Computrol Control System

Variable Speed

Rotary Compound Liner

Control System Operation Manual

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WARNING

To ensure that the equipment described by this Manual, as well as the equipment connected to and used with it, operates satisfactorily and safely, all applicable local and national codes that apply to installing and operating the equipment must be followed. This includes the National Electrical Code in the USA and other applicable legislation, regulations, and codes in practice elsewhere. Since codes can vary geographically and can change with time, it is the user's responsibility to determine which standards and codes apply, and to comply with them.

FAILURE TO COMPLY WITH APPLICABLE CODES AND STANDARDS CAN RESULT IN DAMAGE TO EQUIPMENT AND/OR SERIOUS INJURY TO PERSONNEL.

Persons supervising and performing installation or maintenance must be suitably qualified and competent in these duties, and should carefully study this manual and any other manuals referred to by it prior to installation and/or operation of the equipment.

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation, operation, or adjustment of the equipment.

The contents of this manual are believed to be correct at the time of printing. However, no responsibility is assumed for inaccuracies. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance or the contents of this manual without notice.

Note to Translators

This manual describes many different functions with similar terminology. Please read through the whole manual before beginning to translate. Refer to the Control System Description, Glossary of Terms and Functional Definitions for aid in determining precise translations.

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Control System Description

Liner in a Shop

Safe Operating Procedures

Always follow safety procedures when working on or near the Liner. Ensure that you have adequate training for the tasks you perform and refer frequently to the Operation and Maintenance Manuals for current information. Some safe operating guidelines include:

- Operation and Maintenance Manuals should be readily available for all personnel working with the Liner.
- All personnel using or controlling the Liner should be thoroughly familiar with all operating procedures and safety hazards.
- Do not wear rings, watches, or jewelry while near machinery.
- Do not wear loose fitting clothes, neckties, etc., while near machinery.
- Long hair should be protected with hair net or safety helmet.
- Always wear eye and ear protection while near Liner.
- Only properly trained and experienced personnel should perform mechanical and electrical troubleshooting and repair.
- **NEVER** attempt to perform maintenance, repairs, or clear a jam while machine is in operation.
- Any personnel performing maintenance on the Liner must be absolutely sure that the Liner is taken out of service. The controls must be locked and keys removed and properly marked with a warning sign. Follow the published lockout, tag-out procedures for the plant.
- When clearing jams, ensure that the Emergency Stop Push-Button is depressed before reaching into Liner.
- Keep all Guards in place and ensure they are properly used.
- Never by-pass safety interlocks. Be sure to report any violation of these practices to management.
- Ensure all lifting devices used in the maintenance of the End Liner are properly rated for the lifting task.
- Allow Motors to cool before performing maintenance.

Synopsis of controls

The Variable Speed Rotary Compound Liner is a machine designed to precisely apply compound to container closures at high throughput rates (up to 2150 units/minute). The VSRL-X can control the throughput rate to match line speeds without affecting the quantity or quality of the compound applied by maintaining a constant chuck speed regardless of throughput rate. The throughput rate (Liner speed) can be adjusted using the integrated display unit, which also gives the operator feedback regarding the status of the machine. All functions related to the speed of the machine are adjusted automatically.

The control system for the Electronic Gun Liner consists of two parts: controls for the Liner itself, and controls for the electronic guns. The control system uses two separate Programmable Logic Controllers (PLCs): one PLC is located in the control panel (to control the Liner) and one is located in the upper turret electrical tank (to control the electronic guns). These PLCs communicate via an RS485 serial communication network. The rotation of the upper turret necessitates the use of a non-brush-type slip ring to maintain electrical continuity of incoming 24 VDC power and RS485 connections to the upper turret. The PLC used in the control panel also contains an integrated Programmable Limit Switch (PLS). The PLS reads information from a resolver attached to the main drive to obtain speed and position information which is shared with the panel PLC.

Control System Ordering Options

Number of Downstackers

A Liner can incorporate one (1) or two (2) downstackers (infeed lanes).

Number of Gun Stations

A VSRL Liner can be ordered with three (3), four (4), six (6) or eight (8) stations.

Type of Compound

Liners involve different controls for Water-based, Solvent-based and Plastisol (Oil-based) compounds.

Water-based Liner Options

Controls System Options for Water-based Liners are Compound Rotary Union (with compound tank level control), and Power/Vacuum Brush.

Solvent-based Liner Options

Compound Conditioning Unit, which includes a Heater (with thermostat and over-temperature control) and a Pump (to deliver the compound to the Compound Rotary Union). Control systems for Solvent-based Liners employ explosion-proof motors and sensors, as well as an air purge system which provides an explosion-proof rating for the electronic gun system.

Plastisol Liner Options

Plastisol Conditioning Unit (PCU) that delivers plastisol to the Compound Rotary Union at proper temperature and pressure. The PCU comes with its own control system.

Gun Adjustment

Electronic Guns can be ordered with Full Step (~0.001in/adjustment) or Half Step (~0.0005in/adjustment) control of Gun Lift. Half Step Lift control gives tighter control over compound flow rate, but makes large adjustments difficult. Full Step control is adequate for most applications. Guns can also be ordered with manual adjustment where the adjustment is made using a hand crank instead of adjustment solenoids.

Line Control of Liner Speed

VSRL-X Liners can accept speed-setting commands from Line control. This option involves some form of communication (hardwire interlocks, DF1/DH+, or RS232/RS422) between the Liner controls and the Line Control control system. The form and content of this communication can vary significantly and each request will be handled individually.

Line Control Messages

A limited number of Line Control Messages can be displayed on the Liner display. The number of messages available depends on the configuration of the system. This option involves some form of communication (hardwire interlocks, DF1/DH+, or RS232/RS422) between the Liner controls and the Line Control control system. The form and content of this communication can vary significantly and each request will be handled individually.

Data Collection

The Liner Control system can make information available for data collection systems. Typical data includes a Liner Status Code and operational parameter values. This option involves some form of communication (usually DF1/DH+, or RS232/RS422) between the Liner controls and the Line Control control system. The form and content of this communication can vary significantly and each request will be handled individually.

Liner Control Features

Power Disconnect Switch

To lock out all power to the system, a safety disconnect switch is provided. It is located on the door of the power compartment of the panel. *The disconnect switch should be turned to the OFF position and locked out (following plant procedures) when performing Liner maintenance to remove all power to the Liner and prevent any accidental starting of the main drive.*

Liner Power Selector Switch

A keyed selector switch is provided to lock out all control power to the system, including the PLC and display. It is located on the door to the control power compartment of the panel. The key may only be removed in the OFF position.

Emergency-Stops

Pressing an E-Stop push-button removes all 24 VDC control power from the system, and will stop the Main Drive, the Chuck Drive and any compound conditioning equipment. One E-Stop push-button is mounted on the control panel console. Provisions are made on the control schematics and interconnect documents for more to be added by the customer. The E-Stop push-button on the panel console is a latching 2 position E-Stop push-button with a separate Reset Power push-button to prevent automatic restarts.

Guards

Removable guard doors are located on three sides of the Liner to allow access to the Liner tabletop for maintenance and cleaning. These doors are fitted with safety limit switches indicating the (open or closed) position of each guard door to the panel PLC. If a guard door is opened, power is removed from the drive controllers, the brake is applied (if Liner is running), and a message will be sent to the display. This message can be cleared during any maintenance or gun adjustment requiring the Gun Setup Display, but any attempt to start the Liner with a guard open will latch an alarm and bring back the guard open message. Optionally, guard switches with locking mechanisms can be fitted. With this option, the guard doors will be locked in place by a solenoid lock whenever the main drive control switch is in Run or Jog until 8 seconds after the machine is stopped.

Drive Brake

The Liner Main Drive is fitted with an air-activated mechanical brake. It is electrically fail-safe: the brake solenoid must be energized to release the brake. The brake will be activated by an E-Stop (no control power), a downstacker jam, or a guard being opened while the main drive is turning. If control power is available, the brake will deactivate 10 seconds after the Main Drive is stopped to allow the upper turret to be turned by hand. Activating the brake while the main drive is running causes wear and tear on the gear train, so the brake should be activated only in emergencies. Use the Drive Stop Push-button to stop the Liner under normal conditions as this allows the Liner to coast to a stop.

Drive Modes

The Liner Drives can be set into three different modes of operation using Selector Switch SS1: Jog, Safe, or Run.

Jog

When SS1 is in Jog position, both the Main Drive and Chuck Drive will run at minimum speed as long as the Drive Start Push-button PB3 is pressed. The Jog feature is usually used to test rotation, or to check for obstructions when mechanical adjustments are made.

Safe

Power to the drive controllers is removed while the drives are in Safe mode. The Drive Start Push-button will have no effect. Safe mode allows maintenance and troubleshooting with control power on, without power being applied to the drive controllers. The key can be removed only when SS1 is in the Safe position.

Note: *Remove power to all motors using Main Disconnect Switch DS0 when performing any maintenance tasks that require disassembly of parts.*

Run

Pressing the Drive Start Push-button with Selector Switch SS1 in Run will start the Liner. It will not stop until the Drive Stop or Emergency Stop Push-Buttons are pressed or an alarm of sufficient importance is detected.

Variable Speed Drives

The VSRL-X Liner uses two drive motors: the Main Drive and the Chuck Drive. The Main Drive determines the Liner speed and the Chuck Drive controls the chuck speed. These drives are controlled using Variable Speed Drive Controllers. These devices vary the frequency of the motor supply voltage to vary the speed of the motor.

Main Drive

The Main Drive controller is given an analog input reference signal from the panel PLC to deliver the desired speed. This speed can be set using the integrated display. The Liner speed can also be determined via line control. This system option requires some form of communication with line control: hardwire interlocks, DH+ or RS232/422. In order to execute this option, prior arrangements must be made to establish the form and content of this communication.

Chuck Drive

The Chuck Drive controller is given an analog input reference signal from the panel PLC to deliver the desired speed. The desired chuck speed (rpm) is set using the integrated display. The panel PLC will control chuck speed automatically toward the desired value regardless of Liner speed.

Infeed Selector Switches

The Liner controls feature one selector switch per infeed lane. Turning an Infeed selector switch to ON will put the lane indicated into production (or standby if the line control interlock is off). On Dual-Infeed Liners, infeed lanes can be run independently.

Infeed Timing Signals

The Programmable Limit Switch (PLS) integrated into the M4500 controller handles the timing of the infeed cutoff knives. The PLS reads position and speed information from the resolver attached to the main drive shaft. The proper positions to open and close the knives are determined upon machine setup, and are programmed into the PLS using one channel (timing signal pattern) to open the knives and one channel to close the knives per infeed lane. The PLS includes a speed compensation array to compensate for mechanical delays in the system (in this case solenoid valve actuation times), which means that varying the speed of the machine will have little effect on downstacker timing.

Line Control Interlocks

The Liner controls provide one incoming and one outgoing Line Control Interlock per lane. The Liner In Auto Interlock contact closure (outgoing) tells the Line Control that the Liner is ready to accept ends. The Line Control in turn must supply the Liner with a signal that the rest of the line is ready for the Liner to run, and that there is a sufficient supply of ends to open the infeed.

Discharge Air

The Liner provides air jets at the exit rails to assist the flow of ends out of the machine. Discharge Air is activated when any infeed cutoff knife is opened, and is deactivated 5 seconds after all cutoff knives are closed.

Cleaning Brush

Each Liner comes equipped with a Cleaning Brush to clean any excess compound off of the gun nozzles. On Liners using Water-based compound, there are two options for the Cleaning Brush: the standard brush and the Power/Vacuum Brush. The standard brush engages while ends are being lined, and stays engaged 5 seconds after all cutoff knives are closed. The Power/Vacuum Brush stays engaged for a set time (default 4 minutes), then disengages and cleans itself. On Liners using Solvent-based compound, the Brush is always engaged, but a cleaning fluid mist is sometimes needed to help remove the compound. This mist is applied to the Cleaning Brush using the same air supply as the Discharge Air function.

Oil Bath

The Liner has an oil pump that sprays an oil bath on the lower turret drive mechanism for lubrication. The Oil Pump is mechanically connected to the shaft of the Main Drive. No controls are used to turn the Oil Pump on or off. The Oil Pressure is checked after the Main Drive has been running for 90 seconds to make sure a minimum oil pressure of 5 psi has been established.

Purge Air

On Liners using Solvent-based compound, the air in the upper turret must be purged. This air is fed up through the center shaft with the slip-ring , into the upper turret electrical tank, and out a hole in each gun. Purge Air pressure must be at least 5 psi. No power is sent to the Liner tank or the Liner main drive until the purge pressure switch has been closed for a designated amount of time (default 90 seconds). If the purge air pressure falls below 5 psi, an alarm will latch, all power to the upper turret will be removed and the Liner Main Drive will be turned off.

Optional Compound controls

Optional compound specific controls can be integrated into the Liner control system.

Solvent-based Compound Conditioning Unit

Liners can be ordered with a Compound Conditioning Unit. The Compound Pump and Heater must be ON to allow infeed of ends through the machine. If either the Pump or the Heater trips an overload, both units will be held OFF. The Nordson Heater features a manually adjusted thermostat which should be used to set compound temperature, and an over-temperature switch which can be used to set a maximum limit on compound temperature.

Water-based Level Control

Level control of the rotary union compound tank can be integrated into the Liner controls ensuring that the compound supply in the union remains relatively constant. These controls include overfill and tank empty notification.

Electronic Gun Operation

Each Liner station consists of the following:

- A sensing pad/rod which pushes a rod in front of a sensor to detect an end (called end sensor)
- A gun solenoid which lifts the needle out of the nozzle to allow the flow of compound
- An increase lift solenoid (optional) (see Lift Setting)
- A decrease lift solenoid (optional) (see Lift Setting)
- A Manual push-button (located on the upper turret above each gun)

Gun Modes

The electronic guns operate in three modes: Automatic, Manual, and Bleed.

Automatic Mode

The Guns must be in Automatic mode to start the Liner and run production. When the guns are in Auto mode, they are triggered by the end sensor located at each station. All end sensors are checked approximately once per revolution to make sure that the sensor has cycled off and on. The Liner PLC also checks that each gun has fired during this time. If any sensor fails this test, a fault is latched and sent to the panel PLC, which sends a message to the display indicating sensor failure. If all sensors fail this check, it is displayed as an infeed jam.

Manual Mode

When the guns are in Manual mode, each gun is fired by pressing its respective Manual push-button. The gun will fire for the same amount of time as it would to line an end in Automatic mode. Manual mode can be used to test compound weights and adjustments without running production.

Bleed Mode

When the guns are in Bleed mode, each gun is fired by pressing its respective Manual push-button. The gun will be held on as long as the push-button is held (up to five consecutive seconds). If the gun is on for five (5) consecutive seconds, it will be disabled for fifteen (15) seconds to allow the solenoid coil to cool down. Bleed mode should be used to prime guns after the Liner has been down for maintenance before running production.

Gun Settings

Each gun has two parameters that control its operation (and the amount of compound placed in the end curl during lining): On (Open) Time and Lift Setting.

Gun On Times

The Gun On Time is literally the amount of time the gun is turned on (open) when in Auto or Manual mode. The Gun On Time should be adjusted to give the desired number of turns (laps) of compound on the end when running production. There are limits set for maximum and minimum times allowed which can be changed if needed (factory default range is 10.0 - 75.0ms in most cases).

Gun Lift Settings

The Gun Lift Settings tracks the amount that the gun solenoid lifts the needle out of the nozzle, or how far the gun opens when energized. The Gun Lift Setting should be adjusted along with back pressure and compound temperature to adjust the weight of compound applied to the end. There are limits set for maximum and minimum lifts allowed for solenoid controlled adjustment which can be changed if needed (factory default range is 15 - 65 Steps in most cases).

Functional Descriptions of Controls

Note: Items marked with * are not used for all control systems.

Operator Controls

Push-buttons

Legend Plate	Full Name	Function
E-Stop	Emergency Stop	Removes Power to Control Circuits. Stops Liner immediately in case of emergency.
Reset Power	Reset Control Power	Restores Power to Control Circuits after E-Stop
Drive Start	Drive Start	Starts Liner in Run or Jog Mode
Drive Stop	Drive Stop	Stops Liner using sequential stop - allows production to be finished before machine coasts to a stop.
* Compound Pump/Heater Start	Compound Pump/Heater Start	Starts the Compound Pump and Compound Heater for Solvent-based Compound Conditioning Unit.
* Compound Pump/Heater Stop	Compound Pump/Heater Stop	Stops the Compound Pump and Compound Heater for Solvent-based Compound Conditioning Unit.

Selector Switches

Legend Plate	Full Name	Possible Positions	Function
Liner Power (KEY)	Liner Control Power Switch	(On / Off)	Turns all 120VAC and 24VDC circuits on and off. Key can only be removed in the "OFF" position.
Drive (KEY)	Drive Mode Switch	(Jog / Safe / Run)	Determines Liner Drive operation mode: In Jog, the Drive Start PB must be held down to start drive. Liner will run at minimum speeds and production is not allowed. In Safe, all power is removed to the variable speed drives, which run the Liner. This means the Liner *will not* start with the switch in this position - hence the term safe. The key can only be removed in this position. The Run position allows the Liner to run at normal production speeds in continuous operation.
Infeed	Infeed Switch	(On / Off)	Allows operator to manually control the flow of closures through (production of) the Liner. One switch per lane of infeed.
Speed Control (KEY)	Speed Control Switch	(Local / Line Control)	Determines whether Liner control system should use set speed commands through its own function switches using the display (Local) or from Line Control settings.
* Display	Display Language	(English / Varies)	Switches display messages between English and the alternative language for the particular system.

Function Switches (Part of Display)

Legend Plate	Full Name	Function
Time	Time Function Switch	Allows operator to view the settings for gun open time. This time is used for Auto and Manual Modes. The gun open time determines the number of turns or "lap" of compound around the closure.
* Lift	Lift Function Switch	Allows operator to view the settings for gun lift. The gun lift setting determines the amount the needle is pulled from the nozzle, determining the weight of compound on the closure.
Auto	Auto Function Switch	Puts electronic guns in Auto Mode. See LT1
Man	Manual Function Switch	Puts electronic guns in Manual Mode. See LT2
Bleed	Bleed Function Switch	Puts electronic guns in Bleed Mode. See LT3
Speeds	Speeds Function Switch	Allows operator to view the local settings for Liner production speed (in closures/min) and chuck speed in rpm.
* Level Ctrl	Level Control	Toggles the Level Control Logic On and Off for Water-based Rotary Union Compound Tank. Tank will not fill if Level Control is off.
Alarm Reset	Alarm Reset Function Switch	Resets any Liner control system alarms. Any alarm condition that still exists will not be reset until the condition is corrected.
INC 1 – INC 8	Increase Function Switches	When Time, Lift or Speeds displays are active, these buttons allow the operator to adjust the individual settings (increasing).
DEC 1 - DEC 8	Decrease Function Switches	When Time, Lift or Speeds displays are active, these buttons allow the operator to adjust the individual settings (decreasing).

Lights

Legend Plate	Full Name	Function
Auto	Guns In Auto Mode	This light is illuminated when the electronic guns are in Automatic operation mode. This is the mode used for production
Manual	Guns In Manual Mode	This light is illuminated when the electronic guns are in Manual operation mode. This mode allows the operator to press a button located on the machine to activate a gun for the same amount of time as it would in Automatic (production).
Bleed	Guns In Bleed Mode	This light is illuminated when the electronic guns are in Bleed operation mode. When the guns are in Bleed mode, the operator can press a button located on the machine to activate a gun for as long as this button is pressed. This is used to "bleed" all of the air out of the compound supply lines. This feature should be used after a shutdown of any length of time before resuming production.
Alarm	Alarm	Indicates the control system has detected an alarm condition. This light has a press-to-test feature.

Other PLC Inputs

Device Name	Function
Downstacker Jam Sensor	Detects jams in the downstacker. Flush-mounted with the tabletop looking up at downstacker housing. If the downstacker housing moves up due to jammed closures, the signal goes away, triggering an alarm.
Inverted (End/Cap) Sensor	Detects upside-down closures in the infeed track.
Exit Jam Sensor	Detects jams in the exit rails. Flush-mounted with the tabletop looking up at channel between exit rails.
Plant Air Pressure Switch	Turns on when plant air pressure exceeds 50 psi.
Oil Pressure Switch	Turns on when oil bath pressure exceeds 5 psi.
* Purge Air Pressure Switch	Turns on when purge air pressure exceeds 5 psi.
Guard Limit Switch	Indicates that guard door is closed.
Resolver	Gives speed and position information for Main Drive to PLS/PLC.
* WB Level Control Probes & Amplifiers	Gives fill level information to panel PLC (including overfill and empty).
Line Control Infeed Interlock	When on, this signal enables the infeed downstacker cutoff knives to open.
* Line Control Speed Interlock	Signals Liner what speed to run.

Other PLC Outputs

Device Name	Function
Liner In Auto Interlock	Indicates to Line Control that Liner is ready to run production.
Drive Brake Solenoid	Mechanical brake to stop Liner as quickly as possible in case of emergency.
Infeed Solenoid (s)	When energized, opens the infeed downstacker allowing closures to flow through the machine. One solenoid per infeed lane.
Discharge Air Solenoid	Provides airflow to the air jets to assist closures through the exit rails.
* Compound Fill Solenoid	Operates valve to allow compound to flow into water-based compound rotary union holding tank.
* Power Brush Engage Solenoid	Moves brush into contact with gun tips when energized.
* Power Brush Liquid Solenoid	Sprays cleaning fluid onto brush during cleaning cycle.
* Power Brush Air Solenoid	Vents vacuum to brush to take away the cleaning fluid during cleaning cycle.
* Guard Lock Relay	Controls the lock solenoids on locking guards if installed

Other devices

Device Name	Function
Main Drive Motor	Rotates the turret.
Chuck Drive Motor	Rotates the ring gear along which the chucks rotate.
Variable Speed Drives 1 & 2	Provide precise speed control of the Main and Chuck Drive Motors.
* Compound Pump	Moves solvent-based compound from Conditioning Unit to Liner.
* Compound Heater	Heats solvent-based compound to proper temperature in Conditioning Unit.
* Vacuum Motor	Provides vacuum for self-cleaning Power Brush.
* Brush Motor	Rotates brush head on Power Brush system to help reduce buildup.

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Using the Display

Most troubleshooting can be accomplished by simply following the instructions on the display. All messages are detailed below with corrective action to be taken.

Alarm Messages

Alarm messages indicate problems that necessitate stoppage in production. These conditions must be corrected, and the 'Alarm Reset' function switch pressed to clear the message.

Loss of Control Power

```
  CONTROL POWER OFF-CHECK LINER AND LINE
EMERGENCY STOPS & PRESS 'RESET POWER' PB
```

Trigger: Input wire 501 is off.
Possible causes: E-Stop pressed, Power Supply in self-protect mode, CPR Relay failure.
Corrective Action: Reset All Emergency Stops. Press 'Reset Power' Push-button.
Note: This message does not require 'Alarm Reset' to clear.

Guard Opened (Alarm)

```
        LINER FRONT GUARD OPEN
  CLOSE GUARDS AND RESET TO RUN LINER
```

```
        LINER SIDE GUARD OPEN
  CLOSE GUARDS AND RESET TO RUN LINER
```

```
        LINER REAR GUARD OPEN
  CLOSE GUARDS AND RESET TO RUN LINER
```

```
      GUARD LIMIT SWITCH WAS OPENED
          RESET TO RUN LINER
```

Trigger: Any input wire from guard limit switches LS1-3 off, even momentarily.
Possible causes: Guard door was opened, problem with limit switch, blown fuse.
Corrective Action: Close all guard doors, making sure that limit switch aligns properly.
Note: This message can be reset to allow Gun Setup screens, which will result in a "Guard Open" status message.

Communication Fault

```
  LINER SERIAL NETWORK COMM FAULT: CHECK
  POWER & COMM CABLE TO LINER AND RESET
```

Trigger: Communication function sfunc13 unable to complete successfully.
Possible causes: Loss of Control power to Liner Tank PLC, Liner Tank PLC faulted, communication cable corrupted.
Corrective Action: Simply try to reset. If fault persists, contact an electrician. It will be helpful to the electrician if you note how often this fault occurs.

Low Plant Air Pressure

```
LOW PLANT AIR PRESSURE TO LINER
    CHECK PRESSURE AND RESET
```

Trigger: Input Wire from PS1 is off, even momentarily.
Possible causes: Air pressure dip or loss from main supply, PS1 failure.
Corrective Action: Ensure plant air supply is active and stable above 80 psi.

Low Oil Bath Pressure

```
 LOW OIL BATH PRESSURE - CHECK OIL
PUMP AND PRESSURE SWITCH, RESET TO RUN
```

Trigger: After Liner has been running for 90 seconds, Input Wire from PS2 is off, even momentarily.
Possible causes: Oil pressure dip or loss, low oil level, PS2 failure.
Corrective Action: Check fittings for leaks, check oil level.

Downstacker Jam

```
 CUT-OFF KNIFE AND DOWNFEED SCREW JAM
    CLEAR JAM AND RESET TO RUN
```

Trigger: Input Wire from Downstacker Jam Proximity Sensor is off, even momentarily.
Possible causes: Downstacker housing popped up due to jam, sensor improperly adjusted and/or disconnected.
Corrective Action: If message clears with reset, clear jam in downstacker. Check that sensor is connected and detects the downstacker housing while Liner is stationary.

Drive Failure

```
        MAIN DRIVE FAILURE
CHECK DRIVE FOR DETAILS, RESET TO RUN
```

```
        CHUCK DRIVE FAILURE
CHECK DRIVE FOR DETAILS, RESET TO RUN
```

Trigger: "Drive running" interlocks from Variable Speed Drives off while trying to run Liner.
Possible causes: Drive Controller fault, Drive in "Local".
Corrective Action: Simply try to reset. If problem persists, contact an electrician.

Resolver Failure

```
   RESOLVER ERROR - SPEED RUNAWAY
    CHECK ELECTRICAL CONNECTIONS
```

```
   RESOLVER ERROR - SPEED ZERO
CHECK COUPLING, ELECTRICAL CONNECTIONS
```

```
   RESOLVER OR LINER TURNING BACKWARD
IF RESOLVER, SWITCH LEADS S2 & S4 AT PLS
```

Trigger: resolver information different than expected.
Possible causes: Resolver electrical connections incorrect or mechanical coupling loose.
Corrective Action: Ensure connector and coupling are sound. If problem persists, contact an electrician.

End Sensor Failure

```
  STATION # END SENSOR PRX 1# FAILED ON
OR SENSING ROD STICKING IN UP POSITION
```

```
      NO END DETECTED IN CHUCK #
   OR END SENSOR PRX 1# FAILED OPEN
```

Trigger: Sensor did not signal a loaded end in each chuck properly.
Possible causes: No loaded end, sticky or bent sensing rod, or faulty sensor.
Corrective Action: Check that sensor is ON with closure loaded, OFF when no closure loaded. Check sensing rod for drag when released from top position. Rod should move freely. Clean sensing rod and rod guides.

Gun Did Not Fire

```
      STATION # GUN DID NOT FIRE
CHECK OUTFEED HOPPER FOR UNLINED ENDS
```

Trigger: Compound Application Output was not energized within sensor check timer.
Possible causes: Sticky or bent sensing rod, faulty sensor, anti-bounce timer too long.
Corrective Action: Check that sensor is ON with closure loaded, OFF when no closure loaded. Check sensing rod for drag when released from top position. Rod should move freely. Clean sensing rod and rod guides. Ensure that enough time is allowed for anti-bounce to elapse before next end is to be loaded.

Liner PLC Output Short Circuit

```
  FEEDBACK FOR GUN # SHORT CIRCUIT
REPLACE SOLENOID COIL AND LINER TANK PLC
```

Trigger: Liner PLC feedback input on when output to apply compound solenoid off (timed)
Possible causes: Output circuit damaged due to excessive current load (bad coil), timer set too short, incorrect wiring of feedback input
Corrective Action: Check that timer B1111 is set to at least 20 (10.0ms). Check feedback wiring. Verify output is on when not commanded. If so, replace liner PLC and solenoid coil.

Liner PLC Output Open Circuit

```
  FEEDBACK FOR GUN # OPEN CIRCUIT
REPLACE SOLENOID COIL AND LINER TANK PLC
```

Trigger: Liner PLC feedback input off when output to apply compound solenoid on (timed)
Possible causes: Output circuit damaged due to excessive current load (bad coil), timer set too short, incorrect wiring of feedback input
Corrective Action: Check that timer B1110 is set to at least 20 (10.0ms). Check feedback wiring. Verify output is off when commanded on. If system uses fuse, output may be on, but feedback off if fuse is blown. If so, replace fuse and solenoid coil. If PLC output does not come on in Bleed mode, replace liner PLC.

Inverted End

```
        INVERTED END IN INFEED
  CLEAR END AND RESET TO START INFEED
```

```
   INVERTED END IN LANE 1 INFEED
  CLEAR END AND RESET TO START INFEED
```

```
   INVERTED END IN LANE 2 INFEED
  CLEAR END AND RESET TO START INFEED
```

Trigger: Input from Inverted End Proximity Sensor is off, even momentarily.
Possible causes: Inverted End in Infeed, sensor improperly mounted.
Corrective Action: Clear end or adjust sensor mount so that sensor sees infeed stack.

Exit Jam

```
     EXIT JAM - NO END DETECTED
     CLEAR EXIT RAIL, RESET TO RUN
```

```
     EXIT JAM - SENSOR COVERED
     CLEAR EXIT RAIL, RESET TO RUN
```

Trigger: Input from Exit Jam Proximity Sensor does not cycle on and off properly.
Possible causes: Sensor improperly mounted, end not loaded onto chuck properly, ends not flowing when infeed is on. Note that infeed jams or hang-ups resulting in slow or no flow of ends may be detected as an exit jam.
Corrective Action: Clear end(s) or adjust sensor mount so that sensor sees end in discharge track.

Infeed Jam

```
NO ENDS DETECTED IN CHUCKS - NO END FLOW
  CHECK INFEED FOR BLOCKAGE AND RESET
```

```
NO ENDS DETECTED IN ODD CHUCKS - NO FLOW
  CHECK INFEED FOR BLOCKAGE AND RESET
```

```
NO ENDS DETECTED IN EVEN CHUCKS -NO FLOW
  CHECK INFEED FOR BLOCKAGE AND RESET
```

Trigger: Infeed lane enabled, but no ends detected for that lane for a whole revolution.
Possible causes: Interruption of end flow, usually inside downstacker housing.
Corrective Action: Clear end(s) from downstacker, check for nicks, edges in infeed chute that may cause ends to hang up. Check incoming ends for damage from other equipment.
Note: On machines using Exit Jam detection, this display will probably never be shown, as an Exit Jam would normally be detected first.

Infeed Timing (PLS) Signal Failure

```
INFEED SOLENOID OFF TIMING SIGNAL
FAILED - CHECK CHANNEL 1 OF PLS PROGRAM
```

```
    INFEED SOLENOID ON TIMING SIGNAL
FAILED - CHECK CHANNEL 0 OF PLS PROGRAM
```

Trigger: Infeed timing signals not cycling properly.
Possible causes: PLS Channel not programmed, steep change of speed from fast to slow.
Corrective Action: Simply try to reset. If problem persists, contact an electrician.

Liner PLC Corrupted by Noise

```
      LINER PLC CORRUPTED BY NOISE
CHECK OUTFEED HOPPER FOR SPOILED ENDS
```

```
      LINER PLC CORRUPTED BY NOISE
PLEASE WAIT WHILE LINER PLC IS RESTARTED
```

Trigger: Liner PLC not executing program properly
Possible causes: 24VDC supply to Liner PLC is unstable, DC-DC converter of PLC unstable.
Corrective Action: Try cycling power to liner PLC if the fault won't clear. Ensure the 24VDC supply is clear of electrical noise. If still a problem, verify the 24V contacts of the electrical rotary union.

Electrical Noise Detected in Liner PLC

```
  ELECTRICAL NOISE DETECTED AT M4012
     PLEASE CONTACT AN ELECTRICIAN
```

Trigger: Liner PLC unused memory has been overwritten with false values
Possible causes: 24VDC supply to Liner PLC is unstable.
Corrective Action: Try cycling power to liner PLC if the fault won't clear. Ensure the 24VDC supply is clear of electrical noise. If still a problem, verify the 24V contacts of the electrical rotary union.

Alarm with No Message Assigned

```
NO MESSAGE HAS BEEN ENTERED FOR THIS
 ALARM CONDITION - PRESS 'ALARM RESET'
```

Trigger: Unknown.
Possible causes: Program problem.
Corrective Action: Contact an electrician.
Note: This message is installed to prevent a new alarm from being programmed to stop production without a corresponding message.

Compound Tank Empty (WB Only)

```
   TOO LONG BETWEEN COMPOUND REFILLS
     CHECK COMPOUND TANK AND RESET
```

Trigger: Timer counting production logged between refills has expired.
Possible causes: Compound stringing to lowest probe, less compound used than expected (timer set too short).
Corrective Action: Check closures in discharge for compound. Check compound tank compound level probes. If necessary, ask an electrician to alter the timer value to represent the expected refill timing.

Compound Tank Overfill Suspected (WB Only)

```
COMPOUND FILL SOLENOID ON TOO LONG
  CHECK COMPOUND TANK AND RESET
```

Trigger: Timer timing fill solenoid expires.
Possible causes: Middle probe (or amplifier) malfunction, difference between fill pressure and back pressure too small - causing slow fill rate.
Corrective Action: Check compound tank compound level. As necessary, clean probes or adjust fill pressure.

Compound Tank Overfill (WB Only)

```
COMPOUND HIGH LEVEL FAULT (OVERFILL)
   CHECK COMPOUND TANK AND RESET
```

Trigger: Highest probe conducting to ground.
Possible causes: Highest probe has shorted to ground (through compound or otherwise), amplifier problem.
Corrective Action: Check compound tank compound level. If necessary, clean probes. Ask electrician to check amplifier operation.

Power Brush Vacuum Overload (WB Only)

```
    POWER BRUSH SYSTEM VACUUM OFF
CHECK M3, START VACUUM AND RESET TO RUN
```

Trigger: Signal from M3 auxiliary contact off.
Possible causes: MSP3 is tripped.
Corrective Action: Reset MSP3. If problem persists, contact an electrician.

Low Purge Air Pressure (SB Only)

```
LINER PURGE PRESSURE LOW OR FAILED
       CHECK PRESSURE AND RESET
```

Trigger: Signal from Purge Air Pressure Switch off.
Possible causes: Purge Air pressure dipped below 5psi, problem with switch.
Corrective Action: Check Purge Air Pressure, adjust regulator if necessary.

Plastisol Conditioning Unit Alarms (PCU Only)

```
PLASTISOL CONDITIONING UNIT
OIL PUMP OVERLOAD: CHECK MOTOR AND RESET
```

```
     PLASTISOL CONDITIONING UNIT
PLASTISOL PUMP OVERLOAD: CHECK AND RESET
```

```
     PLASTISOL CONDITIONING UNIT
PLASTISOL MIXER OVERLOAD: CHECK & RESET
```

```
     PLASTISOL CONDITIONING UNIT
PLASTISOL LOW LEVEL: CHECK TANK & RESET
```

Plastisol Conditioning Unit Alarms (PCU Only) (Continued)

```
      PLASTISOL CONDITIONING UNIT
PLASTISOL HIGH LEVEL: CHECK TANK & RESET
```

```
      PLASTISOL CONDITIONING UNIT
   PLASTISOL LOW TEMPERATURE: STANDBY
```

```
      PLASTISOL CONDITIONING UNIT
 PLASTISOL HIGH TEMPERATURE: CHECK TANK
```

```
      PLASTISOL CONDITIONING UNIT
OIL HIGH TEMPERATURE: CHECK TANK & RESET
```

Notes: These alarm messages refer to the standalone PCU control system. The Liner controls receive an interlock signal for display purposes only.

Status Messages

Status Messages are used to alert the operator to the operational status of the machine.

Guns In Manual Mode

```
ELECTRONIC GUNS IN MANUAL OPERATION MODE
PRESS AUTO FUNCTION SWITCH TO RUN LINER
```

Notes: Liner will not run or jog.

Guns In Bleed Mode

```
ELECTRONIC GUNS IN BLEED OPERATION MODE
PRESS AUTO FUNCTION SWITCH TO RUN LINER
```

Notes: Liner will not run or jog.

Drives In Jog Mode

```
      DRIVE SELECTOR SWITCH IN JOG
```

Notes: Press and hold Drive Start PB to jog Liner.

Drives In Safe Mode

```
     DRIVE SELECTOR SWITCH IN SAFE
```

Notes: Power is removed from VSD controllers, control power active.

Guard Open (Status)

```
        LINER FRONT GUARD OPEN
  CLOSE GUARD LS1 TO RUN OR JOG LINER
```

```
        LINER SIDE GUARD OPEN
  CLOSE GUARD LS2 TO RUN OR JOG LINER
```

```
        LINER REAR GUARD OPEN
  CLOSE GUARD LS3 TO RUN OR JOG LINER
```

Notes: Power removed from VSD controllers, pressing Drive Start PB will latch alarm.

Drive Self-Test

```
     DRIVES ARE IN SELF-TEST MODE
    PLEASE WAIT TO RUN OR JOG LINER
```

Notes: Delay allowing VSD controllers to startup after power is restored.

Drive Ready to Start

```
      MAIN DRIVE READY TO START
```

Notes: Pressing Drive Start PB will start machine in Run mode.

Drive Starting

```
      MAIN DRIVE NOT UP TO SPEED TO
     ENABLE INFEED SOLENOID OPERATION
```

Notes: Delay to allow speed of machine to stabilize.

Waiting For Infeed Timing

```
   WAITING FOR INFEED ON TIMING SIGNAL
```

Notes: This message should not be displayed more than one revolution of the turret (blinks).

Production / Standby / Infeed Switched Off

```
   INFEED SELECTOR SWITCHES IN OFF
LINER SPD: #### EPM CHUCK SPD: #### RPM
```

```
         LINER IN PRODUCTION
LINER SPD: #### EPM CHUCK SPD: #### RPM
```

```
      LINER IN AUTOMATIC OPERATION
   LINE CONTROL SHUTDOWN OF END INFEED
```

```
      LANE 1 INFEED SWITCH IN OFF
      LANE 2 LINE CONTROL SHUTDOWN
```

```
      LANE 1 INFEED SWITCH IN OFF
          LANE 2 IN PRODUCTION
```

Notes: Dual infeed machines will show status of each lane individually. If all lanes are switched off or in production, the current speed will be displayed. The current speed is measured ±1RPM of turret.

Message Logic Error

```
A MESSAGE NUMBER WAS CALLED FOR AND THE
MESSAGE WAS NOT FOUND - CALL ELECTRICIAN
```

Notes: Programming error in message logic.

Level Control Off (WB Only)

```
COMPOUND LEVEL CONTROL SYSTEM IS OFF
   PRESS 'LEVEL CTRL' TO ALLOW INFEED
```

Notes: 'LEVEL CTRL' is a toggle, so pressing it when Level Control is On will turn it off.

Compound Pump and Heater Off (SB Only)

```
COMPOUND PUMP/HEATER SYSTEM IS OFF
      START SYSTEM TO ALLOW INFEED
```

Notes: It is a good idea to run compound pump and heater at all times to maintain stable compound temperature.

Purge Air Cycle (SB Only)

```
    AIR PURGE OF LINER & GUNS IN PROCESS
  PURGE TIME REMAINING IS ## SECONDS
```

Notes: Message will count down time remaining.

Plastisol Conditioning Unit Not Started

```
     PLASTISOL CONDITIONING UNIT
     OIL PUMP OFF: START OIL PUMP
```

```
     PLASTISOL CONDITIONING UNIT
   PLASTISOL PUMP OFF - START PUMP
```

```
     PLASTISOL CONDITIONING UNIT
PLASTISOL MIXER NOT ENABLED: START MIXER
```

Notes: All motors must be started for PCU to enable infeed to Liner.

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Operation Procedures

Safe Operating Procedures

Always follow safety procedures when working on or near the Liner. Ensure that you have adequate training for the tasks you perform and refer frequently to the Operation and Maintenance Manuals for current information. Some safe operating guidelines include:

- Operation and Maintenance Manuals should be readily available for all personnel working with the Liner.
- All personnel using or controlling the Liner should be thoroughly familiar with all operating procedures and safety hazards.
- Do not wear rings, watches, or jewelry while near machinery.
- Do not wear loose fitting clothes, neckties, etc., while near machinery.
- Long hair should be protected with hair net or safety helmet.
- Always wear eye and ear protection while near Liner.
- Only properly trained and experienced personnel should perform mechanical and electrical troubleshooting and repair.
- **NEVER** attempt to perform maintenance, repairs, or clear a jam while machine is in operation.
- Any personnel performing maintenance on the Liner must be absolutely sure that the Liner is taken out of service. The controls must be locked and keys removed and properly marked with a warning sign. Follow the published lockout, tag-out procedures for the plant.
- When clearing jams, ensure that the Emergency Stop Push-Button is depressed before reaching into Liner.
- Keep all Guards in place and ensure they are properly used.
- Never by-pass safety interlocks. Be sure to report any violation of these practices to management.
- Ensure all lifting devices used in the maintenance of the End Liner are properly rated for the lifting task.
- Allow Motors to cool before performing maintenance.

Establish control power

1. Ensure the Liner Panel Main Disconnect Switch is ON.
2. Turn Liner Power Selector Switch SS0 to ON.
3. Ensure there are no E-Stops depressed. (The amber Reset Power Push-button PB2 will illuminate).
4. Press Reset Power Push-button PB2.

WARNING!
Do not attempt to remove or disable guards. Ensure that guards are in place and that all personnel are away from moving parts before starting the Liner. Failure to follow safe operating procedures can result in serious personal injury.

Jog Liner

The Liner will jog at minimum speed for both Main Drive and Chuck Drive.

1. Ensure all guards are securely closed, no loose items are around the machine, and that all personnel are clear of moving parts.
2. Turn the turret by hand one full revolution to ensure no interference with rotation.
3. Clear all Immediate Stop Alarms.
4. Turn Drive Selector Switch SS1 to JOG.
5. Press and hold the Drive Start Push-button PB3 – the Liner will turn as long as PB3 is pressed.

Run Liner (Production)

The Main Drive will run at the Local setpoint speed or the Line Control speed, depending on the current position of the Speed Control switch. The chucks will run at the setpoint speed.

1. Ensure all guards are securely closed, no loose items are around the machine, and that all personnel are clear of moving parts.
2. Follow the Jog procedure to ensure there is no interference with rotation.
3. Ensure compound system is active, and compound is ready for lining.
4. Clear all alarms.
5. Press AUTO function switch to place the electronic guns in Auto Mode.
6. Turn Drive Selector Switch SS1 to RUN.
7. Press Drive Start Push-button PB3.
8. Display will read “MAIN DRIVE NOT UP TO SPEED…” for 5 seconds while the drive builds up to production speed.
9. To start production, turn Infeed selector switch to ON.
10. The Liner will alternate between Standby and Production based on the Line Control interlock.

Adjusting Gun Settings

Gun settings can be adjusted using the function switches on the display. Adjustment displays will remain active until an alarm is detected, a new status message is triggered, or the Alarm Reset function switch is pressed.

Adjusting Gun Lifts

1. Clear all alarms.
2. Press "Lift" function switch to load lift setting display:

```
LIFTS    1- ##   2- ##   3- ##   4- ##
STEPS    5- ##   6- ##   7- ##   8- ##
```

3. Press the appropriate adjustment function switch (e.g. INC 1 to raise Gun 1 lift). Holding the function switch down will result in one adjustment per second.

Adjusting Gun On Times

1. Clear all alarms.
2. Press "Time" function switch to load time setting display:

```
GUN OPEN 1-###.# 2-###.# 3-###.# 4-###.#
TIME MS  5-###.# 6-###.# 7-###.# 8-###.#
```

3. Press the appropriate adjustment function switch (e.g. INC 1 to raise Gun 1 on time). Holding the function switch down will result in ten adjustments per second.

Adjusting Liner Speeds

All Liner Speed settings can be adjusted using the controls on the front of the console. Adjustment displays will remain active until an alarm is detected, a new status message is triggered, or the Reset function switch is pressed.

Adjusting Liner Local Speed Setpoint

Note: Some systems support multiple speed settings for Line Control speed control. In this case, pressing and releasing the "Speeds" function switch will cycle through the different settings. If line control speed settings are not supported, and attempts are made to adjust Liner speeds while Speed Control switch is in Line Control, the following display will show:

```
  SPEED SELECT IS IN LINE CONTROL MODE
LINE CONTROL SETTINGS CANNOT BE ADJUSTED
```

1. Clear all alarms.
2. Press "Speeds" function switch to load speeds setting display:

```
LINER EPM 1-SET #### MIN- #### MAX- ####
CHUCK RPM 2-SET #### MIN- #### MAX- ####
```

3. Press INC 1 to increase or DEC 1 to decrease the Auto Speed setting. Pressing and releasing the function switch will result in 1 EPM of adjustment. Holding the function switch down will result in ten adjustments per second at increments of 5 EPM.

Adjusting Chuck Speed Setpoint

1. Clear all alarms.
2. Press "Speeds" function switch to load speeds setting display:

```
LINER EPM 1-SET #### MIN- #### MAX- ####
CHUCK RPM 2-SET #### MIN- #### MAX- ####
```

3. Press INC 2 to increase or DEC 2 to decrease the Chuck Speed setting. Pressing and releasing the function switch will result in 1 RPM of adjustment. Holding the function switch down will result in ten adjustments per second at increments of 5 RPM.

Glossary of Terms

This section defines some terminology used inside this manual.

CCU = **C**ompound **C**onditioning **U**nit – standalone unit that controls temperature and delivery pressure of solvent-based compound used by the Liner.

Downstacker – device on infeed of Liner that singulates the closures from a "stack." One downstacker housing can accommodate one or two infeed lanes.

Electronic Gun – device that applies compound onto a closure with proper placement using a solenoid to move the needle out of the nozzle for a precise period of time.

End– a commonly used name for a closure. Other common names are cap, lid, or top.

Feedscrew – rotating device inside the downstacker with an indent "ramp," which lowers the captured closure to the tabletop.

Infeed Knives (also known as **Cutoff Knives**) – pair of metal pieces that are inserted into the infeed stack to stop the flow of closures into the downstacker mechanism.

Lift – the distance the needle is moved upward from the nozzle when the gun is fired.

On Time (also known as **Open Time**) – the amount of time the gun is fired in Automatic or Manual Modes.

PB = **P**ush-**B**utton

PCU = **P**lastisol **C**onditioning **U**nit – standalone unit that controls temperature and delivery pressure of plastisol used by the Liner.

PLS = **P**rogrammable **L**imit **S**witch – programmable controller that interprets signals from a resolver allowing timing signals based on speed and position information.

PLC = **P**rogrammable **L**ogic **C**ontroller – programmable controller that executes a predetermined program for reading real world inputs, processing information and controlling real world outputs.

Resolver – device consisting of a rotary transformer with one rotor and two stators (wound 90 degrees apart), which provides position and speed information to the control system.

Ring Gear – Orbital gear around which the lower chuck spindles turn. The outside of the ring gear is driven by the Chuck Drive (Motor 2).

SB = **S**olvent-**B**ased compound.

Splitting Blade (also known as cutoff blade) – blade attached to beginning of each feedscrew ramp that separates one closure from the stack.

SS = **S**elector **S**witch.

Steps – the lift adjustment increment of a standard electronic gun. One Step equals approximately one thousandth of one inch (1 Step =~ 0.001 inches).

VSRL-X = **V**ariable **H**igh **S**peed (Rotary Compound) **Liner**. The X is in the place of the number of stations in the model name to refer to all models regardless of the number of stations.

VSD = **V**ariable **S**peed **D**rive (also known as **AFD** = **A**djustable **F**requency **D**rive or **VFD** = **V**ariable **F**requency **D**rive) – controller that varies the frequency, voltage and current to control the speed of a connected motor.

WB = **W**ater-**B**ased compound.

Picture Gallery

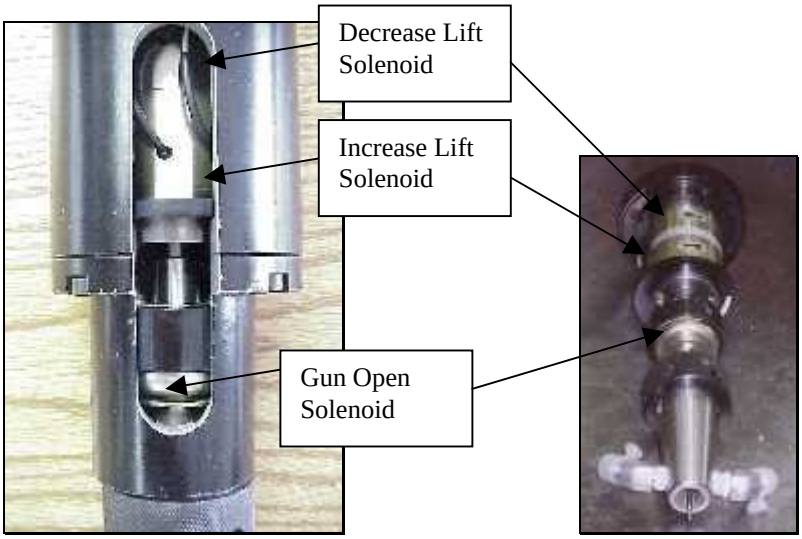


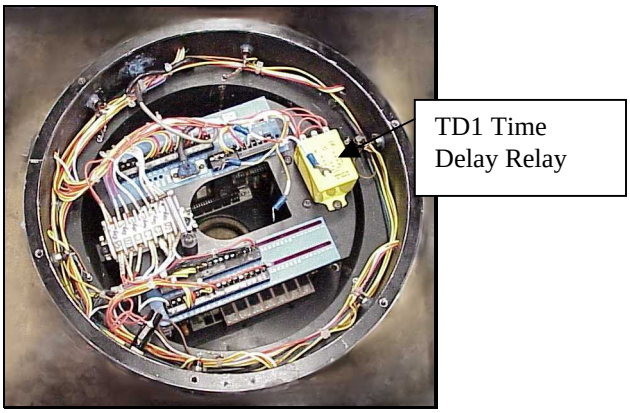
Figure 1 Solenoid Adjust Electronic Gun Solenoids

Figure 2 Downstacker without Infeed chute

Figure 3 Infeed Knives

Figure 4 Feedscrew with splitting blade

Figure 5 Ring Gear with Lower Chuck Spindles



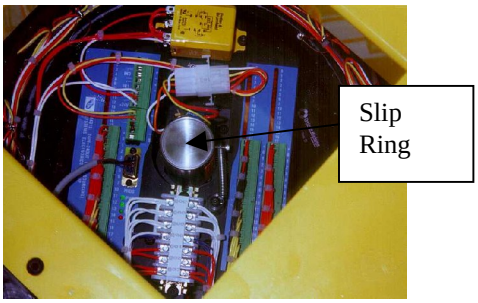


Figure 6 Upper Turret Electrical Tank

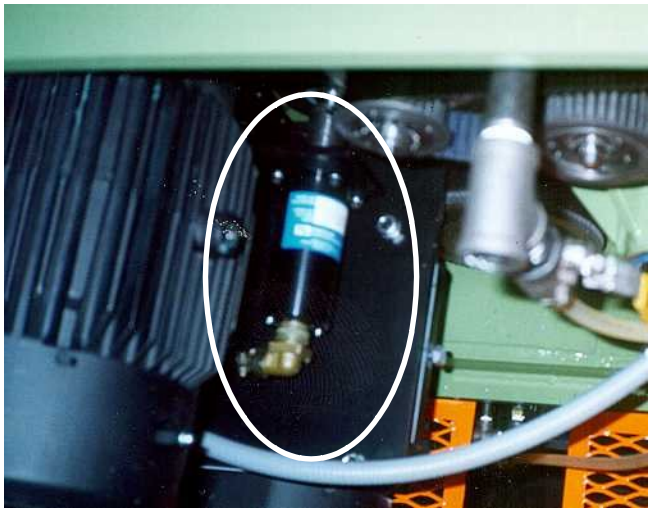


Figure 7 Resolver as mounted under Liner