

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1 Introduction

1.1 General Safety program

Accident free operation will result from a well developed, management sponsored and enforced safety program. Of vital importance to any successful program is the proper selection of guards and devices. However, there is no safety device that will bring “automatic” safety to your operation. Of equal importance to this proper selection of the guard and the device is the training of your personnel. Each person must be trained as to the operation of the guard or safety device, highlighting why they have been provided on the equipment. Rules for safe operating should be written and enforced at all times. A final major concern of an effective safety program is regularly scheduled inspection and maintenance of all of the equipment.

To ensure continued safety at all times, top management, line supervision, safety engineers and all employees must assume their proper share of the responsibility in the program. Only qualified personnel can carry out an effective safety program either as a group or someone who knows your operation and its problems.

To assist you in the development of and continued use of safety programs, many safety minded groups have made guidelines available to you. However, you must know when and how to apply these guidelines. The manufacturer provides information to assist you in properly adjusting and maintaining your equipment. There is no short cut to proper safety; therefore, it is recommended that you comply with their recommendations at all times.

1.2 Warning

This equipment offers various means of operating or controlling machines. The operator must not be in or near the point-of-operation of the machine, or the operating parts of any equipment installed on the machine, or bodily injury could result. The EMPLOYER must post adequate warning signs onto the machine with proper warnings for his machine and the specific application to which the machine and equipment are being applied.
Occupational Safety and Health Act (OSHA) Sections 1910.211, 1910.212, and 1910.217 contain installation information on the distance between danger points and point-of-operation guards and devices. No specific references have been made to which paragraph of OSHA 1910.211, 1910.212, 1910.217 or any other applicable sections because the paragraphs may change with each edition of the publication of OSHA provisions.

All equipment manufactured by us is designed to meet the construction standards of OSHA in effect at the time of sale, but the EMPLOYER installs the equipment so the EMPLOYER is responsible for installation, use, application, training, and maintenance, as well as adequate signs on the machine onto which this equipment will be installed.

Remember, OSHA says that the EMPLOYER must use operating methods designed to control or eliminate hazards to operating personnel.

It shall be the responsibility of the EMPLOYER to establish and follow a program of periodic and regular inspections of his machine to insure that all their parts, auxiliary equipment, and safeguards are in a safe operating condition and adjustment. Each machine should be inspected and tested no less than weekly to determine the condition of the machine. Necessary maintenance or repair of both shall be performed and completed before the machine is operated. The EMPLOYER shall maintain records of these inspections and the maintenance work performed.
PA Industries is not responsible to notify the user of this equipment of future changes in State or Federal laws, or construction standards.

1.3 Warranty Program

We warrant our new parts against defects under normal use and service for a period of 12 months after date of shipment. Our obligation under this warranty is limited to replacing or repairing (at our option) the defective part without charge, F.O.B. our plant in Bloomfield, Connecticut. The defective part must be forwarded to our plant, freight prepaid, for our inspection prior to replacement or repair. **EXCEPT AS EXPRESSLY PROVIDED HEREIN, THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING A WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE**. Furthermore, the seller does not warrant or represent that the equipment complies with the provisions of any law, particularly including the Occupational Safety and Health Act of 1970, and regulations promulgated there under. In no event shall we be liable for special, indirect incidental or consequential damages, however rising.

1.4 Receiving and Inspection

SPECIAL NOTE: P/A INDUSTREIS INC. ASSUMES NO RESPONSIBILTIY IN CONNECTION HEREWITH, NOR CAN IT BE ASSUMED THAT ALL ACCEPTABLE SAFETY MEASURES ARE CONTAINED IN THIS PUBLICATION, OR THAT OTHER ADDITIONAL MEASURES MAY NOT BE REQUIRED UNDER PARTICULAR OR EXCEPTIONAL CIRCUMSTANCES OR CONDITIONS.

RECEIVING INSPECTION:
Before removing the unit from its packaging, check for visual damage, especially if the crate, skid, or carton has been damaged in transit. Any damage caused by shipping should be immediately reported to the carrier. If the unit appears to be in satisfactory condition, remove all packing and wipe rust preventive from rollers with mild solvent.

2 Design

2.1 Components

The Control consists of following major components:

1. Power Disconnect Switch
2. Line Filter (optional, not shown)
3. Primary AC Power Circuit Breaker, 2-pole
4. Primary DC Power Circuit Breaker, 1-pole
5. AC/DC Power Contactor Relay
6. Power Supply, 24VDC
7. Power Supply, 5VDC (optional, not shown)
8. Servo Amplifier
9. PLC Power supply
10. PLC Processor
11. PLC Input Module
12. PLC Output Module
13. PLC Encoder Port Module
14. Output Relays
15. Forward / Reverse Remote Jog Pendant (not shown)
16. Wire Terminals
17. Servo Motor Power cable (not shown)
18. Servo Motor Power cable (not shown)

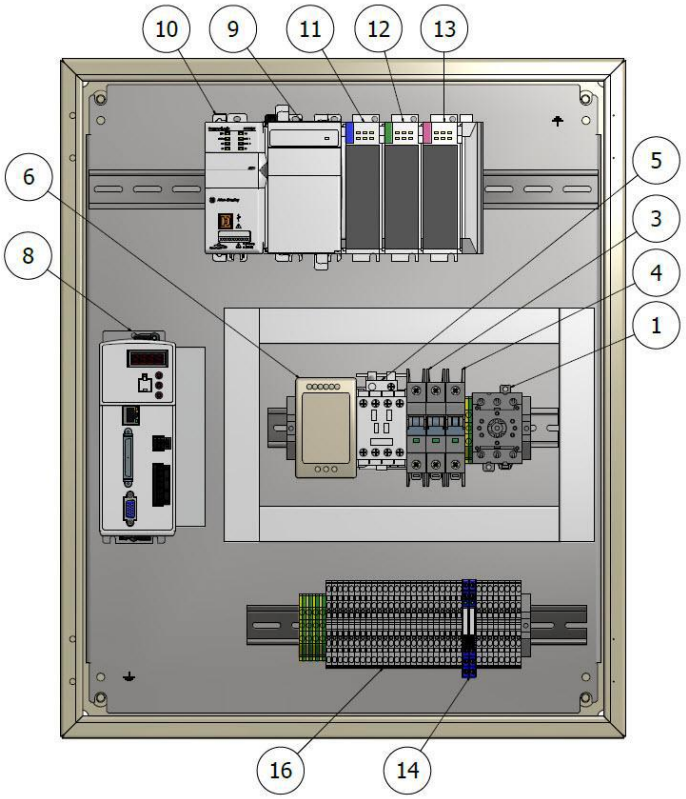


Figure 1

2.2 Operator Dashboard

All operator instruments are located on the front side of the electrical enclosure, the Dashboard:

1. Black/Grey lockable Main Disconnect Switch turns the primary AC and DC power of the Control on and off.
2. Green, illuminated Power On / Reset button turns the secondary AC and DC power of the Control on and resets the servo drive if power is already on.
3. Red, crowned Power Off button turns the secondary AC and DC power of the Control off.
4. Green, illuminated Cycle Start button turns the Control from "Manual" into "Auto".
5. Red Cycle Stop button turns the Control from "Auto" into "Manual" mode.
6. While the In Position light is on when the servo motor is holding steady position. It is off when the servo motor is in motion, the Control is being reset or in fault mode.
7. Black, JTL / Manual selector switch toggles the Control between "Manual" and "JTL" (Jog To Length) modes.
8. Red, push-in/twist-out Emergency Stop button shuts the secondary AC and DC power of the Control off.
9. Operator Data Entry and Display Terminal or HMI (Human-Machine Interface).

Figure 2

2.3 PLC, Servo Drive and Motor Operation Principles

A Servomotor is a specific type of motor and a rotary encoder combination that forms a servomechanism. The encoder provides position and velocity feedback in form of timely continuous electrical pulse (counts) string.

PLC (Programmable Logic Control) calculates proportional, integral and derivative corrections based subsequently on current, accumulated and predicted position and velocity errors. The weighted sum of these corrections is used to produce motion commands for the Servo Drive.

Servo Drive applies electrical current to the Servomotor in correspondence with motion commands.
The motion target is defined by entered into PLC values of length, geometrical characteristics of the feeder's mechanics and amount of the Servomotor encoder counts per one revolution of its shaft.

Let's say one revolution of the servomotor produces (x) amount of electrical counts and it is equal to (y) amount of material linear units (millimeters or inches), therefore the scale of this example is (x / y). In order to move material for (z) amount of material linear units, PLC calculates a motion commands for the Servo drive to rotate the motor for (z • x / y) counts. As the motor moves, its feedback signals are monitored by PLC that applies needed corrections all the way until the motor reaches targeted position.

The motion performance, such as accuracy of positioning and feeding time, is defined by selected Servo Drive and servomotor combination, incoming AC voltage, and entered into PLC values of velocity, acceleration/deceleration and tuning parameters.

3 Operating Features

3.1 Standard

- **Start-Up Mode**
  - The Control in **Start-Up Mode** is being boot-up. The boot-up process of the control is to verify that all its components are not in faulted condition and all external conditions are in the appropriate state.
- **Servo Drive Fault Mode**
  - The servo drive of the Control is in fault condition.
- **Manual Mode**
  - The Control in **Manual Mode** allows for infinite material jogging in both directions, switching to JTL or Auto Modes, altering all the Control parameters and access to all Diagnostic screens.
- **JTL Mode (Jog To Length)**
  - The Control in the **JTL Mode** allows for material jogging in both directions limited within Length, switching to Manual Modes, altering all the Control parameters and access to all Diagnostic screens.
- **Auto Mode**
  - The Control in **Auto Mode** is waiting for the Feed Signal, feeding material or waiting for the Reset Signal. There is a limited access to Diagnostic screens.
- **Diagnostics**
  - **Diagnostics** is a set of screens that allow for manual control of outputs and monitoring digital and encoder inputs. These screens may be accessed in any of the Control mode other than Auto Mode. When Diagnostics are in use the Control cannot be switched into Auto Mode.
- **Continuous Stroke**
  - **Continuous mode** is used in press applications where feeding a length of material can be completed within duration of Feed Signal. In case Feed Signal turns off while feeding is still in progress, Auto mode is stopped and Press-Feeder Synchronization error is displayed on HMI main screen.
- **Single Stroke**
  - **Single stroke mode** is used in press application where feeding a length of material cannot be completed within duration of Feed Signal. Therefore the press makes its stroke only after receiving a confirmation from the Control in form of Permit Press output.
  - Another use of Single Stroke mode is “Cut-to-Length” applications where a shear is used in place of a press and Feed Signal comes from a sensor when shear is open. Dwell time is define by duration of the shear down stroke and Reset signal is applied permanently.
- **Feed Signal**
  - Duration of the **Feed Signal** is a time available for the material feeding and its start and end are defined in degrees by the press position when its die set is open.
- **Reset Signal**
  - **Reset Signal** should be set for 5-10° past BDC of the press and must never overlap Feed Signal. Its purpose to reset Permit Press output in Single Stroke mode and provide confirmation to PLC logic of the press continuous rotation.
- **External Alarm 1**
  - **External Alarm 1** is an input that terminates Auto Mode immediately and the corresponding message is displayed. In order to start Auto Mode this alarm must be cleared.

- **External Alarm 2**
  - **External Alarm 2** is an input that terminates Auto Mode in an orderly fashion, the same way as when Cycle Stop button is pressed. The corresponding message is displayed on HMI. In order to start Auto Mode this alarm must be cleared.
- **Emergency Stop outputs**
  - **Emergency Stop** outputs are two pairs of contact that go off when Emergency Stop button is pressed.
- **Auto Mode output**
  - **Auto Mode** output is a relay that is on during Auto Mode and off in any other.
- **Permit Press output**
  - **Permit Press** output is a relay that is only active in Single Stroke Mode. It turns on when material feeding is complete and stays on either for the duration of Dwell time or, if Dwell is zero, until Reset Signal turns on.
- **In Position Indicator**
  - **In Position Indicator** is a pilot light on Operator Dashboard that is on when the Feed is holding material (not moving). Any motion, manual jogging or Auto Mode index causes In Position Indicator to go off. It is also off when the Control is disabled manually or by the hardware fault.
- **De-Bounce**
  - **De-Bounce** a parameter in milliseconds. Its purpose is to eliminate a mechanical relay contact bouncing effect, when such a relay is used to provide Feed Signal to the Control. Press-Feeder Synchronization monitoring is suppressed for the duration of De-Bounce time after Feed Signal turns on.
- **First Stroke Option**
  - **First Stroke Option** is a parameter with two values – FBP (Feed-Before-Press) and PBF (Press-Before-Feed). A typical use of FBP is Cut-To-Length application. PBF is used mostly in stamping press applications.
- **Batch Count**
  - **Batch Count** is a parameter that indicates how many parts of Batch Size are made.
- **Batch Size**
  - **Batch Size** is a parameter that sets desirable amount of parts to make. When Batch Count reaches Batch Size the Auto Mode is turned off. In order to turn the Control into Auto Mode again, the Batch Count must be reset before attempting to press Cycle Start button.
- **Sub-Batch Size**
  - The purpose of **Sub-Batch** Size is to stop Auto Mode every time amount of made parts reaches its value. In order to turn the Control into Auto Mode again, press Cycle Start button.
- **Length Micro Adjust**
  - The purpose for Length Micro Adjust is to allow incremental altering of Length parameter in Auto Mode.
- **Operator Language**
  - The Control features the following languages: English, German, Spanish, French, Portuguese, Turkish, Dutch, Swedish, Czech, Polish and Russian. A current language is indicated on HMI main screen with a corresponding to the language country national flag. A language selection is as easy as a touch of a button.
- **Units of measure**
  - Units of measure, Metric and Imperial, are both available via easy touch button selection. All corresponding values are converted at the time of selection.

3.2 Optional Features

- **STE (Strip Encoder)**
  - **STE or Measuring Wheel** is a mechanical assembly that consists of mounting frame, slide, slide air cylinder, three way air valve, slide sensor, encoder, encoder wheel, support roller and cable that connect the encoder and the sensor to the Control.

  - When the air valve button is pressed, the slide is pushed down by the air cylinder and the wheel reaches the material. The Sensor indicates that the encoder is engaged. There are two modes of controlling material feeding with STE: Check and Control.

  - **Check Mode**
    - During **Check mode** when the Feed Signal turns on, PLC records current position of the STE. At the end of the move, PLC records current position of STE again, calculates measured by STE distance and deducts it from the Length parameter, forming an error and compares it against STE In Position parameter. If the distance measured by STE is acceptable there is no action taken, otherwise the Auto Mode turns off and STE Positioning error message is displayed. Every press stroke the difference between Length parameter and the distance measure by STE is displayed on HMI main screen.
  - **Control Mode**
    - During **Control mode** the same error is found at the end of the move, but, in this case it is compared against the Feed In Position. If delta fits into it, there is no action taken otherwise the Control commands another move for error distance and the process is repeated. Amount of such repeats is set by “Maximum Correction Moves” parameter. In case all required correction moves are complete and error is still outside the Feed In Position the Auto Mode turns off and STE Correction Move Count Error message is displayed. If during these additional moves the Feed Signal turns off, the Press-Feeder Synchronization fault is declared and Auto Mode turns off.
- **PLS (Programmable Limit Switch)**
  - The **PLS** consists of encoder and a cable that connects it to the Control. Its purpose is to provide programmable press cam outputs. There are 6 outputs available, 2 of them are dedicated as Feed and Reset Signals, the rest can be used for various purposes. The encoder must be connected to the press crank shaft with ration 1:1 via flexible coupling or plastic belt, absolutely no metal chain or rigid coupling is advised due to the sensitive mechanical design of the encoder. When the Control is power up an electrical impulse is sent to the encoder that causes it to send back to the Control a burst of pulses (counts) amount of which is proportional with its absolute position in the scale of 1024 counts per 360°. This position is used as a start point of the press crank shaft rotation. The current position of PLS is displayed on HMI main screen in all modes other than Auto Mode. When in Auto Mode the press speed in strokes per minute is displayed instead.
- **Sequential Feeding**
  - The purpose for **Sequential feeding** is to provide a sequence of feeding parameters that are organized in Steps that are executed sequentially one after another. A complete sequence is considered is a one part for the Batch Count. The last Step is followed by the first one. Each Step consists of Length, Repeat and Gag Output Combination. Step Length is a feeding distance. Step Repeat is an amount of times the Step

must be executed before switching to the next one in sequence. Gag Output Combination defines gag outputs that must be on during the Step. Gag Outputs are turned on and off at the beginning of Feed Signal in press application. As an optional feature gags engagement and disengagement on time can be confirmed and the corresponding fault declared when they fail to do so.

  - **Punching Bench**
    - In the **Punching Bench** application Gag Outputs are turned on at the end of the material feeding in and stay on for the duration of Dwell time. Gags confirmation is not available in this case.

- **Gag Confirmation**
  - **Gag Confirmation** is a set of optional inputs, two pre Gag Output. One confirms gag engagement, the other one disengagement. In case that at least one of the confirmations does not happen on time, the Auto Mode turns off and the corresponding message is displayed on HMI.

4 HMI Navigation

4.1 Program Library

The Program Library is the program storage and consists of 200 parameter sets (programs) that are pre-created in the Control PLC with metric of imperial default values that are specific for each model of the Feed. A program can be infinitely modified, but cannot be deleted.

Each program in PLC memory has its unique identifier number (1-200). This number is displayed on each program selection screen. It will simplify program search if program name starts with its identifier.
Save As function allows for saving a program under different identifier. It is important to understand that if the program with identifier A is saved using “Save As” function under identifier B, the program previously existed under identifier B is deleted.

A program name may consist up to 25 alpha-numerical characters of English alphabet. Each program also has its internal PLC number, which is displayed on the program selection screens. To simplify a program search it is recommended to use a program number as a part of its name.

In order to use a program for production it must be activated (copied) into Run Program. Any library program, including an activated one may be edited at any time and its alterations do not apply to the Run Program - reactivation is required.

A **non-sequential** standard program is a set of the following parameters: Program name, Batch Size, Sub-Batch Size, Motion Profile, Speed, Acceleration and Deceleration.

A **sequential** standard program has a max set of 50 steps that are executed sequentially one after another and the first one after the last. Its parameters are divided into two groups – program common and steps.

The sequential program common parameters are: Last step, Program name, Batch Size, Sub-Batch Size and Motion Profile. Step parameters are: Step Number, Step Length, Repeat Step, Speed, Acceleration, Deceleration and Gags.

As an option both non-sequential and sequential programs may have 4 PLS cams with **on** and **off** press positions. Each cam may have a customer specified name. Cam names are part of setup parameters and may consist up to 25 alpha-numerical characters of English alphabet.

4.2 Main Screen

Figure 3

HMI starts with its banner screen when power turns on.

Touching the Banner screen brings on the *Main* screen.

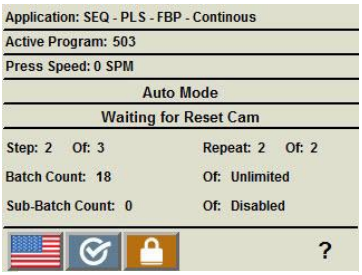


Figure 3A

- The **first line** of the screen displays an abbreviation to describe the current feature selection:
  - STD – standard or SEQ – sequential;
  - PLS – programmable limit switch;
  - STE– Check – strip encoder in Check mode or STE-Control – strip encoder in Control mode;
  - PBF – Press Before Feed or FBP - Feed Before Press;
  - Single – single stroke mode
  - Continuous – continuous stroke mode;

- The **second line** displays name of an active program.
- The **third line** is empty when there is no selected PLS and STE.
- If PLS is selected, Press Position in degrees is displayed in the left corner when the Feed is in Manual mode and Press Speed in strokes per minute in Auto mode.
- If STE-Check is selected a position error in units of length is displayed in the right corner when the Feed is in Auto mode.
- The **fourth line** displays current state of the Control: Start-Up, Servo Drive Fault, Manual, JTL, and Auto.
- The **fifth line** displays a variety of messages:
- Press-Feeder Synchronization Fault – Auto mode was stopped because current motion index was not finished when the Feed Signal turned off.
  - **External Alarm** – Auto mode was stopped because External Alarm input turned on.
  - **Waiting for Reset Cam** – Auto mode is on and waiting for the Reset Signal to turn on.
  - **Waiting for Feed Cam** – Auto mode is on and waiting for the Feed Signal to turn on.
  - **STE Wheel Up** – Auto mode was stopped because STE Wheel Up sensor turned on indicating that the wheel is not resting on the material.
  - **STE Positioning Error** – Auto mode was stopped because STE, by the end of the motion index, declared Positioning error.
  - **STE Correction Move Count Error** – Auto mode was stopped because all required STE correction moves were complete and position error was still outside of the Feed In-Position.
  - **Batch Complete** – Auto mode was stopped because amount of parts equal to Batch Size have been made.
  - **Sub-Batch Complete**– Auto mode was stopped because amount of parts equal to Sub-Batch Size have been made.
  - **Settling Sync Error** – Auto mode was stopped because in STE Check mode during settling time Feed Signal turned off.
  - **Sequence Lost** – during Sequential feeding Auto mode was forced to stop manually resulting error in sequence tracking.
  - **Reset Cam is On** – Either of jog buttons is pressed while Reset Signal is on (die is closed) and no motion permitted.

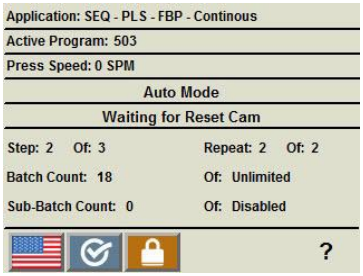


Figure 4

The area below fifth line has two different appearances:

← Sequential feeding it displays Current Step and Repeat;

Non-sequential feeding it displays Length. →

In both cases Current Batch and Sub-Batch Counts are displayed as well.

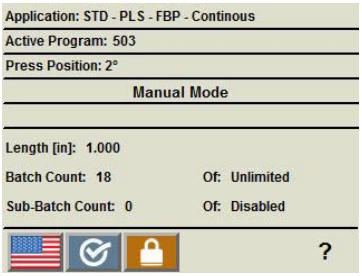


Figure 4A

The Main Screen will have the following three icons displayed:

 → Allows the user to select a language.

 → Displays a list of stored/saved programs.

 → Gives access to the switchboard.

Optional button below will only be accessible when sequential is activated and only while the Control is not in Auto mode:

 → This button will force current step to step one.

In the event a password is selected and the timer for the password timeout is exceed a password entry icon will be displayed:

 → Press to enter a valid password for access to feeder settings.

4.2.1 Switch Board

 Feeder Setup

 Options

 Tuning

 Fault History

 Units

 Diagnostics

 HMI Setup

4.3 Dashboard Parameters (Sub-Screens)

4.3.1 Keypads

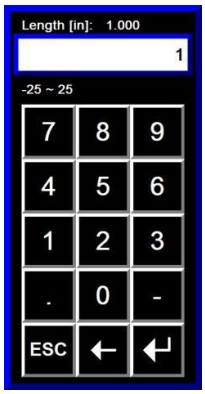


Figure 5

Numerical Keypad – Displays the parameter it's assigned to, the current value, units of measure and permitted minimum and maximum values.

Alpha-Numeric – Displays to enter template names or passwords.

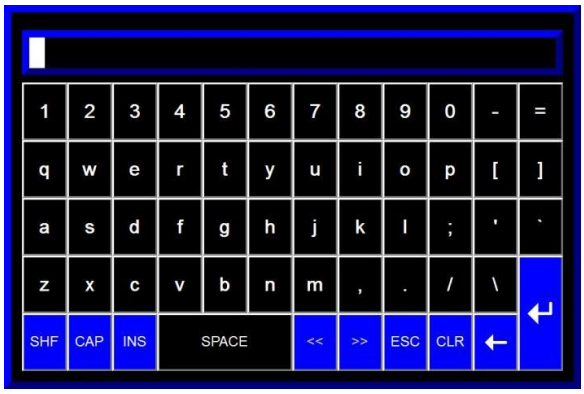


Figure 5A

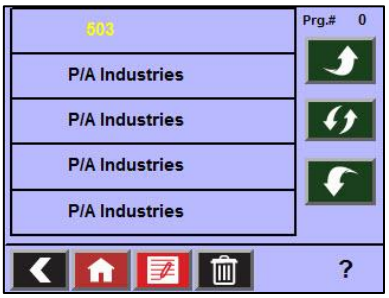
4.3.2 Language Selection

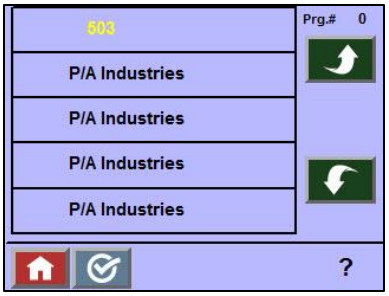
Figure 6

Press the desired flag to select the appropriate language.

4.3.3 Program Selection and Edit

To activate a program select a desired one by touching its name, then press Activate button. Use page up and page down button if needed. The storage space will allow for up to 200 stored programs.





→ **Edit Program (Main Screen):** Brings you to the program list.

→ **Home:** Brings you to the Main Screen.

→ **Activate:** Selects the highlighted program and makes it active.

→ **Page Up:** Scrolls one page up.

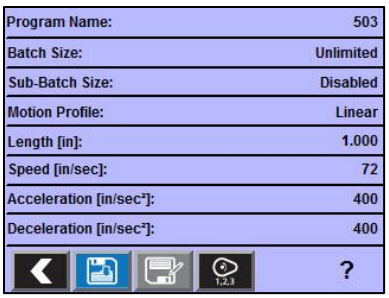
→ **Page Down:** Scrolls one page down.

→ **Edit:** Allows you to edit the selected program.

→ **Delete:** Erases the selected program.

Standard Program Edit

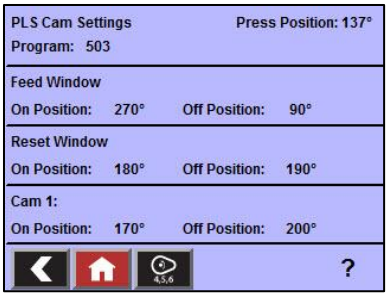
- **Program name** may consist up to 24 alpha-numerical characters. Touch to open entry keypad.
- **Batch Size** is a parameter that defines amount of parts to be made before Auto Mode automatically stops. Maximum value of Batch Size is 10,000,000. Entering 0 will make Batch Size to be unlimited. Touch to open entry keypad.
- **Sub-Batch Size** is a parameter that defines amount of parts within Batch Size to be made before Auto Mode automatically stops. Entering 0 will disable Sub-Batch Size functioning. Touch to open entry keypad.
- **Motion Profile** is a parameter that defines whether the feed motion profile is Linear or S-Curve. In other words, the motion profile is triangle or trapezoidal with linear acceleration / deceleration, or acceleration / deceleration is S-shaped. The S-Curve becomes handy on applications with possible material slippage between the rolls of the feed. Touch to toggle between Linear and S-Curve.
- **Length** is a distance in inches (or millimeters) of the feed index. It is a numeric entry with a range of 0 to the Maximum Length. Touch to open entry keypad.
- **Speed** is the maximum velocity of the material in in/sec (or m/sec). It is a numeric entry. Its maximum value depends on mechanical configuration of the feed and the model of installed servo motor. Touch to open entry keypad.
- **Acceleration** is the rate of acceleration in in/sec2 (or mm/sec2). It is a numeric entry. Normally set to 400 in/sec2 (100 m/sec2). Touch to open entry keypad.
- **Deceleration** is the rate of deceleration in in/sec2 (or mm/sec2). It is a numeric entry. Normally set to 400 in/sec2 (100 m/sec2). Touch to open entry keypad.



→ Saves any changes you made to the program template

→ Save a copy of the current program with changes. This will prompt you to choose a location within the list to store the program.

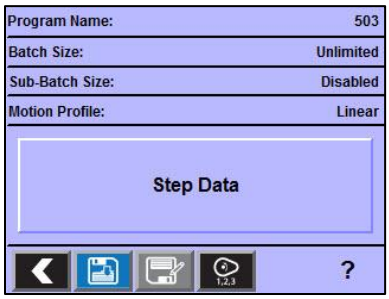
PLS Program Edit



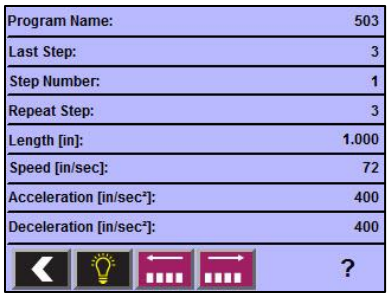
After PLS is activated in the options menu, there will be a cam icon displaye in the Tool Edit screen. Tap this icon to edit the cam positioning. The standard PLS allows for a total of 6 cams.
These degree values will control when the appropriate relay will turn on and off. The screen for PLS cams 1,2,3 and cams 4,5,6 are identical by structure. Each one displays a program name, current press position and three cams On and Off positions in degrees. Feed and Reset Cams are dedicated, used internally by PLC and therefore do not have physical output relay. *Touch to open entry keypad.*

 → Tap to edit Cams. When editing tap again to switch between cams 1, 2, 3 and 4, 5, 6.

Sequential Program Edit



Step Data button opens up screen with step specific parameters.



Last Step indicates how many steps to execute in the sequence of the program. In other words, although there are 50 given steps in each program, the Last Step parameter is the actual count of how many steps will be executed. It is a numeric entry. *Touch to open entry keypad.*

Step Number indicates number of the currently opened step. It is a numeric entry. *Touch to open entry keypad.*

Length is the current step feed index distance in inches (or millimeters). It is a numeric entry with a range of 0 to the Maximum Length. *Touch to open entry keypad.*

Speed is the current step material maximum velocity in inch/sec (or m/sec). It is a numeric entry. Its maximum value depends on mechanical configuration of the feed and the model of installed servo motor. *Touch to open entry keypad.*

Acceleration is the current step material maximum acceleration in inch/sec^2 (or m/sec^2). It is a numeric entry. Normally set to 400 inch/sec^2 (100 m/sec^2). *Touch to open entry keypad.*

Deceleration is the current step material maximum deceleration in inch/sec^2 (or m/sec^2). It is a numeric entry. Normally is set to 400 inch/sec^2 (100 m/sec^2). *Touch to open entry keypad.*

 → Open a new screen to edit any gag outputs or confirmation.

 → Change the step. Press to go to a previous step.

 → Next step. Advances one step.

4.3.4 Feeder Setup

Feed Direction controls the direction of motor rotation. In order to change feed direction, the servo drive must be disabled (by pressing and holding Power On/Reset button.
Touch to toggle between >>> and <<<.

First Stroke Option is a parameter that defines whether the feeder indexes when Cycle Start button is pressed (providing the Press is at TDC) or waiting for the press to make first stroke.
Touch to toggle between Feed Before Press and Press Before Feed.

In Position is a tolerance window around the final material position. This is used to verify the feed index accuracy is within acceptable limits before continuing onto the next function. It is a numeric entry. Normally is set to 0.020" (0.5 mm). *Touch to open entry keypad.*

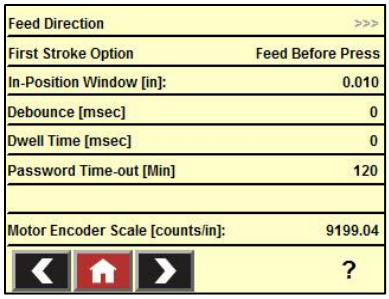
Debounce is the amount of time each input should stay HI or LOW, in order to be recognized. It is a numeric entry, with a range of 0 to 999 msec. It is normally set to 1. *Touch to open entry keypad.*

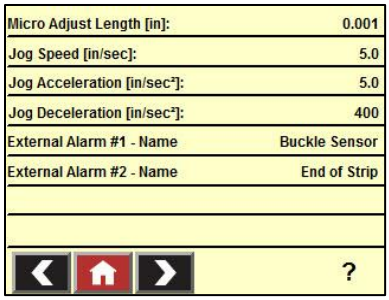
Dwell controls the "On" duration of the "Permit Press" output while the control is in Single Stroke mode. It is also is used for test purposes to make a pause between Feed and *Reset* signals. The next feed length will not be started until Dwell time is expired. It is a numeric entry with a range of 0 to 10000 msec. *Touch to open entry keypad.*

Password time-out is duration of password protection being lifted off. It is a numeric entry with a range of 10-to 120 min. *Touch to open entry keypad.*

Motor Encoder Scale is the encoder scaling parameter used to define the number of encoder counts/inch (or mm). It is not an entry, pressing onto the Scale value will open Feeder's Setup-2 screen. (Scale calculation screen). *Touch to open entry keypad.*
****NOTE: Motor Encoder Scale is not an entry; it is a result of internal calculations based to the rest on parameters of this screen, which are numeric entries. ****

Micro Adjust Increment is a parameter that defines (in non-sequential feeding only) an increment of the Length Micro Adjust function. It is a numeric entry with the range of 0.001 to 0.040 inch (0.025-1.000 mm). Touch to open entry keypad.



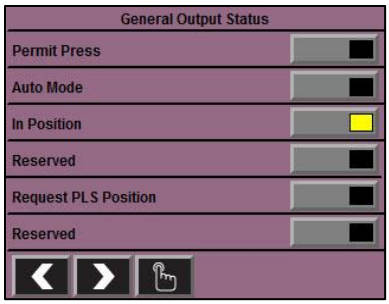


Jog Speed is the maximum jogging speed. It is a numeric entry, typically set for 3.0-5.0 inch/sec (0.07-0.12 m/sec. Touch to open entry keypad.

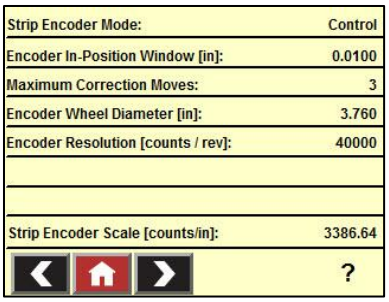
Jog Acceleration is the rate of jogging acceleration. It is a numeric entry with a range of 0-400 in/sec2 (0-10m/sec2) Normally set 10 in/sec2 (0.25m/sec2). Touch to open entry keypad.

Jog Deceleration is the rate of jogging deceleration. It is a numeric entry with a range of 0-400 in/sec2 (0-10m/sec2) Normally set 400 in/sec2 (1.0m/sec2). Touch to open entry keypad.

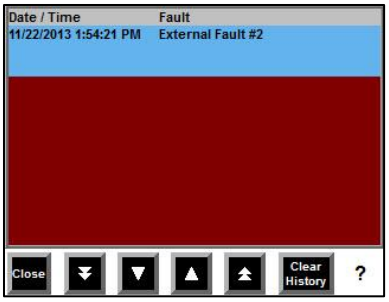
External Alarm #1 & #2 defines a name to be displayed on the Main screen when corresponding input turns ON. It is alpha-numeric entry with the maximum of 25 characters.



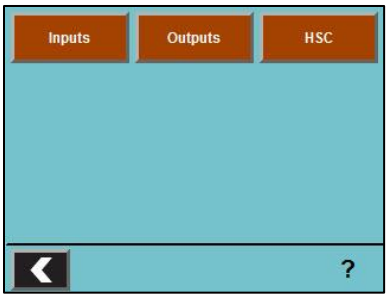
Strip Encoder Scale is not an entry; it is a result of internal calculations based to the rest on parameters of this screen, which are numeric entries. Touch to open entry keypad



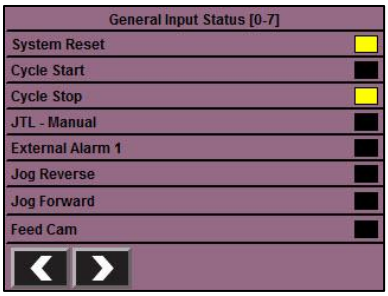
Fault History screen contains a list of all previously registered servo drive faults with date and time of their occurrence. Clear History button deletes all stored faults.

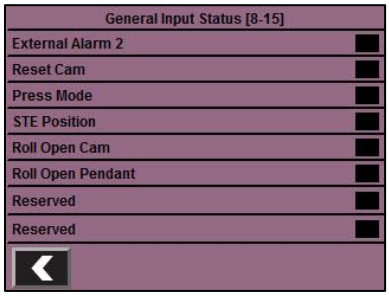


4.3.5 Diagnostics



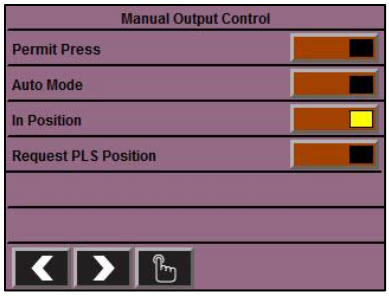
This screen is to select different options of available hardware diagnostics – Inputs, Outputs or optional Encoders (PLS and STE)





Inputs:
Rectangular indicators on the right reflect status of inputs.

Yellow – Input is ON
Black – Input is OFF

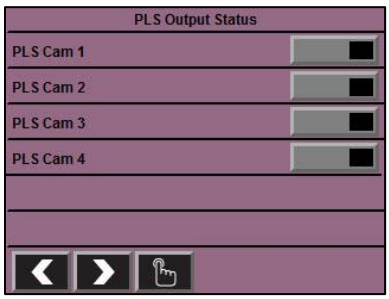


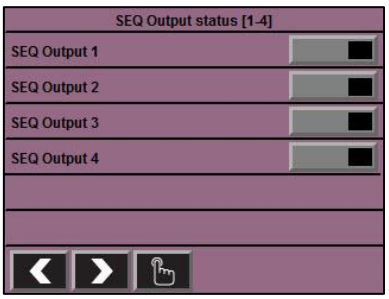
Outputs:
These screens allow for viewing state of outputs and their manual control.

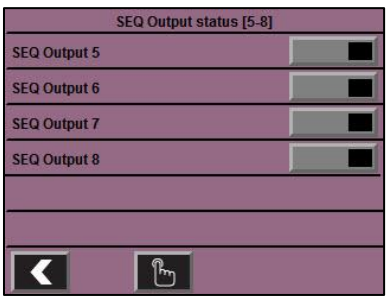
When the screen is open, all output buttons are grayed-out and indicators on the right side of each button reflect current state of outputs

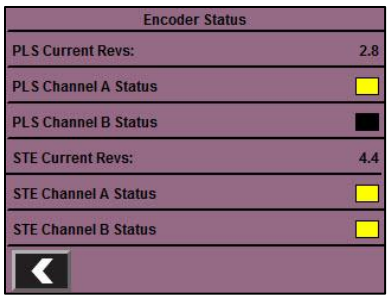
 → Manual Control button is only visible when the Feed is not in Auto mode. This disables the servo drive and enables the output buttons. Press a desired output button and watch the indicators on the button and output module to switch on. Press the button again to switch off.

Following screens are shown only in their first state (output buttons are grayed-out):









Encoder Diagnostics (PLS and STE):

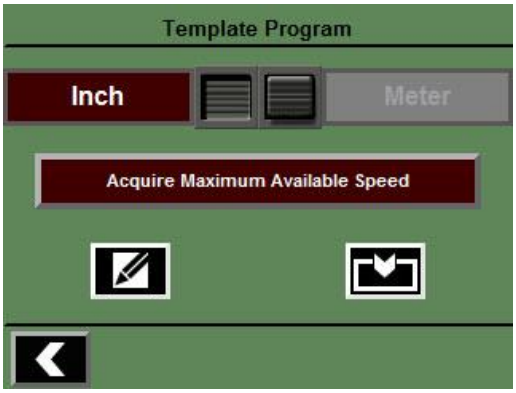
To diagnose an encoder spin a shaft of desired one and watch its revolution counter and signal channels change.

Units of Measure

Changing Units of measure involves re-loading Program Library.

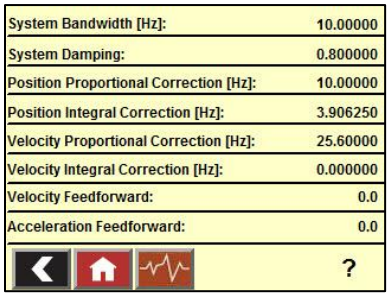
All Scale related parameters of programs and Feeder's Setup are reset to default values during this process.

Program default values, such as default Length, Speed, Acceleration and Deceleration may be edited. Press corresponding button to do so.



Acquire Maximum Speed:

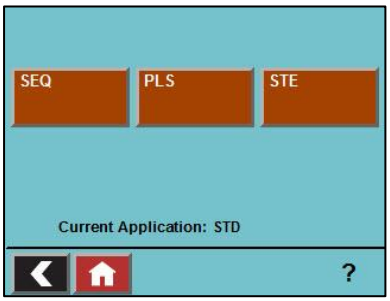
4.3.6 Tuning Settings



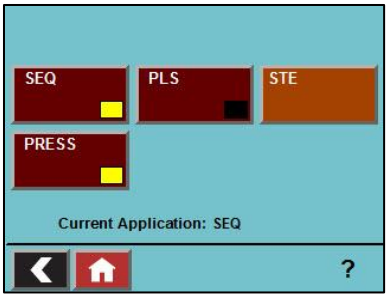
Tuning parameters of the servo drive are extremely important for the feed's performance. **Do not change these parameters** unless it is directed by qualified personnel, such as P/A field or factory representative, etc.

4.3.7 Feeder Options

SEQ, PLS and STE are optional features and protected by authorization code. When an option is purchased with the original order it is unlocked at the factory.



The screen on the left represents locked options, the screen on the right has SEQ Press option unlocked and selected, PLS option unlocked, but not selected. A text string at the bottom of the screen also reflects currently selected options, STD means no options selected.



Any attempt to select locked option will results in prompting for authorization code. If authorization code of an option is obtained from P/A it must be entered in order to unlock the purchased option.

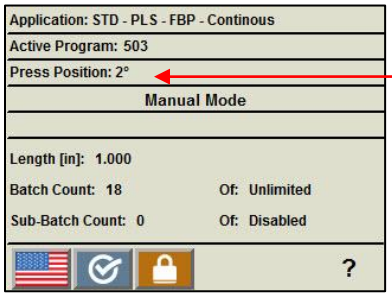
Once an option is unlocked it stays unlocked, a yellow indicator on every option button indicates selection, black one – de-selection.

4.4 Quick Actions

The following quick actions are available:

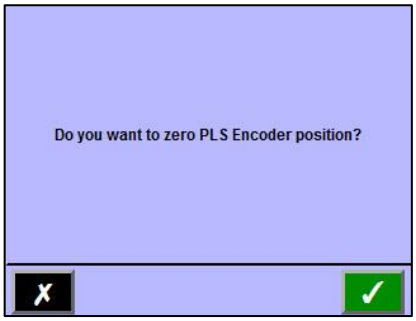
- Initialize PLS
- Acknowledge fault message
- Batch Count Reset
- Sub-Batch Count Reset
- Sequence Reset
- Length micro-adjust

I**nitialize PLS -** (set current position of PLS encode to zero degrees) press and hold PLS readout on the Main screen, then press and hold Proceed button or Back button to quit.

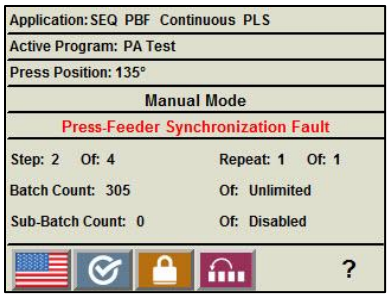


Press and hold here.

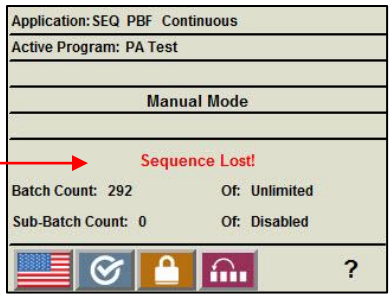
Confirmation Message



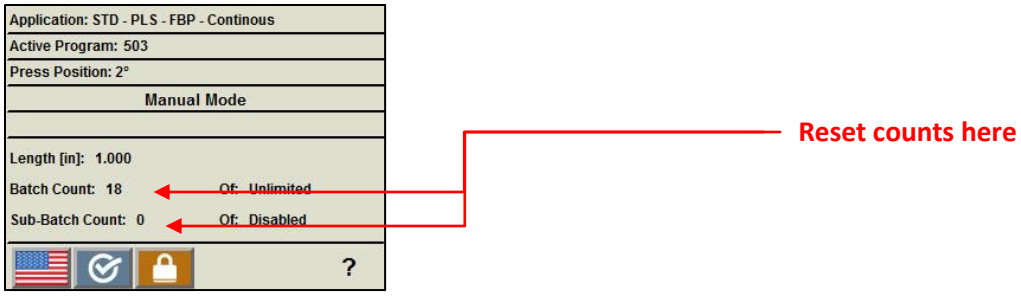
Acknowledge Fault Message – On the Main screen press and hold the given message to clear.



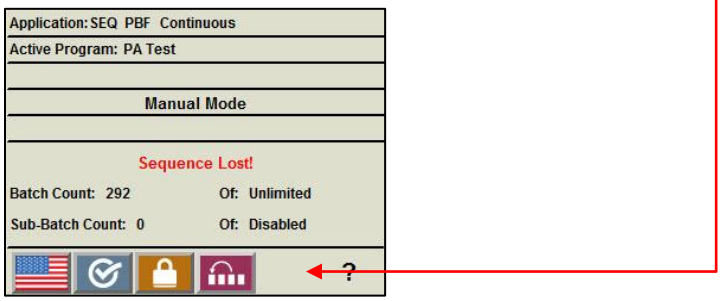
If the message is caused by Alarm 1 or Alarm 2 the fault will clear itself when the corresponding input is cleared.



Reset Batch Count/Sub-Batch Count – Press and hold the number of the field you want to reset.



Reset Sequence – Press and hold the Reset Signal icon. 



Micro-adjust Length - Press numurical value in the Length field while the Feed is in Auto mode and the screen will change its appearance. Press '+' or '–' buttons to adjust Length, x button to close micro-adjust.

5 Running the Feed

IMPORTANT!

The maximum ambient temperature rating of the PAK350 Electrical Control is 95 °F (35 °C)

5.1 Installation an Power Up

Before turning the power on for the first time make sure that the feed is installed mechanically according to the original order specifications and installation manual.

- Make all required connection in accordance with the supplied electrical schematic. Verify incoming power.
- If the feed does not have P/A PLS, verify setting of the press cam switches for the Feed, Reset and Pilot Release cams.
- Turn on the main power disconnect switch - this applies power to the control (24VDC) power supply which, in turn, is applied to the PLC, HMI and Servo Drive. HMI boot up takes about 1 minute, wait until banner screen on HMI turns on.
- Press the green Power On push-button, it will illuminate, indicating that main AC power is applied to the Servo Drive. Wait for the IN POSITION light to illuminate. Touch Banner screen, see Main screen opens up. At this point the Feed should be in Manual Mode and ready to operate.

At the top of the Main screen configuration of the current application is displayed, verify it is correct. If it is not; follow this manual procedures and correct the application.

5.2 Loading

IMPORTANT!

Prior to this step the Electrical Control must be powered up and all needed parameters are loaded. Please refer to the Operation Manual for details.

NOTE: This example is based on using PLS (Programmable Limit Switch) but all PLS timing notes can be translated to other forms of timing.

1. Put the Feeder electrical control into “MANUAL MODE”. Record the present settings of the Feed Cam, Reset Cam, and Pilot Release Cam into a tool set-up record sheet for future reference to the job.

2. Adjust the roll clamping force by pre-loading the two die springs located on top of the feed housing. Normal setting for the roll force spring pre-load is two full turns clockwise from finger tight (factory preset). Be sure to use the jam nut to lock the setting.

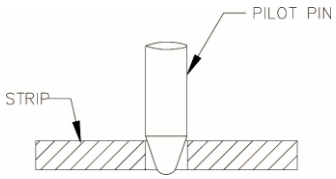
3. Open the Feeder rolls by pulling on the Manual Roll Release Lever and latching it in open roll position. Insert the material through the Feeder rolls, unlatch and close the Feeder rolls by releasing the Manual Roll Release Lever.
4. Adjust for the material thickness using the Material Thickness Adjustment Cam and Adjustable Lock Screw. Make the play at the end of the roll release lever approximately 1/16” (1.5mm).

5. Using the Jog Forward button on the jog pendant, advance the material up to the entrance of the die (far enough where the punches would not pierce the material).

6. Check the vertical alignment of the strip. If necessary, adjust the pass line of the Feeder so that the material is at the proper height.

7. Assuming that the press shut height and the tool are set up properly, jog the press one or two strokes without the feed working.

8. Jog the press down slowly observing when the longest pilot would engage the pilot hole in the material if the material were there. Note the press positional readout and put this setting into your program for the 'Pilot Release On' setting. The 'Pilot Release Off' setting, in most cases, should be 180º. Some drawing applications require the rolls to remain open past 180º.



9. Continue to jog the press slowly until the longest pilot just comes out of the material. Note the press positional readout and put this setting into your program for the 'Feed Cam On' setting. Set the 'Feed Cam Off' point so that there is enough time to complete the Feeder length and enough time to stop the press, if there is a feed fault.

Set the 'Reset Cam On' for 180 degrees and 'Reset Cam Off' for 200 degrees. This setting should never need changing.

5.3 Manual and Auto Modes

In Manual Mode material strip may be moved infinitely in both directions by using Jog Pendant.

- "JTL" mode is used primarily during the threading of the strip through the die. This mode allows the Jog – To – "Feed Length" operations to be performed. While in the "JTL" mode, the strip may be moved infinitely, in both directions, within "Feed Length" The "Jog Forward" button is inactive at the end of the "Feed Length" and "Jog Reverse" button is inactive at the beginning of the "Feed Length".

To switch from "Manual" mode to "Auto" press Cycle Start button, the mode indicator of the Main screen will change accordingly, "Auto" relay will turn on.

The Feed has 2 modes of automatic cycling as follows.

- The feeder can operate with Single Stroke or Continuous modes. The mode is selected through an input to the feed electrical control. The Press single stroke/continuous mode switch should be interfaced to that input for proper operation.
  - During single stroke mode operation, the "Permit Press" relay is activated upon the completion of each feed index.

If the Feed is set to run in Continuous modes, during "Auto" mode, the control keeps check on synchronization of the feeder and the press. If the feeder does not complete the index within the feed cam window, the message **"Press-Feeder Synchronization Fault"** is displayed and Auto Mode is stopped.

The "Permit Press" relay remains activated until the reset cam signal turns on, or for the duration of the Dwell, if the Dwell parameter is programmed.

- Relay may be used to signal the press when to initiate the single stroke cycle. The automatic cycling of the press

and feeder will continue until:

- The batch is completed
- The cycle is stopped by the Operator
- An error occurs. During “Continuous Press” mode, the “Permit Press” is inactive.

The “Auto” relay remains activated until the automatic cycling is stopped by either:

- Cycle Stop button
- Batch Complete internal command
- Press-Feeder Synchronization Fault
- servo drive related error

Under “Cycle Stop” or “Batch Complete” stopping, the output will turn off at the beginning of the Feed Cam Signal. This should allow the press to stop near the top of the stroke.

In the case of “Sync Fault” or other drive fault conditions, the “Auto” relay will turn off immediately upon detection of an error.

6 Troubleshooting

The table below contains the common issues the feeder may encounter.

Table 1: Common Feeder Issues

Symptom	Possible Solution
No power indication when Power On button is pressed	1. Check the main power supply for proper voltage. 2. Check the supply circuit breakers. 3. Verify that the main disconnect switch is on. 4. Verify that the E-Stop is not engaged (E-Stop Loop closed.) 5. Check the bulb in Power On push button.
No display on power up	1. Check 24 VDC power supply.
Feed will not jog	1. Check if the Reset Signal is off, it must be off in order to jog. 2. Check if IN POSITION indicator is off. Check parameters. Check drive for Error Codes. 3. Check the FAULT in display i.e. DRIVE FAULT # ABC. Check for Error descriptions in Section xx
Power On indicator is lit. Feed will not operate.	1. Check that the IN POSITION indicator is lit. If not, check tuning parameters. 2. Check that the Error message is in the Display. If so, check error description in Table 2
Feed will not accept new “Feed Length” or other parameters	1. Make sure that the feed is not in “Auto” Mode. 2. Reset the Feed.
Inaccurate feeding	1. Adjust the rolls for the correct material thickness; the tip of the roll release lever must have a small amount of play/wobble – approx. 1/16’’. 2. Adjust the spring pressure (Do not bottom springs. Catastrophic damage can occur.) 3. Confirm if the rolls are slipping on the strip. Remove oil from the feed rolls, reduce acceleration, check the tool for binding/slugs, etc. 4. Adjust the upstream equipment if the upstream equipment not providing adequate/consistent free loop. 5. Check the roll release for the proper settings
Feed runs backwards	1. Verify that the direction parameter has been set properly (>> or <<).
Drive Fault	This is a generic display prompt indicating a fault on the Servo Drive. 1. Look at the diagnostic display on the Servo Drive. The cause of the fault can be determined by reading the Error Code. 2. Refer to Sections xx. This fault condition can be caused by any one of the errors in the lists. 3. Check the Error Code first, then reset the Servo Drive by turning the power off, waiting 10 seconds, and then powering the Servo Drive back on. 4. Verify that the fault will not reset. Call the factory for assistance.

If the problem you are having does not appear in the above chart, or does and you have questions about it, call the P/A Service Department for assistance. Please have your Model Number and Serial Number ready. However, it is advisable to check the basics before calling to be sure the problem is not something simple that may have been overlooked.

Table 2: Servo Drive Error Codes

Servo Drive Code	HMI Message	Problem or Symptom	Potential Cause	Possible Solution
02	Illegal Hall State	State of Hall feedback inputs is incorrect.	Improper connections.	Check wiring of S1,S2, and S3 Check the power supply to the encoder.
03	Motor Overspeed (FL)	Motor speed has exceeded 125% of maximum rated speed.		Check motor wire phasing. Check cables for noise. Check tuning.
05	Motor Over temperature	The motor thermostat, motor thermistor, or encoder temperature sensor indicates that the motor factory temperature limit has been exceeded.	High motor ambient temperature and/or Excessive Current.	Check motor wiring at motor feedback (MF) connector. Check TS+ and COM wiring. Operate within (not above) the continuous torque rating for the ambient temperature. Lower ambient temperature or increase motor cooling. Verify the proper motor has been selected.
07	Motor Thermal Protection	The thermal model for the motor indicates that the temperature has exceeded 110% of its rating.	The machine duty cycle requires an RMS current exceeding the continuous rating of the motor.	Change the command profile to reduce speed or increase time.
10	Servo Drive Over current	The drive fault output indicates that the power transistors were turned off because of over current, over temperature, or power supply problems.	Motor cables shorted.	Verify continuity of motor power cable and connector.
			Motor winding shorted internally.	Disconnect motor power cables from the motor. Use a meter to check that the resistance of phase-to-phase is not open and that phase-to-ground is open.
			The drive temperature is too high.	Check for clogged vents or defective fan. Make sure cooling is not restricted by insufficient space around the unit. Verify ambient temperature is within the specification.
			Operation above continuous power rating and/or product environmental ratings.	Operate within the continuous power rating. Reduce acceleration rates.
			The drive has a short circuit, Overcurrent or failed component.	Remove all power and motor connections, and perform a continuity check from the DC bus to the U, V, and W motor outputs. If a continuity exists, check for wire fibers between terminals, or send drive in for repair.
			Loss of TTL signal	Check AM+, AM -, BM +, and BMsignals.
11	Servo Drive Over temperature	Inverter thermal switch tripped.	Drive fan failed.	Replace the failed drive.
			The cabinet ambient temperature is above rating.	Check the cabinet temperature.
			The machine duty cycle requires an RMS current exceeding the continuous rating of the controller.	Change the command profile to reduce speed or increase time.
			The airflow access to the drive system is limited or blocked.	Check airflow and re-route cables away from the drive system.
13	Servo Drive Thermal Protection	The thermal model for the power transistors indicates that the temperature has exceeded 110% of its rating.	The machine duty cycle requires an RMS current exceeding the continuous rating of the controller.	Change the command profile to reduce speed or increase time.
			Motor brake on.	Turn motor brake off.

33	Servo Drive Bus Undervoltage	With three-phase power present, the DC bus voltage is below limits.	DC bus voltage for 460V system is below 275V. DC bus voltage for 230V system is below 137V. DC bus voltage for 120V system is below 80V	Verify voltage level of the incoming AC power. Check AC power source for glitches or line drop. Install an uninterruptible power supply (UPS) on your AC input.
35	Servo Drive Bus Overvoltage	The DC bus voltage is measured above a factory limit.	Excessive regeneration of power.	Use a larger system (motor and drive).
			When the motor is driven by an external mechanical power source, it may regenerate too much peak energy through the drive power supply. The system faults to save itself from an overload.	Use a larger system (motor and drive).
			DC bus voltage for 460V system is over 820V.	Install shunt resistor.
43	Feedback Loss	On sin/cos encoders, the sum of the square of the sin/cos signals has been measured below a factory limit. On TTL encoders, the absolute value of the differential A/B signals is below a factory limit.	The motor feedback wiring is open, shorted, or missing.	Check motor encoder wiring. Run Hookup test in RSLogix 5000 software.
47	Feedback Self Test	The feedback device has detected an internal error.	Damage to feedback device.	Call P/A Service Department to return motor for repair.
50	Hardware Overtravel - Positive	Axis moved beyond the physical travel limits in the positive direction.	Dedicated Overtravel input is inactive.	Check wiring. Verify motion profile. Verify axis configuration in software.
51	Hardware Overtravel - Negative	Axis moved beyond the physical travel limits in the negative direction.		
54	Excessive Position Error	Position error limit was exceeded.	Partial loss of feedback signals.	Check all wiring at motor feedback (MF) connector.
			Improperly sized drive or motor.	Verify sizing of system.
			Mechanical system out of specifications.	Increase the feed forward gain. Increase following error limit or time. Check position loop tuning. Verify mechanical integrity of system within specification limits. Check motor power wiring.
55	Excessive Velocity Error	Velocity Error value of the velocity control loop has exceeded the configured value for Velocity Error Tolerance.	Partial loss of feedback signals.	Check all wiring at motor feedback (MF) connector.
			Improperly sized drive or motor.	Increase velocity error limit or time. Check velocity loop tuning. Verify sizing of system.
			Mechanical system out of specifications.	Increase velocity error limit or time. Check velocity loop tuning. Verify mechanical integrity of system within specification limits. Check motor power wiring. Reduce acceleration.

56	Over torque Limit	Motor torque has exceeded a user programmable setting.	Overly aggressive motion profile. Mechanical binding.	Verify motion profile. Verify Overtorque settings are appropriate. Verify sizing of system. Verify torque offset
			Mechanical system out of specifications.	Verify mechanical integrity of system within specification limits.
57	Under torque Limit	Motor torque has fallen below a user programmable setting.	Improperly configured limit. Improperly configured motion. Improperly drive/motor sizing.	Verify motion profile. Verify Overtorque settings are appropriate. Verify sizing of system.
			Mechanical system out of specifications.	Verify mechanical integrity of system within specification limits.
61	Drive Enable Input	The hardware enable input was deactivated while the drive was enabled. This is applicable only when drive enable input is used.	An attempt was made to enable the axis through software while the Drive Enable hardware input was inactive.	Check wiring of drive enable input. Check 24V source.
			The Drive Enable input transitioned from active to inactive while the axis was enabled.	Verify that Drive Enable hardware input is active whenever the drive is enabled through software.
62	Controller Initiated Exception	The controller has requested the drive to generate an exception.	User configured software Overtravel.	Move axis out of soft Overtravel range. Clear soft Overtravel fault. Check soft Overtravel configuration. Consult controller documentation.