System 5100-MPC Press Control

Installation and Operating Manual

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LINK Systems ®

OmniLink 5100

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1 INTRODUCTION

1.1 Regulations, Standards, and User Requirements

OmniLink System 5100-MPC press controls are designed specifically for part revolution clutch mechanical power presses. The design, safeguarding, care, and use of mechanical power presses are addressed by the following North American safety standards:

Federal OSHA 1910.217 regulations
State OSHA programs in some states (usually similar to Federal regulations except for codification)
ANSI B11.1 standards
CSA Z142 in Canada

It is imperative for users to obtain all current safety standards that apply to your press operations and follow them. OSHA and CSA standards *are law* directed at users of power presses. ANSI standards are consensus safety standards that have requirements that apply to the user. All of these standards address both the functional requirements of the press control system design and the safety performance of the clutch/brake control design in the event of malfunctions or component failures. OmniLink System 5100-MPC Press Controls are designed to meet all functional safety requirements of OSHA, CSA, and ANSI; and to provide additional safety features not required by standards when properly applied, adjusted installed and used. The control is designed to go beyond current OSHA, CSA, and ANSI standards for "Control Reliability" and "Performance of Safety Related Functions" in the event of component failure. These standards are intended to significantly reduce the possibility of unintended stroking action of the press due to control or safeguarding component failure. The System 5100-MPC controls are also designed for IEC standards Category 4 safety performance.

Two diverse separately powered microprocessor systems each perform clutch/brake control logic independently and cross communicate with each other to check control agreement. All inputs are isolated and read independently by each channel. Pulsed, dual cross-checked Protective Inputs are provided for safety devices, interlocked barrier guards, safety blocks, and other safety critical input devices, as well as emergency stop inputs. These inputs require that two separate contacts from each protective device, guard, or button be wired into each of the two cross-checked inputs, and that these contacts both operate within a preset time of each other. Failure of either input contact or any wiring fault such as a short, ground or open is detected by the control and stroking is inhibited until the failure or fault is corrected.

A combination resolver and encoder assembly connected to the crank or eccentric shaft of the press gives two sources of crank angular position and speed that are read and checked independently by each microprocessor channel of the control to provide position in stroke and stroking speed of the press slide. Power to the clutch/brake valve(s) passes through four separate relays, whose contacts and wiring are checked by the two hardware independent logic systems for any failure or wiring fault. Control Reliable dual-limit time-based Brake Monitoring, Motion Detection, and Clutch Engagement Time Monitoring are integral to the control.

While the basic *design* of OmniLink System 5100-MPC control components meets or exceeds all relevant safety standards, the user (employer) must ensure that the controls are *applied, adjusted, installed, and used in accordance with Link's instructions and electrical schematics to provide*

controls in compliance with safety standards. Further, they must be used with appropriate safeguarding for the hazards of the press production system to comply with safety standards.

The OmniLink System 5100-MPC press control provides only one element of a press production system. Press production systems consist of the press and its controls, dies, safety devices and guards, operating personnel, method of feeding, and any automation associated with die change, feeding and transfer used in press operations. Only the user (employer) has continuous knowledge and control over *all* elements of the press production system(s) design and use (and attendant hazards), and the personnel assigned to operations. Because of this, safety standards assign the following responsibilities for the care, use, and safeguarding of press production systems to the user.

- Hazard analysis to determine the hazards associated with every operation on each press production system.
- Safeguarding point-of-operation and other hazards associated with the press production system.
- Methods to restrict mode selection, operator station selection, and other press control selections to authorized personnel.
- Training of press operators in the safe method of operation for each production set-up, including but not limited to the function of operator controls necessary to perform the task, the designated method of feeding, the designated method of safeguarding, the hazards associated with the task, and the hazards associated with the improper use or failure to use safeguarding.
- Training of die setters in the safe removal and installation of dies including safeguarding means, transport and storage of dies, energy control, shut height adjustment, die setting control modes, and operator controls.
- Training of maintenance personnel for competence and safe working procedures for inspecting and maintaining press production systems.
- Training of supervisors in safe working procedures for set-up, operation, and maintenance of press production systems.
- Training of authorized and affected personnel relative to lockout/tagout requirements of hazardous energy sources in accordance with ANSI Z244.1, OSHA 29 CFR 1910.147 and other relevant standards.

WARNING: ⚠	Failure to properly apply, install, adjust, and use the OmniLink System 5100-MPC control and to supply appropriate safeguarding for the press production system in accordance with current OSHA 29 CFR 1910.217, ANSI B11.1, and other relevant standards may result in severe injury or death to personnel from point-of-operation or other press production system hazards.

1.2 System Overview

In general, part revolution clutch mechanical power press controls will always have a main power disconnect switch, main drive motor controls, and clutch/brake controls that provide multiple modes for cycling (stroking) of the press. Depending on the press, and the auxiliary systems on the press, control components for flywheel brake, slide adjust motor, various lube systems, hydraulic overload, hydraulic die clamps, rolling bolsters, and monitoring systems such as tonnage monitors and die protection and process monitoring equipment may also be provided. Controls may also make provision for any interface with automation and safeguarding used with the press production system.

Link's OmniLink System 5100-MPC controls are designed to be versatile enough to serve the wide variety of part revolution presses and press applications used in industry. These controls are usually supplied as a complete system, comprising press motor(s) and auxiliary systems controls, clutch/brake controls, automation and safeguarding interface controls, and monitoring systems as needed. They may be supplied either as "Standard" controls for simpler applications, or as a "Custom Engineered" controls with added control features to accommodate presses with more complex auxiliary systems and some limited automation.

> **NOTE:** While this manual explains the variety of standard and optional control features that can be provided in general, Link will supply electrical schematics for each press control supplied that reflect the control components specifically used for that press.

1.2.1 OmniLink System 5100-MPC Basic Components

Figure 1 shows the basic and optional components of the OmniLink System 5100-MPC control related to Clutch/Brake and auxiliary press systems controls, automation and safeguarding interface, and monitoring systems. Motor controls can vary widely and are not included here. These components are:

- OmniLink 805 Color LCD Touch Screen Operator Terminal
- Optional Peak 805-5 Tonnage Monitor Module for Operator Terminal
- Optional 805-3 Communications Module with Serial Feed Interface
- System 5100 Card Rack with 5100-4A Input Module with 56 Inputs and Input Power Supplies
- Optional 5100-4B Input Module with 56 Inputs and Input Power Supplies
- Optional 5100-3B Analog Board for Speed Control and Motor Load for Variable Speed Presses
- Optional 5100-3C Safety Relay Drive and Monitoring Board
- Up to 4 Optional 5100-3CR Safety Relay Output Modules for Safety Interface to Automation
- Up to 2 Optional 5100-2A Programmable Limit Switch Relay Modules with 4 Outputs Each
- Up to 6 Optional 5100-2A Programmable Output Relay Modules with 4 Outputs Each
- Resolver/Encoder Unit

OPERATOR TERMINAL CAN PROVIDE OPTIONAL TONNAGE MONITOR MODULE AND SERIAL COMMUNICATION MODULE WITH SERIAL FEED INTERFACE

RESOLVER /ENCODER

TO PRESS CLUTCH/BRAKE VALVE(S)

TO ANY ADDITIONAL OPTIONAL 5100-2A INPUT MODULES

LOGIC MODULE

5100-4A INPUT MODULE

OPTIONAL 5100-4B INPUT MODULE

OPTIONAL 5100-3B ANALOG MODULE TERMINALS

OPTIONAL 5100-3C SAFETY RELAY DRIVE MODULE TERMINALS

OPTIONAL 5100-2A OUTPUT RELAY MODULE (UP to 6 MODULES)

UP TO 4 OPTIONAL 5100-3CR SAFETY RELAY OUTPUT MODULES

SYSTEM 5100 CARD RACK

OPTIONAL 5100-2A PROGRAMMABLE LIMIT SWITCH RELAY MODULE (UP to 2 MODULES)

Figure 1: System Layout

1.2.2 Standard and Optional Control Features and Functions

Operator Terminal: The user friendly OmniLink 805 Operator Terminal includes a graphic 5.7 inch diagonal liquid crystal color display (640x480 resolution) with an integrated touch screen. It is used for user configuration of control settings, display of all system information including stroke position and diagnostics, stroking mode selection, setting of parameters, and storage and recall of jobs. The Operator Terminal can display either English or Spanish. The display language can be toggled by pressing one softkey. An optional Peak Tonnage Monitor Module with forward and reverse limits and a Serial Communications Module that includes serial feed interface can be mounted in the operator terminal.

Die Protection Inputs: Inputs for up to 4 die protection sensors are provided in the Operator Terminal.

Tonnage Monitor Option: A peak tonnage monitor module with up to 4 channels and a total is available for installation in the Operator Terminal.

Communication Board Option: An optional 805-3 communication board for the OmniLink 805 Operator Terminal provides a serial port that can be configured for RS 485, RS 422, or RS 232 for serial feed interface. This allows the setting, job storage, and job recall of feed parameters on the OmniLink Operator terminal. The communications board also provides an isolated RS 485 serial communication port and an Ethernet port for future options.

Stroking Modes: Off, Inch, Automatic Timed Inch, Setup/Stop Time Test, Single Stroke, and Continuous modes are usually provided as standard. Automatic Single Stroke, Continuous on Demand, and Operator Maintained Continuous modes are optional. Off is always provided, but any of the other modes listed above can be provided or omitted as required for a particular press production system.

Power Supplies: The System 5100 card rack provides separate and isolated power supplies for its microprocessor logic systems and a 24VDC power supply that can provide a total of 2A. The 24VDC power supply is subdivided into multiple current limited 24VDC supplies protected against grounds and inadvertent connection to 120VAC. One of the 24VDC power supplies is for the OmniLink 805 Operator Terminal and Optional PLS and Output Relay modules. Each Input Module used with the System 5100 card rack provides eight individual +24VDC power supplies (each with current limiting and 2 with check pulses for protective inputs) on its terminal strips in order to provide power for field wiring to the inputs. Each Input Module also provides four 24V power supply common connections on its terminal strips.

Control Inputs: The standard 5100-4A and optional 5100-4B input modules used with the System 5100 card rack each provide 56 input terminals. Each input terminal is connected to two separate optical isolation circuits, one for each of the two separately powered microprocessor logic circuits, so that both microprocessors independently read every input. The inputs are driven by 24VDC power supplies, but can withstand inadvertent connection to 120VAC without damage. Inputs for up to two operator stations, OIT operator controls, two light curtains, safety blocks, pressure switches, valve monitoring and other control inputs are standard on the standard 5100-4A input module. This module also includes inputs that are namable and configurable as to type of stop (Top Stop, Immediate Stop, and Master Stop) for auxiliary press systems for lube, flywheel brake, hydraulic overload, etc. that may be used with the press. Multiple dual protective inputs driven from pulsed power supplies are provided for critical safety inputs, safety devices, and interlocked guarding. The optional 5100-4B input module provides for an additional three operator stations and 34 more inputs that are namable and configurable as to stop type.

Control Outputs: Clutch/Brake dual valve outputs for one valve (or two valves whose solenoids are driven in parallel) are standard. An optional second pair of outputs can be provided for separate clutch/brake valves that must be timed relative to turn on and turn off to prevent clutch and brake overlap. Up to 24 optional output relays are available that are configurable for specific functions such as lube systems, motor control interface, hydraulic overloads, flywheel brakes, and other press auxiliary systems. They can also be configured to provide mode information, indicate whether the crankshaft is in motion, and provide other information to press production system automation. Up to four safety relay outputs are also an option. These relays can be programmed to give a control reliable stop signal to automation for emergency stop inputs, light curtains and other protective inputs.

Automatic Top Stop Compensation: Automatic top stop compensation is standard and can be configured and calibrated for variable speed presses so that they stop near the top of stroke at all speeds.

Speed Control and Motor Load Display: The optional 5100-3B Analog module allows the user to set and read speed of variable speed presses through the OmniLink 805 Operator Terminal. It also allows the user to set a fixed Inch mode stroking speed (usually a low speed for finesse inch control) and maximum stroking speeds for each other stroking mode.

Brake Monitor and Motion Detector: The control incorporates a time based stopping performance monitor (brake monitor) with dual setpoint limits. The brake monitor checks the stopping time of the press slide every time the press stops and displays the setpoint limits and stopping time in milliseconds on the press control screen of the Operator terminal. Since the stopping time in the middle of the down stroke is often longer than the stopping time at top of stroke, two setpoint limits are provided, one for top stopping and the other for stopping at other places in the stroke. This allows relatively tight limits to be set at the top of the stroke to be a sensitive indicator of increasing stopping time in the normal top stops during production without causing the brake monitor to trip out at longer mid-stroke stops, which apply the separate mid-stroke limit to the stop time. Motion Detection is also provided to detect failure of the resolver/encoder coupling to the crankshaft that can cause the press control to lose stroke position information.

PLS Outputs: Either four or eight optional programmable limit switch outputs are available to interface with and to sequence and time automation with the stroking of the press. Turn on and off up to two times per stroke at specified angles or on at an angle and off at a specified time after turn on.

Counters: Three production counters – labeled part counter, batch counter, and quality counter - are standard with the control as is a stroke counter for the press. Limits can be set for each production counter. All production counters that are turned on will increment as the press strokes in a production mode. When a counter reaches its programmed limit, it will issue a top stop. This stop will remain active until the counter is reset or is turned off.

Job Storage and Recall: Parameters for up to 100 jobs can be stored, allowing paperless record keeping and a job to be recalled for quick setup each time it is run in the press.

Diagnostics: The superior intelligent diagnostics of the OmniLink System 5100-MPC control are summarized in English or Spanish in the "Reason for the Last Stop" and the "Running Status" areas of the Press Control screen. Each of the two microprocessor logic channels displays the exact reason the press stops, whether due to normal or fault conditions. Similarly, both channels display any normal or

fault condition that prevents the press from stroking. The control is designed to have enough inputs so that it is not necessary to string multiple input devices in series into a single input. By providing an electrical input for each individual input device, diagnosis of the state of each individual input device is possible. The Operator Terminal has screens to display the state of every input, the state of every output, Lube System diagnostics, Operator Terminal diagnostics, the configuration memory of both microprocessor logic channels of the control, and an event log that displays the date, time and reason for the last 256 stops.

Modularity and Ease of Maintenance: The power supply/logic module and the two input modules in the System 5100 card rack can be unplugged from the mother board in the base of the control and replaced for ease of maintenance. The system software is also modular in the sense that the control software can be configured for the presence or absence of many different auxiliary press systems and many variations within the way they work, as well as many choices with regard to input names and action. Configuration software for the control is stored in two separate memory elements on a small circuit board that mounts on the control mother board rather than in the logic board memory elements for the two microprocessors. This allows the power supply logic board to be replaced without having to reconfigure the press control for the specific press because the configuration memory stays in place when the power supply/logic board is exchanged.

Access Control: The OmniLink System 5100-MPC control allows the user to configure four different methods of supervisory control to restrict which personnel can change settings, reset faults or enter values for the control. These methods are "Key Only" mode, "Key or Code" mode, "Code Only" mode, and "Key and Code" mode. The "Key Only" mode lets any person with the RUN/PROG key for the operator terminal change settings or perform any reset. The "Code Only" mode lets the user assign different access codes to personnel and choose the specific settings and resets that each individual is allowed to perform. The RUN/PROG key is not used. The other two choices of access control require the use of both key and code; or allow access by use of either the key or a code without the use of the key.

2   DEFINITIONS AND TERMINOLOGY

This section will give some background and explain the meaning and/or operation of various modes, stop types, and terms used in the press control. It is strongly recommended that this section be read in order to use the press control effectively!

2.1   Stops

There are several different kinds of stops that the press control can generate. Some conditions always generate a particular kind of stop, while others are programmable by the user. Stops may originate from the press control itself (automatic stop on top in Single Stroke mode, for example), Emergency Stop buttons, Master Stop buttons, light curtains, interlock switches, die protection systems, tonnage monitors, and a variety of other press automations systems and sources.

Note that some stop inputs are, by nature, momentary (such as pressing a "Top Stop" button). Others remain asserted (for instance, removing the Safety Blocks plug or pressing a self-latching Emergency Stop button) until some action is taken (restoring the Safety Blocks plus or unlatching the Emergency Stop button). Any stops that remain asserted will prevent a restart of the press.

Stops always take precedence over any "go" signal. In addition, a "Master Stop" has higher priority than an "Immediate Stop", and an "Immediate Stop" has higher priority than a "Top Stop".

2.1.1   Immediate Stop

An "Immediate Stop" is a Category 0 stop that will immediately stop press stroking action, regardless of where it is in the cycle. Note that this does NOT mean that the press will actually stop at the point where the stop was generated, as all presses take some amount of time to drop out the clutch, apply the brake, and come to a stop. For instance, if an over-tonnage occurs at 175 degrees, the press may end up stopped at 200 degrees. The number of degrees a press requires to actually stop depends (among other things) on the design of the press and on stroking speed. All other conditions being equal, the faster the press is stroking, the longer it requires to stop.

2.1.2   Master Stop

A "Master Stop" is a Category 0 stop that has the same effect as an "Immediate Stop" (see Section 2.1.1 above) *with the addition* that it opens the dual LMC safety relays. This removes power from all motor control elements past the LMC as well as the clutch/brake valve circuits.

2.1.3   Emergency Stop (or E-Stop)

An "Emergency Stop" (sometimes abbreviated on the operator terminal as an "E-Stop") can be configured to be an "Immediate Stop" (see Section 2.1.1 above) or a "Master Stop" (see Section 2.1.2 above) initiated by pushing an Emergency Stop control (a red colored, self-latching, stop control on a yellow background – typically a palm or mushroom type button). The inputs used for this stop require two contacts from the Emergency Stop control to be wired to two different input terminals. The inputs are driven from two different pulsed outputs that allow detection of open or shorted wiring fault conditions.

2.1.4 Top Stop

A "Top Stop" is a Category 1 stop that will stop the press at the top of the stroke. Note that all presses take some amount of time to stop. If the control determines that it cannot stop at top in the time left when it receives the stop command, it will make an additional stroke. Many high speed presses take more than 1 full stroke to stop regardless of where the stop occurs.

2.1.5 Intelli-Stop

An "Intelli-Stop" sends a signal to the control to "Immediate Stop" if the stop can be accomplished by the "Critical Angle", otherwise it will "Top Stop". The "Critical Angle" is set on a job basis by the user and depends on machine and tooling characteristics. This stop type is used to attempt to prevent sticking the slide on bottom under load. For instance, the critical angle might be set to 170 degrees. If the control determines that the press can stop before this angle is reached, it will issue an "Immediate Stop" to attempt to prevent further damage to the machine and/or tooling. If, however, the control determines that the press will not be able to stop before 170 degrees, it will issue a "Top Stop" to minimize the chance of sticking the slide, since the press was going to go through the bottom anyway.

2.1.6 Protective Stops

Protective Stops are generated from inputs that require two contacts from each switch or input device to be wired to two different input terminals. Further, the inputs are driven from two different pulsed outputs that allow detection of open or shorted wiring fault conditions. These are provided for critical safety inputs, safety devices, and interlocked guarding. Certain protective stops have a fixed stop type - the Safety Blocks protective input, for instance, is fixed as a "Master Stop". A number of protective stop inputs are provided with a configurable stop type that can be set to either "Master Stop" (see Section 2.1.2 above) or "Immediate Stop" (see Section 2.1.1 above).

2.1.7 Non-Protective Stops

Non-Protective inputs are provided for interface to press auxiliary equipment, additional operator controls such as top stop buttons, process monitoring systems, external automation, and other press production control requirements that are not critical to safety. Even so, the System 5100 control emphasizes functional reliability and these inputs are monitored by both channels of the press control, which will generate signals that will stop the press and prevent further strokes from being made while the stop signal is asserted. Non-Protective Stops are distinguished from Protective Stops by having a single designated terminal on the System 5100 Input Card(s) to which the external input device is wired. Protective Stops have two designated input terminals as described in Section 2.1.6 above.

2.2 Engagement Time

The actual clutch engagement time is measured (4 millisecond resolution) each time the clutch/brake valve(s) solenoids are energized to initiate a stroke. This time is measured from valve activation until crankshaft rotation exceeds the "Motion Threshold". A wiring fault test is performed by the two channels of the press control and adds about 60 milliseconds to the time that the press takes to establish motion. If a separate clutch/brake is used, there is an additional time added set by the "Separate Clutch/Brake Pull-In Delay" parameter. If the sum of these times exceeds the "Engagement Time Limit", the stroke is aborted and the reason for the last stop will display *Motion Did Not Start*. The "Motion Threshold", "Separate Clutch/Brake Pull-In Delay", and "Engagement Time Limit" are set in

the Clutch Configuration screen (see Section 4.2.1).   Monitoring of the engagement time can provide useful diagnostic and preventative maintenance information about clutch wear. Increasing engagement time indicates that clutch wear is causing the air operator that operates the clutch plates to travel further to engage, requiring more (and longer) air flow through the clutch air valve to force the plates together.

2.3   Stop Time

Each time the press stops a time based brake monitor (2 millisecond resolution) measures the time from deactivation of the clutch/brake valve until crankshaft rotation is less than 1.8 RPM. An additional 8 milliseconds is added to this measured value to compensate for the maximum reaction time of the press control.

2.4   Operator Station

An operator station is a set of controls used by the operator to initiate stroking of the press and to stop the press. Note that this is different from the "operator terminal", which is used to configure the parameters governing how the press will run, set up certain automation functions, and provide diagnostics for the system.

"Hand" operator stations consist of, at minimum, a set of two hand Run controls (usually palm buttons) and an Emergency Stop control (a red colored, self-latching, stop control on a yellow background – typically a palm or mushroom type button). Many operator stations also include a Top-Stop button, a "prior action" button used with certain continuous and automatic modes, and an indicator lamp that shows whether the operator station is "On" or "Off". Some operator stations may also have a separate set of Inch buttons, if the control is so configured. "Hand" operator stations may be located on a console, mounted on the machine itself, or supplied on a "run-bar" – depending on customer preference and/or machine considerations.

A single optional "Foot" operator station may also be supplied with the control. This station consists of a foot switch.

Note that either the "foot" station can be active, or one or more "hand" stations can be active. "Foot" and "hand" stations are never used together.

For the System 5100 press control, up to 5 "hand" operator stations or up to 4 "hand" operator stations plus 1 "foot" station can be supplied.

2.5   Press Operating Modes

The press control can operate in several different stroking modes. The selection of which mode to operate in is determined by the needs of the production or setup operation being performed at the time. Note that all press controls may not have all the modes listed here – some are optional.

For certain purposes, the press operating modes defined in this section are grouped into categories. These come into play primarily when configuring input stop types (see Section 4.2.14). The three categories of press operating modes are "Non-Production Modes", "Manual Production Modes", and "Automatic Production Modes".

Non-production modes are typically used for setup or for testing purposes and include:

- Inch
- Timed Inch
- Micro-Inch
- Bar Mode
- Setup/Stop Time Test
- Clutch/Brake Test Mode

Manual production modes are those that generally involve an operator to initiate each cycle. At present there is only one manual production mode:

- Single Stroke

Automatic production modes are those that, once initiated, generally do not require an operator to make successive cycles. They include:

- Continuous
- Continuous on Demand
- (Operator) Maintained Continuous
- Automatic Single Stroke

Note that although (Operator) Maintained Continuous mode does require an operator to maintain the "run" controls (run buttons or foot switch), the press is in all other respect running in continuous and so is classified with the other automatic modes.

2.5.1   Setup/Stop Time Test

This mode permits quick setup of mechanical feeds driven by the press crankshaft or consistent measurement of downstroke stopping time for determination of current OSHA 1910.217 or ANSI B11.1 standards required for safety distance for two hand control and light curtain safety devices.

If the control is configured for operation with separate buttons for Inch (see Section 4.2.9.8), this mode requires the synchronous actuation of the Inch buttons within 0.5 seconds of each other to initiate stroking and, if held, stroking will continue until the slide automatically stops in the downstroke at a programmable position.

If the control is configured for operation without separate buttons for Inch, this mode selection requires the synchronous use of the Run buttons within 0.5 seconds of each other at each active operator station to initiate stroking and, if the buttons are held operated, stroking will continue until the slide automatically stops in the downstroke at a programmable position.

Release of the Inch buttons or any stop input will cause slide stopping action to be initiated at any time. Stroke initiation is allowed only with the main motor running in the forward direction.

2.5.2   Inch

If the control is configured for operation with separate Inch buttons (see Section 4.2.9.8), this mode selection requires the synchronous use of the Inch buttons within 0.5 seconds of each other to initiate stroking and will continue stroking only if the Inch buttons continue to be held actuated. If either Inch button is released anywhere in the stroke, stroking will immediately stop and the buttons will have to be released and synchronously re-actuated to initiate further stroking. The System 5100 control contains an Anti-Repeat feature in Inch mode so that, if the buttons are depressed and held until the slide approaches the top of the stroke, an automatic stop at top occurs and the Inch buttons will have to be released and re-actuated to initiate further stroking

If the control is configured for operation without separate Inch buttons, this mode selection requires the synchronous use of the Run buttons within 0.5 seconds of each other at each active operator station to initiate stroking. While each operator must actuate his individual two buttons within 0.5 seconds of each other, there is no requirement that multiple operators must press the buttons at different stations within 0.5 seconds of each other. Again, all active buttons must be held actuated to continue stroking, and stroking will stop if any button is released or stop at top if all buttons are held until the slide approaches top. After any stop, re-initiation of stroking requires the release and re-actuation of all active buttons.

Stroke initiation is allowed with the main motor running in the forward or reverse direction, or OFF. Crankshaft motion after stroke initiation must exceed the minimum strokes/min threshold if the main motor is running in the forward direction.

2.5.3   Timed Inch

This mode selection functions like the Inch mode (see Section 2.5.2 above) until a programmable downstroke slide position is reached (the "Begin Timed Inch" parameter in Section 4.2.9.5 on page 110). After this point, holding the Inch buttons depressed results in automatically controlled pulsed inching movements of the slide until the dies resist slide motion or until the bottom of the stroke is reached. When the bottom of the stroke is reached, the clutch action will stop. Releasing the buttons will then restore the normal Inch mode function until the press cycles back to the programmed downstroke position. Stroke initiation is allowed only with the main motor running in the forward direction or OFF.

2.5.4   Single Stroke

Depending on press production system operations, one or more operator stations may be provided with the System 5100 control. When multiple operator stations are provided, the user can select which stations are active for particular jobs. The Single Stroke mode selection requires the use of all active operator stations to cause stroking. Operator station controls for Single Stroke are usually two-hand controls (two Run buttons). If a footswitch is provided with the control system, operator station 2 will be factory configured for a foot switch; and stroke initiation is allowed from either the active palm button stations or the foot switch. The foot switch cannot be used in conjunction with any palm button station.

When two-hand controls are used, this mode selection requires the synchronous use of the Run buttons within 0.5 seconds of each other at each active operator station to initiate stroking. While each operator must actuate his individual two buttons within 0.5 seconds of each other, there is no requirement that multiple operators must press the buttons at different stations within 0.5 seconds of each other. When all active operator station run buttons are depressed within 0.5 seconds of each other and concurrently

held, the press will stroke until the slide automatically stops at the top of the stroke (anti-repeat) or any immediate stop or master stop input occurs, such as an emergency stop or other protective or non-protective immediate stop. The press will also stop stroking if any active run button is released in the downstroke, until the crankshaft reaches the angle of automatic carry up. After this angle is reached the press will automatically continue stroking until the slide automatically stops at the top of the stroke (anti-repeat) or any immediate stop input occurs. The automatic upstroke action will also stop if loss of resolver/encoder motion occurs.   Any or all active Run buttons may be released without causing the press to stop once automatic carry up is in effect. Strokes that are interrupted by stop signals in the upstroke can be re-initiated in the upstroke, but the press control will not enter automatic carry up and will run to the top of the stroke only as long as all active Run buttons are depressed. Each time the machine stops, further strokes can be made only after all Run buttons are released.

When operator stations are permanently wired to the control and activated and deactivated by a selector switch, the use of any inactive operator station Run button before a stroke is initiated prevents stroke initiation. The pressing of the inactive Run button is listed as the reason for the last stop, and a warning that an inactive station was used is displayed until the **Reset** softkey in the Press Control screen is pressed. After this warning is acknowledged, further strokes can be made only after all Run buttons are released. The use of any inactive operator station Run button after a stroke has been properly initiated causes an immediate stop and requires all Run buttons to be released before further strokes can be made. This control feature is provided to warn operators when a station they believe is active and necessary for them to use to stroke the press is actually inactive.

Some users specify plug-in operator stations for their press controls. Dummy plugs are used to bypass unused stations when multiple operator stations are used on a given press. When the System 5100 control is provided with plug-in operator stations, the control cannot warn if an operator station that is unplugged and left at the press is mistakenly thought to be active because it can't detect when the Run buttons are actuated.

> **WARNING:** *All* unused plug-in operator stations should be removed from the proximity of the press to prevent operators from mistakenly thinking that the station must be used to stroke the press.

Stroking in the Single Stroke mode is allowed only with the main motor running in the forward direction.

2.5.5 Continuous

This mode selection requires the actuation of a prior action button tied to Input 14 [Cont. & Auto. Modes Setup], and then the Run buttons at each active operator station must be pressed synchronously within 0.5 seconds of each other and held until the press starts stroking. Five seconds are allowed after the setup button is depressed for all active operator station Run buttons to be depressed and held until slide motion begins. After stroke initiation, any or all operator buttons may be released. The press will automatically keep stroking continuously until a top stop, emergency stop, or other stop input occurs. Loss of resolver/encoder motion will also cause automatic stroking to stop. In the event of any stop condition, further strokes can be initiated only after all operator Run buttons and the prior action button tied to Input 14 [Cont. & Auto. Modes Setup] are released. Stroke initiation is prevented if an inactive

operator station Run button is depressed. If operator station 2 is configured for a foot switch, stroke initiation is prevented if the foot switch is selected. Only the active palm button stations may be used to initiate a stroke in this mode. Press stroking is allowed only with the main motor running in the forward direction.

2.5.6   Automatic Single Stroke

This mode is optional. When Automatic Single Stroke mode is provided, one of three different types of operation may be programmed in Factory Configuration. Press stroking is allowed only with the main motor running in the forward direction.

2.5.6.1   Type 1 - Basic (Always Stroke on Arm)

Automatic Single Stroke Type 1 is most often used with coil fed presses where the feed cannot finish feeding material between strokes if the press is stroking in Continuous mode. In this configuration, when Automatic Single Stroke mode is selected, the first stroke must be manually initiated by actuating a prior action button tied to Input 14 [Cont. & Auto. Modes Setup], and then the Run buttons at each active operator station must be pressed synchronously within 0.5 seconds of each other and held until the press starts stroking and reaches the automatic carry up portion of the stroke. Five seconds are allowed after the prior action button is depressed for all active operator station Run buttons to be depressed and held until the crankshaft angle reaches the point of automatic carry up. Stroke initiation is allowed only at the top of the stroke or in the downstroke and initiation is prevented if an inactive station Run button is depressed. If operator station 2 is configured for a foot switch, stroke initiation is prevented if the foot switch is selected. Only the active palm button stations may be used to initiate a stroke in this mode. After reaching the point of automatic carry up, any or all operator buttons may be released and the press control will automatically return the slide to the top. Successive strokes will then be automatically initiated when material is in place and other prescribed conditions are met within a programmable time limit (the "Auto Single Stroke Time" - see Section 3.5.1.4). In the event of any stop condition, or, if the conditions required to automatically stroke the press fail to operate within the allowable time limit, the Automatic Single Stroke mode will be disabled and the press control will display the condition as the reason for the last stop. Further automatic stroking can be initiated only after any conditions that caused the stop are cleared and by re-enabling Automatic Single Stroke mode by the re-use of the prior action button tied to Input 14 [Cont. & Auto. Modes Setup], and then all active operator station Run buttons within 5 seconds to make the first stroke. Automatic strokes are initiated when the auxiliary equipment cycles Input 28 [Auto. Single Stroke Run] low (for at least 50 milliseconds) during the upstroke or while paused at the top and then back high.

2.5.6.2   Type 2 - Regular (Wait for "Auto. Single Stroke Run" on Arm)

In some applications (tandem presses with transfer automation between presses is an example), the auxiliary equipment or press line may not be ready for a part to be made if the first stroke is manually initiated. In this case, Automatic Single Stroke Type 2 is used so that actuating the prior action button tied to Input 14 [Cont. & Auto. Modes Setup], and then the synchronous actuation of Run buttons at each active operator station within 5 seconds will enable the automation to make the first as well as successive strokes. The press control will immediately initiate the first stroke if the auxiliary equipment is ready (Input 28 [Auto. Single Stroke Run] is high). If the auxiliary equipment is not ready, the Automatic Single Stroke mode will remain enabled and will make the first stroke when the auxiliary equipment is ready. In this situation the present running status will immediately display *Waiting for "Auto. Single Stroke Run"* and the press control will initiate automatic strokes if they occur within the

programmed "Auto Single Stroke Time". After any stop condition or other condition that disables automatic stroking, the condition must be cleared and automatic stroking re-enabled by the use of the prior action button tied to Input 14 [Cont. & Auto. Modes Setup], and then all active operator station Run buttons

2.5.6.3   Type 3 - Robot Mode

With Automatic Single Stroke Type 3, any light curtains used will be monitored in a different manner than those used with the first two types of Automatic Single Stroke mode. In order to allow a robot to enter the die area of the press this type will not abort the automatic function if a muted light curtain is blocked - but only if Input 28 [Auto. Single Stoke Run] remains low. If the run signal goes high while the robot is blocking the light curtain the automatic function will be disabled and no further stroking allowed until manually setup and initiated. Otherwise the "Robot" type of Automatic Single Stroke mode is similar to the type 2 configuration described previously.

> **WARNING:** In Automatic Single Stroke Robot Mode, any light curtains used must be located or arranged so that a person *cannot* get inside of the sensing field(s) where they are undetected. If they are able to pass through the sensing field while the press pauses at the top of the stroke the light curtain(s) will not drop the press out of Automatic Single Stroke and severe injury or death may occur from robot feeding action or automatic press stroking action.

2.5.7   Continuous on Demand

Continuous on Demand mode is an automatic mode used when the press is part of a cell of machinery used in a production process. The press is slaved to other machinery in the cell which provides a signal to instruct the press to run continuously for a period of time to produce needed parts and then to stop and wait until another continuous run is needed to produce more parts for the process. This mode requires manual enabling by pressing the prior action button tied to Input 14 [Cont. & Auto. Modes Setup], and the use of all active palm button stations within 5 seconds in order to enable automatic operation. Periods of continuous stroking are then automatically initiated by auxiliary equipment applying a high signal to Input 50 [Cont. on Demand Run/Permissive]. If a [Cont. on Demand Run/Permissive] signal is not received within the preset "Continuous on Demand Time" (see Section 3.5.1.5), the mode will be deactivated and must be manually reactivated. Any stop condition that occurs after the mode is enabled will prevent further automatic stroking until the stop conditions are removed and automatic stroking is manually re-enabled. Stroke initiation is prevented if an inactive station Run button is depressed. If operator station 2 is configured for a foot switch, stroke initiation is prevented if the foot switch is selected. Only the active palm button stations may be used to initiate a stroke in this mode. Stroking is allowed only when the main motor is on and running in the forward direction. Availability of this optional mode is configured by the factory.

2.5.8   (Operator) Maintained Continuous

When Run button are used as operator controls, this mode selection requires the use of a prior action button tied to Input 14 [Cont. & Auto. Modes Setup], and maintained operation of the selected operator station Run buttons to cause stroking. Five seconds are allowed after the prior action button tied to Input 14 [Cont. & Auto. Modes Setup] is depressed for all selected operator station Run buttons to be depressed. After initiation, the press will stroke continuously as long as the Run buttons are depressed.

If buttons are released while the press is in the downstroke, the press will stop immediately. If buttons are released in the upstroke, the press will continue automatically to the top of the stroke. In the event of any stop condition, further strokes can be initiated only after all Run buttons and the prior action button tied to Input 14 [Cont. & Auto. Modes Setup] are released and re-actuated. Stroke initiation is prevented if an inactive station Run button is depressed.

If the press control is configured for a foot switch wired into operator station 2, initiation is allowed with the foot switch only if all other operator stations are turned off. Press operation is allowed only with the main motor running in the forward direction. Availability of this optional mode is configured by the factory.

2.5.9   Bar Mode

This mode is used in combination with an output to automatically turn the main motor off when the mode is selected. A zero speed switch must be wired into the inputs provided. When this mode is selected any further clutch engagement is prevented until the motor turns off (motor forward and motor reverse inputs go Low). These inputs must remain Low while in this mode or the clutch/brake output will turn off and remain off. In addition to this requirement, engagement is prevented until the zero speed switch indicates that the motor is at rest. After meeting these conditions the clutch/brake output can be engaged by pressing the Bar button wired into Inputs 7 and 8. Once engaged, the press may be barred above the zero speed switch threshold. Availability of this optional mode is configured by the factory.

2.5.10 Micro Inch

This mode uses Safety Relay Interface 4 to engage a micro inch motor - either forward or reverse - as determined by external wiring. The normal clutch/brake outputs will not turn on. When this mode is selected, the main motor is turned off and the flywheel brake is applied automatically if motor start/stop control is enabled, or an output (Type 38) can be used if the motor is started with external logic. Engagement of the micro inch motor is prevented until the main motor turns off (motor forward and motor reverse inputs go Low). A zero speed switch must be wired into Inputs 26 and 27, and engagement is prevented until the zero speed switch indicates that the motor is at rest. After meeting these conditions, Safety Relay Interface 4 can be turned on if no stop conditions exist by pressing the Inch mode run buttons. Crankshaft motion above the minimum speed threshold is allowed. The press control will not automatically stop at the top of the stroke. The light curtains do not mute in this mode. Immediate Stop and Cycle Inhibit conditions are the same as Inch mode, except for the function of Inputs 75 and 76. If this mode is configured as On, these two inputs are used to monitor the micro inch feedback signals and will generate an immediate stop if low in any mode other than Micro Inch. Micro Inch mode performs an additional check on these inputs and requires that both switch low within 200mS after the motor is engaged. Since these inputs are on the 2nd input board, this mode is not allowed unless the board is installed. Availability of this optional mode is configured by the factory.

2.5.11 Clutch/Brake Test Mode

This mode will engage the clutch/brake mechanism on machines with a combination clutch/brake or will release the brake and engage the clutch on machines with a separate clutch and brake. If configured, a selection has to be made to allow engagement only at the top of the stroke, only at the bottom, or at the top and bottom. The crankshaft must be within a plus or minus 5 degree window. The separate inch

button Inputs 7 and 8 [Inch/Bar Run] must be used to engage the output, even if Inch mode is configured to function with the selected run buttons. The output will remain on as long as both buttons are pressed. Pressing any other run button will abort the engagement. Engagement is allowed in this mode only if the main motor is off and stopped as detected by the zero speed switch (Inputs 26 and 27). The mode will abort engagement if motion is detected or if position moves outside the allowable window.

> **NOTE:** Clutch/Brake Test mode became available on Press Control firmware versions 1.27 and above but is not typically enabled. It was designed for a specific situation that is not often encountered. Please contact Link if you think you need this mode.

> **WARNING:** Inputs 81-84 are configurable stops as described in Section 4.2.14. When not in Clutch/Brake Test mode, these inputs function as configured. *However, when the press is in Clutch/Brake Test mode, Inputs 81 – 84 are disabled and will not stop the press!*

2.5.12 Trip Mode

This mode allows the press to be operated in manual mode by one operator when a light curtain is installed without holding the run buttons through the downstroke.

> **WARNING:** This mode absolutely *requires one or more light curtains* to be properly applied and used. The light curtain(s) and any required supplementary barriers and guarding must be located and arranged so that a person *cannot* be between the sensing field(s) and the hazard or get around the sensing field(s) to the hazard undetected. Failure to comply with these requirements may result in severe injury or death.

Station 2 MUST be configured as if a foot switch is installed (even when using a button or buttons) and only station 2 can be selected to operate this mode. A light curtain must be wired into light curtain 1 inputs. The press control will verify that a light curtain is installed by displaying the message "Break Light Curtain 1" before stroke initiation is allowed. The operator must block light curtain 1 and unblock it. The message "Ready To Stroke" is displayed and one initiation is allowed by activating the station 2 run button inputs. The run button inputs must be held until motion is established. Unlike Single Stroke, it does not have to be maintained until the point of automatic carry up.

When one stroke is completed, the procedure of breaking the light curtain and initiating the stroke is repeated. A time period is configured such that stroke initiation must occur within the defined time after the light curtain is unblocked or initiation is aborted and the message "Light Curtain 1 Timeout" is shown in the reason for the stop. This time can be set from 1 to 12 seconds, or a setting of 0 will disable the timeout.

If light curtain 1 is muted in the upstroke, it can be blocked without stopping the press during this portion of the stroke and the next cycle will be armed when the light is unblocked. If a stop occurs in the downstroke, the mode can be re-initiated by the procedure described above. It a stop occurs in the upstroke, the same procedure applies except the run button inputs must be maintained to the top of the

stroke. If a stop condition occurs while the mode is armed and waiting for initiation, the procedure must be repeated.

Setup modes (e.g. Inch) will not allow initiation from station 2, and would typically be configured to use separate Inch buttons. Automatic modes (e.g. Continuous) will not allow initiation from station 2, either alone or in combination with stations 1, 3, or 4. The message "Trip Station Selected" indicates that the mode will not allow initiation with this station selected.

Availability of this optional mode is configured by the factory, in versions 1.46 and greater of the press control firmware.

3   OPERATION

3.1   Operator Terminal

Figure 2 shows the operator terminal front panel. This panel consists of a color LCD display with a touch screen and RUN/PROG key switch.
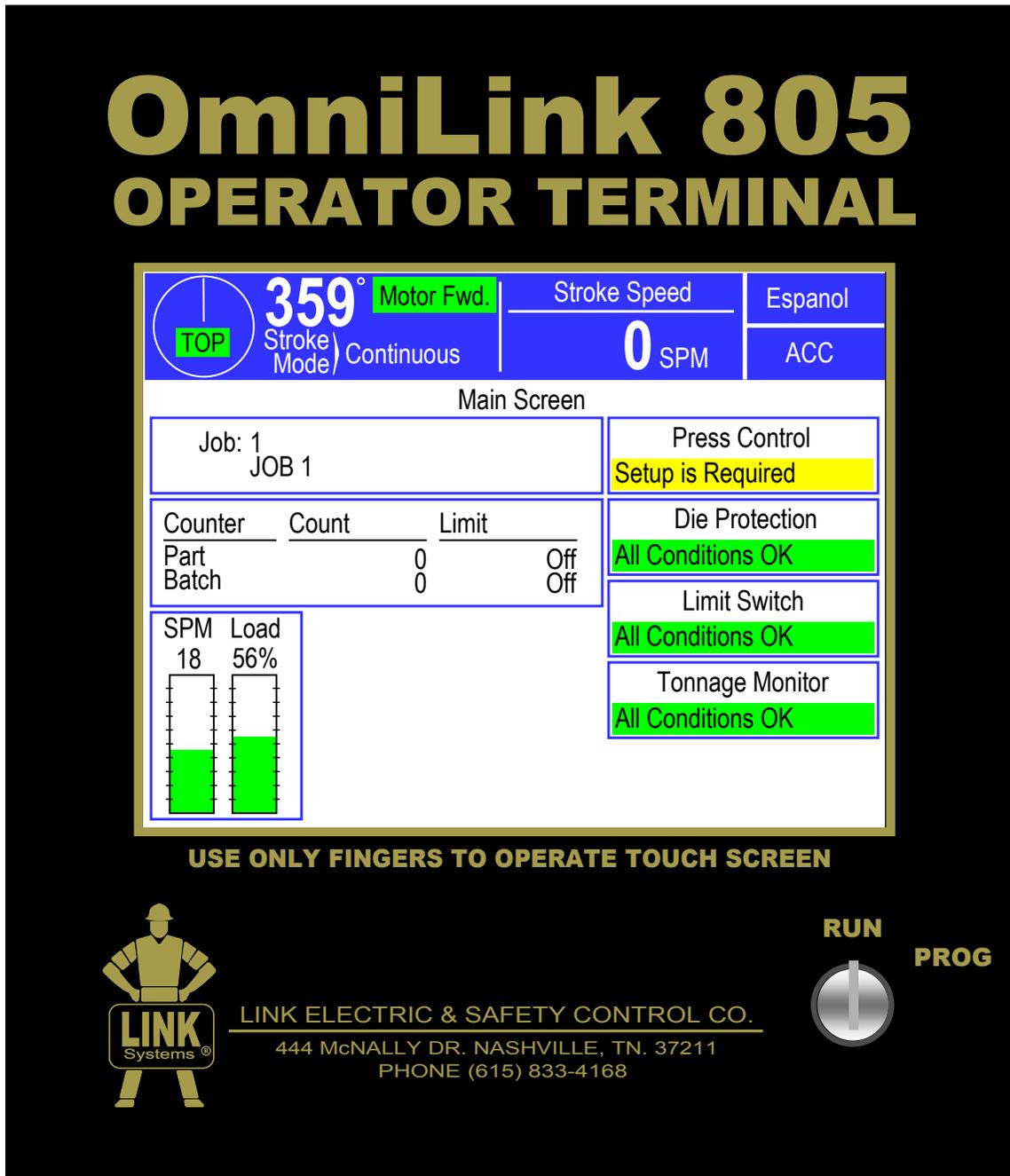
Figure 2: Operator Terminal
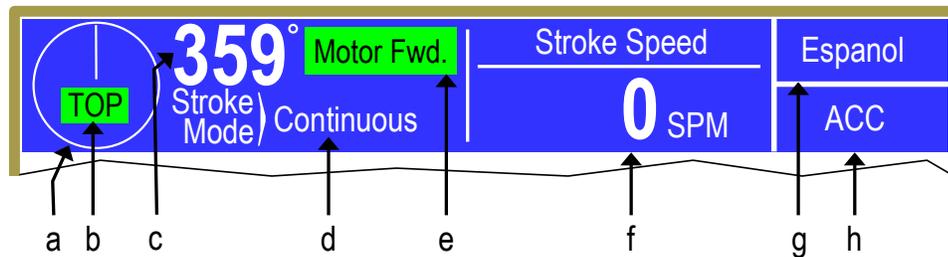
Figure 3: Operator Terminal Top Info Area

The top area of the operator terminal is used to display certain critical information and provide keys that are present regardless of what screen is being displayed. The areas are (refer to Figure 3):

a) **Graphical Display of Crankshaft Angle** — For speeds below 70 SPM or so, this will show the crankshaft angle in either a "clock" format (this is the mode shown in Figure 3) or a "traveling dot" format. Press the screen inside the circle to switch between the formats (this can be done at any time, including while the press is in motion). Above 70 SPM, this will change to rotating arrows to indicate crankshaft motion.

b) **Top/Bottom Indicator** — When the press is stopped within +/- 5 degrees of the top of the stroke, "TOP" will appear in a green background. When stopped within +/- 5 degrees of bottom, "BOT" will appear in a yellow background. Note that for certain presses (such as link drives) "Top" may not be at 0 degrees.

c) **Numeric Display of Crankshaft Angle** — This area provides a numeric readout of the crankshaft angle using larger digits so that they can be read more easily from a distance.

d) **Press Mode** — This will display the currently selected stroking mode of the press.

e) **Main Motor Status** — This area shows whether the main motor is running in the forward direction, the reverse direction, or is off. If an optional zero speed switch is installed and configured, it will also show when the zero speed switch is indicating "zero speed".

f) **Programmable Display Area** — This area can display a variety of information, based on user selection. Some examples items available include press speed (as shown in Figure 3), press control running status, press control reason for the last stop, part count, and distance to the bottom of the stroke. Press inside this area to cycle to the next available item. The operator terminal can also be configured to automatically show a particular item when the press control mode is switch from a setup mode to a production mode, and vice versa. See Section 4.3.1 for more information on configuring this area and the information items available.

g) **Language Switching Key** — This key is used to switch languages used on the operator terminal see Section 3.1.2 for more information.

h) **Quick Access Key** — This key displays the Quick Access screen. See section 3.1.1 for more information.

Areas inside the white portion of the display are shown with a blue border if that area can be selected. For example, pressing the blue bordered jobs area or the blue bordered counters area will take you to screens related to jobs or counters, respectively. Areas usually displayed along the right side and bottom of the display provide softkeys which may be selected by pressing the field. For example, pressing the "Die Protection" bordered area in Figure 3 will select the die protection screen.

3.1.1   ACC Softkey

This is a quick access key. This key will supply direct access from any screen to the Quick Access screen. The quick access screen contains the name of the currently logged in user, the log out softkey, and access to auxiliary communications.

3.1.2   Espanol/English Softkey

This changes the display language from English to Spanish or Spanish to English. If the display is currently in English, touching the **Espanol** softkey will change the display to Spanish. If the display is currently in Spanish, touching the **English** softkey will change the display to English.

3.1.3   RUN/PROG (Run/Program) Switch

This is a keyed selector switch read directly by the operator terminal. The **PROG** (program) position causes the press to perform a Top Stop, and prevents stroke initiation until the switch is returned to the **RUN** position. There are several user access modes that will require the operator to turn the keyed selector to **PROG** position in order to modify parameters. This switch must be in the **PROG** position for control configuration, as described in Section 3.3 on page 30.

3.1.4   Automatic LCD Turn Off

To increase the life of the display backlight, the backlight will automatically dim ten minutes after the press main motor is turned off AND the operator terminal detects no user activity. User activity for this purpose is defined as pressing the touch screen or operating the **RUN/PROG** switch. The backlight is turned back on and the ten minute timer is reset any time the touch screen is pressed on the operator terminal or the **RUN/PROG** key is operated.

3.2 Parameter Entry

Throughout the operator terminal, a standard form of data entry is employed. Parameters that can be changed are indicated by a blue border surrounding the parameter. Touch inside the blue border to edit the parameter.

3.2.1 Numeric Entries

A numeric parameter to be changed is selected by pressing the area on the screen that displays the parameter (surrounded by a blue border). This will bring up an editing screen similar to Figure 4.

If the parameter contains a decimal point, it will be positioned automatically by the operator terminal. The new number is entered with the numeric keypad.

The **Clear** key will clear the present number being entered, and the **Back** key will go back one number. The up and down arrow keys at the bottom right and bottom left of the numeric keypad will increment and decrement the number, respectively.
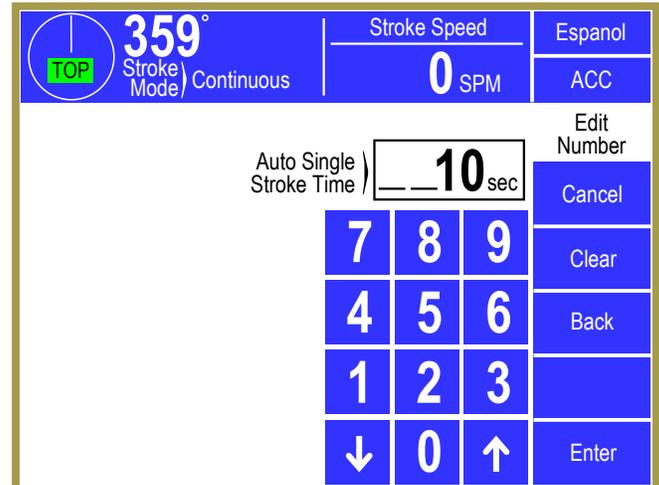
Figure 4: Example Numeric Entry Screen

Press the **Enter** key to accept the new number or abort the change by pressing the **Cancel** softkey. The number will not change from the previous value if the entry process is canceled.

3.2.2 Text Entry

A text parameter to be changed is selected by pressing the area on the screen that displays the parameter (surrounded by a hollow blue box). This will bring up an editing screen similar to Figure 5. The editing cursor position is shown by a black background on the character the cursor is sitting on. Characters typed on the virtual keyboard will appear at the editing cursor, and the cursor will automatically advance to the next position as characters are "typed". The cursor can also be moved by pressing the **Cursor Left** and **Cursor Right** softkeys.

Figure 5: Example Text Entry

To erase characters, position the editing cursor at the start of the characters to erase and hit the **Space** softkey. Likewise, to change a character, position that editing cursor on that character and select the new character. The **Clear** softkey will cause all characters to be erased.

Press the **Lower Case** softkey to display a virtual keyboard with lower case letters. The **Lower Case** softkey will then change to **Numbers & Misc**. Pressing that key will change the virtual keyboard to one

that has numbers and other characters on it. The **Numbers & Misc** softkey will then change to **Upper Case**. Pressing **Upper Case** brings the virtual keyboard back to its original configuration with upper case letters.

Once the text is correct, press the **Enter** softkey to keep the changes or press the **Cancel** softkey to abort the changes.

3.2.3   Selection from a List

Some parameters are not numeric or text, but instead are selected from a list of options. As usual, these parameters are displayed inside a hollow blue box. To change the parameter, press inside the blue box to bring up a selection screen that will be similar to that shown in Figure 6.

Note that the listed selection may all fit on one page or may take several pages to display. If more than one page is necessary to display the list, **Next Page** and **Previous Page** softkeys will be displayed as appropriate.

To choose a new selection for the parameters, press inside the blue box of the new selection. This will cause the new parameter to take effect. Press the **Cancel** softkey to exit the selection screen with no change to the parameter.
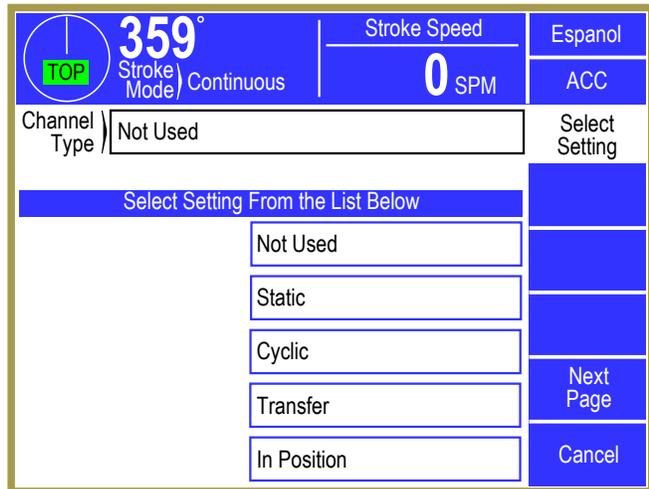
Figure 6: Example List Selection

3.3   Access Control

The System 5100 control has several layers of security relative to configuration of its logical operation of hardware and software and ability to program parameters. The highest level of security is applied to the Factory Configuration items that are used to configure the control before it leaves the factory for the specific press production system requirements and options specified by the purchaser.

In addition, the System 5100 control provides a second level of security - User (Employer) Configuration items that give the user the ability to configure certain aspects of the system to meet his security, information, safety, and production requirements. One of the areas of User Configuration relates to Access Control – a third level of security that allows the person(s) the user designates to make certain parameter settings and reset faults. See Section 4.3.4 for the configuration of the Access Control methods discussed in this section.

The System 5100 control has several parameters or operations that have, or can be configured to have, limited user access, i.e., by employees specified by the user (employer). The ability to perform actions such as job recall, job storage, or changing a tonnage monitor channel limit can be limited to certain personnel. The control provides several means to limit access to these parameters or operations. A complete list of the parameters and operations that can be, or are, limited as to access is listed in the Restricted Items table in Section 3.3.5. The control has the capability to make some of these limited access items available to any operator. Access to these items can be globally un-restricted. The items

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which can be un-restricted to all users are also listed in the Restricted Items Table shown in Section 3.3.5.

In addition to the restricted items listed in the Restricted Items Table shown in Section 3.3.5 there are other parameters that have limited access. These parameters, such as top stop angles and brake monitor settings that are critical to the correct or safe operation of the press, are not listed in the table of user limited access items. These other second level security items are in other User Configuration screens discussed in Section 4. Access to the User Configuration screens and their parameters is protected by the RUN/PROG key and the User Configuration code. Access control will grant access only to the third level security items listed in the Restricted Items Table.

The System 5100 control employs combinations of two different means to limit access to restricted items. These means are the RUN/PROG key switch and a user password system. The user password system assigns names and passwords to up to sixteen users. These two means can be used alone or in combination with each other. When a user employs the proper means to gain access control, he will have the ability to perform the actions and change the parameters which have been designated to his access.

There are four possible modes of operation for the access system. They are the "Key Only" mode, the "Key or Password" mode, the "Password Only" mode, and the "Key and Password" mode. The control can be configured to operate in any one of these four modes.

3.3.1   Key Only Mode

The "Key Only" mode is the least complex of the four modes. This mode employs the RUN/PROG key as the one means of access. Access to restricted items is granted when the RUN/PROG key is in the PROG position.

Although the "Key Only" mode has the advantage of being easy to use, it does have a disadvantage. This mode cannot give a particular user access to only some of the restricted items. When operating in this mode, any user with the RUN/PROG key will have access to all of the restricted items.

3.3.2   Key or Password Mode

The key or password mode allows for either of two means to gain access to the restricted items. Access to restricted items is granted when the RUN/PROG key is in the PROG position. In addition, a user without the RUN/PROG key but with the correct password can access the restricted items that have been designated for the particular user's access only. The system allows for passwords to be assigned to sixteen users. Each user can be assigned access to any or all of the restricted items.

The following is an example of a "Key or Password" mode operation. The RUN/PROG key is given to the die set-up personnel. A press operator is assigned a user name and password.   With the password the operator is assigned permission to reset tonnage monitor faults, reset die protection faults, and reset counters. These are the only three items to which the operator has access. In order to load a die, the set-up personnel must use the RUN/PROG key to recall a job from job storage. The set-up personnel will also be able to make changes to programmable limit switch settings, tonnage monitor settings, and die protection settings. Once the set-up personnel sets the die and verifies its correct operation, the operator is left to run the die. If a tonnage monitor fault occurs, the operator can enter the correct password and then reset the fault. However, the operator cannot change a tonnage monitor limit. This will allow the

operator to keep running the job and reset faults that occur. However, if consistent stops occur because a tonnage monitor high setpoint is being exceeded, the set-up personnel must be called to change the tonnage monitor limit, if it has been determined that the limit should be increased.

The example above can be taken one additional step, if two press operators are given different user names and different passwords. One operator can be assigned the ability to change tonnage monitor limits in addition to the ability to reset the tonnage monitor, while the other operator is not assigned the ability to change the tonnage monitor limits. The control will allow for sixteen users each with a user name, password, and access to selected or all restricted items.

3.3.3   Password Only Mode

The "Password Only" mode allows for sixteen users. Each user can be assigned access to some or all of the restricted items. This mode does not use the RUN/PROG key.

The example listed above indicated that setup personnel required access to all restricted parameters. In the "Key or Password" mode, the setup personnel used the RUN/PROG key to gain access to all of the restricted parameters. In the "Password Only" mode, the setup personnel can still have access to all of the restricted parameters, but the system must be configured as such. The setup personnel must be assigned a user name and password. In addition, all restricted items would be assigned access to the setup personnel.

Since there is no access to all restricted items with the RUN/PROG key, every restricted item must be assigned to at least one user. If any restricted item is not assigned to at least one of the users, it cannot be accessed. For example, if Erase Jobs is not assigned to at least one user, it will be impossible to perform the erase job function. Access to the Erase Jobs must be assigned to at least one user, before the erase job function can be performed.

3.3.4   Key and Password Mode

The "Key and Password" mode requires the user to have the RUN/PROG key, a user name, and a user password. Operation is basically the same as the Password only mode, except that in addition to entering the password the user must switch the RUN/PROG key to the PROG position.

Since there is no access to all restricted items with the RUN/PROG key only, every restricted item must be assigned at least one user. If any restricted item is not assigned to at least one of the users, it can never be accessed.

3.3.5   Restricted Items

The following table lists the restricted items name and function. Some items can be unrestricted. When an item is unrestricted, it is available to any user. Unrestricted items do not require a key or password.

RESTRICTED ITEMS		
NAME	**FUNCTION**	**CAN BE UNRESTICTED**
Reset Brake Monitor	Reset Brake Monitor faults	Yes
Auto SS / COD Time	Change the "Automatic Single Stroke Time", and the "Continuous on Demand Time" in the Press Control screen.	
Critical Angle Setting	Change the "Critical Angle" in the Press Control screen.	
Drive Speed Adjust	Adjust drive speed	Yes
Store Jobs	Store jobs in memory	
Recall Jobs	Recall jobs from memory	
Erase Jobs	Erase jobs in memory	
Counter Settings	Change counter limits and turn counters off and on	Yes
Counter Change	Change counter values	Yes
Counter Reset	Reset counters that have reached their limit	Yes
Counter Config.	Configure counters	Yes
PLS Settings / Names	Change Programmable Limit Switch set points and names	
PLS Reset	Reset PLS Faults	Yes
DP Settings	Change the Die Protection settings	
DP Reset	Reset the Die Protection	Yes
DP Bypass Setup	Bypass the Die Protection	Yes
DP System Bypass	Bypass the Die Protection	
DP Limited Bypass	Bypass the Die Protection	
TM Peak High Limits	Change the Tonnage Monitor high limits	
TM Peak Low Limits	Change the Tonnage Monitor low limits	
TM Reverse Limits	Change the Tonnage Monitor reverse limits	
TM Auto Setup	Perform a Tonnage Monitor automatic limit setup	
TM Reset	Reset the Tonnage Monitor	Yes
TM Bypass	Bypass the Tonnage Monitor	
Feed Settings	Change feed settings	

3.3.6 Password System Operation

Figure 7 displays a typical password entry sequence. This example shows the steps necessary to change the Auto Single Stroke time. This is typical for password entry for all restricted items.
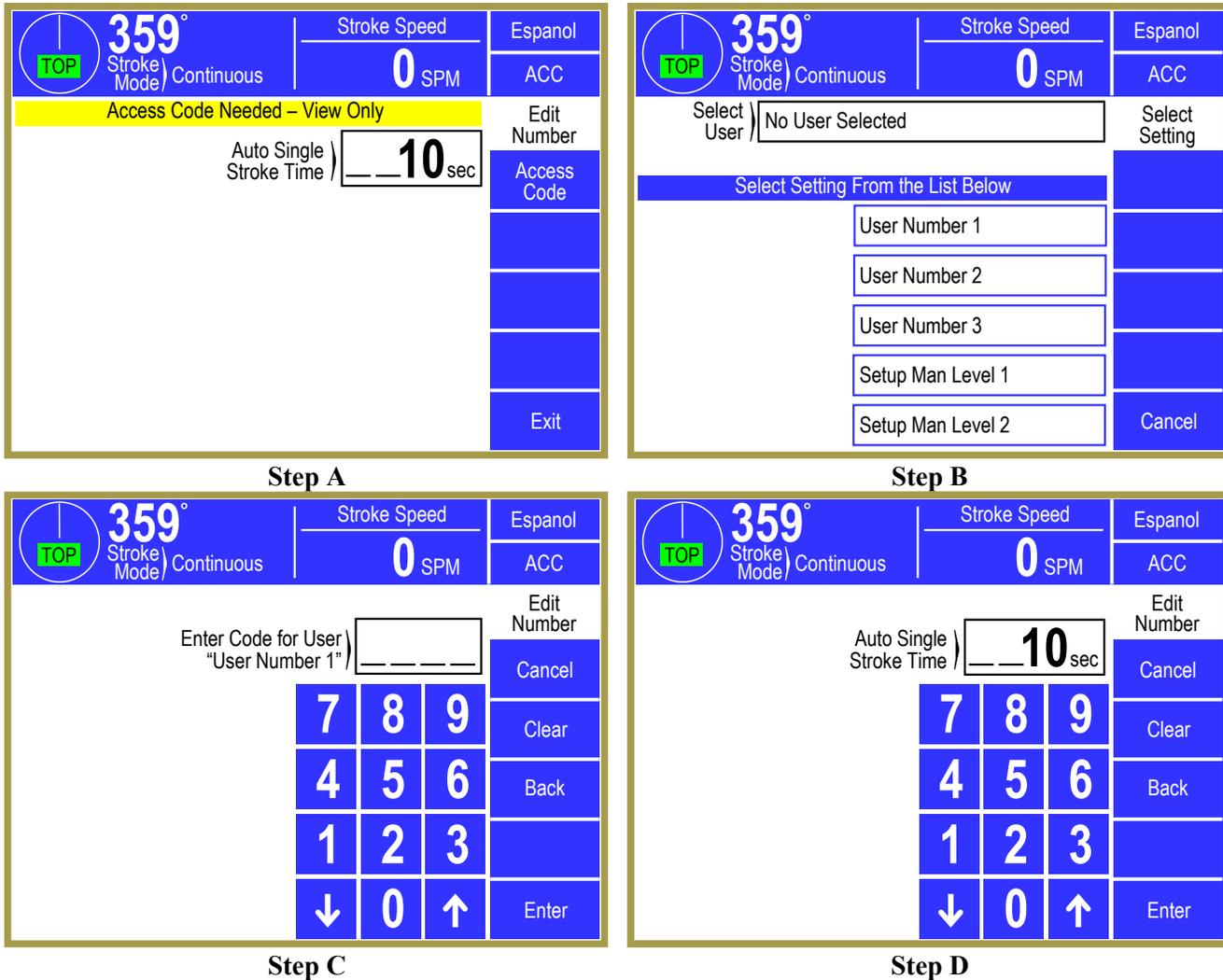
Figure 7: Example Password Entry Sequence

Step A: Select the restricted item. In the example shown in "Step A" of Figure 7 the restricted item is the Auto Single Stroke Time. Once the parameter is selected, if restricted the display will prompt that an access code is required. The user should press the **Access Code** key.

Step B: A list of users that have access to this restricted item will appear. In "Step B" of Figure 7, 5 of the 16 possible users have access to this restricted parameter. The system may have several more users, but the 5 users listed on the screen are the only users that have access to Auto Single Stroke time. The user must select his user name (even if there is only one user name displayed).

Step C: The display will show the selected user name and request the user password as shown in "Step C" of Figure 7. The user must enter the correct password and then press the **Enter** key.

Step D: Upon entry of the correct password, the user will be allowed access to the restricted item. In this example, the user will be allowed to change the Auto Single Stroke Time parameter from the 10 sec setting that was previously programmed.

After performing the steps listed above, the user will be logged in to the password system. The user will have access to all restricted items that have been designated for his access. This access will remain until the user performs a log out or until the user is automatically logged out.

The user can log out by using the **ACC** key. This key will directly switch the display to the Quick Access screen. The **Logout** softkey legend will appear along the bottom of the screen. If the operator presses this key, he will log out. He will no longer have access to the restricted items, unless he repeats steps A through D.

In addition to the manual log out, the system contains an automatic logout. The intent of automatic log out is to reduce the possibility of users other than the intended user from having access to restricted items. If there were no provisions for automatic log out and a user forgot to manually log out, all restricted items to which the user had been designated for access would be available from the log in time until power was removed from the System 5100 control. This presents the possibility of users other than the intended user having access to restricted items. Automatic log out is based upon both time and press strokes. During system configuration automatic Access Timeout parameters are entered. An automatic access timeout time and automatic access timeout strokes are entered. The time entered is the amount of time after the last keystroke that will be allowed before the system will automatically log out the user. For example, if the automatic access timeout is set to 60 seconds, the user will be logged out 60 seconds after the last keystroke. If the user depresses a key before the 60 seconds have elapsed, a new 60 second cycle will be started. The number of strokes that are entered is the number of press strokes after the last keystroke that will be allowed before the system automatically logs out the user. For example, if the automatic timeout is set to 10 strokes, the user will be logged out when the press completes ten strokes after the last keystroke. If the user depresses a key before 10 strokes have been completed, a new 10 stroke cycle will be started (See Section 4.3.4.2)

3.4   Main Screen

Figure 8 shows the Main Operating Screen. This is the screen displayed when the unit first powers up and provides an overall view of the functions available along with general diagnostic information. From this screen the operator may select the Press Control, Die Protection, Programmable Limit Switch, Tonnage Monitor, Job Setups (see "a" in Figure 8), Counters (see "b" in Figure 8), or Motor Control (see "c" in Figure 8). Note that some of these features are optional and may not be available on some controls. Touch inside the blue bordered area of an option to go to that screen.
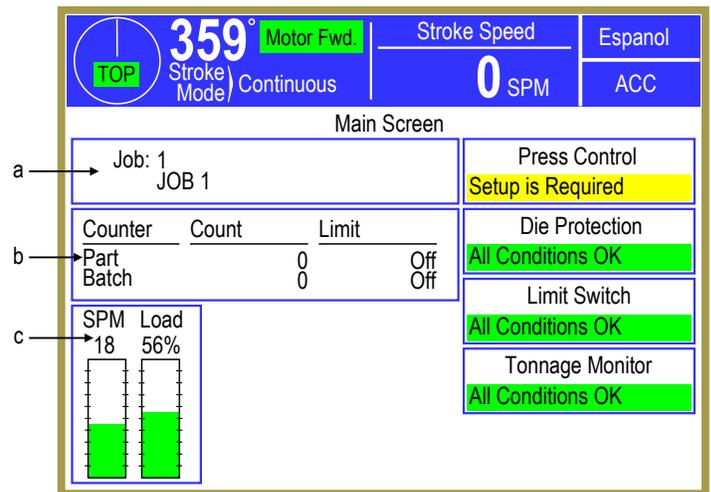
Figure 8: Main Screen

3.5 Press Control

3.5.1 Press Control Main Screen

Pressing inside the blue bordered "Press Control" area on the Main Screen in Figure 8 will cause the Press Control screen shown in Figure 9 to be displayed.

This screen provides the following information:

- A brake monitor used when the press stops at the top of the stroke (Top Stop Time).

- A brake monitor used when the press stops at any position other than top (Mid Stop Time).

- The actual stopping time of the press, measured by the brake monitor.

- Engagement time.

- Auto Single Stroke Time.

- Continuous on Demand Time.

- Critical Angle.

- The event that caused the press to stop (Reason for the Last Stop).

- The event that is keeping the press from stroking, if any exists (Running Status).
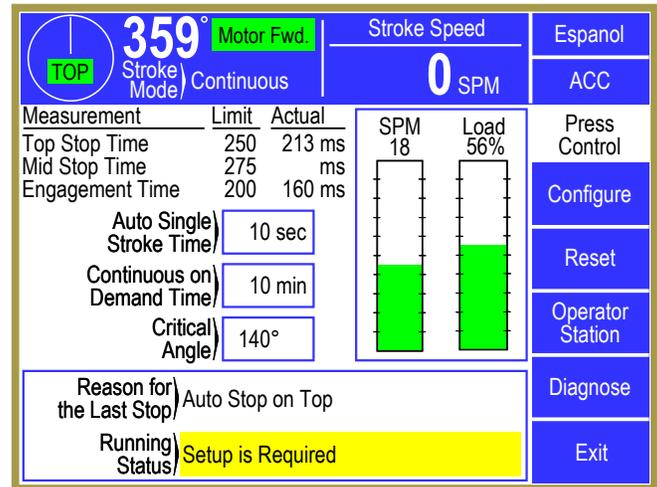
Figure 9: Press Control Screen

If configured, the Motor Speed Adjust screen can be accessed from this screen in order to change the stroking speed of the press by pressing on the blue bordered area with bar graphs and numbers for speed and load. See Section 3.6.

3.5.1.1 Resetting Press Control Errors

The press control screen of Figure 9 alerts the operator of an error condition by displaying a **Reset** softkey. The reason for the error is shown by the "Running Status". The press cannot be operated until the problem is corrected and an operator acknowledges the error by pressing the **Reset** softkey. See Section 7 for conditions that require an operator's response.

3.5.1.2 Brake (Stopping Time Performance) Monitor and Motion Detection

Each time the press stops a time based brake monitor (2 millisecond resolution) measures the time from deactivation of the clutch/brake valve until crankshaft rotation is less than 1.8 RPM. An additional 8 milliseconds is added to this measured value to compensate for the maximum reaction time of the control. If the actual time exceeds the applicable brake monitor limit it will be displayed in red, the present running status will display *Brake Monitor Alarm*, and the operator is required to press the **Reset** softkey that appears on the right side of the touch screen before any further strokes can be initiated.

The reset of the brake monitor can be restricted by access control configuration if desired. The last measured stopping time is displayed beside the limit (Top Stop or Mid Stop) that applied to the position in the stroke where stop occurred. Separate limits are provided for monitoring the stopping time at the top of the stroke ("Brake Monitor Top Stop Limit") or at any position other than top ("Brake Monitor Mid Stroke Stop Limit"). These limits can only be changed in the Brake Monitor configuration screen (see Section 4.2.3 for details).

3.5.1.3   Engagement Time

The actual clutch engagement time is measured (4 millisecond resolution) each time the clutch/brake valve(s) solenoids are energized to initiate a stroke. This time is measured from valve activation until crankshaft rotation exceeds the "Motion Threshold". If the measured time exceeds the "Engagement Time Limit", the stroke is aborted and the reason for the last stop will display *Motion Did Not Start*. Both the "Motion Threshold" and the "Engagement Time Limit" are set in the Clutch Configuration screen (see Section 4.2.1).   Monitoring of the engagement time can provide useful diagnostic and preventative maintenance information about clutch wear. Increasing engagement time indicates that clutch wear is causing the air operator that operates the clutch plates to travel further to engage, requiring more (and longer) air flow through the clutch air valve to force the plates together.

3.5.1.4   Automatic Single Stroke Time

This parameter is the length of time that the press control will wait for the feed (or other automation such as a robot) to initiate a stroke, after the automatic single stroke mode (see Section 2.5.6 on page 21 for details on this mode) has been selected and the first stroke manually initiated or enabled. The press control begins timing at the bottom of the stroke, and requires that Input 28 [Auto Single Stroke Run] go Low (0 volt) for at least 50 milliseconds and back High (24 volt) during the upstroke or while the press control pauses at the top. The next stroke is automatically initiated if the signal from the automation occurs before the time limit is reached. The maximum time allowed for successive automatic strokes initiated by the feed is configured by the factory, and is set for 10 seconds unless a specific application requires otherwise. Any stop input that causes a stroke to not be initiated within this time limit will require clearing the fault and manually re-initiating the stroke. This parameter is stored and recalled with each job setup. If an access control mode (see Section 3.3 on page 30) is being used that requires a password, a user must be configured to have the "Auto SS / COD Time" permission to change this parameter.

3.5.1.5   Continuous on Demand Time

This parameter sets the length of time that the press control will wait for Input 50 [Cont. on Demand Run/Permissive] to go high to initiate continuous stroking after the Continuous on Demand stroke mode (see Section 2.5.7 on page 22 for information about this mode) is activated by manually depressing the set-up button and then the operator control buttons within 5 seconds. When the auxiliary equipment removes the run input (Input 50 goes low) the press control will stop at the top of the stroke, remain enabled, and wait for re-initiation. If continuous stroking is not initiated within this time limit the press control will disable the automatic cycle, display the fault, and will require that the stroke be re-initiated by manual means. The maximum time setting allowed for this parameter is configured by the factory. This parameter is always shown, but is used only if Continuous on Demand mode is selected. This parameter can be stored and recalled with each job setup. If an access control mode (see Section 3.3 on page 30) is being used that requires a password, a user must be configured to have the "Auto SS / COD Time" permission to change this parameter.

3.5.1.6 Critical Angle

This parameter applies to stop signals from automation modules (for instance, die protection performed by the operator terminal) that are programmed to generate an "Intelli-Stop" (see Section 2.1.5 on page 16 for information about this stop type). When an "Intelli-Stop" is generated, the press control will calculate whether or not it thinks it can stop before this angle. If so, it will generate an "Immediate Stop". If not, it will "Top Stop" in order to avoid the likelihood of sticking the slide on bottom. This parameter is stored and recalled with each job setup. If an access control mode (see Section 3.3 on page 30) is being used that requires a password, a user must be configured to have the "Critical Angle" permission to change this parameter.

3.5.1.7 Reason for the Last Stop

Diagnostic information is provided to show the reason the press stops. Once stroking is initiated, the first stopping action is latched and displayed. This is done to capture transient conditions that may return to their proper state after the press stops. This information remains latched until the press stops again. Additional information concerning press stops is stored in the Event Log (see Section 3.5.5.4 on page 43).

3.5.1.8 Present Running Status

Diagnostic information is provided to show any reason why stroking may not be initiated. This information follows the present conditions of the inputs. Any input that prevents stroke initiation is displayed as long as it exists. If multiple stop conditions exist, the clearing of a displayed stop condition will result in the display of another stop condition until no more stop conditions exist. If no stop condition exists, a *Ready To Stroke* message indicates that only the correct run buttons are required to initiate the stroke.

3.5.2 Dual Channel Status Screen

The press control contains two microprocessors that make independent decisions about stop conditions. If both channels report the same event, the message is displayed on one line with no channel designation. If different stop conditions are reported, the message is prefixed with an asterisk (*). The messages and their associated code numbers from both channels can be viewed as shown in Figure 10 by pressing the present running status diagnostic area in the Press Control main screen. The code numbers should be used to locate more detailed explanations of the fault condition (see Section 7.5). If the message indicates a specific input, the input number is displayed prior to the description (e.g. I11 indicates Input 11).
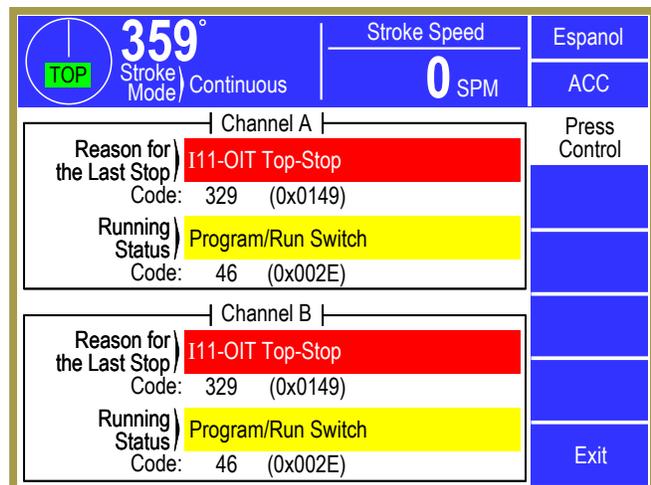
Figure 10: Dual Channel Status Screen

3.5.3 Press Operator Station Screen

If an operator station is turned "Off" (select input goes High), any stroke in progress is aborted and further stroking is prevented until acknowledged at the Operator Terminal by an operator. The Running Status on the Press Control Screen of Figure 9 will indicate *Verify Operator Stations* and the **Operator Station** softkey must be pressed. The screen shown in Figure 11 will be shown to indicate which station has been turned off. If this station has been intentionally turned off, the **Verify** softkey should be pressed to save this as the present combination of active operator stations. No verification is required if a station is turned "On" (input goes Low), the additional station is added to the present combination of active operator stations.

Figure 11: Press Operator Station Screen

The **Operator Station** softkey can also be used to view the present station select status. Verification is required only when one or more stations are turned off and is intended to reduce the possibility that an operator will not realize that his station controls are inactive and that the press can stroke without the use of his controls.

3.5.4 Press Stroking Mode Selection

The present stroking mode of the press control is displayed at the top of the operator terminal. The mode is changed by placing the stroke mode selector switch in the MODE SELECT position. The display automatically displays the screen shown in Figure 12 and allows the operator to choose from the stroking modes shown by touching the desired mode softkey on the display. The "Stroke Mode" area at the top of the operator terminal will change to indicate the new mode. The display will remain in the Mode Select screen until the mode selector is returned to the RUN or OFF position. The modes provided for a particular control are selected by Factory Configuration settings, and stroking modes that have been turned

Figure 12: Mode Select Screen

off by the factory do not appear on the display and are not available to the operator. See Section 2.5 on page 17 for information on stroking modes and how they work.

3.5.5 Press Control Diagnostics

Intelligent diagnostics give operators the reason for the last stop, and any condition that is keeping the press from stroking, on the Press control screen of Figure 9. They also give the individual reason that each microprocessor channel saw for these items as shown in Figure 10. System 5100 controls also have the most extensive specific press control diagnostics available, enabling one to "drill down" into the basic press control input/output and memory functions. Pressing the **Diagnose** softkey shown on the Press Control screen in Figure 9 causes the main diagnostic screen in Figure 13 to be displayed.

This main diagnostic screen will display the following in the white area of the screen:

- The Brake Monitor alarm counter.
- The number of degrees that the press took to stop.
- The angle that the last stop was initiated.
- The speed that the press was stroking when the stop occurred.

There are also several items displayed below "Speed at Stop Initiation" in Figure 13 that give "Raw" diagnostic data for use by Link engineers in order to aid in telephone troubleshooting.

Blue softkeys arranged along the bottom and right side of the screen allow access to diagnostics for Inputs, Outputs, Memory, OIT (operator Interface Terminal), Lube, and an Event Log which records the reason for the last 256 stops to aid in detecting repetitive conditions or production process faults that are causing the press to stop stroking. A **Version Info** softkey is also available on the Diagnose screen so that the firmware versions of the press control and other optional devices can be viewed.

Figure 13: The Diagnose (Main Diagnostic) Screen

3.5.5.1 Input Diagnostics

Pressing the **Input Diagnostics** softkey on the screen in Figure 13 selects the first of several pages of Input Diagnostics screens that show all inputs by using the **Next Page** and **Previous Page** Softkeys.

Figure 14 shows an example page of the Input Diagnostics screen. Each input is displayed with a number, description, and state. The state indicates the voltage level ("Hi" = +24 volts, "Lo" = 0 volts), and is shown for both channel A and channel B separately. The total number of inputs displayed is 56 for a standard control or 112 if configured for the second input card.
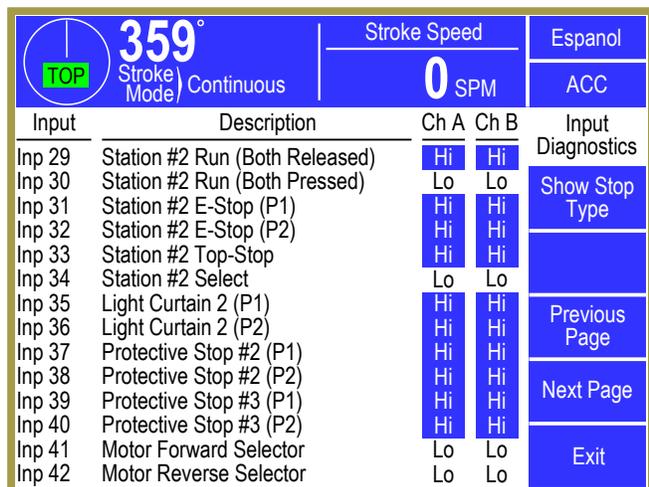
Figure 14: Input Diagnostics Description Screen

The System 5100 press control provides separately isolated input signals to both microprocessor control channels for every input wired to one of its Input Module terminals. This is extremely useful in diagnosing input problems, because if channel A and channel B both display the same input state (Hi or Lo), any problem with an input is the external device wired to the input terminal. If this screen indicates Hi for one channel and Lo for the other, then there is a failure within the input module that feeds the same input to the two different microprocessor logic systems.

The System 5100 input diagnostics are particularly effective because the control is designed to provide enough inputs so that each input device can have its own separate input rather than series multiple devices into one input. For example, each emergency stop button has its own set of inputs so that a failure related to the specific button or its wiring can be diagnosed. This would not be possible if multiple emergency stop buttons were wired in series into the same inputs.

The Show Stop Type screen shown in Figure 15 is displayed when the **Show Stop Type** softkey of Figure 14 is pressed. This screen displays the type of stop that is generated by each input as Top Stop, Immediate Stop, or Master Stop. Protective Immediate Stops and Protective Master Stops all use dual tracking inputs and require two inputs each (see Section 2.1.6 on page 16). Configurable inputs will display the type of stop that each input is programmed for (see Section 4.2.14 on page 128). Inputs that are used for functions other than stop, such as run buttons, station selects, mode selects, etc. will show as blank types. Stop inputs that are unused will display "Input Not Used". To return to the Input Diagnostics screen of Figure 14, press the **Show Description** softkey.
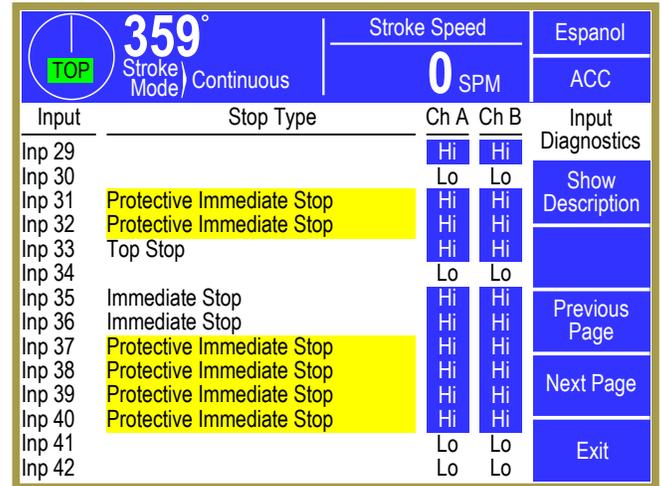
Figure 15: Input Diagnostics Stop Type Screen

3.5.5.2   Output Diagnostics

The screen shown in Figure 16 shows the status of each LMC Relay, Clutch/Brake Valve 1, and Clutch/Brake Valve 2 outputs for both control channels. The Output State indicates the On/Off drive signal for each channel of the press control, and the Feedbacks indicate the state of the relay contacts, which are checked by the system for Control Reliability. Normally open contacts will show as "On" when the relay is energized and normally closed contacts will show as "On" when the relay is turned off (de-energized). The output state and the feedback path will be displayed for each of the four optional safety relays if provided with the control.
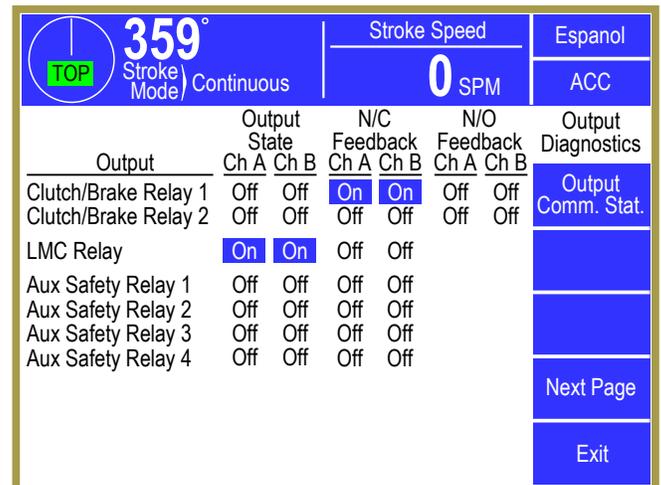
Figure 16: Output Diagnostic Screen

Any installed optional OR relays (OR1 to OR32) and any installed PLS modules can be viewed, along with the programmed function, the intended output state, and the feedback by using the **Next Page** and **Previous Page** softkeys, as shown in Figure 17.   If the "State" and "Feedback" of a particular output channel do not agree, then there is a problem with that output.

Num	Function	State	Feedback
OR1	1: ON in Inch Mode	Off	Off
OR2	3: ON in Continuous Mode	On	On
OR3	4: ON in Auto Single Stroke Mode	Off	Off
OR4	17: ON if Crank in Motion	Off	Off

Figure 17: Output Relays (PLS/OR) Diagnostic Screen

The system 5100 provides up to nine optional output modules. If any of these modules are installed, pressing the **Output Comm. Stat** softkey on the screen shown in Figure 16 will cause the display of the screen shown in Figure 18. The first output relay module is dedicated to PLS 1-4. The next seven modules include configurable outputs OR1 through OR28. The ninth module can be configured as either OR29-32 or PLS 5-8. The Logic Module uses serial communications to write to these output modules to turn the relays on each installed module on and off. It also monitors (reads) the modules that are installed to verify that they remain connected to the communication bus and to verify the commanded on/off state by

Output Boards Communication Status

Output	Installed	Status
PLS 1-4	Yes	OK
PLS 5-8	No	
OR 1-4	Yes	OK
OR 5-8	No	
OR 9-12	No	
OR 13-16	No	
OR 17-20	No	
OR 21-24	No	
OR 25-28	No	
OR 29-32	No	

Figure 18: Output Communication Status Screen

reading feedback of each output relay's state. The diagnostic screen shown in Figure 18 is provided to indicate which of the output modules are installed and the communication status of each module. If any of these modules fail to reply to the Logic Module in a continual manner, a stop condition will be generated and an error message will appear in the Press Control screen Running Status area (e.g. *No Output Board Reply*).   The fault must be corrected and the **Reset** softkey on the Press Control screen pressed in order to allow further stroking. This diagnostic screen can be used to determine which module is not communicating as required.

3.5.5.3   Press Control Memory Compare

Pressing the **Memory Compare** softkey on the Diagnose screen of Figure 13 selects the screen shown in Figure 19. This screen is used to compare the internal memory of both channels of the press control and display any locations that do not agree. If any parameter of either channel becomes corrupt, a *Memory Compare Fault* is displayed in the Press Control Running Status area and further stroking is prevented. This diagnostic screen should be used to determine which parameter is bad (the numbers will be different and appear in Red). All locations indicated as bad must be reprogrammed before the fault condition can be cleared. The memory comparison is done in groups (a heading indicates which screen applies to the group), and additional memory items are accessed with the **Next Page** softkey.

Figure 19: Memory Compare Screen

3.5.5.4   Event Log

The control retains an event log. This log records the reason for the last 256 stops. All reasons for last stop are recorded, except automatic stop on top (such as when the press automatically stops at the top after making a stroke in Single Stroke mode. Each entry in the event log contains the time, date, and the type of stop. The event log is illustrated in Figure 20. Stops are displayed in chronological order with the most recent stop displayed first. The **Next Page** and **Previous Page** softkeys can be used to scroll through the event log.

Figure 20: Event Log Screen

Figure 21: Event Log Detail Information Screen

Pressing a specific stop message will display more detailed information about the conditions that existed when the stop occurred as shown in Figure 21.

3.5.5.5 Version Information

The version information shown in Figure 22 for the control hardware and software can be viewed by depressing the **Version Info** softkey. The three version numbers shown for each installed option are:

Prog. Ver. The software version of the program running on the equipment. This version will change when software updates are installed.

Boot Ver. The version of a special loader program that is put in at the factory. This does NOT change with normal software updates.

Hard. Rev. The hardware revision of the physical electronics.

Figure 22: Version Information Screen

In addition, the **Device Info** softkey will display a screen with more detailed info on it about the currently highlighted device (such as device serial number, manufacturing date, etc). The arrow softkeys move the highlight cursor up and down.

3.5.5.6 Lube Diagnostics

If configured for a main lube system, a Lube Diagnostics screen will be displayed, such as the ones shown in Figure 23 and Figure 24 (the screen shown depends on the type of lube system configured).

Figure 23: Recirculating Lube Diagnostics Screen   **Figure 24: Grease Lube Diagnostics Screen**

Recirculating lubes with pulsing flow sensors (Figure 23) display the actual number of cycles measured during the flow time. Grease lube systems (Figure 24) display the time remaining until the next lube pulse cycle. The **Pulse Lube** softkey provides a manual lube cycle. See Section 0 for more information on the specific type of lube system.

Any pulsed grease auxiliary lube systems configured can be viewed by pressing the **Auxiliary Lube** softkey. The screen shown in Figure 25 provides additional diagnostics such as the number of strokes remaining until the next lube cycle. The **Pulse Aux Lube 1** softkey provides a manual lube cycle. See Section 4.2.21 for more information.
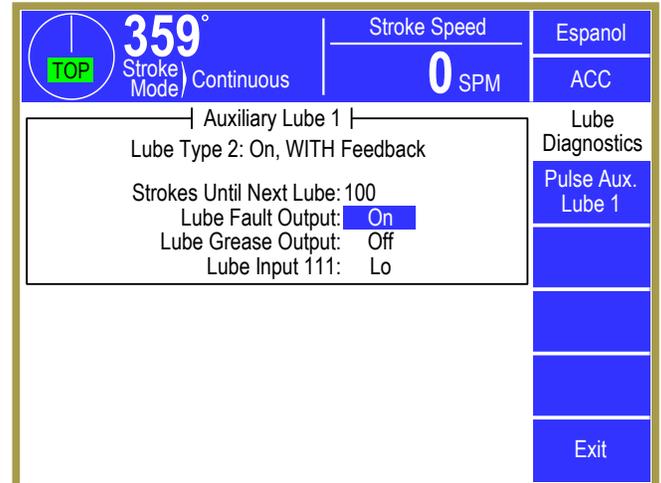
Figure 25: Auxiliary Lube Diagnostics Screen

3.5.5.7 OIT Diagnostics

The screen shown in Figure 26 displays information from the operator terminal rather than from the press control card rack. Most of this information is used by Link personnel for telephone troubleshooting.
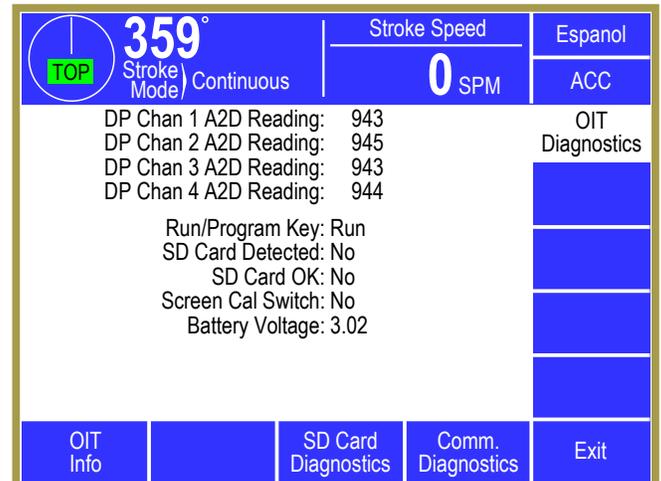
Figure 26: OIT Diagnostics Screen

3.6 Motor Control / Drive Speed Adjustment (When Provided)

If the optional 5100-3B Analog I/O board is installed, it allows the drive speed (speed at which the press will stroke when the clutch is engaged) to be displayed when the press is not stroking. It also allows the operator to enter stroking speed from the Motor Control screen.

Another optional capability that may be provided with the control is the ability to start the lube and/or main motor through the screen.

To get to the Motor Control screen, touch the SPM and Load bar graph area on the Main Screen (see "c" in Figure 8 on page 35) or the similar area in the Press Control screen. Note that if the 5100-3B Analog I/O board is not used but the optional capability to start motors through the screen is used, the SPM and Load bar graphs are replaced with a **Motor Control** softkey at the same location.
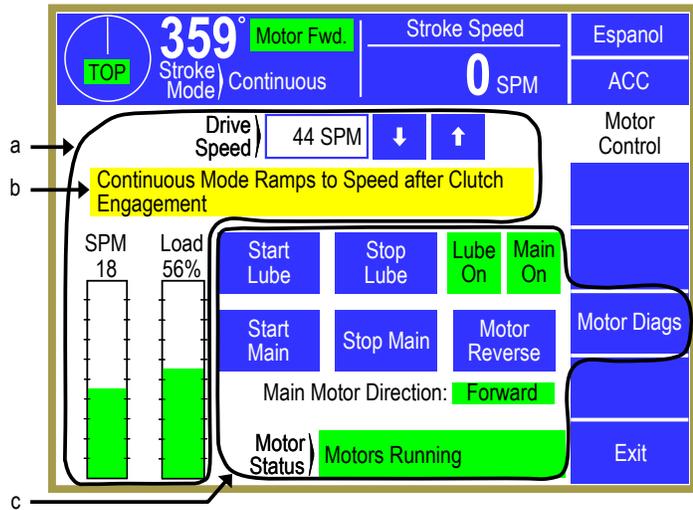
Figure 27: Motor Control Screen

> **NOTE:** Not all the information shown in Figure 27 will appear on all controls. The area indicated by "a" in Figure 27 will only appear if the optional 5100-3B Analog I/O board in installed. Likewise, the area indicated by "c" will only appear if the control is set up to start the lube and/or main motor through the screen.

3.6.1 Drive Speed Adjustment

To change the drive speed, touch the blue bordered Drive Speed parameter as shown in Figure 27 or use the up and down arrow softkeys to increment and decrement the value. When using the arrow keys, the value will continue to increment or decrement the value for as long as they are held, or until a speed limit has been reached. The new speed value will be sent (as an analog signal) to the motor drive.

The stroking speed can be set over the entire speed range of the press (determined by the configuration), but the press control can automatically limit the output in certain modes. For example, a press that has a maximum stroking speed of 400 SPM may be configured to limit single stroke mode to less than 250 SPM. In this situation, the operator can enter a speed setting up to 400 SPM in any mode, but the command signal to the drive will go no higher than 250 SPM when Single Stroke mode is selected (i.e. it will clamp at the configured limit). In addition, the press control can be configured to command a fixed speed in Inch and Timed Inch modes. The operator should be aware of how the press is intended (or has been configured) to function in all stroking modes. When needed, messages are displayed on the screen (see "b" in Figure 27) to indicate if the press control is configured for fixed inching speed, a limit has been placed on single stroke modes, or to indicate some other special mode of operation of which the operator may need to be aware.

As shown in Figure 27, both drive speed (SPM) and motor current (% Load) are displayed in numeric and bar graph formats. The SPM bar graph ranges from 0 SPM to the maximum strokes/minute of the press. The % Load bar graph ranges from 0 to 200%.

If unrestricted by access control configuration, the user can change speed directly on the Speed screen. Otherwise, the user must obtain access by the selected access control means to change the press speed value. If an access control mode (see Section 3.3 on page 30) is being used that requires a password, a user must be configured to have the "Drive Speed Adjust" permission to change this parameter.

3.6.2   Motor Control Operation

The screen of Figure 27 (see the area indicated by "c") shows an example setup of a reversing main motor and a continuous running lube pump motor. The display provides keys to start and stop the main motor, reverse the main motor, and start and stop the lube motor. Indicators are provided to show the on/off status of each motor.

The "Main Motor Direction" indicates the next intended direction of the main motor is shown as forward or reverse. A "Motor Status" message at the bottom of the screen is provided to describe the current state of the motor control interface. Master stop inputs that cause the LMC to turn "Off" will appear in the status message to indicate that the motor cannot be started.

In order to start a motor the "Motors Start Enable" button (a physical button on the control – not a softkey on the screen) must be pressed and held while the **Start Lube**, **Start Main**, or **Start All** softkey is selected. The Motor Status will change from *Waiting for Motors Start Enable* to *Ready to Start Motors* when the enable button is pressed and held to indicate that one of the "Start" softkeys on the operator terminal can be selected. When starting the main motor, the "Motors Start Enable" button must be maintained until the motor contact feedback (Input 19 or 20) goes high. A status message *Waiting for Motor Forward Contactor* or *Waiting for Motor Reverse Contactor* will be displayed until the intended contact turns "On". Typically this will occur quickly enough that the message is not displayed, but can indicate a problem in the field wiring if the condition exists for an extended amount of time.

If a flywheel brake output is configured (Output Relay Type 63), the "Motors Start Enable" button must also be maintained until the flywheel brake pressure switch (Input 44) goes high. The flywheel brake output will turn "On" before either the motor forward or motor reverse output turns "On" in order to prevent starting the motor until the flywheel brake has released and the status message *Waiting for Flywheel Brake to Pressurize* will be displayed. The status message will display *Motors Running* when the main motor start sequence is complete.

The "Motors Start Enable" button must be a momentary switch and cannot be held statically high. The status message *Motors Start Enable Not Released* indicates that the button must be released and re-pressed to start any motor.

Once the main motor is started the "Motors Start Enable" button can be released unless the "Main Motor Control Type" is configured as "3: (Reversing, Maintain in Reverse)", and the motor is running in the reverse direction.

The Motor Control screen provides keys to stop the main motor and/or the lube motor. Turning the lube motor off will also turn the main motor off. The motors can also be turned off by control switches. Any

master stop switch will turn the LMC "Off" and drop out the main motor and the lube motor if configured. Switches in the LMC path such as the Mode Select switch can also turn the motors off. This type of external stop condition is detected by the motor forward or motor reverse contact (Input 19 or 20) switching low. Loss of flywheel brake pressure (Input 44) will turn the main motor off but will not turn off the lube motor output. If configured for a recirculating lube system or if configured to monitor faults on a pulsed grease system, a lube fault will cause a top stop to be generated and can be configured to turn the main motor off when the press stops. A lube fault will not turn the lube pump output off.

When the main motor is turned off, it will not automatically turn back on when the stop condition is removed. It must be manually started as described above. If configured for a zero speed switch, the status message will display *Waiting for Flywheel to Stop* until the conditions that define zero speed are satisfied (see Section 4.2.17.3). During this time period the main motor can be restarted in the same direction it was running when the stop occurred. It cannot be started in the opposite direction until it has first reached zero speed.

3.6.3   Motor Control Diagnostics

The "Motor Diags" diagnostic screen can be used to view the state of the outputs and inputs used for the motor control function. To get to this screen, press the **Motor Diags** softkey on the Motor Control screen (see Figure 27). This screen (an example is shown as Figure 28) provides more detailed information such as which motor output (forward or reverse) is on, which motor starter is engaged, the state of the flywheel brake output, and the status of the flywheel brake pressure switch.

Figure 28: Motor Control Diagnostic Screen

While this information is available in various other diagnostic screens, this screen collects all the inputs and outputs for motor control in one place for ease of use. In addition, softkeys are provided along the bottom of the screen to control the system. The feedback from these commands can be directly observed above.

3.7   Counters

Touch the Counter display area in the Main Screen (see "b" in Figure 8 on page 35) to Counter screen shown in Figure 29. The present quantities of the part counter, batch counter, quality counter, and stroke counter can be viewed.

If counters are configured for unrestricted access, anyone can change the counters and reset them. If configured for access control (described in Section 3.3 on page 30), operators must use the access control means to make changes.

This screen shows production information related to the part, batch, and quality counters. The machine stroke count and "Job Hit Count" is also shown at the bottom of the screen.

Up to 2 sets of counters can be configured for use. Each counter set consists of a Part Counter, Bin Counter, and Scrap Counter. Only the first counter set additionally contains a Quality Counter, which is used when it is desired to stop the press every so many strokes for a quality check. Multiple counter groups are most often used in conjunction with multiple output dies, where separate bin counts, separate part counts, or both are desired. Figure 30 shows what the screen looks like with 2 counter groups enabled. Press inside each blue bordered group box to show a screen similar to Figure 29 for that counter group.

Counters can be driven by strokes of the press (Stroke Based counters) or by sensors tied to a die

Figure 29: Counter Screen
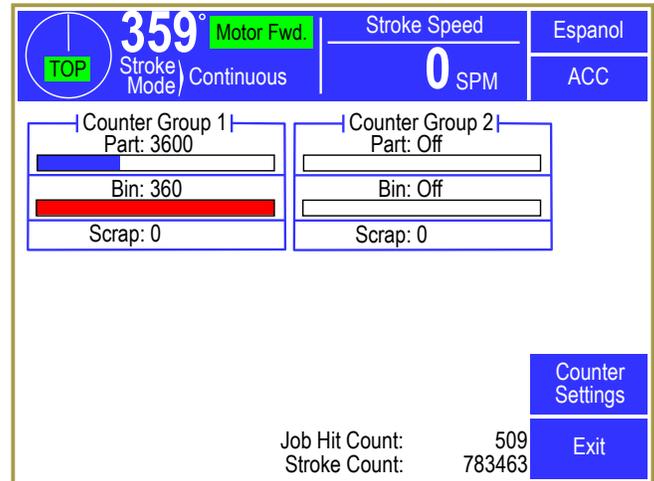
Figure 30: Counter Screen with 2 Groups

protection channel (Sensor Based counters). The counter drive mode is indicated at the bottom left corner of the screen just below the Scrap Rate. Stroke based counters can also be configured to count by a set amount every so many stokes. For instance, a job using a two-out die can be set to count by 2 every stroke. A job using a lamination die could be set to count by 1 every 10 strokes. Each counter group is separately configurable for stroke or sensor based counting.

3.7.1 Configuring Production Counters

Up to 2 counter groups can be enabled on a job by job basis. In other words, one job can have one counter group enabled, while a second job can have 2 counter groups enabled. Stroke based counter groups can also be set to increment by a particular value every so many strokes rather than incrementing by 1. To configure the counters, press the **Counter Settings** softkey in the counter screen of Figure 29.

A screen similar to Figure 31 will appear and allows each counter group to be set to stroke based counting, sensor based counting, or not used. Hitting the **Configure System** softkey in this screen will bring up a screen with three settings – "Maximum Number of Counter Groups", "Enable

Figure 31: Counter Configuration Screen

True (Sensor Based) Part Counters", and "Count in Setup Mode". These settings apply to the system as a whole instead of to a job. The maximum number of counter groups can be set to 1 or 2 and will affect how many counter groups are shown in the screen of Figure 30. If "Enable True (Sensor Based) Part Counters" is set to "No", then "Sensor Based" will NOT be available to choose as a counter group type. Both of these settings are present to allow a reduction in the number of settings presented to operators for features that are not used. Finally, "Count in Setup Mode" controls whether stroke based counter will count in setup modes such as Inch or Timed Inch.

Counter groups that are set to "Stroke Based" also have a **Configure** button shown to the right of the group (as seen in Figure 31 for Counter Group 1). When pressed, a screen will appear that allows the "Counter Increment" and "Counter Frequency" to be set. The "Counter Increment" is how much the counter will be increased when a count occurs. For instance, a two-out die making a simple part would count by 2 every stroke. The "Counter Frequency" is how often the counter should count. A lamination die might produce a part every 10 strokes. If a lamination die with 10 laminations was also a 2 out die, the "Counter Frequency" would be set to 10, and the "Counter Increment" would be set to 2. The counter would then count by 2 every 10 strokes. For typical one-out dies, both of these values would be 1, which would count by 1 every stroke.

3.7.2 Production Counters

The three production counters provided are Part, Batch and Quality. All production counters that are turned "On" will increment as the press strokes.

> **NOTE:** Stroke based Part, Bin, and Quality counters only count if turned "On" and only in production modes unless "Count in Setup Mode" is set to "Yes" in which case they count in all modes. The stroke counter always counts in all modes. Production modes are Single Stroke, Continuous, Automatic Single Stroke, Continuous on Demand, and Maintained Continuous modes. Some press controls may not have all these modes. Sensor based counters count whenever the sensor detects a part, regardless of mode, as long as they are "On".

When the current count reaches the programmed limit, a top stop will be issued. This stop will remain active until the counter is reset or is turned off.

The Part counter usually records the total parts made for a given process setup. The Bin counter usually records a small group of a process run, such as the number of parts that can be put into one container. The Quality counter is typically used to record the number of parts that can be made between quality inspections.

Below each production counter is a bar graph that visually indicates the progress made toward that counters limit. When the count reaches the limit, the bar graph will change from blue to red. The percentage completion for each counter is shown to the right of the bar graph.

Each counter group also contains a scrap counter. For stroke based counter groups, this counter must be manually set by entering a number, or using the **Inc. Scrap** and **Dec. Scrap** softkeys. Sensor base counter groups can have a die protection channel that is assigned to increment the scrap count whenever the scrap sensor detects a part.

3.7.2.1 Turning Production Counters On or Off

Production counters can be turned "On" or turned "Off". When a counter is turned "Off", it does not increase and cannot issue a stop to the press control. A production counter is toggled "On" or "Off" by pressing the **On / Off** softkey for that counter and will be shown in the "State" column. If an access control mode (see Section 3.3 on page 30) is being used that requires a password, a user must be configured to have the "Counter Settings" permission to change this parameter.

3.7.2.2 Changing the Limit for Production Counters

Each production counter has a limit setting. When this limit is reached, a top stop will be issued. The slide will stop at the top of the stroke and further stroking will be prevented until the counter is reset or until the counter is turned off. If an access control mode (see Section 3.3 on page 30) is being used that requires a password, a user must be configured to have the "Counter Settings" permission to change this parameter.

3.7.2.3 Resetting Production Counters

A counter reset will set a production counter's current count to zero. If an access control mode (see Section 3.3 on page 30) is being used that requires a password, a user must be configured to have the "Counter Reset" permission to change this parameter.

Resetting the Part counter will also reset the Batch and Quality counters.

To reset a production counter, touch the **Reset** softkey to right of the counter to reset. The operator terminal will ask for verification before actually resetting the counter.

3.7.2.4 Changing the Count for Production Counters

The current count value of a production counter can be changed. If an access control mode (see Section 3.3 on page 30) is being used that requires a password, a user must be configured to have the "Counter Change" permission to change this parameter.

The current count is changed by touching the counter field of the desired counter and entering the new value. The numeric entry screen provides softkeys to increment or decrement the counter or a new number can be entered.

3.7.3 Stroke Counter

The stroke counter increments anytime the crankshaft travels from the top of the stroke to the bottom of the stroke. Contact Link Systems service department to reset the stroke counter.

3.8   Programmable Limit Switch

The System 5100 press control can optionally support up to 8 programmable limit switch outputs.

3.8.1   Limit Switch Main Screen

If installed, touching the Limit Switch area of the main operator screen (see Figure 8 on page 35) will bring up the screen shown in Figure 32.

This screen gives a "high level" view of the programmable limit switch system. Four channels at a time are shown in the top half of the screen. The channel numbers, modes of operation, descriptions, and "On" or "Off" states of the outputs are shown.

Below this area are shown details of the currently selected channel (the highlighted channel number – in Figure 32 channel 2 is highlighted as the current channel). The currently selected channel can be changed by using the up and down arrow keys to the immediate right of the circular angle display. The circular angle display graphically shows where the limit switch will "fire". Depending on the Mode of the channel, various details, such as "On Angles", "Off Angles", and "On Times" will be show on the left side of the channels details area.

Figure 32: Limit Switch Main Screen

At the bottom of the screen is the "Module Status". This shows the condition of the entire module rather than just a channel. Module communication errors or other similar failures would be indicated in this area.

3.8.2   Limit Switch Settings Screen

If the **Channel Settings** softkey is pressed in the Limit Switch main screen (see Figure 32), the display will show a settings screen for the currently selected channel that should look similar to Figure 33. The appearance of this screen will vary somewhat depending on the "Channel Mode" selected, as some modes do not use some settings.

The **Configure System** softkey will take the user to the Limit Switch configuration area. These screens are discussed in Section 4.4162.

The **Previous Channel** and **Next Channel** softkeys can be used page through the channels without going back to the Limit Switch main screen.
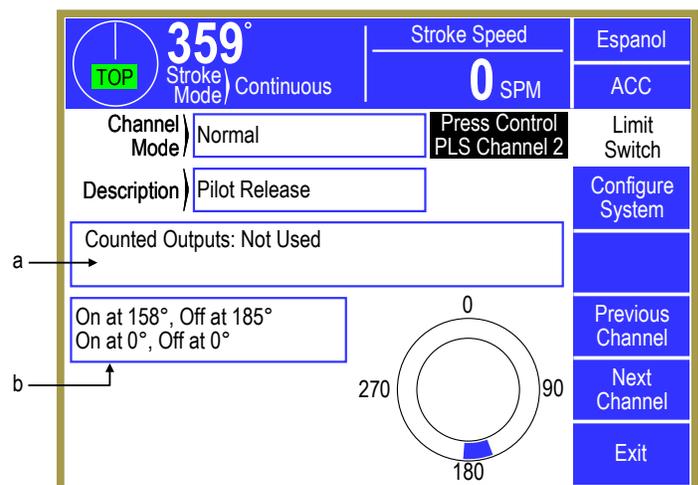
Figure 33: Limit Switch Settings Screen

The "Channel Mode" of the channel sets the basic characteristics of how it will operate. The following channel modes may be selected:

Always Off   The Limit Switch output relay for the channel will always be turned off. While the typical use for this mode if for a channel that is not used for a particular job, note that it can also be useful in conjunction with the "Always On" mode for turning off and on optional automation equipment, such as conveyors, that are not used for every job.

Always On   The Limit Switch output relay for the channel will always be turned on (as long as the control is powered and the Limit Switch relay board is operating properly).

Normal   The Limit Switch output relay will turn on at a particular angle and off at another angle. Each channel can have up to two of these on/off angle pairs (the relay can be made to "fire" in two different places in each stroke). If the second on/off angle is not needed, set both "On Angle 2" and "Off Angle 2" to 0.

Timed Off   The Limit switch output relay will turn on at a particular angle and will remain on for a programmable "On Time". Each channel can have up to two "On Angle" points. If it is desired that the relay only "fire" once in the stroke, then "On Angle" and "On Angle 2" should be set to the same angle. There is only one "On Time" that applies to both "On Angles". This type is especially useful for applications like air blow off or for sprays of lubrication for the material. While the "Normal" mode can be made to work for such applications, it has the disadvantage that if the press stops inside the "On" window, the air or lube will spray continuously until the press is moved.

> **NOTE:**   Software versions 1.39 and greater add a "re-trigger" to the way the "Timed Off" channel mode functions. If the next "On" angle is reached before the time has expired, the output will remain on and the time period starts over. This is typically used to provide a timed pulse at low speeds, but a continuous output at high speeds, or to power scrap conveyors that turn on when the press starts and automatically turn off a few seconds after the press stops.

The "Channel Description" can be selected from a set of names that have previously been entered by the user (see Section 4.4.1 on page 163 for details).

When the channel is in "Normal" or "Timed Off" mode, it can be made a "Counted Output". This allows the channel to be set to fire every so many strokes. Press inside the blue bordered counted outputs area (see "a" in Figure 33) and the counted outputs setting screen will be shown (see Section 3.8.3).

When the channel is in "Normal" or "Timed Off" mode, there are angle and/or time settings associated with it. Press inside the blue bordered angle area (see "b" in Figure 33) and the angle/time settings screen will be shown (see Section 3.8.4).

At the bottom right of the screen is a graphical angle display that shows where the Limit Switch channel will "fire". For "Normal" mode channels the blue arcs in this display show the actual angles where the channel will be "On". For "Timed Off" channels the start of the blue area shows where the channel will turn "On" for the programmed time.

3.8.3 Limit Switch Counted Output Settings Screen

When the channel is in "Normal" or "Timed Off" mode, it can be made a "Counted Output". This allows the channel to be set to "fire" every so many strokes. Press inside the blue bordered counted outputs area (see "a" in Figure 33) and the counted outputs setting screen of Figure 34 will be shown.

A counted output is used when the process does not need something to happen on every stroke. For instance, a scrap chopper may be used to chop up the strip exiting the die for easier handling. Activating the chopper every single stroke would cause unnecessary wear. Instead, a counted output could be used to fire the chopper every 10 strokes (or whatever number still resulted in manageable lengths of scrap).
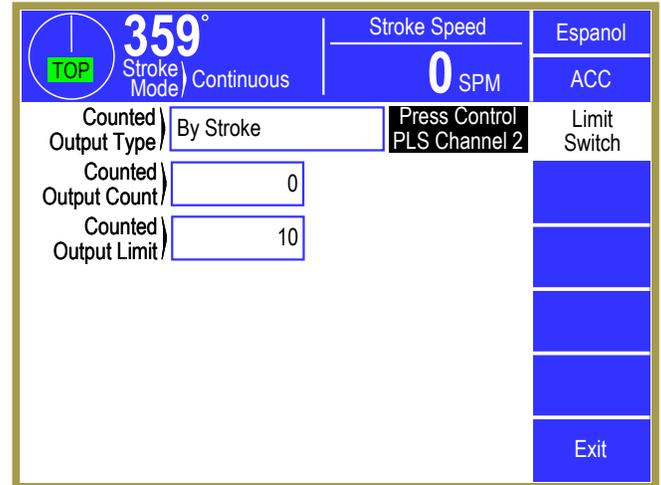
Figure 34: Limit Switch Counted Output Screen

3.8.3.1 Counted Output Type

The "Counted Output Type" can either be "Not Used" or "By Stroke". If set to "Not Used", then the "Counted Out. Count" and "Counted Out. Limit" will not be shown. "By Stroke" causes the "Counted Output Count" to increment each stroke.

3.8.3.2 Counted Output Limit

The "Counted Output Limit" sets the number of strokes before the limit switch output will "fire". For example, if set to 10, the limit switch output would fire one stroke out of every 10.

3.8.3.3 Counted Output Count

The "Counted Output Count" increments each time the press makes a stroke. When the count reaches the limit, the output will fire and the count is reset to 0. The count can be changed, if needed, to set the output to fire in a particular number of strokes or to synchronize the output will another channel that was also a counted output.

3.8.4 Limit Switch Angle and Time Setting Screen

When the channel is in "Normal" mode, then the angles where the output will fire must be set. If the channel is in "Timed Off" mode, then the angles where the output will fire and the time the output will stay on must be set. Press inside the blue bordered angle/time area (see "b" in Figure 33) and the screen of Figure 35 will be shown.

At the bottom right of the screen is a graphical angle display that shows where the Limit Switch channel will "fire". For "Normal" mode channels the blue arcs in this display show the actual angles where the channel will be "On". For "Timed Off" channels the start of the blue area shows where the channel will turn "On" for the programmed time.
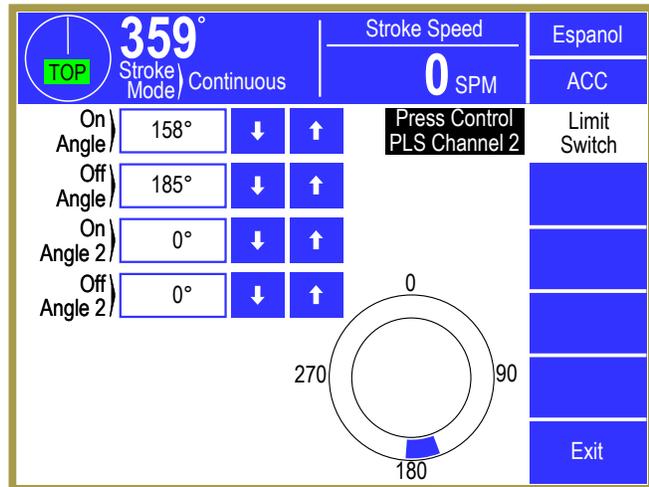
Figure 35: Limit Switch Angle and Time Setting Screen

3.8.4.1 On Angle

Each Limit Switch output can turn on up to two times in a stroke. "On Angle" and "On Angle 2" are the angles in the stroke where the limit switch output should turn "On". If the "Channel Mode" is "Normal", then "Off Angle" and "Off Angle 2" control where the output will turn "Off". If the "Channel Mode" is "Timed Off", then a single "On Time" that applies to both "On Angle" parameters controls how long the output will stay "On". If the output only needs to turn on once in the stroke, then set both "On Angle 2" and "Off Angle 2" to "0" if the channel is in "Normal" mode or set "On Angle 2" the same as "On Angle" if the channel is in "Timed Off" mode. The up and down arrow keys to the right of the parameters can be used to increment or decrement the value without going into the numeric editing screen.

3.8.4.2 Off Angle

"Off Angle" and "Off Angle 2" are only shown if the "Channel Mode" is "Normal". These are the angles in the stroke where the Limit Switch output should turn "Off". The up and down arrow keys to the right of the parameters can be used to increment or decrement the value without going into the numeric editing screen.

3.8.4.3 On Time

The "On Time" is only shown if the "Channel Mode" is "Timed Off". This is the amount of time the output will remain "On" after it passes "On Angle" or "On Angle 2". The up and down arrow keys to the right of the parameters can be used to increment or decrement the value without going into the numeric editing screen.

3.9 Die Protection

The OmniLink 805 Operator Terminal includes four built-in die protection channels which are designed for use in monitoring various material and tool conditions that are important to the correct operation of the process. This is accomplished by installing appropriate sensors and probes in or near the die and connecting these sensors to the die protection channel inputs of the operator terminal. The channels are then programmed through the operator terminal to perform the desired monitoring function for the connected input. In the event that improper conditions occur, the machine can be stopped, avoiding excessive delay in the production process or damage to the tooling and/or press.

3.9.1 Die Protection Features

The die protection channels may be used to monitor parts ejection, stock in place, material in position, stock buckling, end of stock, or other functions of interest. Either solid state (NPN or PNP) or probes and mechanical sensors may be used to drive the inputs. The inputs can be set for NPN or PNP mode on a channel by channel and job by job basis. The input type is recalled with the job.

The operator terminal can be programmed to monitor each individual die protection input in the manner necessary to insure that the process is operating in the intended manner. Each channel can be programmed to function as one of the following types: "Static", "Cyclic", "Transfer", "In Position", "1 Part Detector", or "2 Part Detector" (see Section 3.9.2 for a description of these types).

If the monitor detects a process fault, a stop signal will be sent to the press control. There are three types of stops than can be assigned to an individual channel. When an input malfunction is detected, a Immediate Stop, Top Stop, or Intelli-Stop signal can be asserted. See Section 2.1 on page 15 for a description of how each of these stops work.

The system has the capability of displaying extensive channel diagnostics. The current state of each of the channel inputs is displayed. In addition, a numerical and graphical representation of the channel input's history is available. The last 64 transitions (a transition is either a change in sensor state from on to off or from off to on) of the channel input are stored. This information can be displayed numerically in a table format or graphically.

3.9.2 Die Protection Input Types and Their Uses

Each die protection channel can be programmed for any one of 8 different die protection types: "Static", "Cyclic", "Transfer", "In Position", "1 Part Detector Edge", "1 Part Detector Pass", "2 Part Detector Edge", and "2 Part Detector Pass". In addition, any input can be set to Not Used if desired.

Sensor logic is assigned descriptive names such as "Static", "Cyclic", and "1 Part Detector Pass". Although these names best describe the applications for which they are normally used, their use should not be limited by their assigned name. For example, if a channel requires the logic of a "1 Part Detector Pass" and the sensor is not actually detecting a part out, "1 Part Detector Pass" logic should still be used. Each channel can have its own description. Although the "1 Part Detector Pass" logic is employed, the assigned description can indicate the precise use of the channel.

3.9.2.1   Static

Static inputs are used for sensors that monitor events that are independent of the production machine cycle. Examples are sensors monitoring end of stock and stock buckling. If the input is programmed with a channel type of "Static" and an input type of "Normally Off", the input should NOT be "On" under normal operation. In this case when the input switches "On", a stop will be issued. If the input is programmed with a channel type of "Static" and an input type of "Normally On", the input should be "On" under normal operation. In this case when the input switches "Off", a stop will be issued.

An example of the use of a Static Normally Off input is stock buckling detection, as shown in "a" of Figure 36. The stock to be fabricated is placed between a dual probe in the normal position. The probe remains "Off" (ungrounded) unless the stock buckles upward or downward far enough to touch the upper or lower portion of the probe, turning "On" (grounding) the normally open input, causing a fault.

An example of the use of a Normally On input is an end of stock sensor, as shown in Figure 37. A probe is mounted so that it is "On" (grounded) by the stock being fed into the production machine. When the end of stock is reached, the probe will no longer contact the stock, turning "Off" the input and causing a fault.

An additional feature of Static type inputs is a "Delay Time" parameter which is set by the operator. A programmed time of zero forces ordinary operation of the static input as described above, i.e., if the input is not in the 'normal' state, a fault will occur immediately. However, if a value other than zero is programmed the input is allowed to change from the normal state for the length of time programmed without a fault occurring. If the input does not return to the normal state before the time expires, a fault is generated. This allows the operator to avoid nuisance faults from sensors that 'bounce' open or closed momentarily. The delay time can range from 0 to 65535 milliseconds (65.535 seconds) in 1 millisecond increments.

a) Dual Normally Open Probe Used To Detect Stock Buckle

b) Lever Arm Held Open By Stock Detects End Of Stock

Figure 36: Static Normally Off Example

a) Probe Provides Normally Closed Input To Monitor End Of Stock

b) Limit Switch Provides Normally Closed Input To Monitor End Of Stock
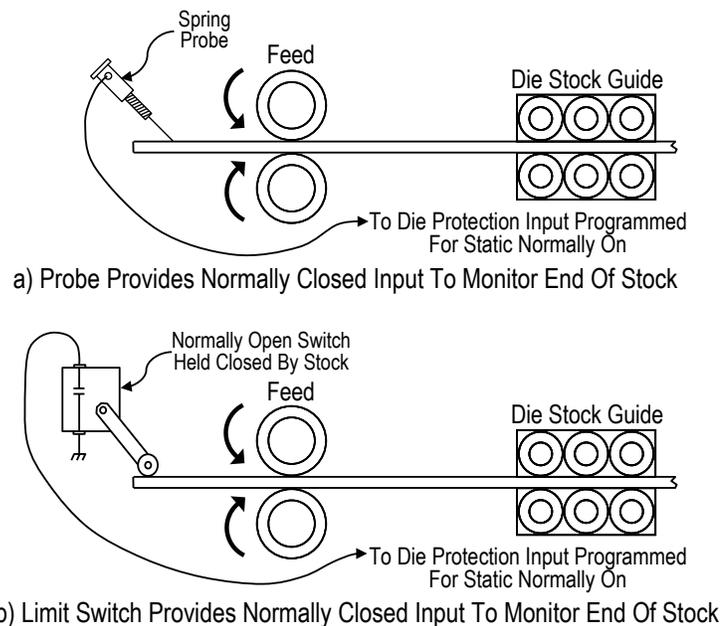
Figure 37: Static Normally On Example

3.9.2.2 Cyclic

Cyclic inputs are derived from monitored events that occur once each machine cycle when the production process is functioning normally. An example of a cyclic event is stripper plate monitoring as shown in Figure 38. In normal operation when the die closes, sensors on the right and left sides of the stripper plate will turn on; then, when the die opens again, the sensors will turn off. When a slug is caught between the stripper plate and the material, a fault condition exists. Because of the slug, the right side of the stripper plate did not come close enough to the right sensor to turn it on. Since the sensor did not turn on, a fault was detected and a stop signal sent to the machine control.

When programming an input for cyclic mode, the operator must enter crankshaft angles to mark the "Window On" and "Window Off" points for a timing window for the cyclic event. The timing window setpoints should be programmed so that the window covers the portion of the stroke in which the cyclic event should occur.
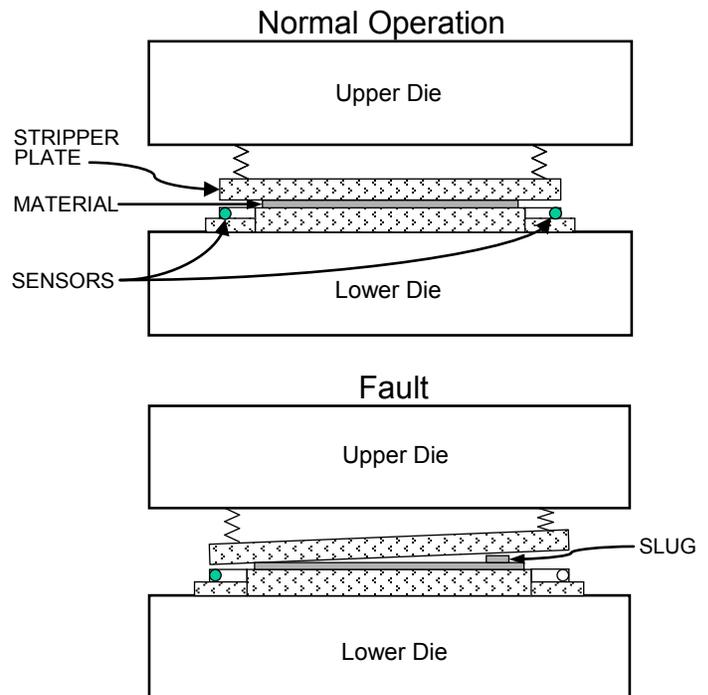
Figure 38: Cyclic Input Example

When a channel is programmed to monitor a cyclic event, the event must occur sometime during the timing window. In addition, the event must turn off sometime during a press stroke. Acceptable and unacceptable conditions for cyclic events are shown in Figure 39. For all of the acceptable conditions the event occurred sometime during the timing window. In addition, the event was off sometime during the stroke. There are also three unacceptable conditions. The left unacceptable figure shows that the event did not occur. The center unacceptable figure shows that event did occur, but did so outside the timing window. The right unacceptable figure shows that the event did not turn off during an entire press stroke. All three of these situations are fault conditions.

Figure 39: Timing Window Examples for a Cyclic Input

Sensors that are used as inputs to cyclic channels can have an "Input Type" of either "Normally On" or "Normally Off". The event is considered to occur when the sensor switches from its normal state. For example, if a cyclic channel is programmed to be "Normally Off", the channel event will occur when the sensor is "On". If a cyclic channel is programmed to be "Normally On", the channel event will occur when the sensor is "Off". In the majority of applications, the input type for a cyclic channel is "Normally Off".

An additional feature for use on cyclic type channels is the "Delay Strokes" parameter which is programmable by the operator. This parameter provides the flexibility to use the cyclic type to monitor events in the production process that may not occur every stroke, but must occur within some number of strokes. An example of such an application is slug detection, where under normal operation slugs are allowed to build up and fall out maybe two or three at a time after several strokes. In such a scenario a slug would not be detected by the sensor on every stroke, this would produce a fault were the "Delay Strokes" feature not used. The operator can enter a number representing the maximum number of strokes that can be run consecutively without the slug being detected within the timing window. If the sensor does not become active within the window for a number of strokes exceeding the "Delay Strokes" number, then a fault will be generated. By contrast, if the sensor does become active within the window on some stroke before the counter expires, then the counter is reset and the full count is again allowed. If the operator desires that the sensor be required to become active on every stroke, then a value of zero should be entered.

3.9.2.3   In Position

"In Position" type channels are used to monitor whether material is fully fed into the die on each cycle of the press. A sensor should be used to detect when the material to be fabricated is fully fed into the die. Figure 40 illustrates an example of the use of a sensor used as an input to a channel programmed for In Position type. In this example the material is fed forward contacting a spring loaded lever arm. A sensor monitors the position of the lever arm. When the

a) Before Feed Progression   b) Correct Feed   c) Over Feed

Figure 40: "In Position" Input Example

material is in the correct position, the sensor turns on. If the feed is too short or too long, the sensor will be off.

When programming a channel for "In Position" type, the operator must enter crankshaft angles to mark the "Window On" and "Window Off" points for a timing window during which the material will move into place. The "Window On" angle must be set to a point before the material gets into position. The

"Window Off" angle should be set to a point after the material has been fed into place. If the material is not in position by the end of the timing window, a fault will be generated. The "Window Off" angle must also be set so that the fault will stop the press before the die closes enough to cause damage.

An illustration of the In Position timing sequence is shown in upper part of Figure 41. This figure shows that the material was fed into place during the timing window and that the material was in place at the end of the timing window.
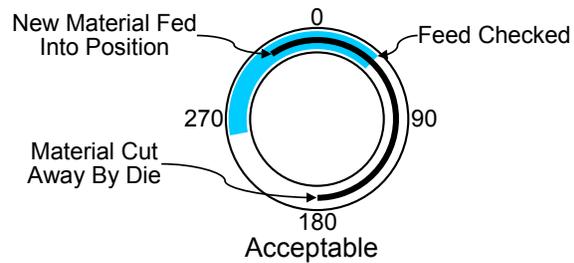
Figure 41 also shows some unacceptable conditions for In Position events. There are three unacceptable conditions shown. The left unacceptable condition shows that the feed was not in place at the end of the timing window. The center unacceptable condition shows that the material did arrive in place during the timing window, but was not in place at the end of the window. As shown in Figure 40, this condition could occur in overfeed situations. The right unacceptable condition shows that the material was sensed as being in position before the beginning of the timing window. All of these are a fault conditions.
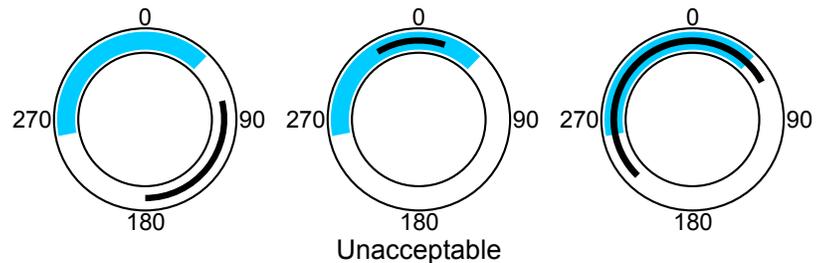
Figure 41: Timing Window Examples for an "In Position" Input

The "Input Type" of the sensor being used to verify material position can be "Normally Off" or "Normally On". The sensor will switch from its normal state when the material is in position. When a "Normally Off" sensor is being used to sense material position; the sensor will be "Off" when the material is not in place, and will be "On" when the material is in place. The example illustrated in Figure 40 is an example of a "Normally Off" sensor. When a "Normally On" sensor is being used to sense material position; the sensor will be "On" when the material is not in place, and will be "Off" when the material is in place. An example of a "Normally On" application is detecting proper material position by looking for a hole in the material. The sensor is "On" when there is material over the sensor. The sensor will switch to "Off" at the proper feed position when the hole is over the sensor.

3.9.2.4   1 Part Detector Edge

The "1 Part Detector Edge" channel logic type is used to monitor ejection of parts that are completely out of the die area as soon as they are sensed by the channel input sensor. The channel logic looks for one part to be sensed during the timing window. Figure 42 shows and example of a small part being sensed by an optical parts detector. When this small part first interrupts the sensing field of the optical parts detector it is completely out of the die area. Detection of the leading edge of this part insures that the part is totally out of the die area.

Small part detected by optical part detector

Transmitter   Receiver
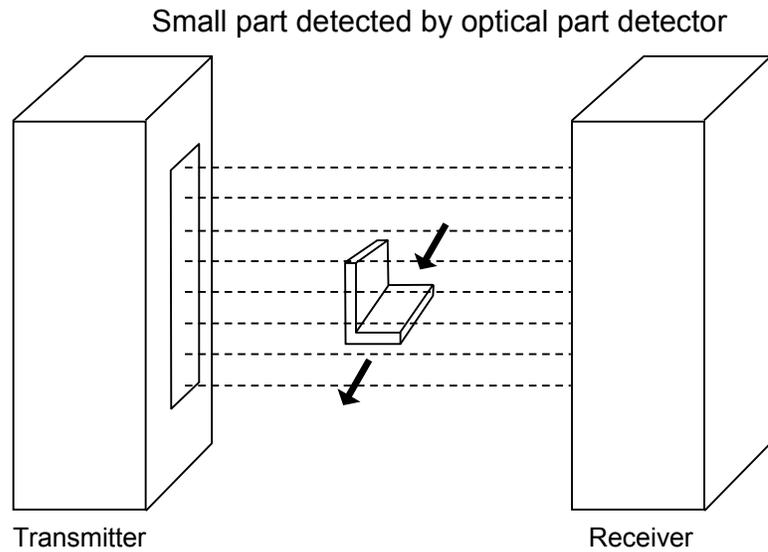
Figure 42: "1 Part Detector Edge" Input Example

The "1 Part Detector Edge" channel type functions much like the "Cyclic" type, the difference being that the timing window must turn on before, not while, the part is being ejected (activating the sensor). In other words, this type requires that the sensor NOT be active when the window turns ON, and then become active at some point during the window. The sensor can still be active at the end of the window. With "1 Part Detector Edge", it is not required that the part completely passes the sensor by the end of the window. The timing is shown in Figure 43.
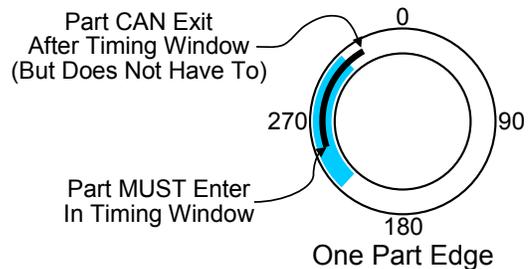
Figure 43: Timing Window Example for a "1 Part Detector Edge" Input

The "Input Type" for the sensor being used to verify part detection can be "Normally Off" or "Normally On". The sensor will switch from its normal state when the part is being detected. When a "Normally Off" sensor is being used to sense part out; the sensor will be "Off" when the part is not in the sensor, and will be "On" when the part is in the sensor. When a "Normally On" sensor is being used to sense part out; the sensor will be "On" when the part is not in the sensor, and will be "Off" when the part is in the sensor.

3.9.2.5   1 Part Detector Pass

The "1 Part Detector Pass" channel logic type is used to monitor ejection for parts that are not completely out of the die area when they are first detected by the channel input sensor. The channel logic looks for one part to be sensed during the timing window, and also looks for the part to be past the sensor at the end of the timing window. By the end of the timing window, the part should be completely past the sensor. Figure 44 shows an example of an exiting part sliding down a chute. When the sensor first detects the leading edge of this part, the trailing edge of the part is still in the die area. Detection of the leading edge of this part does not insure that the part is totally out of the die area. The only way to insure that the part is completely out of the die is to require that it be completely past the sensor by the end of the timing window.

When the part is first detected, its trailing edge is still in the die area.

The part is completely out of the die area when it passes the sensor.
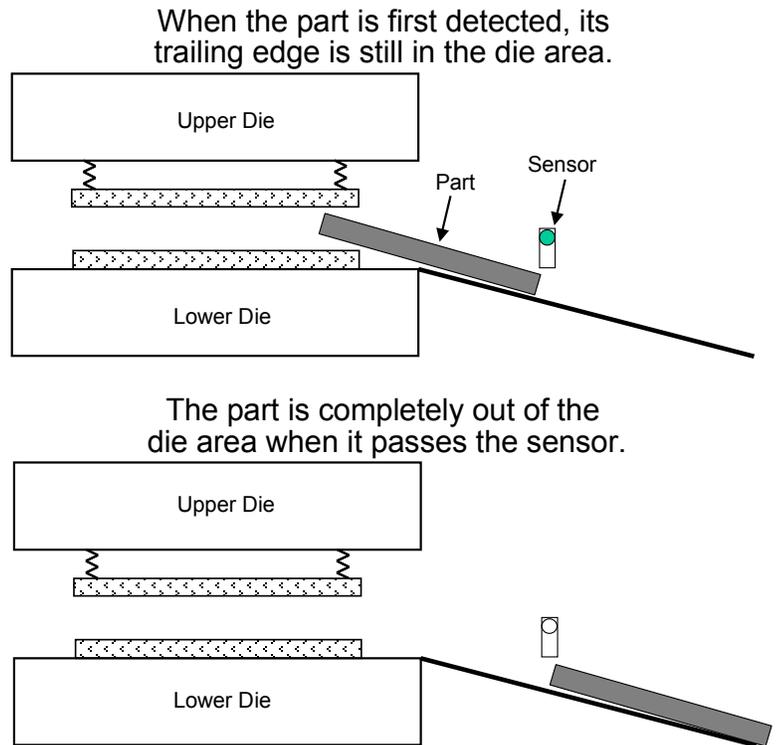
Figure 44: "1 Part Detector Pass" Input Example

The "1 Part Detector Pass" channel type timing requires that the input sensor detect the part during the timing window only. The sensor cannot detect the presence of the part at the beginning or at the end of the timing window, but it must detect the presence of the part during the timing window. In other words, this type requires that the sensor NOT be active when the window turns ON, become active at some point during the window, and not be active at the end of the window. With "1 Part Detector Pass", it is required that the part completely passes the sensor by the end of the window. The timing is shown in Figure 45.
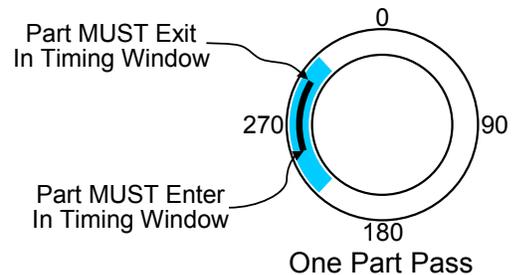
Figure 45: Timing Window Example for a "1 Part Detector Pass" Input

Note that the sensor is not allowed to become active outside the window or a fault will be generated. This provides protection against a part 'bouncing' on a probe-type detector and satisfying the die protection input erroneously.

The "Input Type" of the sensor being used to verify part detection can be "Normally Off" or "Normally On". The sensor will switch from its normal state when the part is being detected. When a "Normally Off" sensor is being used to sense part out; the sensor will be "Off" when the part is not in the sensor, and will be "On" when the part is in the sensor. When a "Normally On" sensor is being used to sense part out; the sensor will be "On" when the part is not in the sensor, and will be "Off" when the part is in the sensor.

3.9.2.6   2 Part Detector Edge

The "2 Part Detector Edge" channel logic type is used to monitor ejection for two parts detected by a single sensor that are completely out of the die area as soon as they are sensed by the channel input sensor. The channel logic looks for two parts to be sensed during the timing window. These parts must not enter the sensor at the same time. There must be a "Separation Time" between the two parts. Figure 46 shows an example of two small parts being sensed by an optical parts detector. When the small part first interrupts the sensing field of the optical parts detector it is completely out of the die area. Detection of the leading edge of a part insures that the part is totally out of the die area.

Two small parts detected by optical part detector
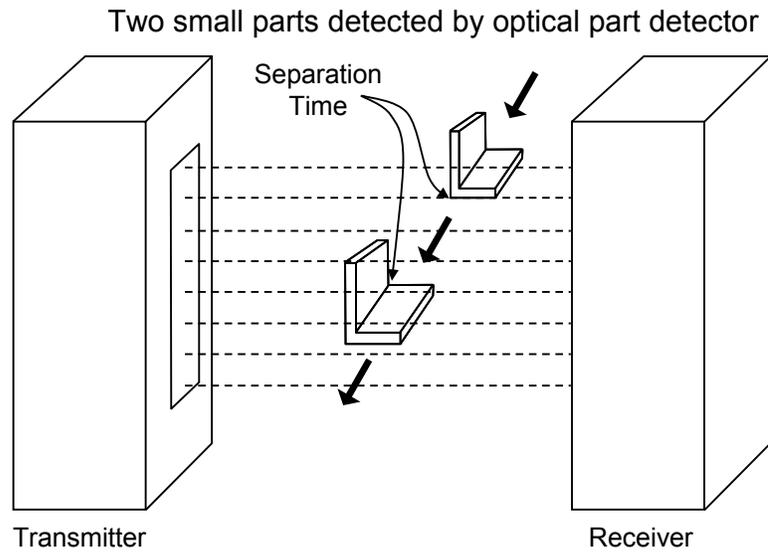
Figure 46: "2 Part Detector Edge" Input Example

The "2 Part Detector Edge" channel type functions much like the "1 Part Detector Edge" type, the difference being that two parts must be sensed. The first part must be sensed in the timing window. The leading edge of the second part must be sensed in the timing window. It is not required that the second part completely passes the sensor by the end of the window. There must be a "Separation Time" between the parts. The first part must completely exit the sensor before the second part enters the sensor. The timing is shown in Figure 47.
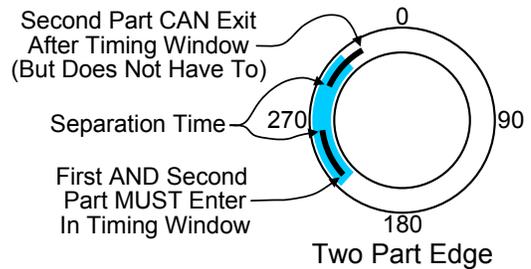
Figure 47: Timing Window Example for a "2 Part Detector Edge" Input

The "Input Type" of the sensor being used to verify part detection can be "Normally Off" or "Normally On". The sensor will switch from its normal state when the part is being detected. When a "Normally Off" sensor is being used to sense part out; the sensor will be "Off" when the part is not in the sensor, and will be "On" when the part is in the sensor. When a "Normally On" sensor is being used to sense part out; the sensor will be "On" when the part is not in the sensor, and will be "Off" when the part is in the sensor.

3.9.2.7   2 Part Detector Pass

The "2 Part Detector Pass" channel logic type is used to monitor ejection for two parts detected by a single sensor. The channel logic looks for two parts to be sensed during the timing window, and also looks for the second part to be past the sensor at the end of the timing window. Figure 48 shows an example of two exiting parts sliding down a chute. When the sensor first detects the leading edge of the second part, the trailing edge of the part is still in the die area. Detection of the leading edge of this part does not insure that the second part is totally out of the die area. The only way to insure that the second part is completely out of the die is to require that it be completely past the sensor by the end of the timing window.

When the leading edge of the second part is first detected, its trailing edge is still in the die area.

The second part is completely out of the die area when it passes the sensor.
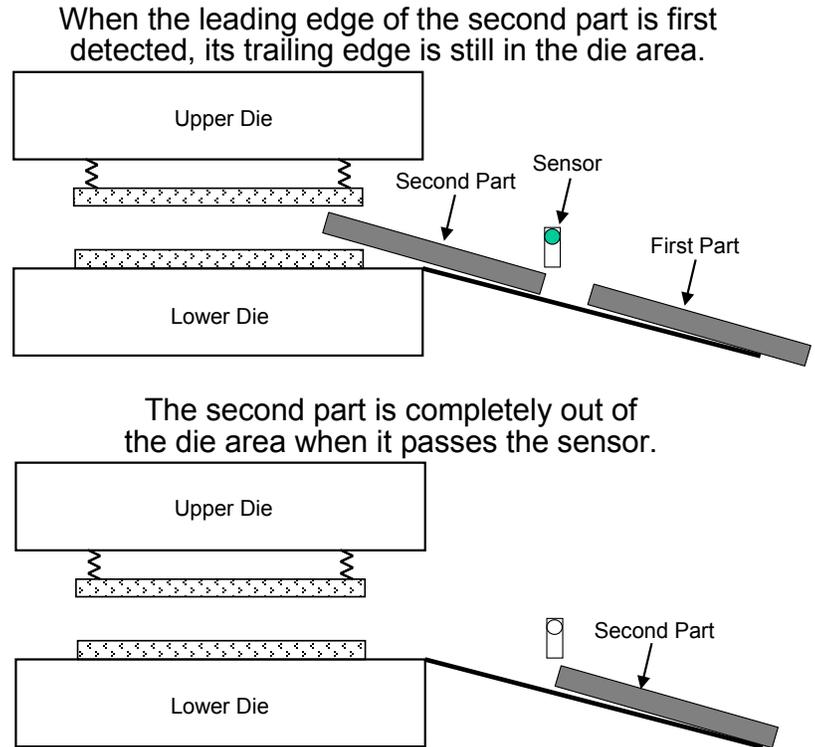
Figure 48: "2 Part Detector Pass" Input Example

The "2 Part Detector Pass" channel type timing requires that the input sensor detect both parts during the timing window only. The sensor cannot detect the presence of a part at the beginning or at the end of the timing window, but it must detect the presence of the parts during the timing window. In other words, the sensor must NOT be active when the window turns ON, must sense two parts during the window, and must not be active at the end of the window. There must be a "Separation Time" between the parts. The first part must completely exit the sensor before the second part enters the sensor. The timing is shown in Figure 49.
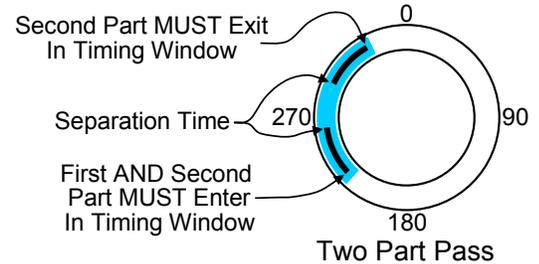
Figure 49: Timing Window Example for a "2 Part Detector Pass" Input

Note that the sensor is not allowed to become active outside the window or a fault will be generated. This provides protection against a part 'bouncing' on a probe-type detector and satisfying the die protection input erroneously.

The "Input Type" of the sensor being used to verify part detection can be "Normally Off" or "Normally On". The sensor will switch from its normal state when the part is being detected. When a "Normally Off" sensor is being used to sense part out; the sensor will be "Off" when the part is not in the sensor, and will be "On" when the part is in the sensor. When a "Normally On" sensor is being used to sense part out; the sensor will be "On" when the part is not in the sensor, and will be "Off" when the part is in the sensor.

3.9.2.8   Transfer

"Transfer" type inputs are used to monitor automatic transfer mechanisms. Some progressive dies cut the part away from the stock at an early stage in the die. Automatic transfer mechanisms are then used to move the separate pieces to the next stage in the die. Each gripper on the transfer mechanism should have a sensor to detect that each part is in place in the transfer mechanism. These switches can be wired to channel inputs programmed as "Transfer" type to monitor the mechanism for dropped parts during the transfer.

When programming a channel for "Transfer" type, the operator must enter crankshaft angles to mark the "Window On" and "Window Off" points for a timing window during which the transfer will occur. The "Window On" setpoint should be set to an angle just after the part is gripped. The "Window Off" setpoint should be set to an angle just before the part is released into the next stage of the die. The timing is shown in Figure 50. The sensor must signal that the part is present for the entire timing window. In addition, the sensor must signal that the part is not present sometime during the press stroke. If the sensor does signal that a part is present for an entire press stroke, a sensor failure is assumed and a stop signal will be issued.
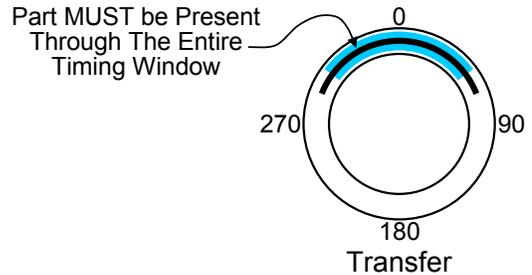
Figure 50: Timing Window Example for a "Transfer" Input

An additional feature of Transfer type inputs is the "Delay Time" parameter, which is programmed by the operator. A programmed time of zero forces ordinary operation of the transfer input as described above, i.e., if the sensor does not report the part present through the entire timing window, a fault will occur immediately. However, if a value other than zero is programmed the channel input is allowed to signal a missing part for the length of time programmed without a fault occurring. If the input does not signal a part present before the time expires and the timing window is still in effect, a fault is generated. This allows the operator to avoid nuisance faults from sensors that 'bounce' open or closed momentarily. The delay time can range from 0 to 65535 milliseconds (65.535 seconds) in 1 millisecond increments.

The "Input Type" of the sensor being used to verify part detection can be "Normally Off" or "Normally On". The sensor will switch from its normal state when the part is being detected. When a "Normally Off" sensor is being used to sense the part; the sensor will be "Off" when the part is not in the sensor, and will be "On" when the part is in the sensor. When a "Normally On" sensor is being used to sense the part; the sensor will be "On" when the part is not in the sensor, and will be "Off" when the part is in the sensor.

3.9.3 Die Protection Main Screen

Pressing inside the blue bordered "Die Protection" area on the Main Screen (see Figure 8 on page 35) will cause the Die Protection screen shown in Figure 51 to be displayed.

This upper half of the screen shows an overview of all four die protection channels. The "Channel Type", "Description", and "State" of each channel is shown.

Next is an area that shows some more specific configuration and diagnostic data for the currently selected channel. The currently selected channel is designated by the highlighted cursor on the channel number (in the example of Figure 51, channel 3 is currently selected. The up and down arrow buttons to the right of the graphical circular angle display move the current channel highlight cursor up and down. The specific information shown in this section will depend on the "Channel Type" selected for the channel.

Figure 51: Die Protection Main Screen

The blue arc in the circular angle display shows the timing window that is set for the channel, assuming the "Channel Type" requires one. The black arc in the circular angle display shows the actual angles where the sensor was "On" in the stroke. This could be displayed as more than one arc if the sensor turns "On" in multiple places in the stroke. The captured sensor angles are automatically updated every stroke. A small tick mark can be seen just inside the inner circle of the angle display shown in Figure 51 at around 160 degrees. This tick mark will only be shown if the "Stop Type" of the channel is set to "Intelli-Stop". It shows the actual angle, adjusted for speed, that will determine whether the channel generates an "Immediate Stop" or a "Top Stop" (see Section 2.1.5 on page 16 for more information about "Intelli-Stop").

At the bottom of the screen the overall "Module Status" of the die protection system is displayed.

The "State" of each input gives the operator general information on the status of the die protection channel. When no error is present on the channel, a simple "On" or "Off" is displayed. When "On", the state is shown with a blue background to make the difference between "On" and "Off" more obvious from a distance. If the channel is bypassed, the background will be yellow, and if the channel has an error, the background will be red and there will be an asterisk after "On" or "Off".

Figure 52 shows an example of what the screen would look like after channel 3, an "In Position" sensor, fails to detect that the material is in place at the end of the detection window. The "State" is

Figure 52: Die Protection Main Screen with Error

"Off*" with a red background. The "Ch. Status" for channel 3 gives the specific reason for the stop – in this case "Not in position at end of window". The "Module Status" indicated that at least one channel has an error.

The **Channel Settings** softkey will display a screen that allows changing parameters for the currently selected channel. This screen is described in Section 3.9.4.

The **Bypass** softkey will display a screen that allows various bypassing operations to be performed for the die protection system as a whole as well as for individual channels. This screen is described in Section 3.9.7 on page 73.

The **Diagnose** softkey will display a screen that allows for in depth diagnosis of the currently selected channel. This screen is described in Section 3.9.8 on page 75.

The **Reset** softkey must be pressed to reset die protection errors. Note that some errors, primarily those generated from "Static" inputs, may not clear until some action is corrected in the die.

3.9.4   Die Protection Channel Settings Main Screen

If the **Channel Settings** softkey is pressed in the Die Protection main screen (see Figure 51), the display will show a settings screen for the currently selected channel that will look something like Figure 53. The appearance of this screen will vary somewhat depending on the "Channel Type" selected, as some types do not use some settings.

The **Configure System** softkey will take the user to the Die Protection configuration area. These screens are discussed in Section 4.5 on page 165.
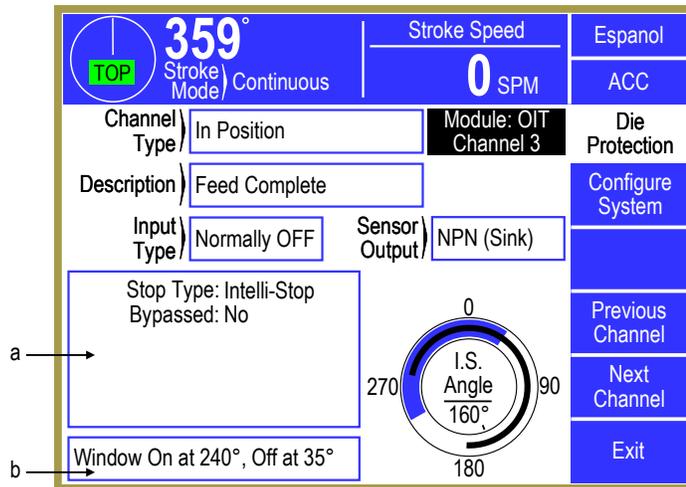
Figure 53: Die Protection Channel Settings Screen

The **Previous Channel** and **Next Channel** softkeys can be used page through the channels without going back to the Die Protection main screen.

The blue arc in the circular angle display shows the timing window that is set for the channel, assuming the "Channel Type" requires one. The black arc in the circular angle display shows the actual angles where the sensor was "On" in the last full stroke (0 to 359 degrees). This could be displayed as more than one arc if the sensor turns "On" in multiple places in the stroke. The captured sensor angles are automatically updated every stroke. A small tick mark can be seen just inside the inner circle of the angle display shown in Figure 53 at around 160 degrees. This tick mark will only be shown if the "Stop Type" of the channel is set to "Intelli-Stop". It shows the actual angle, adjusted for speed, that will determine whether the channel generates an "Immediate Stop" or a "Top Stop" (see Section 2.1.5 on page 16 for more information about "Intelli-Stop"). Likewise, in the center of the circle is the numeric readout of the Intelli-Stop angle that corresponds to the tick mark.

3.9.4.1 Channel Type

The "Channel Type" selects the basic logic that the input will apply to the sensor. The following "Channel Types" are available:

Not Used The channel is not used.

Static Channel type used to monitor sensors that are independent of the machine production cycle. There is no timing window associated with these inputs. See Section 3.9.2.1 on page 58 for more information about this type.

Cyclic Channel type used to monitor events that occur once each machine cycle. These events must occur during the set timing window. See Section 3.9.2.2 on page 59 for more information about this type.

In Position Channel type used to monitor material feed progression. See Section 3.9.2.3 on page 60 for more information about this type.

1 Part Detector Edge Channel type used to monitor part ejection for parts that are completely out of the die area as soon as there are sensed by the channel's input sensor. See Section 3.9.2.4 on page 62 for more information about this type.

1 Part Detector Pass Channel type used to monitor part ejection for parts that are not completely out of the die area when they are first sensed by the channel's input sensor. The part must be completely past the sensor by the end of the timing window. See Section 3.9.2.5 on page 63 for more information about this type.

2 Part Detector Edge Channel type used to monitor two parts whose ejection is sensed by the same sensor. The parts must enter the sensor's sensing field at different times. The last part does not have to exit the sensing field at the end of the timing window. See Section 3.9.2.6 on page 64 for more information about this type.

2 Part Detector Pass Channel type used to monitor two parts whose ejection is sensed by the same sensor. The parts must enter the sensor's sensing field at different times. The last part must be completely past the sensor by the end of the timing window. See Section 3.9.2.7 on page 65 for more information about this type.

Transfer Channel type used to monitor part transfer. The channel's input sensor must report that the part is present through the entire timing window. See Section 3.9.2.8 on page 66 for more information about this type.

3.9.4.2 Description

The "Description" is a helpful label which aids the operator in identifying which sensor is tied to a particular input and what that input is monitoring. This is of particular value if many die protection inputs are used. Since the "Channel Type" labels are by necessity general in nature, an input description can be used to give more specific information to the operator. For example, suppose two separate sensors are being used to check for two different pilot holes in the part. The die protection inputs which these sensors are wired to would both be programmed as "Cyclic" inputs to check proper operation of the sensor (pilot hole both present and absent at different points in the stroke). In this application it would be helpful to specify a description for each input such as "Pilot Hole Left" and "Pilot Hole Right"

so that if a failure occurred the operator would know immediately which hole was not seen. When the "Description" field is touched, a list of available names that can be selected is displayed. This list is configured by the user as explained in Section 4.5.2 on page 166.

3.9.4.3   Input Type

All channel logic types can have either "Normally Off" or "Normally On" input types. A sensor will switch from its normal state when the event that it is monitoring takes place. For example, if a "Normally Off" sensor is being used for stripper plate detection, the sensor will turn "On" when the stripper plate is detected. The majority of sensors used will be "Normally Off" input type.

3.9.4.4   Sensor Output

The "Sensor Output" can be set to either "NPN (Sink)" or "PNP (Source)". Sensors used with the die protection system should have a maximum off-state leakage current no greater than 1.9 milliamps. The maximum on-state voltage drop of the sensor should be no greater than 12 volts. These parameters are usually specified in the datasheet or catalog page for the sensor.

When "Sensor Output" is set to "NPN (Sink)", the die protection input will be pulled up to about 22 volts with a resistor. NPN sensors (also called "sinking" or "current sinking" sensors) connected to the input "pull it down" to something close to 0 volts when the sensor turns "On". In the case of an inductive proximity sensor, the sensor turns "On" when metal is sensed, but any sensor that in effect switches the input to ground when "On" should use this input type. For instance, a mechanical limit switch that is tied between ground and the input would use a "Sensor Type" of "NPN (Sink)". This would also be applied to a whisker probe that is grounded when it touches its target.

When "Sensor Output" is set to "PNP (Source)", the die protection input will be pulled down to 0 volts with a resistor. PNP sensors (also called "sourcing" or "current sourcing" sensors) connected to the input "pull it up" to something close to 24 volts when the sensor turns "On". In the case of an inductive proximity sensor, the sensor turns "On" when metal is sensed, but any sensor that in effect switches the input to 24 volts when "On" should use this input type. For instance, a mechanical limit switch that is tied between 24 volts and the input would use a "Sensor Type" of "PNP (Source)".

Figure 54 shows single, series, and parallel connections for both NPN and PNP solid state sensors. Normally only one sensor is wired to an individual input. This is preferred as it enables individual diagnostics for each sensor. However, multiple sensors can be wired in series or parallel to expand monitoring capabilities.
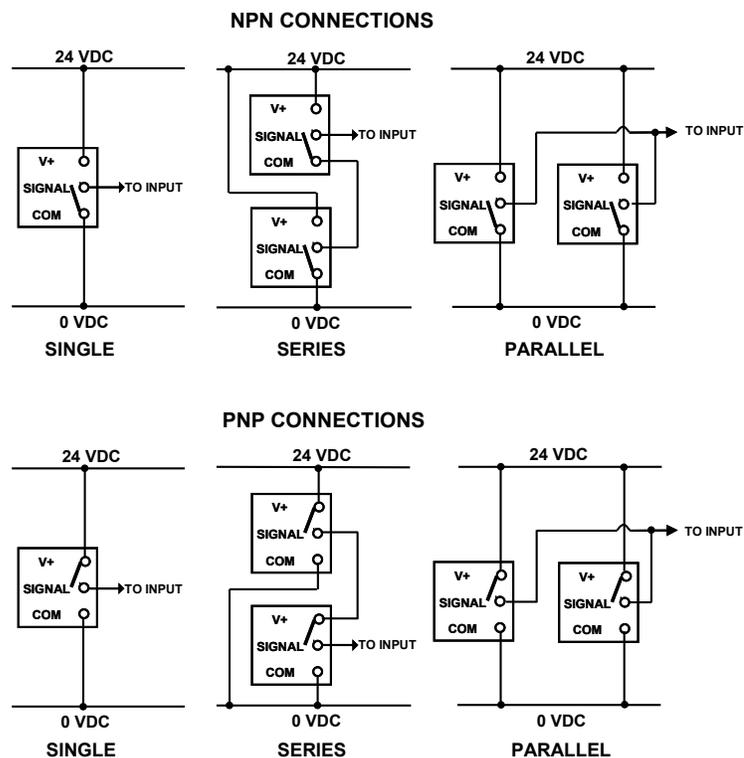
Figure 54: Wiring Sensors in Series and Parallel

When solid state sensors are wired in series or parallel, they must be of the same type. Do not mix NPN and PNP sensors when wiring them in series or parallel. When wiring solid state sensors in series, ensure that the total voltage drop across all sensors does not exceed the value mentioned above. Also, the power up delay for each sensor must be considered since the last sensor in line is not powered until the upstream sensor is closed. When wiring solid state sensors in parallel, the total leakage currents of all sensors must not exceed the maximum leakage current given above.

3.9.5 Die Protection Channel Miscellaneous Settings Screen

Touch inside the miscellaneous settings area (see "a" in Figure 53) to enter the miscellaneous settings screen for the channel. The number and type of parameters in this screen vary depending on the "Channel Type" selected for the channel. The screen shown in Figure 55 is a typical example for an "In Position" channel. The following subsections describe the parameters that may show up in this screen.

3.9.5.1 Stop Type

This selects the type of stop that should be generated if the die protection logic for the channel is not satisfied (i.e. there is an error). The available stop types for die protection channels are
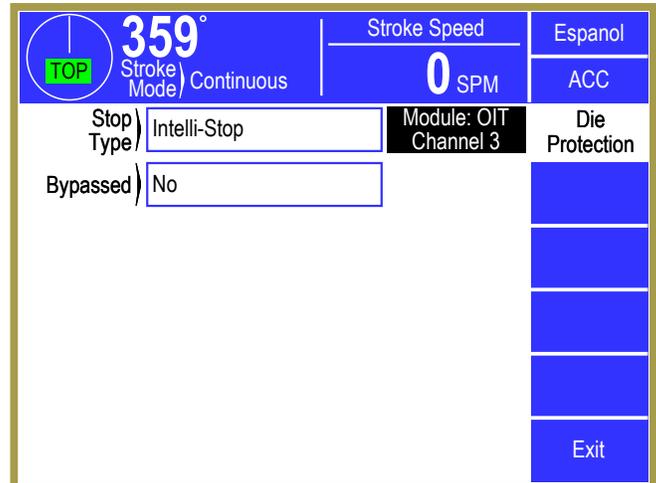
Figure 55: Die Protection Channel Misc. Settings Screen

"Immediate Stop", "Top Stop", and "Intelli-Stop". See Section 2.1 on page 15 for details on these stop types. The user must select a stop type appropriate for the process.

3.9.5.2 Bypassed

Each individual channel can be bypassed. When a channel is bypassed, it no longer monitors its input sensor. It will not send a stop signal to the press control if the input sensor fails to meet the requirements of the selected channel type.

When a channel is bypassed, its state on the die protection main screen will be displayed with a yellow background and its "Ch. State" will show "Bypassed". In addition the "Module Status" will display "One or More Channels Bypassed" highlighted in yellow.

3.9.5.3 Delay Time

This parameter is used by the "Static" and "Transfer" channel types only. This is the time that the system will delay after the detection of a channel fault until a stop signal is issued. If the channel remains in the fault condition for the length of the delay time, a fault will be issued. If the channel returns to a run condition before the full length of the delay time, a fault will not be issued. The maximum value of this delay time is 65535 milliseconds (65.535 seconds). If a delay time is not required, this parameter should be set to 0.

3.9.5.4   Delay Strokes

This parameter is used by the "Cyclic" channel type only. This is the number of strokes that can be made without satisfying the channel logic before a stop is asserted. This purpose of this delay is to accommodate events that may not occur every stroke, but will occur within some number of strokes. An example of such an application is slug detection, where under normal conditions slugs will build up and then fall out maybe two or three at a time. The delay counter allows the operator to enter a number representing the maximum number of strokes that can be run consecutively without the slug being detected within the timing window. If the sensor does not become active within the window for a number of strokes exceeding the counter number, then a fault will be generated. By contrast, if the sensor does become active within the window on some stroke before the counter expires, then the counter is reset and the full count is again allowed. If the operator desires that the sensor be required to become active on every stroke, then a value of zero should be entered into the counter. The maximum "Delay Strokes" value is 255.

3.9.5.5   Separation Time

This parameter is required for the "2 Part Detector Edge" and "2 Part Detector Pass" channel types. When a single sensor input is used to sense multiple parts, the operator must also program a "Separation Time". This is because some parts are irregularly shaped or have holes which may cause the detector to give multiple signals to the channel input for one part. To ensure that the detector counts only once for the first part, the module will wait through a programmed delay after seeing the first part before it begins to look for the next part. This programmed delay must be entered by the operator and is called "Separation Time". The range of allowed values for the separation time is 0 milliseconds to 9999 milliseconds in 1 millisecond increments. The proper value for a particular application will have to be determined by experimentation.

3.9.6   Die Protection Channel Window Angles Setting Screen

Touch inside the window angle area (see "b" in Figure 53) to enter the angle setting screen for the channel. Not all channel types use a timing window, and this area will not appear for those. The screen shown in Figure 56 is a typical example of this screen.

Figure 56: Die Protection Channel Angle Setting Screen

The blue arc in the circular angle display shows the timing window that is set for the channel, assuming the "Channel Type" requires one. The black arc in the circular angle display shows the actual angles where the sensor was "On" in the last full stroke (0 to 359 degrees). This could be displayed as more than one arc if the sensor turns "On" in multiple places in the stroke. The captured sensor angles are automatically updated every stroke. A small tick mark can be seen just inside the inner circle of the angle display shown in Figure 56 at around 160 degrees. This tick mark will only be shown if the "Stop Type" of the channel is set to "Intelli-Stop". It shows the actual angle, adjusted for speed, that will determine whether the channel generates an "Immediate Stop" or a "Top Stop" (see Section 2.1.5 on page 16 for more information about "Intelli-

Stop"). Likewise, in the center of the circle is the numeric readout of the Intelli-Stop angle that corresponds to the tick mark.

3.9.6.1   Window On and Window Off

These are the angular settings in degrees for the timing window.   These parameters are required for all channel types except Static. The permissible values are from 0º to 359º.

Once the timing window values are entered, they will be graphically displaced on the circular display in the lower right corner of the screen. The timing window duration will be highlighted in blue.

3.9.7   Die Protection Bypass Screen

Press the **Bypass** softkey in the die protection main screen (see Figure 51 on page 67) to display the bypass screen as shown in Figure 57. This screen allows the user to bypass the die protection system as a whole, or just individual sensors.

3.9.7.1   System Bypass

If configured to allow System Bypass (see Section 4.5.1.2 on page 165), the screen will display the **System Bypass** softkey. Press this softkey to bypass all the sensors on the die protection system – this effectively turns die protection off.
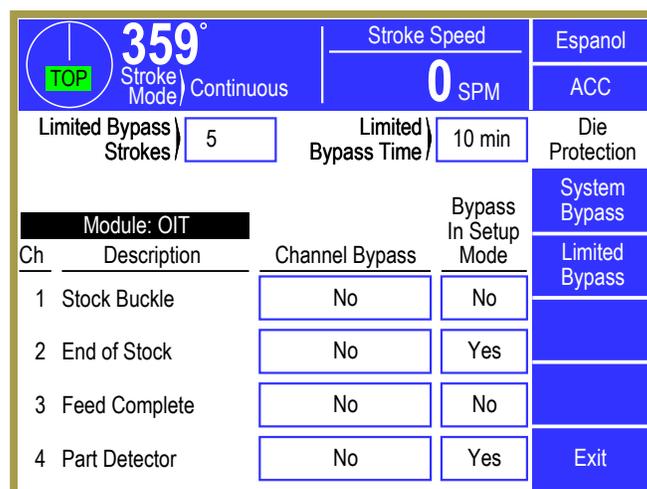
Figure 57: Die Protection Bypass Screen

When system bypass is active, the bypass softkeys change to a single **Cancel Bypass** softkey. Press the **Cancel Bypass** softkey to return the system to normal operation.

In addition to the manual removal of bypass, the unit can be configured to automatically switch off bypass when the press mode is switched from a setup mode (such as Inch or Timed Inch) to a production mode (such as Continuous). This is controlled by the "Auto Unbypass When Switching to Production Mode" parameter as described in Section 4.5.1.3 on page 166. The automatic un-bypass feature only removes the bypass when the press mode *changes* from a setup mode to a production mode. Once in production mode, any user who has been granted access to do so can again select system bypass.

While a system bypass is in effect, all channel states in the die protection main screen will be highlighted in yellow, the "Ch. Status" of each channel will display "Bypassed", and the "Module Status" will display "System Bypassed".

3.9.7.2   Stroke Limited Bypass

If "Limited Bypass Strokes" is greater than zero, a **Limited Bypass** softkey is shown. Press the **Limited Bypass** softkey to bypass all die protection channels for the number of press strokes shown for the "Limited Bypass Strokes" parameter. In addition to the number of strokes limit, a timer (the "Limited Bypass Time" parameter) may also be programmed to limit the time that the stroke limited

bypass remains in effect. Stroke limited bypass will be removed when the number of strokes is reached or when the time expires without making a stroke, whichever occurs first.

The "Limited Bypass Strokes" and "Limited Bypass Time" parameters can be no greater than the "Limited Bypass Maximum Strokes" and "Limited Bypass Maximum Time" parameters described in Section 4.5.1.1 on page 165.

When limited bypass is active, the bypass softkeys change to a single **Cancel Bypass** softkey. Press the **Cancel Bypass** softkey to return the system to normal operation.

In addition to the manual removal of bypass, the unit can be configured to automatically switch off bypass when the press mode is switched from a setup mode (such as Inch or Timed Inch) to a production mode (such as Continuous). This is controlled by the "Auto Unbypass When Switching to Production Mode" parameter as described in Section 4.5.1.3 on page 166. The automatic un-bypass feature only removes the bypass when the press mode *changes* from a setup mode to a production mode. Once in production mode, any user who has been granted access to do so can again select system bypass.

While a limited bypass is in effect, all channel states in the die protection main screen will be highlighted in yellow, the "Ch. Status" of each channel will display "Bypassed", and "Module Status" in the main die protection screen will display "Bypass (X Strokes Remaining)" with X showing how many strokes are left. The strokes remaining will count down as strokes are made.

3.9.7.3   Bypass In Setup Mode

Each individual channels can be configured to automatically bypass when the press mode is switched to a setup mode. These channels will automatically return to normal operation when the press is switched to a production mode - assuming that a system bypass or limited bypass is not in effect. To automatically bypass a sensor in a setup mode, set the parameter in the "Bypass In Setup Mode" column for the channel to "Yes". In the example of Figure 57, channels 2 and 4 set to automatically bypass in setup mode.

3.9.7.4   Channel Bypass

Each individual channel can be bypassed. When a channel is bypassed, it no longer monitors its input sensor. It will not send a stop signal to the press control if the input sensor fails to meet the requirements of the selected channel type. The "Channel Bypass" column in the screen of Figure 57 is the same as the "Bypassed" parameter that can be set in the miscellaneous settings screen (see Section 3.9.5.2 on page 71). It is repeated here for the convenience of setting all bypass parameters in one place.

3.9.8 Die Protection Diagnose Screen

Press the **Diagnose** softkey in the die protection main screen (see Figure 51 on page 67) to display the diagnostic screen as shown in Figure 58. This screen allows the user to diagnose the die protection channel.

The **Previous Channel** and **Next Channel** softkeys can be used page through the channels without going back to the Die Protection main screen.

The blue arc in the circular angle display shows the timing window that is set for the channel, assuming the "Channel Type" requires one. The black arc in the circular angle display shows the actual angles where the sensor was "On" in the selected stroke.

Figure 58: Die Protection Diagnose Screen

This could be displayed as more than one arc if the sensor turns "On" in multiple places in the stroke. The captured sensor angles are automatically updated every stroke. An "Angle Cursor" is displayed on the circular display and is controlled by the **Decrement Cursor** and **Increment Cursor** softkeys. A numeric readout of the cursor angle is shown in the center of the circle.

At the top of the screen the actual input voltage of the channel is displayed. To the right, in parentheses, is the on/off state of the input based on the current voltage and sensor type.

Below that is the number of "in window" transitions that occurred the last time through the timing window (or the current number of transitions if currently inside the window). This can be of help in diagnosing sensor bounce or setting separation times when using 2 part detector channel types.

On the left side of the screen is a list of "On:Off" angle pairs for the currently displayed stroke. Each entry in this list represents an event where the sensor turned on and back off. These are numeric values that correspond to the black arc or arcs that are shown in the circular display to the right.

When this screen is entered, the default display is the last full stroke (0 to 359 degrees). This means that if the current crank angle is at 45 degrees, the display is showing the data from the stroke before. The **Decrement Stroke** and **Increment Stroke** softkeys are used to change the stoke that is shown on the screen. This can range from the current stroke (0 degrees to the current angle) to as many as about 20 strokes back. The exact number of strokes back that can be viewed is dependent on the number of transitions that have occurred per stroke. The system stores the last 64 on/off transitions.

The **Overlay Strokes** softkey will cause all stored capture data from all strokes to be displayed on the angle display. This allows the user to view sensor variation in order to choose the timing window more reliably.
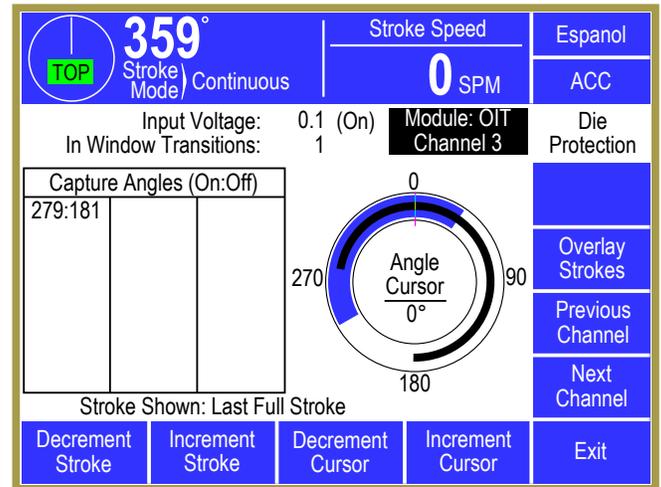
3.10   Job Setups

Touch the current Job display area in the Main Screen (see "a" in Figure 8 on page 35) to select the Job Setups screen shown in Figure 59. The parameters consisting of programmable limit switch settings, automatic feed settings, tonnage monitor settings, die protection settings, and other settings for the current job can be stored for later use. In addition, the settings for a job previously stored can be recalled into the current job.

The jobs can be arranged on the display in either alphabetical order by their description or in numerical order by job number by touching the **Sort By Number** / **Sort By Descrip.** softkey (this softkey toggles between the two descriptions).
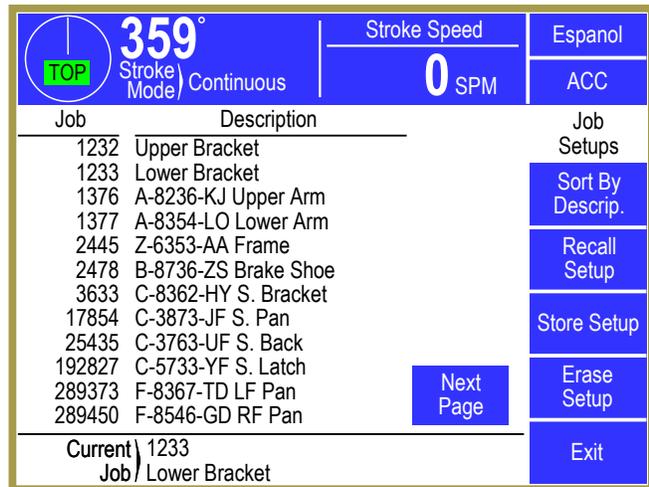
Figure 59: Jobs Screen

This screen allows selections to Recall a job setup, Store a job setup, or Erase a job setup as described in the following sections.

3.10.1   Store Setup

From the Jobs screen shown in Figure 59, touch the **Store Setup** softkey to display the screen shown in Figure 60. The Store Setup screen allows the user to place all settings for the job currently in use into the internal file storage area.

The user must have access control to change the parameters on this screen or store the job. Access control is described in Section 3.3 on page 30. If an access control mode is being used that requires a password, a user must be configured to have the "Store Jobs" permission to store a job.

The screen shown in Figure 60 allows the user to enter a new number under which the job will be
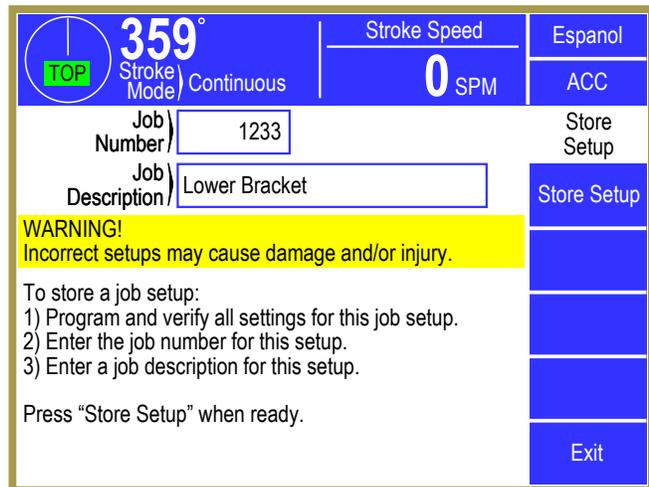
Figure 60: Store Jobs Screen

stored by selecting the "Job Number" field. This number must be unique to store to a new job. Entering a number already in use allows the current settings to replace the previous ones for that job number. After entering a job number, the "Job Description" field can be selected to enter an alphanumeric description. Press the **Store Setup** softkey in order to save the current job information in the internal file system under the job number and job description displayed. The operator terminal automatically returns to the Job Setups screen.

> **NOTE:** The "Current Job" is actually a separate job in the operator terminal. Changes made to the current job are *NOT* automatically made to the stored job. The user must intentionally store the new settings over the old job number if those settings are to be saved permanently under that job number. The "Current Job" does keep the changes that are made until a new job is recalled over it. This allows the stored job to keep a set of baseline parameters that may need minor tweaks (for material thickness variation, for example).

3.10.2 Recall Setup

From the Job Setups screen shown in Figure 59, touch the **Recall Setup** softkey to display the Recall Setup screen shown in Figure 61. If enough jobs are stored to take more than one page to display then **Next Page** and **Previous Page** softkeys will allow additional pages of jobs to be displayed to locate the page that the job is on.

Use the up and down arrow keys to move the highlight cursor to the desired job and then touch the **Recall Selected** softkey to recall the job.

If the job number to recall is already known, the **Recall By Job Num** softkey allows the user to enter the desired job number directly into the operator terminal, which automatically searches the file system and, if located, retrieves the job.
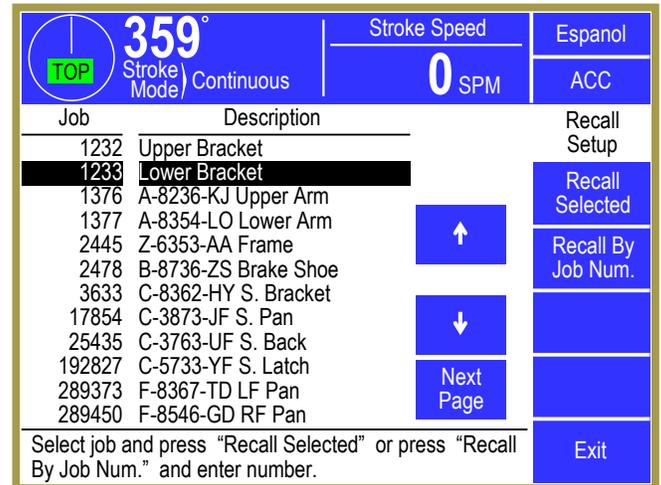
Figure 61: Recall Jobs Screen

For either recall method described above, the operator terminal will ask for confirmation from the user before actually recalling the job.

The user must have access control to perform a job recall. Access control is described in Section 3.3 on page 30. If an access control mode is being used that requires a password, a user must be configured to have the "Recall Jobs" permission to recall a job.

3.10.3 Erase Setup

From the Jobs screen shown in Figure 59, touch the **Erase Setup** softkey to display the Erase Jobs screen. The Erase Jobs screen allows the user to select the job with arrow keys or enter the job number that is to be erased in the same manner as the Job Recall screen does (with **Erase Selected** and **Erase By Job Num.** softkeys).

The operator terminal will ask for confirmation from the user before actually erasing the job.

The user must have access control to perform a job erase. Access control is described in Section 3.3 on page 30. If an access control mode is being used that requires a password, a user must be configured to have the "Erase Jobs" permission to erase a job.

4 CONFIGURATION

4.1 Turning Devices On and Off in the Device Config Screen

Some systems, including the System 5100 Press Control, the 805 Die Protection, and the 805 Tonnage Monitor are optional – or optionally used. Before anything can be configured on these devices, the operator terminal must be made aware that they are installed or intended for use. Press the **ACC** softkey (near the upper right corner of the display) to display the "Quick Access" screen. With the RUN/PROG key in the PROG position, the lower left hand softkey should show as **Device Config**. Press this softkey and enter the system configuration code to gain access to the device config screen as shown in Figure 62. This screen contains a list of the options that can be used with the operator terminal.
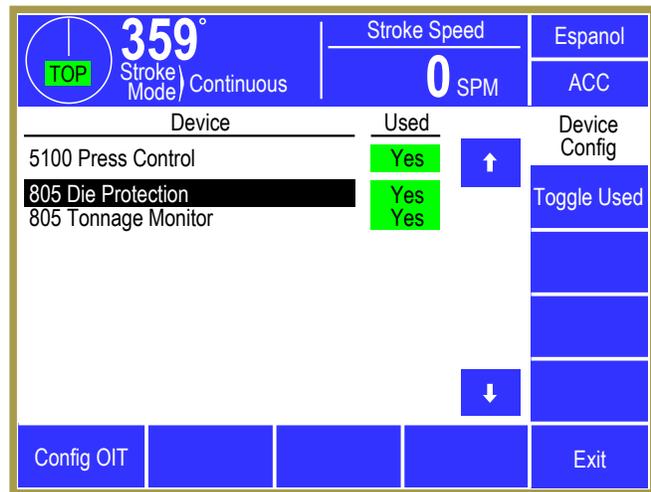
Figure 62: Device Config Screen

Using the arrow keys, highlight the device to be used (or set to unused). Press the **Toggle Used** softkey to change whether or not the highlighted device is "Used".

4.2 Press Control Configuration

The System 5100 control has multiple layers of security relative to configuration of its logical operation of hardware and software and ability to program parameters. The highest level of security is applied to the Factory Configuration items that configure the control before it leaves the factory for the specific press production systems and options specified by the purchaser. Factory configuration items can be changed in the field, but only by consulting Link Systems, getting approval for the change as necessary and safe, and using a one-time access process to change the item using a challenge response method.

In addition, the System 5100 control provides a second level of security - User (Employer) Configuration items that give the user the ability to configure certain aspects of the system to meet the security, information, safety, and production requirements or preferences for the press on which the control is used. The configuration screens are accessible only from the Press Control screen shown previously in Figure 9 on page 36. If the main screen of the operator terminal displays "Option Not Installed" under the "Press Control" area, then "5100 Press Control" should be turned on in the Device Config screen (see Section 4.1 for how to do this). The **Configure** softkey only appears on the Press Control screen when the RUN/PROG switch is in the PROG position and, when touched, the display will ask for the
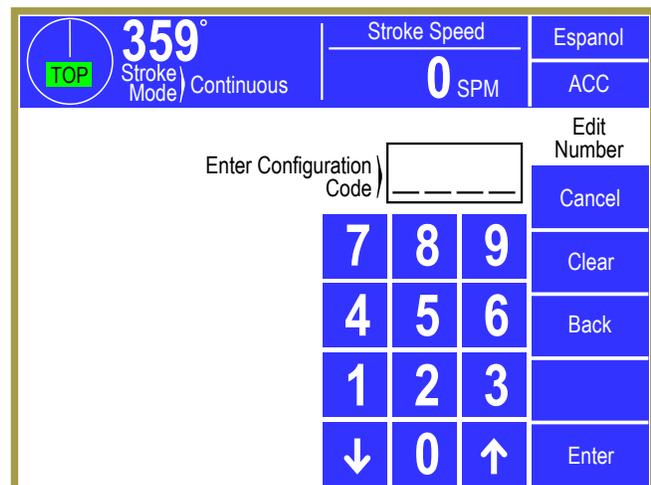
Figure 63: Configuration Code Entry Screen

Configuration code as shown in Figure 63. This Configuration code is user programmable. The original code is sent from the factory to a designated person when the control is ordered. The user has the option of keeping the original code or changing to another. The user must record and protect the current code. This code must be provided only to qualified personnel with knowledge of any safety related requirements for items to be configured (see Section 4.3.4.6).

If the User Configuration code is entered correctly, the selection softkeys shown in Figure 64 are presented. Touching a softkey will result in the display of the associated configuration screen. The configuration screen that appears may have both Factory Configuration items and User Configuration items displayed. If the user touches a Factory Configuration area of the screen the message "Factory Parameter – View Only" will appear

Once access to the configuration screen has been granted, the RUN/PROG switch may be switched back and forth between PROG and RUN. The configuration mode will remain in effect until exited by the user, returning the display to the Press Control screen.
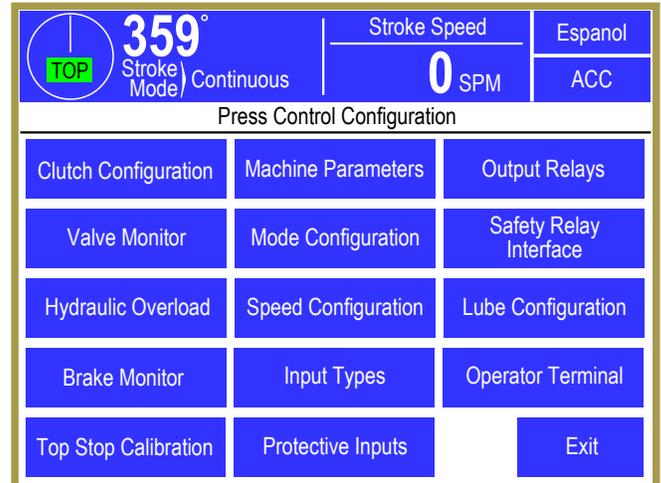
Figure 64: Main Press Control Configuration Screen

4.2.1 Clutch Configuration

The Clutch Configuration screen is accessed by touching the **Clutch Configuration** softkey in the Press Control Configuration screen (see Figure 64 on page 79). This screen (shown in Figure 65) allows adjustments to be made to certain clutch/brake functions. The last three parameters are User Configurable, typically set when the press control is installed.

The System 5100 clutch/brake control incorporates motion detection logic for safety and diagnostic purposes. The parameters "Motion Threshold" and "Loss of Motion Time" are used to determine that the crankshaft is turning when the clutch is engaged and that the System 5100 resolver/encoder that provides crankshaft angular information to the control is coupled to, and turning with the crankshaft.
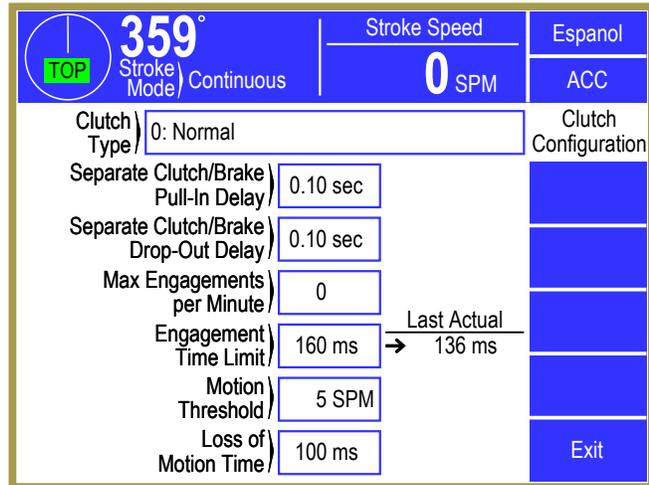
Figure 65: Clutch Configuration Screen

One use of Motion Detection is to detect failure of the resolver/encoder coupling to the crankshaft that can cause the press control to lose stroke position information and may result in the unintended stroking action of the press. If the RPM of the resolver/encoder drops below the "Motion Threshold" setting for a period longer than the "Loss of Motion Time" for any reason, the control will execute a stop output to the clutch/brake valve(s) and will give a diagnostic message of *Motion Stopped* on the "Reason for the Last Stop" in the Press Control screen.

4.2.1.1   Clutch Type

"Clutch Type" is a Factory Configuration parameter.

Type 0   Normal

> This setting configures the press control for a clutch and brake system that is operated by a single dual valve or by separate dual valves for the clutch and brake that are be operated at the same time by driving their solenoids in parallel with the single standard pair of safety relays provided by the System 5100 control.
>
> The "Separate Clutch/Brake Pull-In Delay" and "Separate Clutch/Brake Drop-Out Delay" times are not used for Type 0 but will be set the same between the two press control channels. Both times should be set to 0.10 seconds at the factory.

> **NOTE:** On some larger presses, where two separate dual valves are turned on at the same time, the clutch may engage before the brake is released, causing excessive friction wear and heat in both clutch and brake. Similarly, if two separate valves for the clutch and brake are turned off at the same time, the brake may engage before the clutch releases, causing an excessive friction wear and heat problem. The "Clutch Type" should be set to Type 1 or Type 2 at the factory for these presses.

On presses with two separate valves for the clutch and brake that result in the foregoing clutch brake overlap on start and stop, the System 5100 control provides an optional second pair of dual safety relays so that the solenoids of the two valves may be driven separately. The control then allows the brake valve to be energized first and then the clutch valve to be energized after a settable "Pull-in Delay" to prevent overlap on start-up. Similarly, a "Drop-Out Delay" can be set to de-energize the clutch valve first and then the brake valve to prevent overlap when stopping stroking action of the press.

Type 1   *Separate Clutch/Brake 1*

This setting is intended for press controls that provide two separate pairs of safety relay outputs to drive separate clutch and brake valves. This requires an optional 5100-3A Relay Board that has relay outputs for both the clutch valve and the brake valve (see Figure 82). This configuration type will initiate a drop-out delay sequence only during an automatic stop at top. When configured for this type, a start sequence is initiated at engagement where the brake output (C/B 2) is turned "On" to release the brake and a "Separate Clutch/Brake Pull-In Delay" time is used to delay turning "On" the clutch output (C/B 1). When an automatic stop on top is performed the sequence is reversed. The clutch output (C/B 1) is first turned "Off" at the speed advanced top stop angle (for variable speed presses), and a "Separate Clutch/Brake Drop-Out Delay" time is used to delay turning "Off" the brake output (C/B 2). The pull-in time can be set from 0.02 seconds to 0.98 seconds. The drop-out time can be set from 0.00 seconds to 0.98 seconds. A stop due to any reason other than an auto stop on top will not initiate the stopping sequence, but instead will turn both the brake and the clutch outputs "Off" immediately.

> **NOTE:** If the delay times are set too low, clutch and brake overlap may still occur. If set too high, both the clutch and brake may be "Off" for a short period of time. While these delay times will be set at the factory, it may be necessary to use the challenge response method to change them at the time of control installation.

Type 2   *Separate Clutch/Brake 2*

This setting is intended for press controls that separately drive clutch and brake valves, and instructs the press control to implement the same start and stop sequences as described in Type 1. However, this setting will cause the stop delay sequence described in Type 1 to be used for all stops except master stop (which never uses a delay sequence).

4.2.1.2   Max Engagements per Minute

This parameter limits the maximum number of times that the clutch/brake valve can be energized and de-energized in any one minute interval. This option is typically used to prevent excessive heating of

the clutch. A one minute timer is started upon the first activation of the clutch valve and the number of re-activations is monitored. If the operator attempts to disengage and then re-engage the valve more than this programmed number of settings within the time interval, the press control will automatically inhibit further stroking for the remainder of the 1 minute and the present running status will display *Max. Engagements per Minute Delay*. This monitor also applies to Timed Inch mode in which case the number of automatic pulses at the bottom of the stroke cannot exceed this programmed limit. The limit can be set from 0 to 254. This option is turned off by setting the parameter to 0.

4.2.1.3   Engagement Time Limit

The "Engagement Time Limit" is a User Configurable parameter. Every time a stroke is initiated with the main motor running in the forward direction the press must establish crankshaft motion greater than the "Motion Threshold" within the time set by this parameter. Failure to do so will result in an immediate stop and the reason for last stop will display *Motion Did Not Start*. The stroke initiation time includes a wiring fault test, which is performed by the two channels of the press control. This test will add about 60 milliseconds to the time that the press takes to establish motion. This time will also include the "Separate Clutch/Brake Pull-In Delay" time if configured for such operation. This parameter can be set from 0 to 996 milliseconds.

4.2.1.4   Motion Threshold

The "Motion Threshold" is a User Configurable parameter. Crankshaft SPM (RPM) must exceed the "Motion Threshold" at stroke initiation if the main motor is running in the forward direction. It must maintain motion above this limit while the press is stroking (see also "Loss of Motion Time" in the next section). Failure to establish motion will result in an immediate stop and the reason for the last stop will display *Motion Did Not Start*. Failure to maintain motion above this threshold while stroking will result in an immediate stop and the reason for last stop will display *Motion Stopped*. Whenever slide motion is at rest and the press control is not energizing the clutch/brake valve(s), crankshaft motion must remain below this threshold. If motion above the threshold occurs for greater than 0.1 seconds it will result in the LMC relays turning "Off" to de-energize the drive motor as well as power to the clutch/brake valves. The present running status will display *Motion Before Start* and the **Reset** softkey must be pressed before the LMC will turn back "On". This parameter can be set from 0 to 100 SPM and generally should be set 10% to 30% below the slowest normal stroking speed of the press.

4.2.1.5   Loss of Motion Time

The "Loss of Motion Time" is provided because mechanical backlash of drive system components can cause the crankshaft to turn in jerky motion, falling below the motion threshold for very brief periods of time. The "Loss of Motion Time" setting is chosen to prevent nuisance stopping by permitting crank RPM to drop below the "Motion Threshold" for brief periods of time without the assertion of a stop.

This parameter is a User Configurable item and can be set from 0 to 508 milliseconds. For typical applications this parameter should be set to:

$$\text{Time (in milliseconds)} = 3500 / \text{Max SPM}$$

4.2.2   Soft Clutch / Soft Brake Valve Operation

The typical soft clutch/brake valve contains both a Soft Clutch and a Soft Brake function. However, the characteristics of the Soft Clutch and the Soft Brake operation are configured separately in order to allow for variations in the type of valve used or for situations where only Soft Clutch or only Soft Brake is performed.

The following sections detail the settings needed to properly configure a Soft Clutch / Soft Brake scenario. These settings are found on the Clutch Configuration screen as shown in Figure 65 by using the **Next Page** and **Previous Page** softkeys.

4.2.2.1   Soft Clutch Type

This parameter allows for different variations of soft clutch/soft brake valves. If configured as "0: Not Used", the soft clutch output (Output Relay Type 85) will remain off and Input 79 is a configurable input. If soft clutch is configured as any type other than "0: Not Used", Input 79 is designated as a feedback input and cannot be used for any other function.

The following types can be set:

Soft Clutch Type 0:   Not Used

> Soft Clutch is not used.

Soft Clutch Type 1:   ON at Start

> One example of this type of valve is a Herion Hyrdualic Press Safety Valve with Soft Clutch and Soft Brake.

> This type of valve requires Clutch/Brake Output 1 to turn on the dual solenoids at engagement. The valve has proximity sensors on both poppets. Valve Monitor Type 1 is used to monitor the sensors. The valve monitor provides programmable feedback timers for valve turn on and valve turn off (see Section 4.2.4). The valve has an additional solenoid that is energized for soft clutch (see Figure 66). If a stroke is initiated in modes that perform soft clutch and initiation occurs above the "Soft Clutch Disable Point", output type 85 will turn on about 100mS prior to the C/B 1 output turn on. The output will remain on for a programmable "Soft Clutch "On" Time" after C/B 1 turns on. The combination of Output Relay Type 85 and C/B 1 is required to energize the soft clutch solenoid. Output Relay Type 85 will turn off to command full clutch pressure for the remainder of the stroke. Modes that do not perform soft clutch include Inch, Timed Inch, Bar, Micro Inch, and Clutch/Brake Test mode.

> Input 79 is provided to monitor the feedback of the soft clutch solenoid. The feedback can be configured with the "Soft Clutch Feedback Type" for Normal (input is high when the output is high), or Inverted (input is low when the output is high). The feedback must switch to the correct state within the "Soft Clutch Feedback Time" or a fault is generated. The message *I79 Soft Clutch Track On Fault* indicates that the input did not switch and remain at the correct state when Output Relay Type 85 turns On. The message *I79 Soft Clutch Track Off Fault* indicates that the input did not switch and remain at the correct state when Output Relay Type 85 turns Off. The "Soft Clutch Feedback Type" can be configured as "Not Used" if the valve does not provide feedback.
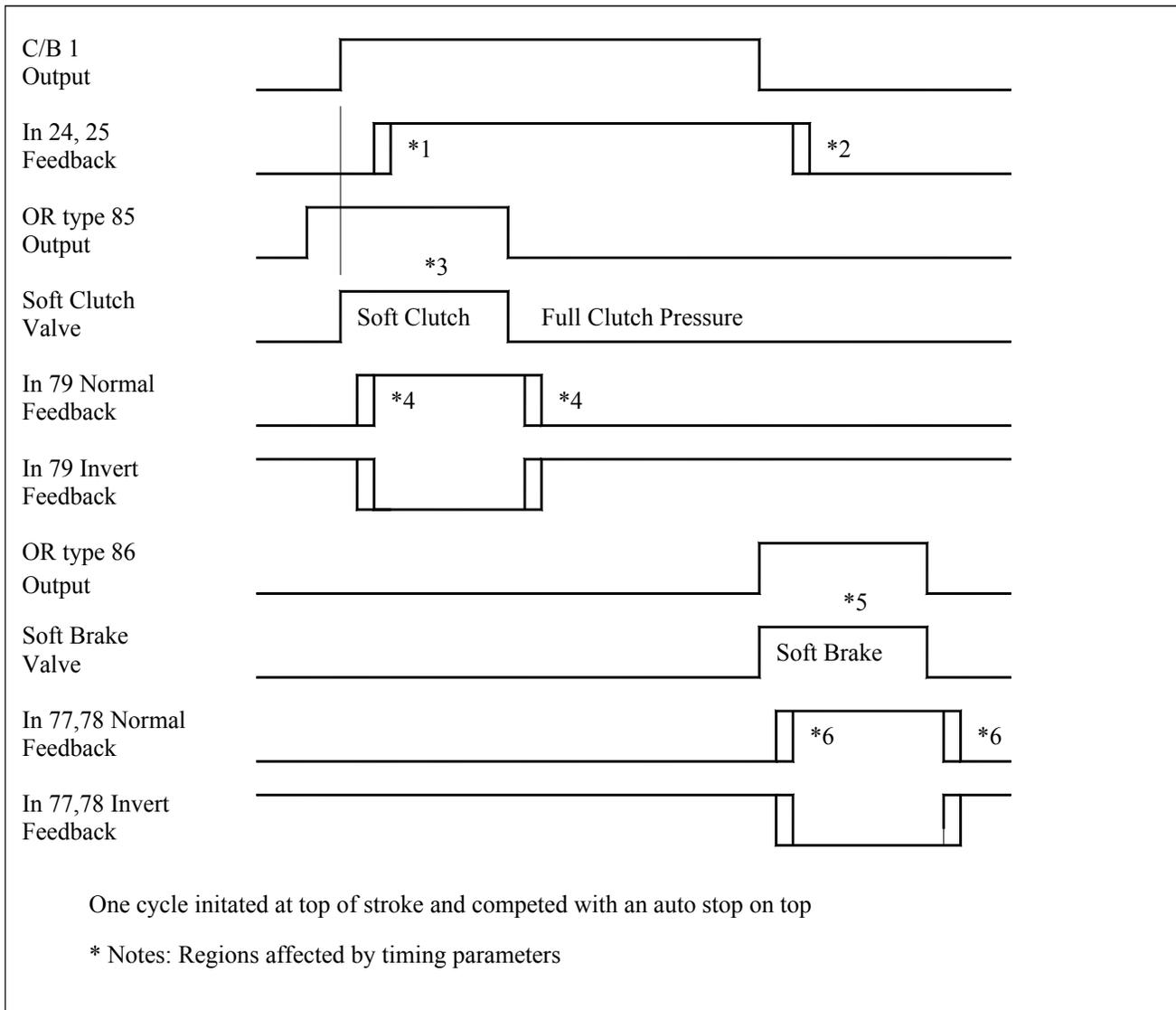
Figure 66: Soft Clutch Type 1 Timing with "Soft Brake Type" set to "Used"

Notes for Figure 66: These regions are affected by the following time parameters.

1. Valve Monitor Type 1 Turn On time.
2. Valve Monitor Type 1 Turn Off time.
3. Soft Clutch "On" time.
4. Soft Clutch Feedback time.
5. Soft Brake "On" time (unless velocity goes below 2rpm).
6. Soft Brake Feedback time.

Soft Clutch Type 2:   OFF at Start

One example of this type of valve is an Orttech (Ortlinghaus) Hydrualic Press Safety Valve with MKB Valve.

This type of valve requires Clutch/Brake Output 1 to turn on the dual solenoids at engagement. The valve has proximity sensors on both poppets. Valve Monitor Type 1 is used to monitor the sensors. The valve monitor provides programmable feedback timers for valve turn on and valve turn off (see Section 4.2.4). The valve has an additional solenoid that remains off at engagement to soft clutch and turns on to command full clutch pressure (see Figure 67). If a stroke is initiated in modes that perform soft clutch and initiation occurs above the "Soft Clutch Disable Point", Output Relay Type 85 will remain Off for a programmable "Soft Clutch "On" Time" after C/B 1 turns on. The combination of Output Relay Type 85 and C/B 1 is required to energize the soft clutch solenoid. Output Relay Type 85 will then turn On to command full clutch pressure for the remainder of the stroke. Modes that do not perform soft clutch include Inch, Timed Inch, Bar, Micro Inch, and Clutch/Brake Test mode.

Input 79 is provided to monitor the feedback of the soft clutch solenoid. The "Soft Clutch Feedback Type" can be configured for "1: Normal (Active Hi)", or "2: Inverted (Active Lo)". Unlike the Soft Clutch Type 1 configuration, this monitor operates only during the time C/B 1 is On. Outside of this time, the feedback can be in either state. The feedback must switch to the correct state within the "Soft Clutch Feedback Time" or a fault is generated. Because the soft clutch is on while Output Relay Type 85 is Off, the message *I79 Soft Clutch Track On Fault* indicates that the input did not switch and remain at the soft clutch state while Output Relay Type 85 is Off. The message *I79 Soft Clutch Track Off Fault* indicates that the input did not switch and remain at the full clutch pressure state after Output Relay Type 85 turned On. The "Soft Clutch Feedback Type" can be configured as "0: None" if the valve does not provide feedback.

C/B 1
Output

In 24, 25
Feedback   *1   *2

OR type 85
Output

Soft Clutch   *3
Valve   Soft Clutch   Full Clutch Pressure

In 79 Normal
Feedback   *4   *4

In 79 Invert
Feedback

OR type 86
Output   Soft Brake

Soft Brake
Valve   *5

In 77,78 Normal
Feedback   *6   *6

In 77,78 Invert
Feedback

One cycle initiated at the top of stroke and completed with an auto stop on top

* Notes: Regions affected by timing parameters
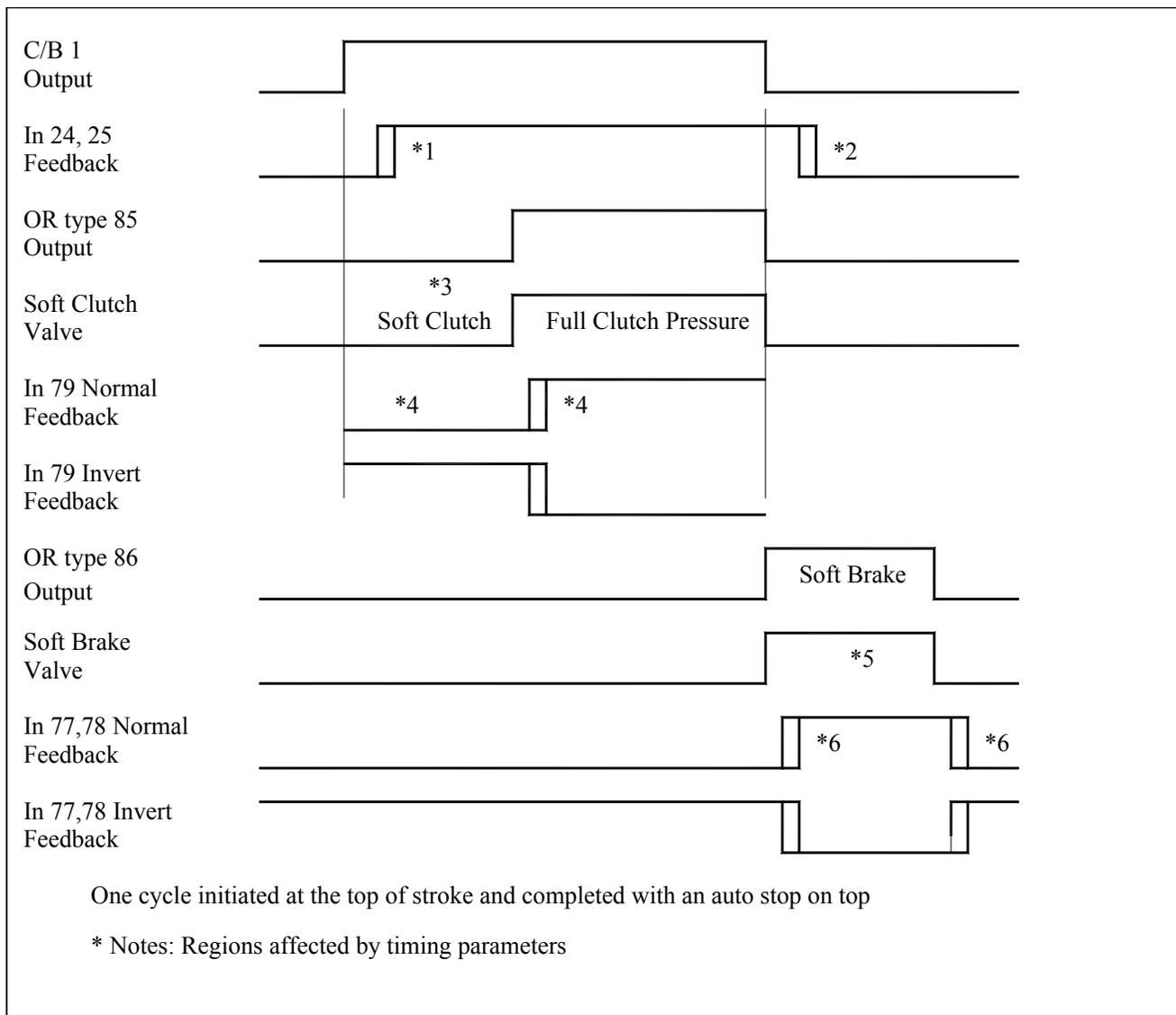
Figure 67: Soft Clutch Type 2 Timing with "Soft Brake Type" set to "Used"

Notes for Figure 67: These regions are affected by the following time parameters.

1. Valve Monitor Type 1 Turn On time.
2. Valve Monitor Type 1 Turn Off time.
3. Soft Clutch "On" time.
4. Soft Clutch Feedback time.
5. Soft Brake "On" time (unless velocity goes below 2rpm).
6. Soft Brake Feedback time.

Soft Clutch Type 3:   ON at Start and during Soft Brake

This type is intended to be used only with an Ortlinghaus Progressive Clutch/Brake Control PC 20, and requires a specific "Clutch Type" to be configured.

Unlike most soft clutch/soft brake valves, this type of valve requires an output that turns on at clutch engagement and remains On during the soft brake process (see Figure 3). This requires the "Clutch Type" to be set to Type "3: Ortlinghaus PC-20" and that Clutch/Brake Output 2 be used to turn on the dual solenoids at engagement. The "Separate Clutch/Brake Pull-In Delay" parameter should be set to .02 seconds. The "Separate Clutch/Brake Drop-Out Delay" parameter should be set to apply the soft brake long enough for crank motion to stop (at the end of that delay the system will Hard Brake). The soft brake output will turn on at the speed advance top stop point (see top stop calibration screen). Due to the timing requirements of this valve, an external force guided relay is used to energize three solenoids within the valve during the soft brake process. The normally closed contact of that relay must be wired into Inputs 77 and 78 and the "Soft Brake Feedback Type" must be set to "1: Inverted (Active Lo)".

The dual valve has proximity sensors on both poppets. Valve monitor Type 7 is used to monitor the sensors on inputs 24 and 25. The valve monitor provides programmable feedback timers for valve turn on and valve turn off (see Section 4.2.4). The valve has an additional solenoid that is energized for soft clutch. If a stroke is initiated in modes that perform soft clutch and initiation occurs above the "Soft Clutch Disable Point", Output Relay Type 85 will turn On about 100 milliseconds prior to the C/B 2 output turn on. The output will remain On for a programmable "Soft Clutch "On" Time" after C/B 2 turns on. The combination of Output Relay Type 85 and C/B 2 is required to energize the soft clutch solenoid. After the soft clutch duration, Output Relay Type 85 will turn Off to command full clutch pressure for the remainder of the stroke. Modes that do not perform soft clutch include Inch, Timed Inch, Bar, Micro Inch, and Clutch/Brake Test mode.

The "Soft Clutch Type" should be set to "3: On at Start and during Soft Brake". Input 79 is provided to monitor the feedback of the soft clutch solenoid. The "Soft Clutch Feedback Type" feedback should be configured for "1: Normal (Active Hi)". The feedback must switch to the correct state within the "Soft Clutch Feedback Time" or a fault is generated. The message *I79 Soft Clutch Track On Fault* indicates that the input did not switch and remain at the correct state when Output Relay Type 85 turns On. The message *I79 Soft Clutch Track Off Fault* indicates that the input did not switch and remain at the correct state when Output Relay Type 85 turns Off. A requirement of this valve is that the soft clutch solenoid must be energized during the soft brake interval. In order to meet the timing requirements of the valve, this is done in external hardware by wiring the relay driven by the soft brake output in parallel with the soft clutch output. This will cause the feedback Input 79 to turn On even though the soft clutch Output Relay Type 85 is off, but will not generate a fault in this type of monitor.
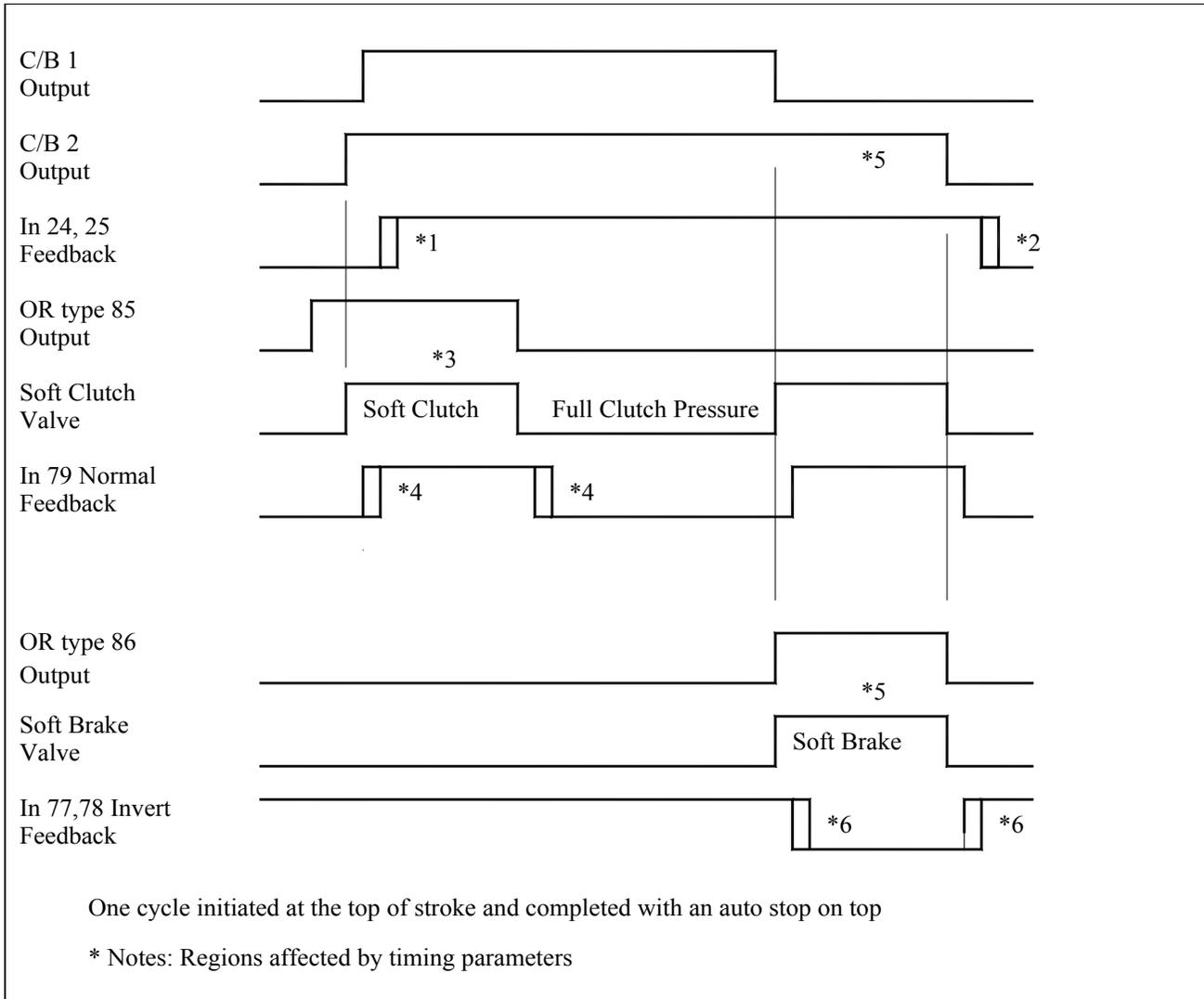
Figure 68: Soft Clutch Type 3 Timing with "Soft Brake Type" set to "Used"

*** Notes for Figure 68: These regions are affected by the following time parameters.**

1. Valve Monitor Type 7 Turn On time.
2. Valve Monitor Type 7 Turn Off time.
3. Soft Clutch "On" time.
4. Soft Clutch Feedback time.
5. "Separate Clutch/Brake Drop-Out Delay" time
6. Soft Brake Feedback time.

4.2.2.2   Soft Clutch Feedback Type

This parameter defines how the soft clutch is monitored, if the valve has a sensor for feedback. If no sensor exists, the parameter should be set to "0: None" and no feedback monitor is performed. Type "1: Normal (Active Hi)" feedback should be used if the sensor switches high when Output Relay Type 85 and C/B 1 are both ON. Type "2: Inverted (Active Lo)" feedback should be used when the sensor switches high when Output Relay Type 85 is off while C/B 1 is on (see Figure 66, Figure 67, and Figure 68).

4.2.2.3   Soft Clutch Feedback Time

This parameter defines the amount of time that the soft clutch feedback (Input 79) requires to switch when the soft clutch solenoid (Output Relay Type 85) is turned on or off. It also applies to the amount of time that the input can switch to an incorrect state when the output is static. If the input fails to switch or remain in the correct state for this time, a fault is generated. This will generate an immediate stop and require the **Reset** softkey to be pressed in the Press Control screen. The time is programmable from 20 milliseconds to 600 milliseconds in increments of 10 milliseconds. This time is limited to no more than 10 milliseconds less than the "Soft Clutch "On" Time", and should be set to the minimum required to monitor the feedback.

4.2.2.4   Soft Clutch "On" Time

This parameter defines the amount of time that the soft clutch will engage at stroke initiation. Note that some types of soft clutch valves require an output to energize a solenoid during this time (see Figure 66). Other types require an output to remain off until this time has expired (see Figure 67). The time is programmable from 20 milliseconds to 600 milliseconds in increments of 10 milliseconds.

4.2.2.5   Soft Clutch Disable Point

This parameter defines a region around zero degrees that the soft clutch will engage at stroke initiation, if the mode allows soft clutch. For example, if the disable point is set to 90 degrees the soft clutch will be applied if initiation occurs anywhere from 270 degrees to 90 degrees. The soft clutch will remain on for the programmed "Soft Clutch "On" Time". If below the disable point, the soft clutch will not engage and the valve will turn on at full clutch pressure. Modes that do not perform soft clutch include Inch, Timed Inch, Bar, Micro Inch, and Clutch/Brake Test mode.

4.2.2.6   Soft Brake Type

This parameter configures the soft brake operation. If configured as "0: Not Used", the soft brake Output Relay Type 86 will remain Off and inputs 77 and 78 are configurable inputs. If "Soft Brake Type" is configured as "1: Used", Inputs 77 and 78 are designated as feedback inputs and cannot be used for any other function. The soft brake Output Relay Type 86 turns On only during an automatic stop at top when C/B 1 turns Off at the speed advanced top stop point (see Figure 66, Figure 67, and Figure 68). Soft brake is not performed in Bar, Micro Inch, Clutch/Brake Test, or Setup/Stop Time Test modes.

4.2.2.7   Soft Brake Feedback Type

This parameter defines how the soft brake feedbacks (Inputs 77, 78) are monitored. Feedbacks that switch high when Output Relay Type 86 is ON should be set to "0: Normal (Active Hi)" and feedbacks that switch low should be set to "1: Inverted (Active Lo)". Soft brake feedbacks cannot be turned off if a soft brake is configured as used.

4.2.2.8   Soft Brake Feedback Time

This parameter defines the amount of time that the soft brake feedback requires to switch when the soft brake (Output Relay Type 86) is turned On or Off. It also applies to the amount of time that the inputs can switch to an incorrect state when the output is static. If either input fails to switch or remain in the correct state for this time, a fault is generated. This will generate an immediate stop, turn the LMC Off, and require the **Reset** softkey to be pressed in the Press Control screen. The time is programmable from 20 milliseconds to 600 milliseconds in increments of 10 milliseconds. If the clutch type is set to Type "3: Ortlinghaus PC-20", the maximum is limited to 150 milliseconds.   This time should not be set greater than the "Soft Brake "On" Time", and should be set to the minimum required to monitor the feedback.

4.2.2.9   Soft Brake "On" Time

This parameter defines the maximum amount of time that the soft brake Output Relay Type 86 remains On when used with "Soft Clutch Type" set to "1: ON at Start" or "2: OFF at Start" (see Figure 66 and Figure 67). The soft clutch output will turn Off before this time expires when crankshaft velocity goes below 2rpm.   The time is programmable from 20 milliseconds to 600 milliseconds in increments of 10 milliseconds. This parameter is not used when "Soft Clutch Type" is set to "3: ON at Start and during Soft Brake".

4.2.2.10   Soft Brake Fault Messages

Error message *I77 Soft Brake Track On Fault* indicates that Input 77 did not switch and remain at the correct state when Output Relay Type 86 turns On. Error message *I78 Soft Brake Track On Fault* indicates that Input 78 did not switch and remain at the correct state when Output Relay Type 86 turns On.

Error message *I77 Soft Brake Track Off Fault* indicates that Input 77 did not switch and remain at the correct state when Output Relay Type 86 turns Off. Error message *I78 Soft Brake Track Off Fault* indicates that Input 78 did not switch and remain at the correct state when Output Relay Type 86 turns Off.

Error message *Soft Brake Over-Run* indicates that the press traveled past 9 degrees while performing a soft brake. The Over-Run monitor is activated anytime the soft brake is turned on and remains active until crankshaft velocity goes below 2rpm. This monitor will generate a fault if the press does not stop before 10 degrees.

All soft brake faults will turn the LMC off and require the **Reset** softkey to be pressed in the Press Control screen.

4.2.3 Stopping Time Performance (Brake) Monitor Configuration

The Brake Monitor screen is accessed by touching the **Brake Monitor** softkey in the Press Control Configuration screen (see Figure 64 on page 79). This screen (shown in Figure 69) allows changes to be made to the brake monitor.

Each time the press stops a time based brake monitor (2 millisecond resolution) measures the time from deactivation of the clutch/brake valve until crankshaft rotation is less than 1.8 RPM. An additional 8 milliseconds is added to this measured value to compensate for the maximum reaction time of the control.

Separate limits are provided for monitoring the stopping time at the top of the stroke ("Brake Monitor Top Stop Limit") or at any position other than top ("Brake Monitor Mid Stroke Stop Limit").
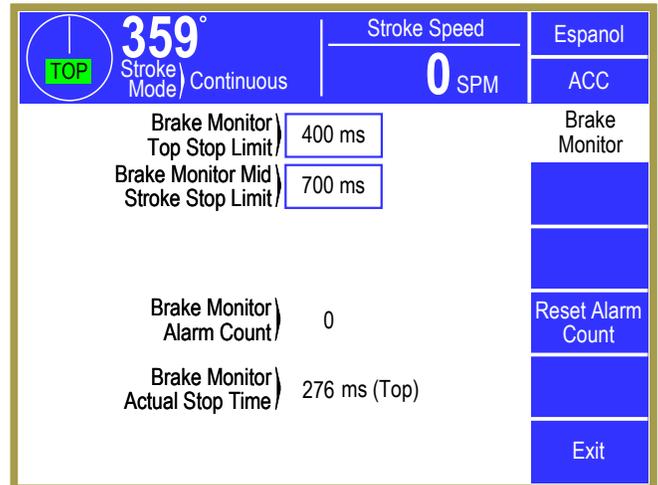
Figure 69: Brake Monitor Configuration Screen

WARNING:	When your press is equipped with two-hand control safety devices and/or presence sensing devices for point of operation protection, only qualified personnel with a knowledge of current ANSI (B11.1) standards and OSHA (CFR 1910.217) regulations or other applicable regulations in a venue that govern the relationship between stopping time and the distance at which two-hand control and/or presence sensing devices are to be located should set or reset stop limits for the brake monitor. These limits must *never* be set for longer times than the time that the safety distance in these standards is based on.

4.2.3.1 Brake Monitor Top Stop Limit

This is a User Configuration parameter that sets the maximum time allowed for the press to come to rest when automatically stopped at the top of the stroke. If the measured stop time exceeds this limit the operator must acknowledge the fault by pressing the **Reset** softkey before any further strokes can be initiated. Since this limit applies only when the press is being automatically stopped at the top of the stroke, it can be set close to the actual top stop time required (which is often less than the time to stop at mid downstroke and can be used to detect a small increase in top stop time. The stopping time to which the limit applies includes the "Separate Clutch/Brake Drop-Out Delay" time if configured for a separate clutch/brake. This limit can be set from 20 to 1000 milliseconds.

4.2.3.2 Brake Monitor Mid Stop Limit

This User Configuration parameter sets the maximum time allowed for the press to come to rest when stopped anywhere in the stroke except the top. If the measured stop time exceeds this limit the operator must acknowledge the fault by pressing the **Reset** softkey before any further strokes can be initiated. Since this limit applies to when the press is stopped in the downstroke, it establishes the maximum

allowable stopping time of the press and can be used to determine the minimum safety distance for two hand control and light curtain safety devices as required by OSHA 1910.217 regulations and current ANSI B11.1 standards. The Setup/Stop Time Test stroking mode can be used to determine the maximum stopping time of the press (see Section 2.5.1 on page 18). The stopping time to which the limit applies includes the "Separate Clutch/Brake Drop-Out Delay" time if configured for a separate clutch/brake. This limit can be set from 20 to 1000 milliseconds.

4.2.3.3   Brake Monitor Alarm Count

An alarm counter maintained in nonvolatile memory increments each time a brake monitor alarm occurs. This counter can be viewed in the press control diagnostic screen and can only be reset in this screen by touching the **Reset Alarm Count** softkey.

4.2.4 Valve Monitor Configuration

The Valve Monitor screen is accessed by touching the **Valve Monitor** softkey in the Press Control Configuration screen (see Figure 64 on page 79). This screen (shown in Figure 70) allows for Factory Configuration of the type of clutch/brake valve monitor that is to be used and the parameters associated with each type of monitor.

4.2.4.1 Valve Monitor Type

Inputs are provided for monitoring the clutch/brake dual air valve. Since there are different valve mechanisms, the internal monitor can be configured by the factory for different types. The type selected alters the function of the valve monitor inputs in the following manner:
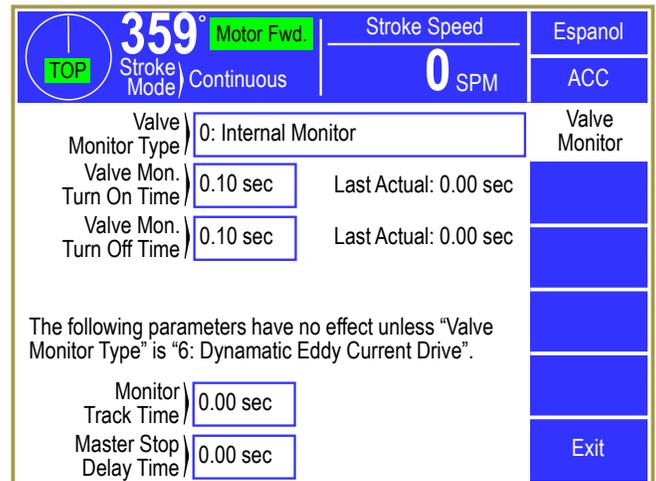
Figure 70: Valve Monitor Configuration Screen

Type 0   Air Valve Internal Monitor (External Reset Button)

Input 24 Function: Input from valve monitor 1 (0 volts = valve fault)
Input 25 Function: Input from valve monitor 2 (0 volts = valve fault)

This is a "static" valve monitor. If either valve monitor input goes low while the press is running the press control will immediately stop and further stroke initiation is prevented until the inputs are in the RUN condition (+24 volts). The status message *Valve Monitor 1* (Input 24) or *Valve Monitor 2* (Input 25) will be displayed. This monitor is intended to be used with a clutch/brake valve that internally monitors for a fault condition, provides an output that indicates a malfunction, and remains locked out until an external reset solenoid is energized by an operator pressing a valve reset button. None of the factory programmed timers are used with this monitor.

Type 1   Air Valve with Proximity Sensors Only

Input 24 Function: Input from proximity sensor 1
Input 25 Function: Input from proximity sensor 2

This is a "timed" valve monitor. When the press control's clutch/brake output is de-energized, both proximity sensors must report that the valve is in the "Off" position (inputs at 0 volts). When the press control's output is energized, both proximity sensors must report that the valve is in the "On" position (both inputs at +24 volts). Since the valve has some physical reaction time, two factory programmed parameters are provided. The parameter 'Valve Mon. Turn On Time" sets the maximum amount of time in which both Inputs 24 and 25 must switch high when the clutch is engaged. If both inputs do not switch high within this amount of time and remain high while stroking, the clutch/brake valve is turned "Off" and *Valve Mon. 1 Pull In Fault* (if input 24 did not switch High) or *Valve Mon. 2 Pull In Fault* (if input 25 did not switch High) is reported as the reason for the stop. The parameter "Valve

Mon. Turn Off Time" sets the maximum amount of time in which both Inputs 24 and 25 must switch low when the clutch is disengaged. If both inputs do not switch low within this amount of time and remain low, the present running status will indicate a *Valve Mon. 1 Drop Out Fault* (if Input 24 did not switch Low in time) or *Valve Mon. 2 Drop Out Fault* (if Input 25 did not switch Low in time). A fault from this type valve monitor generates an immediate stop and requires that the operator press the **Reset** softkey in the Press Control screen before any further strokes can be initiated. The time parameters can be set from 0.02 to 2.00 seconds (in increments of 0.02 seconds).

If the valve inputs **switch** within the programmed limits, the actual time measured is displayed beside the limit.

Type 2   ***Air Valve with Internal Monitor and Clutch Line Pressure Switch***

Input 24 Function: Input from valve monitor (0 volts = valve fault)
Input 25 Function: Input from Clutch Line Pressure Switch

This is a "static and timed" valve monitor. If the static Input 24 goes low the press control will immediately stop and further stroke initiation is prevented until the valve monitor input is in the RUN condition (+24 volts). The status message *Valve Monitor 1* (Input 24) will be displayed. The static input is intended to monitor a clutch/brake valve that internally latches the fault condition until a valve reset solenoid is energized. In addition, when the press control's clutch/brake output is de-energized, the clutch line pressure switch must report that there is no pressure on the output of the clutch valve (input at 0 volts). When the press control's output is energized, the clutch line pressure switch must turn "On" (input at +24 volts) within a programmed time to indicate that the line is pressurized. Since the valve has some physical reaction time, two factory programmed parameters are provided. The parameter "Valve Mon. Turn On Time" sets the maximum amount of time in which Input 25 must switch high when the clutch is engaged. If the input does not switch high within this amount of time and remain high while stroking, the clutch/brake valve is turned "Off" and *Valve Mon. 2 Pull In Fault* is reported as the reason for the stop. The parameter "Valve Mon. Turn Off Time" sets the maximum amount of time in which Input 25 must switch low when the clutch is disengaged. If the input does not switch low within this amount of time and remain low, the present running status will indicate a *Valve Mon. 2 Drop Out Fault*. A fault from the clutch line pressure switch generates an immediate stop and requires that the operator press the **Reset** softkey in the Press Control screen before any further strokes can be initiated. The time parameters can be set from 0.02 to 2.00 seconds (in increments of .02 seconds).

If the valve inputs switch within the programmed limits, the actual time measured is displayed beside the limit.

Type 3   Air Valve with Internal Monitor (Reset Required)

Input 24 Function: Input from valve monitor 1 (0 volts = valve fault)
Input 25 Function: Input from valve monitor 2 (0 volts = valve fault)

This is a "static" valve monitor. If either input goes low, the press control will immediately stop and further stroke initiation will be prevented until the valve monitor inputs are in the RUN condition (+24 volts). The status message *Valve Monitor 1* (Input 24) or *Valve Monitor 2* (Input 25) will be displayed. In addition, the operator must acknowledge the fault by pressing the **Reset** softkey. This is intended to be used with a clutch/brake valve that provides indication of a fault condition but "self resets" when power is removed. None of the factory programmed timers are used with this monitor.

Type 4   Air Valve with Proximity Sensors Only (Inverted Inputs)

This type is the same as Type 1, but with the inputs inverted. That is, 0 volts indicates the valve is "On" and 24 volts indicates the valve is "Off".

Type 5   Air Valve Internal Monitor (External Reset Button, Inverted Inputs)

This type is the same as Type 0, but with the inputs inverted. That is, 24 volts indicates a valve fault, and 0 volts indicates the valve is NOT in a fault condition.

Type 6   Dynamatic Eddy Current Clutch/Brake Drive

Input 24 Function: Dynamatic Run Enable 1 Feedback (0 volts = Run)
Input 25 Function: Dynamatic Run Enable 2 Feedback (0 volts = Run)
Input 77 Function: Dynamatic PCI Clutch Contactor Feedback (0 volts = Run)
Input 78 Function: Friction Brake Pressure Feedback (0 volts = Brake Engaged)
Input 79 Function: Dynamatic Normal Stop Input (0 volts = Stop)

> **NOTE:**   Press Control firmware versions 1.27 and later provide two types of speed advanced top stop compensation. The "Calculation Method" ***MUST*** be selected when this type of valve monitor is selected!

This configuration type controls and monitors a Dynamatic Constant Energy System (CES) Mechanical Press Drive and Controller. The main mechanical components of the Dynamatic CES system are an eddy current clutch, an eddy current brake, and a friction (holding) brake. The CES controller controls the velocity of the slide throughout the press stroke, by controlling the current in both the eddy current clutch and the eddy current brake. In addition, the CES controller will control the stop on top position by first slowing to a preset creep speed before executing a stop. The interlocks between the press control and the drive are extensive and must respond as commanded within programmed time limits at both turn On and turn Off. It may be necessary to refer to the AC/DC drawings supplied with the press control.

The press control provides the following outputs to the drive:

Output Type 72 Function: Enable the drive to run (On to run).
Output Type 73 Function: Signal the drive to stop on top (Off to stop on top).
C/B Relay 1 output Function: Control the friction holding brake.

The stroke initiation sequence is as follows:

1. C/B Relay 1 output turns On to release the friction brake.
2. Input 78 switches from low to high when the brake is released.
3. When Input 78 switches, output (Type 72) turns On to engage Enable relays 1 and 2.
4. Inputs 24 and 25 switch from high to low as the enable relay feedback.
5. Enable relays turn On to engage an external PCI relay.
6. Input 77 switches from high to low as PCI relay feedback.

The time from the turn On of C/B Relay 1 output until all four inputs switch to the correct run condition must be less than the "Valve Mon. Turn On Time" or a fault at stroke initiation will occur. The message will always appear in the present running status along with the **Reset** softkey, which must be pressed to acknowledge the fault. The message will appear in the reason for the last stop if it caused the press to stop. These fault messages are as follows:

Error message 71:   *Valve Monitor 1 Pull In Fault*
                       Input 24 did not switch low or did not remain low while stroking.

Error message 72:   *Valve Monitor 2 Pull In Fault*
                       Input 25 did not switch low or did not remain low while stroking.

Error message 142:   *Valve Monitor 3*
                       Input 77 did not switch low or did not remain low while stroking.

Error message 143:   *Valve Monitor 4*
                       Input 78 did not switch high or did not remain high while stroking.

Error message 70:   *Valve Monitor 1*
                       Input 24 switched low prior to turn on of drive enable 1 (Output Type 72). Only a wiring problem or a fault in the output relay contact should cause this fault.

Error message 69:   *Valve Monitor 2*
                       Input 25 switched low prior to turn on of drive enable 2 (Output Type 72). Only a wiring problem or a fault in the output relay contact should cause this fault.

The stopping sequence will depend upon the type of stop that is being executed, but the portion which checks the feedbacks conform to the following sequence:

1. Output Type 72 and C/B Relay 1 output turn Off.
2. Inputs 24 and 25 switch high as the enable relay feedback.

3. Input 78 switches low when the brake is applied.
4. Input 77 switches high as determined by the Dynamatic controller.

The time from the turn Off of C/B Relay 1" until Inputs 24, 25, and 78 all switch to the correct stop condition must be less the "Valve Mon. Turn Off Time" or a fault at turn off will occur and the **Reset** softkey will need to be pressed. These fault messages are as follows:

Error message 73: *Valve Monitor 1 Drop Out Fault*
Input 24 did not switch high or does not remain high while stopped.

Error message 74: *Valve Monitor 2 Drop Out Fault*
Input 25 did not switch high or does not remain high while stopped.

Error message 143: *Valve Monitor 4*
Input 78 did not switch low or does not remain low while stopped.

The turn off time of Input 77 is dependent on the Dynamatic Drive and will typically be about 450 milliseconds. The "Monitor Track Time" parameter must be set greater than this time, or fault message 142 will occur at turn off and the **Reset** softkey will need to be pressed.

Error message 142: *Valve Monitor 3*
Input 77 did not switch high or did not remain high while stopped.

Error message 144: *Soft Brake Over-Run*
The slide passes 10 degrees after TDC before Input 79 [Dynamatic Normal Stop] goes low during a top stop in production modes sequence (see below). This fault will turn the LMC off and require the **Reset** softkey to be pressed. This indicates a problem with the Dynamatic controller.

An immediate stop will remove the enable (run) signal from the Dynamatic CES controller and at the same time de-energize the friction brake dual air valve. Examples of mid stroke stops are light curtains, E-stop buttons, user definable immediate stops, and any time the control detects an external or internal fault which results in an immediate stop being asserted by the control.

A master stop will remove the enable (run) signal from the Dynamatic controller and at the same time de-energize the holding brake. However, unlike normal operation, the press control will delay turn off of the LMC relay by the "Master Stop Delay Time" parameter (programmed in the Valve Monitor Configuration screen). This is required because the clutch contactor in the Dynamatic CES receives its power through the LMC contacts. The desired turn off sequence of the clutch contactor is for it to turn off 450 milliseconds after the removal of the enable signals, so the LMC should be delayed longer than this time. Examples of master stops are master stop button, die blocks, and user definable master stops.

The output sequence performed to stop at top is changed because of this valve monitor configuration type, and the Top Stop Calibration screen changes accordingly. The settings to stop the press at top are programmed separately for Inch modes and Production modes, rather than the normal Manual and Continuous modes.

A top stop in Inch mode will remove the enable (run) signal from the Dynamatic CES controller and de-energize the friction brake dual air valve at the Inch Modes "Degrees Before TDC" (programmed in the Top Stop Calibration screen). The low and high degrees before top can be speed advanced but are typically set the same.

A top stop in production modes such as Single Stroke, Continuous, Auto Single Stroke, and Continuous on Demand cause the press control to turn output Type 73 Off at the Production Modes "Degrees Before TDC" (programmed in the Top Stop Calibration screen) to signal the Dynamatic CES drive to stop at top. Both the friction brake release output and the Dynamatic run enable output remain on. In response, the Dynamatic reference will decelerate to the creep speed and remain there until the crankshaft passes the Dynamatic's stopping angle. The Dynamatic will then set the reference to 0 and issue a Normal Stop signal (Input 79 goes low). In response, the press control will turn Off the enable (run) signal and its C/B 1 output to engage the friction brake. If during the stop sequence the slide passes 10 degrees before Input 79 [Dynamatic Normal Stop] goes low, the holding brake dual air valve will immediately be de-energized and the LMC contacts will open. This is a fault condition that must be reset by the operator. The angle at which output Type 73 turns off should be far enough away from top to allow the drive to achieve creep speed. The low and high "Degrees before TDC" used for production modes shown in the Top Stop Calibration screen should be set the same. For example, with both parameters set at 90 degrees before TDC, Output Type 73 will turn off at 270 degrees. It will turn back on when the press stops. This output will not turn off in Inch and Setup/Stop Time Test modes.

Type 7   *Proximity Sensors Only (CB 2)*

Input 24 Function: Input from proximity sensor 1
Input 25 Function: Input from proximity sensor 2

This is a "timed" valve monitor that functions like Type 1 except a track is performed on the brake output (CB2) instead of CB1. It would typically be used if separate clutch and brake is configured, and the brake valve requires a timing monitor on the poppets. When the press control's brake output is de-energized, both proximity sensors must report that the valve is in the "Off" position (inputs at 0 volts). When the press control's brake output is energized, both proximity sensors must report that the valve is in the "On" position (both inputs at +24 volts). Since the valve has some physical reaction time, two factory programmed parameters are provided. The parameter "Valve Mon. Turn On Time" sets the maximum amount of time in which both Inputs 24 and 25 must switch high when the brake is engaged. If both inputs do not switch high within this amount of time and remain high while stroking, the clutch/brake valve is turned "Off" and *Valve Mon. 1 Pull In Fault* (if Input 24 did not switch High) or *Valve Mon. 2 Pull In Fault* (if Input 25 did not switch High) is reported as the reason for the stop. The parameter "Valve Mon. Turn Off Time" sets the maximum amount of time in which both Inputs 24 and 25 must switch low when the clutch is disengaged. If both inputs do not switch low within this amount of time and remain low, the present running

status will indicate a *Valve Mon. 1 Drop Out Fault* (if Input 24 did not switch Low in time) or *Valve Mon. 2 Drop Out Fault* (if Input 25 did not switch Low in time). A fault from this type valve monitor generates an immediate stop and requires that the operator press the **Reset** softkey in the Press Control screen before any further strokes can be initiated. The time parameters can be set from 0.02 to 2.00 seconds (in increments of 0.02 seconds).

If the valve inputs switch within the programmed limits, the actual time measured is displayed beside the limit.

This configuration type must be used if an Ortlinghaus Progressive Clutch/Brake Control PC 20 soft clutch/soft brake valve is being used (see Section 4.2.2 on Soft Clutch / Soft Brake operation).

4.2.5 Hydraulic Overload Configuration

The Hydraulic Overload screen is accessed by touching the **Hydraulic Overload** softkey in the Press Control Configuration screen (see Figure 64 on page 79). This screen (shown in Figure 71) allows for configuration of the hydraulic overload if the press is equipped with one. The type of hydraulic overload and the angles associated with reset are Factory Configuration parameters set before the press control is shipped.
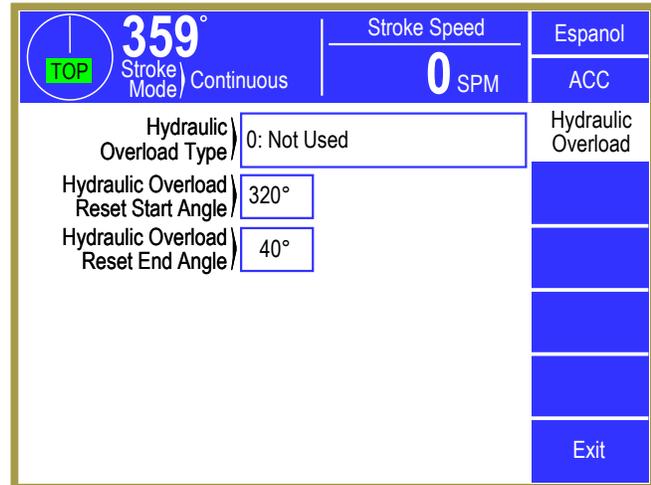
Figure 71: Hydraulic Overload Configuration Screen

4.2.5.1 Hydraulic Overload Type

Type 0   *Not Used (No hydraulic overload on the press)*

Input 53 Function: Not used. Available for use as a configurable input.
Input 54 Function: Not used. Available for use as a configurable input.

This should be selected if the press is not equipped with a hydraulic overload system.

Type 1   *Limit Switch & Pressure Switch*

Input 53 Function: Overload Limit Switch
Input 54 Function: Pump Pressure Switch
Output Relay: Type 36 - Hydraulic Cylinder
Output Relay: Type 35 - Hydraulic Pump

Inputs 53 and 54 are High when the hydraulic overload is in its normal state and the cylinder and pump outputs are turned on to keep the overload reset. If an overload occurs outside the hydraulic overload reset area then Input 53 or 54 should go Low, which will cause an immediate stop (C/B 1 turns off"). This will also cause the cylinder output and the pump output to turn off, reinforcing the overload condition and dumping the hydraulic fluid to tank. In order to reset this condition the **Reset** softkey must be pressed. If in a stroking mode other than Inch, the present running status will display *Run Only In Inch* and the Inch mode must be selected. The Inch run buttons are then used to position the press at the top of the stroke (inside the hydraulic overload reset area). The press can be operated in either forward or reverse. If reverse is used to back off the load, the press control will issue a stop at the "Reverse Top Stop Angle" parameter located in the Machine Parameters screen (see section 4.2.9.17 on page 114). This parameter should be set to stop the press inside the reset window. The cylinder output will turn on, further stroking is prevented, and the present running status will display the programmable name of Input 53 (typically [Hyd. Overload Cylinder]) until the input goes High. When the input goes High, the present running status will display *Hydraulic Overload Pump Delay* for 10 seconds to allow the cylinder connection to seal. The pump output will then turn on and the present running status will display the programmable name of Input 54 (typically [Hyd. Overload Pressure Switch])

until the input goes High. When the input goes High, and the overload has been reset, the press can be returned to the desired stroking mode, and further stroking is allowed.

The reset window is programmed in the Hydraulic Overload configuration screen by setting the "Hydraulic Overload Reset Start Angle" parameter (which can be set from 255 to 350 degrees) and the "Hydraulic Overload Reset End Angle" parameter (which can be set from 1 to 90 degrees).

Type 2   ***Pressure Switch only***

> *Input 53 Function:*   Not Used.
> *Input 54 Function:*   Pump Pressure Switch
> *Output Relay:*   Type 35 - Hydraulic Pump

Input 54 is High when the hydraulic overload is in its normal state and the pump output is turned on to keep the overload reset. If an overload occurs outside the hydraulic overload reset area then Input 54 should go Low, which will cause an immediate stop (C/B 1 turns off). This will also cause the pump output to turn off, reinforcing the overload condition and dumping the hydraulic fluid to tank. In order to reset this condition the **Reset** softkey in the Press Control screen must be pressed. If in a stroking mode other than Inch, the present running status will display *Run Only In Inch* and the Inch mode must be selected. The Inch run buttons are then used to position the press at the top of the stroke (inside the hydraulic overload reset area). The press can be operated in either forward or reverse. If reverse is used to back off the load, the press control will issue a stop at the "Reverse Top Stop Angle" parameter located in the Machine Parameters configuration screen (see section 4.2.9.17 on page 114). This parameter should be set to stop the press inside the reset window. The pump output will then turn on, further stroking is prevented, and the present running status will display the programmable name of Input 54 (typically [Hyd. Overload Pressure Switch]) until the input goes High, at which point the overload has been reset and further stroking is allowed.

The reset window is programmed in the Hydraulic Overload configuration screen by setting the "Hydraulic Overload Reset Start Angle" parameter (which can be set from 255 to 350 degrees) and the "Hydraulic Overload Reset End Angle" parameter (which can be set from 1 to 90 degrees).

Type 3   ***Limit Switch & Pressure Switch (Motor Direction Controlled)***

> *Input 53 Function:*   Overload Limit Switch
> *Input 54 Function:*   Pump Pressure Switch
> *Output Relay:*   Type 36 - Hydraulic Cylinder
> *Output Relay:*   Type 35 - Hydraulic Pump

This system works in the same manner as Type 1 except that the angle the press comes to rest at when an overload occurs is examined. If this angle is less than 180 degrees, the present running status will display *Motor Direction* and further stroking is prevented until the main motor is switched to the reverse direction.

Type 4   **Pressure Switch only (Motor Direction Controlled)**

>   *Input 53 Function:*   Not Used.
>   *Input 54 Function:*   Pump Pressure Switch
>   *Output Relay:*   Type 35 - Hydraulic Pump

This system works in the same manner as Type 2 except that the angle the press comes to rest at when an overload occurs is examined. If this angle is less than 180 degrees, the present running status will display **Motor Direction** and further stroking is prevented until the main motor is switched to the reverse direction.

4.2.6   Top Stop Calibration

The Top Stop Calibration screen is accessed by touching the **Top Stop Calibration** softkey in the Press Control Configuration screen (see Figure 64 on page 79). Top Stop Calibration is a User Configuration area since the control must be calibrated to stop on top for each particular press. All System 5100 controls are capable of automatically adjusting the stop on top angle for variable speed presses. The angle at which the press control begins to stop is automatically adjusted to compensate for the speed of the press in order to come to rest at top of stroke over the operating speed range of the press. System 5100 Controls calibrate the press to stop at top using one of two methods – "Calculation" or "Table Based".

> **NOTE:**   A change was made to the Press Control in software versions 1.27 and later to allow two different methods of performing speed advanced top stop. The default "Calculation" method is the same as all prior software versions and should be used in most applications. In certain situations, a "Table Based" method is provided to allow more flexible adjustment to the stop on top position. One situation where this method should be used is in the case of a Link Drive Press where the resolver cannot be mounted to the shaft that runs at a constant velocity throughout the stroke, but must instead be mounted to the shaft that changes velocity as slide velocity changes. ***In Press Control versions prior to 1.27, the initial top stop calibration screen will be the "Calculation" method screen as shown in Section 4.2.7.***

The initial screen shows the calibration method currently selected. This selection cannot be changed by the user. Link factory access is required. The press must be calibrated with the method currently selected in order to provide speed advanced top stop. The
"Calculation" Top Stop Settings or
"Table Based" Top Stop Settings softkey provides access to the appropriate calibration screen. Access to both calibration screens is provided, but a warning is displayed if the screen selected is not for the current method.
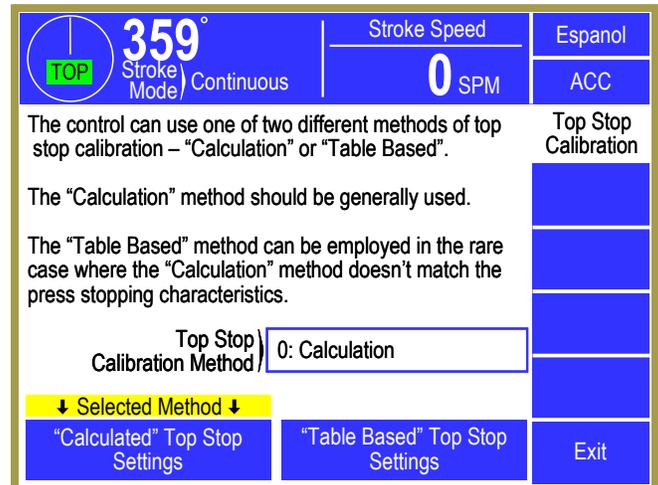
Figure 72: Top Stop Calibration Method Screen

4.2.7 Top Stop Calibration using the "Calculation" Method

> **NOTE:** Prior to Press Control firmware version 1.27, this was the only method of top stop calibration. In those versions, touching the **Top Stop Calibration** softkey in the Press Control Configuration screen (see Figure 64 on page 79) would immediately go to the "Calculation" top stop calibration screen as shown below.

Figure 73 shows the screen used in the "Calculation" method of top stop calibration for both single stroking speed and variable stroking speed presses. Variable speed top stop calibration will be discussed first in Section 4.2.7.1. Single speed calibration is treated as a special case of variable speed top stop calibration and is discussed in Section 4.2.7.2.

The stopping angle calculated by the press control is based on information programmed in the calibration screen. The stopping characteristics can be programmed separately for manual stroking modes that stop after each stroke (Inch, Timed Inch, Single Stroke, and Automatic Single Stroke) and for stroking modes that run multiple strokes before stopping (Continuous, Continuous on Demand, and Maintained Continuous).

Figure 73: "Calculation" Method Top Stop Calibration Screen

4.2.7.1 Variable Speed Calibration Procedure for the "Calculation" Method

Variable speed presses require that a calibration procedure be performed when the press control is installed. This process involves running the press at both a low and high speed and adjusting the top stop position (programmed in degrees before top dead center) to stop the press at the top of the stroke at both speeds. This procedure must be performed for both manual stroking modes and continuous stroking modes. The suggested top stop calibration procedure is as follows once the top stop calibration screen is accessed:

1) Put the press in Continuous mode.

2) Turn the RUN/PROG switch to the PROG position and enter the low and high operating speeds for the press in the "Continuous Stroking Modes" section of the screen. Enter the degrees before top at which the clutch/brake outputs should be de-energized in order to stop the press at the top of the stroke for both the low and high speeds. If these parameters are not known, they can be determined by the following procedure:

   Set both "Low Speed Degrees Before TDC" and "High Speed Degrees Before TDC" in the "Continuous Stroking Modes" section of the screen to 0. Switch to the RUN position, set the machine speed to the low stroking speed and initiate stroking with the appropriate setup/run buttons. With both top stop positions set to the same value, the press control will NOT calculate a stopping angle based on speed but will use the programmed setting at all stroking speeds. Press the top stop

button and examine the "Speed at Stop Initiation" (shown at the bottom of the display) to verify that the actual speed is equal to the programmed low speed. If not, change the "Low Speed SPM" parameter to match the "Speed at Stop Initiation". The "Degrees to Stop" is also displayed at the bottom of the screen. Enter this number into the top stop position settings for both low and high speed "Degrees Before TDC". Initiate stroking again and verify that a top stop results in the correct at rest position. Since the stopping characteristics of the press may be different in the downstroke than in the upstroke, the first programmed top stop position may need to be adjusted by repeating the above procedure to stop the press at the desired top of the stroke. If adjustment is needed, the new value MUST be entered into both low and high speed "Degrees Before TDC" in order to prevent the press control from attempting to calculate a stop angle.

Once adjusted to stop at top at the low speed, set the machine speed to the high stroking speed and initiate stroking with the appropriate setup/run buttons. Press the top stop button and examine the measured speed to verify that the actual speed is equal to the programmed high speed. If not, change the "High Speed SPM" parameter to match the "Speed at Stop Initiation". Near the bottom of the screen the "Degrees To Stop" will be displayed. Enter this value into the top stop position for "High Speed Degrees Before TDC" (do not change the programmed top stop position for "Low Speed Degrees Before TDC"). When the RUN/PROG key is switched to the RUN position, the press control will use the programmed parameters to calculate coefficients used in an equation that describes the stopping characteristics of the press. From this point on the press control will calculate a stopping angle based on speed throughout the entire speed range of the press. Since the stopping characteristics of the press may be different in the downstroke than in the upstroke, it may be necessary to adjust the high speed top stop position in order to stop the press at the desired top of stroke. Once programmed for operation at high speed, the press can be operated at any intermediate speed to verify that the calibration procedure has generated the correct stopping curve.

> **NOTE:** If a curve cannot be fit to the parameters entered, a warning is displayed and the entry is rejected. Verify that the low and high speeds entered are the same as the actual speed of the press. Refusal to accept an entry typically indicates that the "High Speed Degrees Before TDC" is set too low or the "Low Speed Degrees Before TDC" is set too high. At a minimum, the parameters must conform to the following equation:
>
> "High Speed Degrees Before TDC" >
> ("High Speed SPM"/ "Low Speed SPM") * "Low Speed Degrees Before TDC"

3) Put the press in Single Stroke mode.

4) Perform the same top stop calibration procedure as described above except the parameters will be changed in the "Manual Stroking Modes" section of the screen. Typically, the continuous stroke mode settings can be used as a starting point and then adjustments made at the low and high speeds to compensate for different stopping characteristics in a single stroke mode versus a continuous stroking mode. However, for higher speed presses there can be a significant difference due to the amount of time required to fully pressurize the clutch/brake. In some cases a single stroke cannot be calibrated at the highest continuous stroking speed and a lower high speed setting must be used or the "Table Based" calibration method can be used to provide a wider speed range.

5) When the press control is operating with a calibrated stopping curve, the calculated speed and degrees before top dead center can be viewed in the "Factory Diagnostics" screen shown in Figure 74, and should indicate the actual values for this speed.

Figure 74: Top Stop Calibration Factory Diagnostics Screen

4.2.7.2   Single Speed Calibration Procedure for the "Calculation" Method

Single speed presses can be calibrated by setting the "Degrees Before TDC" angles for both low and high speed to the same value. This prevents the press control from calculating a stopping angle based on press speed, and initiates a top stop at the number of degrees before top of stroke regardless of speed. The "Degrees to Stop" and "Speed at Stop Initiation" display can be used to determine the setting. The stopping degrees can be set differently for manual stroking modes and continuous stroking modes.

A more accurate "stop on top" calibration can be achieved by applying speed advance in manual stroking modes, even for single speed presses. In manual modes such as Inch, the stroke is frequently initiated at the bottom of the stroke or in the upstroke. In this instance the press will not achieve full speed when the crankshaft angle reaches the non-speed advanced angle and will stop short of the normal "at top" position. If speed advance is applied, the slower speed will cause the calculated "stop on top" angle to initiate the stop closer to the "top of stroke" angle. An approximate calibration can be made after setting the "High Speed SPM" and "High Speed Degrees Before TDC" to the correct values, by dividing the high speed settings by two and entering these into the Low Speed parameters. It may be necessary to set the "Low Speed Degrees Before TDC" slightly less than half the high speed setting. The continuous stroking mode parameters can be left as non-speed advanced settings, as described above.

4.2.8 Top Stop Calibration using the "Table Based" Method

In the configuration screen of Figure 75 four speeds must be programmed that encompass the speed range of the press for "Manual" stroking modes that stop at the end of each stroke and for "Continuous" stroking modes that top stop only when instructed to.

The Lowest Speed should be set to the minimum operating speed of the press, and the Highest Speed should be set to the maximum. Run the press in continuous at the minimum and maximum SPM and enter the speed that the press actually strokes. Crankshaft SPM is displayed at the top of the screen, while the press is stroking. In addition, the actual "Speed at Stop Initiation" is displayed at the bottom of the screen. This is the speed of the press, measured when the press passes through the calculated top stop angle.

Figure 75: "Table Based" Method Top Stop Calibration Screen

The two middle parameters are typically set to 1/3 and 2/3 of the range, but can be adjusted if necessary. The press control will perform a linear interpolation for all speeds between the programmed settings (e.g. When stroking halfway between the lowest speed and the 1/3 speed, the degrees BTDC will be halfway between the lowest degrees and the 1/3 degrees). Unlike the "Calculation" method (which follows a programmed curve from zero rpm to 2000 rpm), the "Table" method clamps the maximum degrees BTDC at the programmed Highest Speed setting. The press control will not initiate the stop any further from top dead center than this position, even if the actual speed of the crankshaft goes above the Highest Speed setting. Linear interpolation is performed from zero to the Lowest Speed setting (e.g. If the Lowest Speed is programmed at 10 rpm and the lowest degrees BTDC is 20 degrees, at 5 rpm the stop at top is initiated at 10 degrees BTDC).

4.2.8.1 Variable Speed Calibration Procedure for "Table Based" Method

The Degrees required to stop the press at Top Dead Center (Degrees Before TDC) should be programmed for each of the four speed settings. One method to determine the degrees is to set all "Degrees Before TDC" parameters to generate a fixed stop in the upstroke (e.g. 45 Degrees Before TDC), run the press at each of the four speeds, and write down the "Degrees To Stop" displayed at the bottom of the screen. These can then be programmed into the fields provided. Nonsensical entries are rejected. One example of this would be to set the degrees required to stop at a high speed less than the degrees required at a lower speed. Another example would be to set the Highest Speed lower than the 2/3 Speed. Run the press at each of the four speeds again, and adjust the degrees to stop (if necessary) to account for the change in stopping characteristics caused by issuing the stop at a different angle than the original 45 degrees before top. The actual "Speed at Stop Initiation" displayed at the bottom of the screen can be used to verify that the press is stroking at the intended speed.

4.2.8.2 Single Speed Calibration Procedure for "Table Based" Method

All four speeds should be set to the operating speed of the press. All four degrees BTDC parameters should be set to the same value to generate the correct stop at top. When stroking above the Lowest

Speed setting, the stop is initiated at the degrees BTDC programmed. Linear speed advance from zero to the Lowest Speed setting provides a more consistent top stop when stroking the press in dead motor inch or initiating the stroke from anywhere in the stroke.

4.2.8.3   Link Drive Press Calibration Procedure for "Table Based" Method

In situations where the resolver can only be mounted to the shaft that changes velocity as slide velocity changes, the "Calculation" method cannot be used for speed advanced top stop. The "Table Based" method should be used, but calibration is complicated due to the change in velocity in the upstroke combined with a variable speed motor. This combination results in a situation where as the motor increases speed, the number of degrees required to stop increases. However, as the position to generate the stop moves further away from top (in the upstroke), the instantaneous speed of the shaft decreases.

One suggested calibration method is to use the highest speed and "Degrees Before TDC" parameters to find the positions at each of the four speeds. Set the lowest speed, 1/3 speed, and 2/3 speed to zero. Set the highest speed well below the actual stroking speed of the press (e.g. If the press strokes from 20 to 80 SPM, set the speed to 10 SPM). Set the lowest, 1/3, and 2/3 "Degrees Before TDC" to zero. Set the highest "Degrees Before TDC" to a small number (e.g. 10 degrees) as a starting point. In this configuration, the press will always stroke above the highest speed and the highest "Degrees Before TDC" setting will always be used to generate the stop. Run the press at the slowest speed (e.g. 20 SPM) and command a top stop. The control will generate the stop at the programmed setting. The "Degrees to Stop" displayed at the bottom of the screen indicates the number of degrees the press took to stop, when initiated at 10 degrees before TDC. This should be set as the highest "Degrees Before TDC" parameter and the procedure repeated until the correct stop point is determined. Record the "Degrees Before TDC" parameter along with the "Speed at Stop Initiation". Set the parameter back to the initial point (10 degrees) and repeat this procedure while running the press at 1/3 speed, 2/3 speed, and highest speed. After all values have been determined, enter them into the appropriate fields. Note that certain entries are not allowed (e.g. a higher speed range cannot be set less than a lower speed range. The "Degrees Before TDC" for a higher speed range cannot be less than the degrees for a lower speed range).

4.2.9   Machine Parameters Configuration

The Machine Parameters screens are accessed by touching the **Machine Parameters** softkey in the Press Control Configuration screen (see Figure 64 on page 79). These screens (shown in Figure 76, Figure 77, and Figure 78) allow for settings to be made for a specific press installation.

The parameters shown in Figure 76 are User Configuration parameters typically set when the press control is installed.

4.2.9.1   Encoder Offset

The offset is to compensate for misalignment between the resolver/encoder zero and the machine

Figure 76: Machine Parameters Screen Page 1

zero. To set this value, the user must position the crankshaft at top dead center and press the **Set Zero** softkey. The offset value displayed is the number that must be added to the actual resolver reading to get 0 degrees. If the present resolver angle is within the allowable limit, the angular display value will indicate 0 degrees. This value is limited to plus or minus 10 degrees from resolver zero. If the position is beyond the limit, the limit is used as the offset. Coarse adjustment is provided to allow manual entry of the offset angle, from 0 to 9 degrees or 350 to 359 degrees.

4.2.9.2   Auto Turn Off Time

This parameter is the length of time that the main motor can be left on without operating the press and is provided as an energy conservation feature. After this time has elapsed, the press control will turn its LMC relay off until the main motor turns off. The message *Automatic Turn Off* will be displayed in the reason for the last stop. It will also appear in the present running status until Input 19 [N/O Mot. Forward Aux. Contact] and Input 20 [N/O Mot. Reverse Aux. Contact] both go Low. If the motor start/stop circuit is not wired to the output of LMC, this feature should be disabled. The programmed time is limited to between 0 and 254 minutes, and an entry beyond the limit is rejected. An entry of 0 disables this feature.

4.2.9.3   Main Motor Turn On Delay

This configuration parameter can be used on presses with eddy current drives to specify the length of time (in seconds) that a System 5100 Output Relay Type 24 (Delayed Main Motor Output) waits after the drive motor is started in the forward or reverse direction before it turns on to engage an eddy current drive. This time can range from 0 to 120 seconds. This delays engagement of an eddy current drive to give the motor time to come up to speed.

4.2.9.4   Main Motor Turn Off Delay

This configuration parameter can be used on presses with eddy current drives to specify the length of time (in seconds) that the System 5100 Output Relay Type 24 (Delayed Main Motor Output) waits after both the motor forward and motor reverse inputs turn OFF before it turns OFF. This time can range
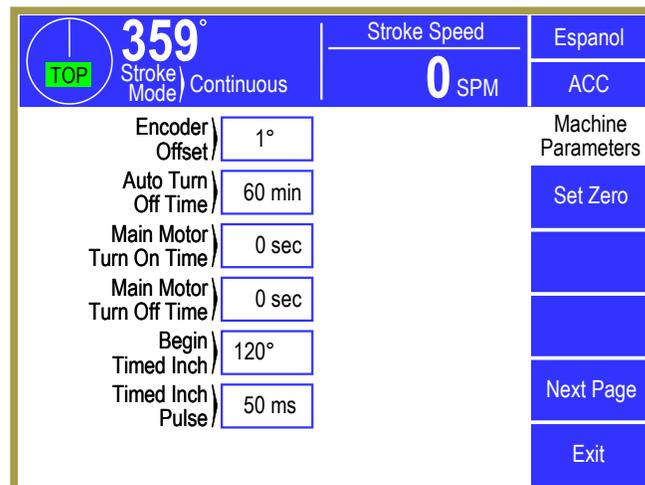
from 0 to 120 seconds. This is typically used to keep the eddy current drive engaged so that the flywheel will stop the motor as it stops.

4.2.9.5   Begin Timed Inch

This parameter applies only in Timed Inch mode and is the angle in the downstroke at which the press control will stop the press, after which the stroking will be governed by the "Timed Inch Pulse" mode for die setting. The press will initiate a stop when this angle is reached in the downstroke and the message *Timed Inch Turn Off* will be displayed as the reason for the last stop. The Inch operator controls must be released and re-actuated to cause pulsing of the clutch/brake output(s) to continue the downstroke in small increments. The timed inch function will continue until the crankshaft angle reaches 180 degrees, the downward motion stalls out on the reaction force of die features, or another stroking mode is selected. This value is limited to between 0 and 135 degrees, and an entry beyond the limit is rejected. It should be set so that the slide stops the before dies close but not so far that an excessive number of pulses are required to close the dies or to reach bottom.

4.2.9.6   Timed Inch Pulse

This parameter sets the length of time that the clutch/brake valve is kept engaged in the Timed Inch mode when the clutch is being pulsed. The press control will automatically turn the clutch valve off after this time period has elapsed. If the run buttons are pressed and held, the press control will pulse the output off for 0.25 seconds then on for the "Timed Inch Pulse" time in a continual manner until the press slide stalls out because of forces created by die features or until the bottom of the stroke is reached as indicated by 180 degree crankshaft position. This value is limited to between 16 and 508 milliseconds, and an entry beyond the limit is rejected.

4.2.9.7   Foot Switch Installed

If this parameter is Factory Configured as "Yes" in Machine Parameters page 2 (see Figure 77), the press control will treat station 2 run button inputs as contacts on a foot switch. The foot switch can be used only in Single Stroke or Maintained Continuous mode and cannot be used along with any other operator station.

4.2.9.8   Separate Inch Buttons Installed

If this parameter is Factory Configured as "Yes", separate Inch run buttons must be wired into Inputs 7 and 8. These are used to stroke the press in Inch, Timed Inch, and Setup/Stop Time Test modes. They will not cause stroking in any production mode. If configured as "No", the press will be inched by the selected operator station run buttons. This parameter must be set to "No" if Bar mode is turned on. Bar mode will then use the buttons wired into Inputs 7 and 8.
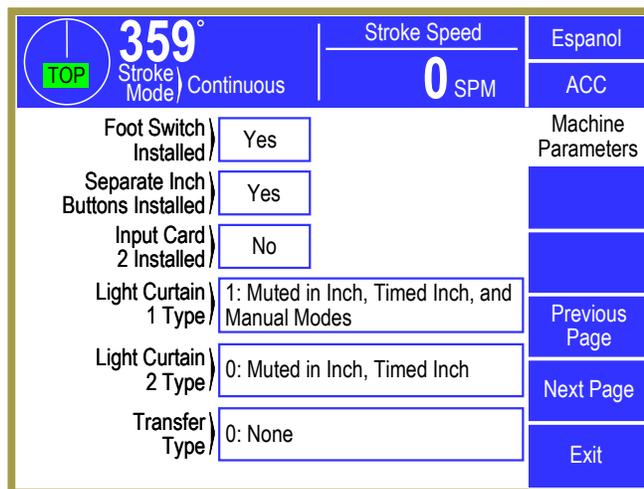
Figure 77: Machine Parameters Screen Page 2

4.2.9.9   Light Curtain 1 Mute Type

This Factory Configuration parameter is found on page 2 of the Machine Settings screen (see Figure 77) and defines how light curtain 1 is muted. If enabled, the light curtain is muted from 180 degrees to the "Top Of Stroke" angle while stroking. When the press stops at top (above the "Start Top Angle") the light curtain is un-muted even if the press slide is at rest in the upstroke.

Muting in the upstroke also depends on the running direction of the main motor. If the motor is running in reverse, the light curtain mutes in reverse (i.e. from 180 to 0 – the upstroke when in reverse). If the motor is turned off (except in Bar Mode and Clutch/Brake Test Mode), the light curtain never mutes.

> **NOTE:**   Light curtains are always muted in modes that *require* the main motor to be OFF. These are the Bar and Clutch/Brake Test Modes.

Like other protective inputs, the light curtain inputs employ a pulsing scheme in order to detect certain wiring faults. Some light curtains with solid state outputs employ their own scheme to check their outputs that is not compatible with the 5100 pulse check. Types 5 through 9 of the Light Curtain Mute Type, described below and prefixed in their description with "[No Pulse]", turn off the 5100 pulse check to allow operation with that type of light curtain. These types are otherwise identical with Type 0 through 4.

The following muting types can be set:

Type 0   *Muted in Inch and Timed Inch modes*

Type 1   *Muted in Inch, Timed Inch, Single Stroke, Maintained Continuous, and Setup/Stop Time Test modes*

Type 2   *Muted in Inch, Timed Inch, Automatic Single Stroke, Continuous, and Continuous On Demand modes*

Type 3   *Muted in all modes*

Type 4   *Not muted (except in Bar and Clutch/Brake Test modes)*

Type 5   *[No Pulse] Muted in Inch and Timed Inch modes*

Type 6   *[No Pulse] Muted in Inch, Timed Inch, Single Stroke, Maintained Continuous, and Setup/Stop Time Test modes*

Type 7   *[No Pulse] Muted in Inch, Timed Inch, Automatic Single Stroke, Continuous, and Continuous On Demand modes*

Type 8   *[No Pulse] Muted in all modes*

Type 9   *[No Pulse] Not muted (except in Bar and Clutch/Brake Test modes)*

4.2.9.10   Light Curtain 2 Mute Type

This Factory Configuration parameter is found on page 2 of the Machine Settings screen (see Figure 77) and defines how light curtain 2 is muted (see Light Curtain 1 Mute Type, above).

4.2.9.11   Transfer Type

This Factory Configuration parameter is found on page 2 of the Machine Settings screen (see Figure 77) and can be used to enable an automation interlock before the stroke is initiated and, if desired, at the end of a stroke in a continuous stroking mode. It is typically used with transfer systems.

Type 0   Not Used

Type 1   Permissive

> This selection will cause the press control to wait at stroke initiation for permission to engage the clutch. In Inch, Timed Inch, Setup/Stop Time Test, or Single Stroke mode activation of the proper run buttons will not initiate a stroke until a permissive input (Input 50 [Cont. On Demand Run/Permissive]) goes High. The present running status will display *Waiting For Run Signal*. The run buttons must be maintained until the transfer indicates stroking is allowed. Input 50 [Cont. On Demand Run/Permissive] does not have to remain high after the stroke is initiated. An output (Type 29) is available to inform the transfer that the press control is "Requesting To Run" which will turn on when the proper run buttons at pressed and held. In Continuous or Maintained Continuous mode this input must go High within the 5 second period after the setup button is pressed (the run buttons must also be maintained). Continuous On Demand mode always uses this input regardless of this parameter setting. If Input 50 [Cont. On Demand Run/Permissive] is not High at manual setup and initiation the mode will be "Armed" and the present running status will display *Waiting For Run Signal*. The mode will automatically time out if the run signal does not go High within the programmed "Continuous On Demand Time" (in the Press Control screen) and must be manually re-setup and initiated. Automatic Single Stroke mode does not monitor this input, but instead is driven by Input 28 [Auto. Single Stroke Run]. The purpose of this function is to allow the automation (e.g. transfer) time to position itself correctly and then engage the stroke.

Type 2   Permissive, Extra Stroke.

> This selection functions the same as Type 1 at stroke initiation. In Continuous, Continuous On Demand, or Maintained Continuous mode this type provides prior notification to the automation that the press control is going to stop the press at the top of the stroke. Output Type 30 (if used) will turn on at 180 degrees to indicate that this stroke will be stopped at top and will turn off when the press stops. If a top stop input goes Low after 180 degrees the press will continue through top and stop on the next stroke. This output would typically be used to inform a transfer of the stop so that it may "park itself". For more information see Section 4.2.16.

4.2.9.12   Top Start Angle

This Factory Configuration parameter is found on page 3 of the Machine Parameters screen (see Figure 78). It defines a region in the upstroke where a single stroke can be initiated and the press will stroke one complete revolution and stop at the next speed advanced top stop point. On a non-link drive press top of stroke is 359 degrees and the Top Start Angle parameter should typically be set around 345 degrees. On a link drive press it should be set around 15 degrees before the "Top Of Stroke" parameter which will be specified by the press manufacturer to be well before 359 degrees. This parameter can be set from 255 to 350 degrees.
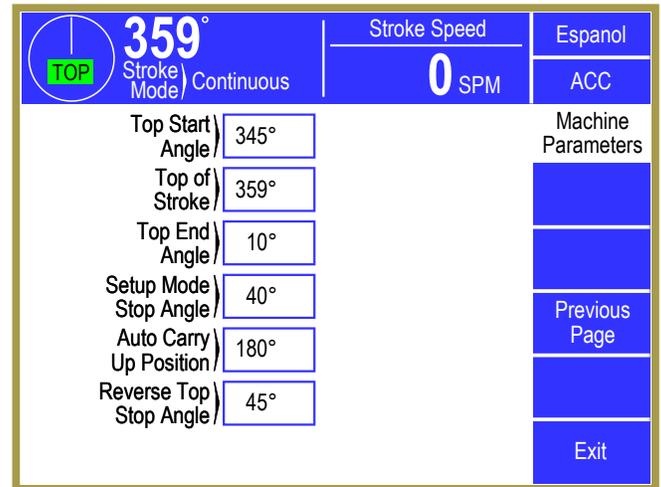
Figure 78: Machine Parameters Screen Page 3

4.2.9.13   Top of Stroke

This Factory Configuration parameter is found on page 3 of the Machine Parameters screen (see Figure 78) and defines the top of the upstroke. While the press is running in a continuous mode this point sets the end of the light curtain mute window. On a non link drive press (top of stroke is 359 degrees) the parameter should be set to 359 degrees. On a link drive press it should be set to the angle that ends upward travel of the slide (around 330 degrees but this depends on the press mechanics). This parameter can be set from 255 to 359 degrees.

4.2.9.14   Top End Angle

This Factory Configuration parameter is found on page 3 of the Machine Parameters screen (see Figure 78) and defines the end of the top of stroke window. It should typically be set to 10 degrees but can be set from 1 to 20 degrees.

4.2.9.15   Setup Mode Stop Angle

This User Configuration programmed angle is found on page 3 of the Machine Parameters screen (see Figure 78). It is used ONLY in the Setup/Stop Time Test mode, and is limited to between 2 and 358 degrees. It is used at all speeds, and is intended to provide a repeatable stop signal with which to measure the stopping time of the press and to aid in the setup of mechanically driven feeds.

4.2.9.16   Auto Carry Up Position

This User Configurable parameter is found on page 3 of the Machine Parameters screen (see Figure 78). It is the angle at which the press control will automatically keep the clutch/brake valve engaged until the machine reaches the top of the stroke. It is used only in Single Stroke and Automatic Single Stroke modes. Once this angle is reached, an operator may release the run buttons without causing the press to stop. This value is limited to between 135 and 180 degrees (for special cases with double-acting presses, contact Link), and an entry beyond the limit is rejected. If a stop occurs in Single Stroke and the press comes to rest past this angle, the next stroke can be initiated by releasing the run buttons and reapplying them. In this case the press control will not enter automatic carry up and the run buttons must be held until the press stops at the top of the stroke.

4.2.9.17 Reverse Top Stop Angle

This User Configurable parameter is found on page 3 of the Machine Parameters screen (see Figure 78) and sets the angle where a stop will be generated in order to position the press around the top of the stroke when running with the main motor in reverse. If a hydraulic overload is configured this angle should cause the press to come to rest within the hydraulic overload reset window. This parameter can be set from 0 to 90 degrees

The press can only stroke in Inch mode with the main drive motor running in reverse. When a press is variable speed and the 5100-3B Analog I/O Module is installed, the Speed Configuration screen will allow a low fixed maximum speed to be set for Inch (see Section 4.2.11.3). The "Reverse Top Stop Angle" is not speed advanced to allow consistent stops near top, as is the case for production modes. The low fixed Inch speed set in the speed configuration mode should produce consistent stops near top when stroking in reverse.

4.2.10 Mode Configuration

The Mode Configuration screen is accessed by touching the **Mode Configuration** softkey in the Press Control Configuration screen (see Figure 64 on page 79). The first page of this screen is shown in Figure 79 and allows for optional stroking modes to be enabled or disabled, along with setting maximum limits for time out of automatic modes. Use the **Next Page** and **Previous Page** softkeys to see all the parameters. *All of the parameters on this screen are Factory Configured and can be changed only with factory authorization.*

Figure 79: Mode Configuration Screen First Page

4.2.10.1 Timed Inch Mode Available

When configured as "Yes", Timed Inch mode may be selected in the "Mode Select" screen; otherwise, it is unavailable.

4.2.10.2 Automatic Single Stroke Mode Available

Type 0   Mode Not allowed.

Type 1   Basic (Always Manually Initiate First Stroke After Arm).

When this type is manually setup by pressing the prior action button tied to Input 14 [Cont. & Auto. Modes Setup] and initiating the operator controls, the first single stroke will be always made.

Type 2   Regular (Wait for Feed in Position on Arm).

When this type is manually setup by pressing the prior action button tied to Input 14 [Cont. & Auto. Modes Setup] and pressing the operator controls, the first single stroke will be made if Input 28 [Auto. Single Stroke Run] is High. If instead, the input is Low at initiation, the mode will be enabled but no actual stroke will be made. The present running status will display *Waiting For "Auto Single Stroke Run"* and the press will monitor Input 28. A stroke will be initiated if the automation gives a High signal before the "Auto Single Stroke Time" (programmed in the Press Control screen) expires. If the automation does not provide a High signal within the "Auto Single Stroke Time", the reason for the last stop will display *No "Auto. Single Stroke Run" in Time* and no further automatic strokes will be allowed. The mode must be manually setup and reinitiated to resume stroking.

Type 3   Robot Mode.

This type configures the press control to function with a robot cell providing Input 28 [Auto Single Stroke Run]. It has the same setup/manual initiation characteristics as Type 2, but differs in its monitoring while waiting for an automatic initiation. Since the robot must enter the die area, which will typically block the light curtain, the press control will not abort

automatic operation if a light curtain that is configured to mute in automatic mode is blocked, unless this occurs when the run signal goes High. A light curtain that is not configured to mute will abort the automatic operation if it is blocked while the press is paused at the top of the stroke, and the mode must be manually re-setup and initiated.

4.2.10.3   Continuous On Demand Mode Available

When configured as "Yes", Continuous On Demand mode may be selected in the "Mode Select" screen; otherwise, it is unavailable.

4.2.10.4   Maintained Continuous Mode Available

When configured as "Yes", Maintained Continuous mode may be selected in the "Mode Select" screen; otherwise, it is unavailable.

4.2.10.5   Bar Mode Available

When configured as "Yes", Bar mode may be selected in the "Mode Select" screen; otherwise, it is unavailable. If Bar mode is allowed then no Separate Inch Buttons will be provided and the "Separate Inch Buttons Installed" parameter must be set to "No" or a fault will be generated when Inch mode is selected.

4.2.10.6   Single Stroke Mode Available

When configured as "Yes", Single Stroke mode may be selected in the "Mode Select" screen; otherwise, it is unavailable.

4.2.10.7   Continuous Mode Available

When configured as "Yes", Continuous mode may be selected in the "Mode Select" screen; otherwise, it is unavailable.

4.2.10.8   Micro-Inch Mode Available

When configured as "Yes", Micro-Inch mode may be selected in the "Mode Select" screen; otherwise, it is unavailable.

4.2.10.9   Maximum Auto Single Stroke Time

This limit defines the maximum time that can be programmed into the "Auto Single Stroke Time" parameter (in the Press Control screen).

4.2.10.10   Maximum Continuous On Demand Time

This limit defines the maximum time that can be programmed into the "Continuous on Demand Time" parameter (in the Press Control screen).

4.2.10.11 Clutch/Brake Test Mode Available

NOTE:	Clutch/Brake Test mode became available on Press Control firmware versions 1.27 and above but is not typically enabled. It was designed for a specific situation that is not often encountered. Please contact Link if you think you need this mode.

When configured as "Yes", Clutch/Brake Test mode may be selected in the "Mode Select" screen; otherwise, it is unavailable. The configuration can be selected to allow engagement only at the top of the stroke, only at the bottom of the stroke, or either position. A plus or minus 5 degree window is applied to the selection.

WARNING: ⚠	*Inputs 81-84 are configurable stops as described in Section 4.2.14. When not in Clutch/Brake Test mode, these inputs function as configured.* **However, when the press is in Clutch/Brake Test mode, Inputs 81 – 84 are disabled and will not stop the press!**

4.2.10.12 Mode Select Type

Normally, the stroking mode of the press is selected from the screen by an operator when the mode select key is in the "Mode Select" position – this is the "0: Normal (Soft Modes)" setting. If the "Mode Select Type" is configured to use one of the "Hard Modes" selections, then certain inputs are set aside to allow external selection of the press control stroking mode.

"Hard Modes" should be used only in applications where the press is one component of a larger cell of devices. An external safety PLC is used to function as a Cell Controller and integrate the devices. It selects the stoking mode of the press by applying the signals into the appropriate inputs.

WARNING: ⚠	It is ***absolutely required*** that whatever is used to select modes and/or initiate stroking is itself a ***safety device*** (typically a safety PLC). Failure to use ***and properly apply*** a safety device for this function may result in severe injury or death to personnel from point-of-operation or other press production system hazards.

Hard Modes are pre-assigned to specific inputs as shown in the table at right. The number of inputs set aside for this purpose depends on the "Mode Select Type" setting, which is chosen to provide the desired modes. If a "Hard Modes" setting is selected, the normal mode select inputs must be strapped to the run position (Input 22 high, Input 23 low). An input is provided for "Off" mode, but all mode inputs low will also be treated as "Off" mode. This allows the PLC to remove power to one mode input before applying power to a new input. A *"Multiple Modes Selected"* fault will occur if more than one input goes high at the same time.

Input	Mode Selected	Mode Select Type
101	Continuous	7
102	Auto Single Stroke	6 and above
103	Timed Inch	5 and above
104	Setup / Stop Time Test	4 and above
105	Clutch / Brake Test	3 and above
106	Micro Inch	2 and above
107	Continuous on Demand Maintained Continuous	1 – 7 8 *(see text)*
108	Single Stroke	1 and above
109	Inch	1 and above
110	Off	1 and above

Note that Operator Maintained Continuous and Bar Modes are not available with "Hard Modes".

The following are the Mode Select Types available:

0: Normal (Soft Modes)   Hard Modes are not used. Mode selection uses the Mode Select key and an operator chooses the mode from the screen. Inputs from 101 to 110 are available as configurable stops.

1: Hard Modes (Inputs 107 - 110)   Hard Modes are used. Inputs 107 to 110 select the modes indicated in the table above. Inputs 101 to 106 are available as configurable stops.

2: Hard Modes (Inputs 106 - 110)   Hard Modes are used. Inputs 106 to 110 select the modes indicated in the table above. Inputs 101 to 105 are available as configurable stops.

3: Hard Modes (Inputs 105 - 110)   Hard Modes are used. Inputs 105 to 110 select the modes indicated in the table above. Inputs 101 to 104 are available as configurable stops.

4: Hard Modes (Inputs 104 - 110)   Hard Modes are used. Inputs 104 to 110 select the modes indicated in the table above. Inputs 101 to 103 are available as configurable stops.

5: Hard Modes (Inputs 103 - 110)   Hard Modes are used. Inputs 103 to 110 select the modes indicated in the table above. Inputs 101 and 102 are available as configurable stops.

6: Hard Modes (Inputs 102 - 110)   Hard Modes are used. Inputs 102 to 110 select the modes indicated in the table above. Input 101 is available as a configurable stop.

7: Hard Modes (Inputs 101 - 110)   Hard Modes are used. Inputs 101 to 110 select the modes indicated in the table above.

8: Hard Modes (Inputs 101 - 110)   Hard Modes are used. Inputs 101 to 110 select the modes indicated in the table above, *but note that Input 107 selects "Maintained Continuous" mode rather than "Continuous on Demand" mode. This type became available in Press Control Software Version 1.40.*

The operation of the mode inputs have been structured so that a safety PLC can use its safety outputs to select the mode in a reliable manner. If an output fails to turn off when it should (which should be detected by the safety PLC), then multiple modes will be selected when the safety PLC turns on the output for the intended mode. This is a fault condition on the press control (*"Multiple Modes Selected"*). If an output fails to turn on (which may or may not be detected by the safety PLC) then the press will be in the "Off" mode and stroking will not be possible. Even though having no input selected will result in the "Off" mode, it is suggested to use Input 110 (the input that explicitly selects "Off")

when the safety PLC wants to select the "Off" mode. This allows for a little better diagnostic coverage in that one output from the safety PLC should always be on except when switching modes.

Note that when switching from one mode to another, the safety PLC should first turn off the output selecting the mode it is switching from, and then turn on the output selecting the mode it is switching to. Failure to do this will result in a *"Multiple Modes Selected"* fault on the press control which must be reset.

For additional feedback and verification, there are a couple of other checks that can be put in place. First, the press control mode can be requested through the Modbus interface from the operator terminal. Second, output relays can be configured for each mode used to turn on when that mode is selected – see Section 4.2.16 for details. The output relays can then drive inputs on the safety PLC for it to verify.

4.2.10.13   Trip Mode Available

When configured as "Yes", Trip mode may be selected in the "Mode Select" screen; otherwise, it is unavailable. This is for a rarely used mode employed in special circumstances.

4.2.10.14   Trip Mode Light Curtain Timeout

The number of seconds that Trip mode will remain armed after coming out of the light curtain. This is for a rarely used mode employed in special circumstances.

4.2.11 Speed Configuration

The Speed Configuration screen is accessed by touching the **Speed Configuration** softkey in the Press Control Configuration screen (see Figure 64 on page 79). If the optional 5100-3B Analog I/O board is installed, the screen shown in Figure 80 can be used to configure the press drive speed. All the parameters on the Speed Configuration screen are User Configurable. This option can be used to display the present speed, percent load of the drive, and control the speed of the drive. Example connections necessary to read and display motor speed are shown in Figure 134 on page 196. Connections to both display and control motor speed are shown in Figure 135 on page 196. Connections to read and display motor % Load are

Figure 80: Speed Configuration Screen

shown in Figure 136 on page 197. Example connections for variable frequency or DC drives are shown in Figure 137 on page 197.

4.2.11.1 Speed Control Type

This User Configurable parameter allows the press control to be configured to store the speed settings for Continuous and Single stroking modes along with the other job settings for each job. The speed control types are:

Type 0 *Not Recalled with Job*

> The speed setting is not recalled when job is recalled. The setting will keep whatever value it had, but can be changed in the Speed screen.

Type 1 *Recall with Job*

> The speed setting is recalled with a job and the motor will automatically drive to the desired speed when the production mode is selected.

Type 2 *Speed Control Not Used*

> The speed control is not used and speed and load bar graphs will not be shown on the Main Screen or the Press Control screen. The Speed screen is not available.

Type 3 *Read Only – No Output*

> The motor speed control option is set to "Read Only" and the press control will not generate analog command signals to the drive. If this configuration type is selected, the operator will be given access to the Press Speed screen, but will not be able to enter a speed parameter.

4.2.11.2   Ramp Speed in Continuous Mode

This User Configurable parameter allows the press control to be configured to ramp the press speed to the programmed continuous speed setting after the clutch is engaged, in Continuous, Continuous On Demand, or Maintained Continuous mode. If this parameter is set to "Yes" and a maximum single stroke SPM is programmed, when Continuous mode is selected (with a speed setting greater than the maximum single stroke speed) the drive is commanded to the maximum single stroke speed before the stroke is initiated. When the clutch is engaged the drive is commanded to the continuous speed setting and remains there while stroking. When the press stops, the drive is commanded to the maximum single stroke speed. This feature is turned off if this parameter is set to "No".

4.2.11.3   Fixed Inch SPM

This User Configurable parameter is used to configure the press control to stroke at a fixed speed in Inch and Timed Inch modes. An example of the use of this parameter would be a press that has a maximum stroking speed of 500 SPM but has been configured to Inch at a fixed speed of 50 SPM. Each time Inch or Timed Inch mode is selected, the analog output of the press control will command the drive to run at 50 SPM. If a fixed Inch SPM is not desired, a programmed setting of 0 will turn this feature off and the press control will base the maximum inch speed on the "Max Single Stroke SPM" if that parameter has been configured.

4.2.11.4   Max Single Stroke SPM

This User Configurable parameter is used to set a maximum stroking speed for single stroking modes (any mode that automatically stops at the end of each stroke). These modes include Single Stroke, Setup/Stop Time Test, Automatic Single Stroke, and can include Inch and Timed Inch if the Fixed Inch SPM" has been set to 0. An example of the use of this parameter would be a press that has a maximum continuous stroking speed of 500 SPM but has been configured to run no greater than 200 SPM in single stroking modes. Note that this is not a fixed speed and that the motor speed adjust screen allows the speed to be set over the entire range. If the programmed speed is greater than the maximum single stroke SPM, the analog output to the drive will "clamp" at the limit. For example, if the press was stroking at 400 SPM in Continuous mode and was then switched to Single Stroke mode the press control would command the drive to run at 200 SPM (the maximum single stroke limit). If the programmed speed setting were then manually decreased, no change would be made to the analog output until the setting went below 200 SPM. The drive would then be commanded to stroke at the programmed settings below the limit. If a maximum single stroking speed is not desired, a programmed setting of 0 will turn this feature off and the press can be initiated in single stroke modes over the entire speed range.

4.2.11.5   Flywheel Tolerance

This parameter is currently unused and should be set to zero.

4.2.11.6   Minimum Production SPM

This User Configurable parameter allows the press control to be configured to reject an operators attempt to run the press below a defined point in production modes. In the example shown in Figure 80 a minimum entry setting of 100 would mean that the press could not be operated in any production mode (Single Stroke or Continuous) below 100 SPM. Note that the press would still Inch at 50 SPM for die setting.

4.2.11.7 Maximum Speed

This User Configurable parameter is used to scale the analog input of flywheel speed wired to the 5100-3B board, for variable speed presses. The maximum strokes/minute value entered should be set slightly greater than the actual high speed at which the variable speed drive is adjusted. Maximum entry is 2500 SPM.

4.2.12 Speed Input Calibration

The Speed Input screen is accessed by touching the **Input Calibration** softkey in the Speed Configuration screen of Figure 80. This screen (as shown in Figure 81) provides parameters used to calibrate the analog input that measures drive speed (voltage applied to terminals S1-S2 of the 5100-3B speed control option board). All parameters shown on this screen are User Configurable. If sufficient information is already known about the drive, the parameters may be entered and then adjusted as necessary. If no information is known about the drive, then see Section 4.2.13.7 on page 126 for the calibration process.

Figure 81: Speed Input Calibration Screen

4.2.12.1   Speed Input Voltage Range

This parameter defines the approximate voltage range that the motor drive will apply to terminals S1-S2 of the 5100-3B speed control option board. This would typically be 10 VDC if connected to a variable frequency drive, or could be as much as 90 VAC if connected to the tachometer generator of an eddy current drive. This parameter can be set from 5 to 91 volts. Setting the voltage range close to the maximum input signal will increase the measured resolution and yield a more accurate SPM reading.

4.2.12.2   Speed Input Cal. Number

This parameter is used to calibrate the voltage applied to terminals S1-S2 of the 5100-3B speed control option board in order to convert this voltage to drive speed in SPM. Calibration is performed by running the motor at maximum speed and adjusting the "Speed Input Cal. Number" until the SPM readout shows the correct speed. This number can be set from 1 to 4095, but since this value defines the resolution it should be set as high as possible within the input voltage range. The drive speed will increase as the "Speed Input Cal. Number" is lowered.

4.2.12.3   Low SPM Input Offset

This parameter is used in the calibration procedure of the flywheel speed input to the press control. If needed, this parameter can be used to adjust the SPM reading at low speed (see Section 4.2.13.7 on page 126).

4.2.12.4   Load Input Cal. Number

This parameter is used to calibrate the voltage applied to terminals S4-S5 of the 5100-3B speed control option board in order to convert it to a % Load value. Calibration is done by running the motor and measuring the load current. The measured value (in amps) divided by the rated current specified on the motor is the % Load. The "Load Input Cal. Number" can then be adjusted to get the correct % Load readout. This number can be set from 1 to 4095. The % Load readout will increase as the number is lowered.

4.2.13 Speed Output Calibration

The Speed Output screen is accessed by touching the **Output Calibration** softkey in the Speed Configuration (see Figure 80 on page 120). The screen shown in Figure 82 is used to calibrate the analog output that controls the drive speed (voltage output on terminals S3-S2 of the 5100-3B speed control option board). The example screen shown here is as it will appear when in "Output Calibration Mode". The information shown at the yellow information bar near the middle of the screen and below will not appear until "Output Calibration Mode" is entered. If sufficient information is already known about the drive the parameters may be entered and then adjusted as necessary. If no information is known about the drive, see Section 4.2.13.6 on page 125 for more information about calibrating the speed control output.
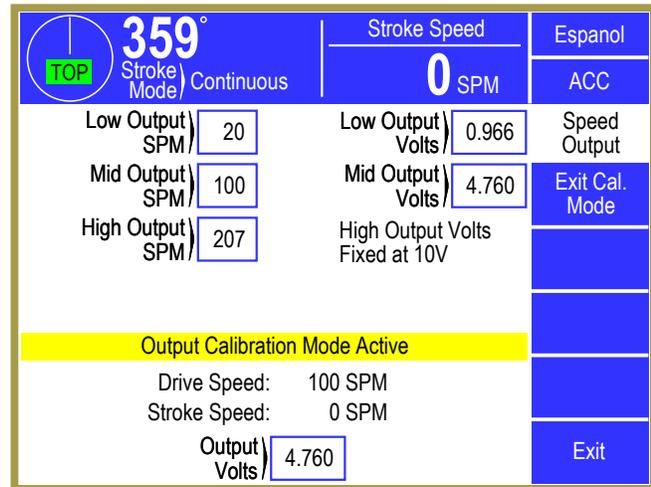
Figure 82: Speed Output Calibration Screen

4.2.13.1   Low Output SPM

This parameter is used to calibrate the analog output from the press control to the motor drive, and to define the low end of the speed range for this press. Operating speeds or configuration speeds (e.g. "Fixed Inch SPM") cannot be set below this value. See Section 4.2.13.6 on page 125 for more information about calibrating the speed control output.

4.2.13.2   Low Output Volts

This parameter sets the analog output voltage required to drive the flywheel speed to the "Low Output SPM". The calibration number is entered in dc voltage (0 to 10.00 VDC).

An example of how this is used would be to set the minimum stroking speed of a press (high speed of 400 SPM) to 50 SPM. After the drive has been calibrated to operate at maximum rated speed with a 10.00 VDC command signal, it is found that 2.0 VDC is required to operate the press at 50 SPM. Setting the "Low Output SPM" to 50 SPM and the "Low Output Volts" to 2.00 will configure the press control to allow operation only from the configured "Low Output SPM" to the configured "High Output SPM". The analog output will be scaled to vary linearly from 2.0 VDC at 50 SPM to 10.00 VDC at 400 SPM.

4.2.13.3   Mid Output SPM

This parameter sets the mid range speed of the press and can be used to compensate for non-linear characteristics of the motor drive. If needed, it is used along with the "Mid Output Volts" to adjust the analog output command signal over the speed range of the press (see Section 4.2.13.6). If not used it should be set to 0.00.

4.2.13.4 Mid Output Volts

This parameter sets the analog output voltage required to drive the flywheel speed to the "Mid Output SPM". The calibration number is entered in dc voltage (0 to 10.00 VDC). An example of how this is used would be after calibrating the low and high speed settings, the press control is programmed to command 225 SPM (1/2 of 50-400 SPM) and outputs 6.00 VDC (1/2 of 2.0-10.0 VDC). However, with this command signal the motor drive only strokes the press at 220 SPM. In this situation the "Mid Output SPM" can be set to 225 SPM and the "Mid Output Volts" can be set to whatever output voltage is required to drive the press to 225 SPM. For example, if 6.10 VDC is required to drive the motor to 225 the "Mid Output Volts" should be set to 6.10. If no adjustment at mid range is required this parameter along with the "Mid Output SPM" should be set to 0.00.

4.2.13.5 High Output SPM

This parameter sets the high speed of the press. The drive must be calibrated so that the press strokes at this speed when the analog output of the press control is at 10.00 VDC.

4.2.13.6 Calibrating the Speed Control Output

Calibrating the stroking speed of the press to analog output of the press control involves the following steps. The press control mode should be set to Continuous. This allows the press to be stroked in Continuous for calibration and the stroking speed used to determine the actual speed of the press.

Step 1   In the Speed Configuration screen turn off the speed limits and program all information that is known about the stroking speed of the press.

Enter the "Maximum Speed" (enter a number slightly higher than the highest speed at which the press will be calibrated).

Turn off "Fixed Inch SPM" by entering 0.

Turn off "Max Single Stroke SPM" by entering 0.

Turn off "Flywheel Tolerance" by entering 0.

Turn off "Minimum Production SPM" by entering 0.

Set Speed Control Type to recall (Type 1) or not recall (Type 0) speeds.

Set "Ramp Speed in Continuous Mode" to "No".

Set "Low SPM Input Offset" to 0.

Set "Low Output SPM" to the lowest speed for this press (this includes the speed at which the press may be Inched).

Set "Low Output Volts" to 0.00.

Set "Mid Output SPM" to 0 until both low and high speeds have been calibrated. This parameter will typically be used only on eddy current drives and can be left at 0 otherwise.

Set "Mid Output Volts" to 0.00.

Set the "High Output SPM" to the highest stroking speed for this press. Once configured, the press control will output 10.00 volts dc to command this speed.

> **NOTE:** If the SPM settings and Output Volts are already known for this type of press and motor drive, these settings can be entered and then adjusted if necessary.

Step 2   If very little or no information is known about the speed settings for this type of press, an Output Calibration mode is provided which allows the analog output to be manually ramped to the full speed signal (10.00 VDC) and the drive calibrated to stroke at the correct maximum strokes/minute. With a final entry of 10.00 VDC the drive can be adjusted to run at the desired highest stroking speed of the press. Press the **Enter Cal. Mode** softkey to enter the output calibration mode.

Step 3   The output calibration voltage can then be adjusted by setting the "Output Volts" parameter until the press is stroking at the programmed "Low Output SPM" and that value should be programmed into the "Low Output Volts" parameter. The analog output should now be calibrated to function linearly from the low SPM to the high SPM. For example,

At 10.00 VDC the high speed was 400 SPM
At 2.00 VDC the low speed was 50 SPM
"Mid Output SPM" and "Mid Output Volts" are not used and both parameters set to 0.

Step 4   The output should now be calibrated to provide a linear command signal from 50 SPM to 400 SPM. Typically, DC and variable frequency drives exhibit linear characteristics and it is not necessary to set mid range parameters. However, eddy current drives can exhibit nonlinear behavior. To check for this, enter an "Output Volts" of 6.00. If the press does not run at 225 SPM, the "Mid Output SPM" and "Mid Output Volts" can be used to linearize the characteristics of the drive.

4.2.13.7   Calibrating Motor Speed and Load Readouts

If the motor speed adjustment option is used, the press control can be configured to display Drive Speed (SPM) and motor % Load. The suggested procedure for calibrating the display is as follows:

Step 1   Set the "Maximum Speed" parameter slightly above the actual highest stroking speed of the press (i.e. the "High Output SPM" parameter).

Step 2   Set the "Low SPM Input Offset" parameter to 0.

Step 3   Once stroking at high speed with a full scale command signal, the SPM input can be calibrated by using the "Speed Input" calibration screen (See Figure 81 on page 123). The "Speed Input Voltage Range" should be set equal to or slightly higher than the voltage on the S1 terminal (with the meter ground lead on the S2 terminal) of the 5100-3B speed control

option board. This voltage may be DC or AC (depending on the type of drive). Once the voltage range is set, the "Speed Input Cal. Number" can be used to set the gain of the A/D input. The maximum entry is 4095 and lower settings will increase the readout. An entry of less than about 1000 indicates that the voltage range is too high. The SPM input will be displayed as "Drive Speed" on the operator terminal.

Step 4 If the "Drive Speed" readout does not match the "Stroke Speed" at low speed, the "Low SPM Input Offset" parameter can be used to provide a zero adjustment. Enter an offset value that causes the SPM to indicate correctly at low speed.

Step 5 Motor current can be calibrated by adjusting the "Load Input Cal. Number" (200 % maximum reading). The maximum entry is 4095 and lower settings will increase the readout. The input voltage (on the S4 terminal of the 5100-3B speed control option board) can be AC or DC with a maximum range of about 17 volts.

4.2.14 Input Types Configuration

Because there are many variations of press production systems with a variety of inputs needed for control logic, monitoring and diagnostics, the System 5100 control provides both standard inputs that are basic to all clutch/brake control systems and configurable inputs. This permits the control to be customized and to make efficient use of the inputs provided, both initially from the factory and later at the user plant if needed. Please see Section 2.1 on page 15 for an explanation of stop types, including the difference between Protective and Non-Protective stops.

To configure the descriptions of all namable inputs and the stop types of certain Non-Protective inputs,

Figure 83: Stop Type Warning Screen

go to the main Press Control Configuration screen shown in Figure 64 on page 79. Touching the **Input Types** softkey will produce the stop type warning message screen shown in Figure 83. This screen will be displayed with a 10 second countdown at the bottom, after which the **Go To Input Types** and **Cancel** softkeys will appear. Touching the **Go To Input Types** softkey will display the Input Types screen of Figure 84.

The screen of Figure 84 shows a list that includes all Protective and Non-Protective Stop inputs that can be named. The screens for configurable inputs will always display the inputs on the second optional Input Module, which has Inputs 57-112, even if it is not provided with the control. If this module is not provided, you can enter descriptions and stop types for these inputs, but these inputs don't exist and are treated as not used by the logic module.

Change the description of the inputs by pressing the blue bordered "Input Description" area next to the input number(s). This will bring up an Edit Text screen so that the description can be entered. Use

Figure 84: Input Types Configuration Screen

the **Next Page** and **Previous Page** softkeys to navigate the pages of inputs. Protective Stops have two designated input terminals in front of the description because they require dual inputs from external devices.

The user can also configure the "Stop Type" for any Non-Protective input that has a blue bordered area to the right of description by pressing this area. Protective input stop types are programmed in the Protective Inputs screen as described in Section 4.2.15. Inputs whose "Stop Type" is usually programmable (see Note that follows) are 45 through 49 and 52 through 55 on the 1st Input Module; and 73 through 84 and 97 through 112 on the 2nd Input Module.

NOTE:	Inputs 45, 46, and 47 will have a fixed Stop Type of "Lube System Controlled" if a lube system is configured.
	Inputs 53 and 54 will have a fixed Stop Type of "Hydraulic Overload Controlled" if a hydraulic overload system is configured.
	Input 111 will have a fixed Stop Type of "Lube System Controlled" if "Aux. Lube 1 Type" is set to Type 2 (On, WITH Feedback).
	Input 112 will have a fixed Stop Type of "Lube System Controlled" if "Aux. Lube 2 Type" is set to Type 2 (On, WITH Feedback).

WARNING:	Inputs 81-84 are configurable stops as described in this section but function differently in Clutch/Brake Test Mode. Clutch/Brake Test Mode was designed for a specific circumstance and is very rarely configured to be available – but if it is available the following behavior applies: When not in Clutch/Brake Test mode, these inputs function as configured. *However, when the press is in Clutch/Brake Test mode, Inputs 81 – 84 are disabled and will not stop the press!*

WARNING:	A hazard analysis **MUST** be performed to determine the appropriate Stop Type to use for the application!
	Safety related stops **MUST** be tied correctly to Protective Stop Inputs. Protective Stops are dual inputs and have a stop type of either "Protective Master Stop" or "Protective Immediate Stop".

All stop conditions described below also apply cycle inhibits when asserted. If any stop is programmed as "Input Not Used" at the Factory, the inputs will be left unwired. A fault (e.g. *Unused Input Active (Board 1)* or *Unused Input Active (Board 2)*) will be generated if an input programmed as "Input Not Used" is later wired for an application and it sees 24V on the input terminal. Inputs configured as "Input Not Used" can be changed by the customer to provide a specific type of stop; however this is on a "one time" basis. Once changed it cannot be changed again without factory authorization, including back to "Input Not Used". Inadvertent change of stop type could cause equipment damage or danger to personnel. The following table lists the types of inputs that can be selected:

Available Non-Protective Stop Types *See Section 2.5 for which modes are classified as Non-Production,* *Manual Production, or Automatic Production modes.*	
Type 0	Master Stop in all modes (turns the LMC Off)
Type 1	Immediate Stop in Non-Production modes.
Type 2	Immediate Stop in Manual Production modes.
Type 3	Immediate Stop in Automatic Production modes.
Type 4	Immediate Stop in Manual and Automatic Production modes.
Type 5	Immediate Stop in all modes.
Type 6	Top Stop in Non-Production modes.
Type 7	Top Stop in Manual Production modes.

Available Non-Protective Stop Types	
See Section 2.5 for which modes are classified as Non-Production, Manual Production, or Automatic Production modes.	
Type 8	Top Stop in Automatic Production modes.
Type 9	Top Stop in Manual and Automatic Production modes.
Type 10	Top Stop in all modes.
Type 11	Immediate Stop in Non-Production and Manual Production modes.
Type 12	Top Stop in Non-Production and Manual Production modes.
Type 13	Input Not Used (A fault is generated if the input goes High).
Type 14	Debounced (0.8sec) Top Stop in all modes (allowed only on Inputs 97 to 110). *Note that this input stop type is used primarily to monitor certain lubrications systems. When the main motor is being controlled through the operator terminal ("Main Motor Control Type" is something other than "Not Controlled") and the "Lube Motor Control Type" is configured to check the lube system, a stop asserted for this type of input will drop out the main motor and/or prevent it from being started. See Section 4.2.17 for more information.*

4.2.15 Protective Inputs

To configure the "Protective Stop Type" and "Track Time" of protective inputs, go to the main Press Control Configuration screen shown in Figure 64 on page 79. Touching the **Protective Input Types** softkey will produce a stop type warning message screen.   This screen will be displayed with a 10 second countdown at the bottom, after which the **Go To Protective Inputs** and **Cancel** softkeys will appear. Touching the **Go To Protective Inputs** softkey will display the Protective Inputs screen of Figure 85.

While the description for the Protective Inputs that can be named is entered in the Input Types configuration screen (see Section 4.2.14), the "Protective Stop Type" and "Track Time" configurations are entered here.
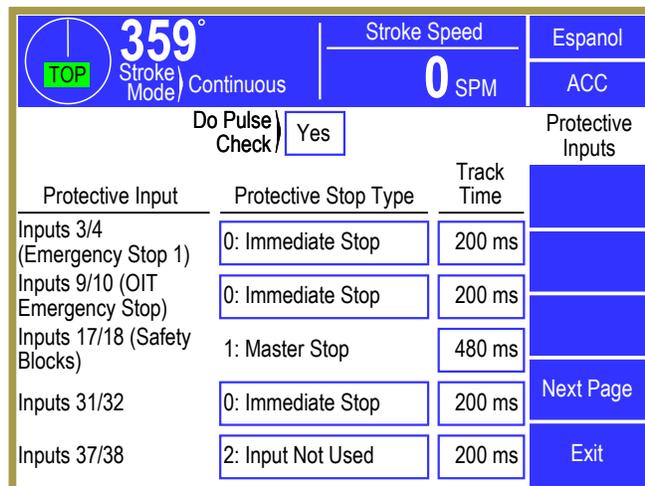
Figure 85: Protective Inputs Configuration Screen

Protective inputs are stop inputs that require two contacts from each switch or input device to be wired to two input terminals. For protective inputs on the 5100-4A Input Module 1 (terminals 1-56), one of the paired inputs must be driven by a "P1" output and the other driven by a "P2" output. These outputs are provided on Input Module 1 (see the Table of Protective Inputs on the next page.). On the 5100-4B Optional Input Module 2 (terminals 57-112), one of the paired inputs must be driven by a "P3" output and the other driven by a "P4" output on the module terminal strip.

The two inputs generate stop signals to both channels of the press control, and can be configured to be an "Immediate Stop" or a "Master Stop" (turns the LMC relays off to remove power from the motor and from auxiliary press control systems as well). "Top Stop" is not an option for Protective inputs. Please

see Section 2.1 on page 15 for an explanation of stop types, including the difference between Protective and Non-Protective stops.

The two inputs are cross-checked and must track each other within a "Track Time" limit. The limit for the two light curtains is fixed at 50 milliseconds, the limit for emergency stop buttons is programmable up to 500 milliseconds, the limit for protective interlocks is programmable up to 1000 milliseconds, and the limit for the safety block is programmable up to 2000 milliseconds. If the inputs fail to track, a fault message (e.g. *Light Curtain 1 Track Fault*) is displayed in the present running status and the **Reset** softkey in the Press Control screen must be pressed. If the inputs have not both shown that they can turn off, the present status will change to indicate that the switch wired to these inputs must be cycled (turned off) to verify that they can correctly reflect the off condition (e.g. *Light Curtain 1 (Cycle the Input)*). An internal hardware failure on either the 5100-4A or 5100-4B Input Modules will generate a cross check fault (e.g. *Light Curtain 1 XCheck Fault*).

Emergency Stop 1 is for operator station 1, which is always used. Therefore, it can be programmed to be an "Immediate Stop" or a "Master Stop", but cannot be set as "Input Not Used" and its description can't be changed. Emergency stops with default descriptions of "Station #2 E-Stop", "Station #3 E-Stop", "Station #4 E-Stop", "Station #5 E-Stop", and "OIT E-Stop" may or may not be used for a particular press production system. They can each be programmed as "Immediate Stop", "Master Stop", or "Input Not Used". Setting an E-Stop as "Input Not Used" will also configure the associated Top-Stop as "Input Not Used". The Top-Stop associated with each Emergency Stop input is listed in the Table below.

If you want to use only the Top-Stop associated with an Operator Station for other purposes, turn the E-Stop to an active stop setting and jumper its input(s) out to P1 and P2 for inputs on Input Module 1; or P3 and P4 for inputs on Input Module 2. You can then name the Top-Stop input in the Stop Type Configuration screen for its new application. Similarly, if the E-Stop is to be used for some other protective purpose, set its stop type in the Protective Inputs configuration screen, name it in the Stop Type Configuration screen and jumper the associated unused Top-Stop input to its 24V power supply.

Emergency Stop	E-Stop Input Numbers	Associated Top Stop	Top Stop Input Number
OIT E-Stop (Operator Terminal E-Stop)	9 & 10	OIT Top Stop (Operator Terminal Top Stop)	11
Station #2 E-Stop	31 & 32	Station #2 Top Stop	33
Station #3 E-Stop	59 & 60	Station #3 Top Stop	61
Station #4 E-Stop	87 & 88	Station #4 Top Stop	89
Station #5 E-Stop	65 & 66	Station #5 Top Stop	67

Protective stops on Inputs 37/38, 39/40, 69/70, 71/72, 91/92, 93/94, and 95/96 can each be programmed as "0: Immediate Stop", "1: Master Stop", "2: Input Not Used", or "3: Immediate Stop in Production Modes".

The configuration setting "3: Immediate Stop in Production Modes" is intended to be used for barriers or other interlocks that must be installed in order to run the press in any production mode, but can be removed during setup. This configuration will not generate a stop if the inputs are low in a non-production mode (See Section 2.5 for which modes are production and non-production). All fault

monitoring functions (e.g. Input Tracking Fault detection) remain active. The safety block is fixed as a master stop and cannot be turned off.

If any stop is programmed as "Input Not Used" at the Factory, the inputs will be left unwired. A fault (e.g. *Unused Input Active (Board 1)*) will be generated if an input programmed as "Input Not Used" is later wired for an application and 24V is detected on the input terminal.

If any Protective Stop with default name Emergency Stop or Protective Stop is programmed as "Input Not Used", it can be changed to "Immediate Stop" or "Master Stop" and named for its new use by the customer on a "one time" basis. Once changed it cannot be changed again without factory authorization.

Light curtain 1 and 2 are fixed as an immediate stop with programmable muting as configured by the "Light Curtain 1 Type" parameter.

The description for "OIT E-Stop", "Station #1 E-Stop", "Safety Blocks", and both light curtains cannot be changed. Descriptions can be programmed for the others..

The following tables summarize the Protective Stop type inputs for Input Module 1 and Input Module 2.

Input Module 1 Protective Inputs Using Pulsed Supplies					
Default Input Description	Input Terminals		Can Change Description in Input Types Screen	Can Change Stop Type & Track Time in Protective Inputs Screen	Comments
	P1	P2			
Light curtain 1	15	16	NO	NO	Inputs 15 & 16 must be jumpered to P1 & P2, respectively, if no Light Curtain 1 is used.
Light curtain 2	35	36	NO	NO	Inputs 35 & 36 must be jumpered to P1 & P2, respectively, if no Light Curtain 2 is used.
Station #1 E-Stop	3	4	NO	YES	Always Used - for Operator Station 1.
Station #2 E-Stop	31	32	YES	YES	Used for Operator Station 2, or, if second operator station is not used, can be unused or assigned name and Stop Type for other use.
OIT E-Stop	9	10	YES	YES	Used for Operator Terminal E-Stop, or, if not for Operator Terminal, can be unused or assigned name and Stop Type for other use.
Safety Blocks	17	18	NO	YES	Inputs 17 & 18 must be jumpered to P1 & P2 if unused.
Protective Stop #2	37	38	YES	YES	Can be unused, or name and stop type can be configured for various applications.
Protective Stop #3	39	40	YES	YES	Can be unused, or name and stop type can be configured for various applications.

Input Module 2 Protective Inputs Using Pulsed Supplies					
Default Input Description	Input Terminals		Can Change Description in Input Types Screen	Can Change Stop Type & Track Time in Protective Inputs Screen	Comments
	P1	P2			
Station #3 E-Stop	59	60	YES	YES	Used for Operator Station 3, or if a third operator station is not used, can be unused or assigned name and Stop Type for other use.
Station #4 E-Stop	87	88	YES	YES	Used for Operator Station 4, or if a fourth operator station is not used, can be unused or assigned name and Stop Type for other use.
Station #5 E-Stop	65	66	YES	YES	Used for Operator Station 5, or if a fifth operator station is not used, can be unused or assigned name and Stop Type for other use.
Protective Stop #4	69	70	YES	YES	Can be unused, or name and stop type can be configured for various applications.
Protective Stop #5	71	72	YES	YES	Can be unused, or name and stop type can be configured for various applications.
Protective Stop #6	91	92	YES	YES	Can be unused, or name and stop type can be configured for various applications.
Protective Stop #7	93	94	YES	YES	Can be unused, or name and stop type can be configured for various applications.
Protective Stop #8	95	96	YES	YES	Can be unused, or name and stop type can be configured for various applications.

4.2.15.1   Pulse Check

If the "Do Pulse Check" parameter (Figure 85) is set to "Yes", the P1/P2 outputs for the first input board and P3/P4 outputs for the second input board are used to generate a different pulsed signal on one input than on the other input of a protective switch that has dual isolated contacts. The pulse check test is performed by applying a 1 millisecond pulse to the P1/P3 outputs and then to the P2/P4 outputs 0.25 seconds later, every 0.5 seconds. This is intended to check for external wiring faults. This is intended to check for external wiring faults that might cause the dual contacts of a switch to function as one contact. Unlike tracking fault detection that is applied to the dual contacts, this test detects faults while the switch is closed (deactivated). A fault is generated if both inputs have been wired together or shorted together, or if either input is wired to 24 VDC. If detected, a fault is generated (e.g. *Board 1 Pulse Check Fault* or *Board 2 Pulse Check Fault*) and the press will not stroke until the fault is cleared.

Field connections for the dual contact switches are provided on each Input Module. The terminals (1P1, 2P1, 3P1, 4P1, 5P1, 6P1, 7P1, 8P1) are all attached to the same power supply (P1) on Input Module 1. The terminals (1P2, 2P2, 3P2, 4P2, 5P2, 6P2, 7P2, 8P2) are all attached to the same power supply (P2) on Input Module 1. The terminals (1P3, 2P3, 3P3, 4P3, 5P3, 6P3, 7P3, 8P3) are all attached to the same

power supply (P3) on Input Module 2. The terminals (1P4, 2P4, 3P4, 4P4, 5P4, 6P4, 7P4, 8P4) are all attached to the same power supply (P4) on Input Module 2.

4.2.16 Output Relays Configuration

Two Programmable Limit Switch modules and seven programmable Output Relay modules can be optionally used with the System 5100 control. Each module can provide 4 relays (1 normally open contact and 1 normally open or normally closed contact) or 4 solid state outputs (AC or DC) (see Figure 109 and Figure 110). If the **Output Relays** softkey on the main Press Control Configuration screen (see Figure 64 on page 79) is pressed, the screen shown in Figure 86 appears.

By pressing the blue bordered area next to each group of potential relay modules, each module can be configured to be "Not Installed" or "Installed". Since Output Relays are optional, depending on application, none or several modules may be installed for a given press.

Figure 86: Output Relays Configuration Screen

When selected to "Installed", the System 5100 control will monitor the relay drive signals for feedback verification. A fault is generated if the feedback signals do not track the intended state of the output. A fault will occur if the relay module is configured to "Installed" but is not physically installed, or if there is a fault with the drive signal to the relay or feedback signal from the relay. The fault must be corrected and the **Reset** softkey pressed in order to allow further stroking. If the output module uses electro-mechanical relays (not solid state), this fault will occur if the relay is removed from the socket or if a problem exists with the coil of the relay.

Figure 87: Output Relays Function Configuration Screen

Optional Output Relays (OR1 through OR28) are available in groups of 4 per module. For each installed OR module, a **Configure Function** softkey is shown (for OR 1-4 and OR 5-8 in the example of Figure 86) that will display a screen similar to Figure 87. This allows the function of each output relay in that bank to be configured. Press inside the blue bordered area next to each OR to bring up a list of functions to select from.

WARNING:	The configurable Output Relays described in this section are *NOT* safety outputs and should *NOT* be used for safety applications. They are intended to be used for interface with automation, indication of certain conditions, or other non-safety uses. Safety applications must use the safety relay interface described in Section 4.2.19 on page 149.

The full list of functions available for assignment to each output relay is listed in the table below.

Type Number	Function
	Output Relay Functions
Type 0	Not Used (Off)
Type 1	Turn On in Inch mode.
Type 2	Turn On in Single Stroke mode.
Type 3	Turn On in Continuous mode.
Type 4	Turn On in Automatic Single Stroke mode.
Type 5	Turn On in Timed Inch mode.
Type 6	Turn On in Continuous On Demand mode.
Type 7	Turn On in Setup/Stop Time Test mode.
Type 8	Turn On in Maintained Continuous mode.
Type 9	Turn On in Bar mode.
Type 10	Turn On in Inch or Timed Inch mode.
Type 11	Turn On in Inch, Timed Inch, or Setup/Stop Time Test mode.
Type 12	Turn On in Single Stroke or Maintained Continuous mode.
Type 13	Turn On in Continuous, Continuous On Demand, or Maintained Continuous mode
Type 14	Turn On in Automatic Single Stroke, Continuous, Continuous On Demand, or Maintained Continuous mode.
Type 15	Turn On if the press is inside the mute window and Light curtain #1 is configured to mute. The mute window includes the entire upstroke while the press is running and un-mutes above the start top angle when the clutch turns Off.
Type 16	Turn On if the press is inside the mute window and Light curtain #2 is configured to mute. The mute window includes the entire upstroke while the press is running and un-mutes above the start top angle when the clutch turns Off.
Type 17	Turn On if motion is above the "Motion Threshold" (programmed in the Clutch Configuration screen).
Type 18	Turn On if no stop conditions exist (i.e. no cycle inhibits). This output will turn on before the setup button is pressed in modes that require prior action. It will stay On while the press is stroking. This output will turn Off each time the press stops while the brake monitor is timing the stop - except in Auto Single Stroke or Continuous on Demand where the output will remain On as long as the mode is armed for automatic initiation.
Type 19	Turn On if there are no stop conditions and the "prior action" has been satisfied for modes that require it (for example, pressing the "Setup" button in Continuous mode). The output will turn back Off if the setup time expires (for modes that requires it) before stroking is initiated. It will stay On while the press is stroking. This output will turn Off each time the press stops while the brake monitor is timing the stop - except in Auto Single Stroke or Continuous on Demand where the output will remain On as long as the mode is armed for automatic initiation.
Type 20	Turn Off if Light curtain #1 is blocked, in any mode other than Inch. Always On in Inch mode. This output ignores any muting configured. A typical use is to stop feed motion if the light curtain is blocked, unless in Inch mode.
Type 21	Turn Off if Light curtain #2 is blocked, in any mode other than Inch. Always On in Inch mode. This output ignores any muting configured. A typical use is to stop feed motion if the light curtain is blocked, unless in Inch mode.

Output Relay Functions	
Type Number	**Function**
Type 22	Turn Off if either Light curtain #1 or #2 is blocked, in any mode other than Inch. Always On in Inch mode. This output ignores any muting configured. A typical use is to stop feed motion if the light curtain is blocked, unless in Inch mode.
Type 23	Turn On when a top stop occurs while stroking. This includes any top stop input, the lube system monitor, either of the two auxiliary lube monitors, any Stop Type 14 debounced input, a top stop from any CAN device (optional PLS Modules, Tonnage Monitor, Die Protection Units, etc.), and the RUN/PROG switch. This output will remain on until the press control initiates an auto stop at top. Turns Off when the press stops.
Type 24	Turn On if either motor forward or reverse input goes High after a "Main Motor Turn On Time" delay. Turn Off if motor stops after a "Main Motor Turn Off" delay. On and off delays are programmed in the Machine Parameters configuration screen.
Type 25	Turn On if the press control is sending a "Request to Run" signal to an automation device (e.g. a transfer) in Inch mode. For more information see "Transfer Type" parameter in the Machine Parameter configuration screen in Section 4.2.9.11.
Type 26	Turn On if the press control is sending a "Request to Run" signal to an automation device (e.g. a transfer) in Single Stroke or Automatic Single Stroke mode. For more information see "Transfer Type" parameter in the Machine Parameter configuration screen in Section 4.2.9.11.
Type 27	Turn On if the press control is sending a "Request to Run" signal to an automation device (e.g. a transfer) in Continuous, Continuous On Demand, or Maintained Continuous mode. For more information see "Transfer Type" parameter in the Machine Parameter configuration screen in Section 4.2.9.11.
Type 28	Turn On if the press control is sending a "Request to Run" signal to an automation device (e.g. a transfer) in Single Stroke, Automatic Single Stroke, Continuous, Continuous On Demand, or Maintained Continuous mode. For more information see "Transfer Type" parameter in the Machine Parameter configuration screen in Section 4.2.9.11.
Type 29	Turn On if the press control is sending a "Request to Run" signal to an automation device (e.g. a transfer) in any mode. For more information see "Transfer Type" parameter in the Machine Parameter configuration screen in Section 4.2.9.11.
Type 30	Turn On if the press control is sending a prior notification that a stop at top will take place. This output will turn On at 180 degrees and turn Off when the press stops. For more information see "Transfer Type" parameter in the Machine Parameter configuration screen in Section 4.2.9.11.
Type 31	Turn On if the program/run switch is in the PROG position.
Type 32	Turn On if digital die protection is in bypass.
Type 33	Turn On if digital tonnage monitor is in bypass.
Type 34	Turn On to run the main grease lubrication pump (output may pulse On/Off if configured to). For more information see Section 0.
Type 35	Turn On to run the hydraulic overload pump. Turn Off if a hydraulic overload occurs. For more information see Section 0.
Type 36	Turn On to engage the hydraulic overload cylinder. Turn Off if a hydraulic overload occurs. For more information see the Section 0.

Output Relay Functions	
Type Number	**Function**
Type 37	Turn On if the main lube system does not have a fault condition. A typical use for this output is to turn the main motor Off after slide motion stops in the event of a lube fault. For more information see the Section 0.
Type 38	Turns On if the zero speed switch monitor allows the main motor to start. This output will turn Off if the main motor is turned Off and the motor forward/reverse selector (Inputs 41 and 42) is switched to the opposite position from the previous direction of rotation when the motor is not at zero speed (Input 26 Low and Input 27 High). When the motor reaches zero speed (Input 26 High and Input 27 Low) this output will turn back On to allow the motor to be started. This output is always Off in Bar and Micro Inch modes. A typical use for this output is to prevent the motor from being restarted in the reverse direction, until it has reached zero speed.
Type 39	Turn On if the flywheel brake pressure switch detects pressure (flywheel brake is released) (Input 44 High). A typical use for this output is to turn the main motor Off if the flywheel brake is applied. It is also used to keep the motor Off until there is brake pressure (i.e. off until the brake is released) by pressing the motor start button.
Type 40	This is a combination of type 37 and 38 (i.e. either system monitor can stop the motor).
Type 41	This is a combination of type 37 and 39 (i.e. either system monitor can stop the motor).
Type 42	This is a combination of type 38 and 39 (i.e. either system monitor can stop the motor).
Type 43	This is a combination of type 37, 38, and 39 (i.e. either system monitor can stop the motor).
Type 44	Turn On if the main motor is started (Input 19 or 20 High), or if Inch, Timed Inch, or Bar mode is selected. This output is intended to drive the flywheel brake and allow "dead motor inch", when the main motor is started with external logic. ***This output should NOT be used to control the flywheel brake when the main motor is being controlled through the operator terminal ("Main Motor Control Type" is something other than "Not Controlled" – see Section 4.2.17.1). Use output Type 63 in that case. It can still be used for some other function if the logic fits what is needed.***
Type 45	Reserved for future use.
Type 46	Reserved for future use.
Type 47	Reserved for future use.
Type 48	Reserved for future use.
Type 49	Reserved for future use.
Type 50	Reserved for future use.
Type 51	Reserved for future use.
Type 52	Reserved for future use.
Type 53	Turn On to run the auxiliary lube #1 grease lubrication pump (output may pulse On/Off if configured to). For more information see Section 0.
Type 54	Turn On to run the auxiliary lube #2 grease lubrication pump (output may pulse On/Off if configured to). For more information see Section 0.
Type 55	Turn On if the auxiliary lube #1 system does not have a fault condition. A typical use for this output is to prevent allowing the slide adjust to move in the event of a counterbalance lube fault. For more information see Section 0.

Output Relay Functions	
Type Number	**Function**
Type 56	Turn On if the auxiliary lube #2 system does not have a fault condition. For more information see Section 0.
Type 57	Turn On if all inputs programmed as "Type 14" (Debounced Stop on Top) are High and the Lube Motor Contact is On (Input 21). A typical application for this is to use one or more inputs (97 through 110) to monitor lube flow sensors. Each of the "Type 14" inputs applies a 0.8 second debounce time. If an input goes low for longer than this time while the press is stroking, a top stop is generated. If the input remains low, the type 57 output will turn Off to stop the main motor after the press stops.
Type 58	Turns On if no external stops exist in Single Stroke mode. This output does not turn off while the brake monitor is timing. Off in all other modes.
Type 59	Turns On if Hydraulic Overload is not in a fault condition.
Type 60	Turns On to run the main motor in the forward direction when configured for motor start/stop control. ***This output type is only used when the main motor is being controlled through the operator terminal ("Main Motor Control Type" is something other than "Not Controlled").***
Type 61	Turns On to run the main motor in the reverse direction when configured for motor start/stop control. ***This output type is only used when the main motor is being controlled through the operator terminal ("Main Motor Control Type" is something other than "Not Controlled").***
Type 62	Turns On to run the continuous running lube pump motor when configured for motor start/stop control. ***This output type is only used when the main motor is being controlled through the operator terminal ("Main Motor Control Type" is something other than "Not Controlled").***
Type 63	Turns On to release the flywheel brake when configured for motor start/stop control. ***This output type is only used when the main motor is being controlled through the operator terminal ("Main Motor Control Type" is something other than "Not Controlled").*** Other output relay types (for example, types 39 through 44) can be used to interface to a flywheel brake when the main motor is controlled by external circuitry.
Type 64	Turns On in Inch mode or in Timed Inch (unless pulsing) when the clutch output (CB1) is Off and crankshaft motion is below the "Motion Threshold". A typical use of this output is to prevent the die clamp system from unclamping unless the press is at rest in a setup mode.
Type 65	Turns On if the Hydraulic Overload (if configured) is not in a fault condition and the counterbalance pressure switch (Input 51) is high. It will turn Off if the hydraulic overload inputs being monitored (depending on the configuration) are low even if inside the reset window. If the hydraulic overload is configured Off, this output will track only input 51. A typical use of this output is to prevent the slide adjust from moving in the event of a hydraulic overload or low counterbalance pressure.

Output Relay Functions	
Type Number	**Function**
Type 66	"Cont. & Auto. Modes Setup" is active. Turns on when setup button (Input 14) is accepted and stays on for a five second time period during which the stroke may be initiated with the selected run buttons. If the stroke is initiated in Continuous mode, the buttons must be held and the output will turn off when motion is established. In Continuous on Demand mode the output will also turn off if initiated but the run signal is suspending clutch engagement. In Automatic Single Stroke mode the output will remain on and the run buttons must be held until the press reaches the bottom of the stroke. It will turn off if the mode allows the press control to be armed at initiation but not make the first stroke. In Maintained Continuous mode the run buttons must be held to continue stroking and the output will remain on until the buttons are released. The output turns off in all other modes.
Type 67	Turn On if the zero speed switch tied to Inputs 26 and 27 is indicating "zero speed".
Type 68	Turn Off if lube level sensor (Input 45) is low and the main lube system is configured for type 01 or 02.
Type 69	Turns On when the press control initiates an auto stop on top. This occurs when the clutch output turns Off at the speed advanced top stop angle. Turns back Off when the press comes to rest as detected by the brake monitor. A typical use for this output is to signal auxiliary equipment (e.g. Transfer) that the press is stopping at the top.
Type 70	Turns On when the clutch output turns On. In Timed Inch mode it remains on while the press control is pulsing to the bottom of the stroke.
Type 71	Turns On when no valve monitor fault exists on channel "A" of the press control. Its operation is determined by the "Valve Monitor Type" parameter (see section 4.2.4). The output reflects the state of the static inputs if no reset is required. Configurations that require the **Reset** softkey be pressed will keep this output Off until the fault is acknowledged.
Type 72	Turns On to enable a Dynamatic Constant Energy System (CES) Mechanical Press Drive and Controller to "Run". This output type only applies to systems with a "Valve Monitor Type" set to "6: Dynamatic C.E.S. Drive". See Section 4.2.4 for more information.
Type 73	Turns Off to signal a Dynamatic Constant Energy System (CES) Mechanical Press Drive and Controller to stop on top. This output type only applies to systems with a "Valve Monitor Type" set to "6: Dynamatic C.E.S. Drive". See Section 4.2.4 for more information.
Type 74	Turns On when a brake monitor fault occurs on press control Channel A.
Type 75	Turns On in Micro-Inch mode.
Type 76	Turns On in Clutch/Brake Test mode.
Type 77	Turns Off if counter-balance pressure switch Input 51 is low. This is typically used to prevent slide adjust if the pressure is low.
Type 78	Turns Off if counter-balance pressure switch Input 51 is low, or if the main lube system has a fault condition. This is typically used to prevent slide adjust.
Type 79	Turns On if the crankshaft angle is within the Output Relay Window 1 region. The start and end angles for this window can be viewed in the Output Relays configuration screen. Factory access is required to change these settings.
Type 80	Turns On if the crankshaft angle is within the Output Relay Window 2 region. The start and end angles for this window can be viewed in the Output Relays configuration screen. Factory access is required to change these settings.

Output Relay Functions	
Type Number	**Function**
Type 81	Turns On if the crankshaft angle is within the Output Relay Window 3 region. The start and end angles for this window can be viewed in the Output Relays configuration screen. Factory access is required to change these settings.
Type 82	Turns Off if the press control has an internal fault that has turned the LMC Off and the **Reset** softkey must be pressed. An example of this type of fault is a Resolver/Optic fault. This output will not turn off if a master stop input causes the LMC to turn off. This is typically used to inform a cell controller that the press control will not allow stroke initiation until the fault is manually acknowledged and reset.
Type 83	Turns Off if the press control has an internal stop condition that will prevent stroke initiation. This generally indicates a condition that should be manually viewed at the operator terminal. Any stop condition that requires a **Reset** softkey will turn this output off. Static conditions such as the program/run switch in program will turn this output off. A job recall initiated by a serial communication command will turn this output off until all option modules are loaded.
Type 84	Turns On when power to the card rack is turned On. This output can be used to temporarily force an output to remain On.
Type 85	Output relay for controlling Soft Clutch.
Type 86	Output relay for controlling Soft Brake
Type 87	Output turns Off if the press is stopped and motor speed is above 105% of the maximum single stroke speed programmed. A typical use of this output is if "Ramp in Continuous" is set to "Yes" and this output is connected to a top stop input. If a stop occurs while running in continuous, the next stroke initiation is prevented until the motor speed slows below the threshold. This can be conditioned with a combination of modes if desired. This output will not turn Off if the "Speed Control Type" is configured as "Not Used".

4.2.17 Motor Start/Stop Control Configuration

By using output relays (see Section 4.2.16), the press control can optionally start and stop the main and lube motors through the operator terminal instead of using external control switches and buttons.

To get to the Motor Control Configuration screen, press the **Motor Control** softkey on the Output Relays Configuration screen (see Figure 86 on page 135). This will bring up a screen like Figure 88.

If enabled, a continuous running lube pump motor can also be controlled by the operator terminal and interlocked with the main motor. This is intended to prevent running the main motor without the lube

Figure 88: Motor Control Configuration Screen

pump. The main motor control allows for both reversing and non-reversing applications. If configured for reversing, the option can be setup to prevent the operator from stopping the main motor and then restarting in the opposite direction until the motor has first come to rest. The flywheel brake can be interlocked with starting and stopping the main motor on presses equipped with one. The outputs required for this option are determined by the application. For example, a press with a non-reversing main motor without a flywheel brake that uses an intermittent grease lube system would require only one output relay (configured as type 60). Since the motor is controlled by the press control, output relay types that are frequently used to stop the main motor (such as types 37 to 43) in the event of a fault (e.g. lube fault) or other conditions (e.g. zero speed switch) are not required and the function can instead be configured in the control. This option requires that Input 56 [Motors Start Enable] be wired to a pushbutton. Inputs 19 [N/O Mot. Forward Aux. Contact] and 20 [N/O Mot. Reverse Aux. Contact] are always required by the press control to indicate the direction of the main motor. They are also used by this option to verify that the motor starts in the intended direction.

> **NOTE:** The settings in this screen, with the exception of "Zero Speed Switch Interlock", are only used when starting the lube and/or main motor through the operator terminal. If the "Main Motor Control Type" is "Not Controlled", then "Flywheel Brake Control Type" and "Lube Motor Control Type" have no effect.

4.2.17.1 Main Motor Control Type

This parameter is used to set the basic characteristics of the motor start/stop control option. The other configuration parameters are used to define the specific application. When this option is selected, the operator terminal will provide screen selections for starting and stopping the main motor. It can also include start/stop control of a continuously running lube pump motor used for recirculating lube systems (see section 4.2.17.4). The recirculating systems can monitor both static and continual running flow sensors to determine if lubrication is correct. The Type 62 output relay should not be used to drive intermittent or pulsed grease lube systems. The pulsed systems control an output to periodically cause lube to flow (Type 34). The main lube systems described in Section 4.2.20 include monitors for both

recirculating lubes and pulsed lubes, which can be configured to stop the main motor in the event of a lube fault.

Type 0   *Not Controlled*

The motor start/stop control option is turned off and the operator screen will not be available. The other configuration parameters described in this section, with the exception of "Zero Speed Switch Interlock", will have no effect, and Output Relay Types 60 through 63 should not be selected.

Type 1   *Controlled (Forward Only).*

The operator terminal is used to start and stop the main motor using a non-reversing motor starter. A flywheel brake interlock can be configured to prevent starting the motor until the brake has released or to drop the motor contactor out if brake pressure is lost (see Section 4.2.17.2). The zero speed switch interlock should be configured as "Not Used". The Lube Motor Control Type parameter can be used to interlock lube systems with the main motor start/stop control. In addition to the main lube system, faults on any input configured as a Stop Type 14 (Debounced Stop on Top (All Modes)) can turn the main motor off depending on how the "Lube Motor Control Type" is configured (see Section 4.2.17.4).

Type 2   *Controlled (Reversing, Latch in Reverse)*

The operator terminal is used to start and stop the main motor using a reversing motor contactor. A flywheel brake interlock can be configured to prevent starting the motor until the brake has released or to drop the motor contactor out if brake pressure is lost (see Section 4.2.17.2). The zero speed switch interlock can be configured to prevent starting the main motor in the opposite direction until the motor has stopped (see Section 4.2.17.3). The lube motor control type parameter can be used to interlock lube systems with the main motor start/stop control. In addition to the main lube system, faults on any input configured as a Stop Type 14 (Debounced Stop on Top (All Modes)) can turn the main motor off depending on how the "Lube Motor Control Type" is configured (see Section 4.2.17.4). This configuration type will seal in the motor starter when started in either forward or reverse, and the "Motors Start Enable" pushbutton can be released after the motor is started.

Type 3   *Controlled (Reversing, Maintain in Reverse)*

This configuration setting functions the same as Main Motor Control Type 2, except that the main motor reverse output relay will not remain on after the motor is started unless Input 56 [Motors Start Enable] is maintained. If the enable button is released, the main motor reverse output relay will turn off. The motor can be re-started by pressing and holding the enable button, and then selecting the **Start Main** softkey. The enable button can be released after the motor is started in the forward direction.

4.2.17.2   Flywheel Brake Control Type

This parameter defines the operation of Output Relay Type 63, and is intended to drive the flywheel brake solenoid. The output turns "On" to release the brake. Air pressure indicates that the brake is released by Input 44 [Flywheel Brake Pressure Switch] switching high.

NOTE: "Flywheel Brake Control Type" is only used when the main motor is being controlled through the operator terminal ("Main Motor Control Type" is something other than "Not Controlled"). A Flywheel brake can still be used when the motor is controlled by an external circuit, but will NOT use Output Relay Type 63. Other Output Relay types may be useful in interfacing with these circuits.

Type 0   *Not Controlled*

This configuration setting informs the press control that there is no flywheel brake to be controlled and that Input 44 [Flywheel Brake Pressure Switch] is to be ignored. This input will have no effect when starting the main motor and will not cause either main motor output to turn "Off". Press Control software version 1.15 or greater keeps output type 63 Off. Earlier versions turn the output On when the main motor is started, if configured to start/stop the main motor through the operator terminal.

Type 1   *Controlled (All Modes)*

This configuration setting will cause the Flywheel Brake output relay (Type 63) to turn "Off" anytime the main motor output is turned "Off" in order to apply the flywheel brake. If Bar mode is selected (if configured), the main motor is turned off and the flywheel brake is applied until the motor reaches zero speed. The output relay is then turned "On" to release the brake and allow bar to be engaged.

Type 2   *Controlled (All Modes but Inch and Timed Inch)*

This configuration setting will cause the Flywheel Brake output relay (Type 63) to turn "Off" anytime the main motor output is turned "Off" except in Inch or Timed Inch modes. This allows the press to run "Dead Motor Inch". This operation allows the clutch to be engaged while the motor is coasting to a stop in order to Inch the press at very slow speed. The operation in Bar mode is the same as described in Flywheel Brake Control Type 1.

4.2.17.3   Zero Speed Switch Interlock

This parameter is used in applications where the main motor can be run in either the forward or the reverse direction. Its purpose is to prevent the motor from being restarted in the opposite direction after it has been stopped, until it has come to rest. Restart in the same direction as the motor was running when the stop button was pressed is allowed at any time. This parameter also allows the OIT to display when "Zero Speed" is achieved (this will be shown just to the right of the crank angle readout at the top left of the screen).

Type 0   Not Used

> This configuration setting instructs the press control to ignore zero speed of the motor when either motor output is turned Off. It allows the operator to reverse the direction and restart the motor at any time.

Type 1   External (Inputs 26 and 27)

> This configuration setting requires that an external zero speed switch be wired into Inputs 26 (N/O) and 27 (N/C). The motor has reached zero speed when Input 26 is high and Input 27 is low. An external zero speed switch is always required if Bar mode is configured, so this setting should be selected to make use of the same hardware for motor start/stop control.

Type 2   Internal (Motor SPM Analog Feedback)

> This configuration setting instructs the press control to use the analog flywheel speed measured with the optional 5100-3B board as the indication that the motor has stopped. The threshold is fixed at 20 a/d converter counts. The SPM threshold can be calculated by:

> Zero Speed (SPM) = (20 * [Maximum Speed]) / [Speed Input Cal. Number]

> This configuration setting is used only for motor start/stop control, and has no effect on Bar mode requirements.

Type 3   Internal (Main Motor Delay Time)

> This configuration setting can be used if no other indication that the motor has reached zero speed exists. The Delayed Main Motor output relay (Type 24) is intended to delay energization and de-energization of an eddy current drive used for the main motor. The de-energization time keeps the drive powered and couples the flywheel to the motor, while the motor is being stopped. Using this "Main Motor Turn Off Delay" (see Section 4.2.9.4) as the zero speed switch configuration will prevent the motor from being started in the opposite direction, while the motor is stopping.

4.2.17.4   Lube Motor Control Type

> **NOTE:**   "Lube Motor Control Type" is only used when the main motor is being controlled through the operator terminal (i.e. "Main Motor Control Type" is something other than "Not Controlled").

This parameter defines how the main motor start/stop control is interlocked with the main lubrication system so that a lube fault can stop the main motor if desired. The recirculating systems can monitor both static and continual running flow sensors to determine if lubrication is correct. The main lube systems described in Section 4.2.20 include monitors for both recirculating lubes and pulsed lubes, which can be configured to stop the main motor in the event of a lube fault. In addition to the main lube system, faults on any inputs configured as Stop Type 14 (Debounced Stop on Top (All Modes)) can turn the main motor off. It also defines the operation of output Type 62 which can be used to start recirculating lube systems through the operator terminal. This output relay should not be used to drive intermittent or pulsed grease lube systems. Pulsed systems control an output to periodically cause lube to flow (Type 34) and do not use this type of start/stop control.

Type 0   Monitor Only (No Main Motor Interlock)

> This configuration setting should be used if there is no main lube system configured in the press control. It can also be used if the main lube is configured for pulsed grease and used to lubricate only components that require it while the press is stroking (e.g. gibs, crankshaft bearings). In this situation, a lube fault should not stop the main motor or prevent it from being started. No lube pump start/stop controls will be available on the operator terminal.

Type 1   Monitor Only (Must be Satisfied to Start Main Motor)

> This configuration setting should be used on presses with intermittent or pulsed grease lube systems that lubricate components that rotate when the main motor is On (e.g. flywheel bearings). It can also be used any time it is desirable for a main lube fault to top stop the press and turn the main motor Off. With this configuration setting, the lube system must be satisfied in order to start the main motor. Any stop condition detected by the lube monitor will be displayed in the Motor Status as well as the Press Control present running status. A fault that requires a reset as acknowledgement (e.g. No Lube Flow) must be reset in the Press Control screen. No lube pump start/stop controls will be available on the operator terminal. Flow monitor sensors wired into inputs 97 through 110 and configured for Stop Type 14 (Debounced Stop on Top (All Modes)) are interlocked to stop the main motor, but the lube pump must be started externally.

Type 2   Controlled (Must be Satisfied to Start Main Motor)

> This configuration setting is intended to be used with continuous running lube pumps required for recirculating lubrication systems. The Motor Control screen provides keys for starting and stopping the lube pump, along with a lube on/off indicator. The lube pump output can be turned "On" by pressing the "Motors Start Enable" button while selecting the **Start Lube** key on the operator terminal. Once the lube pump is started, the lube system will monitor the inputs for proper operation depending on how it is configured (see Section

4.2.20). Flow monitor sensors wired into inputs 97 through 110 and configured for Stop Type 14 (Debounced Stop on Top (All Modes)) are interlocked to stop the main motor. Stop conditions reported by the lube monitor will be displayed in the Motor Status area of the operator terminal. For example, a static lube monitor input may display the message *I46-Low Lube Pressure* to indicate that the input is creating a stop condition. The main motor can be started only after the lube monitor is satisfied. A lube fault while the press is running will generate a top stop and turn the main motor off when the press stops. This fault will not turn the lube pump output off. This configuration requires that an auxiliary contact from the lube pump contactor be wired into Input 21 [N/O Lube Aux. Contact]. The diagnostic message *Lube Pump is Off* will be displayed in the Motor Status until Input 21 goes high, after the lube pump output is turned "On". A problem exists in the field components or wiring if the message persists. The motor diagnostic screen can be used to view the state of the output and the contact feedback input.

Type 3   *Controlled (Start Main also Starts Lube with 30 sec Timeout)*

This configuration functions in the same manner as Lube Motor Control Type 2, except for options when starting the main motor. The **Start Lube** softkey can be used to start the lube pump prior to starting the main motor. However, this configuration provides a **Start All** softkey that can be used to start both the lube motor and the main motor at the same time. A 30 second time period is given for the main lube system monitor to become satisfied, and a lube fault will turn the main motor off after this initial interval. The press control will not allow stroking the press until the lube monitor is satisfied. If both the lube pump and the main motor are off, the "Motor Status" will display *Ready to Start Motors* when all motor stop conditions are removed (e.g. any master stop switch). If only the lube pump is started, any error condition detected by the lube system will be displayed as the status message (e.g. *I46- Low Lube Pressure*). The **Start Main** softkey will allow the main motor to be started, with the 30 second timeout applied to the lube monitor.

Type 4   *Controlled with Low Lube Dropout (Must be Satisfied to Start Main Motor)*

This configuration functions in the same manner as Lube Motor Control Type 2 in that the main lube system monitor must be satisfied before the main motor can be started. In addition to that, a low lube level sensor can be used to turn the lube pump motor off and prevent it from being started if the lube level is low. Lube Type 1 or 2 (see Section 4.2.20) must be configured and the low level sensor must be wired into Input 45.

4.2.18 Output Relay Window Configuration

Output relay Types 79 – 81 (see Section 4.2.16) can be used to indicate the crankshaft is in a particular window, much like a programmable limit switch. The difference being that these windows are inherently related to the machine rather than any particular job and that the configuration is stored in the press control as factory parameters rather than the operator terminal.

To get to the Output Relay Window Configuration screen, press the **Output Window** softkey on the Output Relays Configuration screen (see Figure 86 on page 135). This screen contains the start angle and end angle for output relay Type 79, 80, and 81. Thus, three different regions can be defined. Note, however, that multiple output relays of each type can be defined. For instance, three output relays could be assigned Type 79, and all three would turn on when the crankshaft is within the window defined for Type 79. Each relay could be run to a separate piece of equipment that needed to know the press was in this region.

4.2.19 Safety Relay Interface Configuration

If the **Safety Relay Interface** softkey on the main Press Control Configuration screen (see Figure 64 on page 79) is pressed, the screen shown in Figure 89 appears.

If the *optional* 5100-3C Safety Relay Interface Board is installed, four drive outputs (see Figure 114 on page 172) are provided that are intended to generate stop signals to auxiliary equipment (e.g. servo feed, robot cell, etc.), when wired to the 5100-3CR Safety Relay Modules (see Figure 138 on page 198). The inputs that can control these stop signals are the protective inputs (dual inputs wired to two contacts of the same switch and cross-checked). For more information on the operation of these inputs see Section 4.2.15. The output signals

Figure 89: Safety Relay Interface Configuration Screen

are used to drive two force guided relays (controlled by each channel of the press control) with the series normally closed contacts read and cross checked by the press control (Channel A and Channel B). If the feedbacks fail to indicate the "Off" condition an immediate stop is generated. The LMC is turned off and the present running status will display a relay fault message (e.g. *Aux 1 Ch A N.C. Fault* or *Aux 1 Ch B N.C. Fault*). The LMC will remain off until the **Reset** softkey n the Press Control screen is pressed after the external relay fault has been corrected.

The Output Diagnostics screen can be used to view the intended state of the safety relay drive signal along with the normally closed feedbacks. The series N/C feedback path is built into the 5100-3CR Safety Relay Module and does not require field wiring beyond connecting the 5 conductor cable. Each 5100-3CR Safety Relay Module provides five isolated normally open contacts to route a stop signal to multiple automation components.

By pressing the **Configure** softkey beside the Safety Relay Interface number in Figure 89, the screen in Figure 90 allows each output to be programmed to drop out (turn off) due to any or all of the following conditions:

Figure 90: Safety Relay Interface Function Configuration Screen

- Any Emergency stop button is pressed (ignore any button configured as not used).
- Protective Stop Inputs 37 and 38 go Low.
- Protective Stop Inputs 39 and 40 go Low.
- Protective Stop Inputs 69 and 70 go Low. (It has no effect if no 2nd Input Module).
- Protective Stop Inputs 71 and 72 go Low. (It has no effect if no 2nd Input Module).
- Protective Stop Inputs 91 and 92 go Low. (It has no effect if no 2nd Input Module).

- Protective Stop Inputs 93 and 94 go Low. (It has no effect if no 2nd Input Module).
- Protective Stop Inputs 95 and 96 go Low. (It has no effect if no 2nd Input Module).
- Light curtain #1 (Inputs 15 and 16) goes Low. (No mute applies).
- The output can be programmed to ignore Light curtain #1 in Inch mode (For this to have any effect, light curtain #1 must be selected). This is typically used to allow the feed to jog in inch mode for setup purposes with the light curtain blocked when the safety relay output is used to disable the feed in production modes with the light curtain blocked.
- Light curtain #2 (Inputs 35 and 36) goes Low. (No mute applies).
- Any Master stop occurs.
- Main motor is in reverse.
- Hydraulic overload condition exists. If the hydraulic overload is configured for Type 0 (Not Used) the pump output will turn off and the safety relay will turn off if configured to "Drop Out if Hydraulic Overload Exists). If no hydraulic overload system exists, this setting should be "No"

| NOTE: | Each safety relay monitors the Protective Stop Inputs described above in order to control only the state of the safety relay, regardless of whether the input is a stop to the press control or not. If a Protective Stop is configured as Not Used by the press control and the inputs are left open (Low), a safety relay configured to monitor these inputs will remain Off. This is done intentionally to indicate that the inputs may not be configured to provide the desired level of protection. If these inputs are not intended to turn a safety relay Off, the configuration setting should be set to "No". |

4.2.20 Lube System Configuration

Inputs 45, 46, and 47 can be used to monitor a main lube system if desired. If a lube system is configured, these inputs are used by the lube monitor and are no longer configurable as to stop type in the Input Types configuration screen. Each input stop type is displayed as "Lube System Controlled" in the Input Types configuration screen and cannot be changed. However, the description of the input can still be entered in the Description area of the Input Types configuration screen. Figure 91 shows a typical Lube Configuration screen (in this case set to Type 1). The **Auxiliary Lube 1** and **Auxiliary Lube 2** softkeys will display the configurations screens for the two auxiliary lubes. In addition, the **Lube Diagnostics** softkey is provided as a convenience. This softkey will display the Lube Diagnostics screen (see Section 3.5.5.6 on page 44 for more information) which displays the state of inputs and outputs for the type of lube system selected. Some lube system types will also display additional information (such as actual cycles completed, time to next cycle, etc.). Each type of lube system provides additional configuration parameters as shown below.

Type 1   **Static Lube Monitor**

Input 45:   Debounced Top Stop
Input 46:   Debounced Top Stop
Input 47:   Debounced Top Stop
Output: Lube System Fault

If Input 45, 46, or 47 go Low for longer than the programmed debounce time while the press is stroking, the press control will issue a stop at the next speed advanced top stop angle. The time limit is programmable as shown in Figure 91 for each input up to 999 milliseconds. The programmed name of the input will be displayed in the reason for the last stop. If the condition remains after the press stops or if it occurs while the press is not stroking, a lube fault output will turn off and the present running status will display the programmed name of the input. This output will remain off and further stroking prevented until all three inputs return High, at which time the fault output will turn on. A typical use of the fault output would be to turn the main motor off. The Lube Diagnostics screen will display the inputs and outputs of the lube system (see Section 3.5.5.6).

Figure 91: Lube System Configuration Screen (Type 1)

This lube system can also be used to monitor a level sensor in order to turn the lube pump off and prevent it from being started in a fault condition. The sensor must be wired into Input 45 and a debounce time can be used if desired. If the lube pump is started with external hardware, Output Type 68 can be used to turn the lube pump off and prevent it from being started if Input 45 goes low for longer than the debounce time. If the lube pump is started through the operator terminal, the Lube Motor Control Type parameter can be set to turn the lube off and prevent it from being started in a fault condition (see Section 4.2.17.4).

Type 2 Static Lube with one re-circulating flow rate monitor

Input 45: Debounced Top Stop
Input 46: Debounced Top Stop
Input 47: Flow Rate Sensor
Output: Lube System Fault

If Input 45 or 46 go Low for longer than the programmed debounce time while the press is stroking, the press control will issue a stop at the next speed advanced top stop angle. The time limit is programmable as shown in Figure 92 for each input up to 999 milliseconds. The programmed name of the input will be displayed in the reason for the last stop. If the condition remains after the press stops or if it occurs while the press is not stroking, a lube fault output will turn off and the present running status will display the programmed name of the input. In addition Input 47 must cycle to indicate lube flow. This input must make at least the number of transitions (High to Low, or Low to High) that is programmed in the "Input 47 Flow Cycles" parameter within a time period programmed in the "Input 47 Flow Time" parameter. For example, this input is observed to change High/Low state 20 to 22 times over a 10 second time period. In order to detect when flow stops but allow variation in the actual period the "Input 47 Flow Time" could be set to 10 seconds and the "Input 47 Flow Cycles" could be set to 15. If the sensor fails to make 15 transitions over a 10 second interval, the press control will issue a stop at the next speed advanced top stop angle and display the reason for the last stop as *No Lube Flow*. If the sensor continues to be at fault the present running status will display *No Lube Flow* and the lube fault output will turn off. This output will remain off until all static inputs return High and the flow sensor cycles correctly, at which time the fault output will turn on. A typical use of the fault output would be to turn the main motor off. The Lube Diagnostics screen will display the inputs and output of the lube system (see Section 3.5.5.6). Along with the programmed flow monitor settings, the actual number of transitions being counted will be displayed. In the example above, the diagnostic count would begin incrementing at 15 and count up as high as 20 to 22 (for a correctly functioning lube). Software versions 1.21 and greater display the current count value, which will reset to zero when the timing window begins. In the example above, the count will reset to zero every 10 seconds.

This lube system can also be used to monitor a level sensor in order to turn the lube pump off and prevent it from being started in a fault condition. The sensor must be wired into Input 45 and a debounce time can be used if desired. If the lube pump is started with external hardware, Output Type 68 can be used to turn the lube pump off and prevent it from being started if Input 45 goes low for longer than the debounce time. If the lube pump is started through the operator terminal, the Lube Motor Control Type parameter can be set to turn the lube off and prevent it from being started in a fault condition (see Section 4.2.17.4).
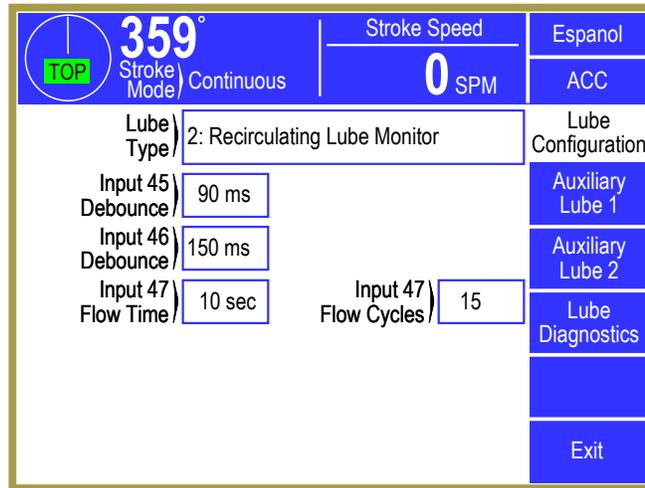
Figure 92: Lube System Configuration Screen (Type 2)

Type 3 Static Lube with dual re-circulating flow rate monitor

Input 45: Debounced Top Stop
Input 46: Flow Rate Sensor 2
Input 47: Flow Rate Sensor 1
Output: Lube System Fault

For Main Lube Type 3 (Figure 93) the system works in the same manner as type 2 with the exception of having one static debounced top stop input and two separate flow sensors. Individual flow monitor times and minimum number of transitions can be programmed for Input 47 and Input 46. If a fault is detected because of Input 46, the displayed message will be *No Lube Flow 2*.

Figure 93: Lube System Configuration Screen (Type 3)

The Lube Diagnostics screen will display the inputs and output of the lube system and the actual number of cycles measured is shown for both Input 46 and 47 (see Section 3.5.5.6 on page 44). Input 45 cannot be used to turn the lube pump off. Output Type 68 should not be used. The Lube Motor Control Type parameter should not be set for Type 4.

Type 4 Pulsed Grease with flow cycle feedback (time while stroking)

Input 45: Debounced Top Stop
Input 46: Debounced Top Stop
Input 47: Lube Flow Cycle Switch
Output: Lube System Fault
Output: Lube Grease Output

For main lube type 4 (Figure 94), If either Input 45 or 46 goes Low for longer than the programmed debounce time while the press is stroking, the press control will issue a stop at the next speed advanced top stop angle. The time limit is programmable for each input up to 999 milliseconds. The programmed name of the input will be displayed in

Figure 94: Lube System Configuration Screen (Type 4)

the reason for the last stop. If the condition remains after the press stops or if it occurs while the press is not stroking, a lube fault output will turn off and the present running status will display the programmed name of the input. In addition, this system will provide an occasional pulse of lubrication (either grease or oil) on a timed interval. It is intended to lubricate mechanical components on the machine that move while the clutch is engaged and the press is stroking (e.g. Gibs, or crankshaft bearings). The "Flow Time" parameter sets the maximum number of seconds that the lube cycle will take place. The actual time duration is determined by the lube cycle switch (Input 47). When working correctly, this input will make the number of complete cycles (i.e. Low to High to Low, or High to Low to High) specified by "Lube Cycles" parameter within the "Flow Time" programmed. This cycle will end the lube and the grease output will turn off. This output will remain off for the programmed "Time Off" (in minutes). The "off" time will accumulate only while the press is stroking and will pause when the press is idle.

The lube cycle will then repeat. If Input 47 fails to complete the correct number of cycles within the "Flow Time", the grease output will turn off and the press control will issue a stop at the next speed advanced top stop angle. The reason for the last stop and the present running status will display *No Lube Flow* and the lube fault output will turn off when the press stops. The present status will remain until the **Reset** softkey is pressed, which will cause another lube cycle. The Lube Diagnostics screen can be used to view the inputs and output of the lube system (see Figure 24 on page 45). Since a lube fault will stop the press, the lube fault output is typically not used to turn the main motor off but may be used as an indicator light. The lube cycle will pause (output off) if the motor is turned off.

The grease output can be programmed to stay on continuously during a lube cycle if a motor driven pump is used to cause lube to flow, or can be pulsed on and off for use with a solenoid driven pump. The "Output Pulse Rate" parameter sets the number of seconds that the grease output will turn on and then off (e.g. a setting of 5 will cause the output to turn on for 5 seconds and then off for 5 seconds). A setting of 0 causes the output to remain on during the lube cycle.

Type 5   **Pulsed Grease with flow cycle feedback (time while motor running)**

Input 45:   Debounced Top Stop
Input 46:   Debounced Top Stop
Input 47:   Lube Flow Cycle Switch
Output: Lube System Fault
Output: Lube Grease Output

This system works in the same manner as Type 4 except that "time off" accumulates while the main motor is running instead of while stroking. This type is intended to lubricate mechanical components that move while the motor is running (e.g. flywheel bearings). The lube fault output is frequently used to turn the main motor off in the event of a lube fault.

Type 6   **Pulsed Grease without flow cycle feedback (time while stroking)**

Input 45:   Debounced Top Stop
Input 46:   Debounced Top Stop
Input 47:   Not Used
Output: Lube System Fault
Output: Lube Grease Output

This system is the same as Type 4 except it is used when no flow cycle switch exists to monitor. In this case the duration of the lube cycle is set by the "Flow Time" parameter.

Type 7   **Pulsed Grease without flow cycle feedback (time while motor running)**

Input 45:   Debounced Top Stop
Input 46:   Debounced Top Stop
Input 47:   Not Used
Output: Lube System Fault
Output: Lube Grease Output

This system is the same as Type 5 except it is used when no flow cycle switch exists to monitor. In this case the duration of the lube cycle is set by the "Flow Time" parameter.

Type 8   **Static Monitor with Off State Check**

Input 45:   Debounced Top Stop
Input 46:   Debounced Top Stop
Input 47:   Debounced Top Stop
Output: Lube System Fault

While the lube pump is running (Input 21 high), this lube system functions the same as Type 1. Inputs 45, 46, and 47 remain high to indicate proper lube flow. If an input goes Low for longer than the programmed debounce time while the press is stroking, the press control will issue a stop at the next speed advanced top stop angle. The time limit is programmable as shown in Figure 91 for each input up to 999 milliseconds. The programmed name of the input will be displayed in the reason for the last stop. If the condition remains after the press stops or if it occurs while the press is not stroking, a lube fault output will turn off and the present running status will display the programmed name of the input. This output will remain off and further stroking prevented until all three inputs return High, at which time the fault output will turn on. The lube fault output (Type 37) can be used to turn off the main motor if the motor is started with external logic. If the motor is started through the operator terminal see Section 4.2.17.4.

If the lube pump is turned off (Input 21 is Low), this lube monitor will also check that Inputs 45, 46, and 47 switch Low to verify that a sensor has not failed statically High. The debounce time applies to each input that was High when the lube pump was on. Output Type 68 will turn off to prevent the lube pump from being started until all three inputs switch Low. This output should be used if the lube pump is started with external logic. If configured to start/stop the lube pump through the operator terminal (see Section 4.2.17.4), this lube monitor will prevent the lube pump from being started and will display any input that does not switch Low in the motor status (see Section 3.6).

The Lube Diagnostics screen will display the inputs and outputs of the lube system (see Section 3.5.5.6).

4.2.21 Auxiliary Lube Systems Configuration

Up to two auxiliary lube systems can be configured to provide lube for auxiliary press systems such as air cushions or counterbalance cylinders. Pressing the **Auxiliary Lube 1** softkey on the main Lube Configuration screen of Figure 91 will display the screen shown in Figure 95. Similarly, pressing the **Auxiliary Lube 2** softkey on the main Lube Configuration screen will display the Auxiliary Lube 2 screen. The **Lube Diagnostics** softkey is provided as a convenience. This softkey will display the Auxiliary Lube Diagnostics screen (see Section 3.5.5.6 on page 44 for more information) which displays the state of inputs and outputs for the type of lube system selected. Both Auxiliary Lube systems 1 & 2 can be either "open loop"

Figure 95: Auxiliary Lube 1 Configuration Screen

systems that use no feedback inputs to monitor that a "shot" of grease or oil has occurred or "closed loop" systems that require a lube cycle switch operated by the flow of grease or oil to indicate that the intended "shot" actually occurred. If either auxiliary lube system requires feedback the System 5100 control will have to have the optional second Input Module to provide Inputs 111 and 112. If configured for feedback, Auxiliary Lube 1 uses Input 111 and Auxiliary Lube 2 uses Input 112 and the Stop Type for those inputs is displayed as "Lube System Controlled" in the Input Types configuration screen and cannot be changed. However, the description of the inputs can still be entered in the Description area of the Input Types configuration screen. If a lube system is not used or is configured for no feedback these inputs are configurable stop inputs if Input Module 2 is provided with the System 5100 control.

The Auxiliary Lube configuration Types are:

Type 0   **Not used**

Input 111: Not Used - Available for use as a configurable input.
Input 112: Not Used - Available for use as a configurable input.
Output: Not Used

Type 1   **On, WITHOUT Feedback**

Input 111: Not Used - Available for use as a configurable input.
Input 112: Not Used - Available for use as a configurable input.
Output: Aux. Lube Grease Output

The Type 1 auxiliary lube system is intended to lubricate other mechanical components on the press such as a counterbalance or a cushion. It can be used to provide an occasional pulse of lubrication after a programmable "off" interval. The Aux. Lube 1 (or 2) "Flow Time" parameter sets the duration of the lube cycle (in seconds) during which time the Aux. 1 (or 2) grease output will turn on (or pulse on/off). After this time period the grease output will turn off and remain off for the programmed Aux. Lube 1 (or 2) "Stroke Interval". Unlike the main lube system the "off" interval is programmed in numbers of

strokes (maximum 99,999). The Auxiliary Lube Diagnostic screen can be used to view the system output status (see Section 3.5.5.6 on page 44). The measured number of "Aux. Lube 1 Lube Cycles" displays the number of strokes remaining until the next lube cycle will take place (lube cycle turns on when count reaches 0). The **Pulse Aux. Lube 1** and **Pulse Aux. Lube 2** softkeys can be used to manually initiate a lube cycle. The lube cycle will pause (output off) if the motor is turned off.

The grease output can be programmed to turn on continuously during a lube cycle if a motor driven pump is used to cause lube to flow, or can be pulsed on and off for use with a solenoid driven pump. The Aux. Lube 1 (or 2) "Pulse Time" parameter sets the number of seconds that the grease output will turn on and then off (e.g. a setting of 5 will cause the output to turn on for 5 seconds and then off for 5 seconds). A setting of 0 causes the output to remain on during the lube cycle.

Type 2   **On, WITH Feedback (Only if 2nd Input Module is provided)**

Input 111: Aux. Lube 1 Cycle Switch
Input 112: Aux. Lube 2 Cycle Switch
Output: Aux. Lube Fault
Output: Aux. Lube Grease Output

This auxiliary lube system is intended to lubricate other mechanical components on the press such as a counterbalance or a cushion. It can be used to provide an occasional pulse of lubrication after a programmable "off" interval. The Aux. Lube 1 (or 2) "Flow Time" parameter sets the maximum duration of the lube cycle (in seconds) during which time the Aux. Lube 1 (or 2) grease output will turn on (or pulse on/off). The actual time duration is determined by the lube cycle switch (Input 111 for Aux. Lube 1 or Input 112 for Aux. Lube 2). When working correctly this input will make the number of complete cycles (i.e. Low to High to Low, or High to Low to High) specified by Aux 1 (or 2) "Lube Cycles" parameter within the Aux Lube 1 (or 2) "Flow Time" programmed. This cycle will end the lube and the grease output will turn off. This output will remain off for the programmed Aux. Lube 1 (or 2) "Stroke Interval". Unlike the main lube system the "off" interval is programmed in numbers of strokes (maximum 99,999), after which the lube cycle repeats. If Input 111 fails to complete the correct number of cycles within the "Flow Time", the grease output will turn off and the press control will issue a stop at the next speed advanced top stop angle. The reason for the last stop and the present running status will display *No Aux. 1 Lube Flow* and the Aux. Lube 1 fault output will turn off when the press stops. The present status will remain until the **Reset** softkey is pressed, which will cause another lube cycle. The Auxiliary Lube Diagnostic screen can be used to view the system input and output status. The measured number of "Strokes Until Next Lube" displays the number of strokes remaining until the next lube cycle will take place (lube cycle turns on when count reaches 0). The **Pulse Aux. Lube 1** and **Pulse Aux. Lube 2** softkeys can be used to manually initiate a lube cycle. The lube cycle will pause (output off) if the motor is turned off.

The grease output can be programmed to turn on continuously during a lube cycle if a motor driven pump is used to cause lube to flow, or can be pulsed on and off for use with a solenoid driven pump. The Aux. Lube 1 (or 2) "Pulse Time" parameter sets the number of seconds that the grease output will turn on and then off (e.g. a setting of 5 will cause the output to turn on for 5 seconds and then off for 5 seconds). A setting of 0 causes the output to remain on during the lube cycle.

4.2.22 Monitor Flow Lube System

Another type of lube system can be configured in addition to or instead of the main lube system monitor. Its' typical use is to monitor flow sensors whose outputs are held high, top stop the press in the event of a sensor fault, and turn the main motor off when the press stops. The number of sensors depends on the press, and must be wired into inputs 97 through 110. The inputs should be configured as Stop Type 14 (Debounced Stop on Top (All Modes)), which applies a 0.8 second debounce time before the input low condition is considered a fault. If any inputs are configured for this type, the lube motor contact must be wired into Input 21 [N/O Lube Aux. Contact] to indicate that the lube pump is running. Output Type 57 can be used to stop the main motor in the event of a fault, if the motor is started with external hardware. If motor start/stop control is configured (see Section 4.2.17) and the Lube Motor Control Type is set to 1 or greater, the Stop Type 14 monitor is internally interlocked to stop the main motor. An example of where both the main lube system monitor and Stop Type 14 configured inputs could be used is where the main lube (type 1) is used to monitor static inputs (e.g. Low level, high pressure) and the lube pump used to drive multiple monitor flow sensors. A lube fault would top stop the press and turn the main motor off, while the low level sensor would turn the lube pump off.

4.3 Operator Terminal Configuration

There are two ways to get to the Operator Terminal configuration screen; first, by touching the **Operator Terminal** softkey in the Press Control Configuration screen (see Figure 64 on page 79); and secondly by touching the **Config OIT** softkey in the Device Config Screen.

The screen shown in Figure 96 can be used to configure the operator terminal to display specific default information in the "top info area" that appears in all operator screens.

The operator can select any of the "Top Area Display" items by pressing the top info area, but the selection made here will be the default at power up. This screen can also be used to set the real time clock if necessary. If desired, the user can enter the press stroke length and the connecting rod length in order to display the distance to bottom of the stroke.

Figure 96: Operator Terminal Configuration Screen

4.3.1 Top Area Display

The center section of the top display area can be configured to show the following items:

- Press Speed (Drive speed at rest and crankshaft speed when press is stroking)
- Press Control Status
- Press Control Reason for Last Stop
- Current Part Count
- Distance to Bottom
- Total Tonnage

The displayed item can change when the stroking mode is changed. The user can chose the item that is to be displayed in Setup modes, such as Inch and Timed Inch, and the item that is to be displayed in Production modes, such as Single Stroke and Continuous.

Note also that touching the "top info area" will cycle through the available information items that are not currently shown. This allows the operator to conveniently see any of the items without having to change them in this screen. The next time the mode is changed, however, the item will be shown as configured here again.

4.3.2   Rod Length and Stroke Length

The "Rod Length" and "Stroke Length" shown in Figure 96 are used to calculate the distance from the bottom of the stroke. These items can be displayed and entered in either inches or millimeters.

The "Rod Length" is the length of the connection between the center of the crankshaft and the slide connection point.

The "Stroke Length" is the total linear travel of the press slide from top to bottom.

The "Rod/Stroke Units" can be changed at any time between inches and millimeters. The "Rod Length" and "Stroke Length" values are automatically converted when the unit is changed and the "Distance to Bottom", if displayed in the top info area, is also converted to the new unit that was selected.

4.3.3   Setting the Date and Time

This control contains a real time clock. To set the time and date, press the **Set Date and Time** softkey shown in Figure 96. The screen of Figure 97 will be displayed. Set the date and time to the desired values and then press the **Enter** softkey to keep the changes. Note that the date and time change only occur at the time the **Enter** softkey is actually pressed. Press the **Cancel** softkey to abandon any changes and keep the current date and time.
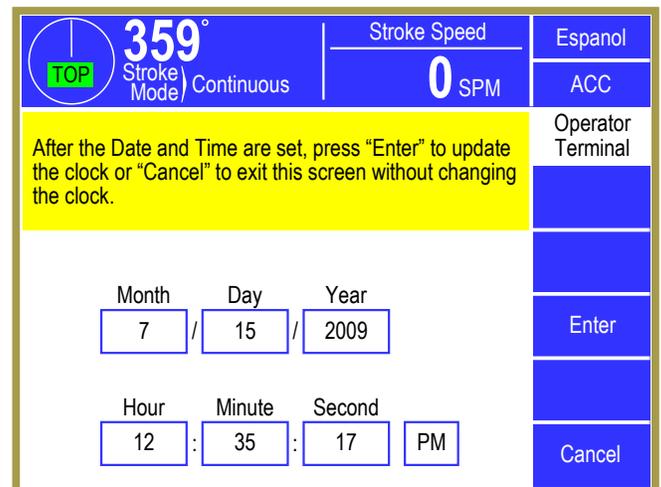
Figure 97: Date and Time Setting Screen

4.3.4 Access Configuration

As described in Section 3.3 on page 30 the user must gain Access Control in order to perform certain operations and change certain parameters. This access control can be obtained by two means, RUN/PROG key or a user password system. These two means can be used alone or in combination with each other.

Press the **Access Config** softkey from the Operator Terminal Configuration screen (see Figure 96) will display the Access Configuration screen shown in Figure 98.

In addition to some basic parameters that determine how access control will work, this screen lists the
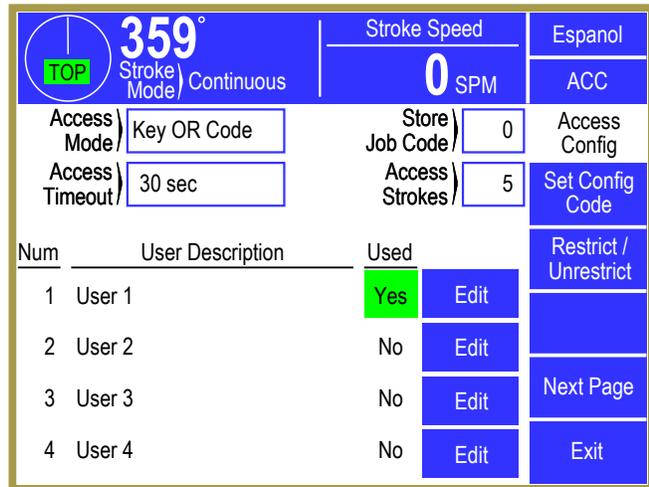
Figure 98: Access Configuration Screen

"Users" that can operate the system. Note that "Users" are ignored if the "Access Mode" is set to "Key Only". The **Next Page** and **Previous Page** softkeys are used to page through up to 16 possible "Users".

The following sections discuss the parameters and features of this screen.

4.3.4.1 Access Mode Configuration

There are four access modes. These are "Key and Code", "Code Only", " Key or Code", and "Key Only". These modes are explained in Section 3.3 on page 30.

4.3.4.2 Access Timeout and Access Strokes

When users gain access by using a password, they remain logged in until they manually log out or are automatically logged out. See Section 3.3.6 on page 34. Automatic log out can be either time based or stroke based.

The timed log out is based upon the time between keyboard activity. If the user does not press any key on the operator terminal within the time programmed, the control will automatically log out the user. The "Access Timeout" parameter sets this time. A time of 0 seconds turns off the timed log out and the system will not automatically log out a user based on time (but manually logging out or stroke based automatic logout will still function).

The "Access Strokes" parameter sets the number of press strokes between keyboard activity that the system will allow before automatically logging out the user. A value of 0 strokes turns off the stroke based automatic log out (but manually logging out or timed based automatic logout will still function).

4.3.4.3 Store Job Code

The "Store Job Code" is an optional access code that can be required before an operator is allowed to store a job and is used ONLY when "Access Mode" is "Key Only". This allows only trusted operators to overwrite a job setup while still allowing other operators to recall job setups and perform other operations. Since the purpose of this code is primarily the protection of known good job setups, it also

applies to job erase operations. A setting of "0" will disable this function, and anyone with the RUN/PROG key will be able to store and erase job setups.

4.3.4.4 Edit User

The control allows for up to sixteen users to have the ability to gain access control. Each user is assigned a name, a password, and various permissions. Touch the **Edit** softkey to the right of a user in the Access Configuration screen (shown in Figure 98) to display the User Configuration screen shown in Figure 99.

This display provides the following information:

- User name/description
- User's current password
- Whether or not the User is "Used"
- A listing of permissions for this user.
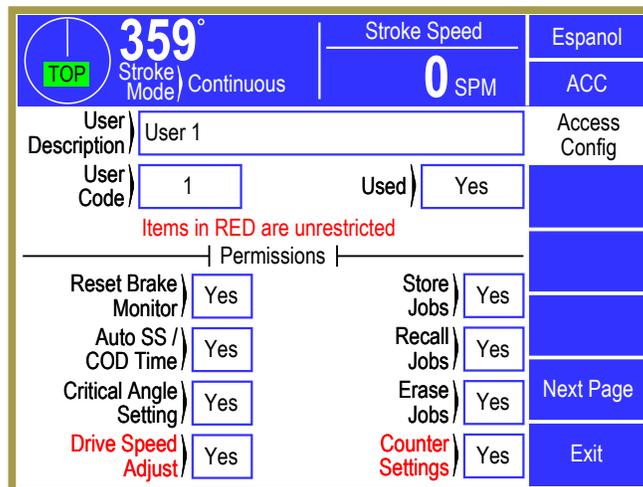
Figure 99: User Access Configuration Screen

The user can be enabled or disabled. When a user is enabled ("Used" set to "Yes"), the user's name will appear on a list of possible users that may obtain access control. When a user is disabled ("Used" set to "No"), the user's name will not appear on a list of possible users that may obtain access control.

Each user can be granted permission to access certain restricted items. A list of these items is shown in Section 3.3.5 on page 32. If a restricted item is configured with a "Yes", the user can obtain access to that item. If the restricted item is configured with a "No", the user cannot obtain access to that item.

4.3.4.5 Restrict/Un-Restrict Access

In addition to the user access system, certain items can be made available to any operator as shown in Figure 100. An example of this would be to allow any operator to reset the production counters. Any item marked as "Yes" can be changed by an operator without the RUN/PROG key or an access code. Note that this is true even if the "Access Mode" is in one of the modes that require a code and the user permission for the same setting is marked to deny access. These settings will override any other restriction.
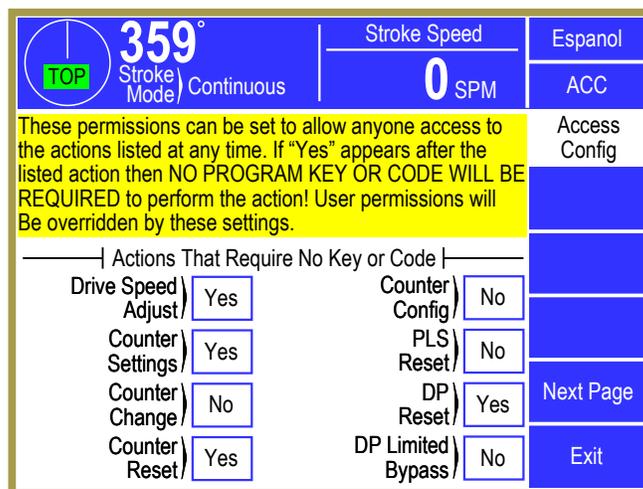
Figure 100: Restrict/Unrestrict Screen

4.3.4.6   Setting the Configuration Code

Selecting the **Set Config Code** softkey in the Access Configuration screen, will display the Configuration Code screen shown in Figure 101. This screen allows the Configuration Code to be changed. This is the configuration code that protects Top Stop Calibration, Machine Parameters, Lubrication Systems Configuration, Operator Terminal Configuration, Restricted Programmable Limit Switch Setting, Names and Messages, Counter Configuration, Tonnage Monitor Configuration, Die Protection Configuration, and Auto Setups Configuration. It is imperative that this code be given only to authorized personnel who are familiar with the control and with the consequences of incorrect parameter settings.
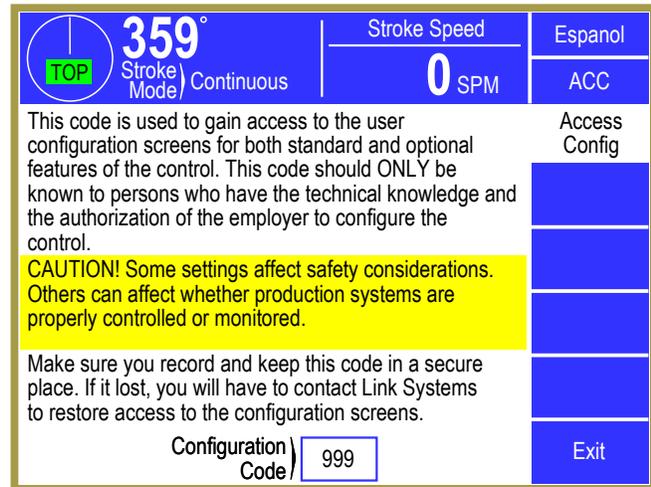
Figure 101: Set Config Code Screen

The configuration code is set at the factory. It is suggested that this code not be changed unless the security of the configuration code has been jeopardized. If a configuration code has been obtained by personnel who do not require access to the configuration parameters, it must be changed. When this code is changed, the previous code will no longer be valid. The value of the new code should be documented and stored in a secure place.

If a current code value is lost, the factory must be consulted.

4.3.5   Configure Auxiliary Communications

The **Auxiliary Comm Setup** softkey provides access to the configuration screens for the communication options These options include serial communication ports for interfacing to electronic servo feeds, auxiliary equipment (such as PLCs), a laptop interface for downloading messages, and a network interface. See the manual pertaining to the particular device that is connected for communication.

4.4   Programmable Limit Switch Configuration

In order for the Programmable Limit Switch to be recognized by the operator terminal, one or more PLS output boars must be set to "Installed". This process is described in Section 4.2.16 on page 135.

Certain limit switch parameters and settings, such as the list of available limit switch descriptions, are not configured by job but instead apply to all jobs. These items are protected by the Configuration Code (see Section 4.3.4.6 on page 162).

The programmable limit switch configuration screen is reached in the following manner:

- From the main screen, enter the Limit Switch screen.
- Press the **Channel Settings** softkey (it does not matter which channel is currently selected).
- With the RUN/PROG key in the PROG position, Press the **Configure System** softkey. Note that this softkey will not appear unless the RUN/PROG key is in the PROG position.
- The system will prompt the user for the Configuration Code.
- After the code is entered correctly, the screen of Figure 102 will be displayed.
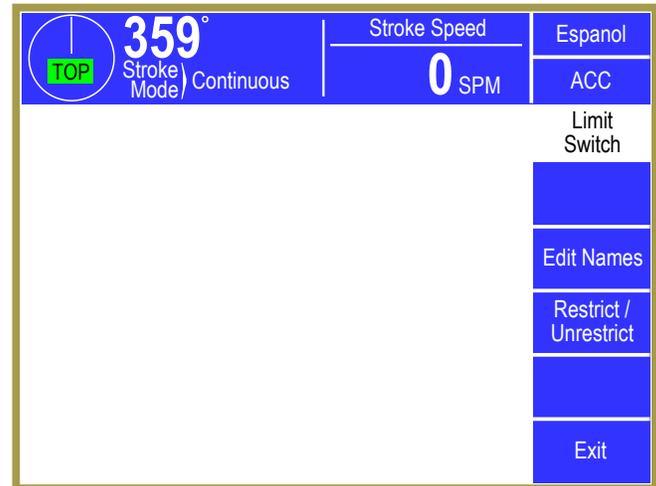
Figure 102: PLS Configuration Main Screen

4.4.1 Editing the PLS Name List

For each limit switch channel, a description can be assigned for a particular job. For instance, Job 1 might use limit switch channel 2 as a stock oiler output while Job 2 uses it as an air blow off.

Press the **Edit Names** softkey (shown in Figure 102) to display the screen of Figure 103. Use the **Previous Page** and **Next Page** softkeys to page through the entire list of 64 names. Touch inside the blue border of a name to change it.

This list of names is displayed for selection when a limit switch channel description is changed. Note that if a particular PLS Name is changed in this screen, then all jobs with limit switch channels set to that description will now show the new description in its place.
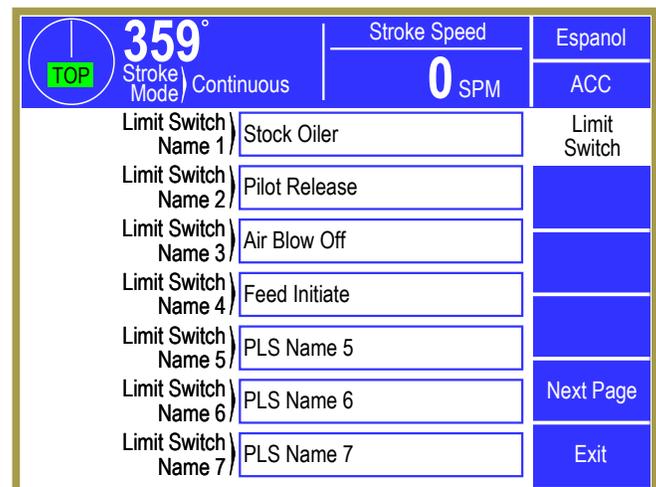
Figure 103: PLS Edit Names Screen

4.4.2   Restricting and Unrestricting PLS Channels

Limit switch channels that stay the same regardless of the job being run can be restricted. When a channel is restricted, it can be viewed but not changed by the operator, and it will not be affected by job recalls.

Press the **Restrict / Unrestrict** softkey (shown in Figure 102) to display the screen of Figure 104. Use the **Previous Page** and **Next Page** softkeys, if displayed, to page through the channels.

Each individual channel can be restricted by changing the "Restricted" setting for that channel to "Yes".
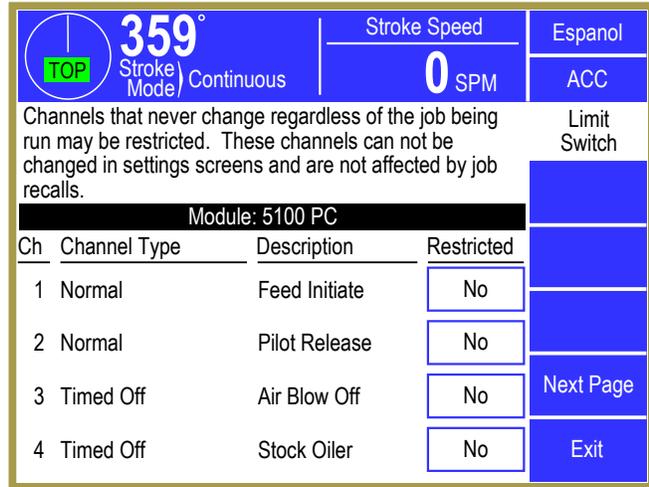
Figure 104: PLS Restrict/Unrestrict Screen

The channel settings cannot be changed while restricted. If a job is recalled the restricted channel settings will not change, even if the restricted channel's settings are different in the recalled job.   In order to make changes to a restricted channel; the restriction must be removed, the change entered, and then again set the channel to restricted.

4.5   Die Protection Configuration

For the Die Protection to be available to the operator, it must be enabled in the Device Config screen. See Section 4.1 on page 78 for details.

Certain die protection parameters and settings, such as the list of available die protection descriptions, are not configured by job but instead apply to all jobs. These items are protected by the Configuration Code (see Section 4.3.4.6 on page 162).

The die protection configuration screen is reached in the following manner:

- From the main screen, enter the Die Protection screen.
- Press the **Channel Settings** softkey (it does not matter which channel is currently selected).
- With the RUN/PROG key in the PROG position, Press the **Configure System** softkey. Note that this softkey will not appear unless the RUN/PROG key is in the PROG position.
- The system will prompt the user for the Configuration Code.
- After the code is entered correctly, the screen of Figure 105 will be displayed.

Figure 105: Die Protection Configuration Main Screen

4.5.1.1   Limited Bypass Maximum Strokes and Maximum Time

Stroke limited bypass is an option that, when selected, allows a user to bypass the monitoring functions of the die protection system for a limited number of strokes and for a limited time. The system will remove the bypass after either limit is reached. If limited bypass is not required, the "Limited Bypass Maximum Strokes" parameter should be set to zero and the **Limited Bypass** softkey will not appear in the die protection bypass screen. If limited bypass is used but the timeout is not required, the "Limited Bypass Maximum Time" should be set to zero. See Section 3.9.7.2 on page 73 for details on how limited bypass operates. "Limited Bypass Strokes" is stored by job but will not be allowed to exceed "Limited Bypass Maximum Strokes" and likewise for "Limited Bypass Time" and "Limited Bypass Maximum Time".

4.5.1.2   System Bypass Allowed

If the "System Bypass Allowed" parameter is set to "Yes", the **System Bypass** softkey will appear on the die protection bypass screen. Any user who has been granted access to this system bypass, can bypass the entire die protection system selecting this softkey. See Section 3.9.7 on page 73 for more information concerning bypassing. If this parameter is set to "No", the **System Bypass** softkey will not appear on the die protection bypass screen and the only means of bypassing the die protection system will be automatic bypass in setup mode and stroke limited bypass, if enabled.

4.5.1.3 Auto Unbypass When Switching to Production Mode

If the "Auto Unbypass When Switch to Production Mode" parameter is set to "Yes", the die protection system will automatically remove any system bypass or limited bypass when the press operating mode is changed from a setup mode to a production mode. This is intended to prevent the system from being inadvertently left in bypass when changing from a setup mode to a production mode.

The automatic unbypass feature only removes the bypass when the press mode *changes* from a setup mode to a production mode. Once in a production mode, any user who has been granted access to do so can again select a bypass.

4.5.2 Editing the Die Protection Name List

For each die protection channel, a description can be assigned for a particular job. For instance, Job 1 might use die protection channel 2 as a stock buckle detector while Job 2 uses it as a feed complete sensor.

Press the **Edit Names** softkey (shown in Figure 105) to display the screen of Figure 106. Use the **Previous Page** and **Next Page** softkeys to page through the entire list of 64 names. Touch inside the blue border of a name to change it.

This list of names is displayed for selection when a die protection channel description is changed. Note that if a particular die protection name is changed in this screen, then all jobs with die protection channels set to that description will now show the new description in its place.
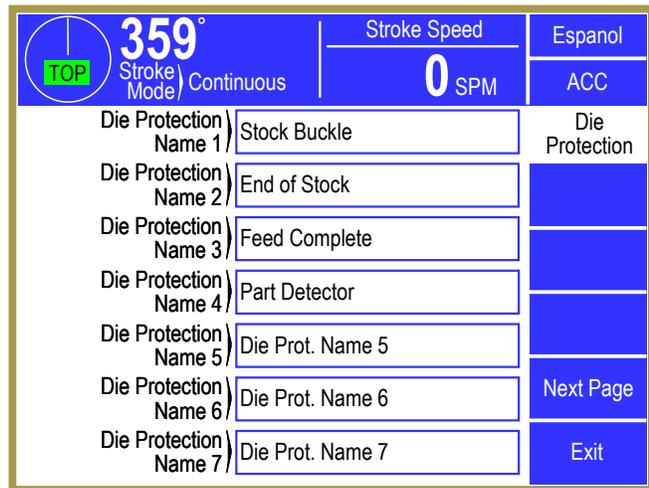
Figure 106: Die Protection Edit Names Screen

4.5.3 Restricting and Unrestricting Die Protection Channels

Die protection channels that stay the same regardless of the job being run can be restricted. When a channel is restricted, it can be viewed but not changed by the operator, and it will not be affected by job recalls.

Press the **Restrict / Unrestrict** softkey (shown in Figure 105) to display the screen of Figure 107. Use the **Previous Page** and **Next Page** softkeys, if displayed, to page through the channels.

Each individual channel can be restricted by changing the "Restricted" setting for that channel to "Yes".

The channel settings cannot be changed while
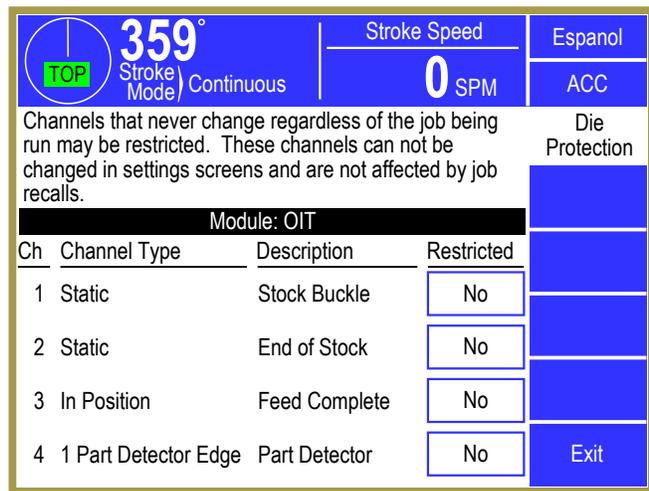
Figure 107: Die Protection Restrict/Unrestrict Screen

restricted. If a job is recalled the restricted channel settings will not change, even if the restricted channel's settings are different in the recalled job.   In order to make changes to a restricted channel; the restriction must be removed, the change entered, and then again set the channel to restricted.

5 COMPONENTS

5.1   System 5100 Control Card Rack

The System 5100 control card rack is shown in Figure 108 (with the optional 2nd Input Module on the left side of the card rack). The 5100-3 Logic Module (center faceplate) is shown with the optional 5100-3B Analog I/O board (terminals S1-S5) for press stroking speed control and motor load display through the OmniLink 805 Operator Terminal. It also shows the optional 5100-3C Safety Relay Interface (which provides connections for up to four 5100-3CR Safety Relay boards) to provide stop command interface with auxiliary equipment.

Power for the OT805 Operator Terminal is provided (+OT, COT terminals) from an internal +24 VDC power supply. This supply also powers the 5100-2A PLS/OR relay modules and any 5100-3CR Safety Relay Boards. The total load on this supply should be less than 0.85 amps.
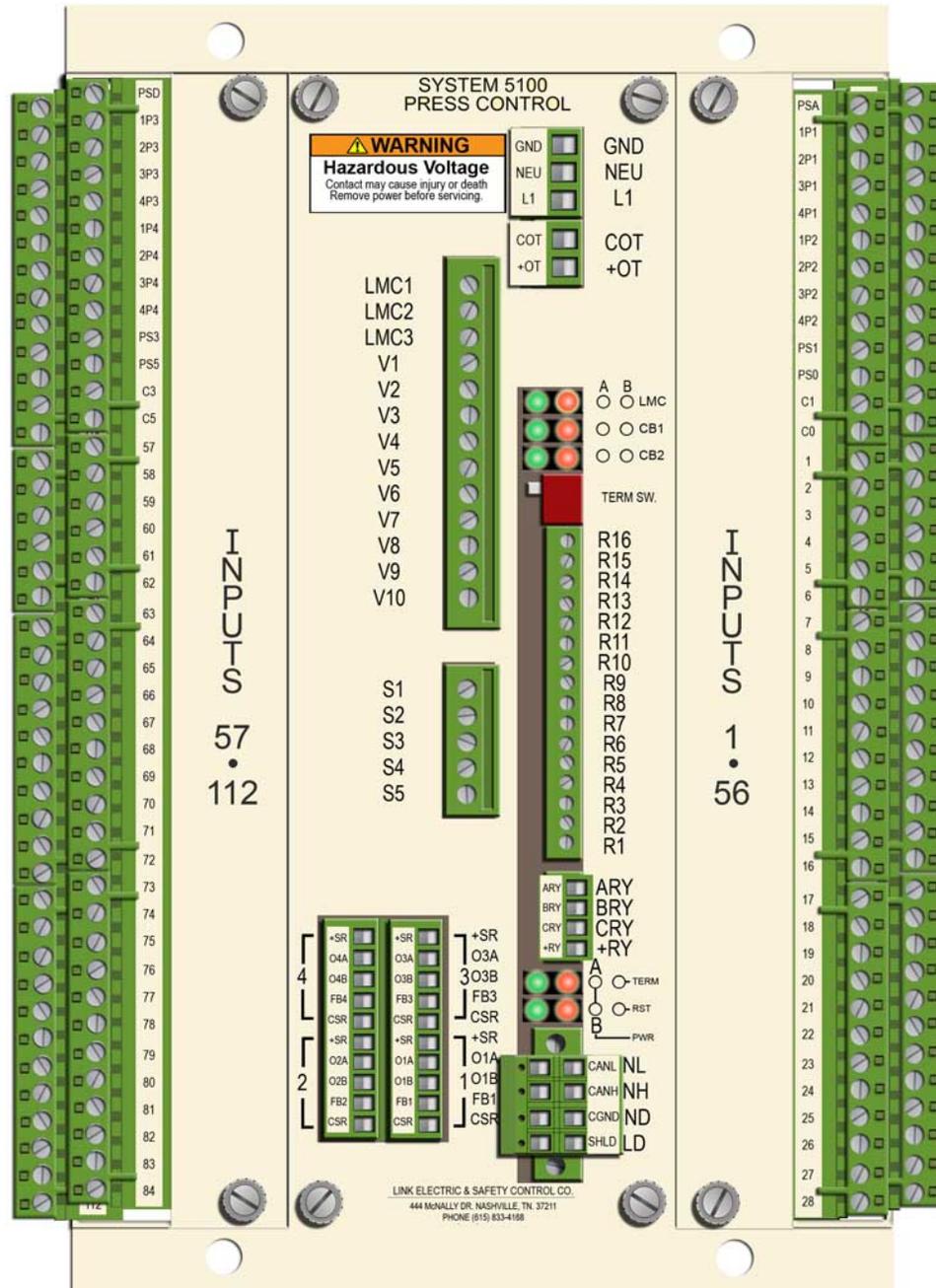
Figure 108: System 5100 Press Control Card Rack

5.2   Optional PLS and OR Relay Modules

The Programmable Limit Switch Module shown in Figure 109 and the OR 1-4 Relay Module shown in Figure 110 each provide four double pole relays. One contact is fused as normally open and the other contact can be normally open or normally closed depending on the position of a 7 amp pico fuse (both fuses shown below each relay).

Each relay drive has an LED indicator (shown as LED1, LED2, LED3, and LED4 along the top of the board). A power supply indicator is also provided (shown as LED5 along the right side of the board).

A pluggable terminal strip contains the communication drive signals for wiring to the 5100-3 Logic Module (labeled ARY, BRY, CBY, +RY). The shield should be connected to CBY at all modules. Wiring is shown in PLS/OR Wiring. If more than one board is connected, the communication cable should be "daisy chained" using the dual

Figure 109: PLS Relay Module
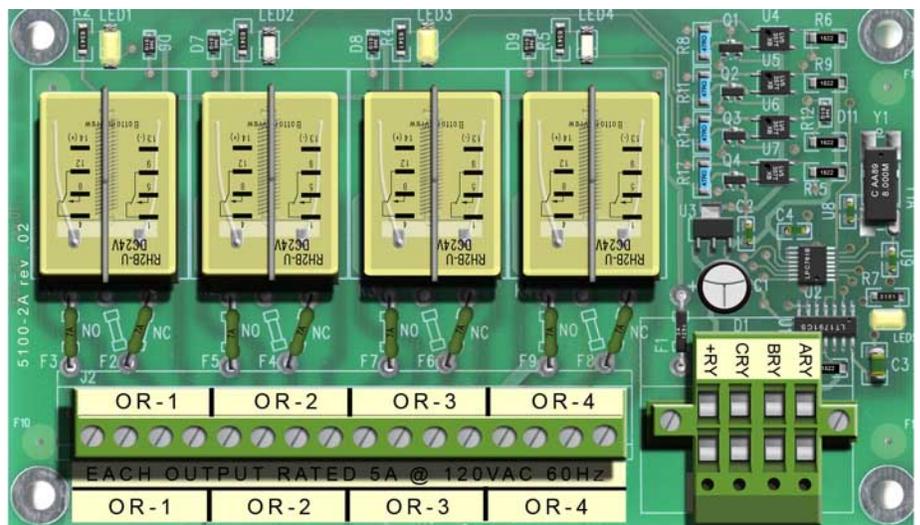
Figure 110: Output Relay Module

connection 4 pin terminal strip supplied. These connections should *NEVER* be made using discrete wire. The recommended high speed serial bus cable must be used. Each relay on the 5100-2A draws about 40 milliamps from the internal 24 VDC power supply used to also power the OT805 Operator Terminal and the 5100-3CR Safety Relay Board (if used).

5.3   Operator Terminal Logic Board

TX RX GND

USB
Type B

USB
Type A

SD Card

SHLD
CGND
CANH
CANL

+OT
COT
DP1
DP2
DP3
DP4
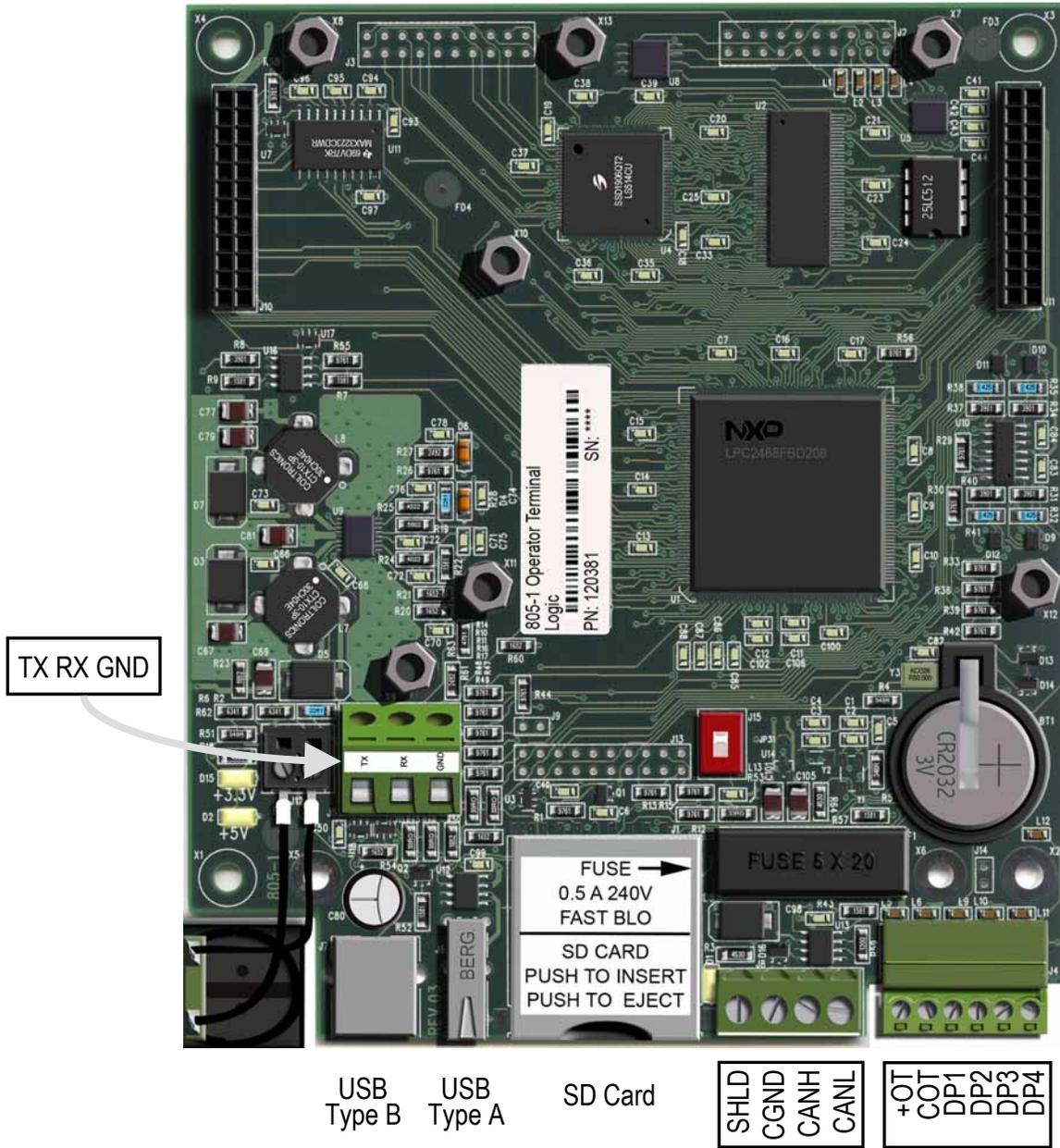
Figure 111: Operator Terminal Logic Board

5.4   Clutch/Brake Drive

The standard relay board shown in Figure 112 is used on presses with a single clutch/brake dual valve or for two separate clutch and brake dual valves which do not require timing between the clutch and brake dual valves. It provides two force guided relays for the LMC (Master Control Relays) and two for the clutch/brake valve. The clutch/brake power is typically fused at 4 amps (slow blow). The LMC path must be fused externally (5 amp normal blow).
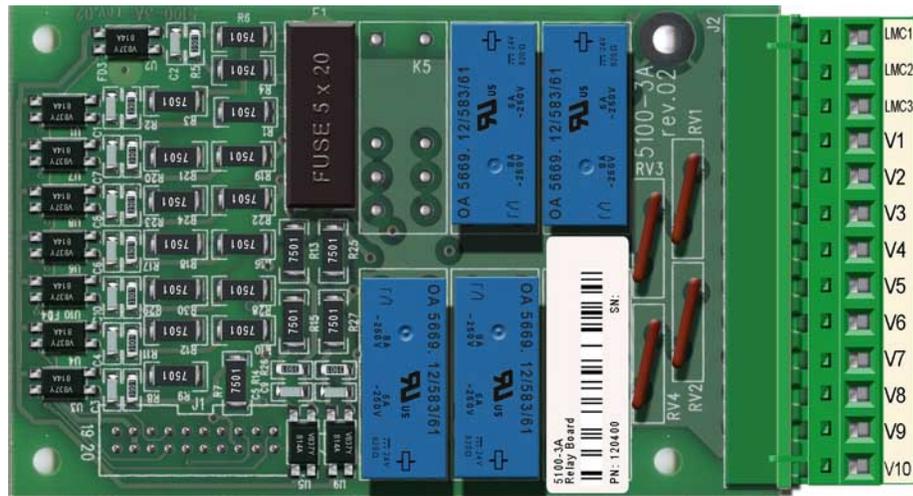
Figure 112: Clutch/Brake Relay Board

Presses with separate clutch and brake assemblies that require timing between clutch and brake to prevent friction overlap on stroke initiation and stop require the optional board shown in Figure 113. An additional pair of force guided relays is provided to drive the second valve separately so that timing can be accomplished. The six relay board is required for separate clutch and brake operation but either board can be used for a combination clutch/brake valve. See Sections 6.6 and 4.2.1 for information on wiring and configuring the clutch.
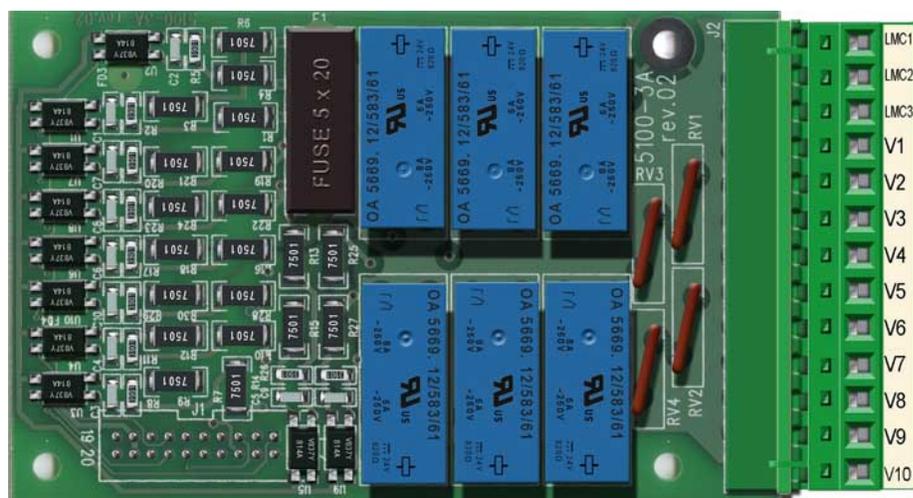
Figure 113: Clutch/Brake Relay Board with Separate Outputs for Two Valves

5.5 Safety Relay Board

The optional 5100-3CR Safety Relay Board shown in Figure 114 provides three isolated normally open contacts for generating stop signals to external equipment due to inputs wired into the press control (e.g. emergency stop buttons, light curtains, barrier interlocks). The inputs that generate a stop signal are separately programmable for each relay to provide maximum flexibility for complex press production systems. Up to four of these boards are allowed in order to provide stop signals to different pieces of equipment due to different interlocks on the press.

Each board is wired into one of the four terminal connections provided on the optional 5100-3C Safety Relay Interface (see terminals on center faceplate of Figure 108). The drive signals (+SR, O1A, O1B, FB1, CSR) must be wired with multi-conductor cable and not with discrete wire. An LED is located next to each relay to indicate that the relay is turned ON. The fuse shown (1/8 amp fast blow) is intended to open only in the event that 120 VAC is accidentally connected to the +SR terminal. This option draws about 65 milliamps from the internal 24 VDC power supply used to power the operator terminal and the output modules. See Section 4.2.18 for more information about configuring this optional feature.

A newer version of this board started shipping with controls in late 2014. All spares and replacements going forward will be of this type as well. It includes an additional 2 terminal connector (seen in the upper right corner of Figure 115, at right) that simplifies wiring when the safety relay is used to drive a contactor.
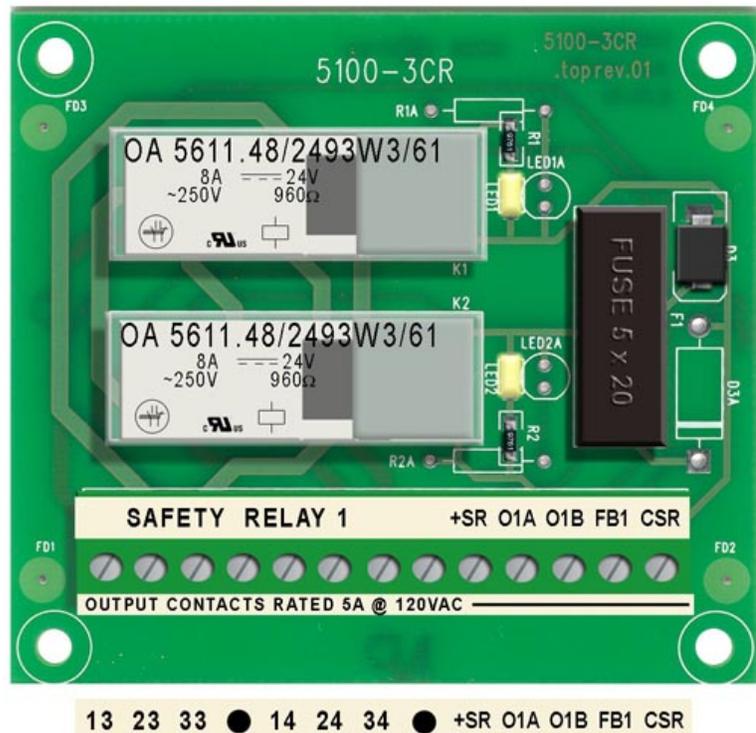
Figure 114: Safety Relay Board (Older Version)
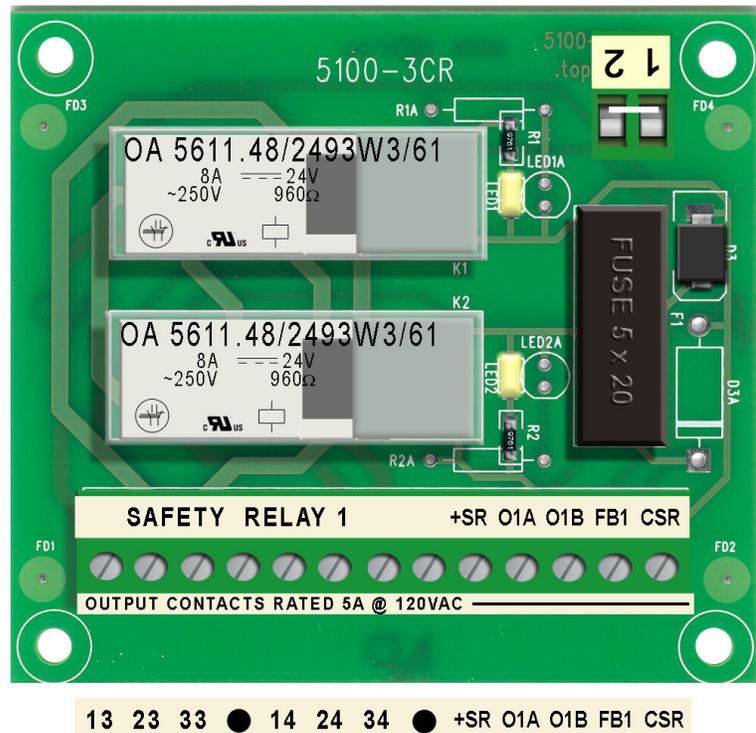
Figure 115: Safety Relay Board (Newer Version)

5.6   Specifications

Table 5.6.1 - Power Supply Requirements	
Device	**Input Power Requirements**
System 5100 Press Control Card Rack	88-120 VAC, 47-63 HZ, 50 VA
5100-2A Relay Output Module	37 mA per relay 160 mA per module (4 relays on)
5100-2B Solid State Output Module	17 mA per output 80 mA per module (4 outputs on)
5100-3CR Safety Relay Module	50 mA per module
OT-805 Operator Terminal	24 VDC @ 200 ma without tonnage monitor 24 VDC @ 250 ma with tonnage monitor

Table 5.6.2 - Output Specifications	
Output Device	**Specification**
LMC 1 – LMC 2	120 VAC, 5 Amp 48 VDC, 5 Amp
Clutch/Brake Outputs CB 1 V3-V4 CB 1 V5-V6 CB 2 V7-V8 CB 2 V9-V10	120 VAC, 1 Amp 48 VDC, 1 Amp
5100-2A PLS or Output Relay Modules with electromechanical relays Terminals 1-2 Terminals 3-4	120 VAC, 5 Amp 48 VDC, 5 Amp
5100-2B PLS or Output Relay Modules with solid state outputs Terminals 1-2	120 VAC, 2 Amp 48 VDC, 2 Amp
5100-3CR Safety Relay Modules Terminals 13-14 Terminals 23-24 Terminals 33-34	120 VAC, 5 Amp 48 VDC, 5 Amp

Table 5.6.2 - Output Specifications	
Output Device	**Specification**
+OT Power Supply	+24VDC, .85Amp max., for use with OT-805, 5100-2A, 5100-2B, and 5100-3CR only.
5100-4A Input board power supplies PS0, PS1, PS2, PSA, PSB, PSC, P1, P2	22VDC, 150mA max. (any one supply). 350mA max per board. Each input used draws 5mA. P1, P2 should only be used to power protective inputs, when "Pulse Check" is enabled.
5100-4B Input board power supplies PS3, PS4, PS5, PSD, PSE, PSF, P3, P4	22VDC, 150mA max. (any one supply). 350mA max per board. Each input used draws 5mA. P3, P4 should only be used to power protective inputs, when "Pulse Check" is enabled.

Table 5.6.3 - Response Time Specifications	
Response Time is defined as the time from a high to low transition on any protective input configured to turn the output Off immediately until the N.O. contact path opens. The input must be configured as a master stop in order to turn the LMC output Off.	
Output	**Maximum Response Time**
Clutch/Brake Output 1	10 milliseconds
Clutch/Brake Output 2	11 milliseconds
LMC	20 milliseconds
5100-3CR Safety Relay Modules 1 - 4	35 milliseconds

Table 5.6.4 - Component Mounting	
Component	**Mounting Orientation**
System 5100 Press Control Card Rack	Must be mounted as shown in Figure 108. A 90 degree orientation is not allowed.
5100-2A or 2B	Any orientation is allowed
5100-3CR	Any Orientation is allowed

6 INSTALLATION

6.1 Card Rack Mounting Dimensions

Figure 116: Card Rack Mounting Dimensions

6.2 PLS and OR Relay Board Mounting Dimensions

5100—2A RELAY BOARD
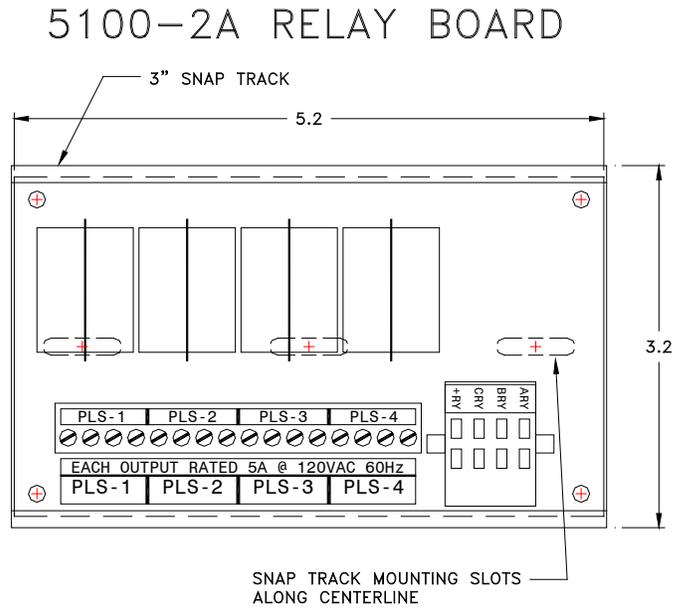
Figure 117: Relay Board Mounting Dimensions

6.3 Operator Terminal Mounting Dimensions
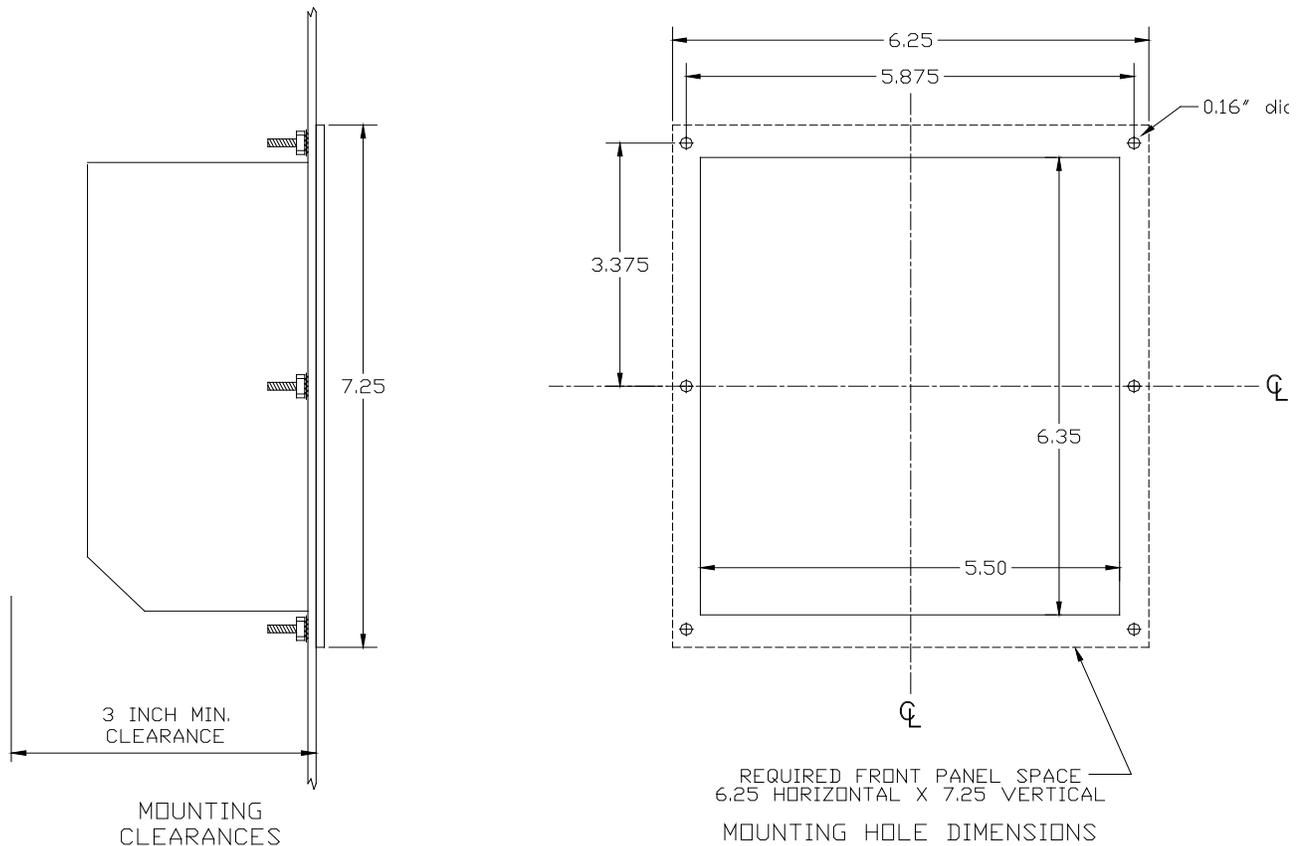
Figure 118: Operator Terminal Mounting Dimensions

6.4 Resolver/Encoder Mounting Dimensions

The mounting dimensions for the resolver/encoder assembly are shown in Figure 119. When the resolver/encoder is driven by a chain, the spring base should be used. The resolver/encoder assembly mounted on the spring base is shown in Figure 120. The shaft of the resolver/encoder is 3/4 " in diameter with a 3/16 " wide keyway. The sprocket attached to the resolver/encoder must be bored and keyed to fit. Do not install the sprocket without a proper size key. After installing sprocket and key, the clip ring must be installed in the groove on the end of the resolver shaft.
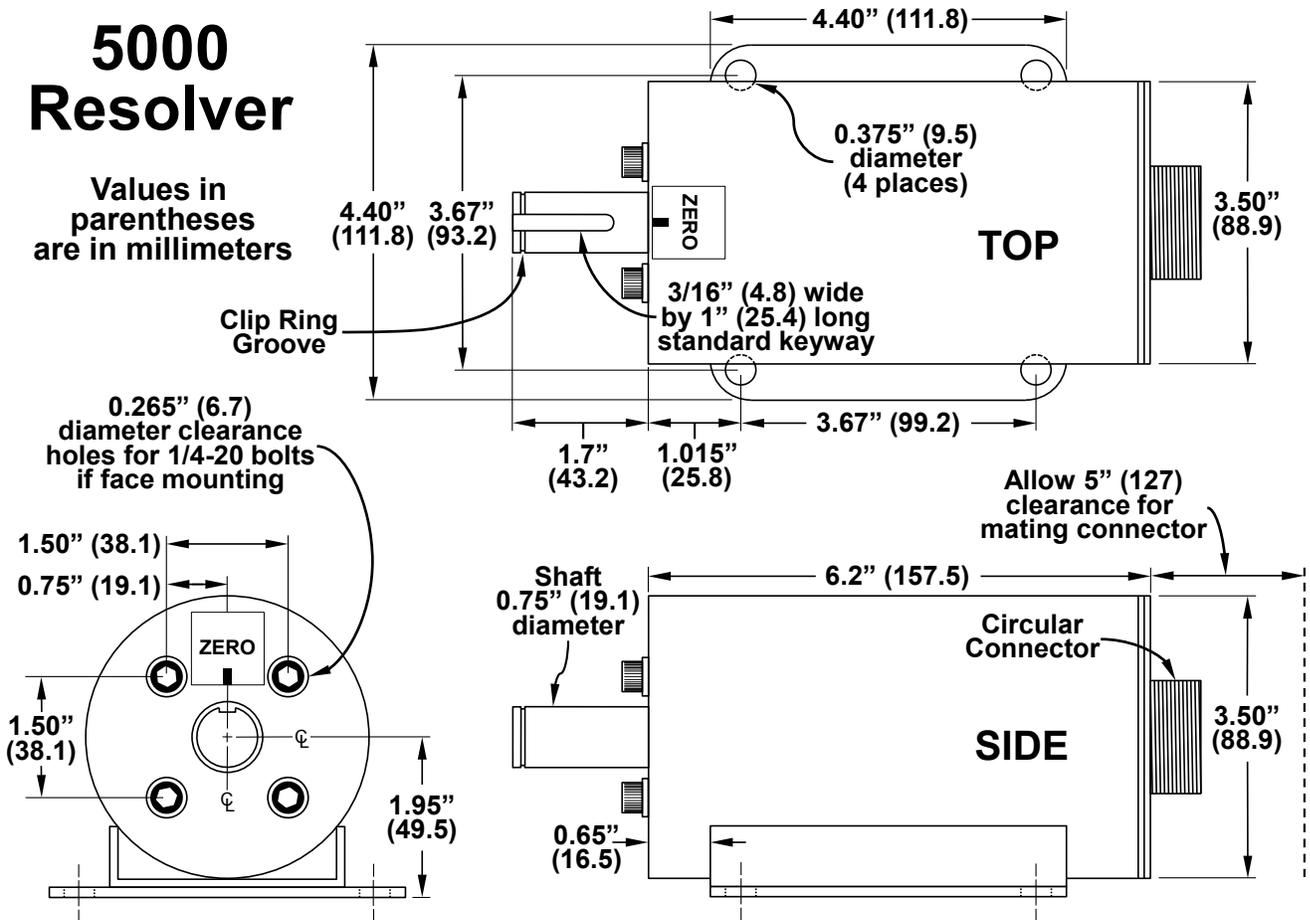
Figure 119: Resolver/Encoder Mounting Dimensions

Another sprocket must be attached to the machine shaft. The proper size hole must be drilled and tapped in the static center of the machine shaft. After attaching the sprocket to the shaft, an additional hole should be drilled approximately 3/4" off of the static center. This hole should be drilled through the sprocket and into the machine shaft. The sprocket should be removed and the off center hole in the machine shaft tapped for a 1/4 " bolt or larger. The off center hole in the sprocket must provide proper clearance for the bolt. Attach the sprocket to the machine shaft with the center bolt and the off center bolt. When attaching the chain to the sprockets, the zero position of the resolver/encoder must be aligned with the top dead center of the machine shaft. The zero position of the resolver/encoder is indicated by the legend on the front of the assembly. When the keyway is aligned with the zero position of the legend, the assembly is at zero. The system 5000 allows the user to program an offset value to make up for minor differences from the machine top dead center and resolver/encoder zero. The offset value is limited to plus or minus 10 degrees of resolver zero.

Spring Base with 5000 Resolver

Values in parentheses are in millimeters

5" (127) clearance for connector

7.9" (200.7)

Shown at 50% spring base compression

Circular connector

5.9" (149.9)

4.1" (104.1)

1.25" (31.8)

Spring Base Bottom Plate

3/8" clearance holes for 5/16-18 bolts to mount spring base to press (4 places)

5.5" (139.7)

1.0" (25.4)

6.5" (165.1)

2.0" (50.8)

7.5" (190.5)

9.5" (241.3)

Max Opening 102°

Mount resolver using narrow set of holes

9.85" (250.2)

ZERO

ZERO

4.35" (110.5)

3.85" (97.8)

4.1" (104.1)

100% Compressed

50% Compressed

0% Compressed

4.2" (106.7)

4.5" (114.3)

4.65" (118.1)

5.0" (127)

0% Compressed

50% Compressed

100% Compressed

Figure 120: Resolver/Encoder with Spring Mounting Base Dimensions

6.5   Press Control Inputs

Each 5100-4A/B Input Module used with the System 5100 card rack provides eight individual +24 VDC power supplies (each with current limiting and 2 with check pulses for protective inputs) on its terminal strips in order to provide power for field wiring to the inputs. Each Input Module also provides four 24V power supply common connections on its terminal strips. Each Input Module provides 56 inputs for the System 5100 control.

The power supplies to be used on Input Module 1 for Inputs 1-56 are shown in the table below.

Power Supplies To Use For Input Module 1 (Inputs 1-56)			
TOP-RIGHT INPUT TERMINALS		**BOTTOM-RIGHT INPUT TERMINALS**	
Input Field 24V Power Supply A	PSA	Input Field 24V Power Supply B	PSB
Protective Input Pulsed Power P1	1P1	Input Field 24V Power Supply C	PSC
Protective Input Pulsed Power P1	2P1	Input Field Common	COM
Protective Input Pulsed Power P1	3P1	Protective Input Pulsed Power P1	5P1
Protective Input Pulsed Power P1	4P1	Protective Input Pulsed Power P1	6P1
Protective Input Pulsed Power P2	1P2	Protective Input Pulsed Power P1	7P1
Protective Input Pulsed Power P2	2P2	Protective Input Pulsed Power P1	8P1
Protective Input Pulsed Power P2	3P2	Protective Input Pulsed Power P2	5P2
Protective Input Pulsed Power P2	4P2	Protective Input Pulsed Power P2	6P2
Operator Station #1 24V Power Supply	PS1	Protective Input Pulsed Power P2	7P2
Separate Inch Button 24V Power Supply	PS0	Protective Input Pulsed Power P2	8P2
Operator Station #1 Common	C1	Operator Station #2 24V Power Supply	PS2
Separate Inch Button Common	C0	Operator Station #2 Common	C2

> **NOTE:**   Specific protected power supplies are provided for each set of Operator Station run buttons. For example, always use PS1 for the 24V connection to Operator 1 Stations Run buttons and C1 for the common connection to these buttons. If Operator Station 2 and/or Separate Inch Buttons are provided, always use PS2 and C2 for the 24V connection to the buttons and PSO and C0 for the common connection to the Separate Inch Buttons, respectively.

The table below summarizes information on inputs 1-56 on Input Module 1.

INPUT	DEFAULT DESCRIPTION	POWER SUPPLY	NAMABLE	REFERENCE SECTION
1	Station # 1 Run (Both Released)	PS1	No	6.5.1.3
2	Station # 1 Run (Both Pressed))	C1	No	6.5.1.3
3	Station # 1 E-Stop (P1)	1P1	No	6.5.2
4	Station # 1 E-Stop (p2)	1P2	No	6.5.2
5	Station # 1 Top-Stop	PS1	No	6.5.3
6	Station #1 Select	PS1 or PSA	No	6.5.4
7	Inch/Bar Run (Both Released)	PS0/C0	No	6.5.1.1
8	Inch/Bar Run (Both Pressed)	PS0/C0	No	6.5.1.1
9	OIT E-Stop (P1) (Operator Terminal)	2P1	Yes	6.5.2
10	OIT E-Stop (P1) (Operator Terminal)	2P2	Yes	6.5.2
11	OIT Top Stop	PS0 or PSA	No	6.5.3

INPUT	DEFAULT DESCRIPTION	POWER SUPPLY	NAMABLE	REFERENCE SECTION
12	OIT Master Stop	PSA	No	6.5.5
13	Slide Adjust OFF/ON	PSA	Yes	6.5.15
14	Cont. & Auto Modes Setup	PS1, PS2, PS3, PS4, PS5, or PSA	Yes	6.5.6
15	Light Curtain #1 (P1)	3P1	No	6.5.7
16	Light Curtain #1 (P2)	3P2	No	6.5.7
17	Safety Block (P1)	4P1	No	6.5.13
18	Safety Block (P2)	4P2	No	6.5.13
19	Motor Forward Contact	PSB	No	6.5.8
20	Motor Reverse Contact	PSB	No	6.5.8
21	Lube Motor Contact	PSB	No	6.5.8
22	Mode Select Switch (Run	PSA	No	6.5.9
23	Mode Select Switch (Mode Select)	PSA	No	6.5.9
24	Valve Monitor 1	PSB	No	6.5.10
25	Valve Monitor 2	PSB	No	6.5.10
26	Zero Speed Switch N/O	PSB	No	6.5.11
27	Zero Speed Switch N/C	PSB	No	6.5.11
28	Auto Single Stroke Run	PSB	No	6.5.12
29	Station #2 Run (Both Released)	PS2/C2	No	6.5.1.3
30	Station #2 Run (Both Pressed)	PS2/C2	No	6.5.1.3
31	Station #2 E-Stop (P1)	5P1	Yes	6.5.2
32	Station #2 E -Stop (P2)	5P2	Yes	6.5.2
33	Station #2 Top Stop	PS2 or PSB	Yes	6.5.3
34	Station #2 Select	PS2, PSA or PSB	No	6.5.4
35	Light Curtain #2 (P1)	6P1	No	6.5.7
36	Light Curtain #2 (P2)	6P2	No	6.5.7
37	Protective Stop #2 (P1)	7P1	Yes	6.5.13
38	Protective Stop #2 (P2)	7P2	Yes	6.5.13
39	Protective Stop #3 (P1)	8P1	Yes	6.5.13
40	Protective Stop #3 (P2)	8P2	Yes	6.5.13
41	Motor Forward Selector Switch	PSA	No	6.5.11
42	Motor Reverse Selector Switch	PSA	No	6.5.11
43	Clutch Air Pressure Switch	PSC	No	6.5.3
44	Flywheel Brake Pressure Switch	PSC	No	6.5.11
45	Configurable Stop	PSC	Yes	6.5.14
46	Configurable Stop	PSC	Yes	6.5.14
47	Configurable Stop	PSC	Yes	6.5.14
48	Configurable Stop	PSC	Yes	6.5.14
49	Configurable Stop	PSC	Yes	6.5.14
50	Cont. on Demand Run/Permissive	PSC	No	6.5.12
51	Counterbalance Air Pressure Switch	PSC	No	6.5.3
52	Configurable Stop	PSC	Yes	6.5.14
53	Configurable Stop	PSC	Yes	6.5.14
54	Configurable Stop	PSC	Yes	6.5.14
55	Configurable Stop	PSC	Yes	6.5.14
56	Motors Start Enable	PSA	No	Not Available

The power supplies to be used on Input Module 2 for Inputs 57-112 are shown in the table below.

Power Supplies To Use For Input Module 2 (Inputs 57-112)					
TOP-LEFT INPUT TERMINALS			**BOTTOM-LEFT INPUT TERMINALS**		
Input Field 24V Power Supply E	PSE		Input Field 24V Power Supply D		PSD
Input Field 24V Power Supply F	PSF		Protective Input Pulsed Power P3		1P3
Input Field Common	COM		Protective Input Pulsed Power P3		2P3
Protective Input Pulsed Power P3	5P3		Protective Input Pulsed Power P3		3P3
Protective Input Pulsed Power P3	6P3		Protective Input Pulsed Power P3		4P3
Protective Input Pulsed Power P3	7P3		Protective Input Pulsed Power P4		1P4
Protective Input Pulsed Power P3	8P3		Protective Input Pulsed Power P4		2P4
Protective Input Pulsed Power P4	5P4		Protective Input Pulsed Power P4		3P4
Protective Input Pulsed Power P4	6P4		Protective Input Pulsed Power P4		4P4
Protective Input Pulsed Power P4	7P4		Operator Station #3 24V Power Supply		PS3
Protective Input Pulsed Power P4	8P4		Operator Station #5 24V Power Supply		PS5
Operator Station #4 24V Power Supply	PS4		Operator Station #3 Common		C3
Operator Station #1 Common	C4		Operator Station #5 Common		C5

The table below summarizes information and recommendations for Inputs 57-112 on Input Module 2.

INPUT	DEFAULT DESCRIPTION	POWER SUPPLY	NAMABLE	REFERENCE SECTION
57	Station # 3 Run (Both Released)	PS3/C3	No	6.5.1.3
58	Station # 3 Run (Both Pressed)	PS3/C3	No	6.5.1.3
59	Station # 3 E-Stop (P3)	1P3	Yes	6.5.2
60	Station # 3 E-Stop (P4)	1P4	Yes	6.5.2
61	Station # 3 Top-Stop	PS3 or PSD	Yes	6.5.3
62	Station # 3 Select	PS3 or PSA	No	6.5.4
63	Station # 5 Run (Both Released)	PS5/C5	No	6.5.1.3
64	Station # 5 Run (Both Pressed)	PS5/C5	No	6.5.1.3
65	Station # 5 E-Stop (P3)	2P3	Yes	6.5.2
66	Station # 5 E-Stop (P4)	2P4	Yes	6.5.2
67	Station # 5 Top-Stop	PS5 or PSD	Yes	6.5.3
68	Station # 5 Select	PS5 or PSA	No	6.5.4
69	Protective Stop # 4 (P3)	3P3	Yes	6.5.13
70	Protective Stop # 4 (P4	3P4	Yes	6.5.13
71	Protective Stop # 5 (P3)	4P3	Yes	6.5.13
72	Protective Stop # 5 (P4)	4P4	Yes	6.5.13
73	Configurable Stop	PSD	Yes	6.5.14
74	Configurable Stop	PSD	Yes	6.5.14
75	Configurable Stop	PSD	Yes	6.5.14
76	Configurable Stop	PSD	Yes	6.5.14
77	Configurable Stop	PSD	Yes	6.5.14
78	Configurable Stop	PSD	Yes	6.5.14
79	Configurable Stop	PSD	Yes	6.5.14
80	Configurable Stop	PSE	Yes	6.5.14
81	Configurable Stop, *but input inactive while in Clutch / Brake Test Mode.*	PSE	Yes	6.5.14 4.2.10.11
82	Configurable Stop, *but input inactive while in Clutch / Brake Test Mode.*	PSE	Yes	6.5.14 4.2.10.11

INPUT	DEFAULT DESCRIPTION	POWER SUPPLY	NAMABLE	REFERENCE SECTION
83	Configurable Stop, *but input inactive while in Clutch / Brake Test Mode.*	PSE	Yes	6.5.14 4.2.10.11
84	Configurable Stop, *but input inactive while in Clutch / Brake Test Mode.*	PSE	Yes	6.5.14 4.2.10.11
85	Station # 4 Run (Both Released)	PS4/C4	No	6.5.1.3
86	Station # 4 Run (Both Pressed)	PS4/C4	No	6.5.1.3
87	Station # 4 E-Stop (P1)	5P3	Yes	6.5.2
88	Station # 4 E -Stop (P2)	5P4	Yes	6.5.2
89	Station # 4 Top Stop	PS4 or PSE	Yes	6.5.3
90	Station # 4 Select	PS4 or PSA	No	6.5.4
91	Protective Stop # 6 (P3)	6P3	Yes	6.5.13
92	Protective Stop # 6 (P4)	6P4	Yes	6.5.13
93	Protective Stop # 7 (P3)	7P3	Yes	6.5.13
94	Protective Stop # 7 (P4)	7P4	Yes	6.5.13
95	Protective Stop # 8 (P1)	8P3	Yes	6.5.13
96	Protective Stop # 8 (P2)	8P4	Yes	6.5.13
97	Configurable Stop	PSE	Yes	6.5.14
98	Configurable Stop	PSE	Yes	6.5.14
99	Configurable Stop	PSF	Yes	6.5.14
100	Configurable Stop	PSF	Yes	6.5.14
101	Configurable Stop, or selects "Continuous" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
102	Configurable Stop, or selects "Auto Single Stroke" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
103	Configurable Stop, or selects "Timed Inch" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
104	Configurable Stop, or selects "Setup / Stop Time Test" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
105	Configurable Stop, or selects "Clutch / Brake Test" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
106	Configurable Stop, or selects "Micro Inch" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
107	Configurable Stop, or selects "Continuous on Demand" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
108	Configurable Stop, or selects "Single Stroke" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
109	Configurable Stop, or selects "Inch" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
110	Configurable Stop, or selects "Off" mode when "Hard Modes" are used.	PSF	Yes	6.5.14 4.2.10.12
111	Configurable Stop	PSF	Yes	6.5.14
112	Configurable Stop	PSF	Yes	6.5.14

6.5.1 Operator Run (Stroking) Controls

The OmniLink System 5100 press control has three sets of inputs for use as operator run controls to cause stroking of the press on Input Module 1. Three additional sets of inputs for operator run controls are supplied on optional Input Module 2. The number of operator run controls provided for a specific press is dependent on its uses. .Some presses may use only a pair of two-hand controls at a single operator station to cause stroking in all modes, while others may use several run control stations the number and use of which is selectable.

All of these operator run control inputs use two inputs of a type that is unique from the rest of the optically isolated inputs of the control. They are designed to meet Control Reliability, Performance of Safety Related Functions and other safety standards in that wiring, short circuit, or component failure will not cause unintended stroking of the press, but will prevent successive strokes until the failure is corrected. A *pair* of input device NC and NO contacts must be connected to each of the two operator station run control inputs and each pair of must be synchronously operated within 0.5 seconds of each other and held until stroking is initiated. In some modes they must continue to be held to maintain stroking action, and if released, the press will stop stroking.

6.5.1.1 Station 0 - Separate Inch Buttons

The press control can be optionally configured so that when Inch, Timed Inch, and Setup/Stop Time Test modes are selected, Separate Inch Buttons are selected automatically to stroke the press. No other operator controls regardless of whether they are selected as "On", will cause the press to stroke in the above modes. These Inch Buttons should be wired to the Power Supply Terminals PS0 and C0 and to Inputs 7 and 8.on Input Module 1 terminal strip (see Figure 121). A fixed time of 0.5 seconds is allowed from the time one button is pressed until the other button is pressed, or the attempted stroke initiation is aborted. The Inch buttons must first both be released and then both pressed within 0.5 seconds of each other before successive stroking motion of the slide can be actuated. There are no associated E-Stop or Top –Stops used with the Stroking controls of Station 0. If Bar Mode is configured as enabled, Inputs 7 and 8 must be used only for Bar and "Separate Inch Buttons" parameter must be set to "No" and cannot be used.

Figure 121: Optional Separate Inch Buttons

If Separate Inch Buttons is configured to "No" in the configuration screens, then all two-hand control buttons at other operator stations that are active must be used to stroke in the Inch, Timed Inch, and Setup/Stop Time Test modes

6.5.1.2   Station 0 - Bar Mode Button

When Bar mode is configured as enabled, Separate Inch Buttons cannot be used. Instead a single bar button will be wired to Inputs 7 and 8 as shown in Figure 122. When Bar Mode is selected the motor will be automatically turned off, the Bar buttons will be automatically selected to operate the clutch/brake system, and a zero speed switch provide with the control must indicate that the flywheel has stopped before the Bar button will be active.
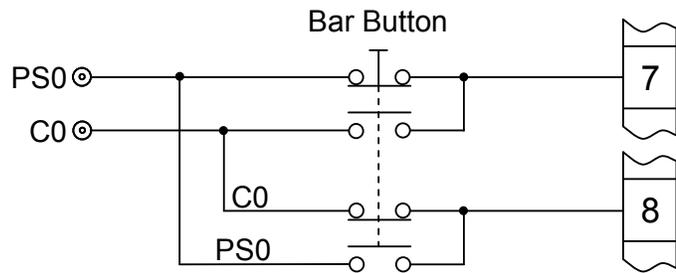
Figure 122: Bar Button

6.5.1.3   Operator Station 1 Through 5 Run Controls

The Single Stroke, Continuous, Automatic Single Stroke, Continuous on Demand, and Maintained Continuous modes (when provided) use the operator controls (normally palm buttons for two-hand control) at all active ("On") operator stations for stroke initiation. When multiple operator stations are provided only the "On" stations are necessary to stroke the press. All operator stations besides Station 0 and Station 2 when configured for footswitch have associated E-Stop and Top-Stop inputs for the station. If not configured for Separate Inch Buttons, the press control is configured so that Inch, Timed Inch, and Setup/Stop Time Test modes also use the active operator stations. A fixed time of 0.5 seconds is allowed to activate the device(s) wired to the two input terminals for each run station. When two-hand controls are used, there can be no greater than a 0.5 seconds delay from the time one button on a given operator station is pressed until the other button is pressed. There is no time limit from one operator station to another. In order to create opposition (i.e. the two inputs can't be wired together), the normally closed and normally open paths of both the left button and the right button are each wired to the two inputs (see Figure 123).
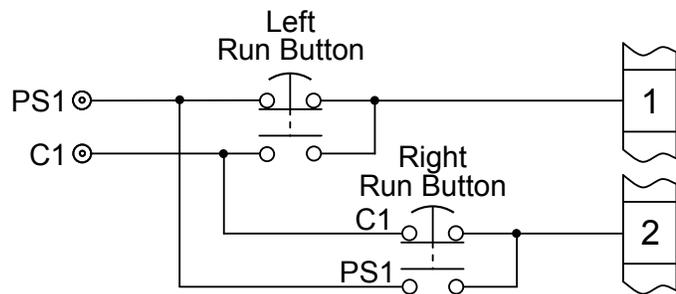
Figure 123: Run Buttons for Operator Station 1

If a footswitch is used with the control, Operator Station 2 Run inputs will always be used for the footswitch inputs and will not be available as an input for two-hand controls. Operator Station 2 will be configured for footswitch by setting "Yes" in the 2nd page of Machine Parameters Configuration for Foot Switch Installed.
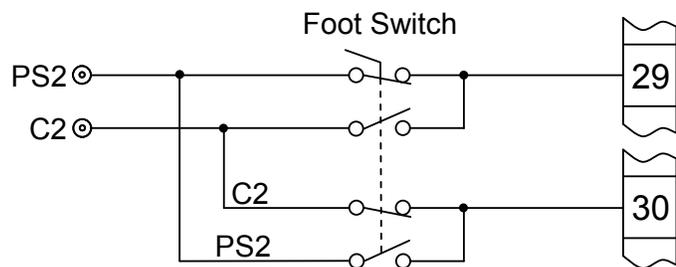
Figure 124: Footswitch Wired to Operator Station 2

Figure 124 shows the footswitch connection to Operator Station 2. A Hand/Foot Selector switch will be provided that will always select Station 2 when in the Foot position. The footswitch can only be used when in Single Stroke or Operator Maintained Continuous (when provided) modes. All other operator stations must be turned off.

Run buttons on un-used stations must be wired as shown in Figure 125.
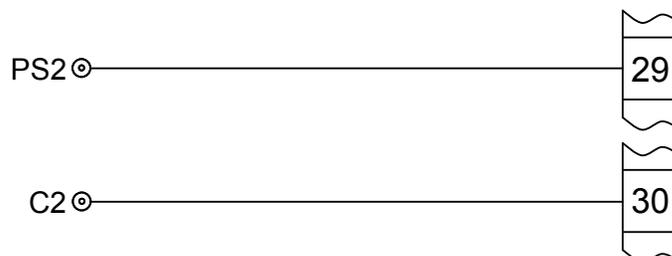
Figure 125: Wiring for Operator Station 2 Run Inputs if Unused

6.5.2 Emergency Stops

These inputs are "Protective" type inputs and require two contacts of the same button to be wired into the inputs provided (see Figure 126). These stops can be configured as Unused, Immediate Stop or Master Stop. When these inputs are not used in conjunction with an operator station (i.e. Operator Run Controls will not be used), the descriptions can be changed for E-Stops on operator stations #2, #3, #4, and #5 (see Section 4.2.14) and they may be used for other protective stops.
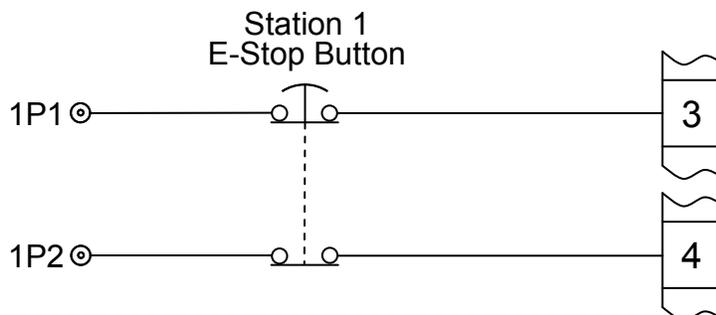
Figure 126: Wiring for Station 1 Emergency Stop Button

6.5.3 Top Stops

A low level (input open) on these inputs cause the press control to stop the next time crankshaft angle reaches the top of the stroke, if any occur while the press is stroking. They prevent the machine from being started anywhere in the stroke, until they are cleared (returned to +24 volt). Station #1 Top Stop must be used and the description cannot be changed. Top Stops for Stations #2 thru #5 along with the OIT Top Stop are configured as "Not Used" if the E-Stop is configured as "Not Used". The input description can be changed on stations #2, #3, #4, and #5 (see Section 4.2.14) and they may be used for other Top-Stop inputs if the associated E-Stop is configured to Immediate Stop or Master Stop and used for a Protective input or its two terminals are jumpered to P1 and P2. .

6.5.4 Station Selects

These inputs define the active operator stations for Single Stroke, Continuous, Automatic Single Stroke, Continuous on Demand, and Maintain Continuous modes. They may define the stations for Inch, Timed Inch, and Setup/Stop Time Test modes if the control has been configured to use these stations. An open input (0 volts) selects the station to be active, and an input of +24 volts de-selects the station. A stroke may not be initiated until all active operator station buttons are pressed, and all inactive stations de-energized. The press control generates an immediate stop if any inactive station is pressed. The "Foot Switch Installed" parameter configures operator station #2 as either Palm Buttons or a Foot Switch. Appropriate Warnings must alert the operators as to how this station functions. If configured as a Foot Switch and the station #2 select line is 0 VDC (station selected), all other operator stations must be inactive. The Foot Switch functions only in Single Stroke and Maintained Continuous modes.

6.5.5 OIT Master Stop

A low level (input open) on this input causes the press control to stop immediately. In addition it will cause the press control to turn off the LMC Relay output and prevent stroke initiation until cleared (returned to +24 volt).

6.5.6 Continuous & Auto Modes Setup Button

The Continuous, Automatic Single Stroke, Continuous on Demand, and Maintain Continuous modes require the prior action setup button be pressed before stroking can be initiated. When the setup button is pressed (input goes from Low to High) the press control will allow 5 seconds for stroke initiation to take place. If all active operator station run buttons are not pressed in the allocated time, the press control will automatically time out the setup action. The mode cannot be setup again until all operator buttons and setup buttons are released.

6.5.7 Light Curtains

The light curtain inputs provide immediate stop signals to the press control, unless muted (ignored) in the upstroke by the light curtain configuration. These inputs can be configured by the factory to provide several methods of muting. This programmed information affects the light curtain only in the upstroke, and an immediate stop is always performed if the inputs open (0 volts) in the downstroke. The Machine Parameters configuration screen describes how the light curtains may be configured.

In the Inch and Timed Inch modes, the upstroke and downstroke are determined by the forward and reverse motor inputs. This affects how the light curtain is muted in the following manner:

Motor Contacts   Conditions when the light curtain is muted

Forward On   Muted from 180 degrees to "Top of Stroke" parameter
Reverse On   Muted from 0 degrees to 180 degrees
Both Off   Never Muted

In Single Stroke, Continuous, Trip Mode, and Maintain Continuous modes, the light curtain is muted from 180 degrees to "Start Top Window" parameter if the press is stopped. Once the stroke is initiated and motion has been established, the light curtain is muted from 180 degrees to "Top of Stroke" degrees to allow auxiliary equipment the entire upstroke in which to perform its function.

In Automatic Single Stroke mode the light curtain is muted from 180 degrees to "Start Top Window" parameter. After stroke initiation the light curtain is muted from 180 degrees to "Top of Stroke" degrees while the press is moving. If the press stops in the "At Top Window", the press control will wait until motion stops before checking if the light curtain is still interrupted. If the light curtain is interrupted after this time, further automatic strokes are prevented and the mode must be manually re-initiated unless the mode is configured for "Robot Mode".

6.5.8 Motor Contact Inputs

These inputs report the state of the main motor, where +24 volts indicates that the motor is on. The press control allows stroke initiation in Inch and Timed Inch modes in either direction or if both motors are off. All other modes will immediately stop, and no additional strokes allowed unless the motor is

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turning in the forward direction. A fault occurs if Inputs 19 and 20 report that both inputs are High. The lube motor contact (Input 21) is used if the lube motor is started through the operator terminal (see Section 4.2.17.4), if the main lube monitor is configured as Type 8 (see Section 4.2.20), or if any input is configured for Type 14 (see Section 4.2.22).

6.5.9 Mode Select

These inputs report the state of the mode selector key switch. The press control allows stroke initiation in only the RUN position. The MODE SELECT position allows the present stroking mode of the press to be selected from the operator terminal. The OFF state is assumed if both inputs are open (0 volts).

6.5.10 Valve Monitor

These inputs are provided for monitoring the clutch/brake dual air valve. Since there are different valve mechanisms, the internal monitor can be configured by the factory for different types. See Section 4.2.4 for information on how these inputs can be used.

6.5.11 Zero Speed Switch/Flywheel Brake/Motors Start Enable

Inputs 26 and 27 are used to connect a zero speed switch, which is required in the following situations:

1) Bar Mode or Micro Inch Mode is enabled.
2) The zero speed switch is being used to prevent the motor from being reversed until it has come to a complete stop (anti-plugging). If external logic is used to start the main motor (see Output Type 38 in Section 4.2.16), then Inputs 41 and 42 [Motor Forward/Reverse Selector] must also be connected.
3) Any Output Relay Type (see Section 4.2.16) is configured that uses the zero speed switch as a condition of operation (such as Type 38 or Type 67). These may be used to interface with external automation or for other purposes.

Input 44 is used if an Output Relay is configured for flywheel brake pressure output (see Output Type 39 in Section 4.2.16). This configuration allows the press control to wait until the brake has pressurized before allowing the motor to start and is used to turn the motor Off if pressure is lost, when the motor is started with external logic. The input is also used when the flywheel brake is controlled through the operator terminal (see Section 4.2.17.2).

See Section 4.2.17 for information on Input 56 [Motors Start Enable].

6.5.12 Automatic Run Inputs/Permissive

Input 28 [Auto. Single Stroke Run] is used to initiate strokes in Automatic Single Stroke mode. Input 50 [Cont. On Demand Run/Permissive] is used to maintain automatic stroking in Continuous on Demand mode (see Section 4.2.10) and can also be used as a stroke permissive input (see Section 4.2.9.11).

6.5.13 Protective Stops

These inputs are "Protective" type inputs and require two contacts of the same switch to be wired into the inputs provided. The descriptions can be changed for some protective stops (see Section 4.2.14).

6.5.14 Configurable Inputs

These inputs provide configurable types of stops and allow description changes (see Section 4.2.14).

6.5.15 Immediate Stop (Default Description "Slide Adjust OFF/ON)

This input is fixed as an immediate stop but the description can be changed (see Section 4.2.14).

6.6 Field Wiring

The standard connections to the Logic Module provide for wiring to the following:

Standard Connections To The System 5100 Logic Module		
FUNCTION	**TERMINALS**	**REFERENCE SECTION**
LMC Relays (Master Control Relays)	LMC 1, 2, 3	6.6.3
C/B (Clutch/Brake) Valve Power	V1, V2	6.6.4 or 6.6.5
C/B Valve 1 Solenoids Drive	V3, V4, V5, V6	6.6.4 or 6.6.5
C/B Valve 2 (If used) Solenoids Drive	V7, V8, V9, V10	6.6.4 or 6.6.5
PLS/OR Drive/Read	ARY, BRY, CRY, +RY	6.6.7
Resolver/Encoder Cable Connections	R1 thru R13	6.6.2
CAN Communication	CANL, CANH, CGND, SHLD	6.6.1
115 VAC Card Rack Power	GND, NEU, L1	6.6.1
Motor Speed/Load (only with optional 5100-3B Analog I/O board)	S1, S2, S3, S4, S5	6.6.8
Safety Relay 1 Drive (with 5100-3C Safety Relay Interface option)	O1A, O1B, FB1, CSR, +SR	6.6.9
Safety Relay 2 Drive (with 5100-3C Safety Relay Interface option)	O2A, O2B, FB2, CSR, +SR	6.6.9
Safety Relay 3 Drive (with 5100-3C Safety Relay Interface option)	O3A, O3B, FB3, CSR, +SR	6.6.9
Safety Relay 4 Drive (with 5100-3C Safety Relay Interface option)	O4A, O4B, FB4, CSR, +SR	6.6.9

6.6.1 Operator Terminal/Card Rack

110 VAC POWER CONNECTOR

LABEL	FUNCTION
GND	GROUND CONNECTION
NEU	AC VOLTAGE – 110 VAC – NEUTRAL
L1	AC VOLTAGE – 110 VAC – INPUT
	CONT. FROM SH. 3, LINE 79

OPERATOR TERMINAL POWER SUPPLY

LABEL	FUNCTION
COT	SUPPLY COMMON
+OT	POSITIVE SUPPLY

HIGH SPEED SERIAL BUS
CONTROLLER AREA NETWORK CONNECTOR

LABEL	WIRE COLOR
CANL	WHITE
CANH	ORANGE
CGND	BLUE
SHIELD	SHIELD

CONNECTOR J4

LABEL	COLOR	FUNCTION
+OT	RED	DC VOLTAGE – POSITIVE SUPPLY
COT	BLACK	DC VOLTAGE – SUPPLY COMMON
DP1		DIE PROTECTION-1 INPUT
DP2		DIE PROTECTION-2 INPUT
DP3		DIE PROTECTION-3 INPUT
DP4		DIE PROTECTION-4 INPUT

Figure 127: Operator Terminal/Card Rack Wiring

The Logic Module is shown with termination switch On (Term Led On). This is required if the only installed CAN based unit besides the Operator Terminal is the Card Rack Logic Module,

6.6.2 Resolver/Encoder Connections to Logic Unit
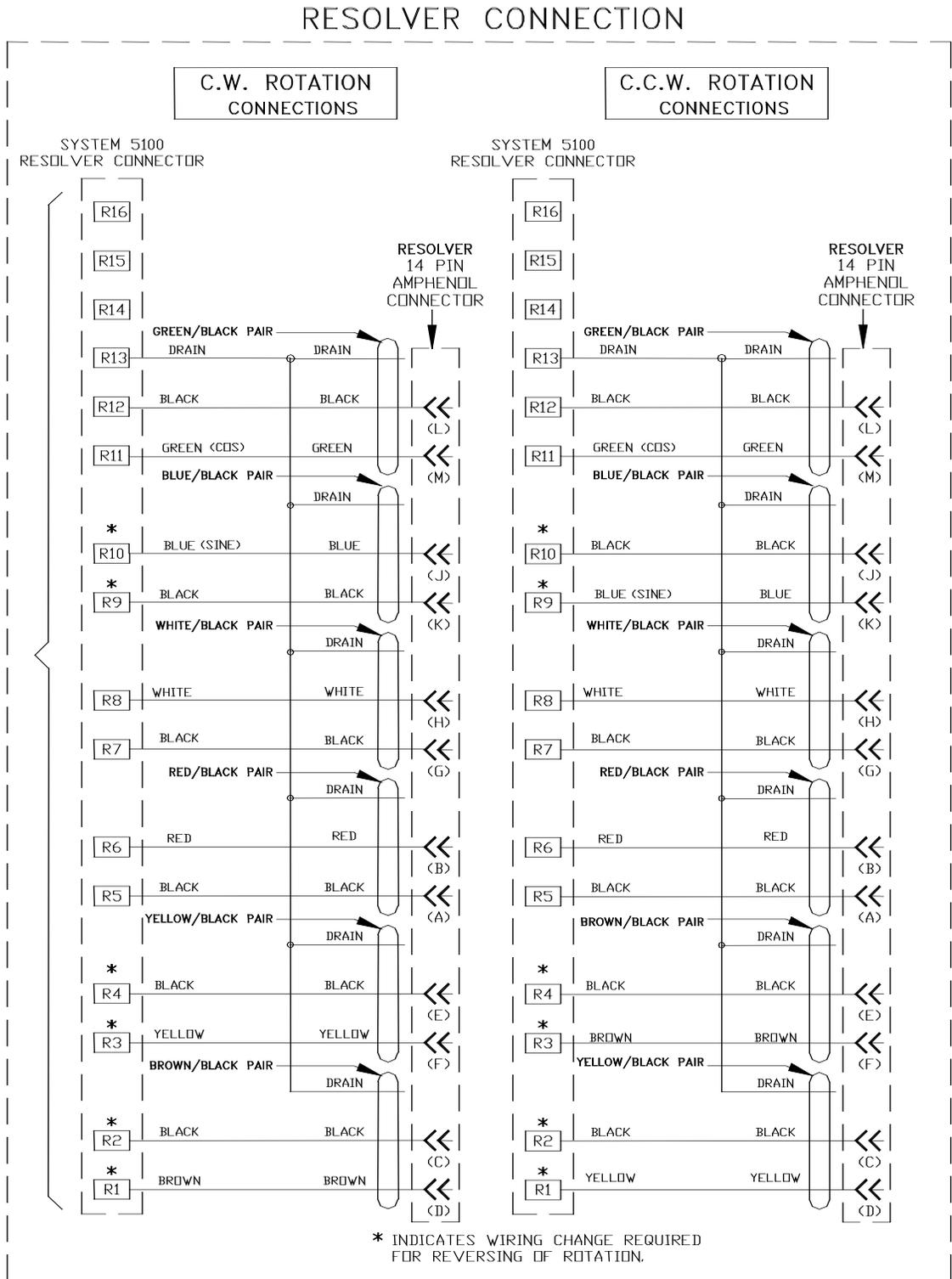
Figure 128: Resolver/Encoder Wiring

6.6.3 LMC AC Wiring
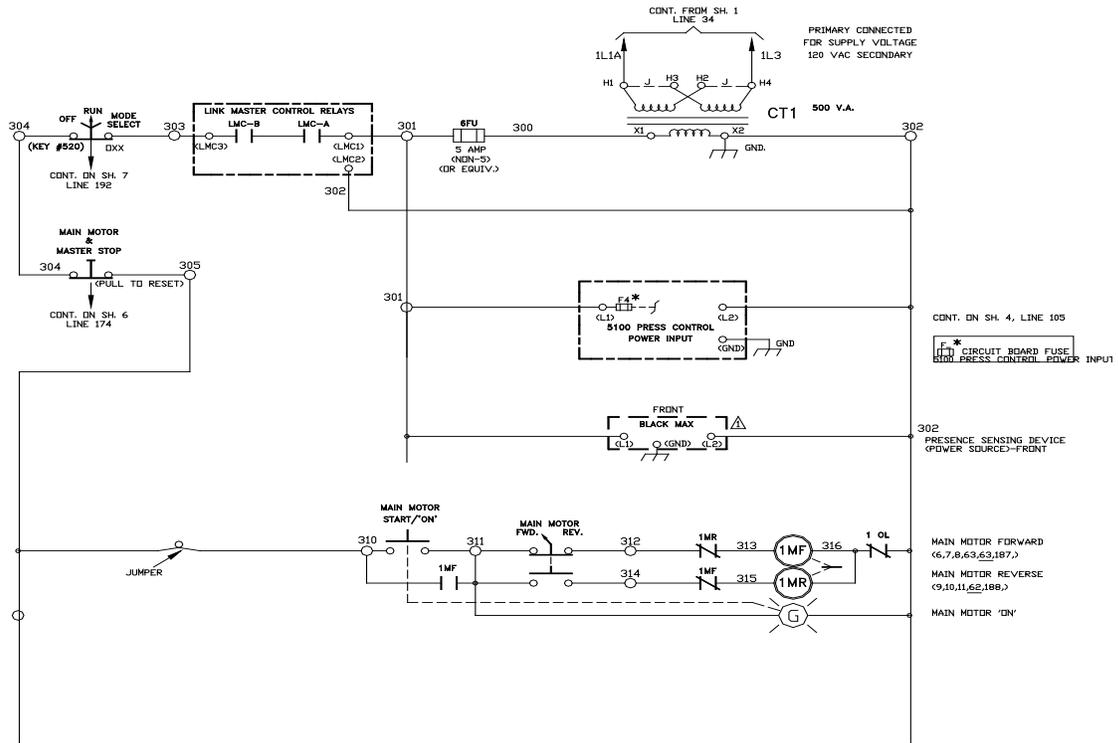
Figure 129: LMC/AC Wiring

6.6.4 Clutch/Brake Valve
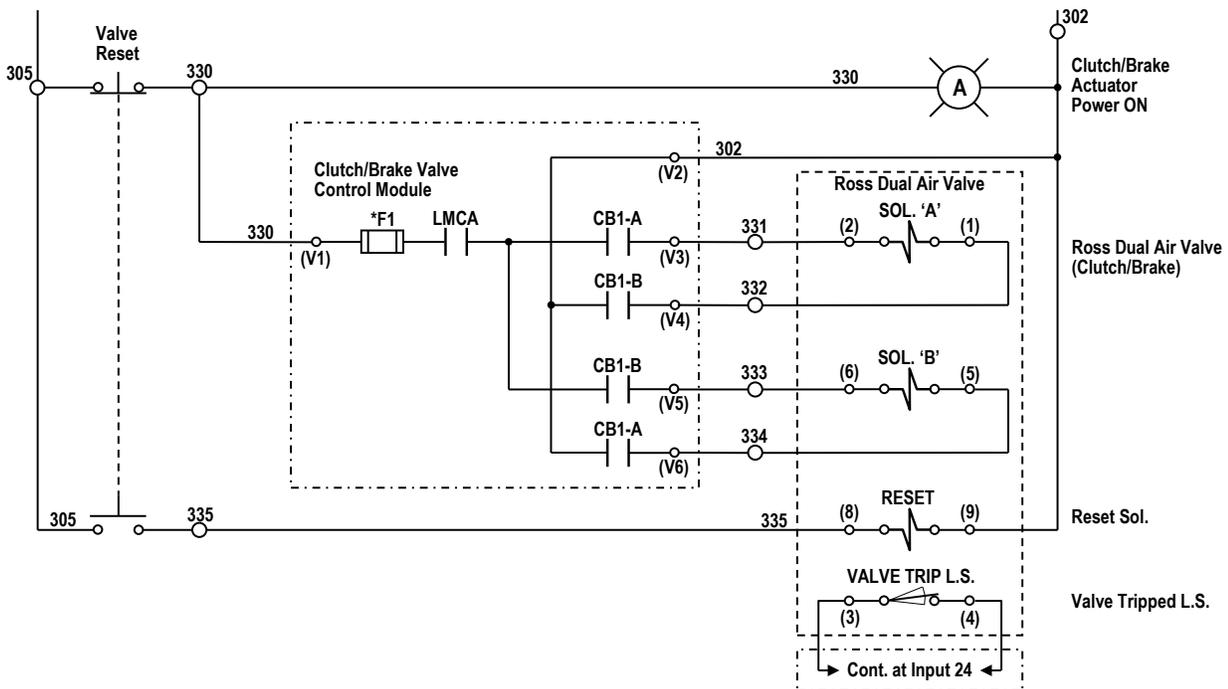
Figure 130: Clutch/Brake Wiring

6.6.5 Separate Clutch/Brake Valves
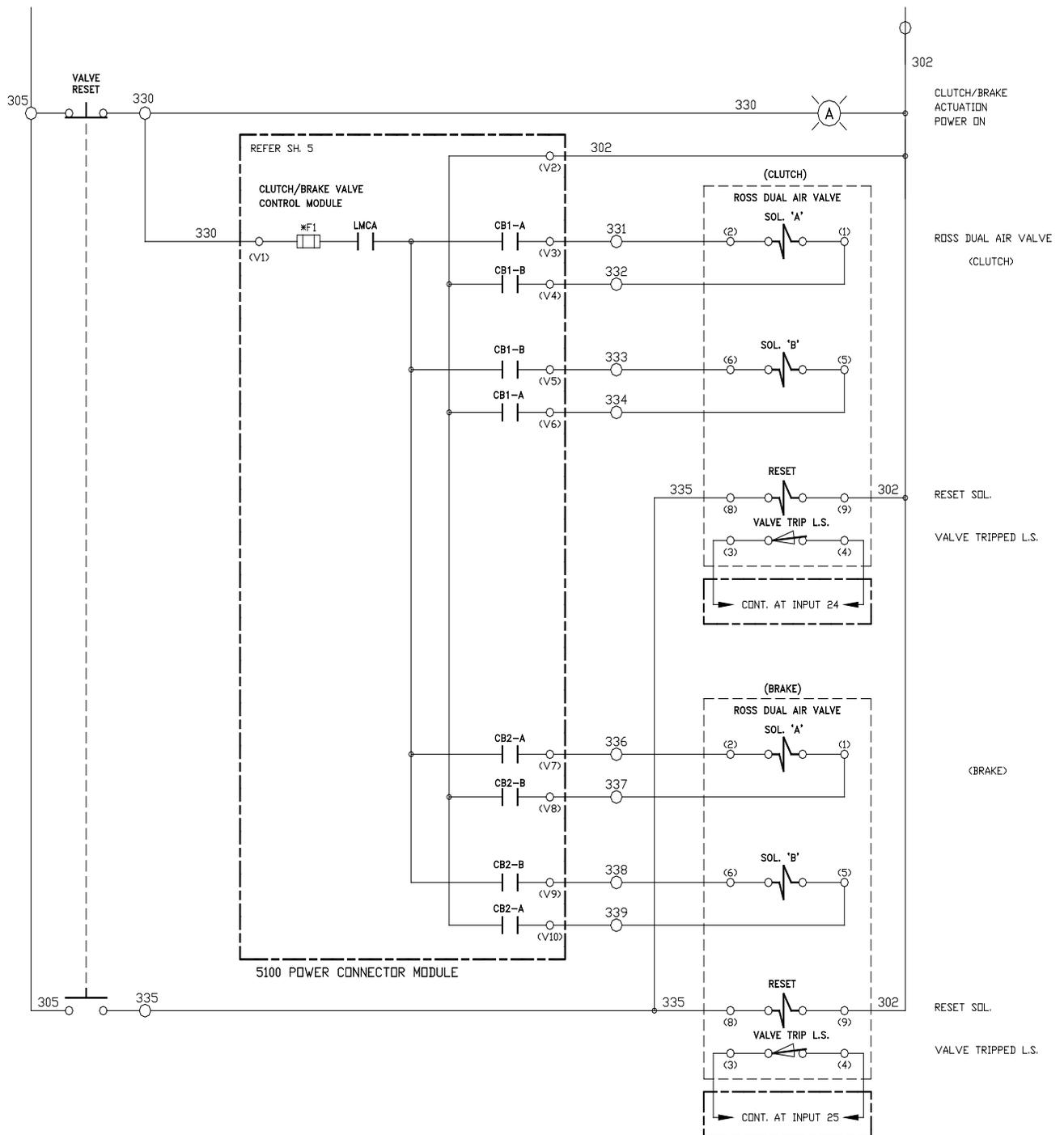
Figure 131: Separate Clutch/Brake Wiring

6.6.6 DC Field Wiring
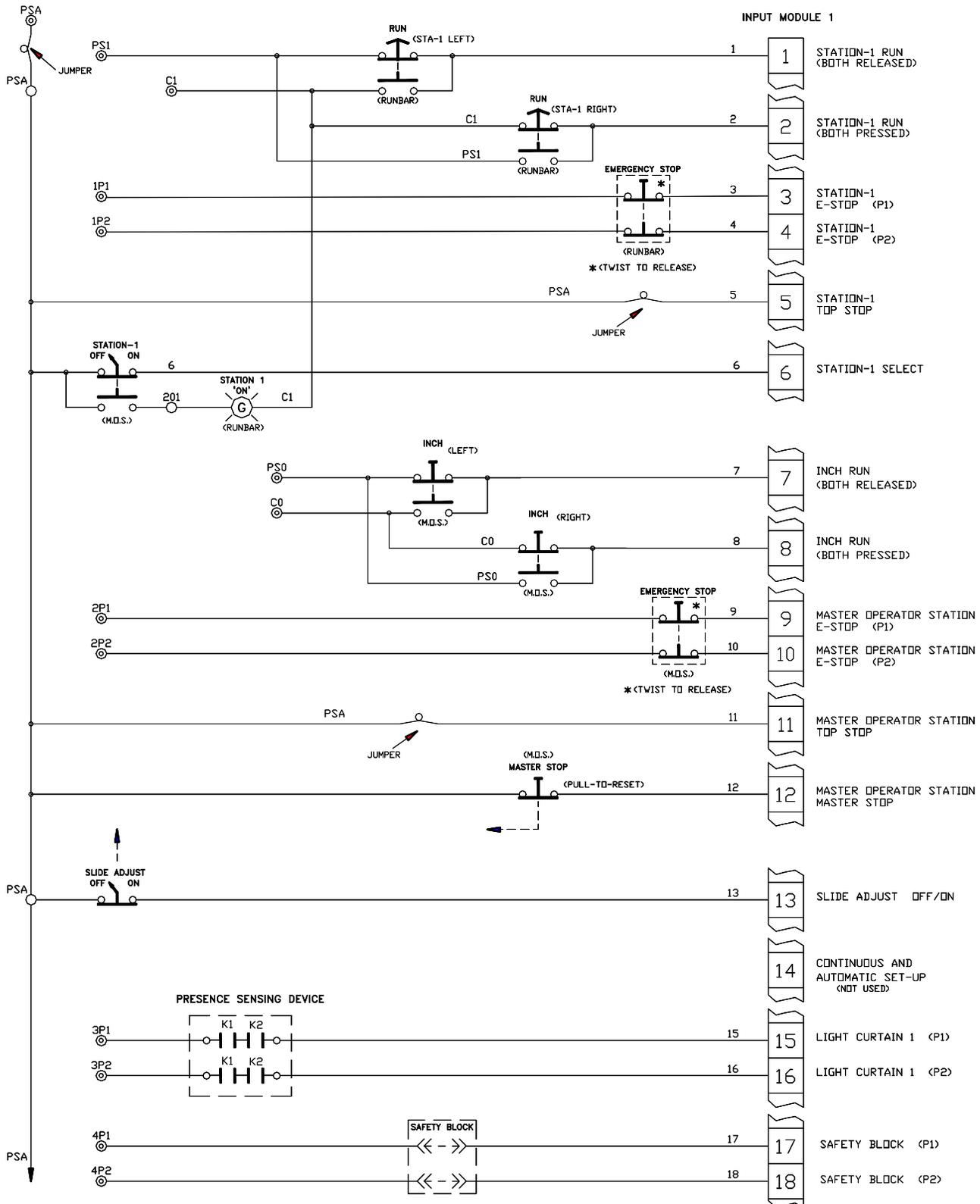
Figure 132: DC Field Wiring

6.6.7 PLS/OR Wiring
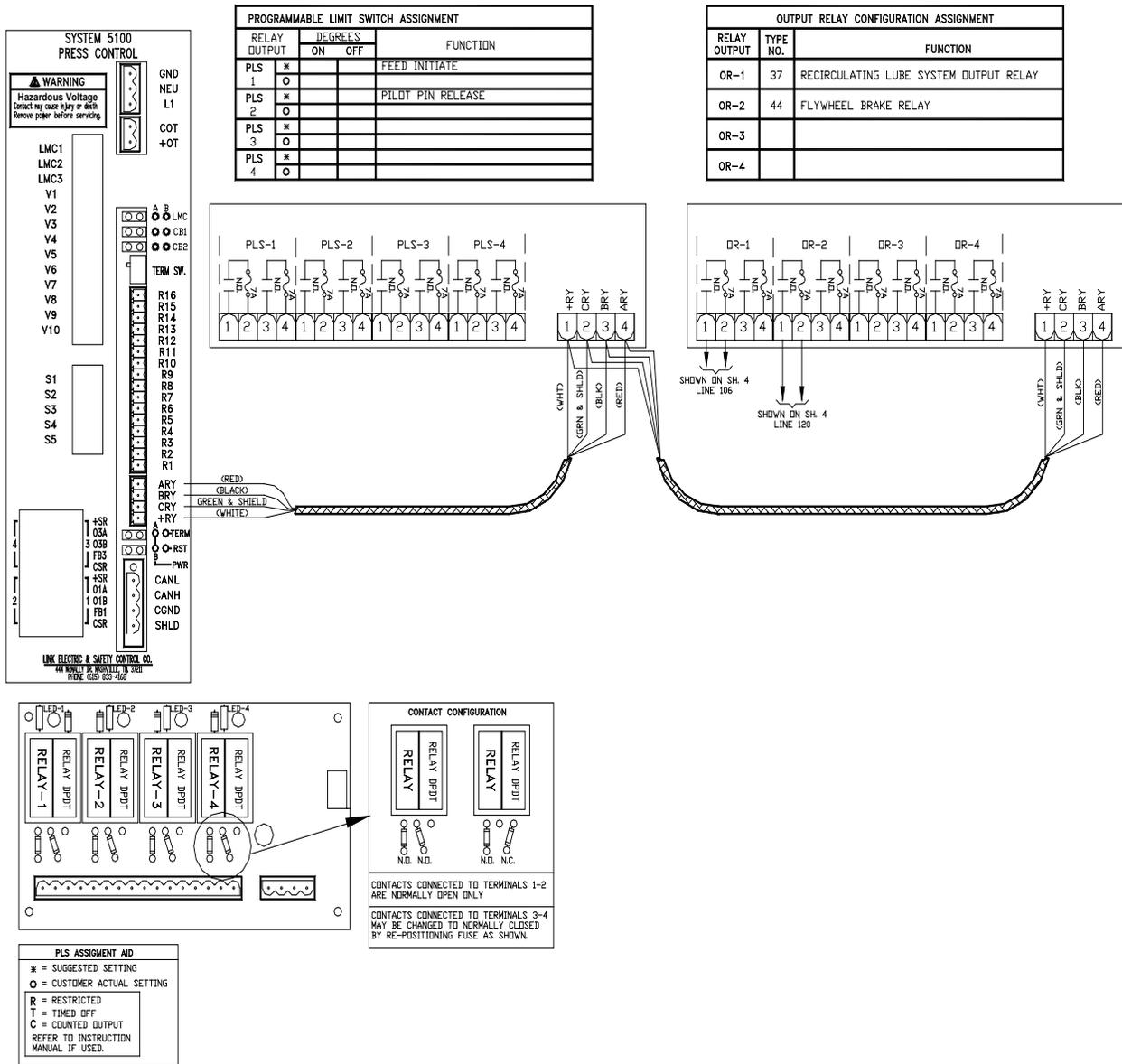
Figure 133: PLS/OR Wiring

6.6.8   Motor Speed/Load Wiring

The examples shown are for illustration. The specific wiring will depend on the drive used.
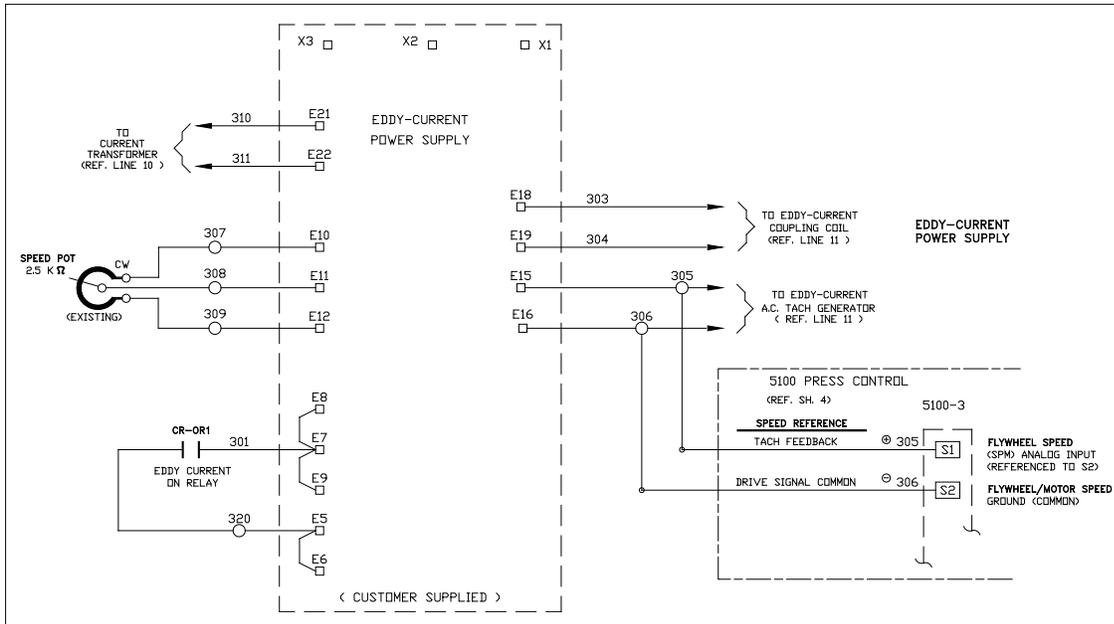
Figure 134: Motor Speed Readout Wiring
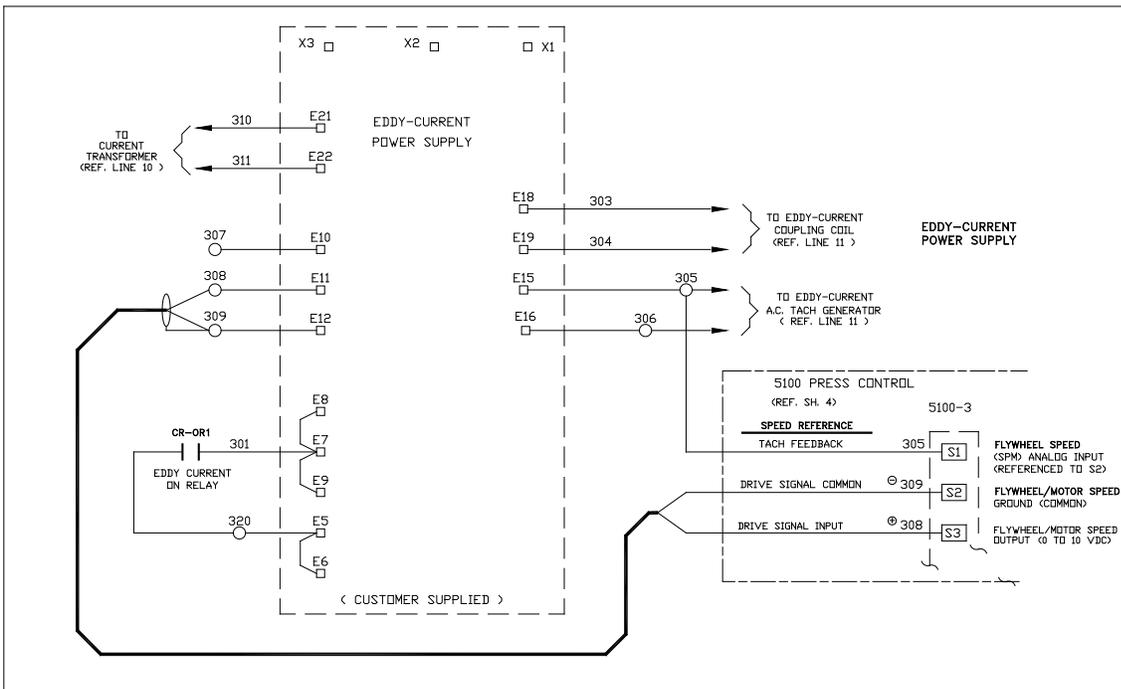
Figure 135: Motor Speed Control Wiring
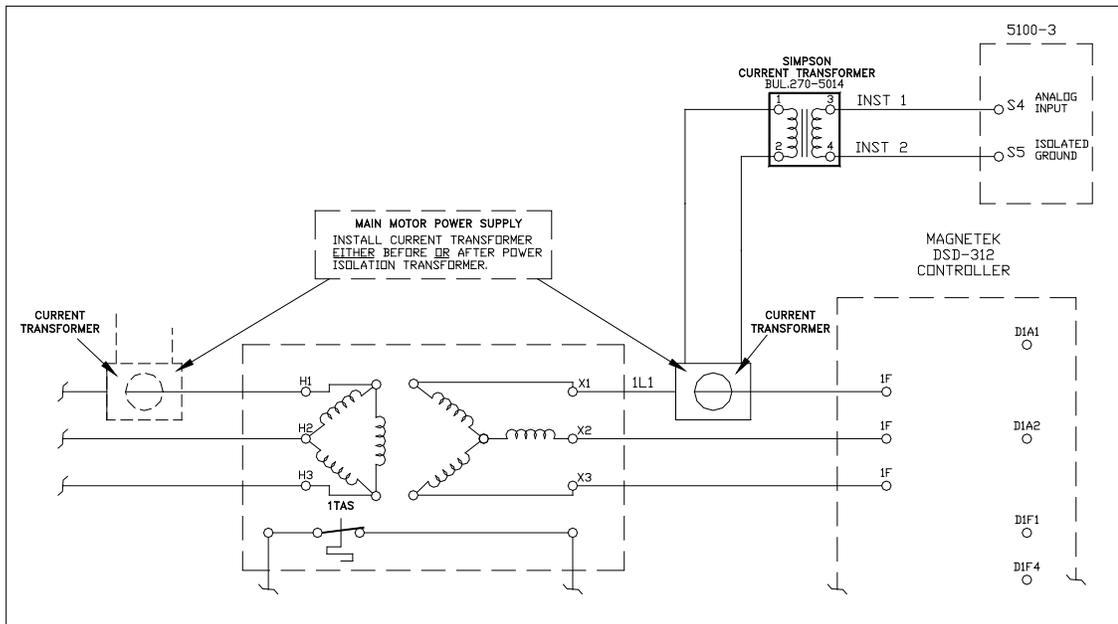
Figure 136: Motor Load Input Wiring
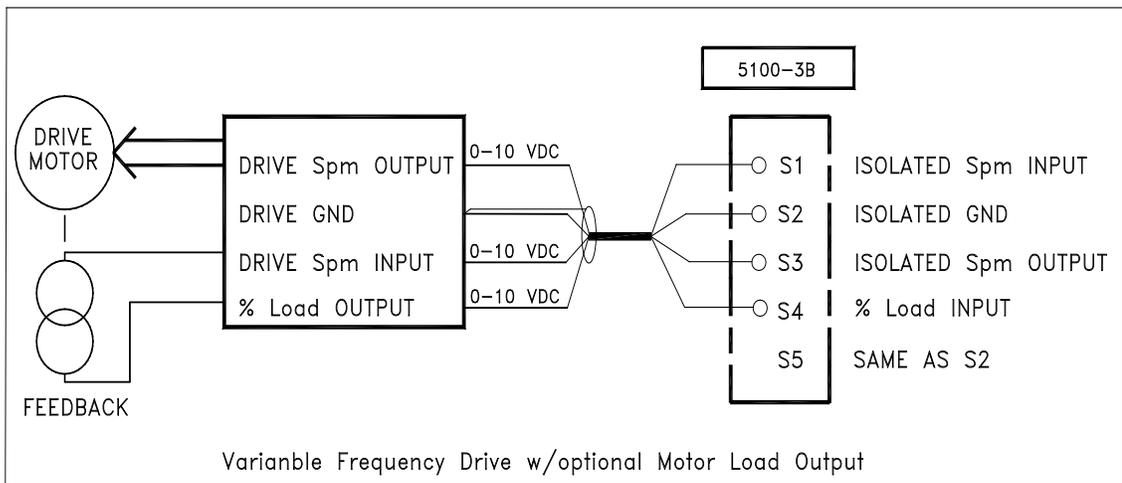
Figure 137: Variable Freq or DC Drive Wiring

6.6.9   Safety Relay Wiring

Figure 138: Safety Relay Wiring

7   TROUBLESHOOTING

7.1   Communication Failure

The message "Communication Failure" in the Present Running Status indicates that the operator terminal cannot communicate with one or both channels of the press control. Press the status field to display the messages of both channels. If only one channel shows a communication failure, change the 5100-3 Logic Module. If the message appears on both channels, turn the power off and measure the resistance from CANH to CANL. The resistance should read about 60 ohms regardless of the number of CAN devices connected. If the reading indicates shorted, inspect the connections at all of the CAN connectors. If the reading is open measure the resistance at the CAN connector on the back of the operator terminal. The operator terminal is always terminated so an open reading could indicate a problem with its terminal strip. A reading of about 120 ohms indicates that only one device is connected or terminated.

The high speed serial bus must be terminated at both ends. The operator terminal is always terminated and therefore *MUST BE* at one end of the bus. The last device at the end of the bus must also be terminated. Devices not at the end of the bus should *NOT* be terminated. Each device has a termination switch and an indicator LED to display whether or not termination is active. If the press control is the only CAN device connected, then the termination switch shown in Figure 108 should be "up" for termination to be active and will be indicated by lighting the red indicator TERM LED on the faceplate. If the press control is not at the end of the bus, then leave this switch OFF.

The 4 pin plug supplied for connection of the high speed serial bus is a double connector plug. As shown in Figure 139, this plug allows for the high speed serial bus cable to be strung from module to module. Note that unlike the power connector, this plug has screws on each side for locking into the socket. *This connector should be screwed down for trouble-free operation.* Please refer to Figure 127 for how to wire this connector.
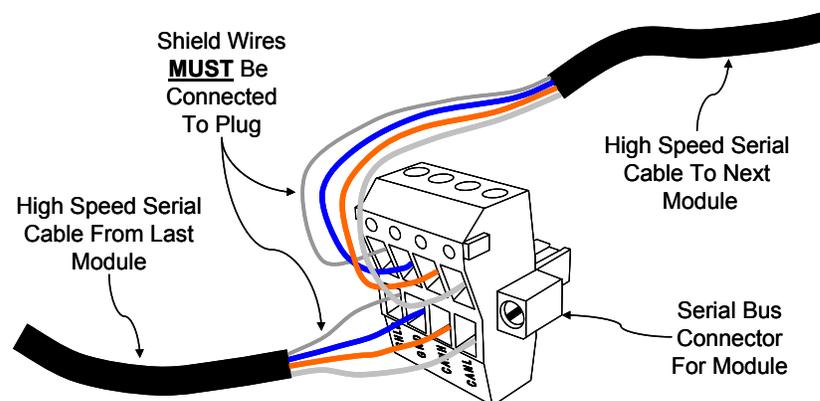
Figure 139 High Speed Bus Connector

A simple method of determining if a unit is at the end of the bus is to check the high speed bus connector. If only one cable is wired into this connector, then the unit is at the end of the bus. If two cables are wired into the connector, then the unit is not at the end of the bus and termination should not be made active.

> **NOTE:** *Always* use the cable specified by Link Systems for the high speed serial bus! This cable has been chosen to optimize communication speed and distance for the serial bus. Use of any other cable may result in communication faults that cause nuisance stops of your press production system. **DO NOT** splice cable sections between modules. Use only unbroken runs of cable between modules.

7.2   Replacing a Logic Module

The 5100-3 Logic Module shown in Figure 108 (center faceplate) is replaced by unscrewing the four knurled screws along with any connectors on the faceplate. When the new module is installed, these screws *MUST* be tightened to maintain the intended frame ground connection. All configuration parameters remain on the memory board installed on the mother board of the card rack.

> **WARNING!**   *ALWAYS* remove the power connector from the module before removing the module from the card rack! *Lethal voltages are present on the circuit board when the unit is powered!*

7.3   Field Power Supply

The internal 24 VDC power supply is used to provide eight (approximately 22 VDC) power supplies on each 5100-4 Input Module. These supplies are each current limited at about 250ma and a short to ground on one will not affect the others. An example of how they should be used is shown in Figure 100 where PS0 is used to power the inch run buttons, PS1 is used to power station #1 connections, PSA is used to power other field connections, etc. In this example, a short to ground on any station #1 connection will result in all inputs connected PS1 to indicate Low in the Input Diagnostic screen (see Figure 13). However, the inputs connected to PSA or PS0 will not be affected. This can be used to locate the short. The power supplies labeled P1 (1P1 thru 4P1) are all internally connected to the same source. The connections labeled P2 (1P2 thru 4P2) are also connected to their own source. These P1/P2 supplies should be used only for protective type inputs connected to input board 1, where P1 powers one contact and P2 powers a second contact of the same device (see more details about Pulse Check in Section 4.2.15.1). If a 2nd input board is installed an additional eight power supplies are provided for field inputs, operator stations 3, 4, and 5, and protective inputs. The power supplies labeled P1 (5P1 thru 8P1) are all internally connected to the same source. The connections labeled P2 (5P2 thru 8P2) are also connected to their own source.

7.4   Diagnosing Resolver/Encoder Faults

The System 5100 Logic module uses signals from the Resolver/Encoder assembly to calculate press angular position. The Resolver/Encoder assembly connects to the press crankshaft in a 1:1 ratio. As the crankshaft rotates, output signals from the Resolver/Encoder assembly vary in response to the current crankshaft angular position. The assembly consists of a brushless resolver and an absolute optical encoder. Both the brushless resolver and absolute optical encoder are connected directly to the shaft of the Resolver/Encoder assembly, which in turn connects directly to the press crankshaft. Outputs from the brushless resolver are used to calculate angular position. The angular position information is checked by quadrant data from an absolute optical encoder. The Resolver/Encoder connections to the System 5100 Logic module are shown in Figure 128 on page 191.

The brushless resolver has three windings; reference, sine, and cosine. The System 5100 Logic module drives the reference winding with an AC signal of fixed magnitude. The magnitude and phase of the sine and cosine windings vary in relation to the angular position of the press crankshaft. The relationship between the Resolver/Encoder shaft angular position and the magnitudes of the sine and cosine windings outputs is illustrated in Figure 140 on page 204.

The optical encoder provides two digital outputs. These digital outputs also vary in response to the angular position of the press crankshaft. The System 5100 Logic module decodes these two digital signals. After decoding the two signals, the System 5100 Logic module determines that the current encoder position is between 45 and 135 degrees, between 135 and 225 degrees, between 225 and 315 degrees, or between 315 and 45 degrees.

After calculating the angular position of the brushless resolver and decoding the outputs of the optical encoder, the System 5100 Logic module compares the results. If the calculated angle of the brushless resolver is not within the decoded range of the optical encoder within a +/- 5° tolerance window, the System 5100 generates a Resolver/Encoder error and error message. Errors and error messages are also generated if the outputs of the brushless resolver indicate that the brushless resolver or System 5100 Logic module are not operating correctly. The possible error messages are listed below.

No Sin/Cos   *Static Fault*

Press the **Reset** softkey in the Press Control screen. If the error message does not reset, the fault is static and the conditions causing the fault are still present on the Logic Module.

Measure the AC voltage from R8 to R7 terminals on the System 5100 Logic module. This is the reference signal to the brushless resolver. The nominal reading is 2.6 VAC and can vary from 2.2 to 3.0 VAC. If the reading is less than 2.2 VAC, remove the wire on terminal R8 and read the voltage from R8 to R7 again. If the reading is still less than 2.2 VAC, replace the System 5100-3 Logic module. If the voltage between R8 and R7 is correct with the wire removed, reconnect the wire to R8. Unscrew the connector on the back of the Resolver/Encoder assembly to determine if the problem is in the Resolver/Encoder cable or the Resolver/Encoder assembly. If the voltage is still low with the connector removed, the problem is most likely in the Resolver/Encoder cable. If the voltage is correct with the connector removed, the problem is most likely in the Resolver/Encoder assembly.

If the voltage reading between R8 to R7 is correct, measure the AC voltages from R10 to R9 and from R11 to R12. The correct readings for these voltages depend on the present position of the Resolver/Encoder assembly shaft (see Figure 140 on page 204). For example, if wired for clockwise rotation and the Resolver/Encoder shaft is positioned at 60 degrees, the voltage from R10 to R9 should read about 2.2 VAC and from R11 to R12 should read about 1.3 VAC. If the readings are correct, replace the 5100-3 Logic Module.

If the voltage from R10 to R9 and from R11 to R12 both read less than about 0.5 VAC, turn the power off and measure the resistance from R10 to R9 and from R11 to R12. These should each read about 170 ohms. Measure the resistance from R8 to R7. This should read about 85 ohms. If all readings are correct, the problem is most likely in the Resolver/Encoder assembly. If any resistance is drastically greater than that listed above (i.e. open circuit), the problem is most likely

in the cable or the cable connection to the Resolver/Encoder assembly. Verify that the connector on the back of the Resolver/Encoder assembly is tight (the connector should be fully seated on the Resolver/Encoder assembly - no threads should be visible) and that the connections on the System 5100 Logic module terminal strip are secure (no terminals have been tightened down on the insulation of the wire). High resistance readings could also indicate a Resolver/Encoder assembly fault. If shorted (much less than 170 ohms or 85 ohms), look at the System 5100 terminal connections for R7, R8, R9, R10, R11, and R12 for any frayed wires touching other wires or the metal faceplate. If the connections appear to be correct, remove both wires of the shorted pair from the terminal on the System 5100 Logic module to see if the short is in the System 5100 Logic module or external to the module. If the short is external to the System 5100 Logic module, disconnect the Resolver/Encoder cable from the Resolver/Encoder assembly to determine if the short is in the cable or the Resolver/Encoder assembly.

No Sin/Cos   *Dynamic Fault*

Press the **Reset** softkey in the Press Control screen. If the error message goes away and allows the press to be run again, the fault is dynamic and the conditions causing the fault may occur only at a specific angle or under shock. This could be caused by a bad Resolver/Encoder assembly, an intermittent connection from the Resolver/Encoder assembly to the System 5100 Logic module that opens under shock, or an intermittent problem with the System 5100 Logic module. Verify that the connector on the back of the Resolver/Encoder assembly is tight (the connector should be fully seated on the Resolver/Encoder assembly - no threads should be visible) and that the connections on the System 5100 Logic module terminals are secure (no terminals have been tightened down on the insulation of the wire). If the fault still occurs without the impact caused by the die, and the press comes to rest at a relatively consistent position in the stroke after the fault occurs, the problem is most likely in the Resolver/Encoder assembly.

Resolver/Optic Fault   *Static Fault*

Press the **Reset** softkey in the Press Control screen. If the error message does not reset, the fault is static and the conditions causing the fault are still present on the System 5100 Logic module R1-R13 terminals.

Measure the DC voltage between terminals R6 and R5. This is the DC supply voltage to the optical encoder. The voltage should read 12 VDC with R6 positive in relation to R5. If the voltage is less than 12 VDC, remove the wire to terminal R6. Measure the voltage again between terminals R6 and R5. If the voltage is still low, replace the System 5100 Logic module. If the voltage is correct, reconnect the wire to terminal R6. Disconnect the Resolver/Encoder cable connector from the Resolver/Encoder assembly to determine if the problem is with the Resolver/Encoder cable or Resolver/Encoder assembly.

If the DC voltage between terminals R6 and R5 is 12 VDC, measure the DC voltages between terminals R1 and R5, R2 and R5, R3 and R5, and R4 and R5 along with the AC voltage between terminals R8 and R7, R10 and R9, R11 and R12. Note the actual position of the resolver shaft (don't go by the angle display on the operator terminal) and from Figure 140 on page 204 it should be possible to determine which signal is incorrect. For example, if wired for clockwise rotation and the resolver shaft positioned at about 60 degrees the readings should be as shown in the following table.

Example Voltages for Resolver at 60 degrees		
Terminal	**Ideal Voltage Reading**	**Possible Voltage Range**
R1 to R5	4 VDC	3.8 to 4.1 VDC
R2 to R5	1 VDC	0.7 to 1.1 VDC
R3 to R5	1 VDC	0.7 to 1.1 VDC
R4 to R5	4 VDC	3.8 to 4.1 VDC
R8 to R7	2.6 VAC	2.2 to 3.0 VAC
R10 to R9	2.2 VAC	1.9 to 2.5 VAC
R11 to R12	1.3 VAC	1.0 to 1.6 VAC

If these readings are correct, replace the System 5100 Logic module. This module could also be the problem if the fault appears on only one channel of the press control (see Section 3.5.1.8 on page 38).

A fault in the Resolver/Encoder assembly could result in one or both optical encoders indicating an incorrect quadrant. For example, a reading between R1 and R5 of 1 VDC and between R2 and R5 of 4 VDC is incorrect for a Resolver/Encoder shaft position of 60 degrees.

Acceptable voltage readings for R1 to R5, R2 to R5, R3 to R5, and R4 to R5 are 0.7 to 1.1 VDC and 3.8 to 4.1 VDC. Voltage readings outside these ranges indicate a potentially broken connection between the System 5100 Logic module and Resolver/Encoder assembly.

Resolver/Optic Fault   *Dynamic Fault*

Press the **Reset** softkey in the Press Control screen. If the error message goes away and allows the press to be run again, the fault is dynamic and the conditions causing the fault may occur only at a specific angle or under shock. This could be caused by excessive clearance in the connection between the resolver and the crankshaft, a bad Resolver/Encoder assembly, an intermittent connection from the Resolver/Encoder assembly to the System 5100 Logic module that opens under shock, or an intermittent problem with the System 5100 Logic module. Verify that the connector on the back of the Resolver/Encoder assembly is tight (the connector should be fully seated on the Resolver/Encoder assembly, no threads should be visible) and that the connections on the System 5100 Logic module terminals are secure (no terminals have been tightened down on the insulation of the wire). If fault still occurs without the impact caused by the die, and the press comes to rest at a relatively consistent position in the stroke after the fault occurs, the problem is most likely in the Resolver/Encoder assembly. Excessive clearance in the connection from the crankshaft to the Resolver/Encoder assembly can create accelerations at the point of impact that appear as a position discrepancy between the brushless resolver and the optical encoder. If driven by a chain and sprocket, the Resolver/Encoder assembly should be mounted on a spring base adjusted to maintain tension on the chain.
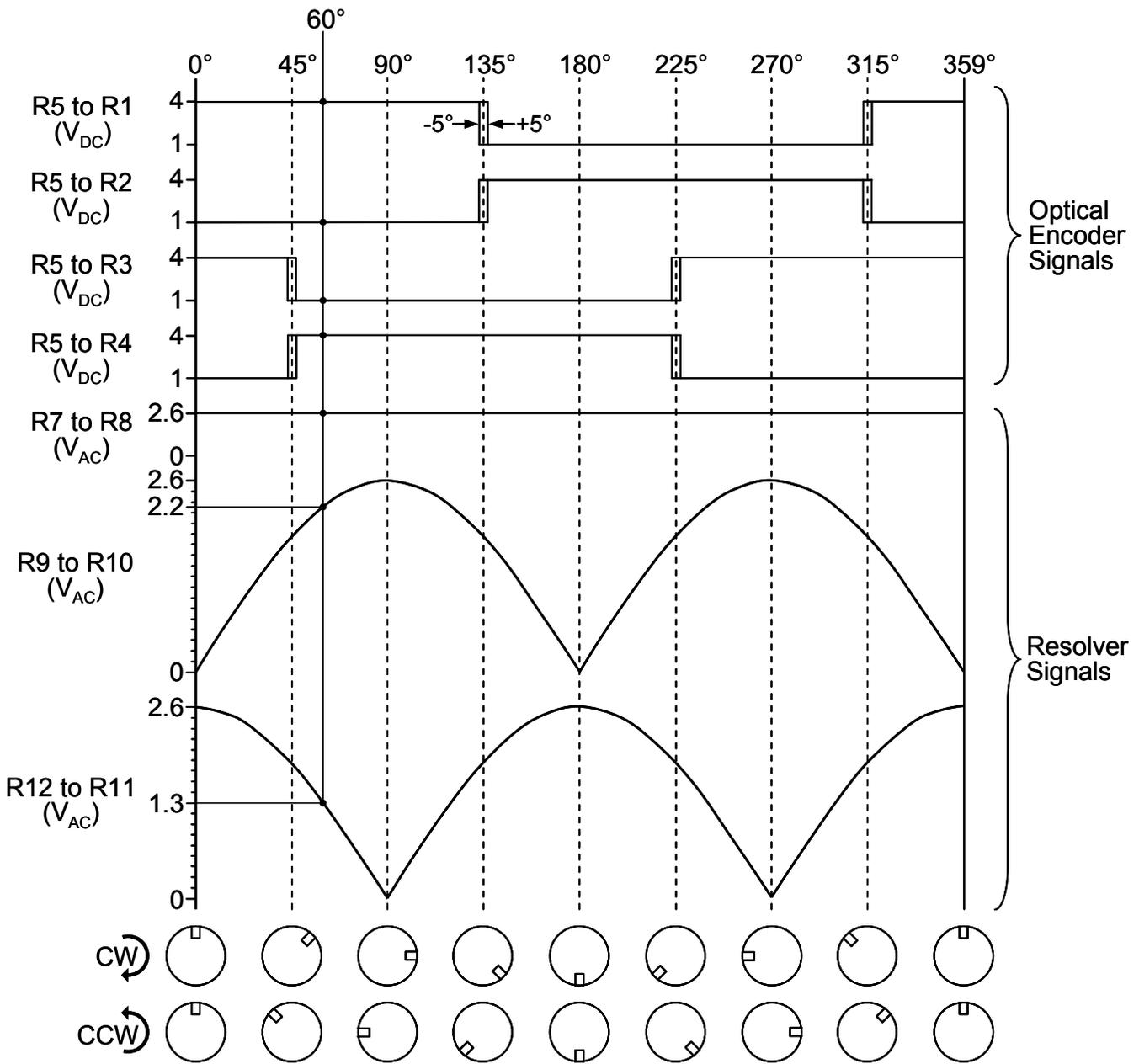
Readings shown for R8, R10, and R11
are as measured with an AC Volt Meter

V(R7 to R8) = 2.6 VRMS 2.5 KHz (nominal)
V(R9 to R10 = V(R8) X SIN (angle)
V(R12 to R11) = V(R8) X COS (angle)

Figure 140: Resolver/Encoder Signals vs Shaft Position

7.5   Diagnostic Codes

Each message that appears in the reason for the last stop or the present running status is assigned a unique code number. This number is shown by pressing the present running field to display the screen shown in Figure 11. The code numbers and messages are shown below:

Code Number: 0 - "Power Up",
    This message appears as a reason for the last stop when power is first applied to the press control. After a stroke has been initiated and stopped, the message is replaced with the cause of the stop and should never appear again until power is turned off and back on. If it does, this would indicate a reset condition has occurred on one or both of the press control channels. Loss of incoming power would cause this condition or an intermittent short to ground on the +24V power supply used by the operator terminal, the PLS/OR boards, and the safety relay interface boards (Not the +24V power used by the press control inputs). If the operator terminal resets (i.e. powers up in the main screen) in conjunction with this fault, it would suggest a shorted condition has occurred. If the operator terminal does not reset, the problem is most likely on the logic module.

Code Number: 1 - "Motion Did NOT Start",
    This message appears only as a reason for the last stop and indicates that when the stroke was initiated, the crankshaft motion did not exceed the "Motion Threshold" within the "Engagement Time Limit". Both of these parameters are located in Clutch Configuration. This fault can also indicate an external problem with the machine, such as low clutch/brake air pressure, high counterbalance pressure, or excessive clutch plate clearance. This would also occur if the press is running in the reverse direction but Input 20 [N/O Mot. Reverse Aux. Contact] is not high. On presses with separate clutch and brake (which requires an optional 5100-3A relay board), the "Engagement Time Limit" MUST be set longer than the "Separate Clutch/Brake Pull-In Delay" plus the time the press takes to establish motion after the clutch engages (see Section 4.2.1 for details).

Code Number: 2 - "Motion Stopped",
    This message appears only as a reason for the last stop and indicates that after initially establishing motion, the crankshaft motion dropped and remained below the "Motion Threshold" for longer than the "Loss of Motion Time". This could be caused by incorrect air pressure, a mechanical problem, or an incorrect setting for the either the "Motion Threshold" or the "Loss of Motion Time".

Code Number: 3 - "Ready To Stroke",
    This message appears in the present running status and indicates that no stop conditions exist, and the stroke will be initiated when the correct operator buttons are pressed.

Code Number: 4 - "Auto Stop On Top",
    This message appears only as a reason for the last stop and means that the press control generated a stop at the speed advanced top stop point. This message indicates a normal stop on top in inch or single stroking modes.

Code Number: 5 - "Motion Before Start",
This message appears in the present running status and means that crankshaft motion was detected without the clutch energized. To generate this fault, motion must exceed the "Motion Threshold" for longer than 0.1 seconds. Motion during the normal stopping time of the press is not part of this check. This condition could be caused by incorrect counterbalance pressure or could be a problem with the clutch/brake. This fault condition will turn the LMC output off and a **Reset** softkey must be pressed before the LMC output will turn back on.

Code Number: 6 - "Other Chan. Did NOT Begin",
This message indicates that one channel recognized a stop condition and reacted to it before the other channel during the engagement sequence. If this occurs on a consistent basis it can indicate a problem on the 5100-3 Logic Module.

Code Number: 7 - "Other Chan. Caused Stop",
This message indicates that one channel recognized a stop condition and reacted to it before the other channel reached the same decision. Each channel makes its own decision about the state of all conditions on the press and will issue a stop signal as soon as a stop condition is detected. This action will be recognized by the other channel and it will react even if it has not yet reached the same decision. Non-safety systems (e.g. lube system) are monitored by channel A of the press control. The operator terminal will display the actual message in the press control screen (either as a reason for the last stop or present running status).

Code Number: 8 - "Inch Button Pressed",
This message would appear in the present running status after the press stopped, if the inch buttons were still being pressed. All run buttons must be released after any disengagement of the clutch/brake. The message could appear in the reason for the last stop if the inch buttons were pressed after a single stroke cycle was initiated. When the buttons are released, the input diagnostic screen should indicate that the normally closed path through both buttons is high and the normally open path is low.

Code Number: 9 - "Station 1 Pressed",
This message would appear in the present running status after the press stopped, if the station 1 run buttons were still being pressed. All run buttons must be released after any disengagement of the clutch/brake. The message could appear in the reason for the last stop if the station was not selected and the run buttons were pressed after a single stroke cycle was initiated. If this were to occur prior to stroke initiation an "Inactive Station Used" fault would be displayed in the present running status. When the buttons are released, the input diagnostic screen should indicate that the normally closed path through both buttons is high and the normally open path is low.

Code Number: 10 - "Station 2 Pressed",
This message would appear in the present running status after the press stopped, if the station 2 run buttons were still being pressed. All run buttons must be released after any disengagement of the clutch/brake. The message could appear in the reason for the last stop if the station was not selected and the run buttons were pressed after a single stroke cycle was initiated. If this were to occur prior to stroke initiation an "Inactive Station Used" fault would be displayed in the present running status. When the buttons are released, the input diagnostic screen should indicate that the normally closed path through both buttons is high and the normally open path is low.

Code Number: 11 - "Station 3 Pressed",
    This message would appear in the present running status after the press stopped, if the station 3 run buttons were still being pressed. All run buttons must be released after any disengagement of the clutch/brake. The message could appear in the reason for the last stop if the station was not selected and the run buttons were pressed after a single stroke cycle was initiated. If this were to occur prior to stroke initiation an "Inactive Station Used" fault would be displayed in the present running status. When the buttons are released, the input diagnostic screen should indicate that the normally closed path through both buttons is high and the normally open path is low.

Code Number: 12 - "Station 4 Pressed",
    This message would appear in the present running status after the press stopped, if the station 4 run buttons were still being pressed. All run buttons must be released after any disengagement of the clutch/brake. The message could appear in the reason for the last stop if the station was not selected and the run buttons were pressed after a single stroke cycle was initiated. If this were to occur prior to stroke initiation an "Inactive Station Used" fault would be displayed in the present running status. When the buttons are released, the input diagnostic screen should indicate that the normally closed path through both buttons is high and the normally open path is low.

Code Number: 13 - "Station 5 Pressed",
    This message would appear in the present running status after the press stopped, if the station 3 run buttons were still being pressed. All run buttons must be released after any disengagement of the clutch/brake. The message could appear in the reason for the last stop if the station was not selected and the run buttons were pressed after a single stroke cycle was initiated. If this were to occur prior to stroke initiation an "Inactive Station Used" fault would be displayed in the present running status. When the buttons are released, the input diagnostic screen should indicate that the normally closed path through both buttons is high and the normally open path is low.

Code Number: 14 - "Inch Button Time Out",
    This message appears as a reason for the last stop if both inch buttons are not pressed within a fixed 0.5 seconds time of each other. This time cannot be changed.

Code Number: 15 - "Inch Button Released",
    This message would appear as a reason for the last stop in Inch, Timed Inch, and Setup/Stop Time Test modes if the either Inch run button is released, causing the press to stop. The input diagnostic screen can be used to view the state of the run button inputs while the press is being stroked.

Code Number: 16 - "Resolver/Optic Fault",
    This message indicates that the position read from the resolver does not agree with the position read from the optical encoder. This could indicate misalignment within the resolver assembly (set by the factory), a wiring problem from the resolver to the Logic Module, or a fault on the 5100-3 Logic Module (see Section 7.4 on page 200 for information on diagnosing resolver faults). This fault will turn the LMC output off. The condition causing the fault must be corrected and the **Reset** softkey must be pressed before the LMC output will turn back on and further strokes allowed.

Code Number: 17 - "No Sin/Cos",

This message indicates that both the sine or cosine signals from the resolver (R10 and R11) are low. This could indicate a resolver failure, a wiring problem from the resolver to the Logic Module, or a fault on the 5100-3 Logic Module (see Section 7.4 on page 200 for information on diagnosing resolver faults). This fault will turn the LMC output off. The condition causing the fault must be corrected and the **Reset** softkey must be pressed before the LMC output will turn back on and further strokes allowed.

Code Number: 18 - "Cross Communication Fault",

If the **Reset** softkey does not clear this fault, change the 5100-3 Logic Module. If it does clear the fault, there may be an intermittent short to ground on the 24 VDC power supply that goes to the operator terminal, the PLS/OR relay boards, and the optional safety relay interface. If there is a short, the reason for the last stop should display "Power Up".

Code Number: 19 - "Stop Time > 4 Seconds",

This message would appear as a reason for the last stop in the event that crankshaft motion did not go below 2 RPM (the press did not stop) four seconds after the clutch/brake output was turned off. Every time the clutch/brake output is turned off the press control will monitor motion in order to perform a brake monitor check when the press stops. However, if motion does not indicate that the press has come to rest after four seconds the LMC will be turned off in order to shut the motor off. This message will then appear in the present running status along with a **Reset** softkey, which must be pressed in order to turn the LMC back on. This fault can indicate a serious malfunction in the Clutch/Brake mechanism such as the clutch plate did not mechanically release. The Clutch/Brake mechanism should be immediately inspected.

Code Number: 20 - "Station 1 Released",

This message would appear as a reason for the last stop in a production mode if running during a portion of the stroke where releasing either station #1 run button causes the press to stop. The input diagnostic screen can be used to look at the state of the run button inputs while the press is being stroked.

Code Number: 21 - "Station 2 Released",

This message would appear as a reason for the last stop in a production mode if running during a portion of the stroke where releasing either station #2 run button causes the press to stop. The input diagnostic screen can be used to look at the state of the run button inputs while the press is being stroked.

Code Number: 22 - "Station 3 Released",

This message would appear as a reason for the last stop in a production mode if running during a portion of the stroke where releasing either station #3 run button causes the press to stop. The input diagnostic screen can be used to look at the state of the run button inputs while the press is being stroked.

Code Number: 23 - "Station 4 Released",

This message would appear as a reason for the last stop in a production mode if running during a portion of the stroke where releasing either station #4 run button causes the press to stop. The input diagnostic screen can be used to look at the state of the run button inputs while the press is being stroked.

Code Number: 24 - "Station 5 Released",
    This message would appear as a reason for the last stop in a production mode if running during a portion of the stroke where releasing either station #5 run button causes the press to stop. The input diagnostic screen can be used to look at the state of the run button inputs while the press is being stroked.

Code Number: 25 - "Inactive Station Used",
    This message appears in the present running status in Single Stroke mode if either run button on a station that is turned Off is pressed. The **Reset** softkey must be pressed to clear this fault. The reason for the last stop will display the station that was used incorrectly.

Code Number: 26 - "No Operator Stations",
    This message appears in the present running status to indicate that no operator stations are selected in a production mode. It will be displayed in Inch mode if Inch has been configured to run from the selected operator stations. The Operator Station screen along with the Input Diagnostics screen can be used to view and verify the station selects.

Code Number: 27 - "Station 1 Time Out",
    This message appears as a reason for the last stop if both run buttons are not pressed within a fixed 0.5 second time period of each other. This time cannot be changed.

Code Number: 28 - "Station 2 Time Out",
    This message appears as a reason for the last stop if both run buttons are not pressed within a fixed 0.5 second time period of each other. This time cannot be changed.

Code Number: 29 - "Station 3 Time Out",
    This message appears as a reason for the last stop if both run buttons are not pressed within a fixed .5 second time period of each other. This time cannot be changed.

Code Number: 30 - "Station 4 Time Out",
    This message appears as a reason for the last stop if both run buttons are not pressed within a fixed .5 second time period of each other. This time cannot be changed.

Code Number: 31 - "Station 5 Time Out",
    This message appears as a reason for the last stop if both run buttons are not pressed within a fixed .5 second time period of each other. This time cannot be changed.

Code Number: 32 - "Mode is Not Allowed",
    This message appears in the present running status if an optional mode is disabled in the "Mode Configuration" screen while the mode is selected. If this mode has intentionally been turned off, select an allowed mode.

Code Number: 33 - "C/B 2 Power Lost",
   This message means that clutch/brake 2 output was turned On but the feedback indicates that the normally open path did not go high or went low while stroking. This would occur if there is no incoming voltage from V1 to V2 (this could either be 24 VDC or 120 VAC), or power is dropping out while stroking. It would also occur if the fuse on the 5100-3A Relay Board was blown (see Figure 113 on page 171). The Output diagnostic screen should provide additional information. Otherwise, the failure is either on the 5100-3 Logic Module or the 5100-3A Relay Board. This fault would also occur if configured for separate clutch/brake but a standard four relay 5100-3A is installed.

Code Number: 34 - "Program Check Fault",
   This message is not used.

Code Number: 35 - "Memory Compare Fault",
   This message appears in the present running status if the non-volatile data memories of the two press control channels do not agree. Use the Memory Compare Diagnostic screen to locate any parameters that are in disagreement (the parameter values will be displayed in Red). Then use the configuration screens to correct the setting (the Memory Compare screen displays the configuration screen where the parameter is located). When all parameters agree this message will go away.

Code Number: 36 - "I1/2-Station 1 Opto Fault",
   Replace the 5100-4A Input Module (Input board 1).

Code Number: 37 - "I29/30-Station 2 Opto Fault",
   Replace the 5100-4A Input Module (Input board 1).

Code Number: 38 - "I7/8-Inch Opto Fault",
   Replace the 5100-4A Input Module (Input board 1).

Code Number: 39 - "I57/58-Station 3 Opto Fault",
   Replace the 5100-4B Input Module (Input board 2).

Code Number: 40 - "I85/86-Station 4 Opto Fault",
   Replace the 5100-4B Input Module (Input board 2).

Code Number: 41 - "I63/64-Station 5 Opto Fault",
   Replace the 5100-4B Input Module (Input board 2).

Code Number: 42 - "Input Board 2 Config. Fault",
   This message appears in the present running status if the parameter "Input Card 2 Installed" is configured for "Yes" in the Machine Parameters configuration screen but no second input board inserted in the card rack. It will also be displayed if a second board is installed in a control that the above parameter is configured for "No". The **Reset** softkey must be pressed to clear this fault, after the configuration is set correctly.

Code Number: 43 - "Speed is Too Fast",
   This message indicates calculated velocity exceeded 3700 RPM.

Code Number: 44 - "Speed Advance Fault",

This message can appear in the present running status if crankshaft velocity is detected as being so fast that the speed advance calculation generates a "degrees before top dead center" (Btdc) greater than 1535 degrees.

Code Number: 45 - This message is not used at this time.

Code Number: 46 - "Program/Run Switch",

This message will appear as the reason for the last stop if it is switched to the PROG position while the press is stroking (the press control will top stop and display this message even if switched back to RUN, or if an intermittent problem exists with the switch). It will appear in the present running status if switched to PROG prior to initiating a stroke. The switch is internal to operator terminal and the OIT Diagnostics screen can be used to view the state.

Code Number: 47 - "Main Motor is Off",

This message appears in the present running status if both Inputs 19 and 20 are low in a production mode. The input diagnostic screen can be used to locate the problem.

Code Number: 48 - "Motor in Reverse",

This message appears in the present running status if Input 19 is low and Input 20 is high in a production mode. The input diagnostic screen can be used to locate the problem.

Code Number: 49 - "No "Auto Single Stroke Run" in Time",

This message appears as a reason for the last stop if Automatic Single Stroke mode times out while paused and waiting for Input 28 [Auto. Single Stroke Run] to go high. The time duration is set in the Press Control screen. This condition will prevent any further automatic strokes from being made until the mode is manually setup and initiated.

Code Number: 50 - "Waiting For "Auto Single Stroke Run"",

This message appears in the present running status while the press control is paused and waiting for Input 28 [Auto. Single Stroke Run] to go high.

Code Number: 51 - "Stop at Setup Position",

This message appears as the reason for the last stop when the press stops at the "Setup Mode Stop Angle" located in the Machine Parameters configuration screen. It occurs only if stroking in Setup/Stop Time Test mode.

Code Number: 52 - "Timed Inch Turn Off",

This message appears as the reason for the last stop when the press stops at the "Begin Timed Inch" parameter located in the Machine Parameters configuration screen. It occurs only if stroking in Timed Inch mode.

Code Number: 53 - "Foot Switch Selected",

This message appears in the present running status if station 2 is configured as a foot switch by the "Foot Switch Installed" parameter in the Machine Parameters configuration screen and station 2 is turned On (in Continuous, Continuous On Demand, or Auto Single Stroke mode). If "Separate Inch Buttons" is set to "No", this message will also appear in Inch, Timed Inch, or Setup/Stop Time Test mode if station 2 is turned On.

Code Number: 54 - "Foot & Station 1 Selected",
This message appears in the present running status if station 2 is configured as a foot switch by the "Foot Switch Installed" parameter in the Machine Parameters configuration screen and station 2 is turned On (in Single Stroke or Maintained Continuous mode) along with station 1. The foot switch cannot be used in combination with any other run station.

Code Number: 55 - "Foot & Station 3 Selected",
This message appears in the present running status if station 2 is configured as a foot switch by the "Foot Switch Installed" parameter in the Machine Parameters configuration screen and station 2 is turned On (in Single Stroke or Maintained Continuous mode) along with station 3. The foot switch cannot be used in combination with any other run station.

Code Number: 56 - "Foot & Station 4 Selected",
This message appears in the present running status if station 2 is configured as a foot switch by the "Foot Switch Installed" parameter in the Machine Parameters configuration screen and station 2 is turned On (in Single Stroke or Maintained Continuous mode) along with station 4. The foot switch cannot be used in combination with any other run station.

Code Number: 57 - "Foot & Station 5 Selected",
This message appears in the present running status if station 2 is configured as a foot switch by the "Foot Switch Installed" parameter in the Machine Parameters configuration screen and station 2 is turned On in Single Stroke or Maintained Continuous mode along with station 5. The foot switch cannot be used in combination with any other run station.

Code Number: 58 - "C/B 1 Fault (V3 to V5)",
This message indicates that a wiring short was detected between clutch/brake output 1 terminals V3 and V5. This test takes place during the turn on sequence of the clutch/brake output 1, and will result in the output being turned Off and a **Reset** required in order to attempt another engagement.

Code Number: 59 - "C/B 1 Normally Closed Fault",
This message means that clutch/brake 1 output was turned On but the feedback indicates that the normally closed path remained closed. This fault could be caused by failure of the relay drive circuit on the channel that detects the condition and would be indicated by the clutch/brake led not turning on. It could also be caused by a hardware failure of the feedback circuit. The failure would most likely be on the 5100-3 Logic Module but could also be on the 5100-3A Relay Board. The Output diagnostic screen may provide additional information.

Code Number: 60 - "LMC Norm. Closed Fault",
This message means that the LMC output was turned Off but the feedback indicates that the normally closed path on the channel that detects the failure is not closed, even though the relay on the other channel is working correctly. The Output Diagnostic screen can be used to view the intended state of the output and the feedback signals from both channels, and should provide additional information. This fault could be caused by a hardware failure of the feedback circuit. The failure is either on the 5100-3 Logic Module or on the 5100-3A Relay Board. The Output diagnostic screen may provide additional information.

Code Number: 61 - "LMC Relay Fault",

This message means that LMC output was turned On but the feedback indicates that the normally closed path remained closed. This fault could be caused by failure of the relay drive circuit on the channel that detects the condition and would be indicated by the LMC led not turning on. The Output diagnostic screen may provide additional information. It could also be caused by a hardware failure of the feedback circuit. The failure would most likely be on the 5100-3 Logic Module but could also be on the 5100-3A Relay Board.

Code Number: 62 - "C/B 1 Power Lost",

This message means that clutch/brake 1 output was turned On but the feedback indicates that the normally open path did not go high or went low while stroking. This would occur if there is no incoming voltage from V1 to V2 (this could either be 24 VDC or 120 VAC), or power is dropping out while stroking. It would also occur if the fuse on the 5100-3A Relay Board was blown (see Figure 112 on page 171). The Output diagnostic screen should provide additional information. Otherwise, the failure is either on the 5100-3 Logic Module or the 5100-3A Relay Board.

Code Number: 63 - "Release Setup Button"

When any stroking mode that requires prior action by way of pressing a setup button is selected or the press stroking cycle is stopped, the press control checks to determine if the setup button is off (Input 14 is low). The input diagnostic screen should be used to determine if this fault is due to an external condition (i.e. a bad setup button, or the button has been jumpered out). If the two channels show a difference of the state of Input 14 the 5100-4A Input Board should be replaced.

Code Number: 64 - "Setup is Required",

This message appears in the present running status in any mode that requires prior action to initiate a stroke (e.g. Continuous, Continuous On Demand, Maintained Continuous, or Automatic Single Stroke). A fixed time of 5 seconds is allowed after the setup button is pressed to initiate the stroke by pressing the selected operator station run buttons.

Code Number: 65 - "Setup Button Time Out",

A fixed time of 5 seconds is allowed after pressing the prior action setup button to initiate the stroke in Continuous, Continuous On Demand, Maintained Continuous, or Automatic Single Stroke mode. This message appears in the reason for the last stop, after this time expires and the setup button must be released and pressed again in order to initiate the stroke.

Code Number: 66 - "Motor Forward/Reverse Fault",

This message indicates that both Input 19 [N/O Mot. Forward Aux. Contact] and Input 20 [N/O Mot. Reverse Aux. Contact] went high at the same time. The input diagnostic screen should be used to determine if this fault is due to an external condition. This fault will turn Off the LMC and require the **Reset** softkey to be pressed.

Code Number: 67 - "Must Start At Top",

Any stroking mode (e.g. Automatic Single Stroke) that requires the press to stop at the top of the stroke before it can be restarted will display this message if the press does not stop above the "Start Top Angle" parameter located in the Machine Parameters configuration screen. The press should be Inched back to the top of the stroke.

Code Number: 68 - "Auto Single Stroke Time Out",
This message is not used at this time.

Code Number: 69 - "Valve Monitor 2",
This message indicates that valve monitor Input 25 is generating a stop condition. The Input Diagnostic screen can be used to view the inputs to determine if this is an external fault with the air valve or wiring. See Section 4.2.4 for more information on the specific type of valve monitor and the error messages that can occur.

Code Number: 70 - "Valve Monitor 1",
This message indicates that valve monitor Input 24 is generating a stop condition. The Input Diagnostic screen can be used to view the inputs to determine if this is an external fault with the air valve or wiring. See Section 4.2.4 for more information on the specific type of valve monitor and the error messages that can occur.

Code Number: 71 - "Valve Mon. 1 Pull In Fault",
This message indicates that valve monitor Input 24 either did not go High at stroke initiation or failed to remain High will the press was stroking. The Input Diagnostic screen can be used to view the inputs to determine if this is an external fault with the air valve or wiring. If this occurs when the stroke is initiated, the "Valve Mon. Turn On Time" parameter may be set too Low. See Section 4.2.4 for more information on the specific type of valve monitor and the error messages that can occur.

Code Number: 72 - "Valve Mon. 2 Pull In Fault",
This message indicates that valve monitor Input 25 either did not go High at stroke initiation or failed to remain High will the press was stroking. The Input Diagnostic screen can be used to view the inputs to determine if this is an external fault with the air valve or wiring. If this occurs when the stroke is initiated, the "Valve Mon. Turn On Time" parameter may be set too Low. See the Section 4.2.4 for more information on the specific type of valve monitor and the error messages that can occur.

Code Number: 73 - "Valve Mon. 1 Drop Out Fault",
This message indicates that valve monitor Input 24 either did not go Low when the valve was disengaged or failed to remain Low while the press was idle. The Input Diagnostic screen can be used to view the inputs to determine if this is an external fault with the air valve or wiring. If this occurs when the press stops, the "Valve Mon. Turn Off Time" parameter may be set too Low. See Section 4.2.4 for more information on the specific type of valve monitor and the error messages that can occur.

Code Number: 74 - "Valve Mon. 2 Drop Out Fault",
This message indicates that valve monitor Input 25 either did not go Low when the valve was disengaged or failed to remain Low while the press was idle. The Input Diagnostic screen can be used to view the inputs to determine if this is an external fault with the air valve or wiring. If this occurs when the press stops, the "Valve Mon. Turn Off Time" parameter may be set too Low. See Section 4.2.4 for more information on the specific type of valve monitor and the error messages that can occur.

Code Number: 75 - "Mode Selected Error",

This message indicates a disagreement between the two channels of the press control regarding the present stroking mode and should not occur under normal conditions. The desired mode should be selected and if this does not clear the error message, use the Input Diagnostics screen to view the state of Input 22 (High if Mode Selector in RUN) and Input 23 (High if Mode Selector in SELECT). If the two press control channels do not agree, replace the 5100-4A Input Module. If this fault occurs only at power up, replace the 5100-1A Memory Module.

Code Number: 76 - "No Lube Flow",

This message indicates a problem exists with the main lube system (not an auxiliary lube). The fault depends on whether this is a recirculating lube system or a pulsed grease lube. See Sections 0 and 3.5.5.6 for lube system configuration and diagnostic information to determine any problem with the lube.

Code Number: 77 - "Unused Input Active (Board 1)",

This message means that an input on Input Board 1 has been programmed as "Not Used", but is detected as High. Unused inputs MUST be left disconnected. The condition must be corrected and the **Reset** softkey pressed to clear this fault. The Input Types Configuration screen can be used to view and set the stop condition to the desired type.

This fault can apply to Inputs 48, 49, 52, and 55. It can also apply to Inputs 45, 46, and 47 (unless a lube is configured), and to Inputs 53 and 54 (unless a hydraulic overload is configured). This fault condition can also be caused by configuring the E-Stops on station #2 (Inputs 31/32) as "Not Used" (which also sets station #2 Top Stop Input 33 as "Not Used"). This fault condition can also be caused by configuring the E-Stops OIT ES (Inputs 9/10) as "Not Used" (which also sets OIT ES Top Stop Input 11 as "Not Used"). This fault condition can also be caused by configuring the protective stops Protective Stop 2 (Inputs 37/38) or Protective Stop 3 (Inputs 39/40) as "Not Used".

The Input Diagnostic screen can be used to view the state of the inputs. Any "Input Not Used" inputs that are not Low will be shown in red. If you cannot reset this error but all "Input Not Used" inputs from 1 to 56 do show Low, there may be a transient condition that is too fast to be seen on the screen and the 5100-4A input module should be replaced. If any inputs from 1 to 56 show High on only one channel of the press control, replace the 5100-4A input module.

Code Number: 78 - "Unused Input Active (Board 2)",

This message means that an input on Input Board 2 has been programmed as "Input Not Used", but is detected as High. Unused inputs MUST be left disconnected. The condition must be corrected and the **Reset** softkey pressed to clear this fault. The Input Types Configuration screen can be used to set the stop condition to the desired type.

This fault can apply to Inputs 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, and 110. It can also apply to Input 111 (unless auxiliary lube 1 uses it) and Input 112 (unless auxiliary lube 2 uses it). If all inputs configured as "Not Used" appear Low or show High on only one channel of the press control, replace the 5100-4B input module. This fault condition can also be caused by configuring the E-Stops on station #3 (Inputs 59/60) as "Input Not Used" (which also sets station #3 Top Stop Input 61 as "Input Not Used"). It can also be caused by configuring the E-Stops station #4 (Inputs 87/88) as "Input Not Used" (which also sets station #4 Top Stop Input 89 as "Input Not Used"). It can also be caused by configuring the E-Stops station #5 (Inputs

65/66) as "Input Not Used" (which also sets station #5 Top Stop Input 67 as "Input Not Used"). This fault condition can also be caused by configuring the protective stops Protective Stop 4 (Inputs 69/70, Protective Stop #5 (Inputs 71/72) as "Input Not Used", Protective Stop #6 (Inputs 91/92) as "Input Not Used", Protective Stop #7 (Inputs 93/94) as "Input Not Used", or Protective Stop #8 (Inputs 95/96) as "Input Not Used".

The Input Diagnostic screen can be used to view the state of the inputs. Any "Input Not Used" inputs that are not Low will be shown in red. If you cannot reset this error but all "Input Not Used" inputs from 57 to 112 do show Low, there may be a transient condition that is too fast to be seen on the screen and the 5100-4B input module should be replaced. If any inputs from 57 to 112 show High on only one channel of the press control, replace the 5100-4B input module.

Code Number: 79 - "Light Curtain 1",
This message means that light curtain 1 (Inputs 15 and 16) is blocked. The Input Diagnostic screen can be used to determine if this is a problem with the light curtain or the field wiring.

Code Number: 80 - "Light Curtain 2",
This message means that light curtain 2 (Inputs 35 and 36) is blocked. The Input Diagnostic screen can be used to determine if this is a problem with the light curtain or the field wiring.

Code Number: 81 - "Verify Operator Stations",
This message means that an operator station select input is detected as being turned Off (goes to 0 VDC for more than 100 milliseconds). Operator stations can be turned On at any time but if turned Off it must be verified that this is the intentional state by using the Operator Station screen's Verify softkey. This screen displays each station select state as On or Off and will display Off* if that station requires verification. If there is a disagreement between the two channels of the press control, the status of each channel will be shown. External intermittent conditions such as a bad connection with a station select wire where the connection opens up (turns On) and then closes (turns Off) would be displayed as the station is now Off but requires a verify. This screen along with the Input Diagnostic screen can be used to determine if a problem exists on the 5100-4A/B Input Module. This fault is non-volatile and cannot be reset by cycling the power.

Code Number: 82 - "I3/4-Emergency Stop 1 XCheck Fault",
This message means that Inputs 3 and 4 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the 5100-4A Input Module should be replaced.

Code Number: 83 - "I31/32-Emergency Stop 2 XCheck Fault",
This message means that Inputs 31 and 32 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the 5100-4A Input Module should be replaced.

Code Number: 84 - "I59/60-Emergency Stop 3 XCheck Fault",
This message means that Inputs 59 and 60 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the 5100-4B Input Module should be replaced.

Code Number: 85 - "I87/88-Emergency Stop 4 XCheck Fault",
    This message means that Inputs 87 and 88 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the 5100-4B Input Module should be replaced.

Code Number: 86 - "I65/66-Emergency Stop 5 XCheck Fault",
    This message means that Inputs 65 and 66 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the 5100-4B Input Module should be replaced.

Code Number: 87 -   "Emergency Stop 0 XCheck Fault" or
                      "I9/10-OIT E-Stop XCheck Fault",
    This message means that Inputs 9 and 10 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the 5100-4A Input Module should be replaced.

Code Number: 88 - "I15/16-Light Curtain 1 XCheck Fault",
This message means that Inputs 15 and 16 do not agree between the two channels. It does not mean that the two inputs don't track each other (see Light Curtain 1 Track Fault). The input diagnostic screen can be used to determine which channel the problem is on. Input board 5100-4A should be replaced.

Code Number: 89 - "I17/18-Safety Block XCheck Fault",
    This message means that Inputs 17 and 18 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the input board 5100-4A should be replaced.

Code Number: 90 - "I35/36-Light Curtain 2 XCheck Fault",
This message means that Inputs 35 and 36 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the input board 5100-4A should be replaced.

Code Number: 91 - "I37/38-Protective Stop 2 XCheck Fault",
    This message means that Inputs 37 and 38 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the input board 5100-4A should be replaced.

Code Number: 92 - "I39/40-Protective Stop 3 XCheck Fault",
    This message means that Inputs 39 and 40 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the input board 5100-4A should be replaced.

Code Number: 93 - "I69/70-Protective Stop 4 XCheck Fault",
    This message means that Inputs 69 and 70 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the input board 5100-4B should be replaced.

Code Number: 94 - "I71/72-Protective Stop 5 XCheck Fault",
　　This message means that Inputs 71 and 72 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the input board 5100-4B should be replaced.

Code Number: 95 - "I91/92-Protective Stop 6 XCheck Fault",
　　This message means that Inputs 91 and 92 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the input board 5100-4B should be replaced.

Code Number: 96 - "I93/94-Protective Stop 7 XCheck Fault",
　　This message means that Inputs 93 and 94 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the input board 5100-4B should be replaced.

Code Number: 97 - "I95/96-Protective Stop 8 XCheck Fault",
　　This message means that Inputs 95 and 96 do not agree between the two channels. The input diagnostic screen can be used to determine which channel the problem is on. If both sets input contacts appear to be operating correctly, the input board 5100-4B should be replaced.

Code Number: 98 - "Brake Monitor Alarm",
　　This message appears in the present running status after the press stops if the measured stopping time of the press exceeds the programmed limit. The Press Control screen will display the programmed "Top Stop Time" (limit used when a stop on top occurs) and the "Mid Stop Time" (limit used at any other stop). It will also display the actual stopping time measured beside the limit that applied to the last stop. Among other reasons, this fault can be caused by a problem with the clutch/brake or incorrectly adjusted counterbalance pressure. The **Reset** softkey must be pressed to clear this fault and allow further stroking. The ability to reset this error may be under access code restriction. When this occurs the Brake Monitor Alarm Count, which is displayed in the Diagnose screen will be incremented.

Code Number: 99 - "C/B 1 Fault (V4 to V6)",
　　This message indicates that a wiring short was detected between clutch/brake output 1 terminals V4 and V6. This test takes place during the turn on sequence of the clutch/brake output 1, and will result in the output being turned Off and a **Reset** required in order to attempt another engagement.

Code Number: 100 - "Mode Selector",
　　This message means that Mode Selector switch is in the mode select position (Input 22 Low, Input 23 High).

Code Number: 101 - "Mode Select is OFF",
　　This message means that Mode Selector switch is in the Off select position (Input 22 Low, Input 23 Low).

Code Number: 102 - "Waiting for Run Signal",
　　This message appears in the present running status while the press control is paused and waiting for Input 50 [Cont. On Demand Run/Permissive] to go high. This will always be true in the Continuous On Demand stroking mode and can also occur in other stroking modes if "Transfer Type" parameter (in Machine Parameters) is configured for either "Permissive" or "Permissive, Extra Stroke".

Code Number: 103 - "No Run Signal in Time",

This message appears as a reason for the last stop if Continuous On Demand Stroke mode times out while paused and waiting for Input 50 [Cont. On Demand Run/Permissive] to go high. The time duration is set in the Press Control screen. This condition will prevent any further automatic strokes from being made until the mode is manually setup and initiated.

Code Number: 104 - "LMC Feedback Fault",

This message appears in the present running status if the LMC output is Off, but no current is detected in the normally closed relay path. Measure the ac voltage between LMC 1 and LMC 2 on the Logic Module, and if it reads correct (120 VAC) the fault is either on the 5100-3A Relay Module or the 5100-3 Logic Module. The LMC output allows for conditions where more current capacity must be switched than allowed by the internal relays. This is done by driving an external machine tool relay to provide power to the press and placing that relay's normally closed contact in press control's feedback path (external contact switches LMC 2 to Neutral). Contact Factory for applications information.

Code Number: 105 - "Run Only In Inch Mode",

This message appears in the present running status after a hydraulic overload occurs to indicate that Inch mode must be used to run the press to the top of the stroke in order to reset the overload system.

Code Number: 106 - "Motor Direction",

This message can appear in the present running status after a hydraulic overload has occurred to indicate that motor direction must be reversed in order to Inch the press to the top of the stroke. For more information on hydraulic overload configuration see Section 0.

Code Number: 107 - "Board 1 Config Fault",

Input board 5100-4A should be replaced.

Code Number: 108 - "No Lube Flow 2",

This message indicates a problem exists with the main lube flow sensor wired into Input 46. This lube sensor must continuously cycle within programmed limits and the message would be displayed if the lube pump were turned Off. See Sections 0 and 3.5.5.6 for lube system configuration and diagnostic information to determine any problem with the lube.

Code Number: 109 - "Ch B Pulse Check Fault",

Logic Module 5100-3 should be replaced.

Code Number: 110 - " Board 1 Pulse Check Fault ",

If the "Do Pulse Check" parameter in the protective inputs configuration screen is set to "Yes", the press control will apply pulses to the P1/P2 24 VDC outputs in order to detect wiring shorts. This message indicates that these output signals have become shorted to each other, or to a +24 VDC power supply, or that a short exists on one or more of the protective inputs wired to Input Module 1. These signals drive Input Pairs 3/4, 9/10, 15/16, 17/18, 31/32, 35/36, 37/38, 39/40. The terminals (1P1, 2P1, 3P1, 4P1, 5P1, 6P1, 7P1, 8P1) are all attached to the same power supply (P1) on the input board. The terminals (1P2, 2P2, 3P2, 4P2, 5P2, 6P2, 7P2, 8P2) are all attached to the same power supply (P2) on the input board. To diagnose where the fault is located, open all dual contact switches wired to the inputs above. If pressing the **Reset** key clears the fault, close each switch one at a time and observe which switch causes the fault. If the fault occurs when a specific switch is closed, then the short (P1-P2)

is located between that switch and the inputs. If the fault occurs when any of the switches are closed, then the short (P1-P2) is located on the power supply side of the connections. In this case, turn the power off and measure the resistance from any P1 to any P2 terminal. If a short is detected, remove the wires from the P1 terminals one at a time to determine which field connection is at fault. If no short is measured from P1-P2, then check for a short from all +24 VDC power supplies PS0, PS1, PS2, PSA, PSB, PSC (or any supply on the 2nd Input Module if installed) to any P1 terminal or to any P2 terminal. If pressing the **Reset** key does not clear the fault when all input connections have been opened, use the "Input Diagnostics" screen to examine the inputs described above. If an input is shown high with no +24 VDC applied, replace Input Module 1. After the cause of the fault is found and corrected, the **Reset** key must be pressed. The pulse check test is performed by applying a 1 millisecond pulse to the P1 output and then to the P2 output 0.25 seconds later, every 0.5 seconds. A pulse check fault requires 1.5 seconds to detect and debounce a fault, after the **Reset** key is pressed.

Code Number: 111 - "Board 2 Pulse Check Fault",

If the "Do Pulse Check" parameter in the protective inputs configuration screen is set to "Yes", the press control will apply pulses to the P3/P4 24 VDC outputs in order to detect wiring shorts. This message indicates that these output signals have become attached to each other or that a short exists on one or more of the protective inputs wired to Input Module 2. These signals drive Input Pairs 59/60, 65/66, 69/70, 71/72, 87/88, 91/92, 93/94, 95/96. The terminals (1P3, 2P3, 3P3, 4P3, 5P3, 6P3, 7P3, 8P3) are all attached to the same power supply (P3) on the input board. The terminals (1P4, 2P4, 3P4, 4P4, 5P4, 6P4, 7P4, 8P4) are all attached to the same power supply (P4) on the input board. To diagnose where the fault is located, open all dual contact switches wired to the inputs above. If pressing the **Reset** key clears the fault, close each switch one at a time and observe which switch causes the fault. If the fault occurs when a specific switch is closed, then the short (P3-P4) is located between that switch and the inputs. If the fault occurs when any of the switches are closed, then the short (P3-P4) is located on the power supply side of the connections. In this case, turn the power off and measure the resistance from any P3 to any P4 terminal. If a short is detected, remove the wires from the P3 terminals one at a time to determine which field connection is at fault. If no short is measured from P3-P4, then check for a short from all +24 VDC power supplies PS3, PS4, PS5, PSD, PSE, PSF (or any supply on the 1st Input Module) to any P3 terminal or to any P4 terminal. If pressing the **Reset** key does not clear the fault when all input connections have been opened, use the "Input Diagnostics" screen to examine the inputs described above. If an input is shown high with no +24 VDC applied, replace Input Module 2. After the cause of the fault is found and corrected, the **Reset** key must be pressed. A pulse check fault requires 1.5 seconds to detect and debounce a fault, after the **Reset** key is pressed.

Code Number: 112 - "Automatic Turn Off",

This message appears in the reason for the last stop if the "Auto Turn Off Time" (located in the Machine Parameters configuration screen is programmed to something other than 0 min and the press has remained idle with the main motor running for longer than that amount of time. It could appear in the present running status if the press is wired such that turning the LMC output Off does not cause the main motor to stop (if this wiring is intentional the parameter must be programmed to 0).

Code Number: 113 - "No Channel A in Time",

This message could appear in the reason for the last stop if devices connected to channel A of the press control (e.g. 5100 die protection) are preventing automatic stroke initiation in Automatic Single Stroke mode.

Code Number: 114 - "Module in Boot Mode",
    This message means that a channel of the press control has detected a corrupt program at power up, or was instructed by the operator terminal to enter boot in order to do a program update. It this occurs at power up, replace the 5100-3 Logic Module.

Code Number: 115 - "Motor is Not Stopped",
    This message appears in the present running status when Bar mode is selected if the zero speed switch indicates that the motor has not come to a complete stop. The zero speed Input 26 should be High and Input 27 should be Low. This check occurs only when the mode is first selected. After that the zero speed switch may or may not remain in the zero state.

Code Number: 116 - "Aux 1 Feedback A N.C. Fault",
    This message means that the optional safety relay interface connected to auxiliary output 1 does not indicate an Off condition when the output is turned Off. This condition must be corrected before the **Reset** softkey will clear this fault. If the fault is not in the external force guided relays then it is a hardware problem on either the 5100-3 Logic Module or the 5100-3C Safety Interface Board. Measure the voltage from terminal FB1 to CSR on the faceplate of the Logic Module. If it reads about 22 to 24 VDC then the normally closed path is working correctly and the problem is internal, otherwise the problem is in the external force guided relays. The Output Diagnostic screen can also be used to locate the problem. When working correctly, if the safety relay output shows Off, both N.C. feedbacks should show On. If the feedbacks are different between the channels, the problem is internal.

Code Number: 117 - "Aux 1 Feedback B N.C. Fault",
    This message means that the optional safety relay interface connected to auxiliary output 1 does not indicate an Off condition when the output is turned Off. This condition must be corrected before the **Reset** softkey will clear this fault. If the fault is not in the external force guided relays then it is a hardware problem on either the 5100-3 Logic Module or the 5100-3C Safety Interface Board. Measure the voltage from terminal FB1 to CSR on the faceplate of the Logic Module. If it reads about 22 to 24 VDC then the normally closed path is working correctly and the problem is internal, otherwise the problem is in the external force guided relays. The Output Diagnostic screen can also be used to locate the problem. When working correctly, when the safety relay output shows Off both N.C. feedbacks should show On. If the feedbacks are different between the channels, the problem is internal.

Code Number: 118 - "C/B 2 Fault (V7 to V9)",
    This message indicates that a wiring short was detected between clutch/brake output 2 terminals V7 and V9. This test takes place during the turn on sequence of the clutch/brake output 2, and will result in the output being turned Off and a **Reset** required in order to attempt another engagement.

Code Number: 119 - "C/B 2 Normally Closed Fault",
    This message means that clutch/brake 2 output was turned On but the feedback indicates that the normally closed past remained closed. This fault could be caused by failure of the relay drive circuit on the channel that detects the condition and would be indicated by the clutch/brake led not turning on. It could also be caused by a hardware failure of the feedback circuit. The failure would most likely be on the 5100-3 Logic Module but could also be on the 5100-3A Relay Module. The Output diagnostic screen may provide additional information.

Code Number: 120 - "C/B 2 Fault (V8 to V10)",
This message indicates that a wiring short was detected between clutch/brake output 2 terminals V8 and V10. This test takes place during the turn on sequence of the clutch/brake output 2, and will result in the output being turned Off and a **Reset** required in order to attempt another engagement.

Code Number: 121 - "Motor is Not Off",
This message appears in the present running status in Bar mode if Input 19 [N/O Mot. Forward Aux. Contact] and Input 20 [N/O Mot. Reverse Aux. Contact] are not both low. When this mode is selected the motor must be turned Off and it must remain Off in order to engage the clutch and bar the press.

Code Number: 122 - "Aux 2 Feedback A N.C. Fault",
This message means that the optional safety relay interface connected to auxiliary output 2 does not indicate an Off condition when the output is turned Off. This condition must be corrected before the **Reset** softkey will clear this fault. If the fault is not in the external force guided relays then it is a hardware problem on either the 5100-3 Logic Module or the 5100-3C Safety Interface Board. Measure the voltage from terminal FB2 to CSR on the faceplate of the Logic Module. If it reads about 22 to 24 VDC then the normally closed path is working correctly and the problem is internal, otherwise the problem is in the external force guided relays. The Output Diagnostic screen can also be used to locate the problem. When working correctly, when the safety relay output shows Off both N.C. feedbacks should show On. If the feedbacks are different between the channels, the problem is internal.

Code Number: 123 - "Aux 2 Feedback B N.C. Fault",
This message means that the optional safety relay interface connected to auxiliary output 2 does not indicate an Off condition when the output is turned Off. This condition must be corrected before the **Reset** softkey will clear this fault. If the fault is not in the external force guided relays then it is a hardware problem on either the 5100-3 Logic Module or the 5100-3C Safety Interface Board. Measure the voltage from terminal FB2 to CSR on the faceplate of the Logic Module. If it reads about 22 to 24 VDC then the normally closed path is working correctly and the problem is internal, otherwise the problem is in the external force guided relays. The Output Diagnostic screen can also be used to locate the problem. When working correctly, when the safety relay output shows Off both N.C. feedbacks should show On. If the feedbacks are different between the channels, the problem is internal.

Code Number: 124 - "Aux 3 Feedback A N.C. Fault",
This message means that the optional safety relay interface connected to auxiliary output 3 does not indicate an Off condition when the output is turned Off. This condition must be corrected before the **Reset** softkey will clear this fault. If the fault is not in the external force guided relays then it is a hardware problem on either the 5100-3 Logic Module or the 5100-3C Safety Interface Board. Measure the voltage from terminal FB3 to CSR on the faceplate of the Logic Module. If it reads about 22 to 24 VDC then the normally closed path is working correctly and the problem is internal, otherwise the problem is in the external force guided relays. The Output Diagnostic screen can also be used to locate the problem. When working correctly, when the safety relay output shows Off both N.C. feedbacks should show On. If the feedbacks are different between the channels, the problem is internal.

Code Number: 125 - "Aux 3 Feedback B N.C. Fault",
This message means that the optional safety relay interface connected to auxiliary output 3 does not indicate an Off condition when the output is turned Off. This condition must be corrected before the **Reset** softkey will clear this fault. If the fault is not in the external force guided relays then it is a hardware problem on either the 5100-3 Logic Module or the 5100-3C Safety Interface Board. Measure

the voltage from terminal FB3 to CSR on the faceplate of the Logic Module. If it reads about 22 to 24 VDC then the normally closed path is working correctly and the problem is internal, otherwise the problem is in the external force guided relays. The Output Diagnostic screen can also be used to locate the problem. When working correctly, when the safety relay output shows Off both N.C. feedbacks should show On. If the feedbacks are different between the channels, the problem is internal.

Code Number: 126 - "Aux 4 Feedback A N.C. Fault",
    This message means that the optional safety relay interface connected to auxiliary output 4 does not indicate an Off condition when the output is turned Off. This condition must be corrected before the **Reset** softkey will clear this fault. If the fault is not in the external force guided relays then it is a hardware problem on either the 5100-3 Logic Module or the 5100-3C Safety Interface Board. Measure the voltage from terminal FB4 to CSR on the faceplate of the Logic Module. If it reads about 22 to 24 VDC then the normally closed path is working correctly and the problem is internal, otherwise the problem is in the external force guided relays. The Output Diagnostic screen can also be used to locate the problem. When working correctly, when the safety relay output shows Off both N.C. feedbacks should show On. If the feedbacks are different between the channels, the problem is internal.

Code Number: 127 - "Aux 4 Feedback B N.C. Fault",
    This message means that the optional safety relay interface connected to auxiliary output 4 does not indicate an Off condition when the output is turned Off. This condition must be corrected before the **Reset** softkey will clear this fault. If the fault is not in the external force guided relays then it is a hardware problem on either the 5100-3 Logic Module or the 5100-3C Safety Interface Board. Measure the voltage from terminal FB4 to CSR on the faceplate of the Logic Module. If it reads about 22 to 24 VDC then the normally closed path is working correctly and the problem is internal, otherwise the problem is in the external force guided relays. The Output Diagnostic screen can also be used to locate the problem. When working correctly, when the safety relay output shows Off both N.C. feedbacks should show On. If the feedbacks are different between the channels, the problem is internal.

Code Number: 128 - "Max. Auto Single Stroke Limit Exceeded",
    This message appears in the present running status to indicate that the "Maximum Auto Single Stroke Time" parameter exceeds a fixed bounds limit (see Section 4.2.10.9). This limit must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 129 - "Auto Single Stroke Limit Exceeded",
    This message appears in the present running status to indicate that the "Auto Single Stroke Time" parameter located in the Press Control screen exceeds a maximum limit. This limit cannot be less than 1 second or greater than the "Maximum Auto Single Stroke Time". The parameter must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 130 - "Max. Continuous on Demand Limit Exceeded",
    This message appears in the present running status to indicate that the "Maximum Continuous On Demand Time" parameter a fixed bounds limit (see Section 4.2.10.10). The parameter must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 131 - "Continuous on Demand Limit Exceeded",
    This message appears in the present running status to indicate that the "Cont. On Demand Time" parameter located in the Press Control screen exceeds a maximum limit. This limit cannot be less than 1

minute or greater than the "Max. Continuous on Demand Time" and must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 132 - "Top Start Angle Limit Exceeded",
This message appears in the present running status to indicate that the "Top Start Angle" parameter located in the Machine Parameters configuration screen exceeds a fixed bounds limit. This limit cannot be less than 255 degrees or greater than 350 degrees and must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 133 - "Top End Angle Limit Exceeded",
This message appears in the present running status to indicate that the "Top End Angle" parameter located in the Machine Parameters configuration screen exceeds a fixed bounds limit. This limit cannot be less than 1 degrees or greater than 20 degrees and must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 134 - "Top of Stroke Angle Limit Exceeded",
This message appears in the present running status to indicate that the "Top of Stroke Angle" parameter located in the Machine Parameters configuration screen exceeds a fixed bounds limit. This limit cannot be less than 255 degrees or greater than 359 degrees and must be set correctly to clear this fault. This limit affects how the light curtain can be muted and should be set to the top of the slide movement. For example, on a non Link Drive press this limit should be set to 359 degrees. On a Link Drive press this angle would typically be around 330 degrees but that depends on the press. The parameter must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 135 - "Manual Top Stop Calibration Invalid",
This message appears in the present running status to indicate that the "Manual Stroking Mode" Speed Advanced Top Stop parameters located in the Top Stop Calibration configuration screen are corrupt and must be reentered. These parameters must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 136 - "Cont. Top Stop Calibration Invalid",
This message appears in the present running status to indicate that the "Continuous Stroking Mode" Speed Advanced Top Stop parameters located in the Top Stop Calibration configuration screen are corrupt and must be reentered. These parameters must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 137 - "Brake Monitor Top Stop Limit",
This message appears in the present running status to indicate that the "Brake Monitor Top Stop Limit" parameter located in the Brake Monitor configuration screen exceeds a fixed bounds limit (see Section 4.2.3.1). This limit must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 138 - "Brake Monitor Mid Stroke Stop Limit",
This message appears in the present running status to indicate that the "Brake Monitor Mid Stroke Stop Limit" parameter located in the Brake Monitor configuration screen exceeds a fixed bounds limit (see Section 4.2.3.2). This limit must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 139 - "Auto Carry Up Position Invalid",
This message appears in the present running status to indicate that the "Auto Carry Up Position" parameter located in the Machine Parameters configuration screen exceeds a fixed bounds limit. This limit cannot be less than 135 degrees or greater than 180 degrees and must be set correctly and the **Reset** softkey pressed to clear this fault.

Code Number: 140 - "BAR/Inch Fault",
This message appears in the present running status when Inch, Timed Inch, or Setup/Stop Time Test mode is selected if Bar Mode has been enabled and the "Separate Inch Buttons Installed" parameter located in the Machine Parameters configuration screen is set to "Yes". The separate Inch run buttons (Inputs 7 and 8) must be used in Bar Mode only. The press control must be configured to Inch with the operator station run buttons.

Code Number: 141 - "Ch A/Ch B Software Incompatible ",
This message means that a program update is required.

Code Number: 142 - "Valve Monitor 3",
See Section 4.2.4 for more information on the specific type of valve monitor and the error messages that can occur.

Code Number: 143 - "Valve Monitor 4",
See Section 4.2.4 for more information on the specific type of valve monitor and the error messages that can occur.

Code Number: 144 - "Soft Brake OverRun",
See Section 4.2.4 for more information on the specific type of valve monitor and the error messages that can occur.

Code Number: 145 - "Run-Inhibit Timeout",
This message is displayed in the "Reason for the Last Stop" when a Run-Inhibit condition has caused Automatic Single Stroke Mode or Continuous on Demand Mode to time out of its armed condition.

Code Number: 146 - "Boot Info is Corrupt",
Replace the logic module.

Code Number: 147 - "Boot Program is Corrupt",
Replace the logic module.

Code Number: 148 - "Boot Block Mismatch",
Replace the logic module.

Code Number: 149 - "Main Program is Corrupt",
Perform a program update to the logic module Channel A or contact Link Systems.

Code Number: 150 - "Multiple Modes Selected",
This message is displayed in the present running status if more than one Hard Mode select input is high (see Section 4.2.10.12 for details). This will turn the LMC Off until the condition is corrected and the **Reset** softkey is pressed.

Code Number: 151 - "Bad "Mode Select" Type",
This message is displayed in the present running status if a Hard Modes option is configured and the second input board is turned Off. It will also occur if the Hard Modes configuration parameter is greater than 7. This will turn the LMC Off until the condition is corrected and the **Reset** softkey is pressed.

Code Number: 152 - "Motion in Clutch/Brake Test",
This message is displayed in the reason for the last stop if motion is detected while the clutch/brake output is engaged in Clutch/Brake Test Mode.

Code Number: 153 - "Mode is "Off"",
This messaged is displayed in the present running status when a Hard Modes option is configured and Off mode input is high. This is the normal method used by the Cell Controller to select Off.

Code Number: 154 - "Manual Top Stop Table Invalid",
This message is displayed in the present running status if one of the "manual stroking modes" parameters used in the "Table Based" top stop calibration screen is out of bounds. All configuration parameters are checked at power up even if the "Calculation" method is the one selected. The "Table Based" top stop settings configuration screen should be used to correct the invalid parameter.

Code Number: 155 - "Continuous Top Stop Table Invalid",
This message is displayed in the present running status if one of the "continuous stroking modes" parameters used in the "Table Based" top stop calibration screen is out of bounds. All configuration parameters are checked at power up even if the "Calculation" method is the one selected. The "Table Based" top stop settings configuration screen should be used to correct the invalid parameter.

Code Number: 156 - "Input Disagreement - Input Board 1",
This message is displayed in the present running status if a stop input is high on one channel and low on the other. The Input Diagnostics screen can be used to view the inputs. Replace input board 1.

Code Number: 157 - "Input Disagreement - Input Board 2",
This message is displayed in the present running status if a stop input is high on one channel and low on the other. The Input Diagnostics screen can be used to view the inputs. Replace input board 2.

Code Number: 158 - "No Memory Board",
This message is displayed in the present running status after power up and indicates that the channel has read all ones from the 5100-1A Non-volatile memory board, the same as if the board were not installed. This board is mounted on the 5100-1 motherboard. The problem could be the memory board or a fault on the 5100-3 logic board that prevents it from accessing the memory.

Code Number: 159 - "C/B 1 Command Fault",
This message indicates a fault on the 5100-3 Press Control Logic Board.

Code Number: 160 - "C/B 2 Command Fault",
    This message indicates a fault on the 5100-3 Press Control Logic Board.

Code Number: 161 - "Break Light Curtain 1",
    This message appears in the present running status when operating in Trip mode to indicate that the light curtain must be cycled before a stroke can be initiated (see operation of Trip mode).

Code Number: 162 - "Light Curtain 1 Timeout",
    This message appears in the reason for the last stop when operating in Trip mode to indicate that the stroke was not initiated within the time configured (see operation of Trip mode).

Code Number: 163 - "Trip Station Selected",
    This message appears in the present running status when operating in modes other than Trip mode to indicate that the press control is configured for Trip mode and station 2 is selected. When configured for Trip mode, station 2 must be used only in Trip mode and cannot be used in any other mode (see operation of Trip Mode).

Code Number: 164 - "Trip Station Not Selected",
    This message appears in the present running status in Trip mode to indicate that station 2 is not selected or is selected along with another station. Only station 2 can be used to operate Trip mode (see operation of Trip mode).

Code Numbers: 257 to 368 - "Namable or Configurable Inputs"
    These code numbers are used to display the "descriptions" of the inputs used by the press control. Inputs 1 to 56 are located on the 1st Input Module and Inputs 57 to 112 are located on the 2nd Input Module. The specific name of many of these inputs can be programmed in operator terminal to reflect the application. The table below describes the input that the code number is referring to.

Mapping of Status Codes to Input Numbers							
Code	Input	Code	Input	Code	Input	Code	Input
257	8	285	6	313	4	341	2
258	36	286	34	314	32	342	30
259	16	287	14	315	12	343	10
260	44	288	42	316	40	344	38
261	24	289	22	317	20	345	18
262	52	290	50	318	48	346	46
263	56	291	54	319	28	347	26
264	64	292	62	320	60	348	58
265	92	293	90	321	88	349	86
266	72	294	70	322	68	350	66
267	100	295	98	323	96	351	94
268	80	296	78	324	76	352	74
269	108	297	106	325	104	353	102
270	112	298	110	326	84	354	82
271	7	299	5	327	3	355	1
272	35	300	33	328	31	356	29
273	15	301	13	329	11	357	9

**Mapping of Status Codes to Input Numbers**

Code	Input		Code	Input		Code	Input		Code	Input
274	43		302	41		330	39		358	37
275	23		303	21		331	19		359	17
276	51		304	49		332	47		360	45
277	55		305	53		333	27		361	25
278	63		306	61		334	59		362	57
279	91		307	89		335	87		363	85
280	71		308	69		336	67		364	65
281	99		309	97		337	95		365	93
282	79		310	77		338	75		366	73
283	107		311	105		339	103		367	101
284	111		312	109		340	83		368	81

Code Number: 512 - "PLS Board Feedback Error",
This message means that the feedback does not track the intended state of the output (either relay or solid state) of the 5100-2A/B PLS Module labeled PLS 1-4. It requires that a **Reset** softkey be pressed when the problem is corrected. The Output Diagnostic screen can be used to view the output and the feedback. If a 5100-2A relay board is being used the relay must be in the socket (change the relay). Otherwise replace the 5100-2A or 5100-2B board.

Code Number: 513 - "Output Board 1 Feedback Error",
This message means that the feedback does not track the intended state of the output (either relay or solid state) of the 5100-2A/B Output Module labeled OR 1-4. See the message PLS Board Feedback Error code 512 for diagnostics.

Code Number: 514 - "Output Board 2 Feedback Error",
This message means that the feedback does not track the intended state of the output (either relay or solid state) of the 5100-2A/B Output Module labeled OR 5-8. See the message PLS Board Feedback Error code 512 for diagnostics.

Code Number: 515 - "Output Board 3 Feedback Error",
This message means that the feedback does not track the intended state of the output (either relay or solid state) of the 5100-2A/B Output Module labeled OR 9-12. See the message PLS Board Feedback Error code 512 for diagnostics.

Code Number: 516 - "Output Board 4 Feedback Error",
This message means that the feedback does not track the intended state of the output (either relay or solid state) of the 5100-2A/B Output Module labeled OR 13-16. See the message PLS Board Feedback Error code 512 for diagnostics.

Code Number: 517 - "Output Board 5 Feedback Error",
This message means that the feedback does not track the intended state of the output (either relay or solid state) of the 5100-2A/B Output Module labeled OR 17-20. See the message PLS Board Feedback Error code 512 for diagnostics.

Code Number: 518 - "Output Board 6 Feedback Error",
    This message means that the feedback does not track the intended state of the output (either relay or solid state) of the 5100-2A/B Output Module labeled OR 21-24. See the message PLS Board Feedback Error code 512 for diagnostics.

Code Number: 519 - "Output Board 7 Feedback Error",
    This message means that the feedback does not track the intended state of the output (either relay or solid state) of the 5100-2A/B Output Module labeled OR 25-28. See the message PLS Board Feedback Error code 512 for diagnostics.

Code Number: 520 - "Output Board 8 Feedback Error",
    This message means that the feedback does not track the intended state of the output (either relay or solid state) of the 5100-2A/B Output Module labeled OR 29-30 or PLS 5-8. See the message PLS Board Feedback Error code 512 for diagnostics.

Code Number: 521 - "I3/4-Emergency Stop 1 Track Fault",
    This message will appear in the present running status if Inputs 3 and 4 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Emergency Stop 1 (Cycle the Input)" code 559). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). A typical track time for a stop button would be 200 to 240 milliseconds.

Code Number: 522 - "I31/32-Emergency Stop 2 Track Fault",
    This message will appear in the present running status if Inputs 31 and 32 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Emergency Stop 2 (Cycle the Input)" code 560). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). A typical track time for a stop button would be 200 to 240 milliseconds.

Code Number: 523 - "I59/60-Emergency Stop 3 Track Fault",
    This message will appear in the present running status if Inputs 59 and 60 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Emergency Stop 2 (Cycle the Input)" code 561). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). A typical track time for a stop button would be 200 to 240 milliseconds.

Code Number: 524 - "I87/88-Emergency Stop 4 Track Fault",
    This message will appear in the present running status if Inputs 87 and 88 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Emergency Stop 4 (Cycle the Input)" code 562). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). A typical track time for a stop button would be 200 to 240 milliseconds.

Code Number: 525 - "I65/66-Emergency Stop 5 Track Fault",
 This message will appear in the present running status if Inputs 65 and 66 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Emergency Stop 5 (Cycle the Input)" code 563). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). A typical track time for a stop button would be 200 to 240 milliseconds.

Code Number: 526 - "Emergency Stop 0 Track Fault" or
                    "I9/10-OIT E-Stop Track Fault",
 This message will appear in the present running status if Inputs 9 and 10 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "OIT E-Stop (Cycle the Input)" code 564). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). A typical track time for a stop button would be 200 to 240 milliseconds (maximum limit is 500 milliseconds).

Code Number: 527 - "Light Curtain 1 Track Fault",
 This message will appear in the present running status if Inputs 15 and 16 do not track each other within a fixed 50 millisecond time limit. The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Light Curtain 1 (Cycle the Input)" code 565). The Input Diagnostic screen can be used to determine why the two contacts on the light curtain do not switch the same.

Code Number: 528 - "I17/18-Safety Block Track Fault",
 This message will appear in the present running status if Inputs 17 and 18 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Safety Block 0 (Cycle the Input)" code 566). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). A typical track time for a safety block plug would be 1sec (the maximum limit is 2000 milliseconds).

Code Number: 529 - "Light Curtain 2 Track Fault",
 This message will appear in the present running status if Inputs 35 and 36 do not track each other within a fixed 50 millisecond time limit. The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Light Curtain 2 (Cycle the Input)" code 567). The Input Diagnostic screen can be used to determine why the two contacts on the light curtain do not switch the same.

Code Number: 530 - "I37/38-Protective Stop 2 Track Fault",
 This message will appear in the present running status if Inputs 37 and 38 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Protective Stop 2 (Cycle the Input)" code 568). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the

switch is sticking). The necessary track time depends on the type of switch wired into the inputs (the maximum limit is 1000 milliseconds).

Code Number: 531 - "I39/40-Protective Stop 3 Track Fault",
 This message will appear in the present running status if Inputs 39 and 40 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Protective Stop 3 (Cycle the Input)" code 569). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). The necessary track time depends on the type of switch wired into the inputs (the maximum limit is 1000 milliseconds).

Code Number: 532 - "I69/70-Protective Stop 4 Track Fault",
 This message will appear in the present running status if Inputs 69 and 70 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Protective Stop 4 (Cycle the Input)" code 570). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). The necessary track time depends on the type of switch wired into the inputs (the maximum limit is 1000 milliseconds).

Code Number: 533 - "I71/72-Protective Stop 5 Track Fault",
 This message will appear in the present running status if Inputs 71 and 72 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Protective Stop 5 (Cycle the Input)" code 571). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). The necessary track time depends on the type of switch wired into the inputs (the maximum limit is 1000 milliseconds).

Code Number: 534 - "I91/92-Protective Stop 6 Track Fault",
 This message will appear in the present running status if Inputs 91 and 92 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Protective Stop 6 (Cycle the Input)" code 572). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). The necessary track time depends on the type of switch wired into the inputs (the maximum limit is 1000 milliseconds).

Code Number: 535 - "I93/94-Protective Stop 7 Track Fault",
 This message will appear in the present running status if Inputs 93 and 94 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Protective Stop 7 (Cycle the Input)" code 573). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). The necessary track time depends on the type of switch wired into the inputs (the maximum limit is 1000 milliseconds).

Code Number: 536 - "I95/96-Protective Stop 8 Track Fault",
    This message will appear in the present running status if Inputs 95 and 96 do not track each other within a programmable "Input Track Time" (programmed in the "Protective Inputs" configuration screen). The **Reset** softkey must be pressed to clear this fault after the inputs return to the same High/Low state (see "Protective Stop 8 (Cycle the Input)" code 574). The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same (e.g. One contact on the switch is sticking). The necessary track time depends on the type of switch wired into the inputs (the maximum limit is 1000 milliseconds).

Code Number: 537 - "Hydraulic Overload Pump Delay",
    This message appears in the present running status during the process of resetting a hydraulic overload (if the configuration is set to a type that uses both a cylinder output and a pump output). There is a 10 second interval after the cylinder output turns On and the limit switch makes until the pump output is turned On to allow the overload mechanism to fully seal (see Section 0 for information on hydraulic overload configuration).

Code Number: 538 - "No Output Board Reply",
    This message indicates loss of serial communication to one of the 5100-2A/B Output Relay Modules (OR1 to OR32). See the message "No PLS Board Reply" (Code 539) for diagnostics.

Code Number: 539 - "No PLS Board Reply",
    This message indicates loss of serial communication to the 5100-2A/B PLS Module labeled PLS 1-4 (see Section 3.5.5.2). Check the +5V LED located on the Module. If it is off, check the +24 VDC (+RY to CRY) input to the Module. If there is +24 VDC check the 0.4 amp pico fuse. Turn power off and measure the resistance from ARY to BRY on the module. If the resistance appears approximately correct, change the 5100-2A/B Module. The correct resistance depends on the number of 5100-2A/B Modules connected as described in the table at right. The Output Comm. Stat. Diagnostic

Resistance Based on Number of Boards	
Number of Boards	**Resistance (Ohms)**
Logic Module Only	1600
1	1500
2	1400
3	1300
4	1200
5	1100
6	1050
7	990
8	940
9	890

screen can be used to view the communication status of all of the output modules.

Code Number: 540 - "No Output Board 1 Reply",
    This message indicates loss of serial communication to the 5100-2A/B Output Relay Module labeled OR 1-4. See the message "No PLS Board Reply" (Code 539) for diagnostics. Prior to press control software version 1.17, code 538 was used instead.

Code Number: 541 - "No Output Board 2 Reply",
    This message indicates loss of serial communication to the 5100-2A/B Output Relay Module labeled OR 5-8. See the message "No PLS Board Reply" (Code 539) for diagnostics. Prior to press control software version 1.17, code 538 was used instead.

Code Number: 542 - "No Output Board 3 Reply",

    This message indicates loss of serial communication to the 5100-2A/B Output Relay Module labeled OR 9-12. See the message "No PLS Board Reply" (Code 539) for diagnostics. Prior to press control software version 1.17, code 538 was used instead.

Code Number: 543 - "No Output Board 4 Reply",

    This message indicates loss of serial communication to the 5100-2A/B Output Relay Module labeled OR 13-16. See the message "No PLS Board Reply" (Code 539) for diagnostics. Prior to press control software version 1.17, code 538 was used instead.

Code Number: 544 - "No Output Board 5 Reply",

    This message indicates loss of serial communication to the 5100-2A/B Output Relay Module labeled OR 17-20. See the message "No PLS Board Reply" (Code 539) for diagnostics. Prior to press control software version 1.17, code 538 was used instead.

Code Number: 545 - "No Output Board 6 Reply",

    This message indicates loss of serial communication to the 5100-2A/B Output Relay Module labeled OR 21-24. See the message "No PLS Board Reply" (Code 539) for diagnostics. Prior to press control software version 1.17, code 538 was used instead.

Code Number: 546 - "No Output Board 7 Reply",

    This message indicates loss of serial communication to the 5100-2A/B Output Relay Module labeled OR 25-28. See the message "No PLS Board Reply" (Code 539) for diagnostics. Prior to press control software version 1.17, code 538 was used instead.

Code Number: 547 - "No Output Board 8 Reply",

    This message indicates loss of serial communication to the 5100-2A/B Output Relay Module labeled OR 29-32 or PLS 5-8. See the message "No PLS Board Reply" (Code 539) for diagnostics. Prior to press control software version 1.17, code 538 was used instead.

Code Number: 548 - "Station 1 Power-Up Fault",

    This fault appears in the present running status when power is first applied to the press control if station 1 run buttons are not in the released position. The Input Diagnostic screen can be used to view the inputs, which should indicate "Station # 1 Run N/C" is High and "Station #1 Run N/O" is Low if the run buttons are working correctly. The problem MUST be corrected before the **Reset** softkey will clear this fault. If the inputs show the opposite condition to that described above with the run buttons released, then check to see if the wires to the inputs are reversed. In order to prevent the condition where two inputs get connected together and cause the press control to stroke from either run button (not both), the 5100 press control requires that these inputs have opposition. When both buttons are released the normally closed path through both buttons causes the N/C input to go +24 VDC and the N/O input to dc ground. With both buttons pressed the normally open path through both buttons causes the N/C input to go ground and the N/O input to +24 VDC.

Code Number: 549 - "Station 2 Power-Up Fault",

    This fault appears in the present running status when power is first applied to the press control if station 2 run buttons are not in the released position. The Input Diagnostic screen can be used to view the inputs, which should indicate "Station # 2 Run N/C" is High and "Station #2 Run N/O" is Low if the run buttons are working correctly. The problem MUST be corrected before the **Reset** softkey will clear

this fault. If the inputs show the opposite condition to that described above with the run buttons released, then check to see if the wires to the inputs are reversed. In order to prevent the condition where two inputs get tied together and the press control is actually stroking from either run button (not both), the 5100 press control requires that these inputs have opposition. When both buttons are released the normally closed path through both buttons causes the N/C input to go +24 VDC and the N/O input to dc ground. With both buttons pressed the normally open path through both buttons causes the N/C input to go ground and the N/O input to +24 VDC.

Code Number: 550 - "Station 3 Power-Up Fault",
This fault appears in the present running status when power is first applied to the press control if station 3 run buttons are not in the released position. The Input Diagnostic screen can be used to view the inputs, which should indicate "Station # 3 Run N/C" is High and "Station #3 Run N/O" is Low if the run buttons are working correctly. The problem MUST be corrected before the **Reset** softkey will clear this fault. If the inputs show the opposite condition to that described above with the run buttons released, then check to see if the wires to the inputs are reversed. In order to prevent the condition where two inputs get tied together and the press control is actually stroking from either run button (not both), the 5100 press control requires that these inputs have opposition. When both buttons are released the normally closed path through both buttons causes the N/C input to go +24 VDC and the N/O input to dc ground. With both buttons pressed the normally open path through both buttons causes the N/C input to go ground and the N/O input to +24 VDC.

Code Number: 551 - "Station 4 Power-Up Fault",
This fault appears in the present running status when power is first applied to the press control if station 4 run buttons are not in the released position. The Input Diagnostic screen can be used to view the inputs, which should indicate "Station # 4 Run N/C" is High and "Station #4 Run N/O" is Low if the run buttons are working correctly. The problem MUST be corrected before the **Reset** softkey will clear this fault. If the inputs show the opposite condition to that described above with the run buttons released, then check to see if the wires to the inputs are reversed. In order to prevent the condition where two inputs get tied together and the press control is actually stroking from either run button (not both), the 5100 press control requires that these inputs have opposition. When both buttons are released the normally closed path through both buttons causes the N/C input to go +24 VDC and the N/O input to dc ground. With both buttons pressed the normally open path through both buttons causes the N/C input to go ground and the N/O input to +24 VDC.

Code Number: 552 - "Station 5 Power-Up Fault",
This fault appears in the present running status when power is first applied to the press control if station 5 run buttons are not in the released position. The Input Diagnostic screen can be used to view the inputs, which should indicate "Station # 5 Run N/C" is High and "Station #5 Run N/O" is Low if the run buttons are working correctly. The problem MUST be corrected before the **Reset** softkey will clear this fault. If the inputs show the opposite condition to that described above with the run buttons released, then check to see if the wires to the inputs are reversed. In order to prevent the condition where two inputs get tied together and the press control is actually stroking from either run button (not both), the 5100 press control requires that these inputs have opposition. When both buttons are released the normally closed path through both buttons causes the N/C input to go +24 VDC and the N/O input to dc ground. With both buttons pressed the normally open path through both buttons causes the N/C input to go ground and the N/O input to +24 VDC.

Code Number: 553 - "Inch Buttons Power-Up Fault",
    This fault appears in the present running status when power is first applied to the press control if the Inch run buttons are not in the released position. The Input Diagnostic screen can be used to view the inputs, which should indicate "Inch Buttons Run N/C" is High and "Inch Buttons Run N/O" is Low if the run buttons are working correctly. The problem MUST be corrected before the **Reset** softkey will clear this fault. If the inputs show the opposite condition to that described above with the run buttons released, then check to see if the wires to the inputs are reversed. In order to prevent the condition where two inputs get tied together and the press control is actually stroking from either run button (not both), the 5100 press control requires that these inputs have opposition. When both buttons are released the normally closed path through both buttons causes the N/C input to go +24 VDC and the N/O input to dc ground. With both buttons pressed the normally open path through both buttons causes the N/C input to go ground and the N/O input to +24 VDC.

Code Number: 554 - "Aux 1 Ch B Fault",
    This message indicates that Channel B output command does not track Channel A. Replace the 5100-3A Logic Module.

Code Number: 555 - "Aux 2 Ch B Fault",
    This message indicates that Channel B output command does not track Channel A. Replace the 5100-3A Logic Module.

Code Number: 556 - "Aux 3 Ch B Fault",
    This message indicates that Channel B output command does not track Channel A. Replace the 5100-3A Logic Module.

Code Number: 557 - "Aux 4 Ch B Fault",
    This message indicates that Channel B output command does not track Channel A. Replace the 5100-3A Logic Module.

Code Number: 558 - "Lost OIT Communications",
    This message indicates that serial communication was lost and then restored between the Operator Terminal and the 5100-3 Logic Module. The **Reset** softkey must be pressed to clear the message. This condition will occur if a program update is loaded in the operator terminal. It would also occur due to an intermittent loss of +24 VDC to the operator terminal, but in that condition the operator terminal would drop out and power back up. Check the serial communication lines from the operator terminal to the logic module to verify a good connection in the screw connectors. The problem could be either on the operator terminal board or the 5100-3 Logic Module.

Code Number: 559 - "Emergency Stop 1 (Cycle the Input)",
    This message will appear in the present running status after an Input Track fault has been detected (see "Emergency Stop 1 Track Fault" code 521) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 560 - "Emergency Stop 2 (Cycle the Input)" or
"I31/32-E-Stop 2 (Cycle the Input)",
   This message will appear in the present running status after an Input Track fault has been detected (see "Emergency Stop 2 Track Fault" code 522) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 561 - "Emergency Stop 3 (Cycle the Input) "or
"I59/60-E-Stop 3 (Cycle the Input)",
   This message will appear in the present running status after an Input Track fault has been detected (see "Emergency Stop 3 Track Fault" code 523) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 562 - "Emergency Stop 4 (Cycle the Input)" or
"I87/88-E-Stop 4 (Cycle the Input)",
   This message will appear in the present running status after an Input Track fault has been detected (see "Emergency Stop 4 Track Fault" code 524) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 563 - "Emergency Stop 5 (Cycle the Input)" or
"I65/66-E-Stop 5 (Cycle the Input)",
   This message will appear in the present running status after an Input Track fault has been detected (see "Emergency Stop 5 Track Fault" code 525) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 564 - "Emergency Stop 0 (Cycle the Input)" or
"OIT E- Stop (Cycle the Input)",
   This message will appear in the present running status after an Input Track fault has been detected (see "OIT E-Stop Track Fault" code 526) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 565 - "Light Curtain 1 (Cycle the Input)",
   This message will appear in the present running status after an Input Track fault has been detected (see "Light Curtain 1 Track Fault" code 527) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 566 - "Safety Block (Cycle the Input)",

This message will appear in the present running status after an Input Track fault has been detected (see "Safety Block Track Fault" code 528) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 567 - "Light Curtain 2 (Cycle the Input)",

This message will appear in the present running status after an Input Track fault has been detected (see "Light Curtain 2 Track Fault" code 529) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 568 - "Prot. Stop 2 Track Fault (Cycle the Input)" or
"I37/38-Prot. Stop 2 (Cycle the Input)",

This message will appear in the present running status after an Input Track fault has been detected (see "Protective Stop 2 Track Fault" code 530) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 569 - "Prot. Stop 3 Track Fault (Cycle the Input)" or
"I39/40-Prot. Stop 3 (Cycle the Input)",

This message will appear in the present running status after an Input Track fault has been detected (see "Protective Stop 3 Track Fault" code 531) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 570 - "Prot. Stop 4 Track Fault (Cycle the Input)" or
"I69/70-Prot. Stop 4 (Cycle the Input)",

This message will appear in the present running status after an Input Track fault has been detected (see "Protective Stop 4 Track Fault" code 531) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 571 - "Prot. Stop 5 Track Fault (Cycle the Input)" or
"I71/72-Prot. Stop 5 (Cycle the Input)",

This message will appear in the present running status after an Input Track fault has been detected (see "Protective Stop 5 Track Fault" code 532) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 572 - "Prot. Stop 6 Track Fault (Cycle the Input)" or
$\qquad$ **"I91/92-Prot. Stop 6 (Cycle the Input)",**
   This message will appear in the present running status after an Input Track fault has been detected (see "Protective Stop 6 Track Fault" code 533) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 573 - "Prot. Stop 7 Track Fault (Cycle the Input)" or
$\qquad$ **"I93/94-Prot. Stop 7 (Cycle the Input)",**
   This message will appear in the present running status after an Input Track fault has been detected (see "Protective Stop 7 Track Fault" code 534) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 574 - "Prot. Stop 8 Track Fault (Cycle the Input)" or
$\qquad$ **"I95/96-Prot. Stop 8 (Cycle the Input)",**
   This message will appear in the present running status after an Input Track fault has been detected (see "Protective Stop 8 Track Fault" code 535) and that the fault was cleared by pressing the **Reset** softkey, but the inputs have not indicated the Off state. The button must be re-pressed (both inputs must go Low) in order for the **Reset** softkey to clear this fault. The Input Diagnostic screen can be used to determine why the two contacts on this button do not switch the same.

Code Number: 575 - "No Aux 1 Lube Flow",
   This message can appear in the reason for the last stop if a fault occurs with Input 111 [Aux. 1 Lube Cycle] while the press is stroking. It will appear in the present running status and prevent further stroking until the **Reset** softkey is pressed. This message indicates that the lube cycle input failed to make the correct number of complete cycles within the programmed time limit when the Aux. 1 Grease Output turned On. See Sections 4.2.21 and 3.5.5.6 for auxiliary lube system configuration and diagnostic information to determine any problem with the lube.

Code Number: 576 - "No Aux 2 Lube Flow",
   This message can appear in the reason for the last stop if a fault occurs with Input 112 [Aux. 2 Lube Cycle] while the press is stroking. It will appear in the present running status and prevent further stroking until the **Reset** softkey is pressed. This message indicates that the lube cycle input failed to make the correct number of complete cycles within the programmed time limit when the Aux. 2 Grease Output turned On. See Sections 4.2.21 and 3.5.5.6 for auxiliary lube system configuration and diagnostic information to determine any problem with the lube.

Code Number: 577 - "Lube Pump is Off",
   This message will appear in the present running status and prevent further stroking until the lube pump motor is started through the operator terminal (see Section 3.6). This message will only appear if the press control is configured to start/stop the lube and main motors (see Section 4.2.17).

Code Number: 578 - "Max. Engagements per Minute Delay",
This message will appear in the present running status when the number of clutch engagements exceeds the maximum engagements per minute parameter (see Section 4.2.1.2) in a one minute interval. Further stroking is prevented until the remaining time expires.

Code Numbers 579 to 590 – Reserved

Code Number: 591 - "System Initializing",
This message will momentarily appear in the present running status when the operator terminal is transferring settings to the press control or automation modules in the system. This typically only occurs at power up or when a job is recalled.

Code Numbers: 592 to 622 - "Run-Inhibit - XXXXX",
This message (with XXXXX replaced by the subsystem that is causing the inhibit) will appear in the present running status when one of the control subsystems needs to prevent the initiation of a stroke due to a condition that is not an error, but takes some time to clear. An example would be a counterbalance pressure that has not yet reached its setpoint after a change. Such a condition does not require a reset, but the press should not run until the pressure is at the required level. If the inhibit does not clear itself, go to the screen for the subsystem causing the inhibit condition for more information.

Code Numbers 523 to 639 – Reserved

Code Number: 640 - "Lost Lube Aux. Contact (Inp. 21)",
This message will appear in the reason for the last stop if motors are being controlled through the operator terminal and if Input 21 [N/O Lube Aux. Contact] drops out when it is supposed to be engaged. In this condition, the main motor will also drop out. This is to aid in diagnosing intermittent connections to the lube motor contactor. This message is not present in press control software versions prior to version 1.21.

Code Number: 641 - "Lost Main Motor Contact (Inp. 19, 20)",
This message will appear in the reason for the last stop if motors are being controlled through the operator terminal and if Input 19 [N/O Motor Forward Aux. Contact] or Input 20 [N/O Motor Reverse Aux. Contact] drops out while they should be engaged. This is to aid in diagnosing intermittent connections to the main motor contactor. This message is not present in press control software versions prior to version 1.21.

Code Number: 642 - "Lost Flywheel Brake Feedback (Inp. 44)",
This message will appear in the reason for the last stop if Input 44 [Flywheel Brake Feedback] drops out while it should be engaged. In this condition, the main motor will also drop out. This is to aid in diagnosing intermittent connections to the flywheel brake feedback device. This message is not present in press control software versions prior to version 1.21.

Code Number: 643 - "Must Start at Bottom",
This message will appear in the present running status if Clutch/Brake Test mode is selected, configured to allow engagement only at the bottom of the stroke, and crankshaft angle is not between 175 and 185 degrees. This message is not present in press control software prior to version 1.23.

Code Number: 644 - "Must Start at Top or Bottom",
This message will appear in the present running status if Clutch/Brake Test mode is selected and crankshaft angle is not within +-5 degrees of the top or the bottom of the stroke. This message is not present in press control software prior to version 1.23.

Code Number: 645 - "All Modes are "Off"",
This message will appear in the present running status if Hard Modes configuration is turned On and none of the mode select inputs configured are high. This will occur during normal operation as the Cell Controller de-selects one mode and then selects another. This message is not present in press control software prior to version 1.23.

Code Number: 646 - "Hardware Failure - Input Board 1",
This message will appear in the present running status if the inputs read by both channels indicate a failure on input board 1. The Input Diagnostic screen can be used to view the inputs. While the problem can be on the logic board, input board 1 (5100-4A) should be replaced first.

Code Number: 647 - "Hardware Failure - Input Board 2",
This message will appear in the present running status if the inputs read by both channels indicate a failure on input board 2. The Input Diagnostic screen can be used to view the inputs. While the problem can be on the logic board, input board 2 (5100-4B) should be replaced first.

Code Number: 648 - "Aux 1 Relay Feedback Track Fault",
This message will appear in the present running status if the feedbacks from safety relay 1 are not the same on both channels. This fault cannot be caused by field wiring. While the problem can be on the logic board, the 5100-3C board should be replaced first.

Code Number: 649 - "Aux 2 Relay Feedback Track Fault",
This message will appear in the present running status if the feedbacks from safety relay 2 are not the same on both channels. This fault cannot be caused by field wiring. While the problem can be on the logic board, the 5100-3C board should be replaced first.

Code Number: 650 - "Aux 3 Relay Feedback Track Fault",
This message will appear in the present running status if the feedbacks from safety relay 3 are not the same on both channels. This fault cannot be caused by field wiring. While the problem can be on the logic board, the 5100-3C board should be replaced first.

Code Number: 651 - "Aux 4 Relay Feedback Track Fault",
This message will appear in the present running status if the feedbacks from safety relay 4 are not the same on both channels. This fault cannot be caused by field wiring. While the problem can be on the logic board, the 5100-3C board should be replaced first.

**Code Number: 652 - "Output 1 N.O. Track Fault" or
"C/B 1 N.O. Track Fault",**
This message indicates that only one normally open feedback turned on when the clutch/brake output 1 was turned on. Replace the 5100-3A board.

Code Number: 653 - "Output 2 N.O. Track Fault" or
"C/B 2 N.O. Track Fault",
　　This message indicates that only one normally open feedback turned on when the clutch/brake output 2 was turned on. Replace the 5100-3A board.

Code Number: 654 - "C/B 1 N.O. Opto Fault",
　　This message indicates a problem with the opto-coupler feedback on clutch/brake output 1. Replace the 5100-3A board.

Code Number: 655 - "C/B 2 N.O. Opto Fault",
　　This message indicates a problem with the opto-coupler feedback on clutch/brake output 2. Replace the 5100-3A board.

Code Number: 656 - "I79 Soft Clutch Track On Fault ",
　　This message indicates a tracking fault at turn On of the soft clutch valve. Input 79 is used to monitor the soft clutch valve (if configured). The input did not switch to the correct state within the "Soft Clutch Feedback Time". See Section 4.2.2 on Soft Clutch / Soft Brake valve operation.

Code Number: 657 - "I79 Soft Clutch Track Off Fault ",
　　This message indicates a tracking fault at turn Off of the soft clutch valve. Input 79 is used to monitor the soft clutch valve (if configured). The input did not switch to the correct state within the "Soft Clutch Feedback Time". See Section 4.2.2 on Soft Clutch / Soft Brake valve operation.

Code Number: 658 - "I77 Soft Brake Track On Fault ",
　　This message indicates a tracking fault at turn On of the soft clutch valve. Input 77 is used to monitor the soft brake valve (if configured). The input did not switch to the correct state within the "Soft Brake Feedback Time". See Section 4.2.2 on Soft Clutch / Soft Brake valve operation.

Code Number: 659 - "I78 Soft Brake Track On Fault ",
　　This message indicates a tracking fault at turn On of the soft clutch valve. Input 78 is used to monitor the soft brake valve (if configured). The input did not switch to the correct state within the "Soft Brake Feedback Time". See Section 4.2.2 on Soft Clutch / Soft Brake valve operation.

Code Number: 660 - "I77 Soft Brake Track Off Fault ",
　　This message indicates a tracking fault at turn Off of the soft clutch valve. Input 77 is used to monitor the soft brake valve (if configured). The input did not switch to the correct state within the "Soft Brake Feedback Time". See Section 4.2.2 on Soft Clutch / Soft Brake valve operation.

Code Number: 661 - "I78 Soft Brake Track Off Fault ",
　　This message indicates a tracking fault at turn Off of the soft clutch valve. Input 78 is used to monitor the soft brake valve (if configured). The input did not switch to the correct state within the "Soft Brake Feedback Time". See Section 4.2.2 on Soft Clutch / Soft Brake valve operation.

8   NOTES

8.1   Software Versions

The information in this manual is based on 5100 Press Control software version 1.41 and 805 Operator Terminal software 2.04, released 01/26/2017.

8.2   Configuration Code

The configuration is used to gain access to the press control configuration screens.

This code is sent to qualified supervisory personnel when the System 5100 press control is shipped from Link Systems. It can be used to change certain user configuration parameters. Contact Link Systems service department to change any factory configuration setting.