System 2600
Programmable Limit Switch and Die Protection

Installation and Operating Manual

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Rev. 02

PLS / Die Pro.

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1 INTRODUCTION

The System 2600 is a stand-alone die protection and, optionally, programmable limit switch (PLS) unit that can be used with any existing press control. It serves two primary purposes - die protection and automation.

The die protection capabilities of the System 2600 offer enough flexibility to meet the needs of almost any die protection application.

The System 2600 features six built-in die protection channels which are designed for use in monitoring various material

Figure 1: System 2600

and tool conditions that are important to the correct operation of the stamping process such as:

- Misfeed of the material (long feed, short feed, stock buckle)
- Verification of part ejection
- Stripper position
- Verification of slug ejection / detection of slug stacking
- End of stock

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.

Either solid state (NPN or PNP) sensors or probes and mechanical sensors may be used to drive the inputs. This is configurable on a per-channel and per-job basis so using a variety of sensors is a valid option. Once configured, these settings will be automatically recalled with each job.

The System 2600 can be programmed to monitor each individual die protection input in the manner necessary to ensure that the process is operating in the intended manner. Each channel can be programmed to function as one of several logic types, which are covered in the configuration section.
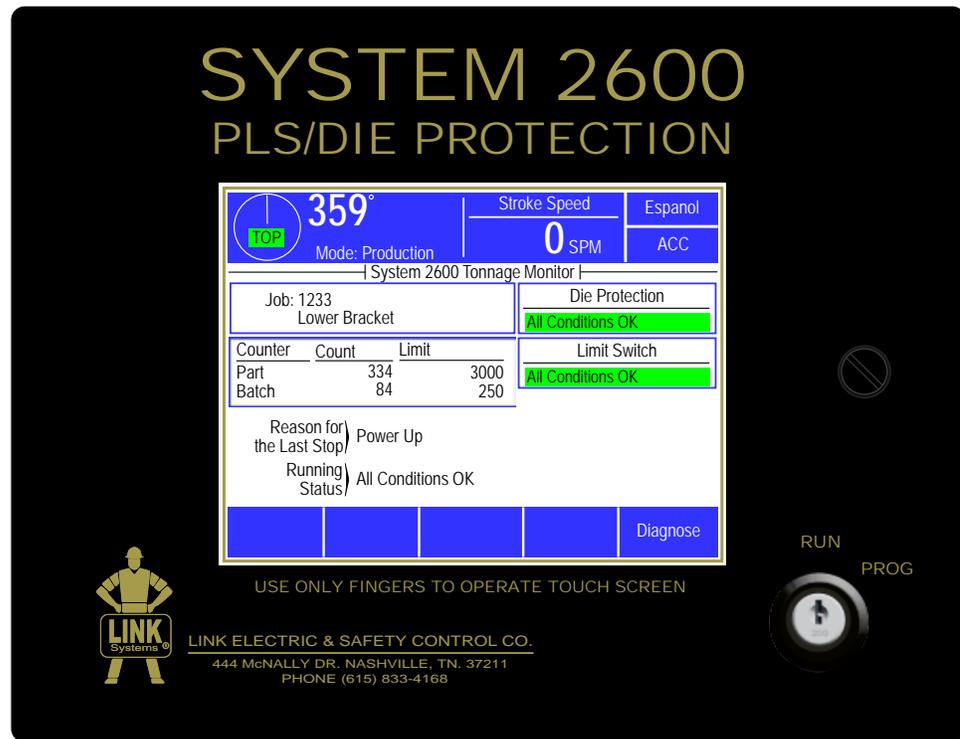
If the monitor detects a process fault, a stop signal will be sent to the press control. There are two types of stops than can be assigned to an individual channel - Immediate Stop or Top Stop.

The programmable limit switch can be used to drive and/or time automation systems in the stamping process such as:

- Feeds
- Transfer systems
- Lube systems
- Robotic systems
- Air blow off
- Part diverters
- Gagged tools

1.1   Features

- Storage for 500 jobs of settings associated with the standard and optional functions of the system.

- The unit can be operated in English or Spanish language. The language can be switched at any time (including while the press is running) with a softkey that is always present in the upper right corner of the display.

- Extensive and flexible security is provided for setting parameters and resetting faults. This can be based on having the RUN/PROG key, passcodes, or both. With optional communications card, it can even be based on RFID cards or fingerprint readers.

- Additional auxiliary inputs can be configured for such things as indicating setup mode.

- Six die protection inputs are supplied. Each input is individually configurable on a job-by-job basis for NPN or PNP sensors, channel logic parameters, and a user supplied description.

- Each die protection channel can be individually set on a job-by-job basis to automatically bypass when in a setup mode (and un-bypass when not in setup mode), if desired. This feature can eliminate the need to manually bypass all channels when setting up the die and the associated risk of forgetting to un-bypass them.

- Extensive diagnostics are supplied showing in real time where in the stroke sensors are actually detected both graphically and in numeric form. After a stop, not only the last stroke but several previous strokes can be viewed. This allows the actual condition that caused a stop to be viewed in cases where higher speed presses take more than one stroke to stop. An "Overlay" mode can also superimpose multiple strokes on the screen so that sensor hit-to-hit variation can be directly viewed an adjusted for.

- If bypassing of the entire unit is needed or desired, a setting is available that will automatically un-bypass it when switching back to a production mode.

- Up to 8 programmable limit switch outputs can be added (4 at a time). Both electromechanical and solid-state outputs are available. Each output is individually configurable on a job-by-job basis for output logic, related parameters, and a user supplied description.

- Separate "Top Stop" and "Immediate Stop" relay contacts are provided for interface to the press control.

- Up to 4 programmable output relays can be installed that can be configured to indicate various conditions such as "Crank in Motion", "Bypassed", "Down Time Code Active", "In Setup Mode", "Inhibit Condition Active", and others.

- Status messages for each channel indicate the first alarm condition that occurred during the stroke.

- Powerful counting capability with up to two flexibly configured counter sets (each set with part, bin, and scrap counters that can be driven by stroke or with part sensors).

- The system uses an encoder tied to the crankshaft of the press so that position dependent parameters such as die protection windows, PLS angles, and so on are entered directly in degrees and require no external cam switches.

- The Clutch/Brake signal of the press can be monitored by the 2600 to detect problems with the coupling of the encoder to the crankshaft such as a broken chain.

- The crank angle is always displayed both graphically and in degrees.

- Crank speed, distance to bottom, and a number of other readouts are available in the top info area.

- An optional communications card is available with 2 serial ports and an Ethernet port. The communications card enables the use of the following features:

  - The optional LinkNet shop floor information collection system networks the unit, collects downtime, production, and other information, and offers extensive reporting and management features.

  - An optional MODBUS protocol (RTU or TCP) can be used over serial port or Ethernet port for connectivity to PLC's or data collection programs.

  - An optional serial feed interface can display and set length, speed, and acceleration for a wide range of supported servo feeds.

  - An optional security system interface can allow the use of RFID card readers or fingerprint readers for user permissions.

1.2   Specifications

Size: 8.75" wide, 6.75" high, 4.5" depth.

Input Power: 90-264 VAC, 47-63 Hz, 17 VA or
                                        24VDC +/- 10% (0.4 Amps).

Press Speed Capability: Up to 2000 strokes per minute

2   DEFINITIONS AND TERMINOLOGY

This section will give some background and explain the meaning of various settings and readings in the unit. It is strongly recommended that this section be read in order to use the unit effectively!

2.1   Stops

There are two different kinds of stops that the system can generate. Some conditions always generate a particular kind of stop, while others are programmable by the user.

2.1.1   Immediate Stop

An "Immediate Stop" sends a signal to the control to immediately stop the press, 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 a request to stop 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   Top Stop

A "Top Stop" sends a signal to the control to 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 typically make an additional stroke. Many high speed presses take more than 1 full stroke to stop regardless of where the stop occurs.

3   OPERATION

3.1   Operator Interface

The operator interface consists of a color LCD display with a touch screen and a RUN/PROG switch.
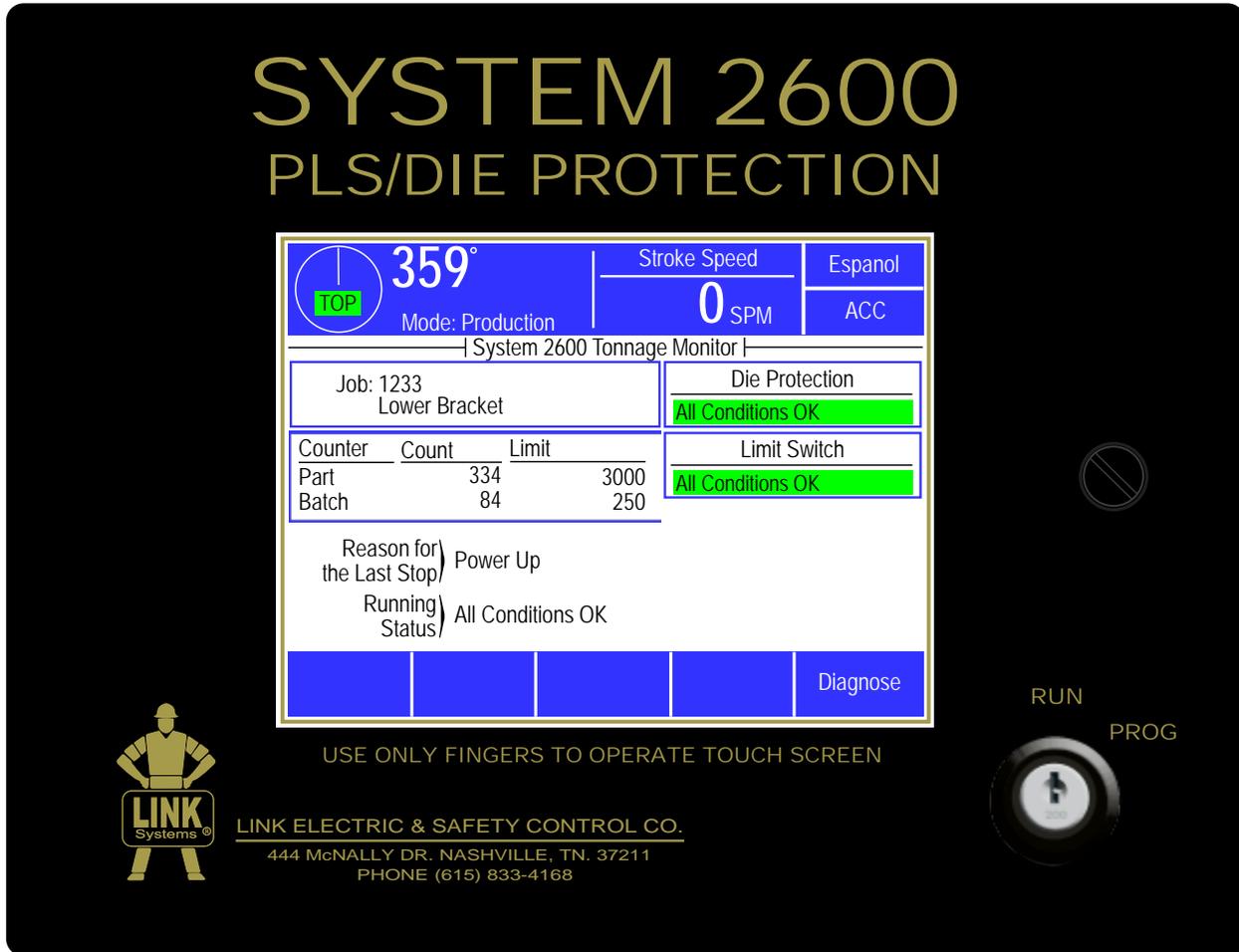
Figure 2: System 2600

Areas inside the white portion of the display are shown with a blue border if that area can be selected. For example, referring to the figure above, 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 Diagnose softkey will display the diagnostics screens.

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 left side of this area will always show crankshaft position information and, if so configured, whether the machine is in production or setup mode.
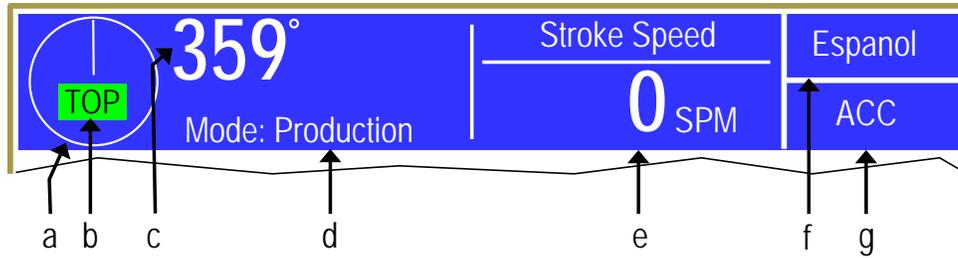
Figure 3: Top Info Area *with* 5100-11 Encoder

Figure 3 shows the top info area. The information available is:

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) ***Mode***   This indicates that the press is in a Setup or a Production mode. If setup mode indication is not used then this will not appear. (See section 4.2.3 on page 56),

e) ***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), the unit's current status, 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 switched from a setup mode to a production mode, and vice versa. See section 4.11.1 on page 65 for more information on configuring this area and the information items available.

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

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

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 System 2600. The PROG (program) position causes the unit to assert a Top Stop, and prevents machine 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 the PROG position in order to modify parameters. This switch must also be in the PROG position for unit configuration.

3.1.4   Automatic LCD Turn Off

To increase the life of the display backlight, the backlight will automatically dim ten minutes after the last production cycle is detected 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 interface or the RUN/PROG key is operated.

3.1.5   Parameter Entry

Throughout the operator interface, a standard form of data entry is employed. Parameters that can be changed are indicated by a hollow blue box with the parameter inside. Touch inside the hollow blue box to edit the parameter.

3.1.5.1 Numeric Entries

A numeric parameter to be changed is selected by pressing the area on the screen that displays the parameter (surrounded by a hollow blue box). 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.
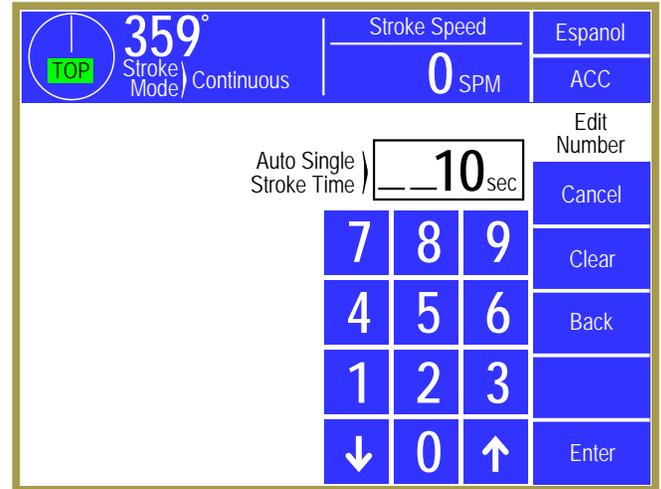
Figure 4: Example Numeric Entry Screen

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.

3.1.5.2 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.

To erase characters, position the editing cursor at the start of the characters to erase and hit the Space
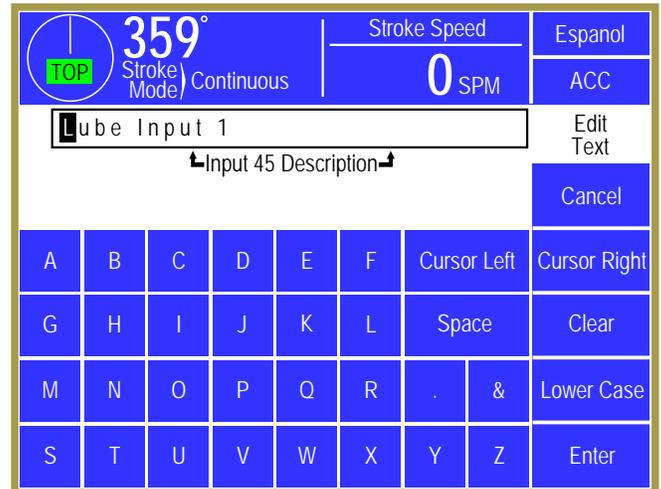
Figure 5: Example Text Entry

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.

3.1.5.3   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.
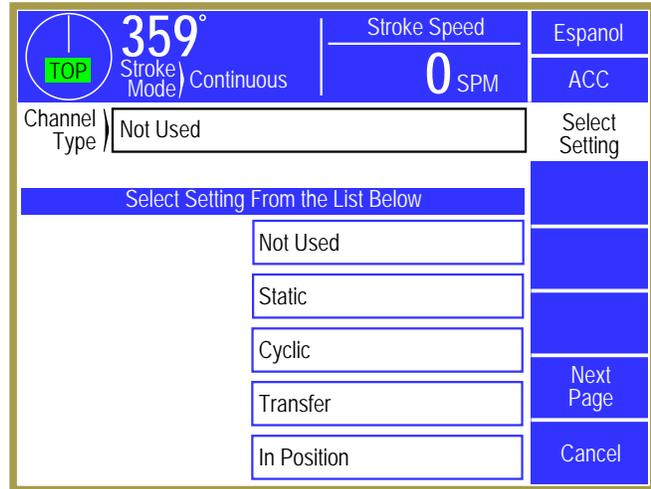
Figure 6: Example List Selection

3.1.6   Configuration Code

A default configuration code to get into the Configuration screen is supplied with the system and can be changed by the user.

3.1.7   Access Control Modes

The control has many parameters or operations where access may need to be restricted to certain personnel. Common examples include resetting faults, changing limit settings, and bypassing modules. The control provides several means to limit access to these parameters or operations. These parameters and operations are called restricted items.

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

There are four possible modes of operation for the restricted 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.

3.1.7.1 Key Only Mode

The "Key Only" mode is the least complex of the four modes. This mode employs the RUN/PROG key as the only method to limit access to restricted items. Any user with the RUN/PROG key can access all of the restricted items. Without the RUN/PROG key, user access to all of the restricted items is prohibited.

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.

3.1.7.2 Key or Password Mode

The key or password mode allows for either of two methods to gain access to the restricted items. A user with RUN/PROG key can access all of the restricted items. A user with the correct password can access the restricted items that have been designated for that particular user 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 can reset die protection faults. This is the only die protection related item to which the operator has access. In order to load a die, the set-up personnel will use the RUN/PROG key to recall a job from job storage. The set-up personnel will also be able to make changes to 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 die protection fault occurs, the operator can enter the correct password and then reset the fault. However, the operator cannot change die protection settings. This will allow the operator to keep running the job and reset faults that occur. However, if consistent stops occur because a die protection setting needs changing, the set-up personnel must be called to change it.

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 die protection settings in addition to the ability to reset faults, while the other operator is not assigned the ability to change the settings.

3.1.7.3 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 items. In the "Key or Password" mode, the setup personnel used the RUN/PROG key to gain access to all of the restricted items. In the "Password Only" mode, the setup personnel can still have access to all of the restricted items, 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.

3.1.7.4   Key and Password Mode

The "Key and Password" mode requires the user to have the RUN/PROG key, user name, and 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.

3.1.8   Access Control Operation

To gain access control the user must use one of two means or a combination of these two means. These means are the RUN/PROG key or the user password system.

3.1.8.1   RUN/PROG Key Switch Operation

The RUN/PROG key switch is located on the lower right side of the System 2600. This is a two-position switch. The key is removable in the RUN position only. If the RUN/PROG key switch is being used as a means to access the restricted items, the switch must be turned to the PROG position. When the RUN/PROG key switch is switched to the PROG position, the press will Top Stop and stroking will be prohibited until the switch is returned to the RUN position.

When operating in the Key Only mode the key switch is the only means available to access the restricted items. All restricted items are accessible when the RUN/PROG key switch is switched to the PROG position.

When operating in the "Key or Password" mode, the key switch is one of the means available to access the restricted items. All restricted items are accessible when the RUN/PROG key switch is switched to the PROG position.

When operating in the "Key and Password" mode, the key switch and password must be used to access the restricted items. In this mode, the user will be granted access only to the restricted items that have been assigned to him.

3.1.8.2   Password System Operation

Figure 7 displays an example password entry sequence. This example shows the steps necessary to change a numeric value but is typical for password entry for all restricted items.
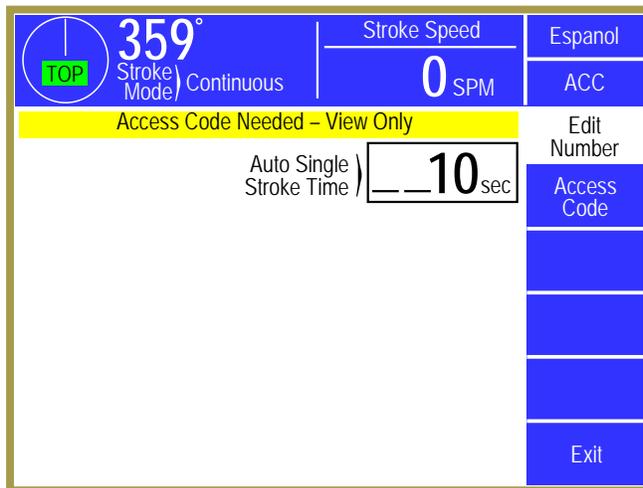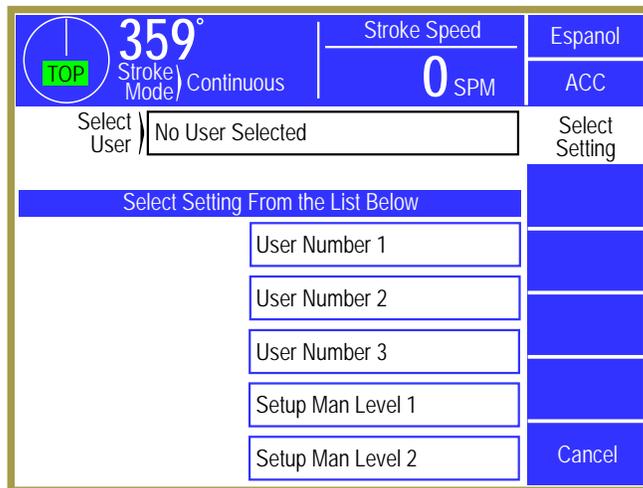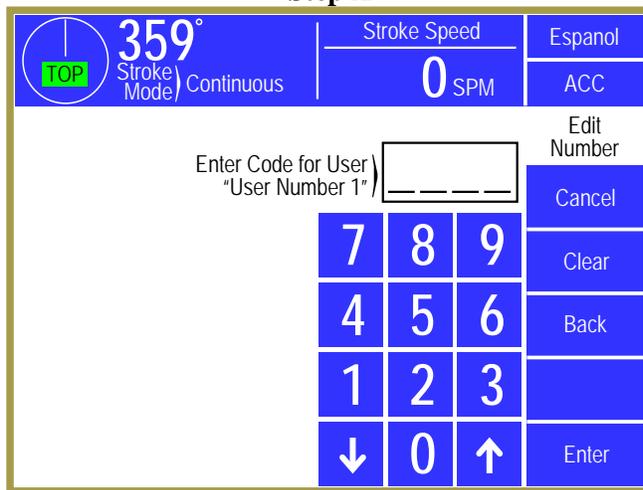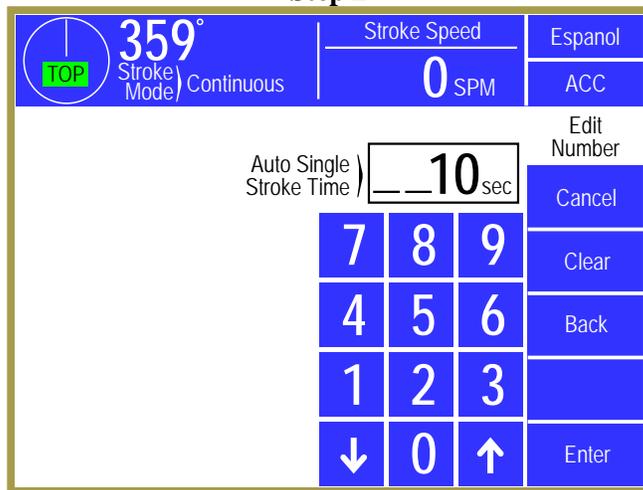
Figure 7: Example Password Entry Sequence

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 soft key 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 1 through 4.

In addition to the manual log out, the system contains an automatic logout function. The intent of automatic log out is to reduce the possibility of users other than the intended user 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 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 key stroke 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 key stroke. If the user presses 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 key stroke 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 10 strokes after the last key stroke. If the user presses a key before 10 strokes have been completed, a new 10 stroke cycle will be started.

3.1.9 Restricted Items

When operating in one of the code access modes, various items and functions of the system can be programmed as allowed or restricted for different users. The following table lists the different items and functions in the unit that can be configured to be restricted. See section 4.11.4 for details on how to set up restrictions.

System 2600 Restricted Items/Functions	
Name	**Function**
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
Counter Change	Change counter values
Counter Reset	Reset counters that have reached their limit
Counter Config.	Configure counters
PLS Settings/Names	Change settings and names of PLS channels
PLS Reset	Reset PLS Faults
PLS Bypass	Bypass PLS Channels
DP Settings	Change settings of die protection channels
DP Reset	Reset die protection faults
DP Bypass Setup	Change die protection bypass settings
DP System Bypass	Allow bypassing of all die protection functions
DP Limited Bypass	Allow the limited bypassing of all die protection functions
Feed Settings	Allow changing feed settings through the servo feed interface
Special Interface	Allow operation of certain other optional interfaces

3.1.10 Unrestricted Items

Certain operations can be configured to be completely unrestricted. That is, regardless of the Access Control Mode, these items can be set to require no RUN/PROG key or code. For the most part, the available items consist of reset operations for the various automation systems and limited bypass operations. For instance, if you don't want your operators changing settings for the die protection channels, but you do trust them to reset die protection faults after taking care of whatever tripped, then you can unrestrict the die protection reset function while still restricting all other functions. See section 4.11.4 for details on how to set up restrictions.

The following table lists the different items and functions in the unit that can be configured to be completely unrestricted. Once unrestricted, no RUN/PROG key or code will be necessary to change the item or perform the function.

System 2600 Unrestricted Items/Functions	
Name	**Function**
Counter Settings	Change counter limits and turn counters off and on
Counter Change	Change counter values
Counter Reset	Reset counters that have reached their limit

Counter Config.	Configure counters
PLS Reset	Reset PLS Faults
PLS Bypass	Bypass the PLS
DP Reset	Reset die protection faults
DP System Bypass	Bypass the die protection system
DP Limited Bypass	Limited bypass of the die protection system
Feed Settings	Change feed settings though the servo feed interface
Special Interface	Change settings in certain other optional interfaces

3.2   Main Operator Terminal Screen

The operator interface main screen shown in Figure 8 provides the current status of the System 2600 overall and indicates if attention is required. This is the initial screen displayed when the unit powers up.

From this screen the operator may navigate to Die Protection, Limit Switch, Job Setups (see "a" in Figure 8) or Counters (see "b" in Figure 8) by pressing inside the blue-bordered box of each area. Some additional features are optional (such as LinkNet) and will become available if enabled.
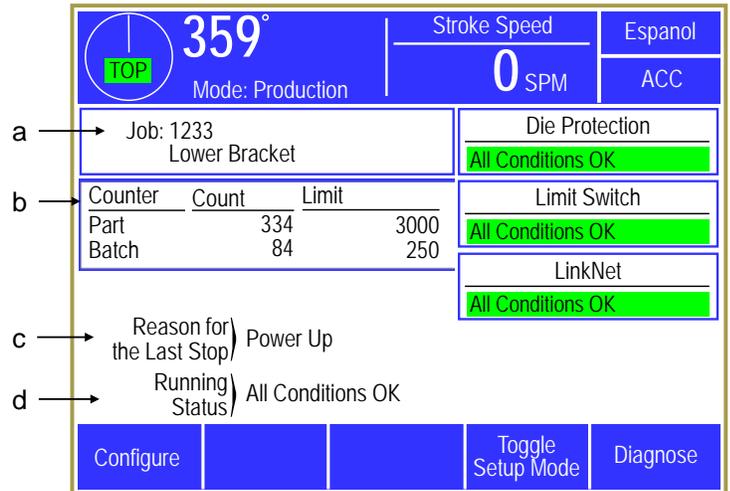
Figure 8: Operator Terminal Main Screen

The status of the die protection and Limit Switch subsystems (seen as "All Conditions OK" in green in the example of Figure 8) could indicate any of the following conditions:

"All Conditions OK"   No alarms exist and no stop signals are being given by the module.

"Error Condition Exists"   An alarm or an error has been detected and must be reset before the control will allow stroking. Go into the system screen to see the details of the error condition.

"System Bypassed"   The module is bypassed and will not supply a stop signal to the control if an alarm occurs.

"Option Not Installed"   This will be displayed as the status for the Limit Switch when no limit switch relays modules are installed.

3.2.1   Reason for the Last Stop

Diagnostic information is provided to show the reason that the press stopped (see "c" in Figure 8). Once a cycle 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 3.6.4 on page 54).

> **NOTE:**   The press control for the machine will have other stop sources besides the System 2600 (E-Stop buttons, light curtains, etc.) that can stop the press without the System 2600 knowing why.   When this happens the "Reason for the Last Stop" will show ***External Stop.*** Stops initiated by the System 2600 (such as from counters, die protection channels, etc.) will display specific information on what caused the stop.

3.2.2 Running Status

Diagnostic information is provided to show the reason why the unit is currently asserting a stop (see "d" in Figure 8). 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, then the message *All Conditions OK* indicates the System 2600 is not asserting its stop outputs. The "Running Status" message will indicate where the operator needs to go to take corrective action (reset a counter, clear a die protection fault, etc.).

> **NOTE:** The press control for the machine will have other stop sources besides the System 2600 (E-Stop buttons, light curtains, etc.).
>
> A "Running Status" of **All Conditions OK** refers to only the System 2600 itself so other stop sources applied to the actual press control may prevent the press from running.

3.2.3 Configure Softkey

The System 2600 configuration area is available by pressing the Configure softkey. This key only appears when the RUN/PROG key is in the PROG position. See section 4 on page 55 for information on configuring the System 2600.

3.2.4 Diagnose Softkey

Additional detailed diagnostic information is available through the Diagnose softkey. See Section 3.6 on page 53 for information on the diagnostic screens and information available.

3.2.5 Toggle Setup Mode

Depending on the configuration, a Toggle Setup Mode softkey may be displayed in the main screen. This allows the operator to manually toggle the System 2600 between production and setup modes. This can affect whether or not counters count and automatic bypassing of selected die protection channels. See section 4.2.3 on page 56 for information on the configuration parameter that controls this.

3.3   Die Protection

The System 2600 features 6 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.

Either solid state (NPN or PNP) sensors or probes and mechanical sensors may be used to drive the inputs. This is configurable on a per-channel basis so using a variety of sensors is a valid option. Once configured, these settings will be automatically recalled with each job.

The System 2600 can be programmed to monitor each individual die protection input in the manner necessary to ensure that the process is operating in the intended manner. Each channel can be programmed to function as one of several logic types as described in the following sections.

If the monitor detects a process fault, a stop signal will be sent to the press control. There are two types of stops than can be assigned to an individual channel - Immediate Stop or Top Stop (See Section 2.1 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.

3.3.1   Die Protection Channel Types

Each die protection channel can be programmed for any one of 11 different die protection types: "Not Used", "Static", "Cyclic", "Transfer", "In Position", "In Position Inhibit", "1 Part Detector Edge", "1 Part Detector Pass", "2 Part Detector Edge", "2 Part Detector Pass", and "Part Detect Anywhere".

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.

3.3.1.1   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 9. 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.

a) Dual Normally Open Probe Used To Detect Stock Buckle

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

Figure 9: Static Normally Off Example

An example of the use of a Normally On input is an end of stock sensor, as shown in Figure 10. 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

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

b) Limit Switch Provides Normally Closed Input To Monitor End Of Stock

Figure 10: Static Normally On Example

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.

3.3.1.2 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 11. 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.
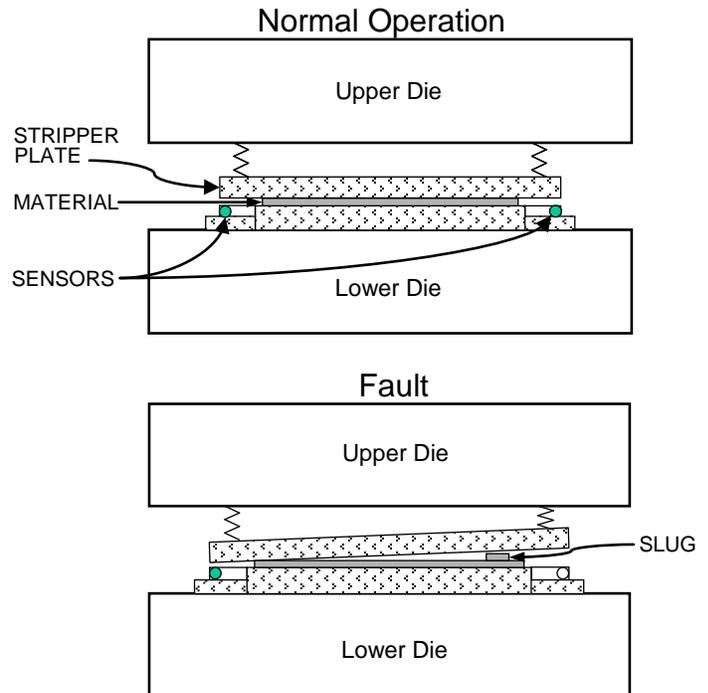
Figure 11: Cyclic Input Example

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 12. 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 12: 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.

3.3.1.3   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 13 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.

a) Before Feed Progression   b) Correct Feed   c) Over Feed
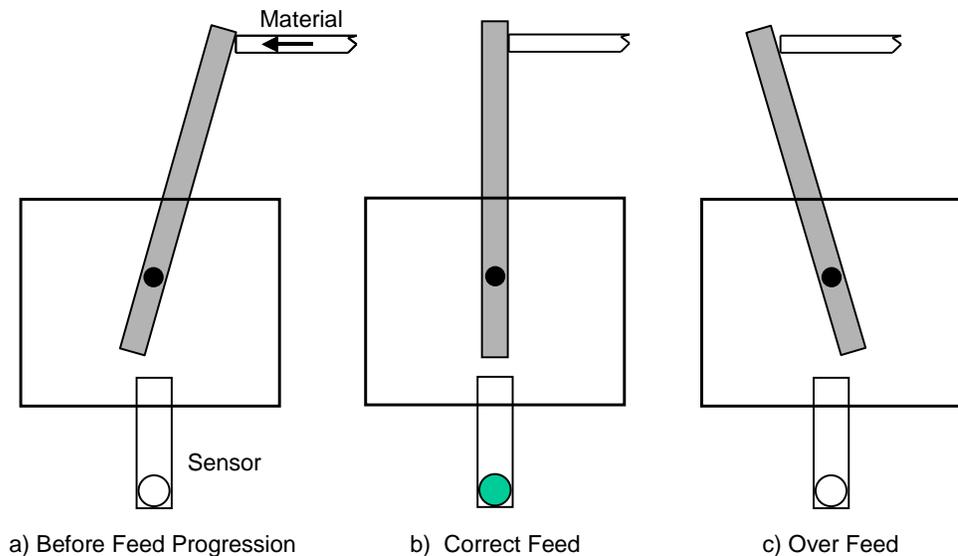
Figure 13: "In Position" Input Example

When the 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 14. 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.
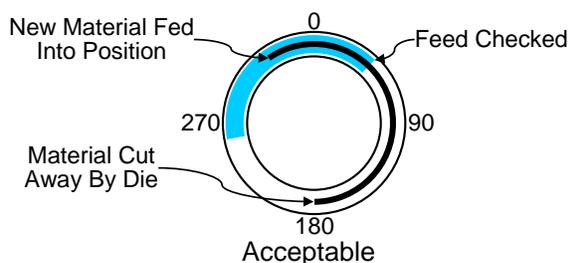
Figure 14 also shows some unacceptable conditions for In Position events. There are three unacceptable conditions shown. The left unacceptable condition shows that the feed was not in place at the end of the timing window. The center unacceptable condition shows that the material did arrive in place during the timing window, but was not in place at the end of the window. As shown in Figure 13, 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 fault conditions.
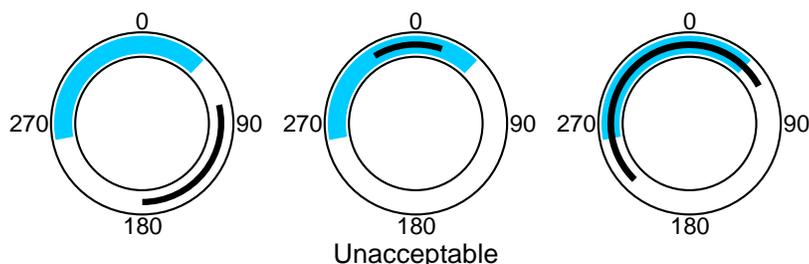
Figure 14: Timing Window Examples for an "In Position" Input

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 13 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.

3.3.1.4   In Position Inhibit

"In Position Inhibit" operates the same as "In Position" but with the additional characteristic that when the press is stopped inside the timing window, it will assert a stop until the sensor turns on. In other words, it will not allow the press to start until the sensor is made. When the press is running, it operates exactly like "In Position". This mode is especially handy when the press is running in Single Stroke with a long and/or slow feed progression as it prevents the next stroke until the material is in place. Otherwise, it might be possible to "false start" and hit the end of the timing window before the material has fed up – which will then cause a stop in the downstroke. Also see section 4.2.5 on page 56 for more information on how inhibit behaves and the considerations for its use.

3.3.1.5   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 15 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 ensures that the part is totally out of the die area.

Small part detected by optical part detector

Figure 15: "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 16.
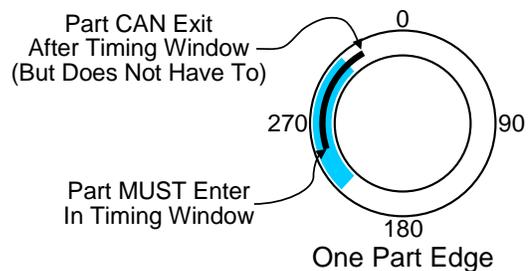
Figure 16: Timing Window Example for a "1 Part Detector Edge" Input

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.

3.3.1.6   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 17 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 ensure that the part is totally out of the die area. The only way to ensure 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.
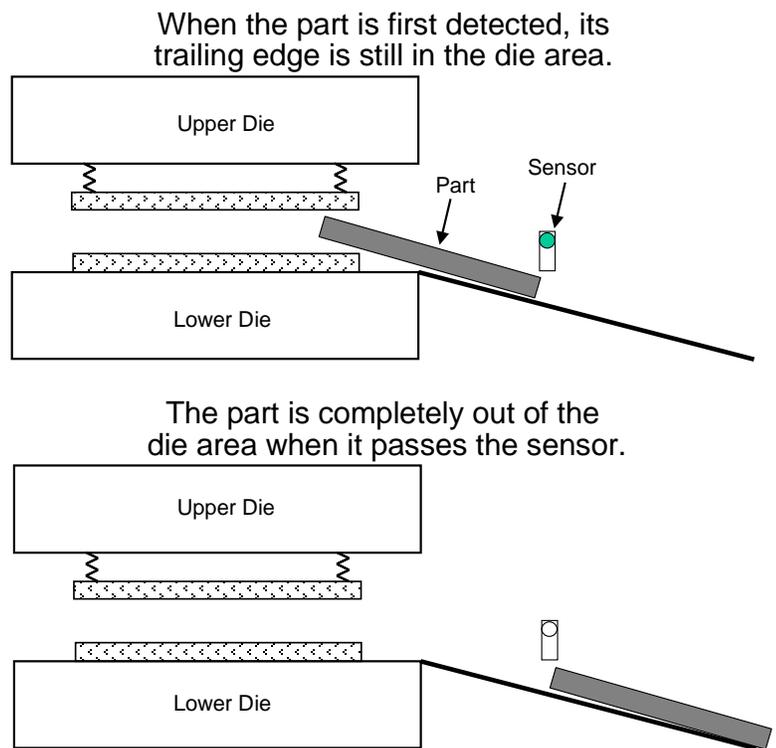
Figure 17: "1 Part Detector Pass" Input Example

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 18.

Figure 18: 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.

3.3.1.7 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 19 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 ensures that the part is totally out of the die area.
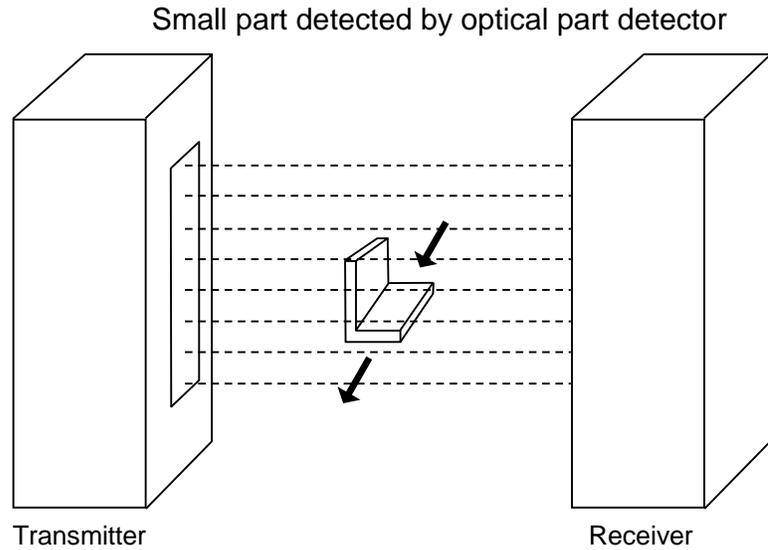
Two small parts detected by optical part detector
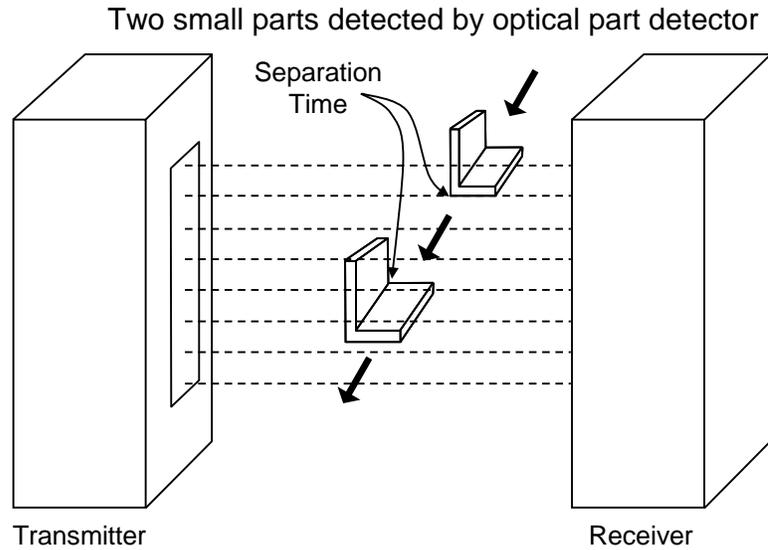
Figure 19: "2 Part Detector Edge" Input Example

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 20.
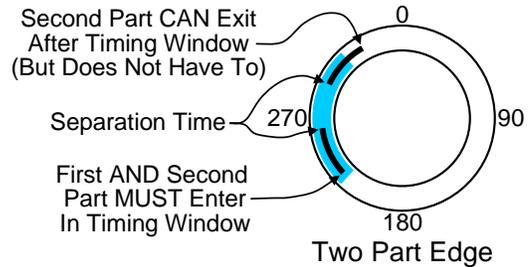
Figure 20: Timing Window Example for a "2 Part Detector Edge" Input

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.

3.3.1.8   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 21 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 ensure that the second part is totally out of the die area. The only way to ensure 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.

Upper Die

Second Part   Sensor

First Part

Lower Die

The second part is completely out of the die area when it passes the sensor.

Upper Die

Second Part

Lower Die
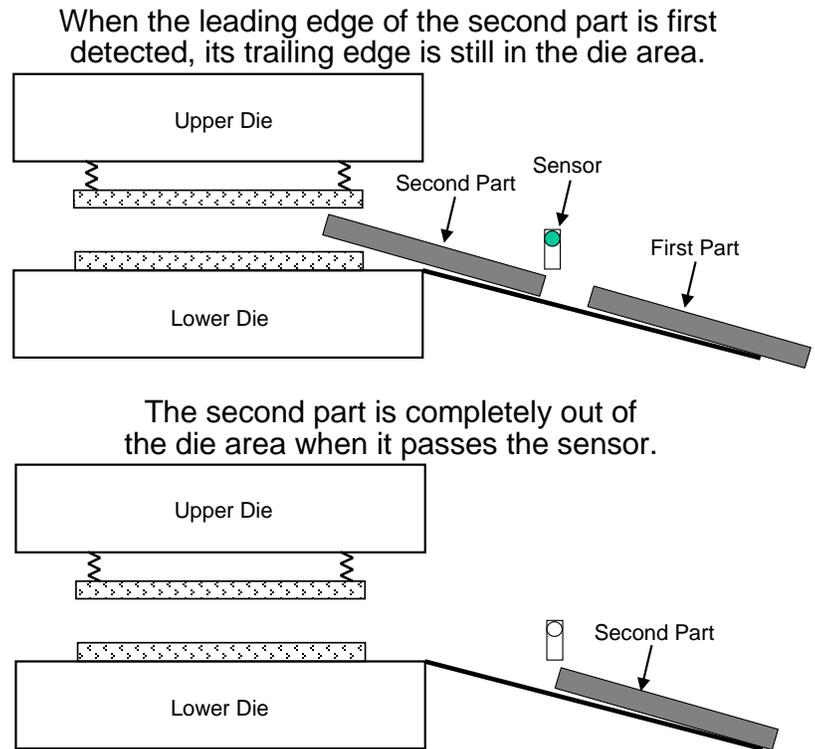
Figure 21: "2 Part Detector Pass" Input Example

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 22.

Second Part MUST Exit
In Timing Window

0

Separation Time   270   90

First AND Second
Part MUST Enter
In Timing Window

180

Two Part Pass

Figure 22: Timing Window Example for a "2 Part Detector Pass" Input

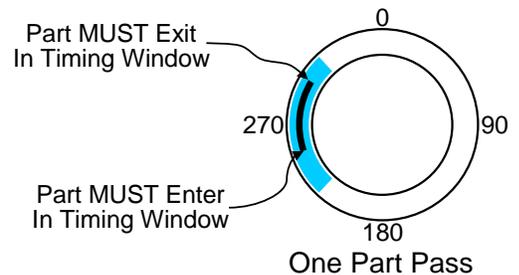Note that the sensor is not allowed to become active outside the window or a fault will be generated. This provides protection against a part 'bouncing' on a probe-type detector and satisfying the die protection input erroneously.

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.

3.3.1.9   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 23. 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.
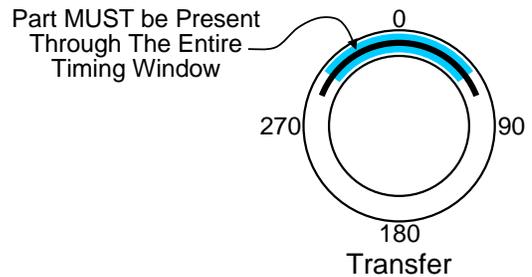
Figure 23: Timing Window Example for a "Transfer" Input

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.
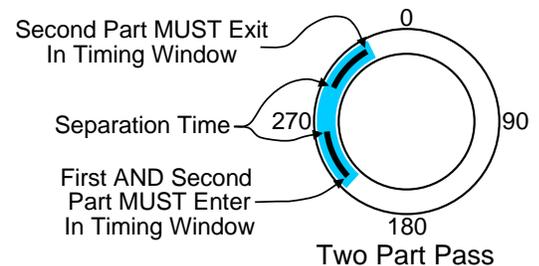
3.3.1.10 Part Detect Anywhere

The "Part Detect Anywhere" type is distinct from the other part detect types in that is does not use a timing window, never issues a stop, and its only effect is to drive a sensor-based counter. This type is always "looking" to see a part, including when the press is not running. This can be especially useful if "watching" for parts to come off of a conveyor as they drop into a bin. Even after the press stops running, parts may be queued on the conveyor and still be dropping past the part sensor.

This type uses the "Separation Time" parameter to prevent false multiple counts from thin and/or tumbling parts. After a part is detected, a new part will not count until the separation time has passed.

3.3.2 The Die Protection Main Screen

Pressing inside the blue bordered "Die Protection" area on the Main Screen (see Figure 8 on page 21) will cause the Die Protection screen shown in Figure 24 to be displayed.

The upper half of the screen shows an overview of up to four die protection channels at a time. Channels 1 to 4 are shown on the first page, and channels 5 and 6 are shown on the second. The "Channel Type", "Description", and "State" (On or Off) of each channel is shown.
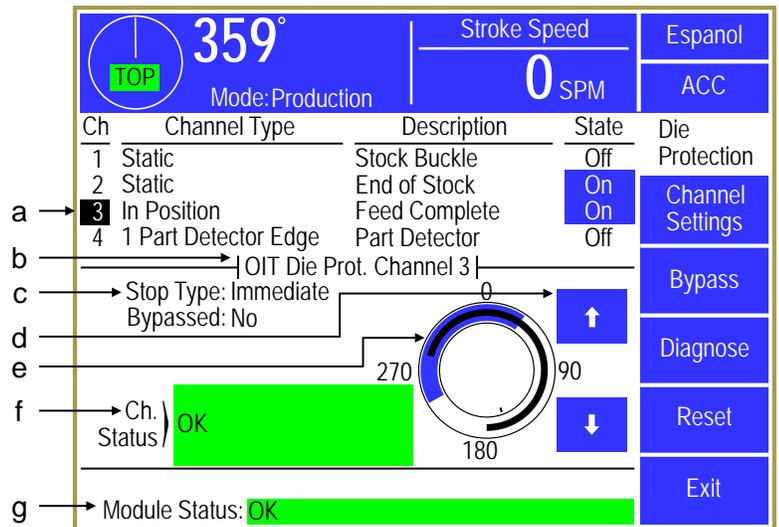
Figure 24: Die Protection Main Screen

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 24, 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.

There are several softkeys on this screen that come into play at various times. The softkeys and other functions of this screen are discussed in the following sections. Some softkeys may not be shown at times depending on the RUN/PROG key position, whether the press is running, and other factors.

In Figure 24, the various parts of the screen are:

a) *Channel List*   This area displays the channels (4 at a time) along with the channel type, description, and whether the sensor is On or Off. Note in the example above that channel 3 is highlighted and that the highlighted channel has additional information shown in the bottom half of the screen. The Up and Down arrow keys (pointed to by "d" in Figure 24) are used to move the highlighted cursor from channel to channel.

b) *Detailed Info Title*   This line shows which channel the information below it applies to. This is the same as the channel which is highlighted by the channel cursor (shown by "a" in Figure 24).

c) *Detailed Info*   This area shows information on the particular settings that apply to the channel type. This varies from type to type.

---

d)	*Channel Navigation Keys*	These Up and Down arrow keys are used to select which channel is currently selected and shown in the detailed information area (and move the channel cursor as seen by "a" in Figure 24). The first page of this screen shows channels 1 to 4. When on channel 4, hitting the down arrow again will change pages to show channels 5 and 6. Likewise, when on channel 5 (the first channel of the second page), hitting the Up arrow key will change to the first page and select channel 4.
e)	*Graphical Angle Display*	The blue part of 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.
f)	*Channel Status*	Each channel has a status that indicates any alarms conditions or other problems related to just that channel.
g)	*Module Status*	The overall status of the die protection system.
Channel Settings *Softkey*		This softkey brings up the channel settings screen for the currently selected channel (in the example of Figure 24 it would be channel 3). See section 3.3.3 on page 35 for more information on the settings screen.
Bypass *Softkey*		Press this softkey to go to the die protection bypass screen where various bypass options can be configured. See section 3.3.6 on page 40 for more information on the bypass screen.
Diagnose *Softkey*		This softkey Brings up the diagnostics screen for the currently selected channel (in the example of Figure 24 it would be channel 3). See section 3.3.7 on page 42 for more information on the settings screen.
Reset *Softkey*		This softkey is used to reset die protection fault conditions. Note that some errors, primarily those generated from "Static" inputs, may not clear until some action is corrected in the die.

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 25 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 25: 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.

3.3.3 Die Protection Channel Settings Main Screen

If the **Channel Settings** softkey is pressed in the Die Protection main screen (see Figure 24), the display will show a settings screen for the currently selected channel that will look something like Figure 26. The appearance of this screen will vary somewhat depending on the "Channel Type" selected, as some types do not use some settings.

The **Previous Channel** and **Next Channel** softkeys can be used page through the channels without going back to the Die Protection main screen.
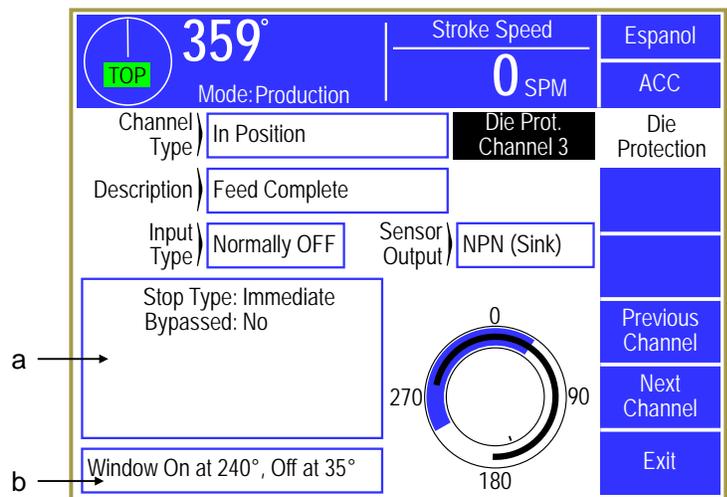
Figure 26: Die Protection Channel Settings Screen

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.

3.3.3.1 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 3.3.1.1 on page 24 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 3.3.1.2 on page 25 for more information about this type.

In Position   Channel type typically used to monitor material feed progression. See Section 3.3.1.3 on page 26 for more information about this type.

In Position Inhibit   Channel type typically used to monitor material feed progression. See Section 3.3.1.4 on page 27 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 3.3.1.5 on page 28 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 3.3.1.6 on page 29 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 3.3.1.7 on page 30 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 3.3.1.8 on page 31 for more information about this type.

Transfer   Channel type typically used to monitor part transfer. The channel's input sensor must report that the part is present through the entire timing window. See Section 3.3.1.9 on page 32 for more information about this type.

Part Detect Anywhere   Channel type used to drive a sensor-based part counter not related to press position. See Section 3.3.1.10 on page 32 for more information about this type. Note that this type is only available for selection when one or more counters have been configured for sensor-based counting.

3.3.3.2 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 4.6 on page 61.

3.3.3.3 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.

3.3.3.4 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 27 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.

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.
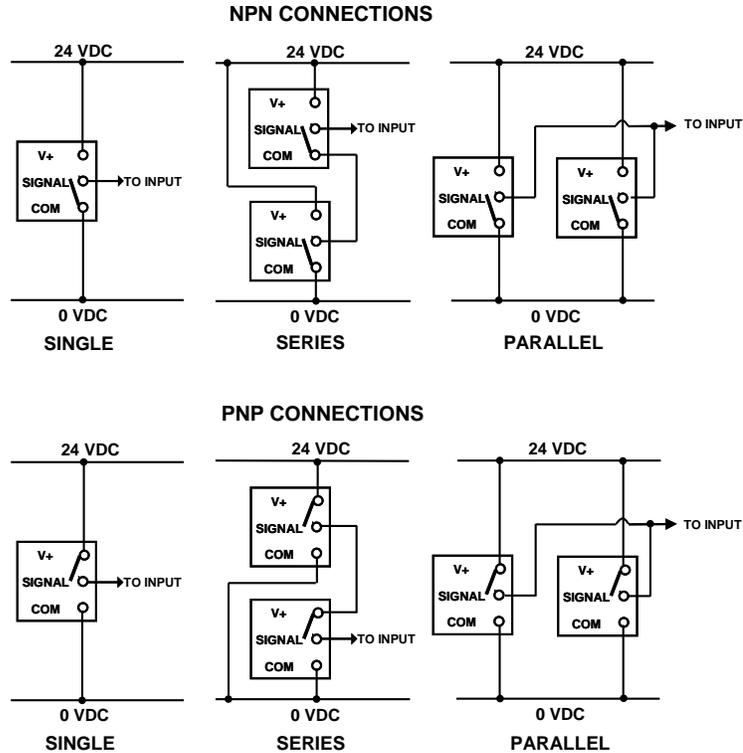
Figure 27: Wiring Sensors in Series and Parallel

3.3.4 Die Protection Channel Miscellaneous Settings Screen

Touch inside the miscellaneous settings area (see "a" in Figure 26) 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 28 is a typical example for an "In Position" channel. The following subsections describe the parameters that may show up in this screen.

3.3.4.1 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 28: Die Protection Channel Misc. Settings Screen

"Immediate Stop" and "Top Stop". See Section 2.1 on page 9 for details on these stop types. The user must select a stop type appropriate for the process.

3.3.4.2　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. Status" will show "Bypassed" in the detailed information area. In addition, the "Module Status" will display "One or More Channels Bypassed" highlighted in yellow.

3.3.4.3　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.

3.3.4.4　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 on 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.

3.3.4.5　Separation Time

This parameter is required for the "2 Part Detector Edge" and "2 Part Detector Pass" channel types and is can be used with the "Part Detect Anywhere" type. 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.

3.3.4.6 Increment Counter

This parameter is available for "Cyclic" and all "Part Detector" channel types. It is available only when a counter had been configured for sensor-based counting and selects which, if any, counter to increment when the sensor is detected.

3.3.5 Die Protection Channel Window Angles Setting Screen

Touch inside the window angle area (see "b" in Figure 26) 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 29 is a typical example of this 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.
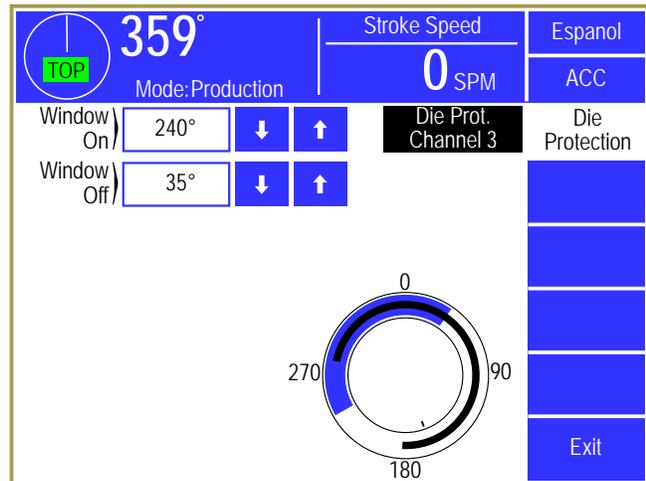
Figure 29: Die Protection Channel Angle Setting Screen

3.3.5.1 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" and "Part Detect Anywhere". 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.

3.3.6 Die Protection Bypass Screen

Press the Bypass softkey in the die protection main screen (see Figure 24 on page 33) to display the bypass screen as shown in Figure 30. This screen allows the user to bypass the die protection system as a whole, or just individual sensors.

3.3.6.1 System Bypass

If configured to allow System Bypass (see Section 4.5 on page 60), 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.
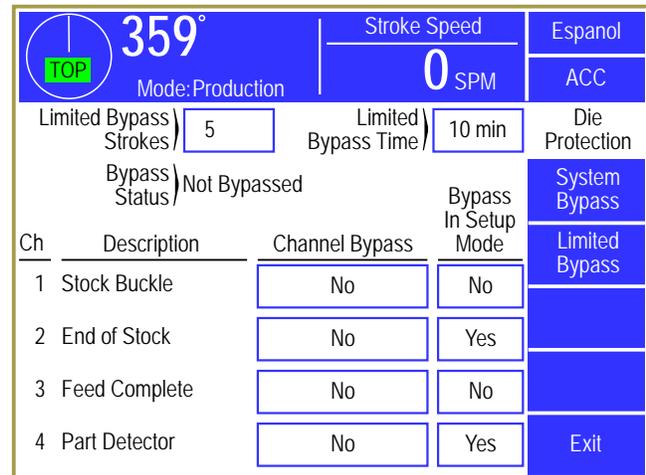
Figure 30: Die Protection Bypass Screen

When system bypass is active, the bypass softkeys change to a single Cancel Bypass softkey and the "Bypass Status" changes to "System Bypassed" with a yellow background. 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 setup mode to production mode. This is controlled by the "Auto Unbypass When Switching to Production Mode" parameter as described in Section 4.5.3 on page 60. The automatic un-bypass feature only removes the bypass when the press mode *changes* from setup mode to 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".

3.3.6.2   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 on page 60.

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 setup mode to production mode. This is controlled by the "Auto Unbypass When Switching to Production Mode" parameter as described in Section 4.5.3 on page 60. The automatic un-bypass feature only removes the bypass when the press mode *changes* from setup mode to 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.

3.3.6.3   Bypass In Setup Mode

Each individual channel 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 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 30, channels 2 and 4 set to automatically bypass in setup mode.

3.3.6.4   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 30 is the same as the "Bypassed" parameter that can be set in the miscellaneous settings screen (see Section 3.3.4.2 on page 39). It is repeated here for the convenience of setting all bypass parameters in one place.

3.3.7 Die Protection Diagnose Screen

Press the **Diagnose** softkey in the die protection main screen (see Figure 24 on page 33) to display the diagnostic screen as shown in Figure 31. 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 31: 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 state of the channel is displayed ("On" or "Off"). 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 stroke 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.

3.4 Limit Switch

The System 2600 can optionally support up to 8 programmable limit switch outputs.

3.4.1 Limit Switch Main Screen

If installed, touching the Limit Switch area of the main operator screen (see Figure 8 on page 21) 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 which in Figure 32 is channel 2). The currently selected channel can be changed by using the up

Figure 32: Limit Switch Main Screen

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.

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.

3.4.2 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 Previous Channel and Next Channel softkeys can be used page through the channels without going back to the Limit Switch main screen.
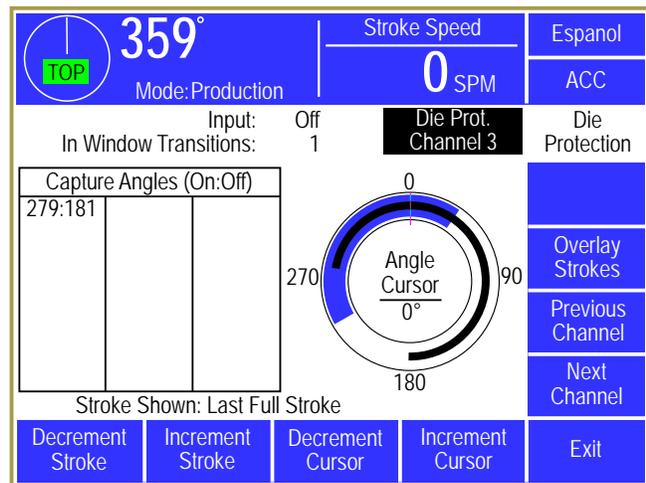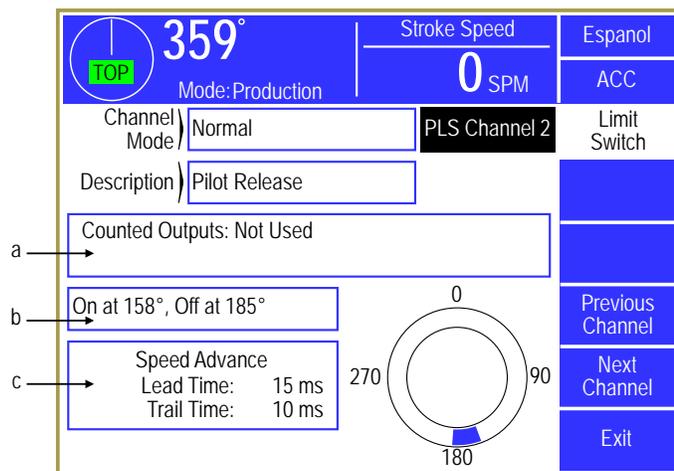

Figure 33: Limit Switch Settings Screen

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.

Timed Off   The Limit Switch output relay will turn on at a particular angle and will remain on for a programmable "On Time". 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:**   Timed Off channels can "re-trigger". 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.

Toggle   The Limit Switch output relay will turn toggle (turn off if it is currently on and on if it is currently off) at a particular angle. This is mostly used in conjunction with counted outputs so that the limit switch changes every so many strokes. For instance, this could be used to divert parts from one output bin to another every 1500 strokes. The press can continue production while the bin that was just switched away from is changed out with an empty bin.

The "Channel Description" can be selected from a set of names that have previously been entered by the user (see Section 4.7 on page 61 for details).

When the channel is in "Normal", "Timed Off", or "Toggle" 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 3.4.3).

When the channel is in "Normal", "Timed Off", or "Toggle" 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 3.4.4).

When the channel is in "Normal", "Timed Off", or "Toggle" mode, the channel can be speed advanced. Press inside the blue bordered angle area (see "c" in Figure 33) and the speed advance settings screen will be shown (see Section).

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.

3.4.3 Limit Switch Counted Output Settings Screen

When the channel is in "Normal", "Timed Off", or "Toggle" 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

3.4.3.1 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.

3.4.3.2 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.

3.4.3.3 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.

3.4.4 Limit Switch Angle and Time Setting Screen

When the channel is in "Normal" or "Toggle" 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" and "Toggle" channels the start of the blue area shows where the channel will turn "On" for the programmed time.
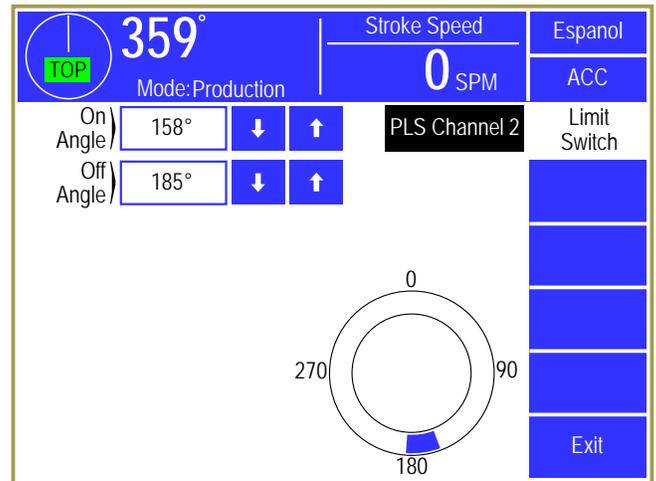
Figure 35: Limit Switch Angle and Time Setting Screen

3.4.4.1   On Angle

The "On Angle" is the angle in the stroke where the limit switch output should turn "On". If the "Channel Mode" is "Normal", then the "Off Angle" controls where the output will turn "Off". If the "Channel Mode" is "Timed Off", then "On Time" controls how long the output will stay "On". 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.

3.4.4.2   Off Angle

The "Off Angle" is only shown if the "Channel Mode" is "Normal". This is the angle 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.

3.4.4.3   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 the "On Angle".   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.

3.4.5   Limit Switch Speed Advance Settings Screen

When the channel is in "Normal", "Timed Off", or "Toggle" mode, it can be Speed Advanced.

Press inside the blue bordered speed advance area (see "c" in Figure 33) and the speed advance setting screen of Figure 36 will be shown.

Speed advance allows the limit switch output to adjust its turn on and turn off points based on the speed of the press and the mechanical reaction time of what the limit switch is controlling. The result of this is that things like pilot releases can be made to actually release at the same point over a range of press speeds.
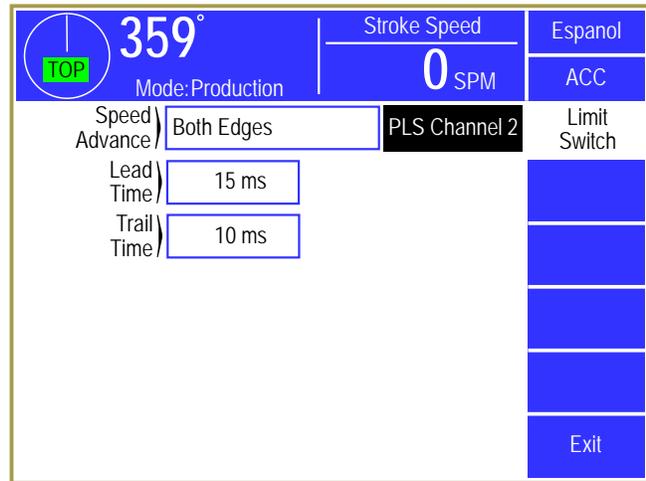
Figure 36: Limit Switch Speed Advance Screen

For instance, if a feed pilot release takes 85 milliseconds to actually mechanically release the material, then the "Lead Time" would be set to 85 milliseconds. In our example the "On Angle" for the limit switch channel is set to 160 degrees (the point where the release is supposed to occur). At 60 SPM the crank will travel about 31 degrees in 85 milliseconds and so the angle at which the system will actually turn the limit switch on will be 129 degrees (160-31). This will result in the material being mechanically released at 160 degrees, as intended. At 150 SPM the crank will travel about 77 degrees in 85 milliseconds and the system will actually turn the limit switch on at 83 degrees (160-77). Again, this will result in the material being mechanically released at 160 degrees, as intended.

The feed pilot release may take 80 milliseconds to "regrip" the material and so that is set as the trail time. The system will adjust the "Off Angle" based on this time in a similar manner as described above so that the mechanical action will occur at the intended angle.

The end result is that the process can be run at a higher speed than would otherwise be attainable.

3.4.5.1   Speed Advance

"Speed Advance" can be "Not Used", "Leading Edge", "Trailing Edge" or "Both Edges".

3.4.5.2   Lead Time

The "Lead Time" is the mechanical reaction time when the limit switch turns on.

3.4.5.3   Trail Time

The trail time is the mechanical reaction time when the limit switch turns off.

3.5   Counters

Touch the Counter display area in the Main Screen (see "b" in Figure 8 on page 21) to go to the counter screen.

The System 2600 can support 1 or 2 counter groups. A counter group includes a part counter, a batch (or bin) counter, and a scrap counter. The first counter group also has a quality counter, which is intended to allow the machine to stop every so many cycles for a quality check.

The present quantities of the part counter, batch counter, quality counter, scrap counter, and cycle counter can be viewed along with the limits of those counters that have them.
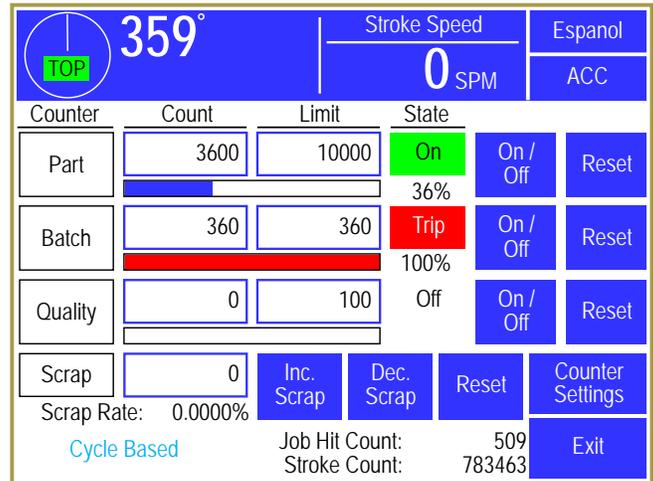
Figure 37: Counter Screen

If counters are configured for unrestricted access, anyone can change the counters and reset them. If configured for access control (described in section 3.1.7 on page 14), operators must use the selected access control method to make changes.

If only one counter group is enabled, which is typical, then the Counter screen shown in Figure 37 is what will initially appear. If 2 counter groups are enabled, then initially the screen shown in Figure 38 will appear. This will show an overview of the status of both counter groups. Pressing anywhere inside of the blue bordered counter group will then display the counter screen for that counter group as shown in Figure 37.

Counters can be driven by cycles of the machine (Cycle Based counters) or by sensors tied to a hardware input (Sensor Based counters). The counter drive mode is indicated in the lower left corner of the counter screen. As described in the
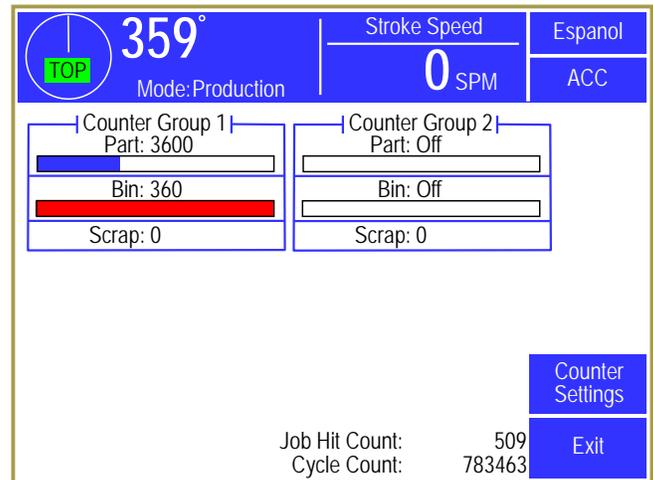
Figure 38: Counter Group Screen

following section, cycle based counters can also be configured to count by a set amount every so many cycles and each counter group can be separately configured for cycle or sensor-based counting.

3.5.1 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. Cycle based counter groups can also be set to increment by a particular value every so many cycles rather than incrementing by 1. To configure the counters, press the Counter Settings softkey in the counter screen of Figure 37.

A screen similar to Figure 39 will appear and allows each counter group to be set to cycle based counting, sensor-based counting, or not used. Hitting the Configure System softkey in this screen will bring up a screen with three settings –

Figure 39: Counter Configuration Screen

"Maximum Number of Counter Groups", "Enable 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 to 2 and will affect how many counter groups are shown in the screen of Figure 39. If "Enable True (Sensor Based) Part Counters" is set to "No", then "Sensor Based" will not be available to choose as 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 cycle based counters will count when a "setup mode" is active.

Counter groups that are set to "Cycle Based" also have a Configure button shown to the right of the group (as seen in Figure 39 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 job producing two parts per cycle would count by 2 every 1 cycle. The "Counter Frequency" is how often the counter should count. A lamination die might produce a part every 10 cycles. 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 cycles. For typical one-out jobs, both of these values would be 1, which would count by 1 every 1 cycle.

If a counter group is set to "Sensor Based" then it is driven by one or more die protection inputs. For those die protection channels types that have "Increment Counter" settings that are set to the counter group, the counter will increment when the channel senses a part.

3.5.2 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:** Cycle based Part, Bin, and Quality counters only count if turned "On" and only when not in "Setup Mode" unless "Count in Setup Mode" is set to "Yes" in which case they count in all modes. The cycle counter always counts in all 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 Batch 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.

3.5.2.1 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 3.1.7 on page 14) is being used that requires a password, a user must be configured to have the "Counter Settings" permission to change this parameter.

3.5.2.2 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 3.1.7 on page 14) is being used that requires a password, a user must be configured to have the "Counter Settings" permission to change this parameter.

3.5.2.3 Resetting Production Counters

A counter reset will set a production counter's current count to zero. If an access control mode (see section 3.1.7 on page 14) 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.

3.5.2.4 Scrap Counter

The scrap counter can be set, incremented, and decremented manually. If the Inc. Scrap key is pressed, then 1 is added to the scrap count and 1 is subtracted from the part and bin counters. Likewise, if the

Dec. Scrap key is pressed, then 1 is subtracted from the scrap count and 1 is added to the part and bin count. If the scrap count value is edited by pressing inside the blue bordered box showing the count, then the part and bin count is not affected. When the counter group is "Sensor Based", then the scrap count is incremented each time the corresponding scrap counter hardware input is triggered without affecting the part or bin count.

3.5.2.5   Changing the Count for Production Counters

The current count value of a production counter can be changed. If an access control mode (see section 3.1.7 on page 14) 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.

3.5.3   Cycle Counter

The cycle 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 cycle counter.

3.6   The Diagnose Screen

Pressing the Diagnose softkey in the main screen will bring up the diagnostic screen shown in Figure 40.   Some of the information in this screen is used by Link personnel for telephone troubleshooting, but the following items are of general interest:

Inputs 0 to-5 – Shows the status of the 5 inputs (I0, I1, I2, I3, I4, and I5) that are located at the bottom of the System 2600 enclosure. Depending on the configuration, these inputs can be used to indicate setup mode or other future uses. The text at left of each input will indicate its currently configured function.
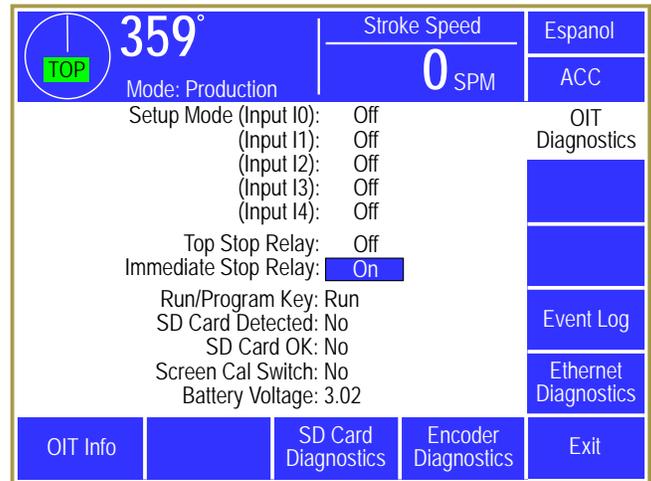
Figure 40: Main Diagnostic Screen

Top Stop Relay – Shows the On/Off status of the top stop relay. Note that "On" indicates the System 2600 is NOT asserting a top stop.

Immediate Stop Relay – Shows the On/Off status of the immediate stop relay. Note that "On" indicates the System 2600 is NOT asserting an immediate stop.

Run/Program Key – Show the position of the RUN/PROG key on the front of the operator terminal. Use this to verify that the key switch is operating correctly.

SD Card Detected and SD Card OK – These two lines show whether an SD Card is inserted into the SD Card slot of the operator terminal and, if inserted, whether the card has been successfully read.

Battery Voltage – The operator interface uses one CR2477 coin cell battery to maintain its calendar/time functions and a small amount of battery backed memory. This voltage of a new battery should be slightly more than 3 volts. This value will be shown in yellow when the voltage drops below 2.4 volts and in red when it drops below 2.19 volts. Most settings are stored in flash memory and are not lost when the battery fails, but some things that are updated very rapidly (like the current counter values) are written into battery backed RAM. If, after powering down and back up, the counter values are 0, then check this readout and replace the battery if needed.

3.6.1   Ethernet Diagnostics

Pressing the Ethernet Diagnostics softkey in the screen of Figure 40 will bring up a screen that shows information about the current state of the Ethernet connection.

> **NOTE:**   The Ethernet Diagnostics softkey and screen will only appear if the optional communications card is installed.

The information near the top of the screen shows the Host Name of the operator terminal and whether or not there is an active Ethernet connection. An active connection is when there is an Ethernet cable plugged into the Ethernet jack AND the other end of the cable is connected to an active hub or switch. Most of the other information shown on this screen are standard Ethernet settings that can be used by

information technology personnel to verify proper operation on the company network. In particular, the IP Address is often necessary to know to make connections to the operator terminal from things such as Modbus masters and from LinkNet data collectors.

3.6.2 SD Card Diagnostics

Pressing the SD Card Diagnostics softkey in the screen of Figure 40 will bring up a screen that shows information about any SD Card that is inserted in the SD Card connector, if any. For the most part the information displayed here is useful for Link personnel to use when troubleshooting over the telephone. The exception to this is the Backup / Restore softkey. See Section 6 on page 73 for information on backing up and restoring the terminal.

3.6.3 OIT Info Screen

Pressing the OIT Info softkey in the screen of Figure 40 will bring up a screen that shows information about the operator terminal hardware, and its software version.

3.6.4 Event Log

The System 2600 retains an event log which can be displayed by pressing the Event Log softkey in the screen of Figure 40. This log records the reason for the last 256 stops. All reasons for last stop that are generated by the System 2600 are recorded. Each entry in the event log contains the time, date, and the type of stop. The event log is illustrated in Figure 41. 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.
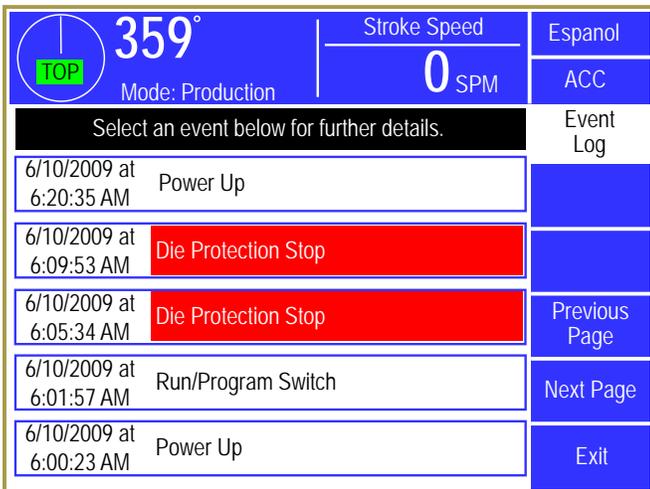
Figure 41: Event Log Screen
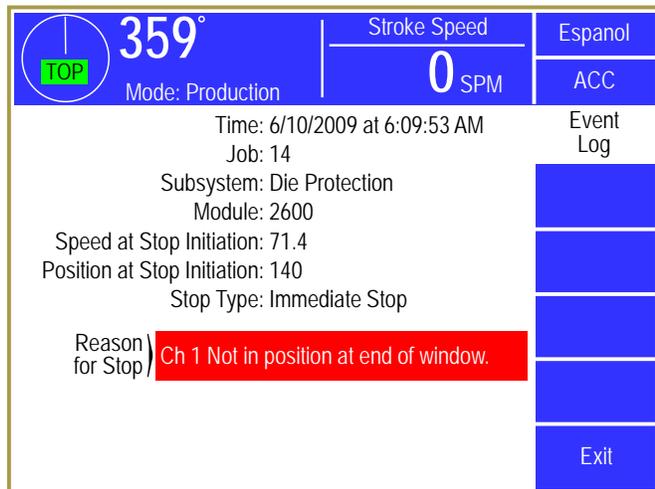
Figure 42: Event Log Detail Information Screen

Pressing a specific stop message will display more detailed information about the conditions that existed when the stop occurred as shown in Figure 42.

4 CONFIGURATION

4.1 The Main Configuration Screen

The configuration screens of the System 2600 are accessed by selecting the **Configure System** softkey in the main screen (see Figure 8 on page21) with the **RUN/PROG** keyed selector switch in the **PROG** position. The operator terminal will request entry of the configuration access code and upon correct entry will provide the configuration menu shown in Figure 43.

This screen provides access to the individual configuration screens discussed in the following sections.
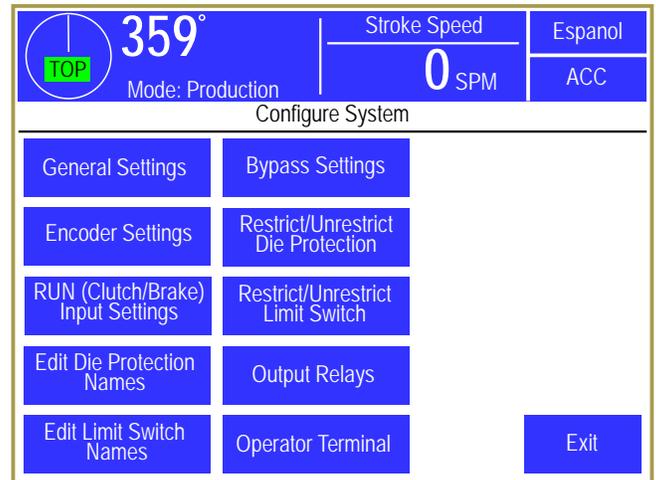
Figure 43: Main Configuration Screen

4.2 The General Settings Configuration screen

Press the **General Settings** softkey in the main configuration screen as shown in Figure 43 to display the screen shown in Figure 44 at right.

The following sections describe the settings in this screen.

4.2.1 Allow Speed Advanced Outputs

This parameter determines whether limit switch outputs can employ speed advance. If speed advance is not needed then set this to "No" and will eliminate some settings in the Limit Switch settings areas.
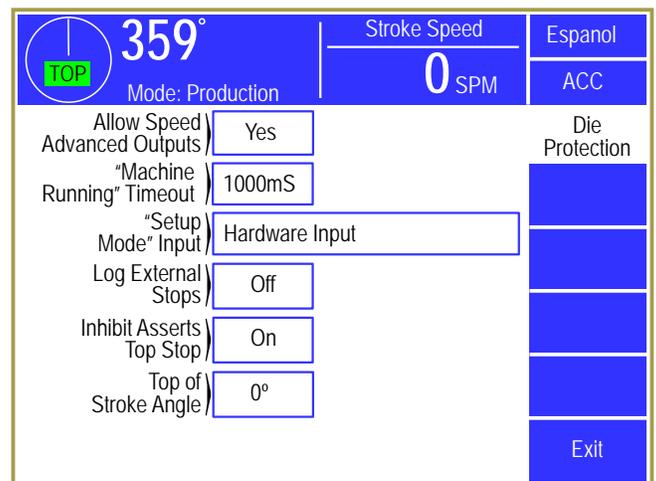
Figure 44: General Settings Configuration Screen

4.2.2 Machine Running Timeout

This parameter is used by the system to help determine when the press is considered to be running. When not using the "RUN" input to monitor the Clutch/Brake signal and the crank speed exceeds 3 SPM, the system is considered to be running and changing most settings is prevented. After motion drops below 3 SPM for longer than this time, the press is considered to no longer be running. In this case, the parameter should usually be set to 1000ms. If using the "RUN" input, this setting can be set at 100ms. One other use of this parameter whether "RUN" is used or not, is when the press is run in Single Stroke mode for production. In this case, you can set the parameter to slightly longer than the delay between strokes to maintain the "Running" status if using data collection software such as LinkNet or a 3rd party software monitoring the machine via Modbus.

4.2.3 Setup Mode Input

This parameter can be used to define how the system should detect that the press is in a setup mode, if desired. The setting "Operator Selected" will result in a **Toggle Setup Mode** softkey on the Main Screen, in order to allow an operator to easily inform the unit that the press is in a setup or production mode. The setting "Hardware Input" defines Input 0 as indicating that the press is in a setup mode when the input is switched to ground (ON). This input would typically be driven by an output from the press control, and allows automatic detection of a setup mode. The setting "Not Used" will cause the system to assume that the press is always in a production mode. Setup mode (if used), allows individual die protection channels to be automatically bypassed and un-bypassed.

4.2.4 Log External Stops

A stop is considered External when the press stops and the cause is not coming from the System 2600. Setting this parameter to "On" will cause these events to be recorded in the event log along with other internal stops.

4.2.5 Inhibit Asserts Top Stop

In most cases this setting should be set to "Yes".

Most stops triggered by the System 2600 are the result of captured conditions (such as a stock buckle sensor being triggered) that must be reset by the operator to clear. This allows transient conditions to be properly captured and diagnosed. However, some conditions, such as the RUN/PROG in the PROG position, self-clear when the condition is resolved – in this case putting the RUN/PROG switch back in the RUN position. This type of condition is referred to as a "Run Inhibit", or just an "Inhibit". In particular, the die protection channel type "In Position Inhibit" can be used to prevent stroking of the press until the logic is satisfied – at which point it self-clears. The typical case would be a very long feed length that can't complete in time to run the press continuously.

One complication is that some press controls have Top Stop inputs that also require a manual reset. If using "In Position Inhibit" on these controls it would stop the process on every stroke and require a manual reset on the press control by the operator. By setting this parameter to "No", inhibit conditions will not drop out the Top Stop relay. An output relay module can be added to the System 2600 that has a separate output for inhibit conditions. If supported by the press control, it can be tied into the control in such a way as to avoid resetting the press control on every stroke while preventing stroking if asserted. Note that even if a separate inhibit output is used, the Top Stop relay of the System 2600 must still be tied in the press control for actual latched Top Stop conditions!

4.2.6 Top of Stroke Angle

This setting allows the System 2600 to display "TOP" properly for Link Drive presses that have a top dead center point that is not 0 degrees. The graphical angle indicator in the top left corner of the screen will display "TOP" when stopped at plus or minus 5 degrees of the setting. For standard presses this should be 0 degrees. Note that this has NO operational effect at all - this is purely for operator convenience.

4.3   Encoder Settings Configuration Screen

Press the **Encoder Settings** softkey in the main configuration screen as shown in Figure 43 to display the screens shown in Figure 45.

4.3.1   Trigger Mode

This parameter is fixed as "Link 5100-11 Rotary Transducer" and cannot be changed.

4.3.2   Encoder Offset

This parameter is used at installation to set the zero position of the encoder at the top of the stroke. The offset can be entered directly, or the press can be positioned at the top of the stroke and Set Zero selected or at the bottom of the stroke and Set 180 selected. These softkeys will select the proper encoder offset value to make the current reading 0 degrees or 180 degrees respectively.

Figure 45: Encoder Settings Screen

4.3.3   Encoder Reversed

This parameter allows flexibility when mounting the crankshaft transducer by allowing it to turn counter-clockwise when the press is running in the forward direction if set to "Yes".

4.3.4   Crankshaft Hysteresis

This parameter controls how much in the opposite direction from the initial direction of travel the crankshaft must move before the system allows the reading to change or "go backwards". It is used to prevent false triggering of limit switch and die protection windows when the press is right on the edge of a window and the reading varies due to vibration and/or chain or coupler slack. 5.0 degrees is normally a reasonable value and this should only be changed if instructed by Link technicians.

4.4   RUN (Clutch/Brake) Input Settings Configuration Screen

Press the **RUN (Clutch/Brake) Input Settings** softkey in the main configuration screen as shown in Figure 43 to display the screens shown in Figure 46.

The System 2600 can optionally use a motion detection system to detect coupling failures that result in the encoder not being driven by the crankshaft. If encoder decoupling occurs, the system cannot perform its monitoring and control functions that depend on crankshaft angular position. The motion detector generates an immediate stop signal if it senses motion below the SPM (strokes per minute) configured in the
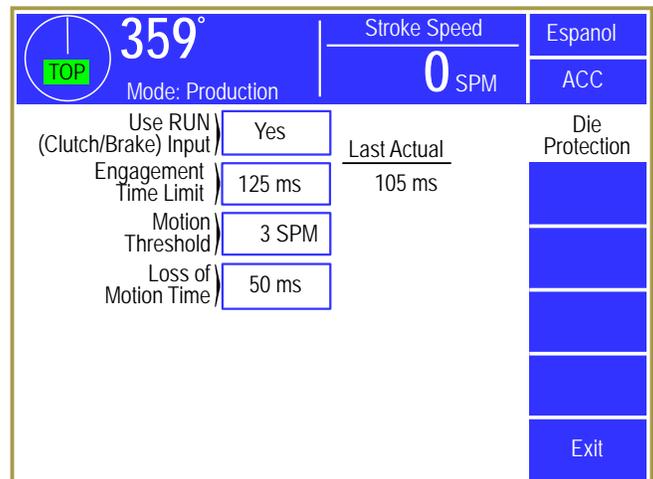
Figure 46: RUN Input Settings Screen

"Motion Threshold" setting for a period of time greater than the "Loss of Motion Time". The Loss of Motion Time setting is used to compensate for erratic motion on some geared presses where the gears cog back and forth as the press strokes, resulting in temporary dips below the Minimum Press Speed SPM setting.

4.4.1   Engagement Time Limit

When the press control sends an electrical signal to the clutch/brake valve(s) to start stroking the press, there is a time delay before the air flow (or hydraulic system on some presses) can push the clutch plates together and ramp up crank speed. Then the clutch plates slip until the equivalent flywheel SPM is reached. This is illustrated in Figure 47.

Every time a stroke is initiated in the forward direction, the press must establish a stroking speed greater than the "Motion Threshold" within the time set by the "Engagement Time Limit". Failure to do so will result in an immediate stop and the reason for last stop will display *Motion Did NOT Start*. This parameter can be set from 0 to 999 milliseconds.
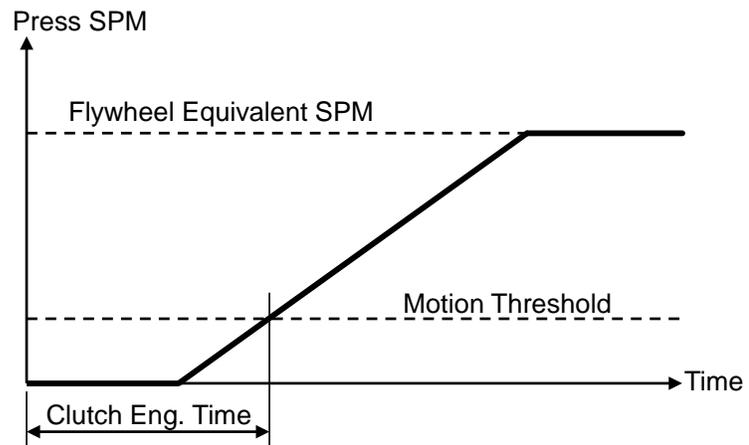
Figure 47: Clutch Engagement Time

In addition to detecting faults, the "Engagement Time Limit" provides useful diagnostic information relating to clutch wear. As clutch plates wear, the volume of air that must flow into and be stored in the clutch increases, which also increases the engagement time. The increased volume of air stored in the clutch also takes longer to flow out when the air valve dumps pressure to stop stroking, resulting in longer stopping times for the press. Most presses provide for adjustment or shimming to compensate for clutch wear. Exceeding the clutch "Engagement Time Limit" may indicate that clutch adjustment or shimming should be performed. When possible, it is preferable to adjust the clutch clearance to the press manufacturers recommended setting to determine the clutch engagement time with optimum clearance.

To determine the value to enter as the "Engagement Time Limit", first set the value to 999. This will prevent stops while the correct time is being determined. Then put the press in Single Stroke Mode and stroke the press several times. The "Last Actual" engagement time is displayed on this screen just to the right of the "Engagement Time Limit". Some margin for wear must be accommodated so that adjustment on a frequent basis is not necessary. A typical wear margin of 20% is usually sufficient. To determine the number to enter for the "Engagement Time Limit" with a 20% wear margin, take the longest time actual engagement time observed and multiply it by 1.2. For example, if the longest actual engagement time is 100 milliseconds, enter a value of 120 milliseconds (100 X 1.2 = 120) for the "Engagement Time Limit".

4.4.2 Motion Threshold

Press SPM must exceed the "Motion Threshold" after stroke initiation if the main motor is running in the forward direction (see Figure 47 for the relationship between "Engagement Time" and "Motion Threshold"). Failure to establish motion will result in an immediate stop and the reason for the last stop will display *Motion Did NOT Start*.

It must also maintain motion above this limit while the press is stroking (see also "Loss of Motion Time" and Figure 48).   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 250 milliseconds it will result in a stop and the present running status will display *Motion w/o Clutch Signal*.

This parameter can be set from 0 to 255 SPM and generally should be set 10% to 30% below the slowest normal stroking speed of the press.

4.4.3 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 a jerky motion, falling below the motion threshold for very brief periods of time. Figure 48 shows an exaggerated illustration of this. The "Loss of Motion Time" setting is chosen to prevent nuisance stopping by permitting press SPM to drop below the "Motion Threshold" for brief periods of time without the assertion of a stop.
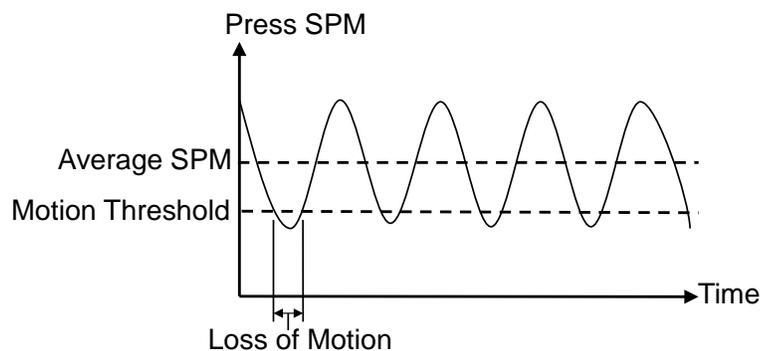
Figure 48: Loss of Motion Time and Motion Threshold

For typical applications this parameter should be set to:

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

For example, if the press maximum speed is 100 SPM, then this value would be set to:
3500 / 100 = 35 milliseconds

Like wise a press with a maximum speed of 20 SPM would be set to:
3500 / 20 = 175 milliseconds

NOTE:	If the loss of motion time value calculated by the formula is shorter than the time that motion can dip below the "Motion Threshold", loss of motion faults will result. If these occur, you may increase the time calculated by the formula but, in no case should this time be increased more than 2.5 times the value calculated by the formula.

4.5   Bypass Settings Configuration Screen

Press the **Bypass Settings** softkey in the main configuration screen as shown in Figure 43 to display the screens shown in Figure 49.

4.5.1   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 3.3.6.2 on page 41 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".

Figure 49: Bypass Settings Configuration Screen

4.5.2   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 by selecting this softkey. See Section 3.3.6 on page 40 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.

4.5.3   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 setup mode to production mode. This is intended to prevent the system from being inadvertently left in bypass when changing from setup mode to production mode.
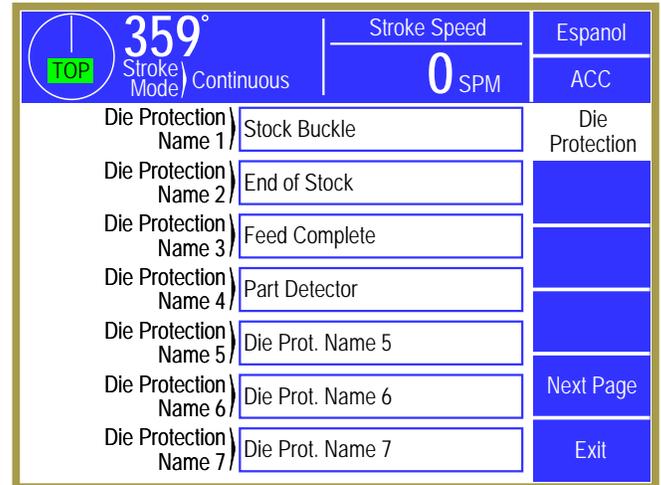
> **NOTE:**   The automatic unbypass feature only removes the bypass when the press mode *changes* from setup mode to production mode. Once in a production mode, any user who has been granted access to do so can again select a bypass.

4.6 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 Die Protection Names** softkey in the main configuration screen as shown in Figure 43 to display the screens shown in Figure 50. Use the **Previous Page** and **Next Page** softkeys to page through the entire list of 200 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.

Figure 50: Edit Die Protection Names Screen

359°	Stroke Speed
TOP Stroke Mode / Continuous	0 SPM

Die Protection Name 1: Stock Buckle
Die Protection Name 2: End of Stock
Die Protection Name 3: Feed Complete
Die Protection Name 4: Part Detector
Die Protection Name 5: Die Prot. Name 5
Die Protection Name 6: Die Prot. Name 6
Die Protection Name 7: Die Prot. Name 7

Espanol / ACC / Die Protection / Next Page / Exit

> **NOTE:** If a particular die protection name is changed in this screen, then all jobs with die protection channels set to that description will show the new description in its place.

4.7 Editing the Limit Switch 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 Limit Switch Names** softkey in the main configuration screen as shown in Figure 43 to display the screens shown in Figure 51. Use the **Previous Page** and **Next Page** softkeys to page through the entire list of 200 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.

Figure 51: Edit Limit Switch Names Screen

359°	Stroke Speed
TOP Mode: Production	0 SPM

Limit Switch Name 1: Stock Oiler
Limit Switch Name 2: Pilot Release
Limit Switch Name 3: Air Blow Off
Limit Switch Name 4: Feed Initiate
Limit Switch Name 5: PLS Name 5
Limit Switch Name 6: PLS Name 6
Limit Switch Name 7: PLS Name 7
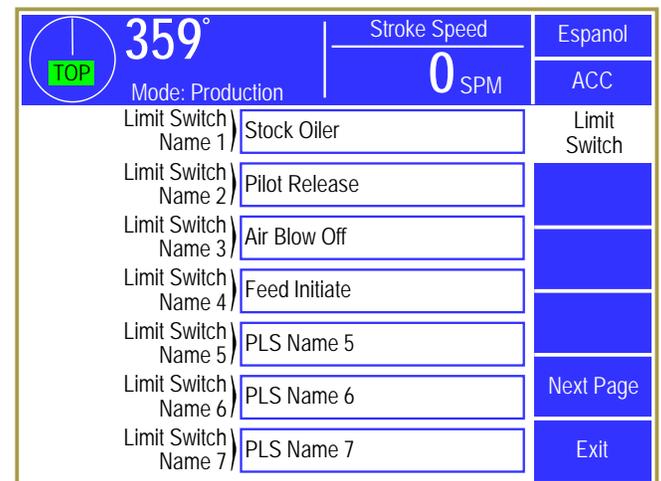
Espanol / ACC / Limit Switch / Next Page / Exit

> **NOTE:** If a particular limit switch name is changed in this screen, then all jobs with limit switch channels set to that description will show the new description in its place.

4.8 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 Die Protection softkey in the main configuration screen as shown in Figure 43 to display the screens shown in Figure 52. 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 52: Restrict/Unrestrict Die Protection Screen

NOTE: 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 the channel set again to restricted.

4.9 Restricting and Unrestricting Limit Switch 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 Limit Switch softkey in the main configuration screen as shown in Figure 43 to display the screens shown in Figure 53. 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 53: Restrict/Unrestrict Limit Switch Screen

NOTE: 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 the channel set again to restricted.

4.10 Output Relays Configuration

Two Programmable Limit Switch modules and one programmable Output Relay module can be optionally used with the System 2600. 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 section 7.5.8 on page 91 for connection information).

Press the **Output Relays** softkey in the main configuration screen as shown in Figure 43 to display the screens shown in Figure 54.

By pressing the blue bordered area next to each group of potential relay modules, each module can

Figure 54: Output Relays Configuration Screen

be configured to be "Not Installed" or "Installed". Since Output Relays are optional, depending on application, none or all modules may be installed for a given press.

When selected to "Installed", the System 2600 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 clear the error. 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 55: Output Relays Function Configuration Screen

If optional output relays OR 1-4 are installed, then a **Configure Functions** softkey is shown just to the

right of its setting (as in the example of Figure 54) that will display a screen similar to Figure 55. 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.

NOTE:	A given output relay type can be configured on more than one output relay if additional contacts of that type are needed. For instance, if more than one piece of auxiliary equipment needs independent contacts that indicate the system is in setup mode, then Type 7 could be selected for both "OR 1" and "OR 2".

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

Output Relay Functions	
Type Number	**Function**
Type 0	Not Used (Off)
Type 1	Turn On if Die Protection Bypassed
Type 2	Turn Off if Stroking Inhibited
Type 3	Turn Off if Top Stop
Type 4	Turn Off if Immediate Stop
Type 5	Turn Off if Any Stop
Type 6	Turn Off if Any Stop or Inhibit
Type 7	Turn On if in Setup Mode
Type 8	Turn On if Crank in Motion
Type 9	Turn On if Run/Prog Switch in Prog, Off in Run
Type 10	Turn On if Unit is powered
Type 11	Turn On if LinkNet Down Time Code is Active

4.11   Operator Terminal Configuration

The Operator Terminal configuration screen is accessed by touching the **Operator Terminal** softkey in the Main Configuration screen (see Figure 43 on page 55).

The screen shown in Figure 56 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.

Figure 56: Operator Terminal Configuration Screen

4.11.1   Top Area Display

The center section of the top display area can be configured to show the following items:

- Part Count
- Current Status
- Reason for Last Stop
- Total Tons
- Cycle Rate
- Press Speed (if using optional 5100-11 encoder)
- Distance to Bottom (if using optional 5100-11 encoder)

The displayed item can change when the stroking mode is changed. The user can chose the item that is to be displayed in Setup mode and the item that is to be displayed in Production mode.

Note also that touching the "top info area" in any screen 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.

4.11.2   Rod Length and Stroke Length

The "Rod Length" and "Stroke Length" shown in Figure 56 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.

4.11.3 Setting the Date and Time

The operator terminal contains a real time clock. To set the time and date, press the Set Date and Time softkey shown in Figure 56. The screen of Figure 57 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.
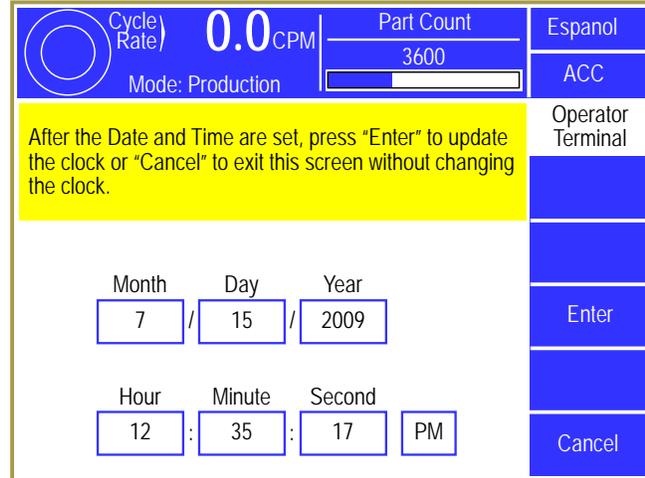
Figure 57: Date and Time Setting Screen

4.11.4 Access Configuration

As described in section 3.1.7 on page 14 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 56) will display the Access Configuration screen shown in Figure 58.

In addition to some basic parameters that determine how access control will work, this screen lists the
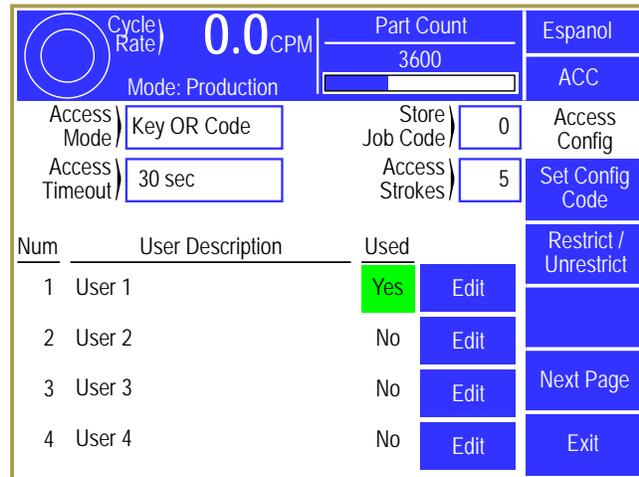
Figure 58: Access Configuration Screen

"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.

4.11.4.1 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 3.1.7 on page 14.

4.11.4.2 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 3.1.8.2 on page 16. 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).

4.11.4.3 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.

4.11.4.4 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 58) to display the User Configuration screen shown in Figure 59.

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.
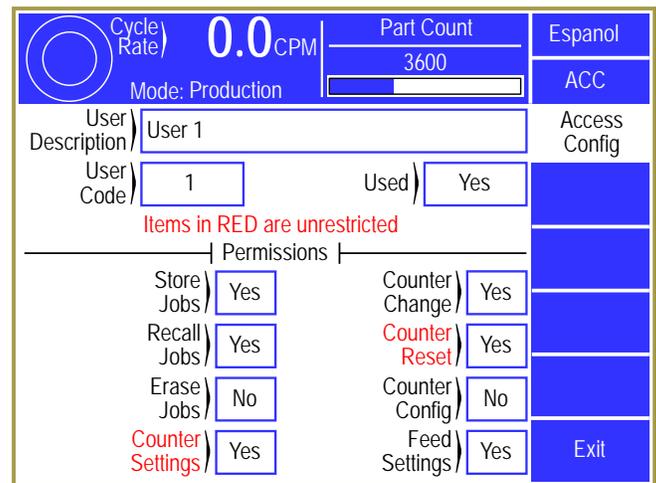
Figure 59: User Access Configuration Screen

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 3.1.9 on page 19. 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.

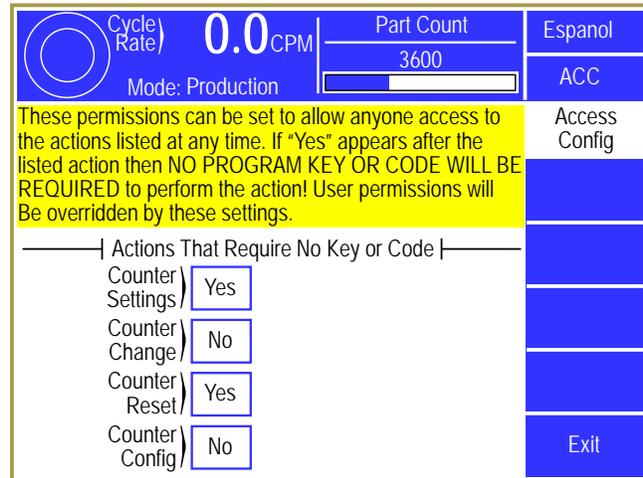### 4.11.4.5 Restrict/Un-Restrict Access

In addition to the user access system, certain items can be made available to any operator as shown in Figure 60. 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 60: Restrict/Unrestrict Screen

4.11.4.6 Setting the Configuration Code

Selecting the Set Config Code softkey in the Access Configuration screen, will display the Configuration Code screen shown in Figure 61. 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.
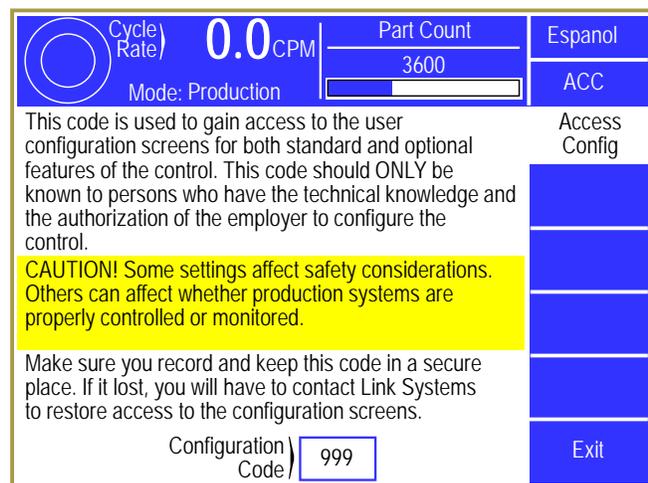
Figure 61: Set Config Code Screen

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 for a recovery procedure.

4.11.5 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 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.

5 JOB SETUPS

Touch the current Job display area in the Main Screen (see "a" in Figure 8 on page 21) to select the Job Setups screen shown in Figure 62. The parameters consisting of die protection settings, limit switch settings, part counters, scrap counters, 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).
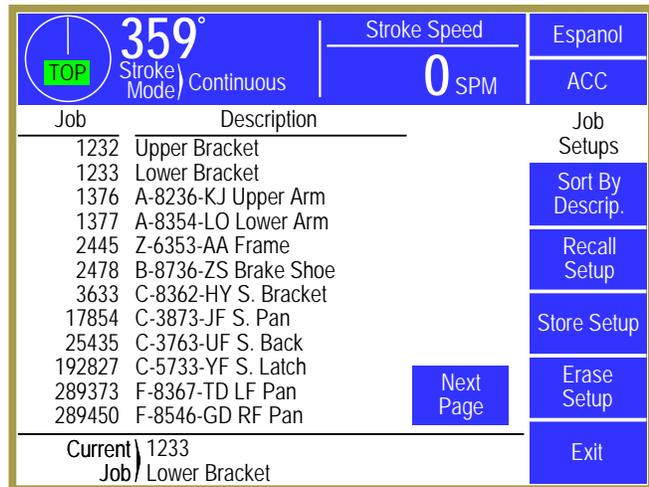
359°	Stroke Speed	Espanol
TOP Stroke Mode Continuous	0 SPM	ACC

Job	Description	Job Setups
1232	Upper Bracket	
1233	Lower Bracket	Sort By Descrip.
1376	A-8236-KJ Upper Arm	
1377	A-8354-LO Lower Arm	Recall Setup
2445	Z-6353-AA Frame	
2478	B-8736-ZS Brake Shoe	Store Setup
3633	C-8362-HY S. Bracket	
17854	C-3873-JF S. Pan	
25435	C-3763-UF S. Back	Erase Setup
192827	C-5733-YF S. Latch	Next Page
289373	F-8367-TD LF Pan	
289450	F-8546-GD RF Pan	Exit

Current Job: 1233 Lower Bracket

Figure 62 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.

5.1 Store Setup

From the Jobs screen shown in Figure 62, touch the Store Setup softkey to display the screen shown in Figure 63. 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 3.1.7 on page 14. 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 63 allows the user to enter a new number under which the job will be

359°	Stroke Speed	Espanol
TOP Stroke Mode Continuous	0 SPM	ACC

Job Number: 1233 — Store Setup

Job Description: Lower Bracket — Store Setup

WARNING!
Incorrect setups may cause damage and/or injury.

To store a job setup:
1) Program and verify all settings for this job setup.
2) Enter the job number for this setup.
3) Enter a job description for this setup.

Press "Store Setup" when ready.

Exit

Figure 63 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.
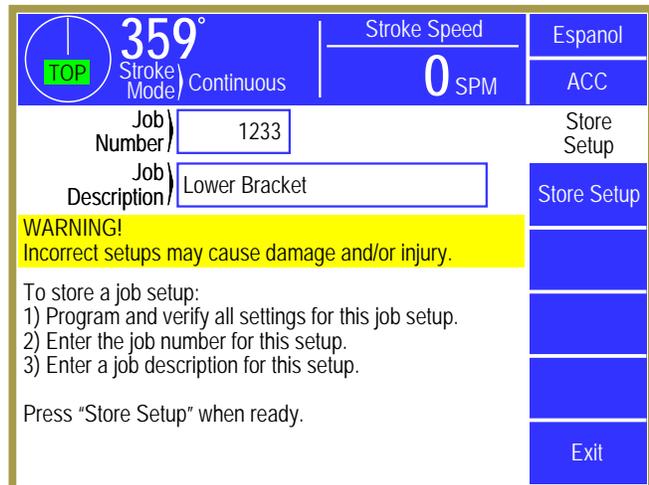
NOTE: The "Current Job" is actually a separate job in the operator terminal. Changes made to the current job are **NOT** automatically made to the stored job. The user must intentionally store the new settings over the old job number if those settings are to be saved permanently under that job number. 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).

5.2   Recall Setup

From the Job Setups screen shown in Figure 62, touch the Recall Setup softkey to display the Recall Setup screen shown in Figure 64. 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.
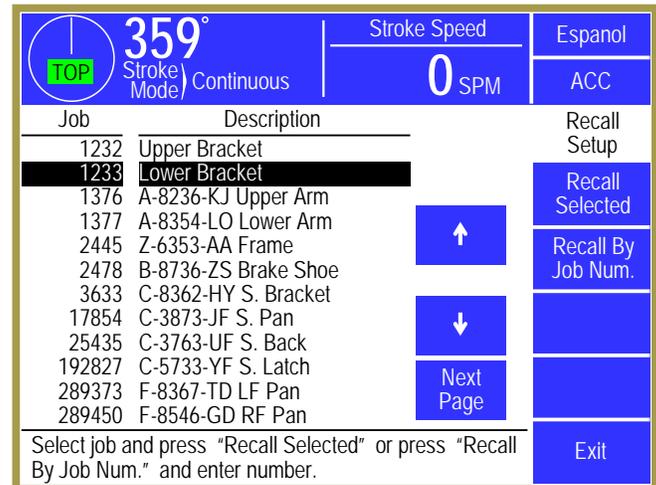
Figure 64 Recall Jobs Screen

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 3.1.7 on page 14. 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.

5.3   Erase Setup

From the Jobs screen shown in Figure 62, 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 3.1.7 on page 14. 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.

5.4   Data Storage

All settings are stored on the Micro-SD card located on the circuit board in the door of the unit. If necessary, the 2600-2 board (the board in the bottom of the enclosure) can be swapped between units and will still receive the proper settings for that press.

5.5   New Die Installation

In normal operating conditions, the job recall function is used to load the system with the settings and parameters for the die being used. However, when a new die is installed in the machine, these settings may not be defined. The settings presently in the unit remain in effect and may cause issues when the press is run. Carefully review the current settings and make needed adjustments before running the press. After the correct settings are established for the die, along with all other system settings, the present settings should be stored under a job number and description for recall later.

6   BACKING UP AND RESTORING THE SYSTEM 2600

The System 2600 stores its settings in its internal storage. This section is intended to give maintenance personnel the necessary procedures to back up and restore the memory to a secure digital card. Backups that are created can be used to restore the settings stored in the backup to the same unit, or to a different unit in cases where the original unit must be replaced due to damage.

A "secure digital" (SD) flash card is used to store the backup data. This type of flash card is commonly available from stores such as Radio Shack, Best Buy, Wal-Mart, Target, etc. Since a single backup will take up less than 64KB of space, even the smallest capacity SD cards will have more than enough space for backups. The location of the SD card slot is on the circuit board attached to door of the unit as shown in Figure 65.

6.1   Backup Procedure

To back up the unit, first go to the backup / restore screen. To get there:

- From the main screen (the screen shown when the unit is first turned on), press the Diagnose softkey.

- Press the **SD Card Diagnostics** softkey.

Figure 65: SD Card Location

- Press the Backup / Restore softkey. Note that this key will not appear unless the RUN/PROG key is in the PROG position.

- The unit will ask for the Configuration Code. Enter the code and the Backup/Restore screen will be shown.

The screen will indicate whether an SD card is present and, if so, whether there are any backup files on it.

To make a backup file:

- Press the Backup OIT softkey. Note that this key will only be present if the RUN/PROG key is in the PROG position AND an SD Card is inserted in the SD Card slot of the OIT.
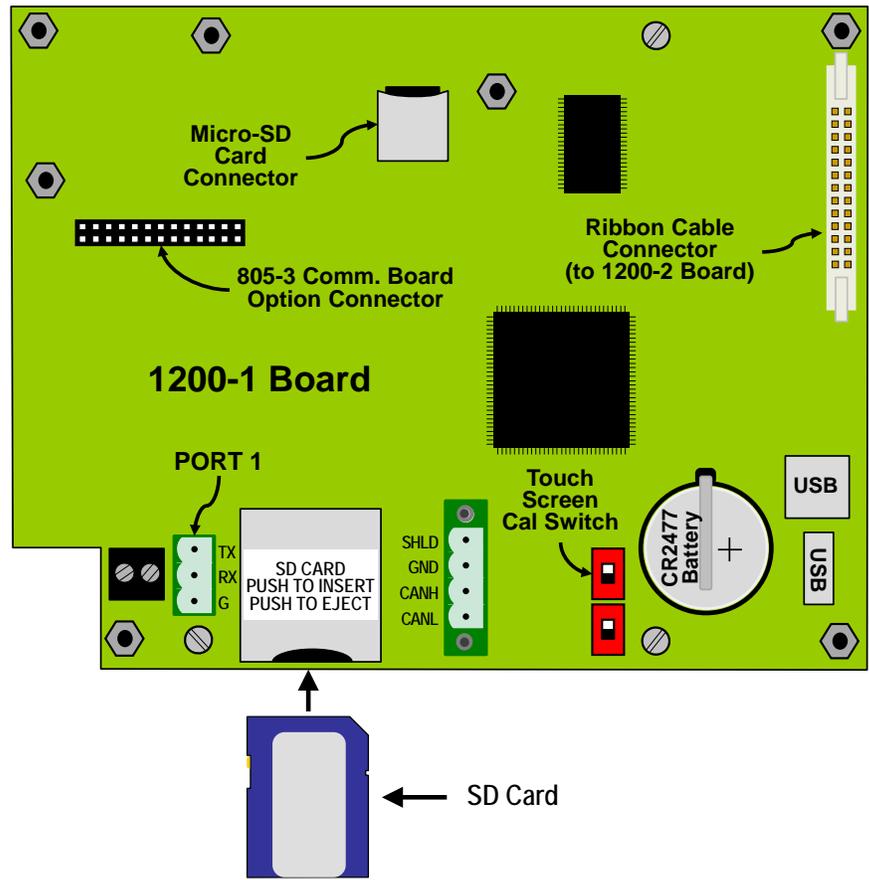
- A new screen will appear that will allow a short description of the backup to be entered. In addition to this, the serial number of the unit and the date and time (according to the OIT clock) will automatically be stored with the backup.

- This screen will also show a warning if a backup file for this unit is already present. Multiple units can be backed up on one SD Card, but only one backup file from *each* unit can be stored on a given card.

- After a description has been entered, press the Execute Backup softkey to start the backup.

- A progress bar at the bottom of the screen will indicate the status of the backup, and after completion a message will appear indicating the success or failure of the operation.

- Hit Exit to go back to the main backup / restore screen.

The main backup / restore should now indicate that is has found a backup file for this unit.

NOTE:	One SD Card can store backup files from many different units, but only one backup file from each *individual* unit can be stored on a card. To make multiple backups of a single unit, use a different card for each backup.

6.2   Restore Procedure

WARNING:	Unlike backups, which make no changes, a restore of a backup file will completely replace the settings and information contained in the unit. Make absolutely sure you restore the intended backup file!

To restore the unit, first go to the backup / restore screen. To get there:

- From the main screen (the screen shown when the unit is first turned on), press the Diagnose softkey.

- Press the **SD Card Diagnostics** softkey.

- Press the Backup / Restore softkey. Note that this key will not appear unless the RUN/PROG key is in the PROG position.

- The unit will ask for the Configuration Code. Enter the code and the Backup/Restore screen will be shown.

The screen will indicate whether an SD card is present and, if so, whether there are any backup files on it. The screen will also indicate whether there is a backup file that was originally made from the same operator terminal and/or whether backup files exist that were made from different operator terminals.

Backups made from the same unit show up in the main backup / restore screen. The user entered description is shown along with the date and time that the backup was made. To restore a backup file to the same unit that made it:

- From the main backup / restore screen press the Execute Restore softkey. Note that this key will not appear unless the RUN/PROG key is in the PROG position and an SD Card is inserted that has a backup file that was created from the same unit.

- A warning screen will appear that explains the original information in the unit will not be recoverable after the restore is started. Press the Execute Restore softkey in this screen and a progress bar at the bottom of the screen will show the progress of the operation. ***Do not remove power from the unit until the operation is finished.***

- Press the Exit softkey and the unit will reboot with the new settings.

Sometimes, such as when the original unit has been damaged, it may be necessary to restore a backup file made from a different operator terminal. To do this:
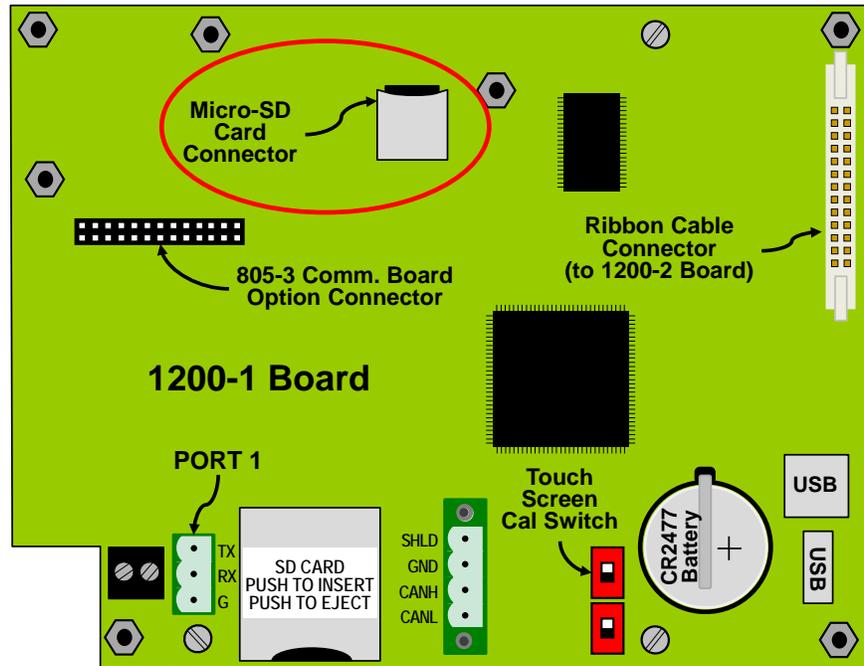
- From the main backup / restore screen press the View Other Backups softkey. Note that this key will not appear unless the RUN/PROG key is in the PROG position and an SD Card is inserted that has a one or more backup files that were created from different unit.

- A screen will appear with the backup files available to choose from. These files are listed with the serial number of the operator terminal that made them, the date and time they were made, and the user entered description of the backup. Select a file from this screen by pressing the name of the file to restore.

- A warning screen will appear that explains the original information in the operator terminal will not be recoverable after the restore is started. Press the Execute Restore softkey in this screen and a progress bar at the bottom of the screen will show the progress of the operation. ***Do not remove power from the unit until the operation is finished.***

- Press the Exit softkey and the operator terminal will reboot with the new settings.

6.3   Memory Swap-out Procedure

In cases where a unit is being swapped out with another, but there is no backup file available or the only one available is badly out of date, the Micro-SD card that contains the information stored on the unit may be moved to the new unit. Note that it will be necessary to remove the optional 805-3 communications board, if installed, to get access to the Micro-SD card.

Before starting this procedure, make sure all power is removed from both units.

Carefully remove the Micro-SD card from its connector on the circuit board. The connector opens by gently pushing it towards the

Figure 66: SD Card Location

top of the board (there will usually be a tactile "click") and then it will hinge up. The Micro-SD card can then be removed.

In the same manner, open the Micro-SD carrier on the new unit, remove the Micro-SD card that was in it, and place the chip from the original unit into the carrier of the new operator terminal. Close the connector and gently push down toward the bottom of the board. There will usually be a tactile "click" when the connector is seated properly.

After the Micro-SD card is installed, power up the new unit and verify that the settings are correct.

7 INSTALLATION

7.1 Preliminary Installation Considerations

The System 2600 comes in its own enclosure that should be located close to the machine control for easy access, keeping in mind that the operator will need to interact with the screen from time to time.

The wiring instructions for installation contained in this manual are necessarily generic since the unit may be interfaced with a wide variety of presses using multiple relay and electronic components. *If the installer has questions related to the proper installation of the system, contact the service personnel at Link Systems.* Always test each component of the system installation to see that proper function is obtained.

> **WARNING:** Improper system installation or improper interface from the System 2600 to the machine control may result in damage to the machine or other equipment and increase the possibility of injury to operators and others. Use qualified installers.

Installation of this system should be done in accordance with OSHA's lockout/tagout regulations (see CFR 1910.147). You will be mounting components on or near the machine, and may be exposed to mechanical hazards if machine movement should occur during mounting activities. Depending on the interface requirements to the machine control, you may also be wiring electrical circuits that will use 120VAC or 240VAC voltages. Unless these circuits are de-energized during wiring activities, a serious or even fatal shock may occur. Remove hazardous energy during system installation.
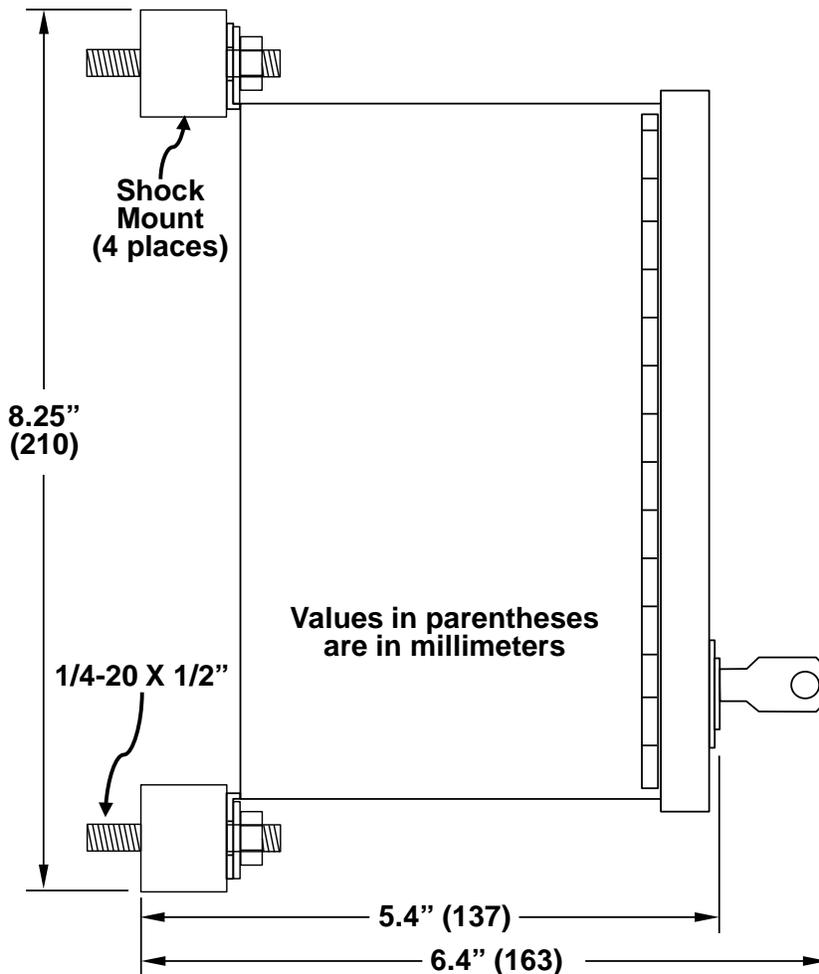
> **WARNING:** Failure to comply with CFR 1910.147 regulations and remove hazardous energy during installation of the Machine Monitor may result in serious injury or death! Use only qualified installers trained in lockout procedures for installation.
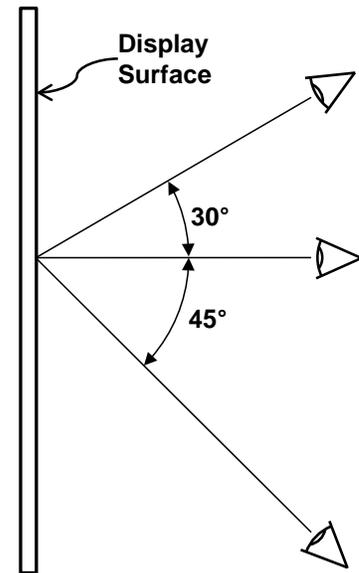
7.2   Mounting the System 2600

The System 2600 comes in an enclosure ready to bolt on to the machine.

Consideration should be given to the viewing angle of the operating personnel.   Figure 67 shows the most usable viewing angles for the LCD display used in the Link OIT - about 30 degrees "above" to 45 degrees below is preferable. Going further in either direction by about 20 degrees is possible, if absolutely necessary. Viewing the operator terminal from slightly "below" it generally results in the best display quality.

Also note that the door on the System 2600 enclosure opens to the left when viewing the unit from the front. Make sure the unit is mounted in a location that allows the door to open as access will be required for wiring and maintenance activities such as firmware updates.
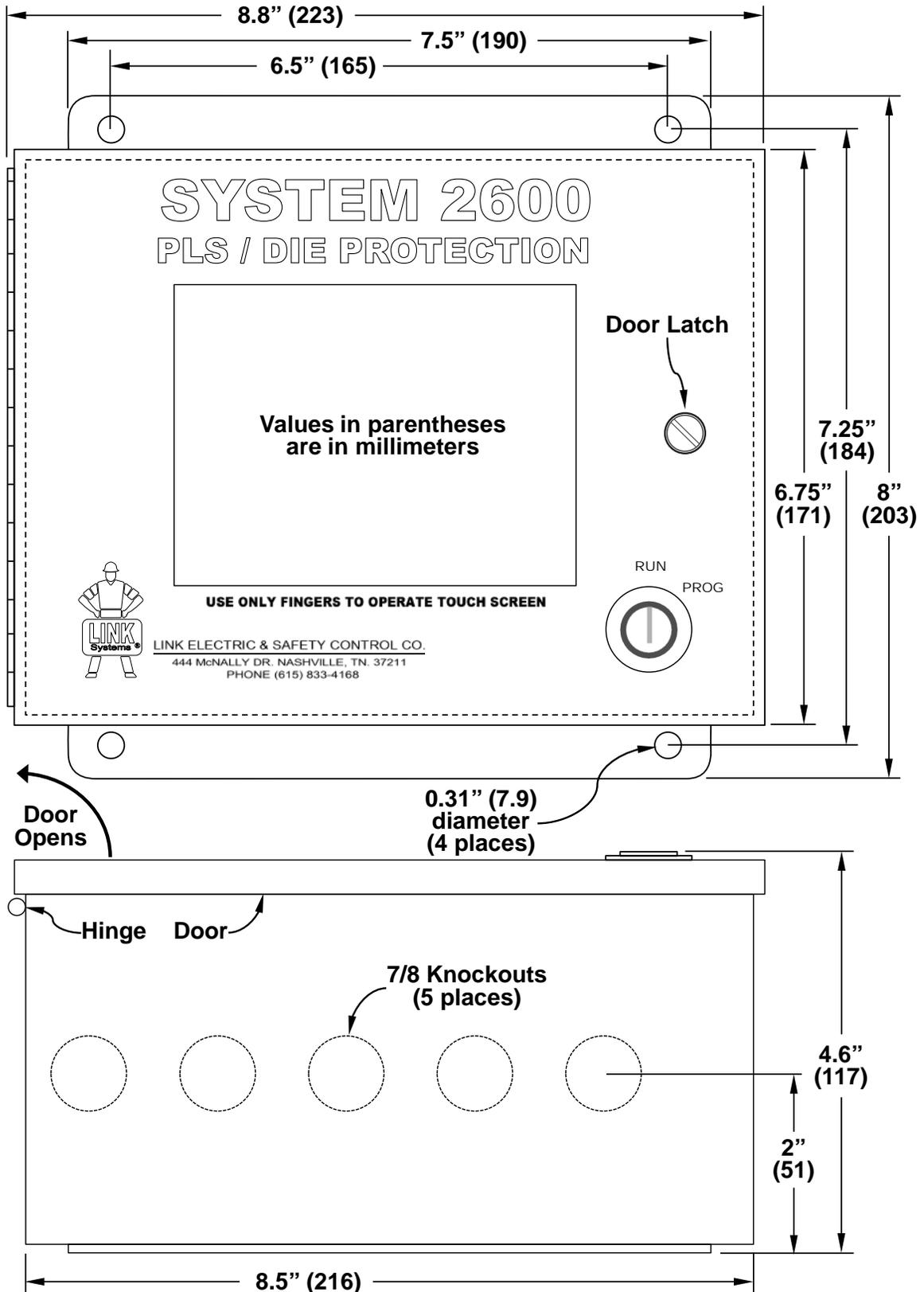
Figure 67: OIT Viewing Angles

The dimensions and mounting requirements for the System 2600 are shown in Figure 68 and Figure 69.

Figure 68 shows a side view when using the provided shock mounts which should be used when mounting the System 2600 to the press frame.

Five knockouts on the bottom side of the enclosure are provided that will accept 1/2 inch cord grip or Seal-Tite connectors. Power, Top Stop, and Immediate Stop connections should be wired through the knockout on the right. Strain gauge wires should not be routed along with any other signal.

Figure 68: Enclosure Dimensions Side View with Shock Mounts

Figure 69: Enclosure Dimensions

The following dimensions appear in the figure:

- 8.8" (223)
- 7.5" (190)
- 6.5" (165)
- Door Latch
- SYSTEM 2600
- PLS / DIE PROTECTION
- Values in parentheses are in millimeters
- 7.25" (184)
- 6.75" (171)
- 8" (203)
- RUN
- PROG
- USE ONLY FINGERS TO OPERATE TOUCH SCREEN
- LINK ELECTRIC & SAFETY CONTROL CO.
- 444 McNALLY DR. NASHVILLE, TN. 37211
- PHONE (615) 833-4168
- Door Opens
- 0.31" (7.9) diameter (4 places)
- Hinge
- Door
- 7/8 Knockouts (5 places)
- 4.6" (117)
- 2" (51)
- 8.5" (216)

7.3   Mounting the Encoder

The System 2600 requires a Link 5100-11 encoder to get angle information from the crankshaft or eccentric.

The encoder may be direct driven by a coupling off the center of the shaft or driven by a chain or timing belt as shown in Figure 70.

Chain and sprockets may have been purchased from Link Systems. If so, the sprockets will be 35B28 (28 teeth) and chain will be size 35 roller chain. Link suggests that, if the customer provides chain and sprocket, the same type be used. The electronic offset capability (see Section 4.3.2 on page 57) during calibration can correct mechanical misalignment.

Figure 70: Resolver Mounting to Shaft

A spring-loaded mounting base (see Figure 71) will be supplied when the encoder will be chain driven to maintain chain tension.

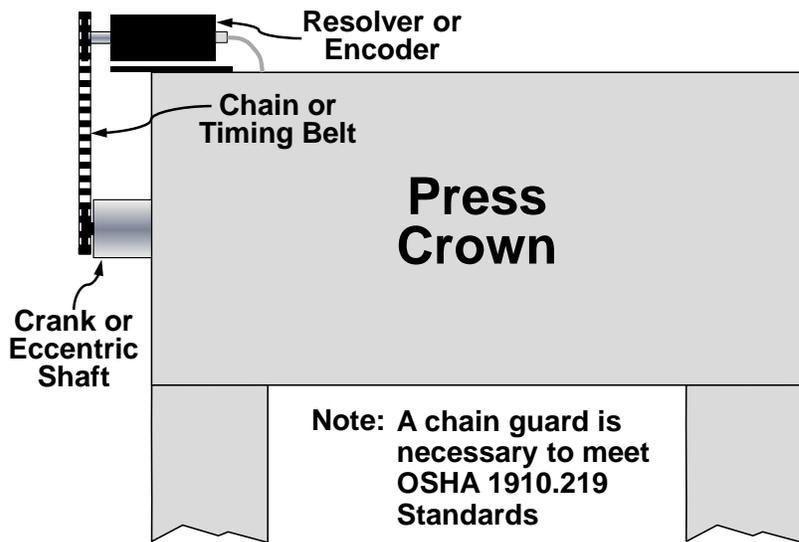**NOTE:** *The encoder must be driven on a one-to-one basis with the press.* That is, one stroke of the press must result in exactly one turn of the encoder. If you have a press that only provides access to an intermediate shaft or back shaft for connection of the encoder, you will have to determine how many turns this shaft makes for each turn of the crank or eccentric shaft. You must then use sprockets of different size, chosen to provide one turn of the encoder for one turn of the crank or eccentric shaft.
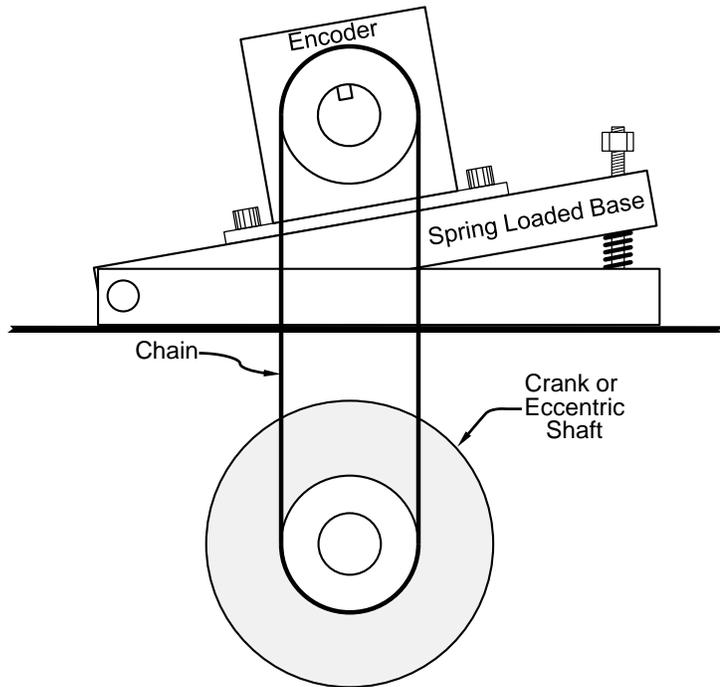
Figure 71: Encoder on Spring Base

The 5100-11 encoder shaft is 3/4 inches in diameter with a 3/16 inch wide by 1 inch long standard keyway. The sprocket attached to the 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.

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 inch 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 inch 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, it is not necessary for the zero position of the encoder to be aligned with the top dead center of the machine shaft. The system allows the user to program an offset value to make up the differences between the machine top dead center and encoder zero.

The following show dimensions for the 5100-11 as well as mounting dimensions when used in conjunction with the spring base.
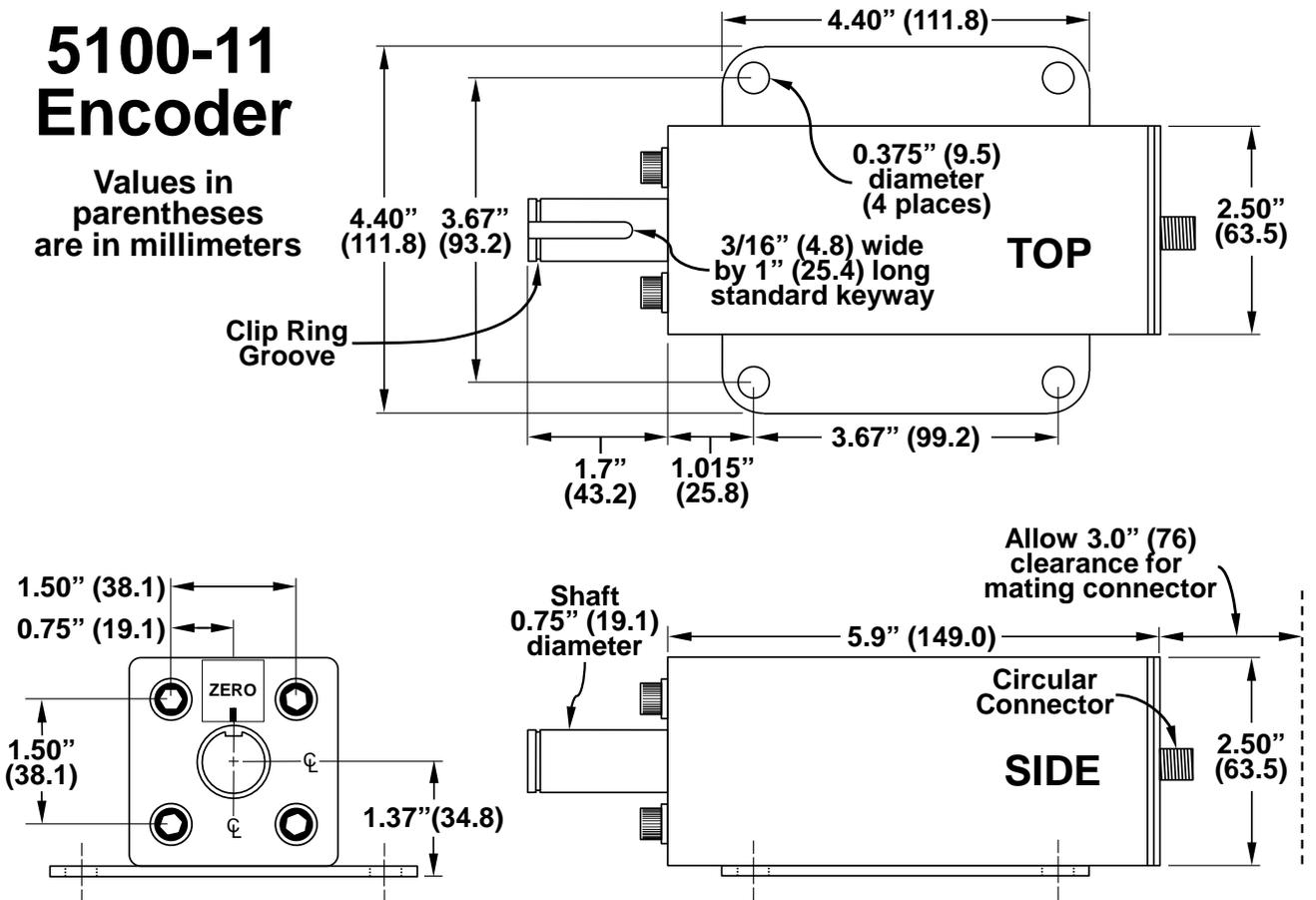

Figure 72: 5100-11 Encoder Dimensions

3" (76)
Clearance for connector

7.6" (193)

Shown at 50% spring base compression

Circular connector

4.9" (124.5)

3.5" (88.9)

Spring Base with 5100-11 Encoder

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)

Values in parentheses are in millimeters

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

3.5" (88.9)

3.75" (95.3)

3.25" (82.6)

4.0" (102)

4.3" (109.2)

4.5" (114.3)

4.65" (118.1)

100% Compressed
50% Compressed
0% Compressed

0% Compressed
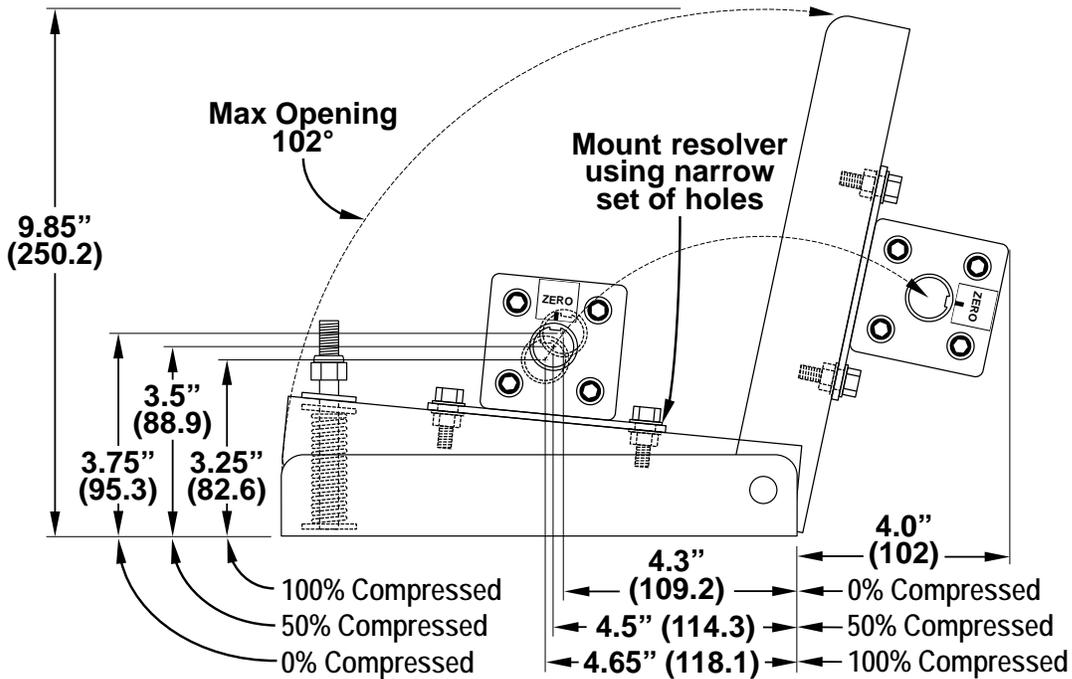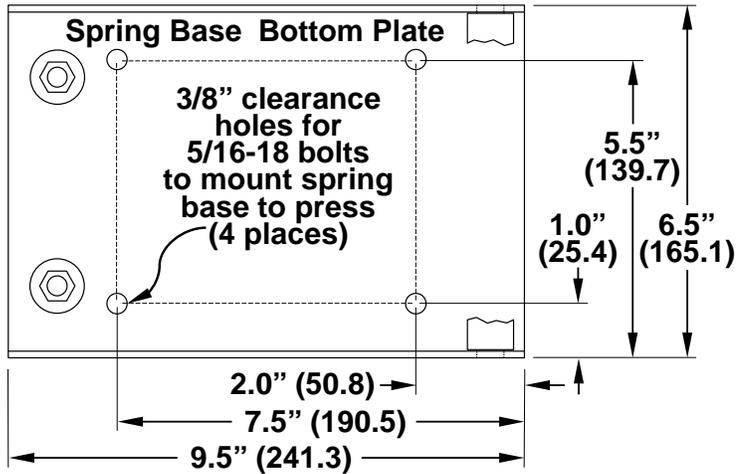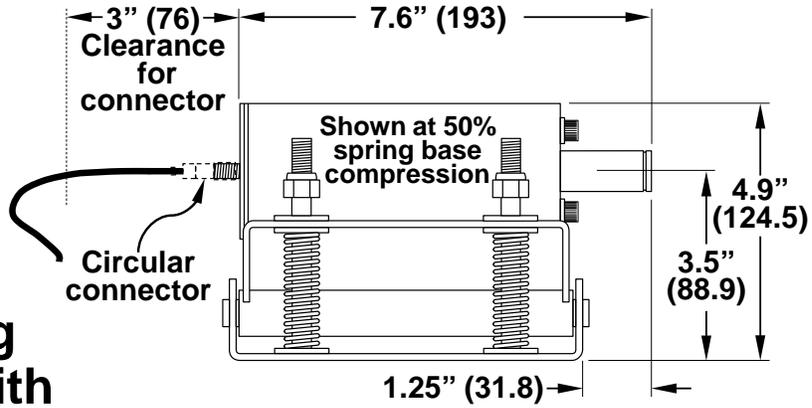50% Compressed
100% Compressed

Figure 73: Spring Base with 5100-11 Encoder Dimensions

7.4   Installing the 805-3 Communications Card

The optional 805-3 communications board mounts on the circuit board in the door of the System 2600 as shown in Figure 74. Carefully mate it to the matching connector on the 1200-1 board and secure it with 3 6-32 X 1/4" screws.

If properly installed, the System 2600 will automatically detect the board. A quick check is to see if the Ethernet Diagnostics softkey is present in the main diagnostics screen as shown in Figure 40 on page 53. Pressing that key will bring up a screen that shows the state of the Ethernet connection, the MAC address of the unit, and other diagnostics related to this board.
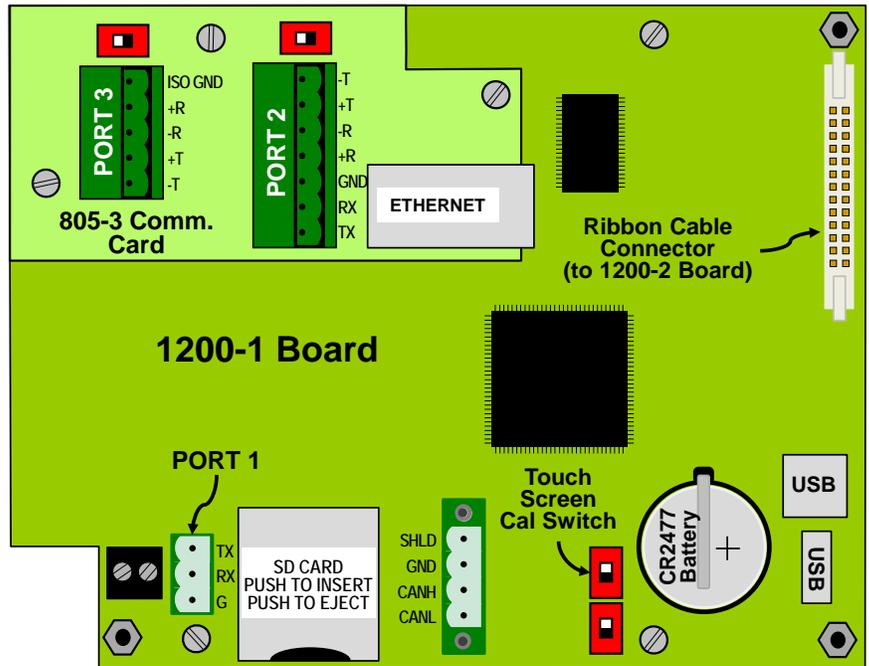

Figure 74: 805-3 Comm. Board Mounting

7.5   System Wiring

7.5.1   Conduit Runs

Wiring for the System 2600 should generally be run in conduit. The use of flexible liquid tight conduit with ground is suggested, but hard conduit can also be used. Figure 75 shows some of the typical conduit runs that may be required.

The conduit runs that will or may be needed, depending on the options purchased and features used on the System 2600 are:

- Conduit from the 5100-11 encoder to the System 2600.

- Conduit for 120VAC or +24VDC to power the System 2600. Often it will be most convenient for this to come from the control enclosure in which case the Top Stop and Immediate Stop connections between the System 2600 and the press control can also go in that run.

- Conduit for 120VAC or +24VDC to power the Model 2620 Sensor Interface, if used. Often it will be most convenient for this to come from the control enclosure.

- Conduit for the Top Stop and Immediate Stop connections between the System 2600 and the Press Control if run separately from the power.

- Conduit for low voltage connections between the System 2600 and the Press Control. This would be for connections such as programmable limit switch control cable and wiring for the setup mode input. Some of these may be optional connections and may not be used depending on application.

- Conduit for serial or Ethernet connections to the System 2600 for Serial Feed Interface, LinkNet or Modbus communications, if needed.

> **NOTE:**   Do not run both 120VAC and lower voltage circuits in the same conduit from the System 2600 to the press control. If you have both 120VAC circuits and low voltage circuits, run them in separate conduits as shown in Figure 75.
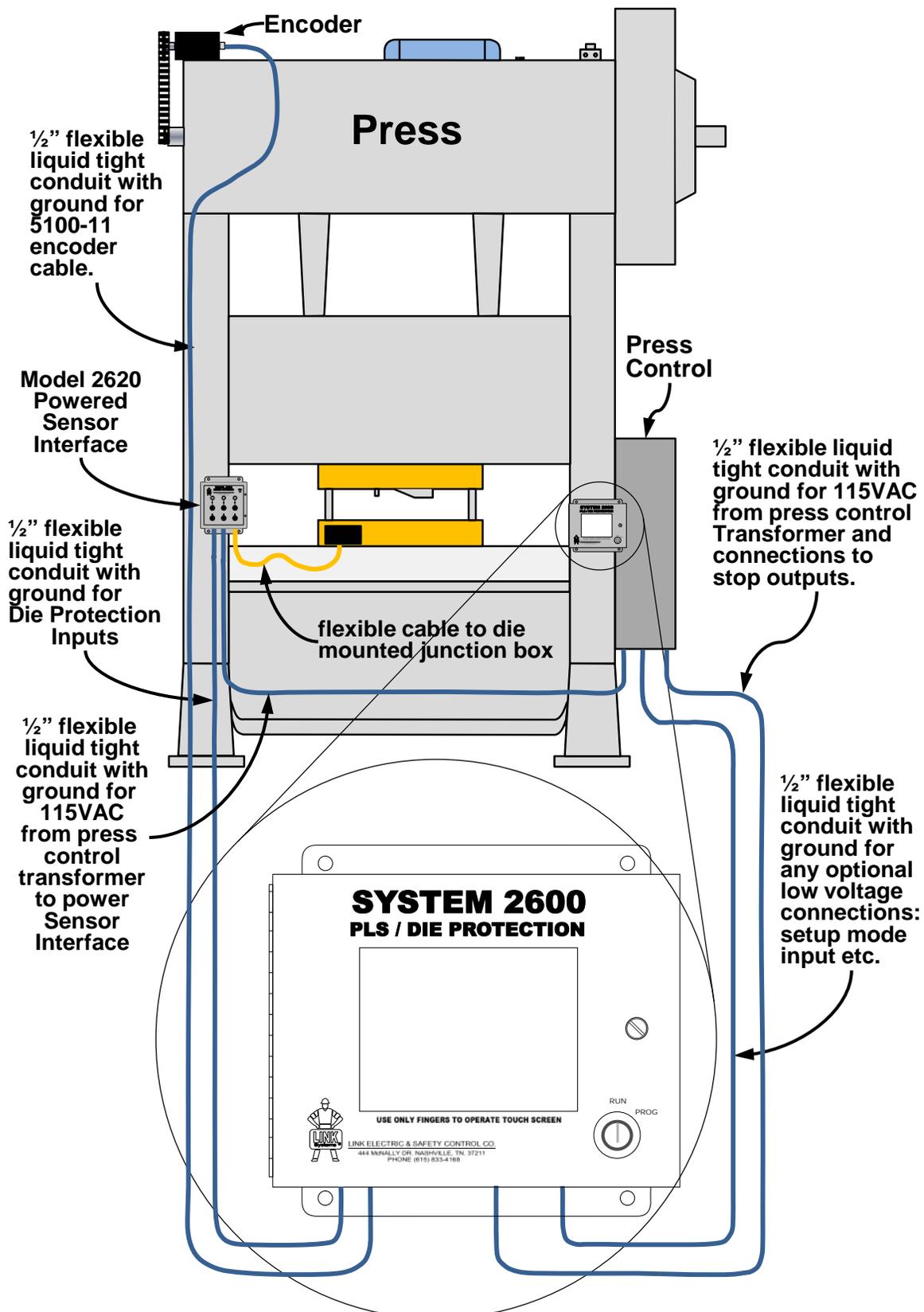
Figure 75: General View of Wiring Runs for Installation

Labels within the figure:

Encoder

½" flexible liquid tight conduit with ground for 5100-11 encoder cable.

Press

Model 2620 Powered Sensor Interface

½" flexible liquid tight conduit with ground for Die Protection Inputs

½" flexible liquid tight conduit with ground for 115VAC from press control transformer to power Sensor Interface

flexible cable to die mounted junction box

Press Control

½" flexible liquid tight conduit with ground for 115VAC from press control Transformer and connections to stop outputs.

½" flexible liquid tight conduit with ground for any optional low voltage connections: setup mode input etc.

SYSTEM 2600
PLS / DIE PROTECTION

USE ONLY FINGERS TO OPERATE TOUCH SCREEN

RUN PROG

LINK ELECTRIC & SAFETY CONTROL CO.
444 McNALLY DR. NASHVILLE, TN. 37211
PHONE (615) 833-4168

7.5.2 Wiring Power for the System

> **WARNING:** National Codes and standard (NEC, VDE, BSI, etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection, and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

The System 2600 can be powered from 120VAC, 240VAC, or +24VDC. +24VDC is sometimes used when building low voltage panels for Arc Flash compliance.

Pull wires with the appropriate color code in conduit between the System 2600 enclosure and the press control. Remember to run high voltage wiring in one conduit and low voltage wiring in a separate conduit.

The control transformer in the press control will preferably be used to supply the 120VAC power for the System 2600. Make sure the control transformer will be able to supply the necessary power (about 17VA or 0.15 Amps at 120VAC). If not, an additional control transformer will be needed.

> **WARNING:** The System 2600 can be powered from **EITHER** 100-240 VAC **OR** +24VDC. **Never** hook up both AC and DC power at the same time. The +24VDC power input is provided to allow low voltage for Arc Flash compliance.
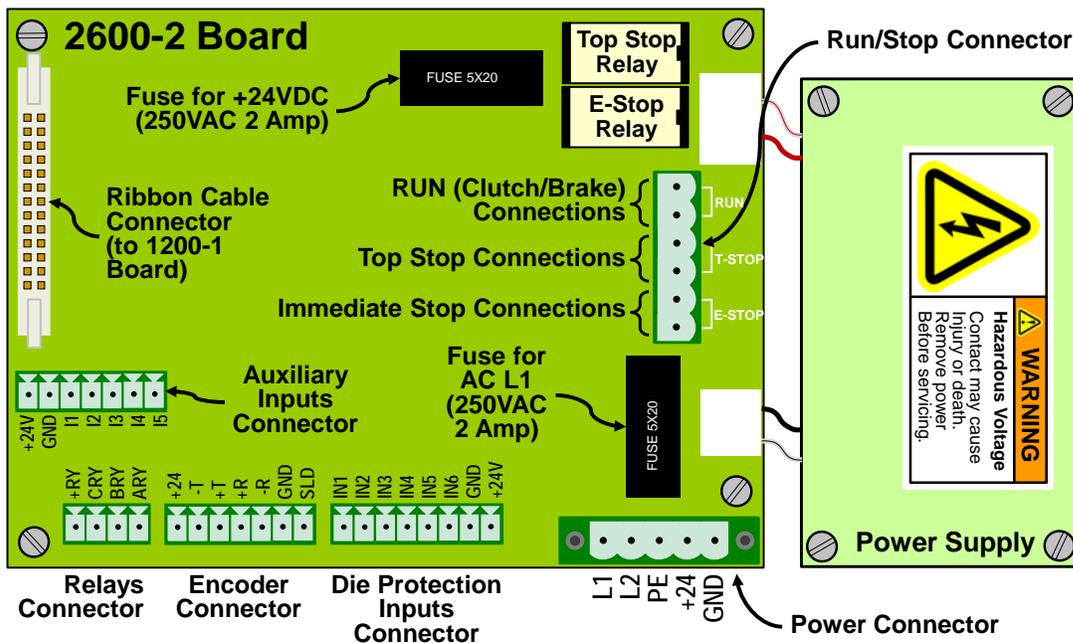

Figure 76: 2600-2 Board Connections

When using AC Power, use the L1, L2 and PE terminals (See Figure 76).

When using +24VDC Power, use the +24, GND, and PE terminals.

The power wiring should be at least 16 GA.

There is an amber LED indicator which indicates that an internal power supply is functioning. This indicator should always be lit as long as power is on.

> **NOTE:** *PE (Protective Earth) should be grounded when using AC or DC power.* It is the only connection used with either power source.

Power Connections for the System 2600 (See Figure 76 for Power Connector Location)	
L1	90-260 VAC Line 17 VA (0.15 Amp at 120 VAC)
L2	90-260 VAC Neutral
PE	Protective Earth *(used with both AC and DC input power)*
+24	+24VDC +/- 10% Input Power (0.4 Amps)
GND	Ground - +24VDC Return

7.5.3   Wiring the Stop Outputs

Normally open electromechanical relay contact outputs are provided for sending stop signals to the press control. See the "Run/Stop Connector" on Figure 76 for the location of the connector. A separate Top Stop output (T-Stop, terminals 3 and 4) and Immediate Stop output (E-Stop, terminals 1 and 2) are provided. Each output is rated for a maximum of 250VAC or 30VDC at 5Amps, and is NOT fused internally.

Figure 77 shows the connector pint numbers of the stop connector and the way the relay contacts are arranged.
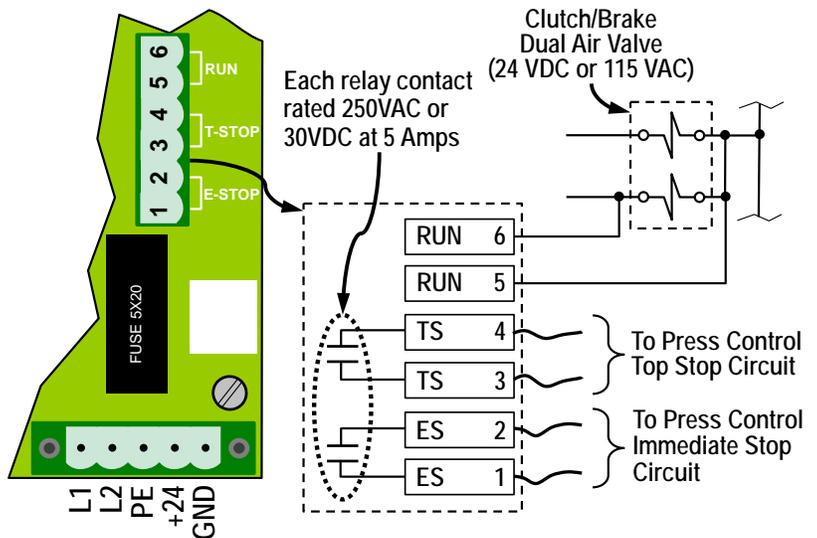
Figure 77: Breakaway of Run/Stop Connector

Pull the wires in the appropriate conduit (low or high voltage depending on the circuit voltage) between the System 2600 enclosure and the press control.

7.5.4   Wiring the RUN (Clutch/Brake) Input

In the case of Mechanical Presses, the System 2600 can optionally use a signal from the press clutch/brake control that indicates when the press clutch is engaged (the press is stroking). This signal is derived from the voltage across the dual air valve solenoid (in some cases a hydraulic valve may be used) that controls stroking and may be 24VDC or 120VAC.

Two wires must be pulled through the appropriate conduit (low or high voltage depending on valve solenoid voltage) between the press control and the System 2600. On the press control end the wires must be connected to opposite sides of one solenoid of the dual air valve as shown in Figure 77. On the System 2600 end, the wires must be connected to terminals 5 and 6 of the "Run / Stop Connector" (See Figure 76 to locate this connector). *Note that the RUN input connections are NOT polarized, either side of the air valve can be connected to either RUN input connection.*

Some presses have a single dual air valve that operates both clutch and brake. Others have two dual air valves, one for the clutch and one for the brake. *When two dual air valves are used, always wire to a solenoid for the valve that controls the clutch.*

7.5.5 Wiring the 5100-11 Rotary Transducer

The 5100-11 encoder is used with the System 2600 to provide crankshaft angle and speed.

A standard M12-8 cordset is used to connect to the encoder and should be run in conduit.

Figure 78 shows how the M12-8 cordset should be wired to the System 2600 encoder connector.
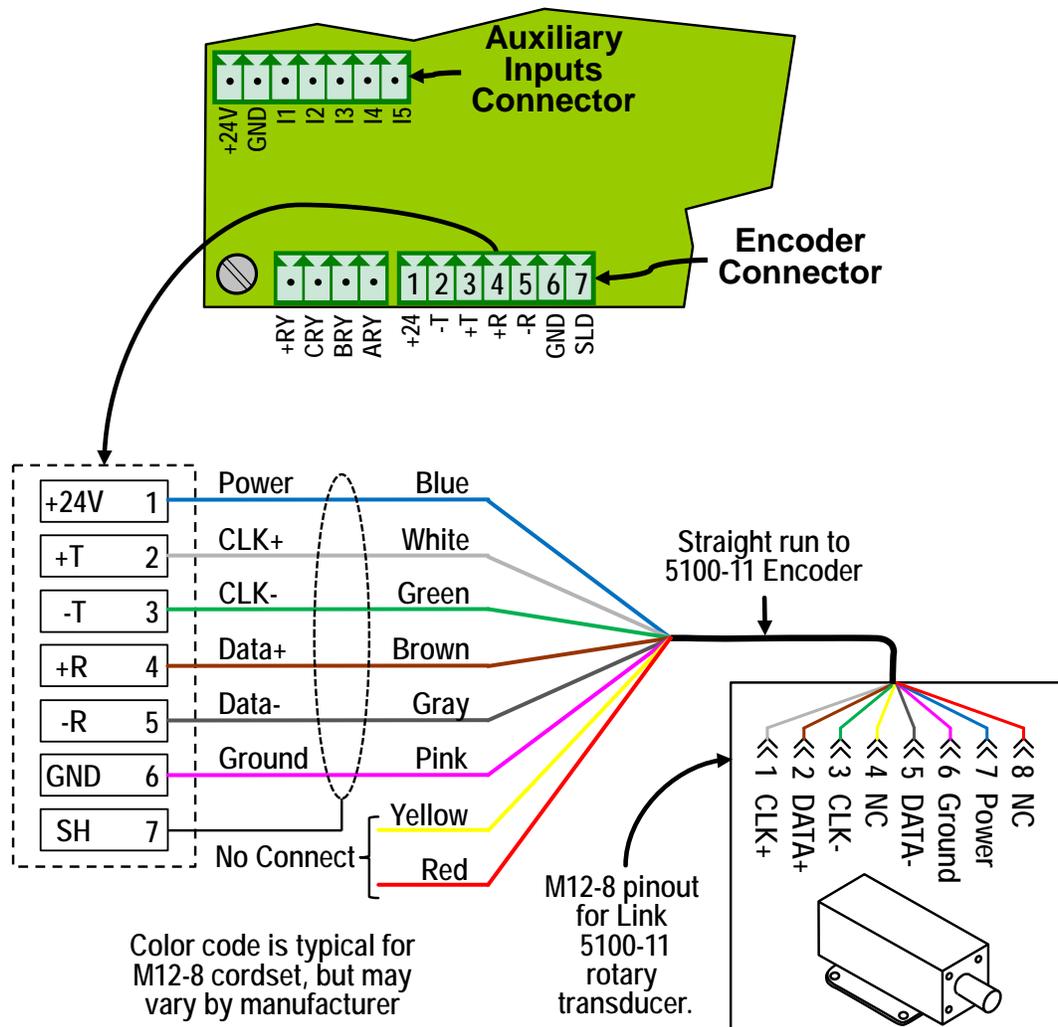
Figure 78: 5100-11 Encoder Connections

7.5.6 Wiring the Auxiliary Inputs

Auxiliary Inputs 1, 2, 3, 4, and 5 are internally pulled up to the internal +24VDC power supply. An input is switched "On" when it is connected to ground. A ground terminal is provided for field connections.

At present only I1 has a defined use, which is a hardware input from the press control indicating it is in a setup mode when the input is grounded as shown in the Figure at right.
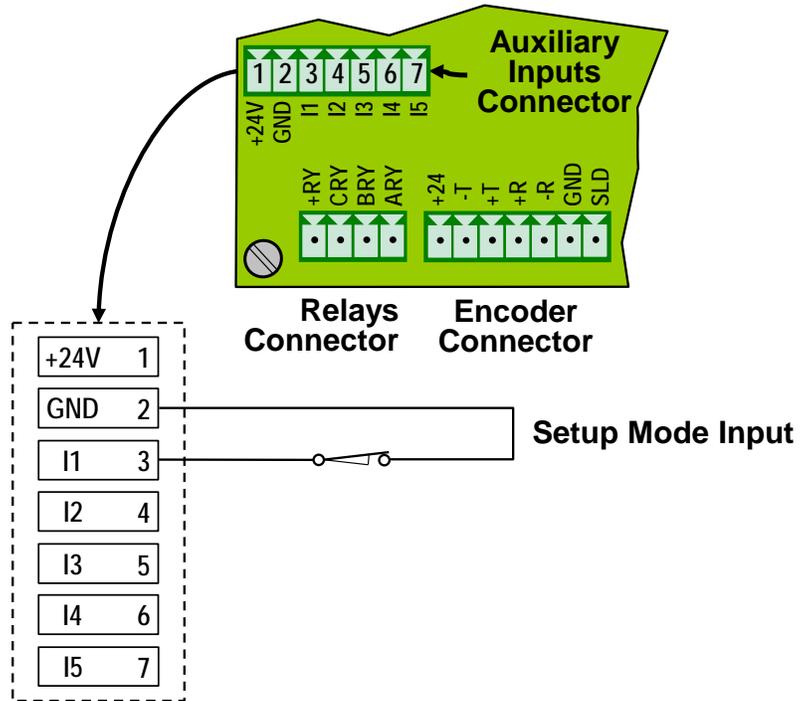
Figure 79: Auxiliary Inputs Connection for Setup Mode

7.5.7 Wiring the Die Protection Inputs

There are six die protection inputs plus ground and 24 volts on the die protection inputs connector.

Each input can be set programmatically by job to NPN mode (where the input is grounded to turn "On") or PNP mode (where the input is connected to +24V to turn "On"). Because of this, all standard 3 wire solid state sensors that use the classic brown (+24V), blue (ground), and black (signal out) color code can be wired as shown in the example of Figure 80.

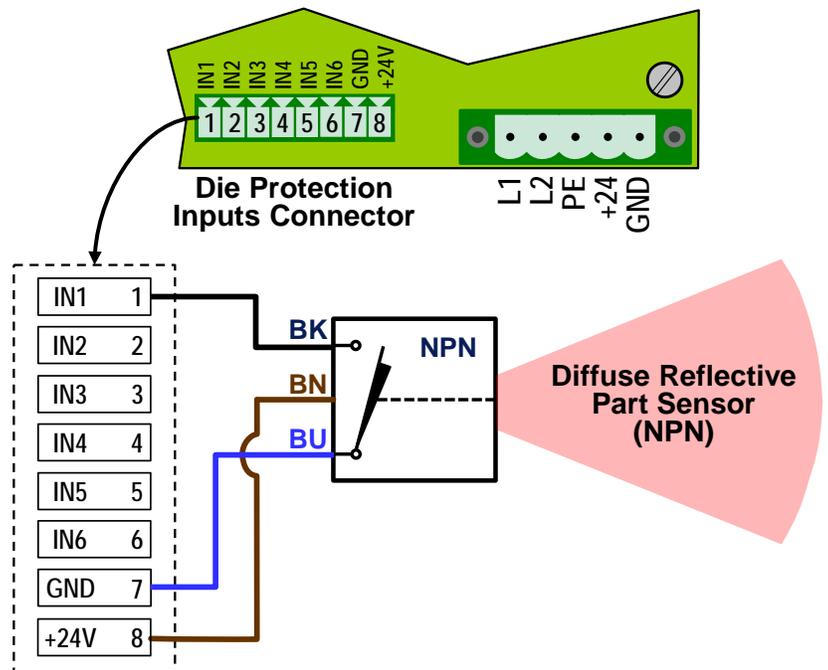This example is showing a NPN part sensor powered using the internal power supply of the System 2600.

Figure 80: Die Protection Inputs Connection Wiring Example with Internal Power Supply

Likewise, mechanical switch sensors or spring probes would simply ground the input if was set to NPN mode, or connect it to +24V if it was set to PNP mode.

The System 2600 can supply 200 milliamps to sensors if only 4 PLS outputs are installed. It can supply 50 milliamps if 8 PLS outputs are installed.

If more power is required for sensors, then Figure 81 shows how an external power supply can be connected for additional sensor power.

Also note that if the System 2600 itself is powered by +24VDC instead of 120VAC, then it can pass along 1 amp to sensors.
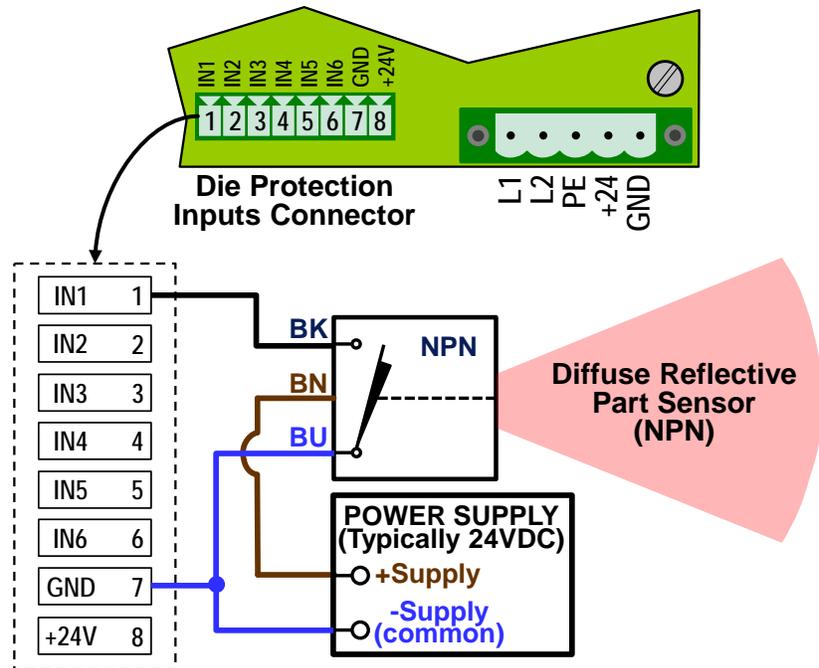
Figure 81: Die Protection Inputs Connection Wiring Example with External Power Supply

Finally, perhaps the best and most flexible way to connect the inputs is by way of using the Model 2620 Sensor Interface unit. This is a powered connection box that can supply 0.5 amps to sensors using its internal power supply or can pass through up to 10 Amps of an external +24VDC supply. It has 6 standard M12 sensor connectors on its front and 3 banana jack / binding post connectors for discrete sensor connections. It also has options for standard or customer supplied bulk connectors so that a single cable can be plugged in from the die that connects all sensors at once.

This interface comes standard with a six conductor plus ground cable that is wired from the output connector of the 2620 to GND and IN1 to IN6 of the System 2600 die protection inputs connector.
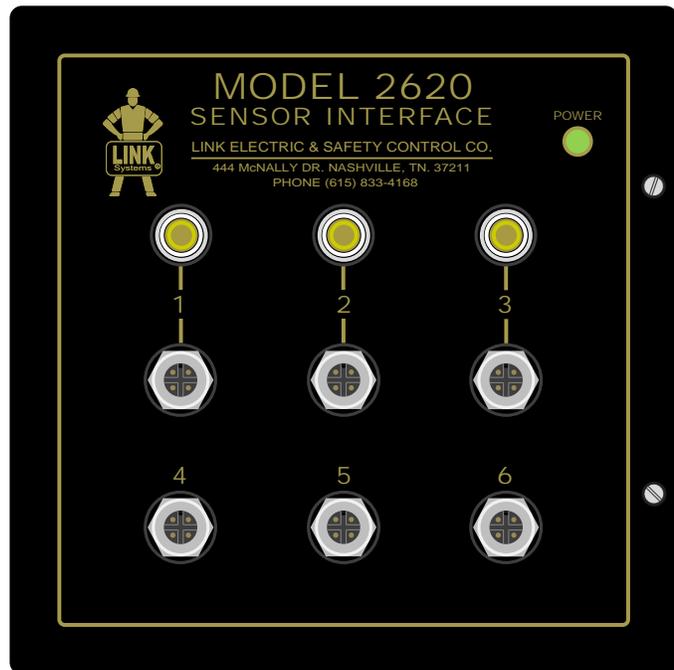
Figure 82: Model 2620 Sensor Interface

### 7.5.8 Wiring Optional Limit Switch Modules

The System 2600 can support 0, 4, or 8 limit switch outputs as well as 0 or 4 configurable output relays that support a variety of signaling functions (see section 4.10 on page 63 for details). The relay modules can be mounted in an existing enclosure or mounted in a Link supplied enclosure with the same dimensions as the System 2600 itself. The Link supplied enclosure can hold all three optional relay modules
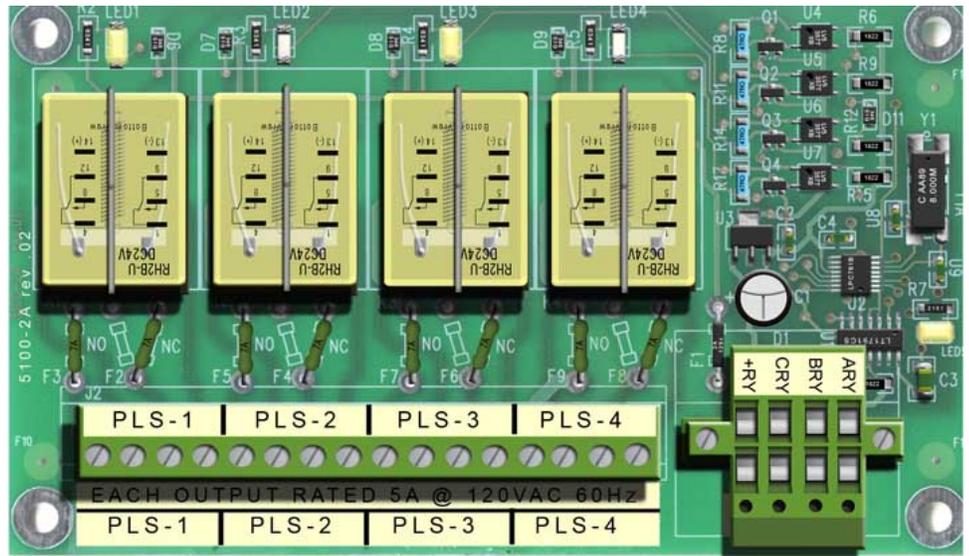
**Figure 83: Electro-Mechanical Limit Switch Module**

Figure 84 shows how to connect limit switch modules to the System 2600. The special double plugs on the limit switch modules allow simple daisy chaining of the wiring from the System 2600 to the first module, and then to the second and third modules, if used.

The order that the modules are connected is not important.
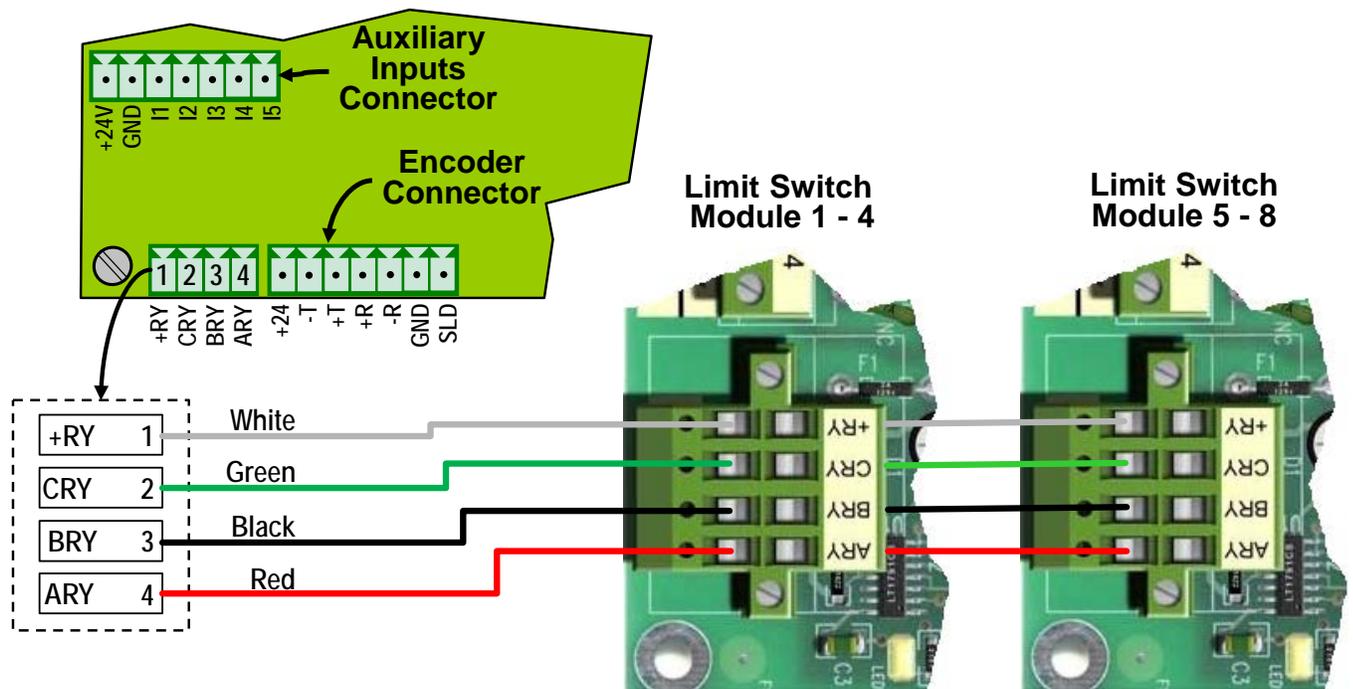
Figure 84: Limit Switch Module Wiring

Figure 85 shows the contact arrangement of the electromechanical limit switch outputs with each output having two normally open outputs. One of the outputs on each channel can be turned into a normally closed contact by moving a pico-fuse as illustrated on the circuit board.
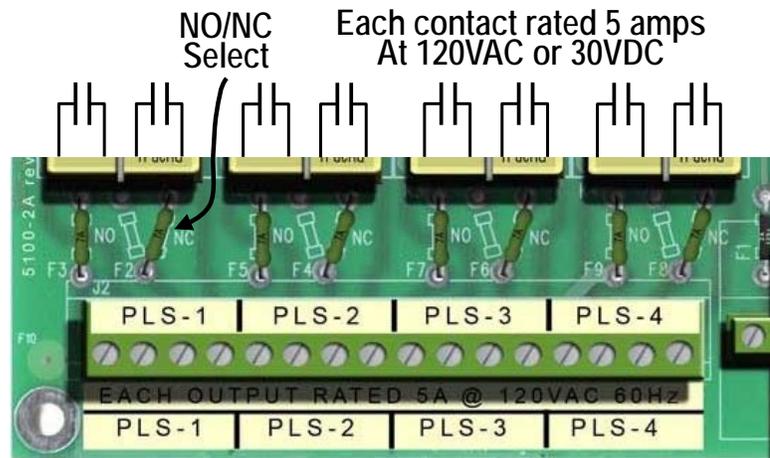
Figure 85: Limit Switch Outputs

Solid-state relay output modules are available for PLS 1-4 and PLS 5-8. These are often necessary for higher speed presses, for applications where no contact bounce can be tolerated, or for applications that require very short turn-on periods (<50 milliseconds). These relay modules have provisions for 4 solid-state relays that can be populated individually as AC or DC types. These modules are daisy-chained in the same manner as described for the electromechanical types.

Relay Module Specifications	
Item	**Specification**
Electromechanical Relay Contact Rating	120 VAC Max, 5 Amps 30 VDC Max, 5 Amps
Solid State AC Relay	24 to 120 VAC Max, 3 Amps @ 45° ambient, 2 Amps @ 70° ambient
Solid State DC Relay	60 VDC Max, 3 Amps @ 45° ambient, 2 Amps @ 70° ambient
Relay Contact Fuse (all relay types)	Littlefuse 0251007 (7 Amp, 125V AC or DC, Fast Blow)