HMC2420
Press Control

HMC2420 PRESS CONTROL

SECTION 1

INTRODUCTION

You have just purchased the most advanced press control system available. HELM INSTRUMENT COMPANY, INC. manufactures a complete line of press control solutions for use on metal stamping, forging, compaction and assembly presses.

At HELM, quality is inherent not only in the design of our products but in the attitudes of our employees as well. We're working together to give you the best. After all, that's what our business is all about - providing innovative instrumentation to help make your manufacturing process more productive and your operation more effective.

THE HMC2420 SYSTEM

HMC2420 consists of an operator interface type enclosure containing the, run buttons, press control processors, magnetics and Human Machine Interface (HMI). These components are laid out for the maximum operator efficiency. The operation of Helm-Pak is discussed later in this manual.

The main control enclosure contains MicroLogix processors, magnetics, relays, power supply and fusing.
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The Run Station T-Stand is supplied with operating push buttons, lamps and the PanelView operator Interface, run/inch buttons, armed continuous, Top Stop, Cycle Stop and E-Stop push buttons.

The dual MicroLogix rack configurations provide the redundant control of the clutch and brake system. Both controllers monitor all clutch/brake I/O and exchange information about machine status. They are linked by hardwired I/O so if one controller detects a condition different from that detected by the other, the control logic is designed to declare a fault and turn off all outputs to press valves. The other controller is designed to follow suit.

Compliance:
The package uses two redundant MicroLogix 1500 processors with application software for self testing and verification to meet the safety requirements of ANSI B11.1, OSHA 1910.217 and CAN/CSA Z142-M90 press safety regulations for mechanical stamping presses.

WARNINGS

> ⚠ **ATTENTION**: Identifies information about practices or circumstances that can lead to property damage. Identifies information that is especially important for successful application and understanding of the product.

DANGER
HIGH VOLTAGE
TURN OFF POWER
BEFORE SERVICING

DANGER
PINCH POINT
WATCH YOUR
HANDS

⚠ **DANGER**
FOLLOW
LOCKOUT/TAGOUT
PROCEDURES.
AUTHORIZED
PERSONNEL ONLY.

CAUTION
WEAR SAFETY
GLASSES WHEN
USING EQUIPMENT
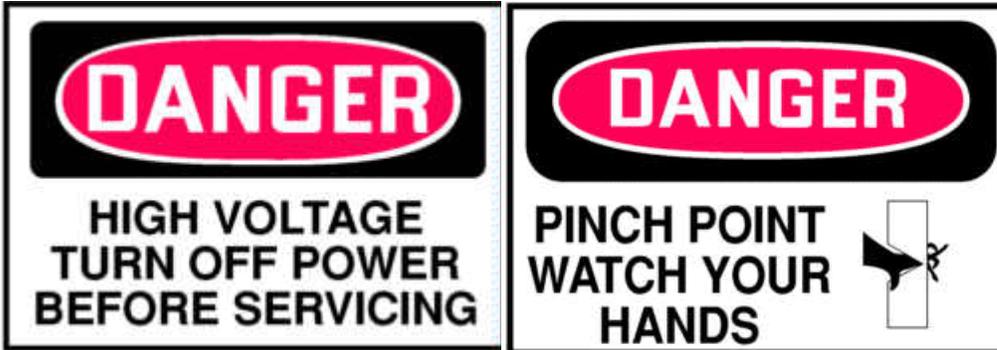
REPLACING MODULES

Do not remove modules under power.

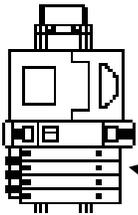The module location in a system is critical to proper operation of the Helm-Pak press control. If a module is replaced, ensure that the proper module is inserted into the proper position. If it is not the ladder programming will not recognize the module and the Helm-Pak control will become unstable and unsafe to operate.

FUSES

The fuse for the Helm-Pak System is located in the front of the enclosure on a terminal strip in the center of the enclosure. Replacement is 5-amp Buss fuse.

5 amp Buss fuse

⚠	**SAFETY FIRST** Check all light curtains, barriers, safety shields and personnel safety devices to ensure that they are present and functioning properly. If they are not, do not proceed with starting the press. Authorized personnel should make any repairs that are required before starting the press. *Always wear eye and ear protection when operating a stamping press.*

SECTION 2

INTRODUCING CLUTCH / BRAKE SOFTWARE

WHAT IS CLUTCH / BRAKE SOFTWARE?

The Micro Logic Clutch/Brake Control System is a bundle of hardware, software, and engineering documents designed to control the clutch and/or brake mechanism on a mechanical stamping press that has a part-revolution friction clutch and/or brake. This system uses two Micro Logic processors for clutch/brake control.

The clutch/brake control system is designed to signal brake wear by monitoring the brake monitor cam (BCAM). Should it see the BCAM closed after a normal cycle stop has been initiated and before the press comes to a top stop, it is designed to protect against press restart.

I/O modules in both Clutch/Brake configurations are identical for clutch/brake control. If the processor in one system detects a condition different from that detected by the other, its control logic is designed to declare a fault and turn off all outputs to press valves. The other processor is designed to follow suit. Dual processors control outputs to clutch/brake valve.

Clutch/Brake Modes:
The operator can select the mode of control system operation with the selector switch located on a control panel.

Mode	Operation
Inch	Jog the press through successive parts of the cycle by pressing and releasing the pair of INCH buttons. If INCH buttons are held, the press will stop at the top of its stroke.
Single-stroke	Run the press through one complete cycle by holding both RUN buttons until completion of the down stroke.
Continuous	Run the press continuously until stopped by a stop-on-top command or until a fault is detected. The method to start the press is a factory configured option where operator presses the CONTINUOUS SETUP button and press both RUN buttons in all active stations within five seconds.

SECTION 3

QUICK START INSTRUCTIONS

- Turn power on.
- Set CONTROL POWER to ON
- Press CONTROL POWER RESET
- Press FAULT RESET if indicator is lit
- Start Main Motor
- Adjust Slide
- Select Continuous
- Run Press at Top Speed in continuous
- Initiate 90° Brake Test
- System setup is complete

♦ To **EMERGENCY STOP** press push **E-STOP** button

♦ To stop the press in a non-emergency press **TOP STOP**

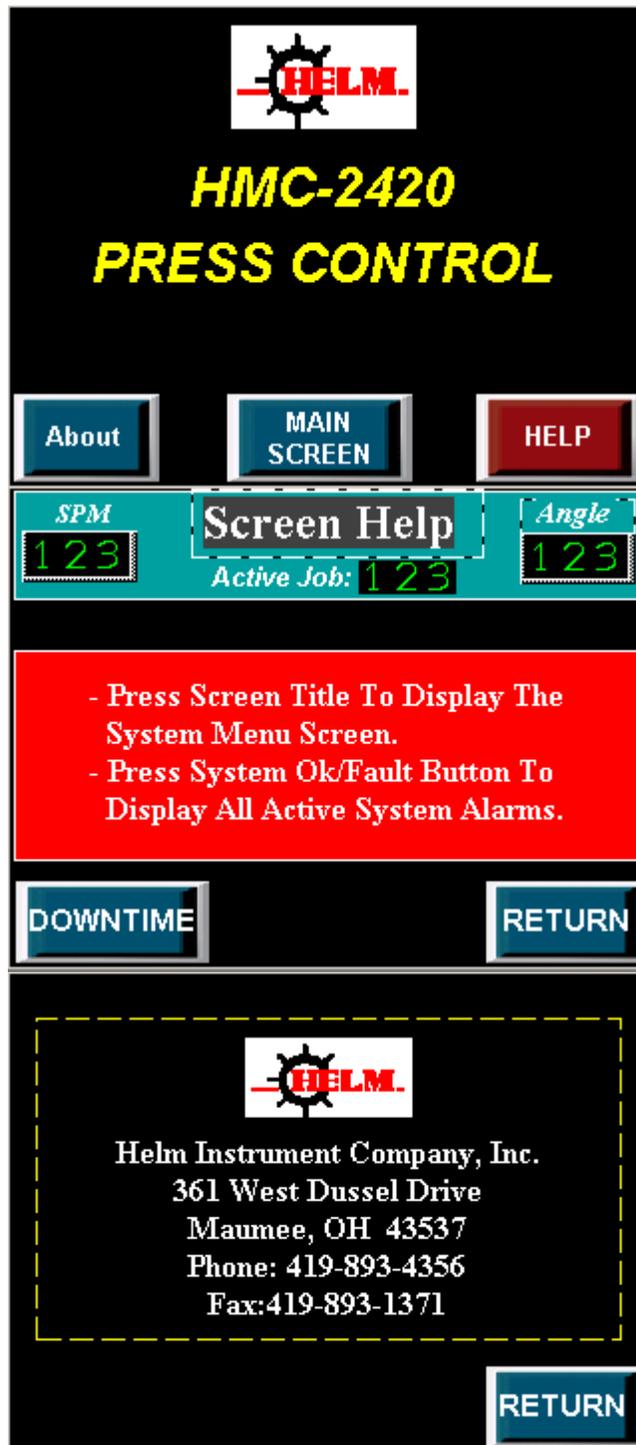## SHUT DOWN SYSTEM

To shut down HMC2420:

- Go to Main Menu

- Shut off Main Motor

- Shut Control Power off.

SECTION 4
Startup Screen

Status
- Screen help and information about Helm Instrument Company.

Control
- No control

System Overview
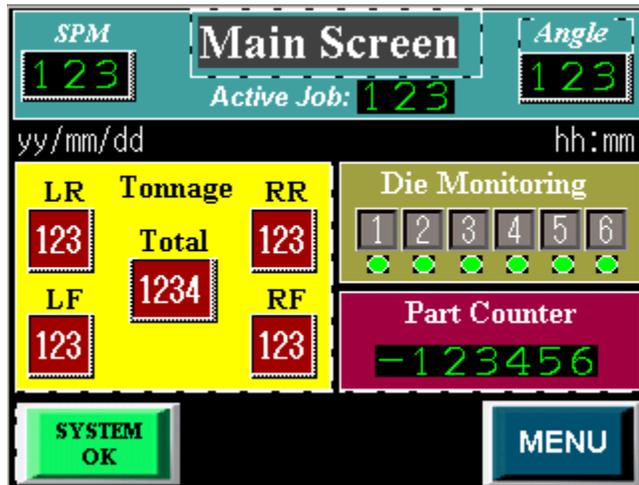
Status
- Strokes Per Minute (SPM)
- Angle
- Date/Time
- Active Job Number
- Part and Batch Counters Setpoint and Actual displays
- System OK/System Alarm Status
- 4 Channel Tonnage Display
- Die Monitoring Status

Control
- Touching either the Part or Batch Counter will display the Counter Screen
- Touching the Header (System Overview) will display the Main Menu
- Touching System OK/System Alarm will display the Active Alarms
- Touching the tonnage area will display the tonnage main screen

Fault conditions are indicated on the screen on the System OK/System Alarm Button. Clear any faults by pressing the FAULT RESET button on the operator station.

Resolver Setup

Controls resolver setup function

Status

- Strokes Per Minute (SPM)
- Date/Time
- Displays Brake Fault Preset time
- Displays Actual Brake Stopping time
- Resolver Rotation Direction*

Control

- Setup AMCI Resolver pushbutton – Displays Setup AMCI Verify Screen
- Zero AMCI Resolver pushbutton – Displays Zero AMCI Verify Screen
- Brake Fault Preset – Alarm value for Brake Stopping time
- Die Monitoring Inch Bypass Off/On pushbutton – If selected to On, the Die Monitoring will be bypassed in Inch mode
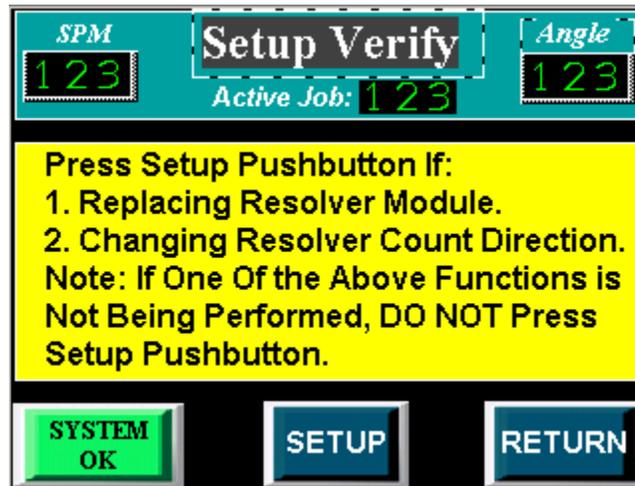
Setup Verify

Status

- Setup AMCI Resolver pushbutton – Used only when replacing AMCI module or changing the resolver count direction. The initial setup is done at Helm Instrument Company before the unit shipped.

Control

- Setup AMCI Resolver pushbutton – Configures AMCI Resolver Module

Zero Verify

Status
- Strokes Per Minute (SPM)
- Date/Time

Control
- Zero AMCI Resolver pushbutton – Configures the AMCI Resolver to 180°

Resolver Rotation

Status
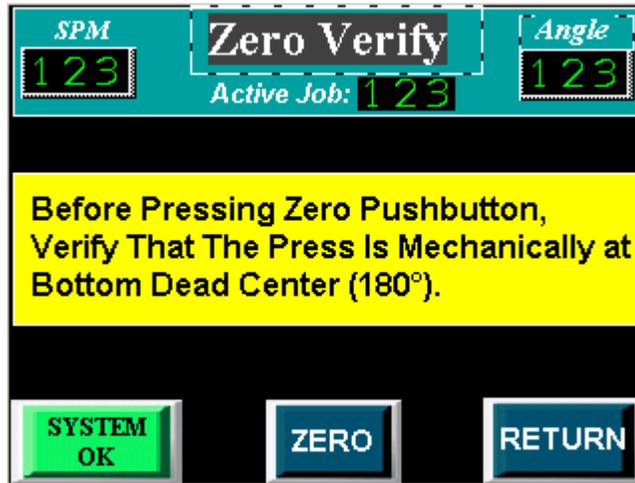- Setup AMCI Resolver pushbutton – Used only when replacing AMCI module or changing the resolver count direction. The initial setup is done at Helm Instrument Company before the unit shipped.

Control
- Resolver rotation – To reverse the resolver rotation select the FWD/REV pushbutton

Top Stop Setup

Resolver Setup

SPM **123**   Active Job: **123**   Angle **123**

90º Brake Test	Brake Stop Time (mS)	Resolver Rotation
ON / OFF	Setpoint **1234** Actual **1234**	FWD

SYSTEM OK   SETUP   ZERO   RETURN

Sets up calculated Top Stop Angle on Initial startup.

Top Stop Control

SPM **123**   Active Job: **123**   Angle **123**

+/- Degree(s) **−12** º   Calculated Top Stop Angle **−123** º

PLC Scan Time **−1.2** mS

SYSTEM OK   RETURN
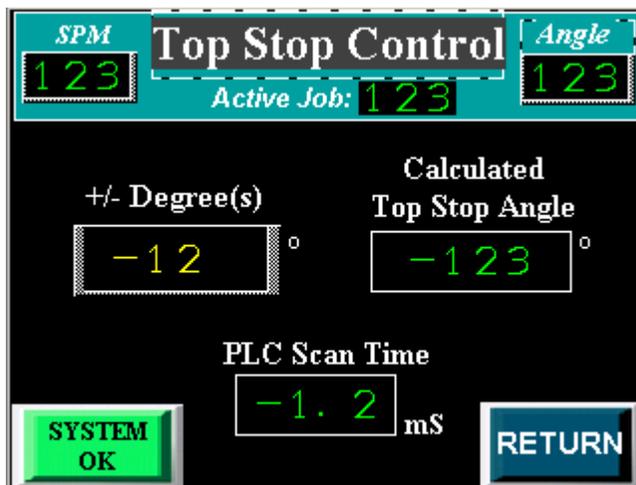
Status

- 90° Brake Test – Indicates if 90° brake test is enabled.
- Calculated Top Stop Angle – Displays Calculated Top Stop Angle.
- PLC Scan Time – Displays PLC scan time in milliseconds.

Control

- +/- Degree(s) – Adjust Top Stop Angle +/- 10°.

System Menu

Status
- Strokes Per Minute (SPM)
- Angle
- Date/Time

Control
- Selection of what screen to display
  - Main Screen
  - System Setup
  - Lube Control
  - Active Control
  - Recipe Control
  - Tonnage
  - Top Stop Adjust
  - DM Sensor Status
  - Help Screen

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Lube Control

Status
- Press Cycles Actual – Displays actual press cycles.

Control
- Mode – Off, Pushbutton, cyclic, or timer mode can be used to control the lube output.
- Timer on time/off time – Enter on and off times to control the lube output when timer mode is selected.
- Setpoint – Enter setpoint for number of press cycles to control the lube output.

System Alarms

Status
- System alarms – Displays active alarms and trigger month, date, and time
- When an alarms occurs the fault reset light on the enclosure will light red.

Control
- View History alarms

Status
- History alarms – Displays history alarms and trigger month, date, and time

Control
- Scroll up or down the history alarms
- Clear all history alarms
- Return to active alarms

SECTION 5
Active Die Monitoring
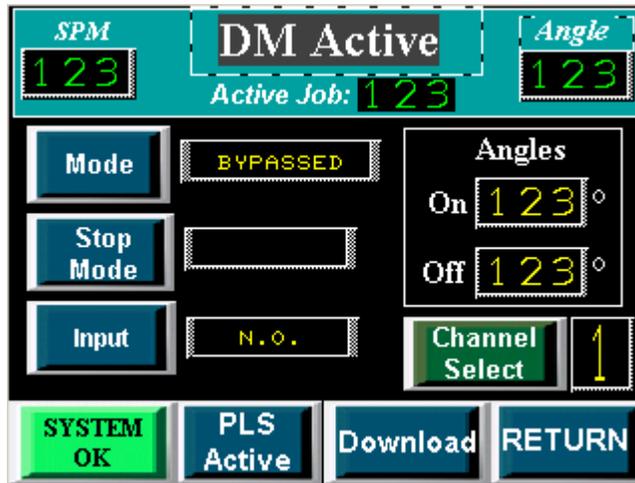
Status
- Indicates current selected channel
- Displays current channel Name, Mode, Input, and Output
- Displays current channel On Angle, Off Angle, and Intermittent Cycles Setpoints

Control
- Mode pushbutton – Selects operating mode for channel (Bypass, Static, Cyclic, In-Position)
- Input pushbutton – Selects whether the input wired is normally open or normally closed
- Output pushbutton – Selects what action will take place if the channel faults (Top Stop, Emergency Stop, Warning)

Active Die Monitoring Control Continued…
- Save Changes pushbutton – Saves the screen changes to the active registers
- PLS pushbutton – Displays active PLS screen
- Return pushbutton – Displays Menu
- On Angle Setpoint – Degree angle for the start of the look window
- Off Angle Setpoint – Degree angle for the stop of the look window
- Intermittent Cycles Setpoint – Number of rotations before the On and Off angle setpoints are looked at.

Die Monitoring Mode Descriptions

- **Static Mode** - Use this mode to detect that an event occurred independent of the press stroke. When a static-mode input turns Off, the programmed output is turned On. For example, use it to detect end of stock.

- **Cyclic Mode** - Use this mode to verify that a pulse from the sensor (OFF-ON-OFF) occurred within the window once each stroke. For example, use it to detect that a part moved past a monitor.

Transition Diagram	For These Expected Transitions	Input is NOT ALLOWED When Sensor:	Which Results in a Fault Signal Sent After:
	Sensor turns ON then OFF within window	1. Stays ON beyond window	Window goes OFF
		2. Turns ON outside window	Sensor turns ON
		3. Remains OFF for the cycle	Next window goes on

- **In-Position Mode** - Use this mode to verify that the sensor signal remained ON within the entire window once each stroke. The signal must cycle OFF outside the window. Use it to detect if an ejector and other automation parts are retracted to home position.

Transition Diagram	For These Expected Transitions	Input is NOT ALLOWED When the Sensor Signal:	Which Results in a Fault signal Sent After:
	Sensor turns ON before, and OFF after window	1. turns OFF before window goes OFF	sensor turns OFF
		2. does not turn OFF outside window	next window goes ON
		3. remains OFF for the cycle	next window goes OFF

Die Monitoring Sensor Status
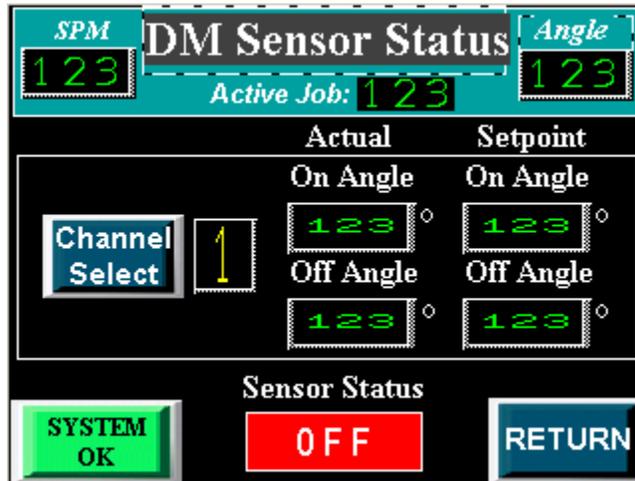
Status

- Displays current channel On Angle, Off Angle values (indicates angles at which the sensor actually turns on and off, used to setup sensor)
- Displays current channel setpoint for the on/off angles.
- Displays Sensor Status On/Off

Control

- Selection of DM Channel 1-6

Status

- Displays Active Job#
- System OK/System Alarm Status
- Active Job Number
- Strokes Per Minute (SPM)
- Angle

Control

- Save Active settings to Recipe

Active PLS (Programmable Limit Switch)
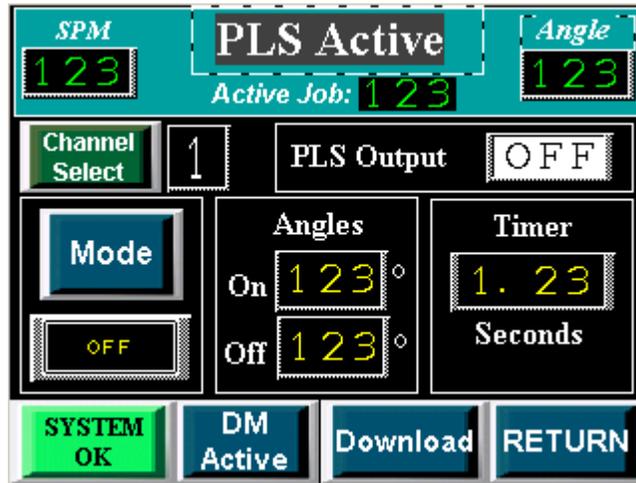
Status

- Indicates current selected channel
- Displays current channel Mode
- Displays current channel On Angle, Off Angle, Intermittent Cycles, and Timer Setpoints

Control

- Mode pushbutton – Selects operating mode for channel (Bypassed, Timer, Angle)
- On Angle Setpoint – Degree angle the PLS output turns On
- Off Angle Setpoint – Degree angle the PLS output turns Off
- Intermittent Cycles Setpoint – Number of rotations before the On and Off angle setpoints are looked at
- Save Changes pushbutton – Saves the screen changes to the active registers
- Display Active Die Monitoring screen pushbutton
- Return pushbutton – Displays Active Die Monitoring/PLS Menu

Recipe Die Monitoring/PLS Menu

Status
- Current Recipe Job
- System OK/System Alarm Status
- Recipe Job Number
- Strokes Per Minute (SPM)
- Angle

Control
- Recipe Job Setpoint – Enter Recipe number (1-100)
- Display Recipe Die Monitoring screen pushbutton
- Display Recipe PLS screen pushbutton
- Load to PLC pushbutton – Loads current Recipe selected to the PLC
- Return pushbutton – Displays System Overview screen

Recipe Die Monitoring

Status
- Indicates current selected channel
- Displays Recipe channel Name, Mode, Input, and Output
- Displays Recipe channel On Angle, Off Angle, and Intermittent Cycles Setpoints

Control
- Name pushbutton – Selects a pre-programmed name for the channel
- Mode pushbutton – Selects operating mode for channel (Bypass, Static, Cyclic, In-Position)
- Input pushbutton – Selects whether the input wired is normally open or normally closed
- Output pushbutton – Selects what action will take place if the channel faults (Top Stop, Emergency Stop, Warning)

Recipe Die Monitoring Control Continued…
- Save Changes pushbutton – Saves the screen changes to the current Recipe
- PLS pushbutton – Displays Recipe PLS screen
- Return pushbutton – Displays Recipe Die Monitoring/PLS Menu
- On Angle Setpoint – Degree angle for the start of the look window
- Off Angle Setpoint – Degree angle for the stop of the look window
- Intermittent Cycles Setpoint – Number of rotations before the On and Off angle setpoints are looked at.

Recipe PLS (Programmable Limit Switch)

Status

- Indicates current selected channel
- Displays Recipe channel Mode
- Displays Recipe channel On Angle, Off Angle, Intermittent Cycles, and Timer Setpoints

Control

- Mode pushbutton – Selects operating mode for channel (Bypassed, Timer, Angle)
- On Angle Setpoint – Degree angle the PLS output turns On
- Off Angle Setpoint – Degree angle the PLS output turns Off
- Intermittent Cycles Setpoint – Number of rotations before the On and Off angle setpoints are looked at
- Save Changes pushbutton – Saves the screen changes to the current Recipe
- Display Recipe Die Monitoring screen pushbutton
- Return pushbutton – Displays Recipe Die Monitoring/PLS Menu

PROGRAMMABLE LIMIT SWITCH AND DIE MONITORING OPERATION

PLS / DM software is a group of engineered press-control products for PLC processors. This software controls the operation-of:
- Programmable Limit Switch (PLS) for crankshaft synchronization
- Die Monitoring (DM) to protect your press dies and machinery

WHAT IS A PROGRAMMABLE LIMIT SWITCH?

The Programmable Limit Switch is ladder logic for a PLC -based control system that times or sequences outputs according to precise and repeatable positions of a crankshaft. Crankshaft positions are monitored by a resolver. You can use PLS to integrate auxiliary press machinery such as lifters, grippers, blow-off valves, and inter-press automation into your stamping press control system.

HOW A PLS CHANNEL WORKS

You preset the rotational position (preset angle) at which you want the PLS output to turn ON. You select how you want the PLS output to turn OFF: by preset angle or preset time.
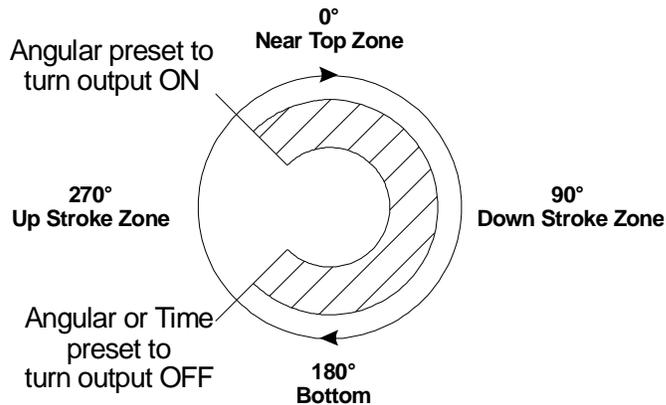
Then, you can program your application-specific output response, such as using the PLS output bit as a trigger to:

- initiate part movement between presses in a transfer line
- look for correct part movement with a die monitor track function
- initiate die automation devices such as grippers and lifters

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WHAT IS DIE / AUTOMATION (DM) MONITORING?

Die/Automation Monitor software is designed to monitor sensors that report correct part movement relative to the crankshaft angle of a stamping press, and to detect a variety of deviant conditions. You can use this product to detect the absence, misalignment, or the unwanted presence of parts moving through an automated stamping process. When the software detects a fault, it responds according to what you selected as the fault response:

- warning (programmable response)
- top stop (initiates relay output to machine)
- stop now (initiates relay output to machine clutch stop)

BENEFITS OF THE DIE/AUTOMATION MONITOR

Helps protect expensive tooling with high-speed sensor monitoring. For example, if the software and sensors detect a misaligned part, a programmed response stops the machine.
When retooling, an operator can call up a preconfigured job setup from a control panel and save setup time.
You can reconfigure the system with a variety of input sensors and programmed output responses to suit a variety of control requirements.

FEATURES OF THE DIE/AUTOMATION MONITOR

- User-friendly operation with HMI (Human/Machine Interface) terminal
- Keyboard configuration of up to 16 inputs of each type
- Part file management to store job setups
- You can monitor the crankshaft angle when an input turns On or Off
- You can monitor sensor On/Off, synchronized with the crankshaft
- Based on standard PLC programmable controller technology

Cyclic Mode Transition Diagram	Expected Transition Occurs Within Window	Input is NOT ALLOWED When Sensor:	Which Results in a Fault SIGNAL Sent After:
	Sensor turns ON then OFF within window a-b (Pulse-type signal)	1. stays ON beyond the window	window goes OFF
		2. turns ON outside the window	sensor turns ON
		3. remains OFF for the cycle	next window goes ON

DESCRIPTION OF MODES

The purpose of DM channels is to verify that predictable conditions in your press operation take place. When the software detects a fault condition, it sets a selected output response. You select the type of mode for each channel from the following:

- Bypassed
- Static
- Cyclic
- In Position

Use the following table to help you select the types of channel modes required for your application.

Mode:	Signal must be seen as follows, or function sets an output action:
static	continuously
cyclic	Thru a preset angular window once every cycle.
in position	thru a preset angular window (with part in place)

DEFINITION OF DIE MONITORING WINDOW

Window Input signals for Cyclic (CYC) and In-position (POS) modes are synchronized with the rotation of the crankshaft, and must be detected within a zone of crankshaft rotation. We call this zone a window. For example, a part-detect signal could be expected within a window of 80-110º to indicate that a part was inside a die before it was hit by a stroke.

When the software detects input signals that are different from those described here, the software generates a fault signal. We graphically define these (window) inputs as follows:
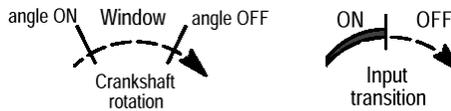
Cyclic (CYC) N.O. Use this mode to verify that a pulse from the sensor (OFF-ON-OFF) occurred within the window once each stroke. For example, use it to detect that a part moved past a monitor.

Transition Diagram	For These Expected Transitions	Input is NOT ALLOWED When Sensor:	Which Results in a Fault Signal Sent After:
	Sensor turns ON then OFF within window	1. stays ON beyond window	window goes OFF
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		3. remains OFF for the cycle	next window goes ON

Cyclic (CYC) N.C. Use this mode to verify that a pulse from the sensor (ON-OFF-ON) occurred within the window once each stroke. For example, use it to detect that a part moved past a monitor.

Transition Diagram	For These Expected Transitions	Input is NOT ALLOWED When Sensor:	Which Results in a Fault Signal Sent After:
	Sensor turns OFF then ON within window	1. stays OFF beyond window	window goes OFF
		2. turns OFF outside window	sensor turns OFF
		3. remains ON for the cycle	next window goes OFF

In-Position (POS) N.O. Use this mode to verify that the sensor signal remained ON within the entire window once each stroke. The signal must cycle OFF outside the window. Use it to detect if an ejector and other automation parts are retracted to home position.

Transition Diagram	For These Expected Transitions	Input is NOT ALLOWED When the Sensor Signal:	Which Results in a Fault signal Sent After:
	Sensor turns ON before, and OFF after window	1. turns OFF before window goes OFF	sensor turns OFF
		2. does not turn OFF outside window	next window goes ON
		3. remains OFF for the cycle	next window goes OFF

In-Position (POS) N.C. Use this mode to verify that the sensor signal remained OFF within the entire window once each stroke. The signal must cycle ON outside the window. Use it to detect if an ejector and other automation parts are retracted to home position.

Transition Diagram	For These Expected Transitions	Input is NOT ALLOWED When the Sensor Signal:	Which Results in a Fault signal Sent After:
	Sensor turns OFF before, and ON after window	1. turns ON before window goes ON	sensor turns ON
		2. does not turn ON outside window	next window goes OFF
		3. remains ON for the cycle	next window goes ON

Static Mode (STC) Use this mode to detect that an event occurred independent of the press stroke. When a static-mode input turns Off, the programmed output is turned On. For example, use it to detect end of stock.

OUTPUT RESPONSES FOR DIE MONITORING CHANNELS

When the software detects a channel fault, it displays the channel number and type of fault on an Operator Interface screen. The software also sets a fault response that you select from the following:

- Warning (displays alarm banner on the active screen)
- Stop on top
- Stop now
- Output by-passed (no fault response)

APPLY DM SENSORS TO A STAMPING PROCESS IN A VARIETY OF WAYS.

Typical PLS / DM / Load Monitoring Application
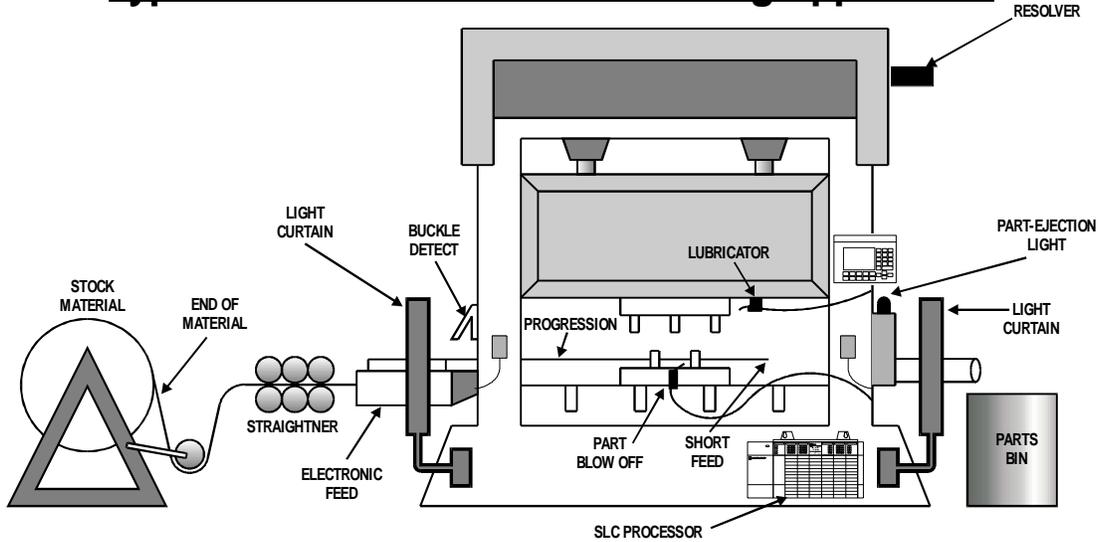
FOR EXAMPLE:

SENSORS TO DETECT MOVEMENT OF A PART
> *Part in position*
> *Part ejected*
> *Feed*
> *Coil*
> *Misfeed*

SENSORS TO DETECT STATIC CONDITIONS
> *Lube*
> *End of feed*
> *Die clamps*
> *Air pressure*

LIMITED WARRANTY

Helm Instrument Co., Inc. ("HELM") hereby warrants that the instruments and sensors (collectively the "Product") manufactured by it and sold to customer, are free from defects in material and/or workmanship under normal use subject to the following conditions. This warranty shall not apply to any Product which has been subjected to improper installation, misuse, negligence, accident, alteration, where service has been performed by other than an authorized Helm serviceman, or where the serial number has been defaced or altered. This warranty shall extend for the one (1) year period from date of shipment from our factory or authorized dealer, provided that the product is returned, freight prepaid, to Helm within the one (1) year warranty period within specific written authorization to perform repairs. Helm's obligations and the exclusive remedy of customer under this warranty are limited to repairing or replacing any defective Product at no additional charge and returning Product to customer freight paid. Repair parts and replacement Products shall be furnished on an exchange basis and shall be either new or reconditioned. All replaced parts and Products shall become the property of Helm.

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Should you have any questions concerning this Warranty, you may contact Helm by writing or calling:

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