System 1200
Tonnage Monitor

Installation and Operating Manual

Doc # L-1200-1021
Rev. 01

Tonnage Monitor

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Table of Contents

Table of Figures

1 INTRODUCTION

The System 1200 is a stand-alone Tonnage Monitor that can be used with any press control. Its primary purpose is to measure and display the force being applied to the frame of a mechanical, hydraulic, or servo power press. The force applied during the working portion of the stroke is compared with allowable limits based on the capacity of the machine and correct operation of the die and material being used. Tonnages beyond these limits cause various types of stop signals to be sent to the press control depending upon the importance of the overload. Present tonnage readings, status messages, and present tonnage limits can be examined or programmed through the operator interface. Additional capabilities and options can be added to provide even more capabilities.

1.1 Features

- Storage for 500 jobs of settings associated with the standard and optional functions of the system.
- Up to four strain gage connections for use on one, two, or four channel machines.
- Separate "Top Stop" and "Immediate Stop" relay contacts are provided for interface to the press control.
- Can be used with mechanical cam switches or a programmable limit switch connected to the crankshaft of the press to define the top of the stroke (Auto-Zero Window), the working portion of the stroke (Sample Window), and up to four "data windows" within the sample window.
- If no cam switch is available, it can be configured to operate in "Threshold Mode" and use only the tonnage signal to capture and monitor the peak positive and negative tonnage.
- If not needed for cam switch signals, five inputs can be individually configured for such things as setup mode, part counters, or scrap counters.
- For each job, limits can be set for the maximum allowable forward tonnage (High Limit), minimum required forward tonnage (Low Limit), and maximum allowable reverse tonnage (Reverse Limit) on a channel by channel basis.
- A maximum allowable forward tonnage limit for the machine is established when the module is installed, based on the capacity of the machine (Machine Rating) and cannot be turned off.
- Limits can be programmed manually, automatically calculated by the tonnage monitor, or recalled through the use of job setups.
- Status messages for each channel indicate the first alarm condition that occurred during the stroke.
- Low limits can be set to automatically bypass when in a setup mode, if desired. These limits are then automatically restored when switching back to a production mode. This feature typically eliminates the need to manually bypass all limits on the tonnage monitor and the associated risk of forgetting to un-bypass it.
- If manually bypassing all limits on the tonnage monitor is needed, a setting is available that will automatically un-bypass the tonnage monitor when switching back to a production mode.

- For each job, low limits can be set to automatically bypass for the first few strokes (user selected number) to accommodate presses that "ramp up" to speed causing false low limit alarms on startup. This setting also works in conjunction with the auto-setup feature to allow accurate setpoints in these cases.
- 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).
- For more accurate monitoring, an optional encoder can be connected to the crankshaft. The use of the encoder also enables the following features:
    - Position dependent parameters such as the auto-zero window, the working portion of the stroke, and data windows are entered directly into the tonnage monitor and require no external cam switches. This also leaves digital inputs available for setup mode indication and sensor based part and scrap count inputs.
    - A total tonnage curve can be programmed that places limits on the maximum allowable total tonnage at specific positions in the stroke.
    - Tonnage graphs are more directly comparable when the press speed changes.
    - A reference graph can be stored for each job and overlaid with the current tonnage graph for comparison.
    - The crank angle and crank speed are displayed.
    - A distance to bottom readout is available.
    - Certain servo press operations that dwell at bottom can be better graphed by varying the graph sample rate when crank speed drops below a programmed value.
- 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 tonnage monitor, 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.

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).
Gain Range:	500 to 32500.
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 tonnage monitor. It is strongly recommended that this section be read in order to use the tonnage monitor effectively!

2.1 Tonnage

The tonnage monitor reads forming forces ("tonnage") from strain gages mounted on the machine frame. Each strain gage is a "channel". Tonnage monitors typically have two or four strain gages depending on the type of machine. For example, OBI presses typically use two strain gages (one on each side), and straight side presses typically use four strain gages (one on each corner). Sections 7.6 and 7.7 starting on page 91 cover strain gage location considerations and mounting procedures.

2.1.1 Channel Tonnage

A channel tonnage is the tonnage read from a single strain gage. A numerical channel tonnage reading shown by the tonnage monitor is the highest tonnage exerted on that channel through the stroke.

2.1.2 Total Tonnage

In addition to recording the maximum tonnage measured for each channel, the tonnage monitor calculates and records the instantaneous summation of all channels. It performs the same peak measurement on this value as is performed on the individual channels. This value is displayed as the total tonnage exerted on the machine frame at any single position in the stroke.

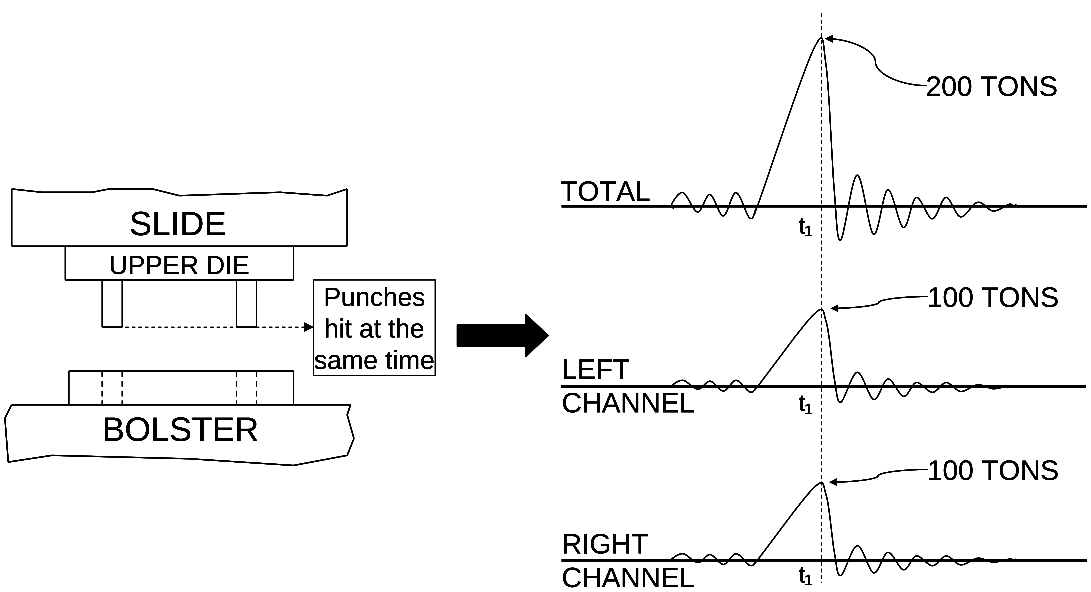

Figure 1: Example Die 1 with Signature

When forces occur on all channels at the same time, the maximum total tonnage is the summation of the maximum channel tonnages. For example, the die shown in Figure 1 contains two equally sharp punches of equal cross-sectional area and equal length. This die is located in the center of an OBI press bed equipped with a two channel tonnage monitor with strain gages mounted on both sides of the press frame. If the tonnage required for each punch is 100 tons and both punches impact the material at the same position in the stroke (at the same time) the graph in Figure 1 shows the forces applied to the left and right sides of the machine frame along with the resulting total force. This process would result in the tonnage monitor displaying 100 tons for the left channel, 100 tons for the right channel, and 200 tons for the total.

When forces occur on the individual channels at different positions in the stroke (at different times), the total force depends on the amount of force exerted at any specific position. If the die described in the previous example had punches of different lengths as shown in Figure 2, the punches would not impact the material at the same position in the stroke.

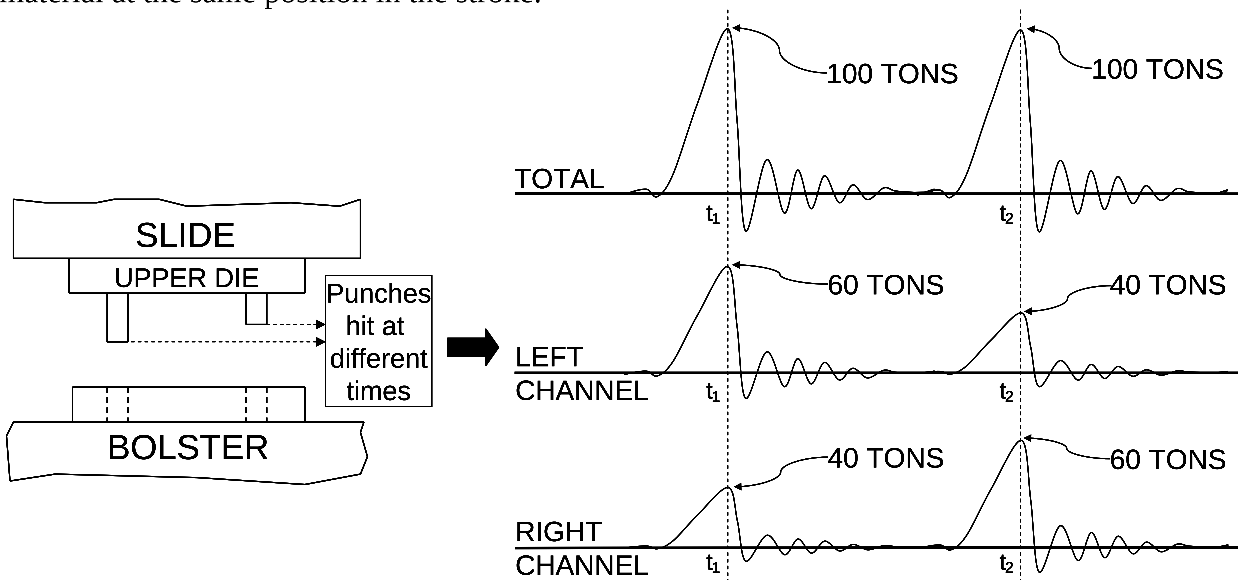

Figure 2: Example Die 2 with Signature

The graph in Figure 2 shows that the punch on the left contacts the material first and exerts a total force of 100 tons at time t1, with 60 tons distributed to left side of the machine frame and 40 tons distributed to the right. After the left punch breaks through the material, and at a different position in the stroke, the punch on the right contacts the material and exerts a total force of 100 tons at time t2, with 60 tons distributed to the right side of the machine frame and 40 tons distributed to the left. This process would result in the tonnage monitor displaying that the maximum tonnage measured on the left side of the machine frame was 60 tons, that the maximum tonnage measured on the right side of the machine frame was 60 tons, and that the maximum total tonnage exerted on the machine frame was 100 tons.

2.1.3 Reverse Tonnage

In addition to monitoring the “forward” tonnages for a press, the tonnage monitor also measures and monitors the “reverse” tonnage. A press frame acts as a kind of stiff spring. When exerting tonnage in the down part of the cycle, portions of the press frame stretch proportionally to the tonnage exerted. In the case of a punch, for example, the tooling comes down and contacts the material. The press frame starts stretching, and this generates tonnage exerted on the material. Finally, the tonnage exerted is sufficient for the punch to “break through” the material, and when it does the press frame tries to “spring back” to its original shape. Just like a regular spring, the press will overshoot its original resting position due to inertia and will actually compress instead of stretch. The tonnage registered on the frame during this “rebound” is the reverse tonnage. Reverse tonnages are typically much harder on the press than forward tonnages. As a result, press manufactures usually allow much less reverse tonnage on a machine than forward tonnage. For instance, a 500 ton machine may only be rated for 50 tons of reverse load.

2.2 Data Windows

Peak tonnage monitors capture the maximum tonnage seen by each strain gage over the stroke. This maximum tonnage is compared to setpoints to determine if an alarm should be generated to stop the production process. While this is adequate for most applications, complex tooling can produce multiple peaks resulting in only the highest peak being checked against setpoints. Where closer monitoring is desired in these applications, the tonnage monitor provides up to four “Data Windows” to monitor additional peaks other than the absolute maximum peak tonnage. These additional peaks are referred to as “local” peaks. Each data window consists of a separate high and low limit that are used from a given start angle to a given end angle or is enabled via hardware inputs – depending on whether or not the optional 5100-11 encoder is used.

The tonnage graph in Figure 3A is for a two station die. The first station (between 165 and 170 degrees) cuts out the part (local peak), and the second station (at 180 degrees) stamps a logo onto the part (absolute peak).

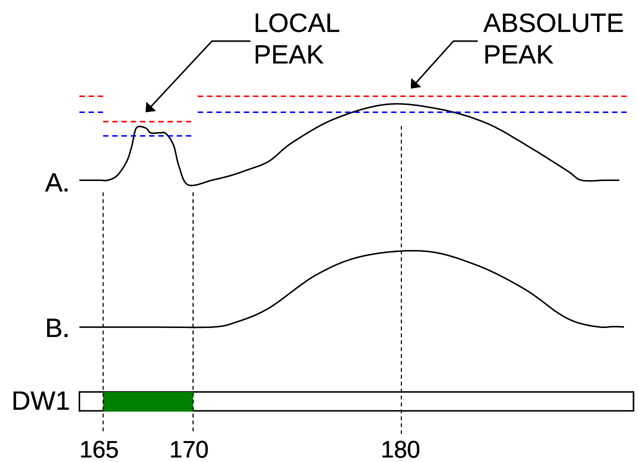

Figure 3: Example Data Window

Since the tonnage required to coin the logo is greater than the tonnage required to cut the part, the local peak is not checked using a normal peak tonnage monitor. The local peak could completely disappear and a normal peak tonnage monitor would not detect any anomaly in the process since the absolute peak limits are still being satisfied. This is exactly what would happen if the material did not feed between strokes as shown in Figure 3B. Using a single data window, however, places a separate high and low limit on the local peak.

2.2.1 Data Window Start Angle

The Start Angle for a data window is the angle at which the setpoints for that data window start to be enforced. For example, in Figure 3 data window 1 has a start angle of 165 degrees.

2.2.2 Data Window End Angle

The End Angle for a data window is the angle at which the setpoints for that data window stop being enforced. For example, in Figure 3 data window 1 has an end angle of 170 degrees.

2.3 Limits

The tonnage monitor can compare the tonnages it reads to limits set for each job. The following sections detail these limits.

2.3.1 Machine Rating Limit

The machine rating limit, unlike low and high limits, is intended to protect the machine rather than the tooling. This limit can be configured to be between 100% and 125% of the tonnage rating for each channel with a typical value of 125%. For instance, on a 400 ton machine with a four channel tonnage monitor module, each channel is rated at 100 tons (400 ton machine divided by four channels). The machine rating limit for each channel in this case would be 125% of 100 tons which is 125 tons. Note that it is possible to get a machine rating alarm even though the total tonnage does not exceed the machine rating. Suppose the tonnages for the above machine read 80 for channel 1, 90 for channel 2, 130 for channel 3, 80 for channel 4, and 380 for the total. A machine rating alarm would be indicated on channel 3 even though the total tonnage was less than 400 tons. A machine rating alarm results in an Immediate Stop to the press. ***Unlike high, low, and reverse limits, this limit can NOT be bypassed.***

2.3.2 Low Limits

A low limit is the minimum tonnage required to properly produce a particular part. There are separate low limits for each channel of the tonnage monitor. If something in the process changes during normal operation that causes any channel to not reach its' minimum limits, a Top Stop is issued. In setup modes (Inch and Timed Inch for the System 5100 Press Control) it is common to operate the press without material in the die during the setup operation. In order to prevent unintended stops, the tonnage monitor can be configured to automatically turn OFF the Low Limits during these modes. The Low Limit for a particular channel cannot be set greater than or equal to that channels' high limit.

2.3.3 High Limits

High Limits should be set above the maximum tonnage required to properly produce a particular part and is set for each channel of the tonnage monitor. If something in the process changes during normal operation that causes the tonnage developed to exceed this maximum limit, a stop (configurable as an Immediate Stop or Top Stop) is issued.

2.3.4 Reverse Limits

A Reverse Limit should be set more negative than the maximum reverse tonnage developed when properly producing a particular part and is set for each channel of the tonnage monitor for the peak tonnage only. ***Data windows do NOT have reverse limits associated with them.*** If something in the process changes during normal operation that causes the tonnage developed to exceed this maximum reverse limit, a Top Stop is issued. Excessive reverse tonnages are damaging to the machine frame and reverse tonnage limits are active during the entire working portion of the stroke.

2.3.5 Total Tonnage Limit

There is only one limit that can be applied to the total tonnage. If so configured (see section 4.9 on page 62 for details), the machine rating de-rate table will apply a limit to the total tonnage that varies with the crank angle (related to height off the bottom of the stroke). The machine rating is specified by the press manufacturer at a specific height off the bottom of the stroke. Above this height the total tonnage available is limited by the torque of the crankshaft and clutch and will decrease as the height off the bottom increases. The machine rating de-rate table tells the tonnage monitor how to limit the total tonnage. An Immediate Stop will be issued if this limit is exceeded.

2.4 Stops

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

2.4.1 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 an over-tonnage occurs at 175 degrees, the press may end up stopped at 200 degrees. The number of degrees a press requires to actually stop depends (among other things) on the design of the press and on stroking speed. All other conditions being equal, the faster the press is stroking, the longer it requires to stop.

2.4.2 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 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.

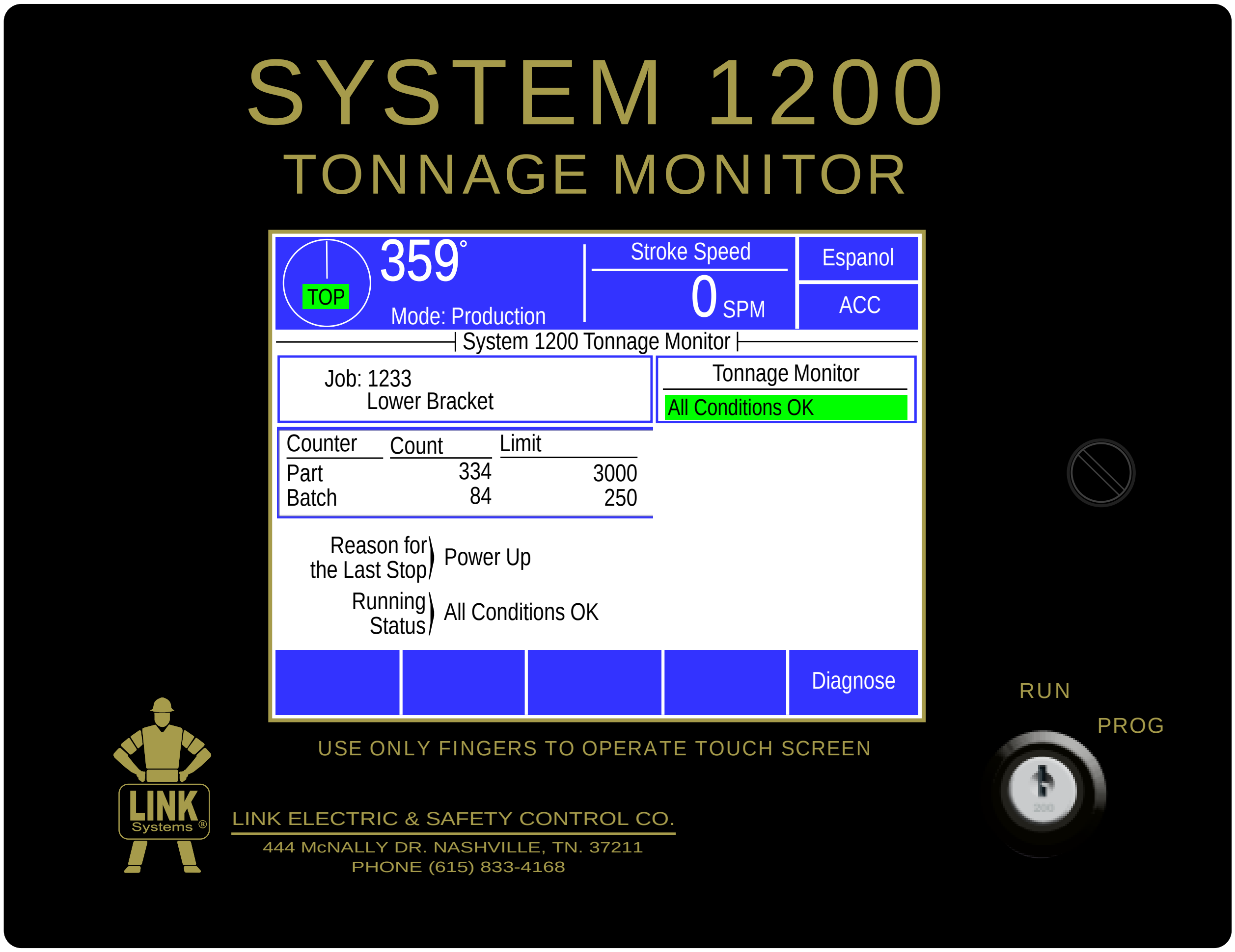

Figure 4: System 1200 Tonnage Monitor

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 vary slightly depending on whether or not the optional 5100-11 encoder is used to provide crankshaft position information.

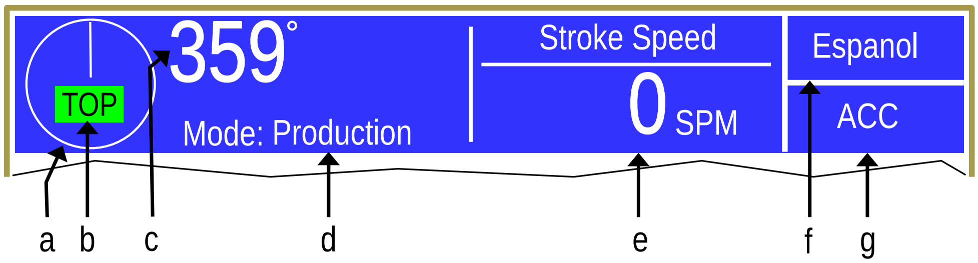

Figure 5: Top Info Area *with* 5100-11 Encoder

Figure 5 shows the top info area when the tonnage monitor is used with the optional 5100-11 encoder. 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 5) 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 4.2.5 on page 53),

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 5), tonnage monitor current status, reason for the last stop, part count, total tonnage, 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 4.10.1 on page 64 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.

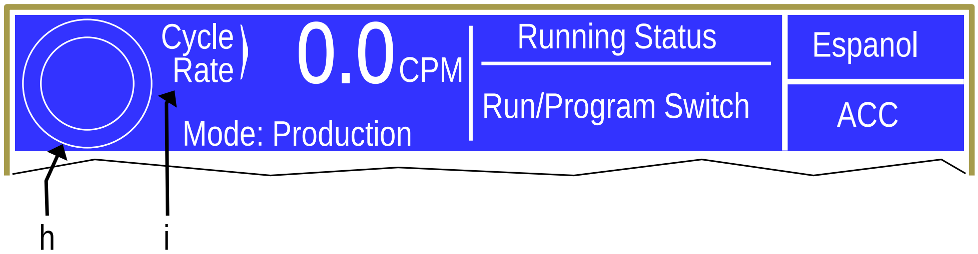

Figure 6: Top Info Area *without* 5100-11 Encoder

When the 5100-11 encoder is not used, then some of the information and capabilities provided by the encoder become unavailable. Figure 6 shows what the top info area looks like in that case. The differences from Figure 5 are:

h) Cycle indicator	Since there is no longer anything providing crank angle, the system can only know that a production cycle is on progress. This can be by a cam switch or by "seeing" the tonnage rise as the tooling exerts force on the material. This circle will have rotating arrows in it to indicate a cycle is active.
i) Cycle Rate Readout	Without an encoder, crank angle and stroking speed are not available. By using the time between cycles, the tonnage monitor can give a readout of the production cycles per minute. This should be very similar to strokes per minute when running in a continuous mode, but will differ quite a bit if running in single stroke or some other non-continuous mode. For instance, the press may be set to 60 SPM, but the operator may make a stroke every 10 seconds. In that case the cycle rate would be 6 CPM. Note that cycle rate is also available when using the 5100-11 encoder as one of the selectable readouts in the programmable display area (area "e" in Figure 5)

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 tonnage monitor. The PROG (program) position causes the tonnage monitor 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 tonnage monitor 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 7.

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.

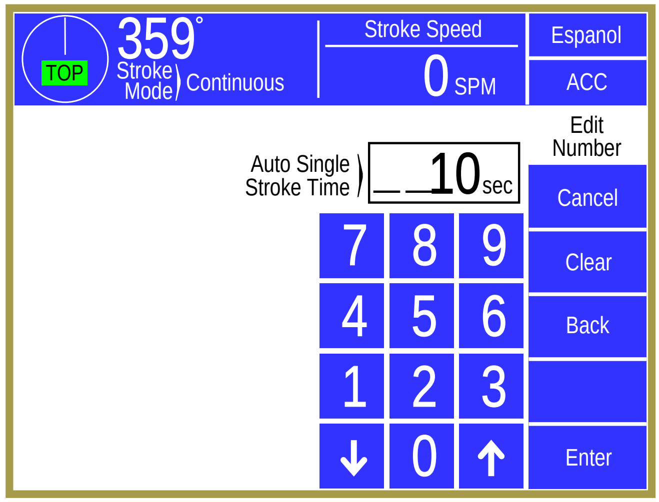

Figure 7: Example Numeric Entry Screen

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 8. The editing cursor position is shown by a black background on the character the cursor is sitting on. Characters typed on the virtual keyboard will appear at the editing cursor, and the cursor will automatically advance to the next position as characters are "typed". The cursor can also be moved by pressing the Cursor Left and Cursor Right softkeys.

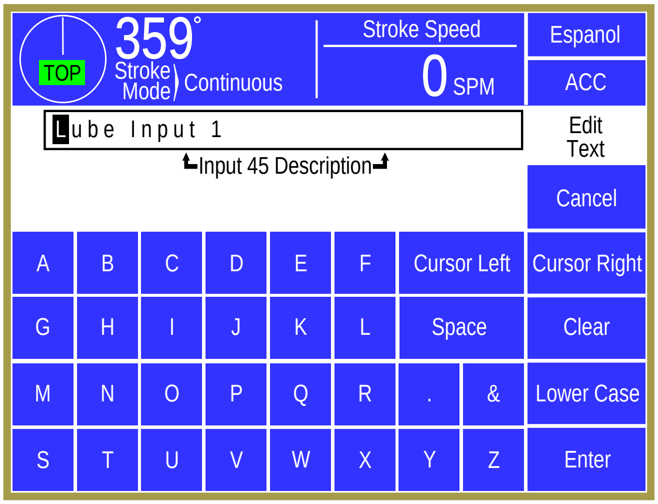

Figure 8: Example Text Entry

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

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

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

3.1.5.3 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 9.

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.

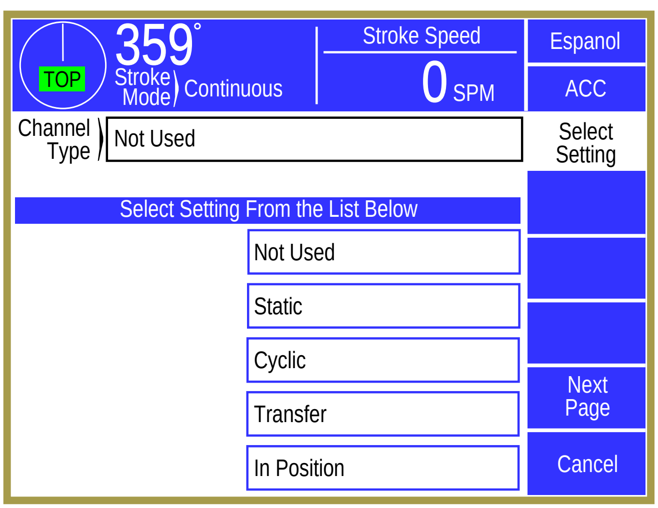

Figure 9: Example List Selection

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.

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 tonnage monitor faults. This is the only tonnage monitor 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 tonnage monitor limits.

Once the set-up personnel sets the die and verifies its correct operation, the operator is left to run the die. If a tonnage monitor fault occurs, the operator can enter the correct password and then reset the fault. However, the operator cannot change tonnage monitor limits. This will allow the operator to keep running the job and reset faults that occur. However, if consistent stops occur because a tonnage monitor limit needs changing, the set-up personnel must be called to change the limit.

The example above can be taken one additional step if two press operators are given different user names and different passwords. One operator can be assigned the ability to change tonnage monitor limits in addition to the ability to reset faults, while the other operator is not assigned the ability to change the limits.

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 1200. 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 10 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.

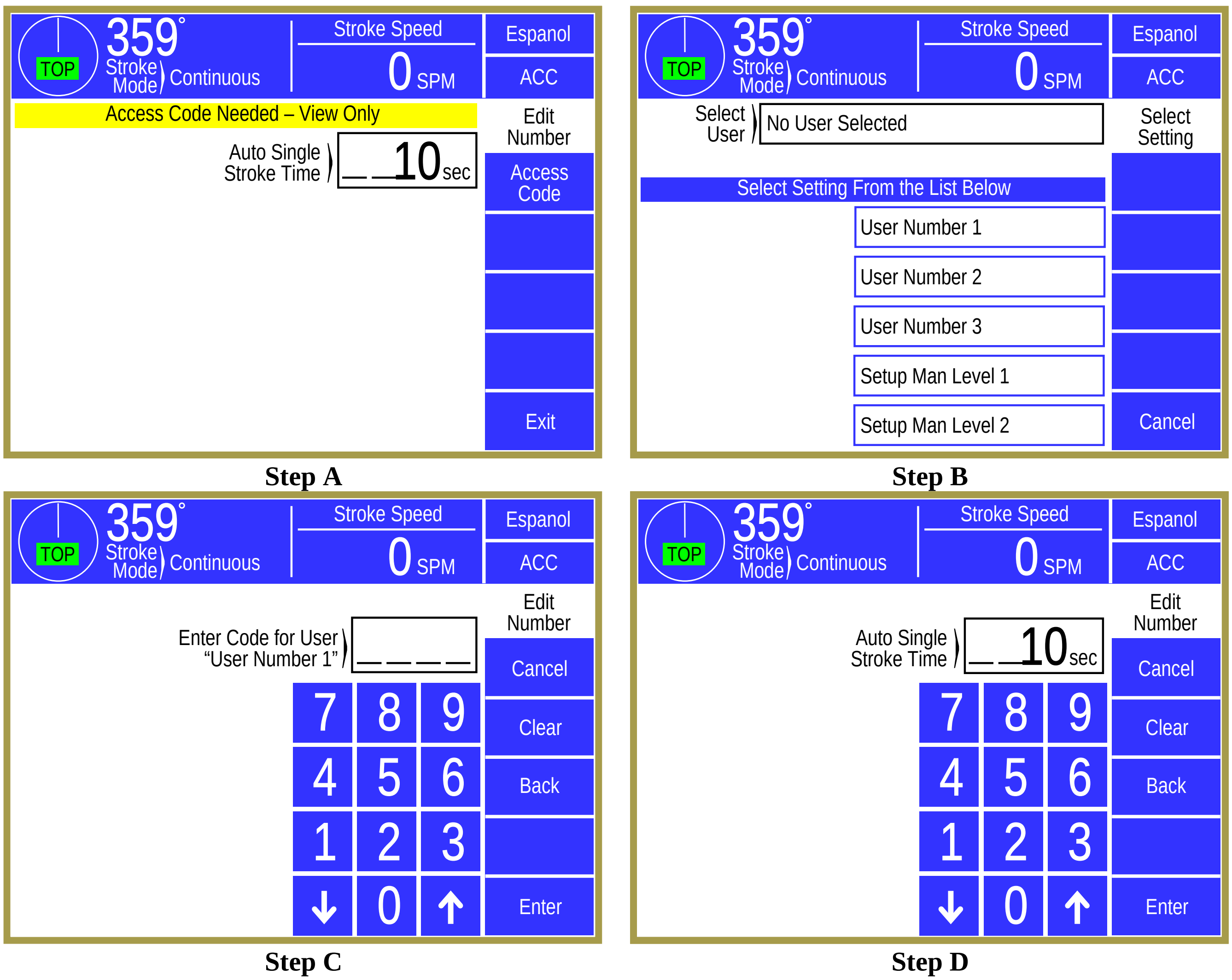

Figure 10: Example Password Entry Sequence

Step A: Select the restricted item. In the example shown in “Step A” of Figure 10 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 10, 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 10. 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 tonnage monitor that can be configured to be restricted. See section 4.10.4 for details on how to set up restrictions.

System 1200 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
TM Bypass	Bypass the limit alarms of the tonnage monitor.
TM Reset	Reset tonnage monitor faults.
TM Peak High Limits	Set peak high limits.
TM Peak Low Limits	Set peak low limits.
TM Reverse Limits	Set reverse limits.
TM Auto Setup	Run an auto setup operation. This operation will change all limits.

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, motor speed, and limited bypass operations. For instance, if you don't want your operators changing settings for the tonnage monitor, but you do trust them to reset the tonnage monitor after taking care of whatever tripped a limit alarm, then you can unrestrict the tonnage monitor reset function while still restricting all other functions. See the operator terminal manual for details on how to unrestrict items.

The following table lists the different items and functions in the tonnage monitor 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 1200 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
TM Peak Low Limits	Set peak low limits.
TM Reset	Reset tonnage monitor faults.

3.2 Main Operator Terminal Screen

The operator interface main screen shown in Figure 11 provides the current status of the tonnage monitor overall and indicates if attention is required. This is the initial screen displayed when the tonnage monitor powers up.

From this screen the operator may navigate to the Tonnage Monitor, Job Setups (see "a" in Figure 11) or Counters (see "b" in Figure 11) by pressing inside the blue-bordered box of each area. Some additional features are optional (such as LinkNet) and will become available if enabled.

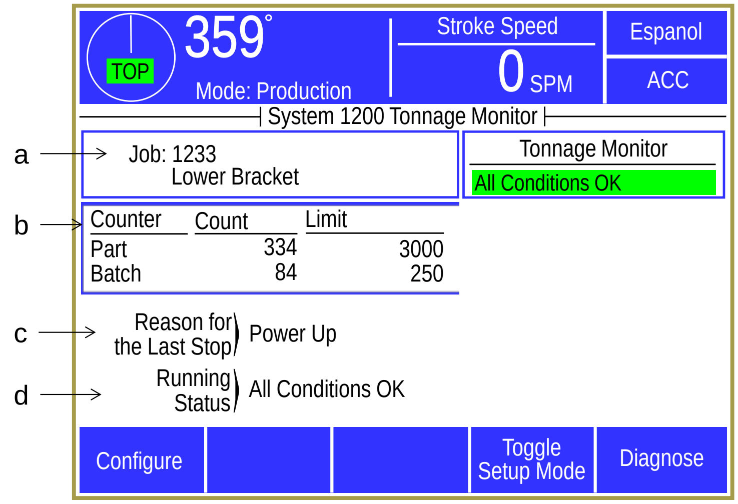

Figure 11: Operator Terminal Main Screen

The status of the tonnage monitor module (seen as "All Conditions OK" in green in the example of Figure 11) 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 tonnage monitor 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.
"Auto-Setup Active"	The tonnage monitor is collecting data to automatically set alarm levels. During this process the High, Low, and Reverse limits are bypassed.

3.2.1 Reason for the Last Stop

Diagnostic information is provided to show the reason that the press stopped (see "c" in Figure 11). 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 3.9.4 on page 49).

> **NOTE:** The press control for the machine will have other stop sources besides the System 1200 (E-Stop buttons, light curtains, etc.) that can stop the press without the System 1200 knowing why.
> When this happens the "Reason for the Last Stop" will show ***External Stop***. Stops initiated by the System 1200 (such as from counters, tonnage monitor, 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 tonnage monitor is currently asserting a stop (see “d” in Figure 11). 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* indicate the System 1200 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 tonnage alarm, etc.).

NOTE:	The press control for the machine will have other stop sources besides the System 1200 (E-Stop buttons, light curtains, etc.). A “Running Status” of ***All Conditions OK*** refers to only the System 1200 itself so other stop sources applied to the actual press control may prevent the press from running.

3.2.3 Configure Softkey

The System 1200 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 52 for information on configuring the System 1200.

3.2.4 Diagnose Softkey

Additional detailed diagnostic information is available through the Diagnose softkey. See Section 3.9 on page 48 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 1200 between production and setup modes. This can affect whether or not counters count and automatic bypassing of the low limits in the tonnage monitor. See section 4.2.5 on page 53 for information on the configuration parameter that controls this.

3.3 The Tonnage Monitor Main Screen

Press the "Tonnage Monitor" touch area (the area that has the tonnage monitor status and is surrounded by a blue rectangle) in the Main screen to go to the tonnage monitor main screen. This screen shows the maximum forward tonnages recorded during the last stroke, the description and status of each channel, the overall status of the tonnage monitor, and a graphical representation of the limits that apply to each channel.

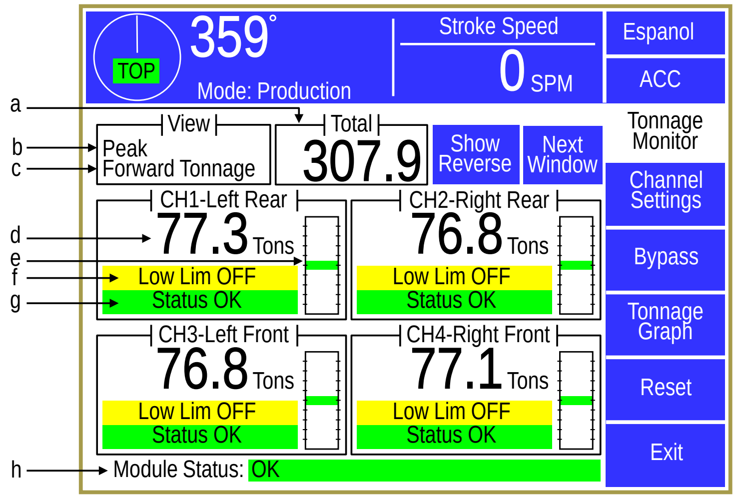

Figure 12: Tonnage Monitor Main Screen Showing Peak Forward Tonnage

Peak forward tonnage and peak reverse tonnage can be selected for viewing. Figure 12 is an example of a peak forward tonnage view, and Figure 13 shows a peak reverse tonnage view. Two channel screens look much the same but have no channel three or channel four information sections.

There are several softkeys on the main tonnage monitor 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 12, the various parts of the screen are:

a) Total Tonnage Reading This is the numeric value for the total tonnage.

b) Window This line indicates which tonnages are being viewed - Peak, Data Window 1, Data Window 2, Data Window 3, or Data Window 4.

c) Tonnage Direction This indicates whether forward or reverse tonnage is being viewed.

d) Tonnage Reading The numeric tonnage reading for this channel and view. In the example screen of Figure 12, this is the peak forward tonnage for channel 1.

e) Graphical Limit Bar	This is a floating bar graph that graphically indicates where the tonnage for the channel is relative to the low and high setpoints for that channel. The bottom of the graph is the low limit and the top of the graph is the high limit. A tonnage that is halfway between the low and high limits will show a green bar in the middle of the graph. If the tonnage were to start going up towards the high limit (perhaps due to material thickness variation), the bar would also go up and would first turn yellow, and then red as it approached the high limit. Likewise, if the tonnage started to go down towards the low limit, the bar would go down and first turn yellow, and then red as it approached the low limit.
f) Bypass Status	If any limits are bypassed, it will be indicated by "Bypassed", "Low Lim OFF", "Rev Lim OFF", or "Low/Rev Lim OFF" highlighted in yellow in the indicated location. See section 3.5 on page 37 for more information on bypassing the tonnage monitor.
g) Channel Status	Each channel also has a status that indicates any alarms conditions or other problems related to just that channel.
h) Module Status	The overall status of the tonnage monitor.
Show Reverse ***Softkey***	This softkey changes the tonnages displayed to peak reverse tonnage (see Figure 13: Tonnage Monitor Main Screen Showing Reverse Tonnage). This key is only present when viewing peak forward tonnage. See section 3.3.1.2 on page 28 for more information.
Next Window ***Softkey***	This softkey is used to display the forward tonnages that occur in the selected data window. The key will not be shown if no data windows are configured
Channel Settings ***Softkey***	This softkey brings up the tonnage monitor channel settings screen. This screen is where high, low, and reverse limits are set for each channel. The channels settings screen can also be brought up by pressing the screen anywhere inside a channel box. See section 3.4 on page 33 for more information on this screen.
Bypass ***Softkey***	Press this softkey to go to the tonnage monitor bypass screen where various bypass options can be configured. See section 3.5 on page 37 for more information on the bypass screen.
Tonnage Graph ***Softkey***	This softkey allows the tonnage waveform to be viewed.
Reset ***Softkey***	This softkey is used to reset tonnage alarms and fault conditions. See section 3.3.2.7 on page 30 and section 3.3.3.3 on page 32 for more information on resetting alarm and error conditions.

Figure 13 shows a four channel screen when viewing reverse tonnages. Notice that there are no limit bars when viewing reverse tonnage as there is only one reverse limit for each channel. The Show Reverse softkey has also changed to Show Forward to allow switching back to the forward tonnage view.

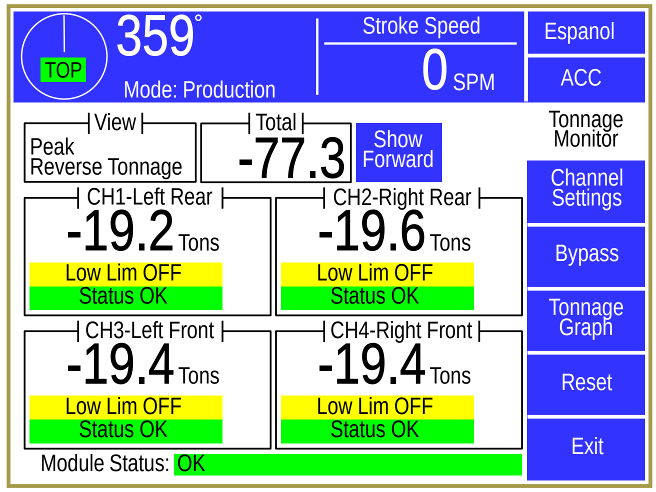

Figure 13: Tonnage Monitor Main Screen Showing Reverse Tonnage

3.3.1 Selecting a View

As explained in section 2.2 on page 11, data windows can monitor "local" peaks with a separate set of setpoints from the "absolute" peak. Each set of tonnages makes up a "view" in this screen and is indicated by the "View" box on the screen. The absolute peak tonnages are called the "Peak" view. In all, there are six different possible views of tonnages - peak forward, peak reverse, data window 1 forward, data window 2 forward, data window 3 forward, and data window 4 forward. The default view on entering the screen is peak forward tonnages.

3.3.1.1 Viewing the Peak and Data Window Tonnages

The Next Window softkey allows the operator to select which set of tonnages are shown on the tonnage monitor screen. The view can be the maximum forward tonnage that occurred anywhere during the last stroke (Peak) or the maximum tonnage that occurred during a particular data window (Data Window 1 through Data Window 4). Each time the Next Window softkey is hit the view will change. The order is Peak, Data Window 1, Data Window 2, Data Window 3, Data Window 4, and then back to Peak.

3.3.1.2 Showing Forward and Reverse Tonnage

When viewing peak forward tonnage, press the Show Reverse softkey to change the view to reverse tonnages. The key will change to read Show Forward.

When viewing peak reverse tonnage, press the Show Forward softkey to change the view to forward tonnage. The key will change to read Show Reverse.

> **NOTE:** If the current view is a Data Window, the **Show Reverse** softkey will be removed. Reverse tonnage applies only to the Peak Sample Window.

3.3.2 Tonnage Alarms

The Main Tonnage Monitor screen provides a status indication for each channel. This message indicates any tonnage alarm or error condition that has occurred and under normal operating conditions should show "Status OK".

If a tonnage alarm occurs, the message will change to reflect the ***first*** alarm detected on that channel during the stroke. In addition the module status at the bottom of the Main Tonnage Monitor screen will indicate "One or More Channel Errors".

If the tonnage monitor was the ***first*** system that stopped the press, then the Running Status in the Main screen will show "Tonnage Monitor Stop".

Any tonnage alarm stop will remain in effect and further stroking prevented until the alarm is reset by pressing the Reset softkey.

> **WARNING:** Tonnage alarms can generate a stop before the bottom of the stroke. When the Reset softkey is pressed, the tonnage monitor is effectively **BYPASSED** until the top of the stroke. Make sure to clear the fault condition before reengaging the press.

3.3.2.1 Low Alarm

One of the messages listed below in the Channel Status indicates that the maximum tonnage recorded during the last stroke did not reach the Low Limit setting.

"Low Peak Alarm"	Tonnage did not reach the Low Limit set in Peak Tonnage.
"Low DW1 Alarm"	Tonnage did not reach the Low Limit set in Data Window #1.
"Low DW2 Alarm"	Tonnage did not reach the Low Limit set in Data Window #2.
"Low DW3 Alarm"	Tonnage did not reach the Low Limit set in Data Window #3.
"Low DW4 Alarm"	Tonnage did not reach the Low Limit set in Data Window #4.

This limit is not checked and the message will not appear until the press reaches the end of the working portion of the stroke for the peak low limit – or the end of the data window for a data window low limit. When the condition is detected on any channel, a Top Stop is issued.

3.3.2.2 High Alarm

One of the messages listed below in the Channel Status indicates that the maximum tonnage recorded during the last stroke exceeded a High Limit setting.

"High Peak Alarm"	Tonnage exceeded the High Limit set in Peak Tonnage.
"High DW1 Alarm"	Tonnage exceeded the High Limit set in Data Window #1.
"High DW2 Alarm"	Tonnage exceeded the High Limit set in Data Window #2.
"High DW3 Alarm"	Tonnage exceeded the High Limit set in Data Window #3.
"High DW4 Alarm"	Tonnage exceeded the High Limit set in Data Window #4.

When the condition is detected on any channel, a stop is issued. The type of stop issued depends on whether the high setpoint is a peak high setpoint or a data window high setpoint. A peak high alarm will issue a stop as configured by the "Peak High Limit Stop Type" setting. A data window high alarm will issue a stop as configured by the "DW High Limit Stop Type" setting. See Section 4.2 on page 52 for details on these settings.

3.3.2.3 Reverse Alarm

A Channel Status message that reads "Reverse Alarm" indicates that the maximum reverse tonnage recorded during the last stroke exceeded the Reverse Limit setting. When the condition is detected on any channel, a Top Stop is issued.

3.3.2.4 Machine Rating Alarm

A Channel Status message that read "Machine Rating" indicates that the maximum forward tonnage recorded during the last stroke exceeded the channel rating as set by the “Machine Rating Alarm Level” (see section 4.5.1 on page 58 for details). When the condition is detected on any channel, an Immediate Stop is issued.

3.3.2.5 Reverse Rating Alarm

A Channel Status message "Reverse Rating" indicates that the maximum reverse tonnage recorded during the last stroke exceeded the reverse channel rating as set by the “Reverse Machine Rating Alarm Level” (see section 4.5.2 on page 58 for details). When this condition is detected on any channel, a Top Stop is issued.

3.3.2.6 Total Alarm

This alarm condition indicates that the maximum ***total*** tonnage exceeded the capacity of the machine at the height in the stroke at which it occurred. It is the only limit applied to the total tonnage and may or may not coincide with any channel alarm. When the condition is detected on the total tonnage, an Immediate Stop is issued.

This alarm will only occur if the tonnage monitor is configured to de-rate the total tonnage capacity. The machine rating is specified by the press manufacturer at a specific height off the bottom of the stroke (for example .25 inches). Above this height the total tonnage available is limited by the torque of the crankshaft and will decrease as the height off the bottom at which the tonnage occurs increases (see section 4.9 on page 62 for how this de-rate curve is programmed).

3.3.2.7 Resetting Tonnage Alarms

When a tonnage alarm occurs, the tonnage monitor will issue a stop (the type of stop depends on the alarm type and configuration). This stop will remain in effect and further stroking prevented until the alarm is reset by pressing the Reset softkey in the main tonnage monitor screen.

WARNING: Tonnage alarms can generate a stop before the bottom of the stroke. When the Reset softkey is pressed, the tonnage monitor is effectively **BYPASSED** until the top of the stroke. Make sure to clear the fault condition before reengaging the press.

3.3.3 Error Conditions

A number of error conditions can be reported by the tonnage monitor. Some of these conditions are reported in the "Module Status" area (see "a" in Figure 12) and some are reported for a particular channel in the channel status area (see "b" in Figure 12).

3.3.3.1 Module Error Messages

The following is a list of errors that can appear in the "Module Status" area:

"One or More Channel Errors" One or more channels have an error. This message is most often seen when a tonnage alarm is active.

"Total Alarm" A "total alarm" has been tripped. See section 3.3.2.6 for information on total alarms.

"Setpoint Error" The module has detected one or more invalid setpoints (high limit less than low limit, limits higher than machine rating, etc). One likely cause for this error is a change to the machine rating or a change in the "Max Forward Setpoint Level". Changing either of these settings can result in limits that exceed the new maximum allowed by the settings. The tonnage monitor module will clamp the limits to allowable levels and generate the "Setpoint Error" message to inform the user of the change. When this error is generated all setpoints should be checked and adjusted as needed.

"Window Angle Error" The module has detected one or more invalid window angle settings. This can occur when the "Sample Window Start Angle" and "Sample Window End Angle" are not between 90 and 270 degrees, or the "Auto-Zero Start Angle" and the "Auto-Zero End Angle" are not between 270 and 90 degrees. The tonnage monitor module will adjust the angles to the minimum extent necessary to make them valid and generate this error to inform the user of the change. All window angles should be checked and verified when this occurs.

3.3.3.2 Channel Errors

In addition to tonnage alarm conditions (see section 3.3.2), the following errors can be indicated in the channel status for an individual channel:

"Zero Error" The tonnage monitor cannot zero the strain gage on the channel. Swap the strain gage in question with a working channel and press the Reset softkey. If the "Zero Error" message moves to the other channel the problem is in the strain gage or its external wiring. It may take several seconds to generate the error. If the error remains on the same channel the problem is on the tonnage monitor module.

3.3.3.3 Resetting Errors

If an alarm or error condition is detected, a stop signal is issued. To reset the error, press the Reset softkey in the Main Tonnage Monitor screen. Note that depending on configuration, this key may appear only with the RUN/PROG keyed selector switch in the PROG position. In addition, if access codes have been enabled (see section 3.1.7 on page 19 for details), the operator will also require an access code to reset the tonnage monitor.

3.4 The Channel Settings Screen

The channel settings screen can be selected by pressing the Channel Settings softkey in the tonnage monitor main screen (See Figure 12 on page 26). It can also be selected by touching the screen inside any of the channel information boxes. In that case, the channel settings screen will automatically display the settings for that particular channel.

Note that the labels for the information in this screen change depending on the channel and window that are being displayed. So the high limit for the channel 2 peak setting will be displayed as "Channel 2 Peak High Limit" as shown in Figure 14 at right.

When data window settings are displayed by using the Next Window softkey (explained later in this section) the high limit would show as "Channel 2 DW1 High Limit" as shown in Figure 15 at right. In addition, the reverse setpoint information is replaced by data window settings (On/Off, start angle, and end angle) since data windows do not have reverse setpoints.

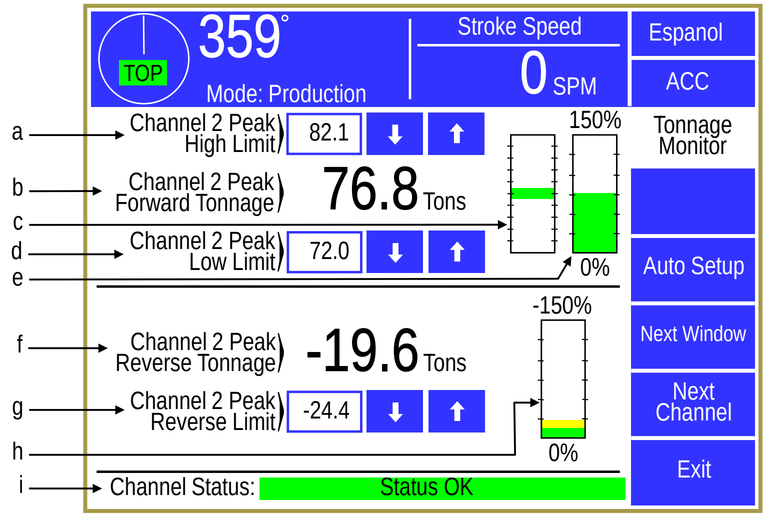

Figure 14: Tonnage Monitor Channel Settings Screen when displaying Peak Settings

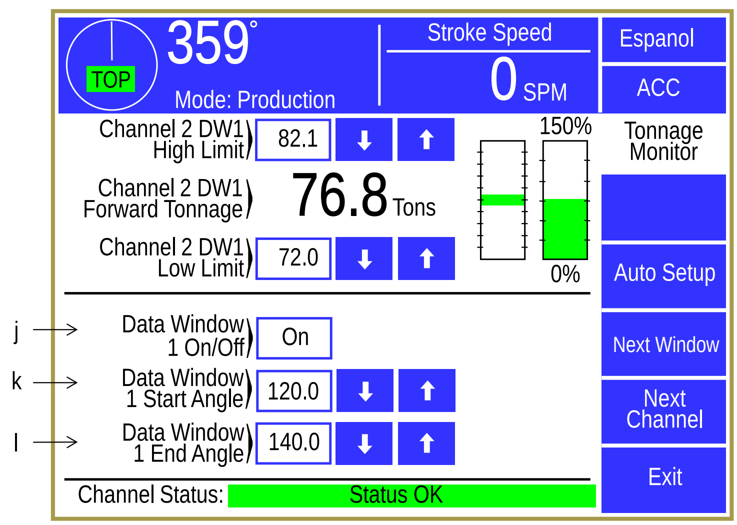

Figure 15: Tonnage Monitor Channel Settings Screen when displaying Data Window Settings

Items on this screen include:

a) High Limit The high limit for the currently displayed window and channel.

b) Peak Forward Tonnage The last captured forward tonnage for the currently displayed window and channel.

c) Graphical Limit Bar — This is a floating bar graph that graphically indicates where the tonnage for the channel is relative to the low and high setpoints for that channel. The bottom of the graph is the low limit and the top of the graph is the high limit. A tonnage that is halfway between the low and high limits will show a green bar in the middle of the graph. If the tonnage were to start going up towards the high limit (perhaps due to material thickness variation), the bar would also go up and would first turn yellow, and then red as it approached the high limit. Likewise, if the tonnage started to go down towards the low limit, the bar would go down and first turn yellow, and then red as it approached the low limit.

d) Low Limit — The low limit for the currently displayed channel.

e) Channel Forward Rating Graph — This bar graph shows the percent of channel rating that the tonnage represents. It will be green to 100% channel rating, yellow from 100% to 125% channel rating, and red from 125% to 150% channel rating. For example, a 400 ton 4 channel machine would have a 100 ton channel rating. For this case, if a channel read 100 tons then the graph would be all green up to about 2/3 of the graph. If the channel read 110 tons, then a little yellow would show above the green. If the channel read 130 tons, there would be red above the yellow. In general, this graph should always be kept in the green.

f) Peak Reverse Tonnage — The last captured reverse tonnage for the currently displayed channel. Note that this is only shown for the Peak and does not apply to data windows.

g) Reverse Limit — The reverse limit for the currently displayed channel. Note that this is only shown for the Peak and does not apply to data windows.

h) Channel Reverse Rating Graph — This bar graph shows the percent of reverse channel rating that the reverse tonnage represents. It will be green to 10% channel rating, yellow from 11% to 50% channel rating, and red from 51% to 150% channel rating. Note that this is only shown for the Peak and does not apply to data windows.

i) Channel Status — The status of the currently displayed channel

j) Data Window On/Off — This determines whether the data window is active. When "On", the data window setpoints are enforced from the "Data Window Start Angle" to the "Data Window End Angle" or while the matching Data Window input is on, depending on whether or not the optional 5100-11 encoder is used. When "Off", these settings are not used at all and will NOT stop the press. This setting will only appear when viewing data window settings.

k) Data Window Start Angle — The angle at which the data window setpoints will start to be enforced. This setting will only appear when viewing data window settings and only when the optional 5100-11 encoder is installed, which allows the System 1200 to read crank angle.

l) Data Window End Angle — The angle at which the data window setpoints stop being enforced. This setting will only appear when viewing data window settings and only when the optional 5100-11 encoder is installed, which allows the System 1200 to read crank angle.

Auto Setup ***Softkey*** — This softkey brings up the Auto Setup screen. See section 3.4.1.4 on page 36 for more information on automatically setting limits. Once an auto setup process has been initiated, this softkey will change to Cancel Auto Setup.

Cancel Auto Setup ***Softkey*** — This softkey only appears if Auto Setup is currently active. Pressing this softkey will cancel the auto setup process and the key will change back to Auto Setup.

Next Channel ***Softkey*** — This softkey will display the next channel.

Next Window ***Softkey*** — This softkey will display the next Data Window, if data windows are configured. It will return to the Peak Window when all data windows have been viewed. This softkey will not be displayed if no data windows are configured.

3.4.1 Setting Limits

As can be seen in Figure 14, there are three limits that must be set in the tonnage monitor for it to perform its function. Each channel has a low, high, and reverse limit for Peak settings. Data Window settings have a High and Low limit.

> **NOTE:** These limits are restricted items and access to them is controlled by the RUN/PROG key, access code, or both as described in section 3.1.7 on page 19.

3.4.1.1 Setting High Limits

To set a high limit, touch inside the blue box in which the limit number appears. Enter the new limit with the numeric keypad that appears and press the Enter softkey to set the limit. The high limit MUST be greater than the low limit for that channel but less than “Max Forward Setpoint Level” (see section 4.5.3 on page 58 for details).

3.4.1.2 Setting Low Limits

To set a low limit, touch inside the blue box in which the limit number appears. Enter the new limit with the numeric keypad that appears and press the Enter softkey to set the limit. The low limit MUST be less than the high limit for that channel. Note that setting this value to zero effectively disables it.

3.4.1.3 Setting Reverse Limits

To set a reverse limit, touch inside the blue box in which the limit number appears. Enter the new limit with the numeric keypad that appears and press the Enter softkey to set the limit.

3.4.1.4 Automatically Setting Limits

Tonnage limits can be automatically set by the tonnage monitor by using a process where 16 stokes are made in order for the unit to determine the normal variation in the process.

The Auto Setup softkey brings up a screen that can initiate an automatic calculation of tonnage limits based on the tonnages that the machine is currently generating. Like manually setting limits, this is a restricted function. The operator must have access via RUN/PROG Key or access code depending on how the system has been configured (See section 3.1.7 on page 19 for access configuration details). When this key is pressed, a screen will appear which allows the operator to enter an "Auto Setup Tolerance" (percent of machine rating of each channel) which is applied to the peak tonnage recorded during the automatic setup process.

Press the Execute Auto Setup key to start the auto setup process (this will also automatically exit to the tonnage monitor main screen). The "Auto Setup Tolerance" percentage of the channel rating is added to the highest tonnage recorded in the 16 successive strokes made in the auto setup mode in order to calculate the High Limit. The tolerance is subtracted from the lowest peak tonnage recorded during the procedure in order to calculate the Low Limit. The tolerance is subtracted from the most negative peak tonnage recorded in order to calculate the Reverse Limit. The 16 strokes of the automatic setup process will not begin until after the number of strokes set in the "Low Limit Bypass Strokes" parameter (see Section 3.5.4 on page 38 for details) have elapsed.

WARNING: While in auto setup mode, the tonnage monitor module will ignore any high, low, or reverse alarm. Only machine rating alarms are active. For progressive dies, material should complete its progression through all stations before beginning auto setup.

The actual tonnages and number of strokes remaining are automatically updated each stroke. A maximum of 120 seconds is allowed between strokes or the setup procedure will automatically abort and leave the present limits unchanged. After the last stroke, the tonnage monitor module will automatically exit the automatic setup mode and calculate the tonnage limits. Normal operation will continue with the new limits. Low limits and reverse limits are updated even if turned OFF. Once started, the Auto Setup softkey in the channel settings screen changes to Cancel Auto Setup. The automatic setup procedure can be aborted at any time before the sixteenth stroke by pressing this softkey. The previously entered limits will then remain in effect.

3.5 The Tonnage Monitor Bypass Screen

The bypass settings screen can be selected by pressing the Bypass softkey in the tonnage monitor main screen (See Figure 12 on page 26).

Two of the items on this screen, “Auto Unbypass When Switching to Production Mode” and “Bypass Low Limits in Setup Mode” are displayed for reference and cannot be changed in this screen as they are not job related settings (see section 4.6 on page 59 for information on these parameters).

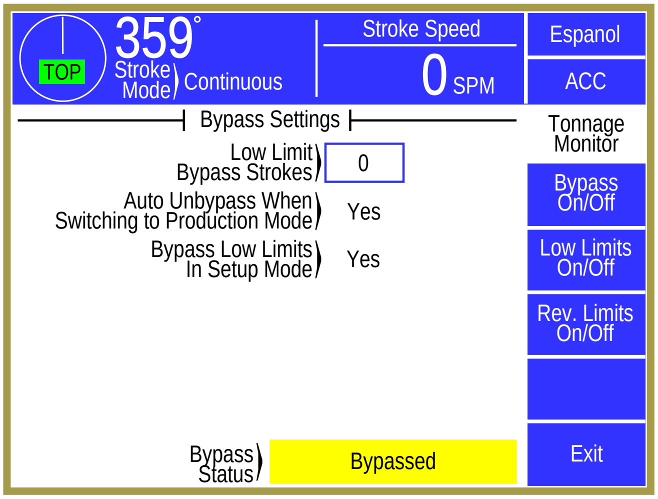

Figure 16: Tonnage Monitor Bypass Screen

3.5.1 Bypassing the Tonnage Monitor

The Bypass On/Off softkey toggles the tonnage monitor bypass between ON and OFF. Like changing setpoints, this is a restricted operation. The operator must have access to this operation via RUN/PROG Key or access code depending on how the system has been configured (See section 3.1.7 on page 19 for access configuration details). When bypassed, all tonnage monitor limits are ignored with the exception of machine rating alarms. In addition, the tonnage monitor status will say “System Bypassed” with a yellow background and “Bypassed” will be displayed with a yellow background just below the tonnage reading on each channel. The module will always power up with Bypass turned OFF.

3.5.2 Turning Low Limits ON or OFF

Pressing the Low Limits On/Off softkey will toggle all low limits ON or OFF. Like changing setpoints, this is a restricted operation. The operator must have access to this operation via RUN/PROG Key or access code depending on how the system has been configured (See section 3.1.7 on page 19 for access configuration details). When low limits are turned off, “Low Lim OFF” will be displayed with a yellow background just below the tonnage reading on each channel.

NOTE:	Individual low limits can be effectively turned OFF by setting the limit to zero.

3.5.3 Turning Reverse Limits ON or OFF

Pressing the Rev. Limits On/Off softkey will toggle all reverse limits ON or OFF. Like changing setpoints, this is a restricted operation. The operator must have access to this operation via RUN/PROG Key or access code depending on how the system has been configured (See section 3.1.7 on page 19 for access configuration details). When reverse limits are turned off, “Rev Lim OFF” will be displayed with a yellow background just below the tonnage reading on each channel.

3.5.4 Low Limit Bypass Strokes

Some presses may “ramp up” to speed to accommodate transfer mechanisms or for other reasons. Often this results in a lower peak tonnage for the first few strokes. This setting will automatically bypass low limits for a given number of stokes after starting the press. Set this value to 0 to disable this behavior. This setting also affects the auto-setup procedure in that the 16 strokes for the auto-setup will not begin until the low limit bypass strokes have been made. This can be up to 31 strokes.

3.6 The Tonnage Monitor Graph Screen

The Tonnage Graph softkey in the main tonnage monitor screen provides the operator or die setter more detailed analysis of machine forces by displaying tonnage signatures.

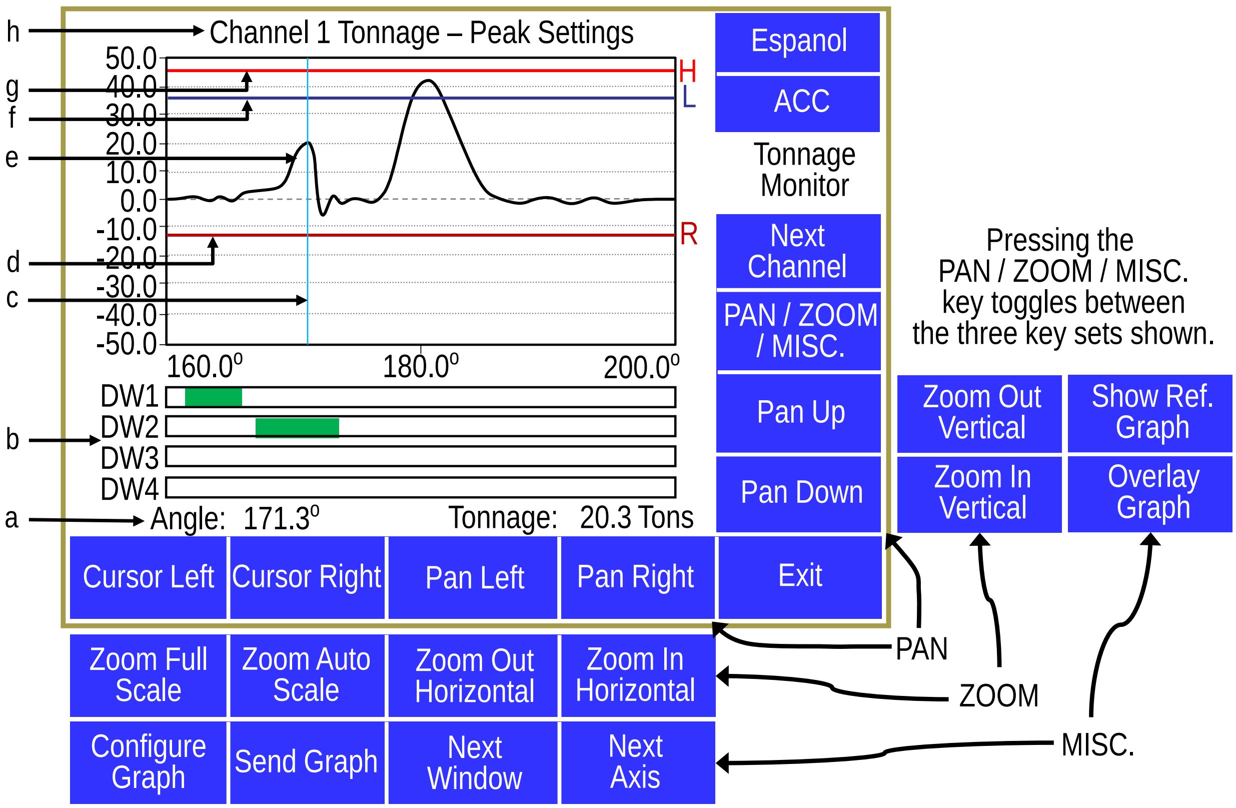

Figure 17: Tonnage Graph Screen

Notice that in Figure 17 there are three versions of several of the softkeys. The PAN / ZOOM / MISC softkey toggles between which key set is shown. When entering the screen, the PAN set is shown. Pressing the PAN / ZOOM / MISC softkey will cause the 4 horizontal keys and 2 vertical keys indicated in Figure 17 to change to the ZOOM set. Pressing PAN / ZOOM / MISC again will change those keys to the MISC. set. Pressing that key again will bring up the PAN set once again. Note that some keys may not display depending on configuration.

Referring to Figure 17, the features of this screen are:

a) Cursor Readout — The angle or time and its corresponding tonnage at the point where the vertical measuring cursor (at 171.3 degrees in Figure 17 and pointed to by "c") is sitting.

b) Data Window Indicators — If data windows are used, this area graphically displays where the data windows are active relative to the graph. This allows data windows to be properly set relative to local peaks or other feature of interest.

c) Measuring Cursor	The measuring cursor can be moved across the graph with the Cursor Left and Cursor Right softkeys when in PAN mode. The Angle or Time and Tonnage (a) are updated as the cursor moves. The cursor is extremely helpful for proper placement of data window start and end angles.
d) Reverse Limit Bar	This line (in red) graphically shows where the reverse limit is set with respect to the tonnage waveform. For a "good" hit, no part of the tonnage waveform should extend below this line. The "R" to the right of the line is for "Reverse".
e) Tonnage Waveform	This is the actual tonnage waveform collected by the tonnage monitor. The x-axis is crankshaft angle (or time, depending on the mode) with 180 degrees being bottom dead center. The y-axis is in tons with the tonnage values given on the left side of the graph.
f) Low Limit Bar	This line (in blue) graphically shows where the low limit is set with respect to the tonnage waveform. For a "good" hit, some part of the tonnage waveform should extend above this line. The "L" to the right of the line is for "Low".
g) High Limit Bar	This line (in red) graphically shows where the high limit is set with respect to the tonnage waveform. For a "good" hit, no part of the tonnage waveform should extend above this line. The "H" to the right of the line is for "High".
h) Graph Title	The graph title indicates exactly what is being viewed. The first part of the title indicates the channel being viewed - Channel 1, Channel 2, Channel 3, Channel 4, or the Total. The second part of the title indicates which set of setpoints is being viewed - Peak, Data Window 1, Data Window 2, Data Window 3, or Data Window 4.
Next Channel ***Softkey***	This softkey cycles through the channels displayed by the graph. A four channel tonnage monitor will cycle through channel 1, channel 2, channel 3, channel 4, total tonnage, and then back to channel 1. Likewise, a two channel tonnage monitor will cycle through channel 1, channel 2, total tonnage, and then back to channel 1. The channel being displayed is indicated in the title above the graph as shown by "h" in Figure 17.
PAN / ZOOM / MISC. ***Softkey***	Toggles between PAN, ZOOM, and MISC. keys are shown in Figure 17.
Pan Up, Pan Down, Pan Left, Pan Right ***Softkeys***	Allows panning of the graph to move it to areas of interest. Use in combination with the zoom keys to control the view.
Cursor Left, Cursor Right ***Softkeys***	Moves the measuring cursor left and right.

Zoom In Horizontal, Zoom Out Horizontal *Softkeys*

These softkeys zoom in or out on the angle or time axis, depending on the x-axis mode.

Zoom In Vertical, Zoom Out Vertical *Softkeys*

These softkeys zoom in or out on the tonnage axis.

Zoom Full Scale *Softkey*

This softkey displays the graph from the beginning of the sample window to the end of the sample window and from -100% of machine rating to 150% of machine rating.

Zoom Auto Scale *Softkey*

This softkey causes the display to attempt to find the "interesting" portion of the signature and zoom in on that part. This works by checking the beginning and end of the signature for values close to zero and sets the start and end angles where tonnage starts to show. The minimum tonnage on the graph is then set just below the lowest tonnage of the signature and the maximum tonnage on the graph is set just above the highest tonnage of the signature. This should work the vast majority of the time to fill the screen with the actual working portion of the tonnage signature. If for any reason it does not, however, the graph can always be adjusted by hand.

Show Ref. Graph *Softkey*

If a reference graph has been stored for the job, this softkey will appear and toggles the display of the reference graph on the screen. The key will change to Hide Ref. Graph when the reference graph is displayed.

Overlay Graph *Softkey*

This softkey puts the graph screen in overlay mode. As long as the screen is not exited, the channel changed, or the graph moved, successive hits will be drawn on top of display without erasing pervious hits. This allows hit to hit variability to be seen graphically. The key will change to Cancel Overlay when in this mode. Pressing it again returns the graph screen to normal display mode.

Next Axis *Softkey*

This softkey toggles the x-axis of the graph between time and crank angle. Showing the graph by time will only look different in cases where the press slows down or stops during the sample window - typically for material flow purposes. Note that crank angle is only available when the optional 5100-11 encoder is used.

Next Window *Softkey*

This softkey cycles through the peak and data window settings for the currently displayed channel and graphically displays the setpoints on the graph.

Send Graph *Softkey*

This softkey allows the user to send the tonnage graph to a laptop, the LinkNet network, or to a reference graph depending on the configuration of the system.

Configure Graph *Softkey* This softkey brings up the tonnage monitor graph settings screen. See section 3.7 on page 42 for more information on this screen.

3.6.1 Sending the Graph

The Send Graph softkey commands the tonnage monitor module to transmit all present tonnage data to some other destination. When this softkey is pressed, a list will appear with the available sending options. Note that not all options may be available at any given time. The progress of these operations is shown at the top of the screen just above the tonnage graph in a special progress window. The possible options are:

Store As Reference The system can store one "reference" tonnage waveform per job. This reference waveform can be overlaid with the current waveform to make a direct on-screen comparison of the two. The "Store As Reference" selection of the Send Graph softkey will retrieve the tonnage waveform from the tonnage monitor, make a reference waveform from it, and store it under the current job number. Note that this operation is a restricted operation and may require the RUN/PROG key and/or an access code depending on system configuration (see section 3.1.7 on page 19 for details). After success or failure is reported, press any key to resume normal operation of the screen.

Send To Laptop This option is only available if the laptop interface has been set up in auxiliary communications. In addition, a computer with the Link Graphical Tonnage Analyzer must be connected to the laptop port for this operation to succeed. When the "Send to Laptop" option of the Send Graph softkey is selected, the system will retrieve the tonnage waveform from the tonnage monitor and transfer it to the laptop. After success or failure is reported, press any key to resume normal operation of the screen.

3.6.2 Reference Waveforms

For each job, one reference waveform may be stored. This will typically be a "known good" waveform representative of a setup that is producing good parts. If a problem, or suspected problem, later comes up with the job, the reference waveform can be "overlaid" with the current waveform to check for important differences. See section 3.6.1 for information on storing a reference waveform.

To display a reference waveform, press the Show Ref. Graph softkey (as seen in Figure 17). Note that this softkey will only be displayed if a reference waveform has been previously stored for the current job and the MISC. keys are being displayed using the PAN / ZOOM / MISC. softkey. The reference waveform will show in green, overlaid with the current waveform which will still be in black. Once the reference waveform is displayed, the Show Ref. Graph key changes to Hide Ref. Graph. Pressing this key again will remove the reference waveform from the screen leaving only the current waveform.

3.7 The Tonnage Monitor Configure Graph Screen

Hitting the Configure Graph softkey in the Tonnage Graph screen display a screen with parameters that affect the way the tonnage graph is acquired. The settings in this screen are not often used, and can usually be left at the default values. However, in cases where the press is very slow, or when a servo press slows down or stops at the bottom of the stroke, these will need to be set appropriately in order to get a usable graph. The system stores as many as 4096 points per channel when capturing tonnage signatures.

3.7.1 Graph Sample Rate Parameter

This parameter should be set to the smallest value that will capture the entire waveform. Note that the sample rate for limit comparison is always at the highest rate – only the signature display sample rate is changed. If the press is very slow the signature buffer can fill up before the stroke is completed and the last half of the signature will not be captured. In that case, raise this value and make another stroke to see if the waveform is captured. The setting can be changed in 0.2 millisecond increments. The default value of 0.2 milliseconds will usually work for press speeds of 30 SPM or faster, while 0.4 milliseconds should work for 15 SPM or faster.

3.7.2 Graph Slow Sample Threshold Speed Parameter

Some servo press operations will run at a “normal” speed for most of the stroke but may stop and dwell at the bottom to allow material to flow. We would like a fast sample rate during the fast forming part of the stroke while still being able to capture the slower flow part of the stroke. To deal with this situation, this parameter sets the speed below which the tonnage monitor will shift to a fixed slow sample rate to capture the tonnage change while dwelling at the bottom for material flow characteristics. When the press speeds back up, the faster sample rate is restored. When viewing the tonnage graph by angle, the signature will look pretty much like it normally would if the press did not slow down or stop at the bottom. When viewing the signature by time, however, the dwell period will be clearly seen on the graph and is indicated by a gray graph color for that portion of the graph. Setting this parameter to 0 SPM will disable this behavior. It should also be noted that this will have no effect unless the optional 5100-11 encoder is used as that is what allows the system to read crankshaft speed.

3.8 Counters

Touch the Counter display area in the Main Screen (see "b" in Figure 11 on page 24) to go to the counter screen.

The System 1200 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.

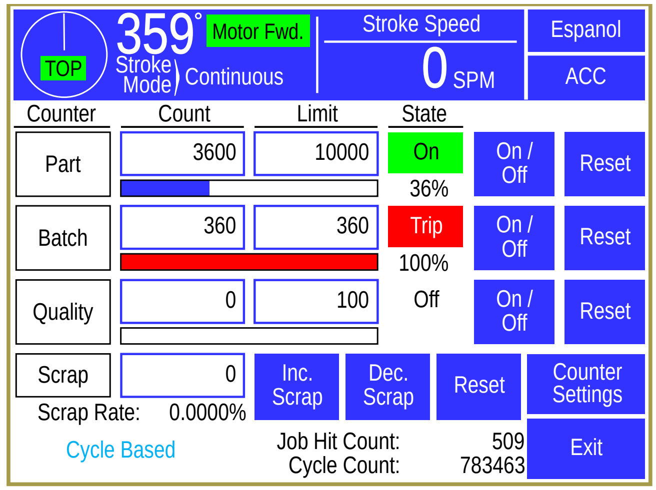

Figure 18: Counter Screen

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 19), 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 18 is what will initially appear. If 2 counter groups are enabled, then initially the screen shown in Figure 19 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 18.

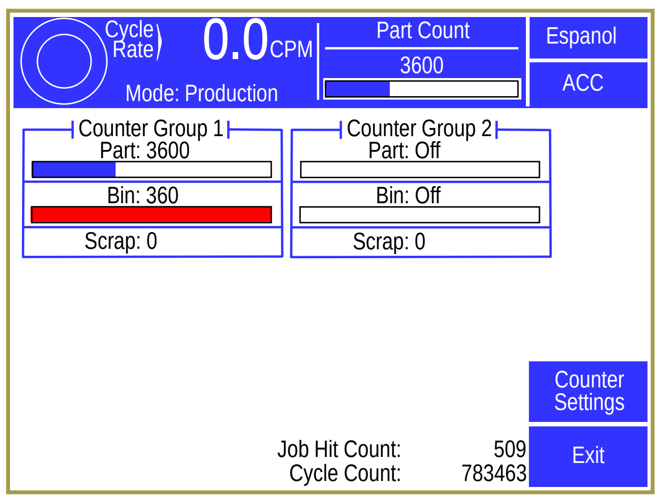

Figure 19: Counter Group Screen

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 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.

3.8.1 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 18.

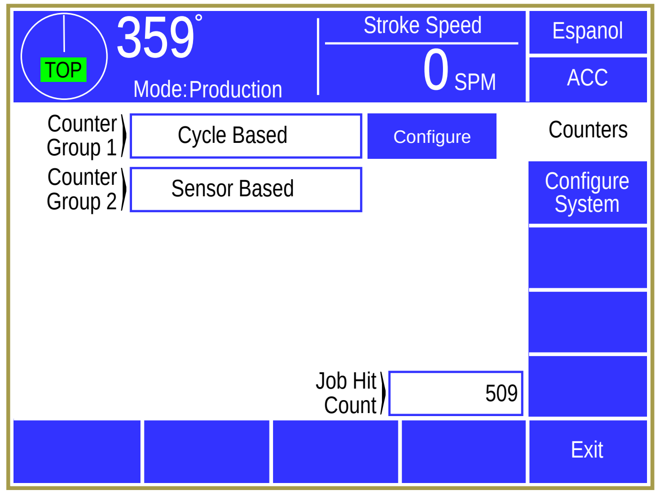

Figure 20: Counter Configuration Screen

A screen similar to Figure 20 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 – “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 20. 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 20 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 its corresponding hardware inputs. See section 4.4 on page 56 for information on configuring inputs for this purpose.

3.8.2 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.

3.8.2.1 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 19) is being used that requires a password, a user must be configured to have the "Counter Settings" permission to change this parameter.

3.8.2.2 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 19) is being used that requires a password, a user must be configured to have the "Counter Settings" permission to change this parameter.

3.8.2.3 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 19) 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.

3.8.2.4 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.

3.8.2.5 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 19) 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.

3.8.3 Cycle Counter

The cycle counter increments anytime the System 1200 determines that the machine has completed a cycle. For mechanical presses this is typically when a stroke has been made. For servo presses this may be more complicated but will be determined by the Cam Zero signal. Contact Link Systems service department to reset the cycle counter.

3.9 The Diagnose Screen

Pressing the Diagnose softkey in the main screen will bring up the diagnostic screen shown in Figure 21. Some of the information in this screen is used by Link personnel for telephone troubleshooting, but the following items are of general interest:

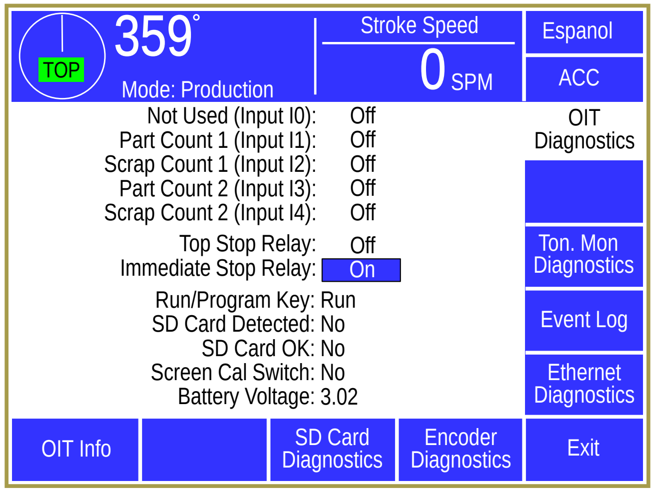

Figure 21: Main Diagnostic Screen

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 1200 enclosure. Depending on the configuration, these inputs can be used as Cam Zero, Data Window enables, setup mode enable, or for part and scrap counter sensors. The text at left of each input will indicate its currently configured function.

Top Stop Relay – Shows the On/Off status of the top stop relay. Note that "On" indicates the System 1200 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 1200 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.

3.9.1 Ethernet Diagnostics

Pressing the Ethernet Diagnostics softkey in the screen of Figure 21 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.

3.9.2 SD Card Diagnostics

Pressing the SD Card Diagnostics softkey in the screen of Figure 21 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 72 for information on backing up and restoring the terminal.

3.9.3 OIT Info Screen

Pressing the OIT Info softkey in the screen of Figure 21 will bring up a screen that shows information about the operator terminal hardware, and its software version.

3.9.4 Event Log

The System 1200 retains an event log which can be displayed by pressing the Event Log softkey in the screen of Figure 21. This log records the reason for the last 256 stops. All reasons for last stop that are generated by the System 1200 are recorded. Each entry in the event log contains the time, date, and the type of stop. The event log is illustrated in Figure 22. 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.

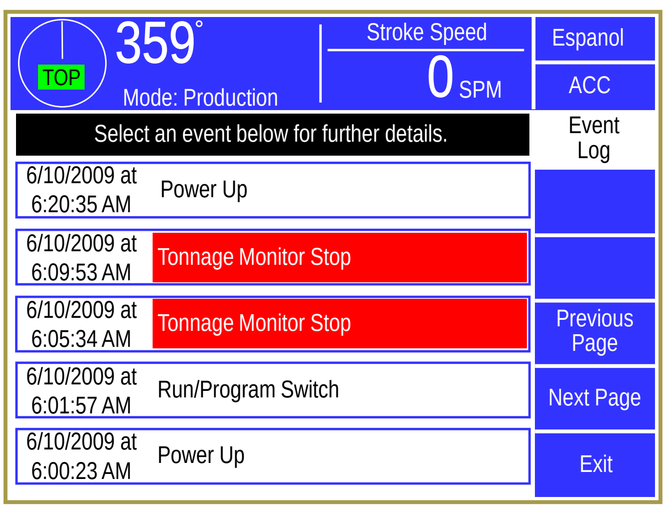

Figure 22: Event Log Screen

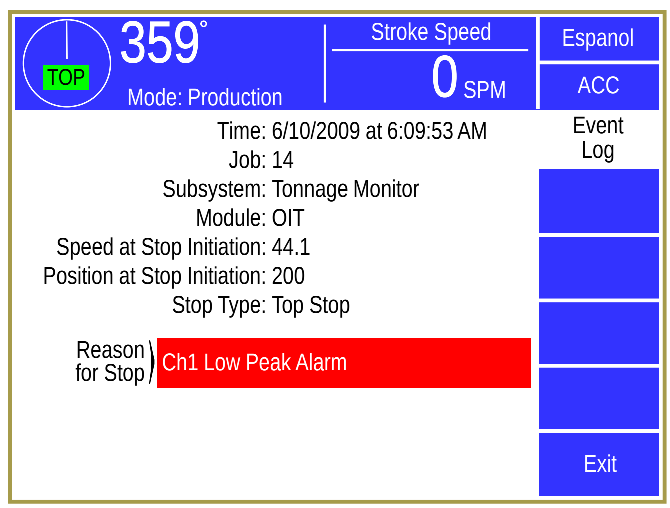

Figure 23: Event Log Detail Information Screen

Pressing a specific stop message will display more detailed information about the conditions that existed when the stop occurred as shown in Figure 23.

3.9.5 The Tonnage Alarm Diagnostics Screen

Pressing the **Ton. Mon. Diagnostics** softkey in the Diagnose screen of Figure 21 will bring up the diagnostic screen shown in Figure 24 at right.

Note that the alarm counters on this screen can only be reset from the Alarm Levels Configuration screen.

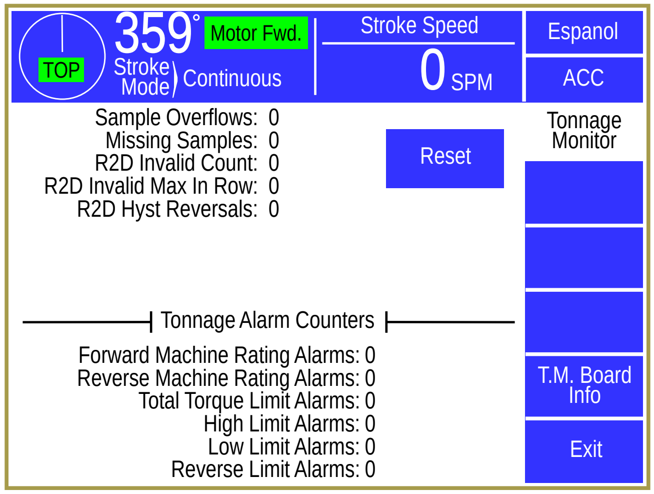

Figure 24: Tonnage Alarm Diagnostics

Items on this screen include:

Forward Machine Rating Alarms	The number of forward machine rating alarms that have occurred since the last time the alarm counters were reset.
Reverse Machine Rating Alarms	The number of reverse machine rating alarms that have occurred since the last time the alarm counters were reset.
Total Torque Limit Alarms	The number of total torque limit alarms that have occurred since the last time the alarm counters were reset.
High Limit Alarms	The number of high limit alarms that have occurred since the last time the alarm counters were reset.
Low Limit Alarms	The number of low limit alarms that have occurred since the last time the alarm counters were reset.
Reverse Limit Alarms	The number of reverse limit alarms that have occurred since the last time the alarm counters were reset.
T.M. Board Info ***Softkey***	This key will bring up a screen with specific information related to the tonnage monitor circuit board such as serial number, lot number, etc. This information is generally useful only to the factory for troubleshooting support.

Sample Overflows These items are used for telephone troubleshooting with the factory.
Missing Samples
R2D Invalid Count
R2D Invalid Max In Row
R2D Hyst Reversals
Reset ***Softkey***

4 CONFIGURATION

4.1 The Tonnage Monitor Configuration Screen

The configuration screens of the tonnage monitor module are accessed by selecting the Configure System softkey in the tonnage monitor channel settings screen (see section 3.4 on page 33) 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 25.

This screen provides access to the individual configuration screens discussed in the following sections.

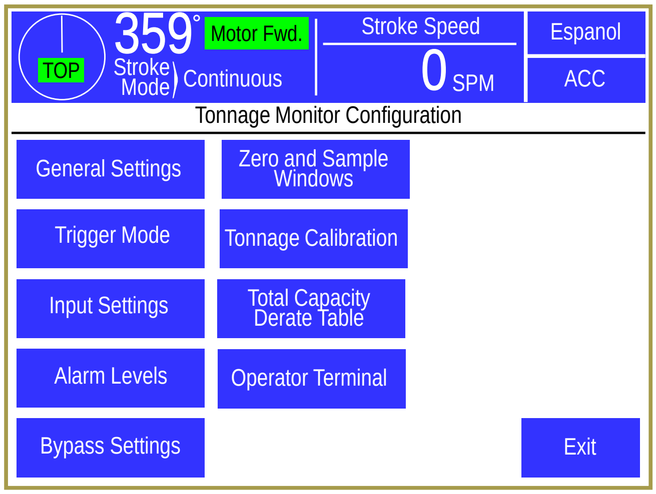

Figure 25: Tonnage Configuration Screen

4.2 The Tonnage Monitor General Settings Configuration screen

Press the **General Settings** softkey in the tonnage monitor configuration screen as shown in Figure 25 to display the screen shown in Figure 26 at right.

The following sections describe the settings in this screen.

4.2.1 Number of Data Windows

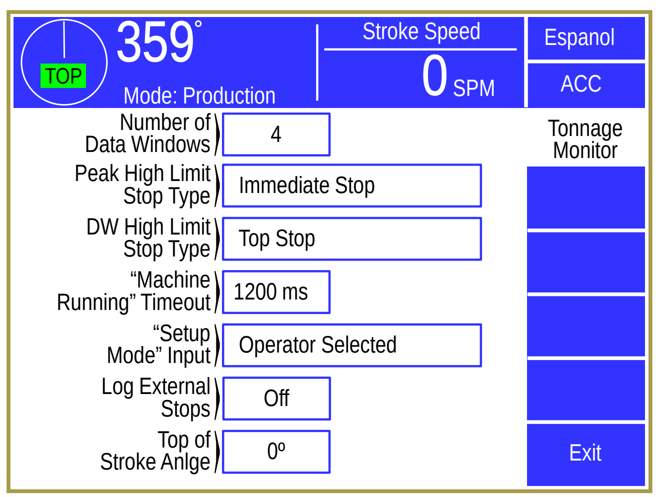

Figure 26: General Settings Configuration

This parameter defines the number of Data Windows that will be monitored and displayed on the operator terminal. Data windows can be used to monitor specific regions of the process, in addition to the peak tonnage. One example would be to monitor a punch that occurs before a bottom forming operation and is much lower tonnage than the peak tonnage of the entire process. A data window can be set to monitor only when the punch occurs. High and low limits can be set that apply only to the tonnage that occurs inside the window.

A setting of zero selects no data windows and only the Peak Window can be viewed. A setting from 1 to 4 enables data windows, and a "Next Window" softkey beside the Peak View allows the tonnages that occurred only inside the data window selected to be viewed. High and low limits can be set to generate alarms for tonnage conditions that occur only inside the window. If configured for the optional encoder, each window allows the entry of a start angle and an end angle. All settings are stored and recalled along with the other job settings. If an encoder is not used, the start and end angles cannot be programmed. Instead, the window is activated by Inputs 1 thru 5. These inputs would typically be controlled by a programmable limit switch.

4.2.2 High Limit Stop Type

This parameter defines the type of stop signal issued when a High Alarm occurs in the working portion of the stroke. Choices are Immediate Stop and Top Stop.

4.2.3 Data Window High Limit Stop Type

This parameter defines the type of stop signal issued when a High Alarm occurs inside one of the Data Windows. Choices are Immediate Stop and Top Stop.

4.2.4 Machine Running Timeout

This parameter is used by the tonnage monitor to determine if the press is running. When a start of the process is detected, changes to limits and other settings are prevented while the press is running. Detection of a start would be defined as entering the sample window (if set for encoder or cam switch mode), or tonnage above the threshold (if set for threshold mode). This parameter should be set longer than the time to make one stroke at the slowest press speed. One other use of this parameter 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.

4.2.5 Setup Mode Input

This parameter can be used to define how the tonnage monitor should detect that the press is in a setup mode, if desired. The setting “Operator Selected” will cause the tonnage monitor to provide a **Toggle Setup Mode** softkey on the Main Screen, in order to allow an operator to easily inform the tonnage monitor 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 must be driven by the press control, and allows automatic detection of a setup mode. This selection is not allowed if the trigger mode is configured for “Cam Mode”. The setting “Not Used” will cause the tonnage monitor to assume that the press is always in a production mode. Setup mode (if used), allows low limits to be automatically bypassed.

4.2.6 Log External Stops

A stop is considered External when the press stops for longer than the Machine Running Timeout, and the cause is not coming from the tonnage monitor. Setting this parameter to “On” will cause these events to be recorded in the event log along with tonnage alarms.

4.2.7 Top of Stroke Angle

This setting allows the System 1200 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. This only has effect when Trigger Mode is CAN Bus or the Link Encoder.

4.3 The Tonnage Monitor Trigger Mode Configuration Screen

Press the **Trigger Mode** softkey in the tonnage monitor configuration screen as shown in Figure 25 to display one of the screens shown in Figures 14, 15, or 16 (depending on the Trigger mode selected). Figure 34 shows the modes allowed.

4.3.1 Trigger Mode

This parameter defines the method that the tonnage monitor uses to determine if the press is at the top of the stroke (the Auto-Zero Window) or is in the working portion of the stroke (the Sample Window). Note that the **Top Info Area** will change based on the configuration. Crankshaft position will be shown only if the rotary transducer is installed. The possible selections are described below:

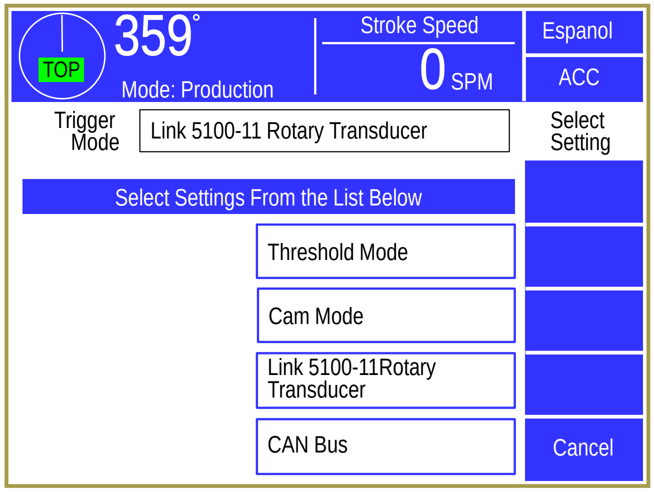

Figure 27: Selecting Trigger Mode

4.3.2 Threshold Mode

This Trigger Mode instructs the tonnage monitor to use only the strain gauge signals as the indication of the zero window or sample window. If all channel signals remain below the "Acquisition Threshold", then the tonnage monitor assumes that the press is in the auto-zero window, and will control long term temperature drift of the gauges. The sample window is detected when tonnage on any channel goes above this threshold. The parameters described below configure how this trigger mode functions.

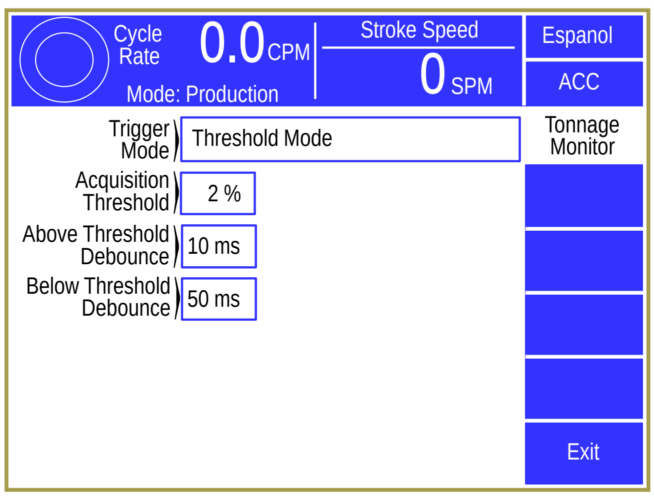

Figure 28: Threshold Trigger Mode Config

4.3.2.1 Acquisition Threshold

This parameter defines the tonnage level that controls the Auto-Zero Window and the Sample Window. When all channel signals remain below this level, the tonnage monitor will enter the Auto-Zero Window. It will monitor, filter, and control any long term drift in the strain gauge signals. If any channel input transitions above this threshold for longer than the "Above Threshold Debounce" time, the sample window is detected. The tonnage monitor will sample, store, and monitor each channel's tonnage at the "Sample Rate" configured as long as it remains in the sample window. When all channel signals go below the threshold in the positive and negative direction for longer than the "Below Threshold Debounce" time, the Auto-Zero Window is detected and the stroke is complete. The suggested default value is 5% of channel rating.

4.3.2.2 Above Threshold Debounce

This parameter defines how long each channels signal can remain above the Acquisition Threshold before the Sample Window is detected. The main purpose for this parameter is to reject any noise transient that could trigger a false stroke. The suggested default value is 10 milliseconds.

4.3.2.3 Below Threshold Debounce

This parameter defines how long all channel signals should remain below the Acquisition Threshold before the stroke is competed and the Auto-Zero Window is detected. The suggested default value is 50 milliseconds.

4.3.3 Cam Mode

This Trigger Mode instructs the tonnage monitor to use Input 0 as a "Cam Zero" indication that the press is in the auto-zero window. When Input 0 is switched to ground (On), the tonnage monitor will automatically control any long term temperature drift of the gauges. When the input is Off, the sample window is detected. This input is typically driven by a mechanical cam switch or a programmable limit switch connected to crankshaft. Inputs 1-4 can be used as data window selectors, if desired (see section 4.5.1).

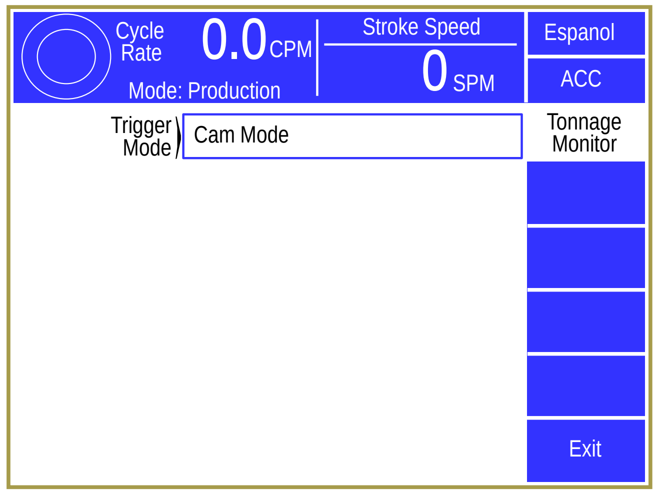

Figure 29: Cam Mode Trigger Config

4.3.4 Link 5100-11 Rotary Transducer Mode

This Trigger Mode instructs the tonnage monitor to directly read the position of the crankshaft. The Auto-Zero Window and Sample Window functions are controlled internally. See section 4.8 for information on configuring the zero and sample windows. The On/Off angles of data windows, if configured are entered on the operator terminal and included in the other job data.

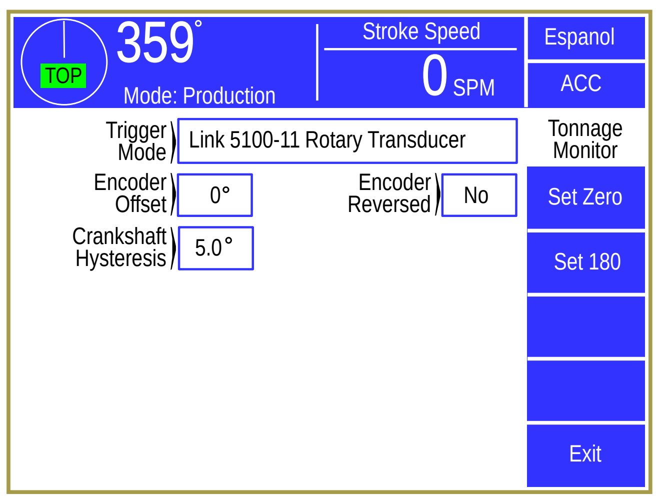

Figure 30: Rotary Transducer Trigger Config

4.3.4.1 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.

4.3.4.2 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”.

4.3.4.3 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.

4.3.5 CAN Bus Mode

This Trigger Mode instructs the tonnage monitor to take its crank angle information from a CAN Bus connection to a System 2600. This lets information from the same encoder that drives the System 2600 be passed on to the System 1200 and avoid installing an additional encoder. See section 7.5.5 for information on wiring this connection.

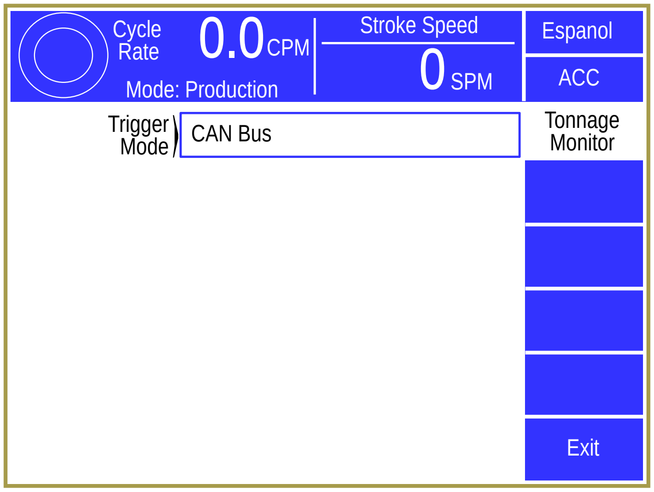

Figure 31: Cam Mode Trigger Config

4.4 The Tonnage Monitor Input Settings Configuration Screen

Press the **Input Settings** softkey in the tonnage monitor configuration screen as shown in Figure 25 to display the screen shown in Figure 32.

The following sections describe the settings in this screen.

4.4.1 Input 0 Function

Input 0 is defined as “Cam Zero” any time that the Trigger Mode is set to “Cam Mode”, and cannot be changed (see Trigger Mode Configuration screen). Input 0 can be used as a Setup Mode selector or counter input in “Threshold Mode”, “Link 5100-11 Rotary Transducer” mode or “CAN Bus” mode.

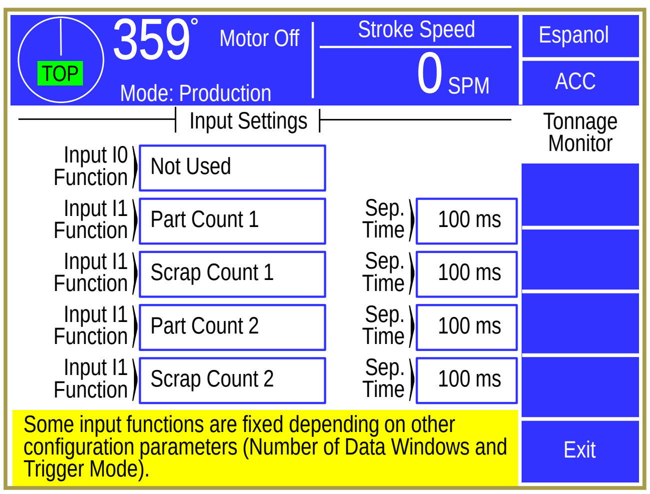

Figure 32: General Settings Configuration

Note that “Setup Mode” is only available when the “Setup Mode Input” parameter (see General Settings Configuration screen) is configured as “Hardware Input”. The present function and on/off state of the input can be viewed in the Diagnose screen.

4.4.2 Input 1 – 4 Function

Inputs 1-4 can be configured as data window inputs, or counter inputs “Threshold Mode or “Cam Mode”. When set as a data window, the window is active when the input is switched to ground (On). These inputs are automatically defined as part count triggers and scrap count triggers in “Link 5100-11 Rotary Transducer” mode or “CAN Bus” mode, since data window on/off angles are entered on the operator terminal. The present function and on/off state of the inputs can be viewed in the Diagnose screen.

4.4.3 Separation Time

When inputs are defined as counter inputs, an addition field appear to the right of the input to enter the separation time. This time prevents the sensing of an additional part until the entered time has elapsed after the input has gone away. This prevents tumbling parts that might be sensed multiple times by an optical sensor from falsely counting multiple times. It can also eliminate problems with relay contact bounce if that is being used to drive the counters. Unless running at extremely high speeds or multiple actual parts being sensed by the same sensor with a very short separation time, 100 milliseconds is a good place to start for this value. Raise the time if multiple parts are falsely sensed.

4.5 The Tonnage Monitor Alarm Levels Configuration Screen

Press the Alarm Levels softkey in the tonnage monitor configuration screen as shown in Figure 25 to display the screen shown in Figure 33.

The following sections describe the settings in this screen.

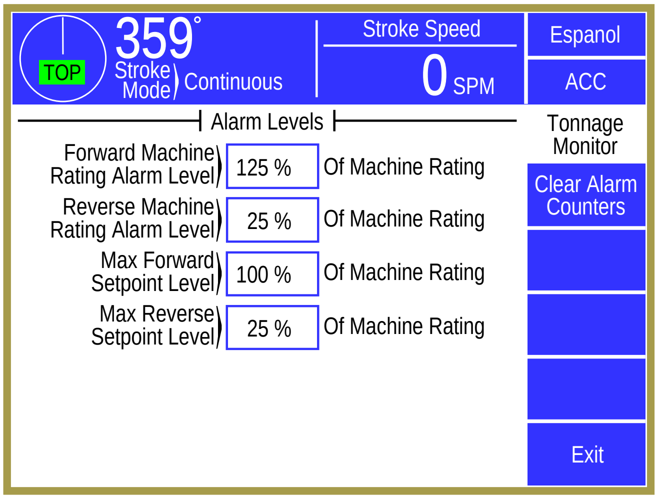

Figure 33: Alarm Levels Configuration Screen

4.5.1 Forward Machine Rating Alarm Level

This is the level at which a channel triggers a machine rating alarm for forward tonnage and can be set from 100% to 125% of machine rating. Remember that machine rating alarms only apply to individual channels, not the total tonnage. For instance, a four channel setup on a 400 tons press results in a per-channel capacity of 100 tons. If this setting is 125% then the machine rating alarm level for each channel would be 125 tons.

4.5.2 Reverse Machine Rating Alarm Level

This is the level at which a channel triggers a machine rating alarm for reverse tonnage and can be set from 10% to 100% of machine rating. Remember that machine rating alarms only apply to individual channels, not the total tonnage. For instance, a four channel setup on a 400 tons press results in a per-channel capacity of 100 tons. If this setting is 25% then the machine rating alarm level for each channel would be 25 tons.

4.5.3 Max Forward Setpoint Level

This is the maximum forward tonnage to which a low or high limit setpoint can be set and can be 10% to 125% of machine rating. Remember that limit setpoints only apply to individual channels, not the total tonnage. For instance, a four channel setup on a 400 tons press results in a per-channel capacity of 100 tons. If this setting is 100% then the maximum limit level for each channel would be 100 tons.

4.5.4 Max Reverse Setpoint Level

This is the maximum reverse tonnage to which a reverse limit setpoint can be set and can be 10% to 100% of machine rating. Remember that limit setpoints only apply to individual channels, not the total tonnage. For instance, a four channel setup on a 400 tons press results in a per-channel capacity of 100 tons. If this setting is 25% then the maximum reverse limit level for each channel would be 25 tons.

4.6 The Tonnage Monitor Bypass Settings Configuration Screen

Press the Bypass Settings softkey in the tonnage monitor configuration screen as shown in Figure 25 to display the screen shown in Figure 34.

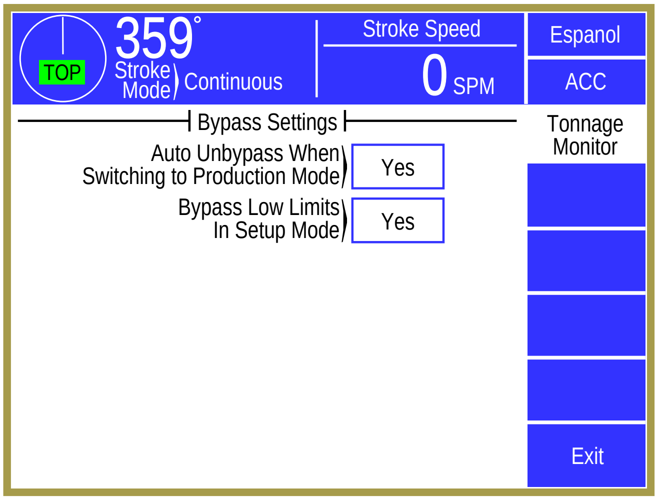

Figure 34: Bypass Settings Configuration Screen

The following sections describe the settings in this screen.

4.6.1 Auto Unbypass When Switching to Production Mode

The Bypass On/Off softkey in the tonnage monitor bypass screen bypasses all limits except Machine Rating limits. As such, it is a powerful tool when setting up a die when strokes must be made before material is completely fed and tonnages are at regular production levels. However, there is a danger that the operator will forget to turn bypass back off. When this setting is "Yes", the tonnage monitor will automatically turn bypass OFF when switching from a setup mode to a production mode.

4.6.2 Bypass Low Limits in Setup Mode

When setting up a die, often the tonnage will not meet the limit requirements because the material is not yet fed, the material is not completely threaded through the die, or the slide is in the process of being adjusted to get a good part. In each of these cases, the tonnage is almost always too low and therefore violates the low limits. When this setting is "Yes", the tonnage monitor will automatically bypass the low limits while in a setup mode. If "Setup Mode Input" is configured as "Hardware Input" (see section 4.2.5 on page 53), this happens with no operator intervention and clears itself when going back to a production mode. While in setup mode, the low limits are clearly indicated as off in each channel status line with "Low Lim OFF" displayed in yellow. The benefit of this setting is that high and reverse limits are not bypassed, thus providing greater machine protection, and that the operator does not have to remember to turn the low limits back on when going to production mode.

4.6.3 Resetting Alarm Counters

The alarm counters that are displayed in the Tonnage Monitor Diagnose screen (see section 3.9 on page 48) can be reset by pressing the Clear Alarm Counters softkey. The OIT will ask for confirmation before clearing the counts.

4.7 The Tonnage Monitor Zero and Sample Windows Configuration Screen

Press the Zero and Sample Windows softkey in the tonnage monitor configuration screen as shown in Figure 25 to display the screen shown in Figure 35. The following sections describe the settings in this screen.

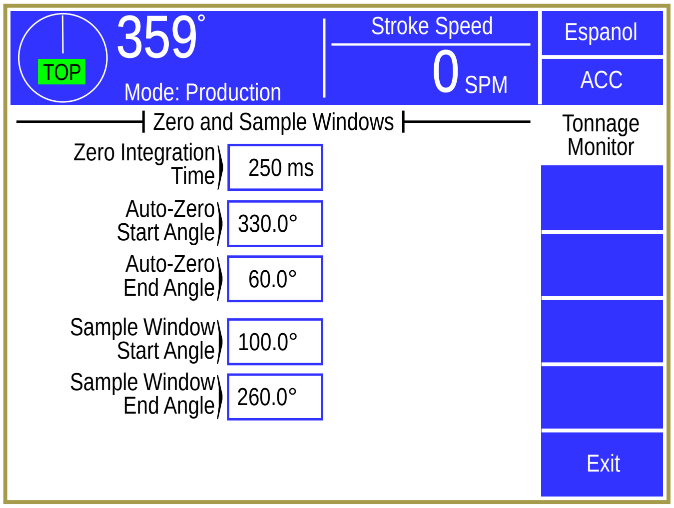

Figure 35: Zero and Sample Windows Configuration Screen

4.7.1 Zero Integration Time

This parameter defines the amount of time that the analog inputs are averaged and applied to the zero compensation circuit, while inside the Auto-Zero Window. The suggested default value is 250mS.

4.7.2 Auto-Zero Start Angle

Temperature changes cause expansion or contraction of the machine and induce strains which can be detected by the tonnage monitor strain gages mounted to the machine frame. In addition, strain gages are manufactured with an inherent zero imbalance which can change if the gage experiences any long term creep. Slowly varying signals such as these are compensated by measuring the strain gage signals while the machine frame is not exposed to any force and integrating the offset to zero. This is performed by the tonnage monitor module automatically when the press is at the top of the stroke. The "zero" portion of the stroke begins at the Auto-Zero Start Angle and ends at the Auto-Zero End Angle. The suggested default value is 300 degrees. This parameter is used only if the tonnage monitor is configured to use the 5100-11 rotary transducer.

4.7.3 Auto-Zero End Angle

See Auto-Zero Start Angle for information on Auto-Zero. The suggested default value for this parameter is 60 degrees. This parameter is used only if the tonnage monitor is configured to use the 5100-11 rotary transducer.

4.7.4 Sample Window Start Angle

This angle defines the point in the down-stroke where the tonnage monitor module starts taking samples for comparison with the limits. After it is reached each sample is examined in order to capture the peak tonnage for comparison with the limits in effect. The determination of peak tonnage continues until the end of the working portion of the stroke (Sample Window End Angle). Since this angle defines the start of the working portion of the stroke, it should be set prior to the angle that tooling forces begin. The suggested default value is 100 degrees. This parameter is used only if the tonnage monitor is configured to use the 5100-11 rotary transducer.

4.7.5 Sample Window End Angle

This angle defines the point in the up portion of the stroke where the tonnage monitor stops sampling the peak tonnage. Alarm counters are updated at this time. Since this angle defines the end of the working portion of the stroke it should be set beyond the angle where tooling forces end. The suggested default value is 260 degrees. This parameter is used only if the tonnage monitor is configured to use the 5100-11 rotary transducer.

4.8 The Tonnage Monitor Tonnage Calibration Configuration Screen

Press the Tonnage Calibration softkey in the tonnage monitor configuration screen as shown in Figure 25 to display the screen shown in Figure 36.

The following sections describe the settings in this screen.

4.8.1 Number of Channels

Before the tonnage monitor is calibrated, the number of channels to use must be set correctly. The number of channels to use should be set to 2 or 4.

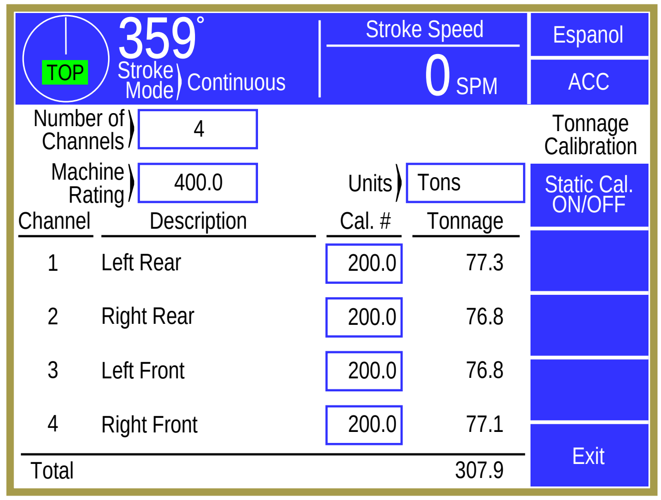

Figure 36: Tonnage Monitor Tonnage Calibration Screen

4.8.2 Machine Rating

The Machine Rating is the total capacity of the machine frame as defined by the press manufacturer and is typically specified at some position off the bottom of the stroke. The tonnage monitor will use this parameter along with the number of channels to determine the rating of each channel. The scale factors calculated are used to translate strain gage outputs into tonnage values. This value should be set at the time that the tonnage monitor module is installed and not changed afterward.

4.8.3 Units

This setting determines whether the tonnage monitor works in units of Tons or Metric Tons. This setting can be changed at any time without recalibrating the tonnage monitor. All setpoints and other tonnage related items will automatically change to the unit selected. For example, a press specified from the manufacturer as a 400 metric ton press can have its machine rating entered while the units are set to metric tons. However, the load cells available for calibrating the press display U.S. tons. Switch the unit back to tons and the machine rating changes to 440.9. Now calibrate the press using U.S. tons. After calibration, the units can be changed back to metric tons if desired.

NOTE: Units can be changed at any time without messing up the calibration or the setpoints. Everything will still work correctly including stored jobs.

4.8.4 Cal. #'s

Changes can be made to the tonnage monitor calibration numbers (gain) with the RUN/PROG keyed selector switch in the PROG position. The press can be operated with the selector switch in the RUN position and will update the actual peak tonnage each stroke. See section 8 on page 97 for calibration procedures.

4.9 The Tonnage Capacity Derate Table Screen

Press the Total Capacity Derate Table softkey in the tonnage monitor configuration screen as shown in Figure 25 to display the screen shown in Figure 37.

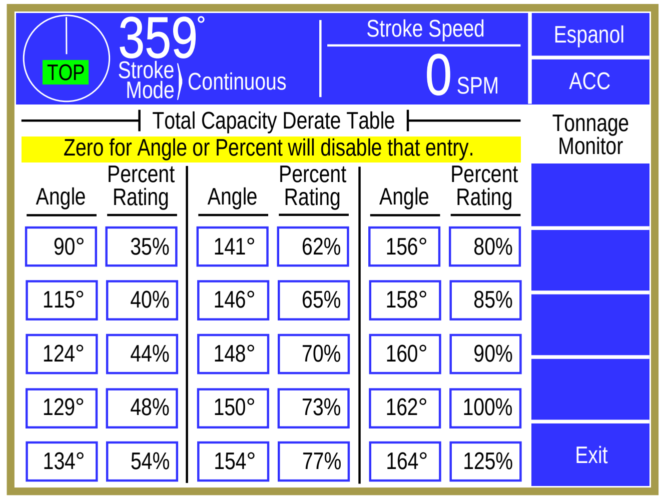

Figure 37: Tonnage Monitor Total Capacity Derate Screen

A mechanical power press is typically specified by its manufacturer with a tonnage capacity rating and a height off of the bottom of the stroke at which this rating applies. The mechanical advantage created in the translation of the rotary motion of the crankshaft to the linear motion of the slide changes depending upon crankshaft angle. The constant torque of the clutch develops more downward force as the crankshaft angle travels from 90 degrees (mid stroke) to 180 degrees (bottom).

If torque were the only limiting factor, the press could deliver infinite tonnage at the bottom of the stroke. However, the elastic limits of the press frame place an additional limitation on tonnage near the bottom. Below the point where the machine is rated, a Machine Rating limit of no more than 125% of rated capacity is placed on each strain gage mounted to the machine frame in order to stop the machine before permanent damage is done to the structural members (see section 4.5.1 on page 58 for how this limit is set).

Above the point where the press is rated, an additional limit can be set so that the torque available from the clutch is not exceeded. This torque is delivered to the entire machine frame and is measured by examining only the total tonnage (combined tonnage on all frame members). Since the limit is placed on the tonnage (and not directly measuring torque), it must decrease as crankshaft angle moves from 180 to 90 degrees (de-rates the machine rating). Tonnage curves are available from the press manufacturer that describes the amount of total tonnage that can be developed at different points in the stroke.

If desired, the total tonnage can be de-rated by examining the press manufacturers' tonnage rating curve for a particular type machine and entering this information into the tonnage monitor. The entry process requires that the machine curve be divided into 16 discrete regions with a single tonnage limit that applies for each region. Height off the bottom of the stroke must be converted to crankshaft angle in order to position each region.

Figure 38 shows an example tonnage de-rate curve for a 12 inch stroke press with a 30 inch connecting rod. Rated tonnage is specified at 0.25 inches off the bottom. In the example, the limits are placed approximately 5% beyond the rating.

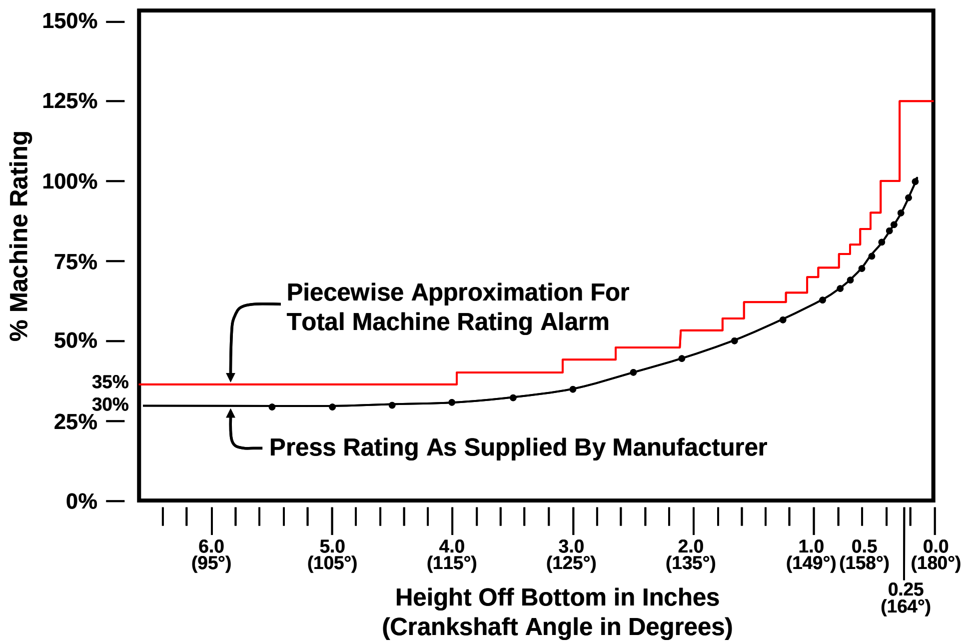

Figure 38: Example Tonnage De-rate Curve

Figure 37 shows the table of 16 angle regions and % of machine rating for that angle region approximated from the curve. The screen shows that a Total Alarm will occur if tonnage exceeds 35% of machine rating from 90 degrees to 114 degrees, 40% from 115 to 123 degrees, etc. This feature is not required and may be bypassed by leaving 125% for all tonnage limits or 0 degrees for each angle that is not used.

4.10 Operator Terminal Configuration

The Operator Terminal configuration screen is accessed by touching the Operator Terminal softkey in the Main Configuration screen (see Figure 25 on page 52).

The screen shown in Figure 39 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.

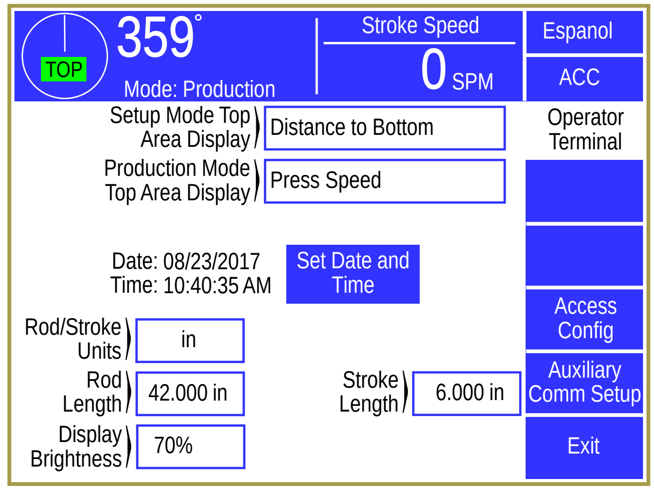

Figure 39: Operator Terminal Configuration Screen

4.10.1 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.

4.10.2 Rod Length and Stroke Length

The “Rod Length” and “Stroke Length” shown in Figure 39 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.

4.10.3 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 39. The screen of Figure 40 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.

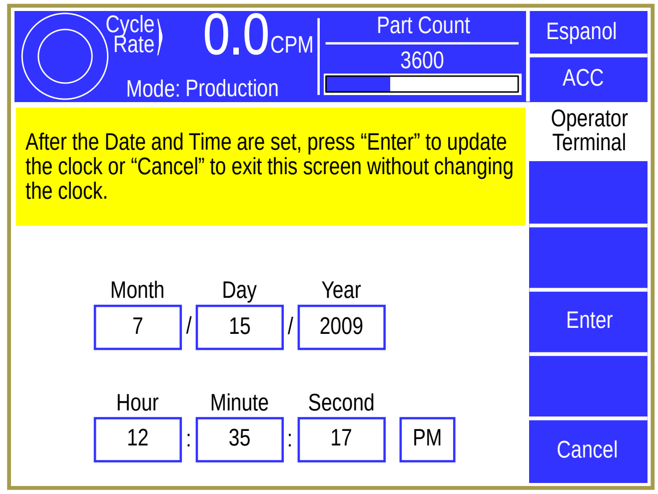

Figure 40: Date and Time Setting Screen

4.10.4 Access Configuration

As described in section 3.1.7 on page 19 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 39) will display the Access Configuration screen shown in Figure 41.

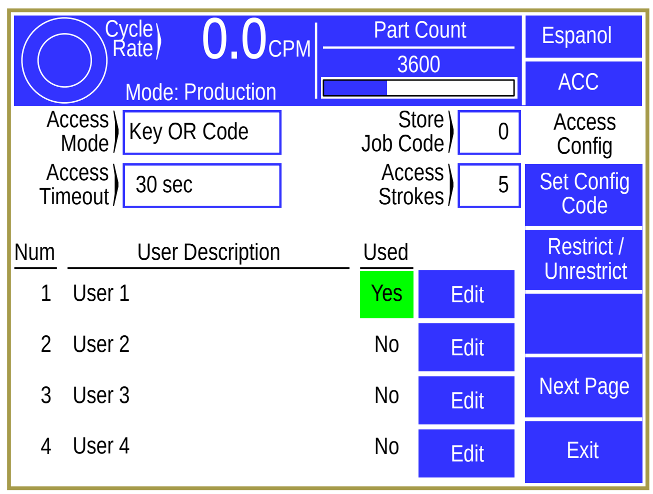

Figure 41: Access Configuration Screen

In addition to some basic parameters that determine how access control will work, this screen lists the “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.

4.10.4.1 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 19.

4.10.4.2 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 21. 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).

4.10.4.3 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.

4.10.4.4 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 41) to display the User Configuration screen shown in Figure 42.

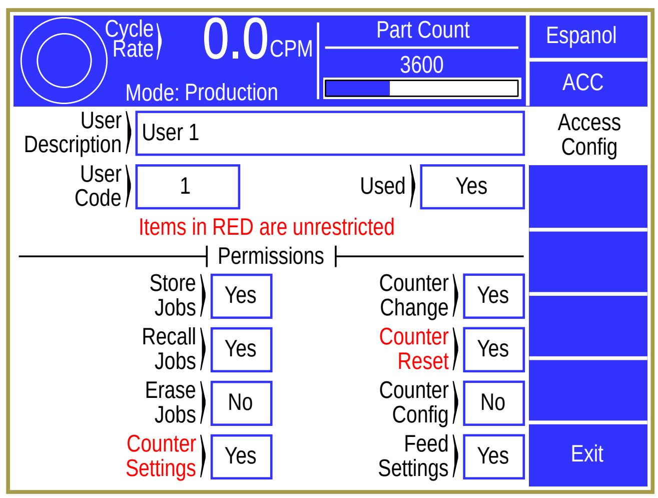

Figure 42: User Access Configuration Screen

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.

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 23. 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.

4.10.4.5 Restrict/Un-Restrict Access

In addition to the user access system, certain items can be made available to any operator as shown in Figure 43. 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.

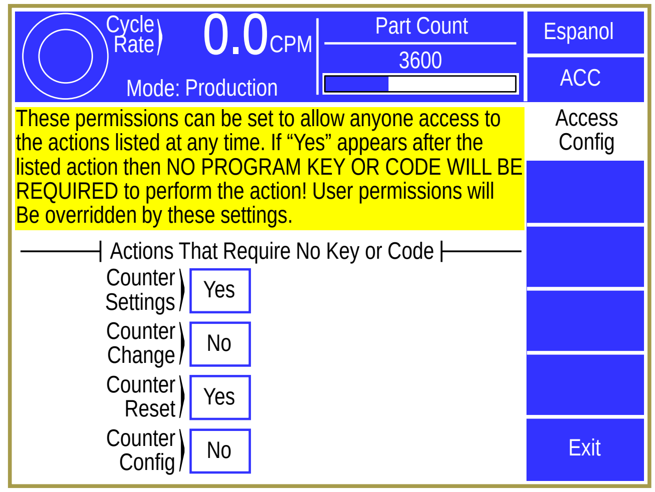

Figure 43: Restrict/Unrestrict Screen

4.10.4.6 Setting the Configuration Code

Selecting the Set Config Code softkey in the Access Configuration screen, will display the Configuration Code screen shown in Figure 44. 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.

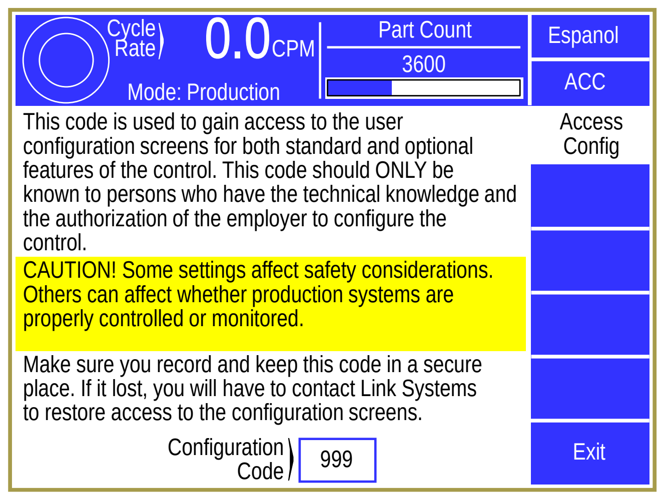

Figure 44: Set Config Code Screen

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.

4.10.5 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 11 on page 24) to select the Job Setups screen shown in Figure 45. The parameters consisting of tonnage monitor 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).

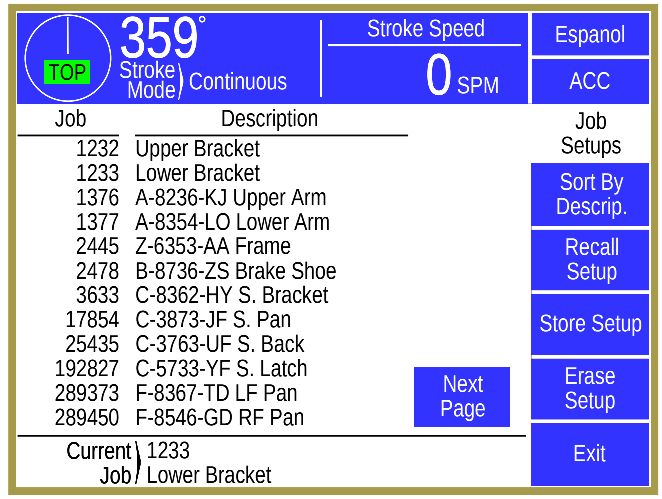

Figure 45 Jobs Screen

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 45, touch the Store Setup softkey to display the screen shown in Figure 46. 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 19. 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.

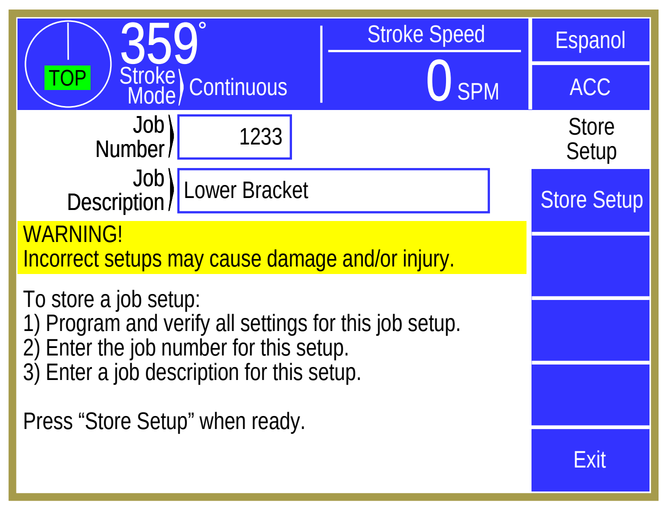

Figure 46 Store Jobs Screen

The screen shown in Figure 46 allows the user to enter a new number under which the job will be 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 45, touch the Recall Setup softkey to display the Recall Setup screen shown in Figure 47. 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.

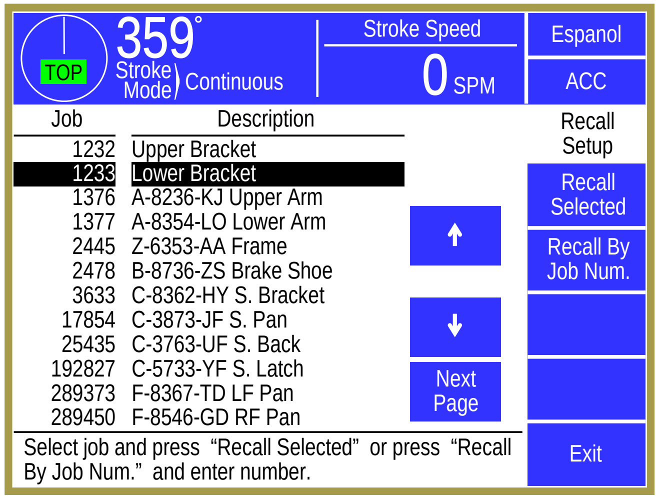

Figure 47 Recall Jobs Screen

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.

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 19. 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 45, 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 19. 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 tonnage monitor settings (including calibration) are stored on the Micro-SD card located on the 1200-1 Logic board. If necessary, the 1200-2 board can be swapped between presses 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 tonnage monitor module with the correct low, high, and reverse limits for the die being used. However, when a new die is installed in the machine, the tonnage requirements may not be defined. The limits presently in the tonnage monitor remain in effect and may cause tonnage alarms when the press is run. While the bypass feature can be used to prevent tonnage alarms from occurring, it will bypass ***all*** alarms (except machine rating alarms). Instead, it is suggested that the High Limits and Reverse Limits be set for the approximate tonnage rating of the die. The Low Limits can be automatically disabled in setup modes (see section 4.6.2 on page 59). After the correct tonnage monitor 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 1200

The System 1200 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 48.

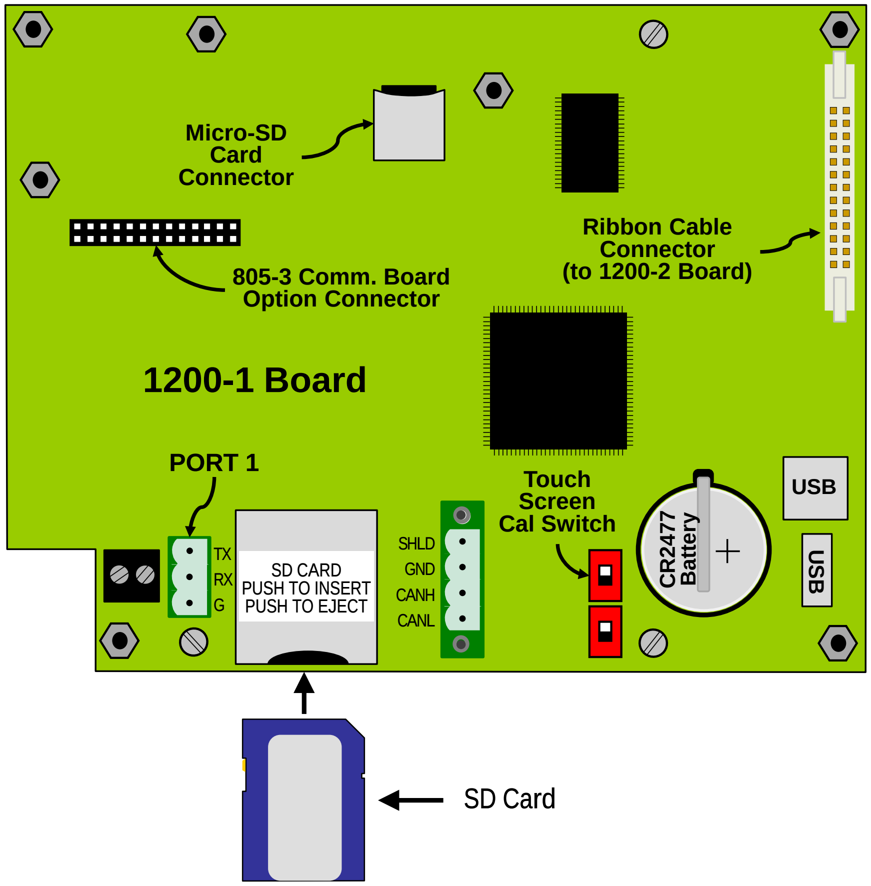

Figure 48: SD Card Location

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.
- 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

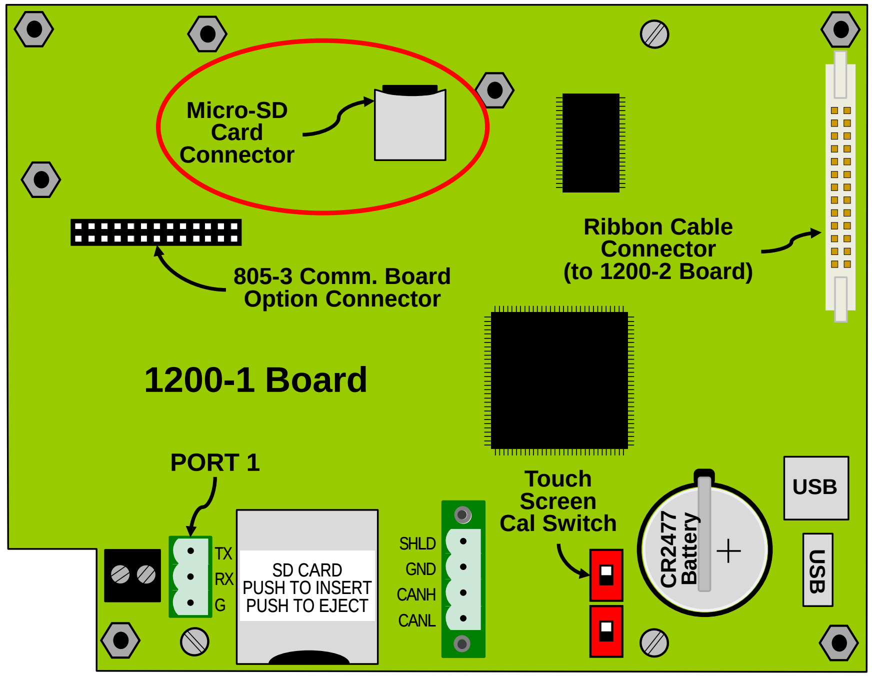

Figure 49: SD Card Location

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 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 1200 Tonnage Monitor 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 1200 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 1200

The System 1200 comes in an enclosure ready to bolt on to the machine.

Consideration should be given to the viewing angle of the operating personnel. Figure 50 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 1200 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.

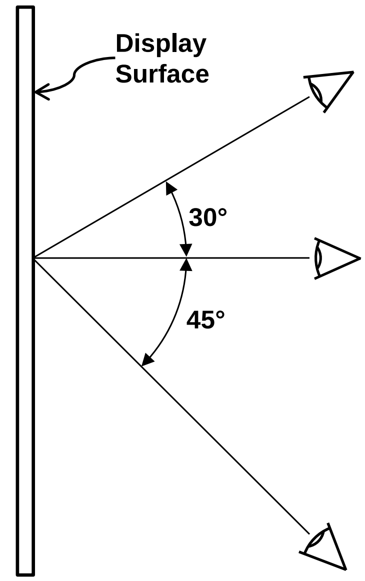

Figure 50: OIT Viewing Angles

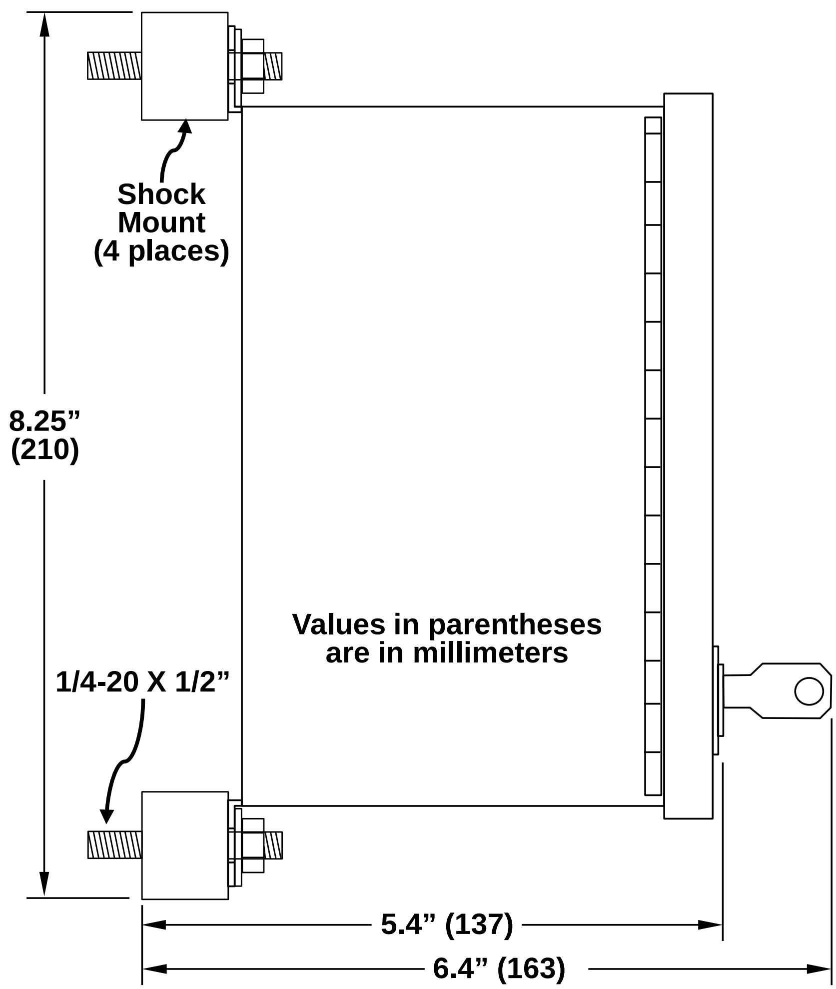

Figure 51: Enclosure Dimensions Side View with Shock Mounts

The dimensions and mounting requirements for the System 1200 are shown in Figure 51 and Figure 52.

Figure 51 shows a side view when using the provided shock mounts which should be used when mounting the System 1200 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.

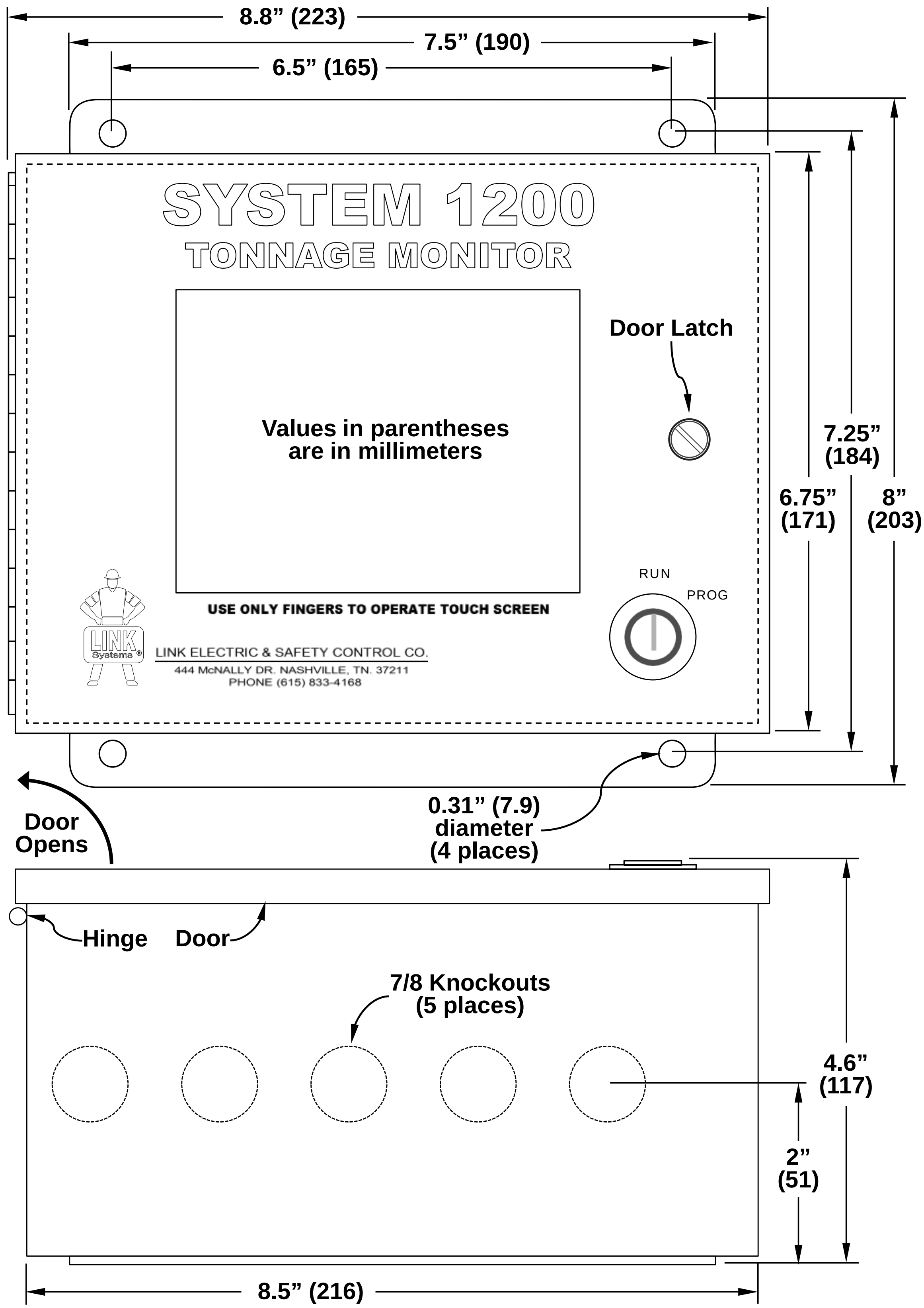

Figure 52: Enclosure Dimensions

7.3 Mounting the Optional Encoder

The System 1200 can optionally use 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 53.

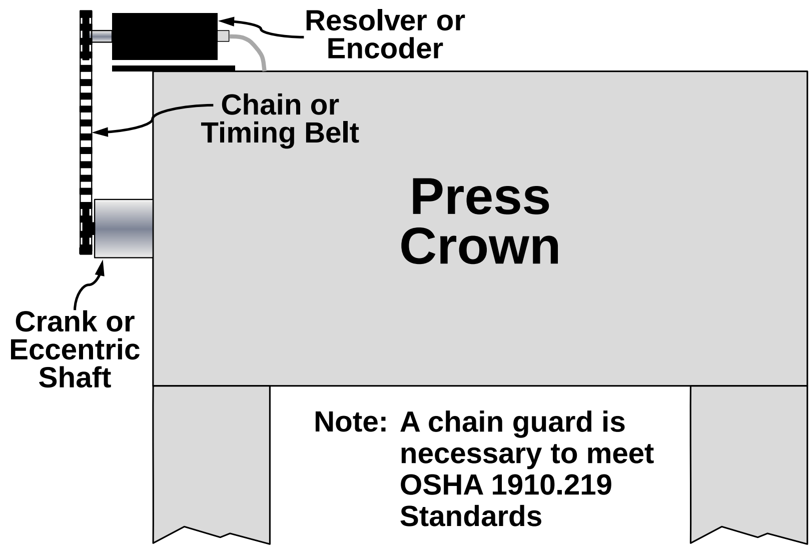

Figure 53: Resolver Mounting to Shaft

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 4.3.4.1 on page 55) during calibration can correct mechanical misalignment.

A spring loaded mounting base (see Figure 54) will be supplied when the encoder will be chain driven to maintain chain tension.

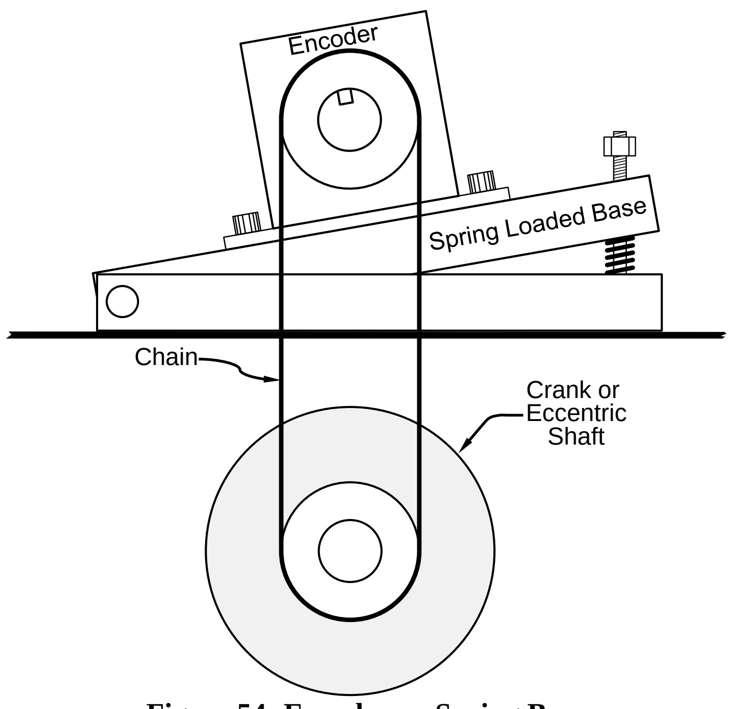

Figure 54: Encoder on Spring Base

> **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.

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.

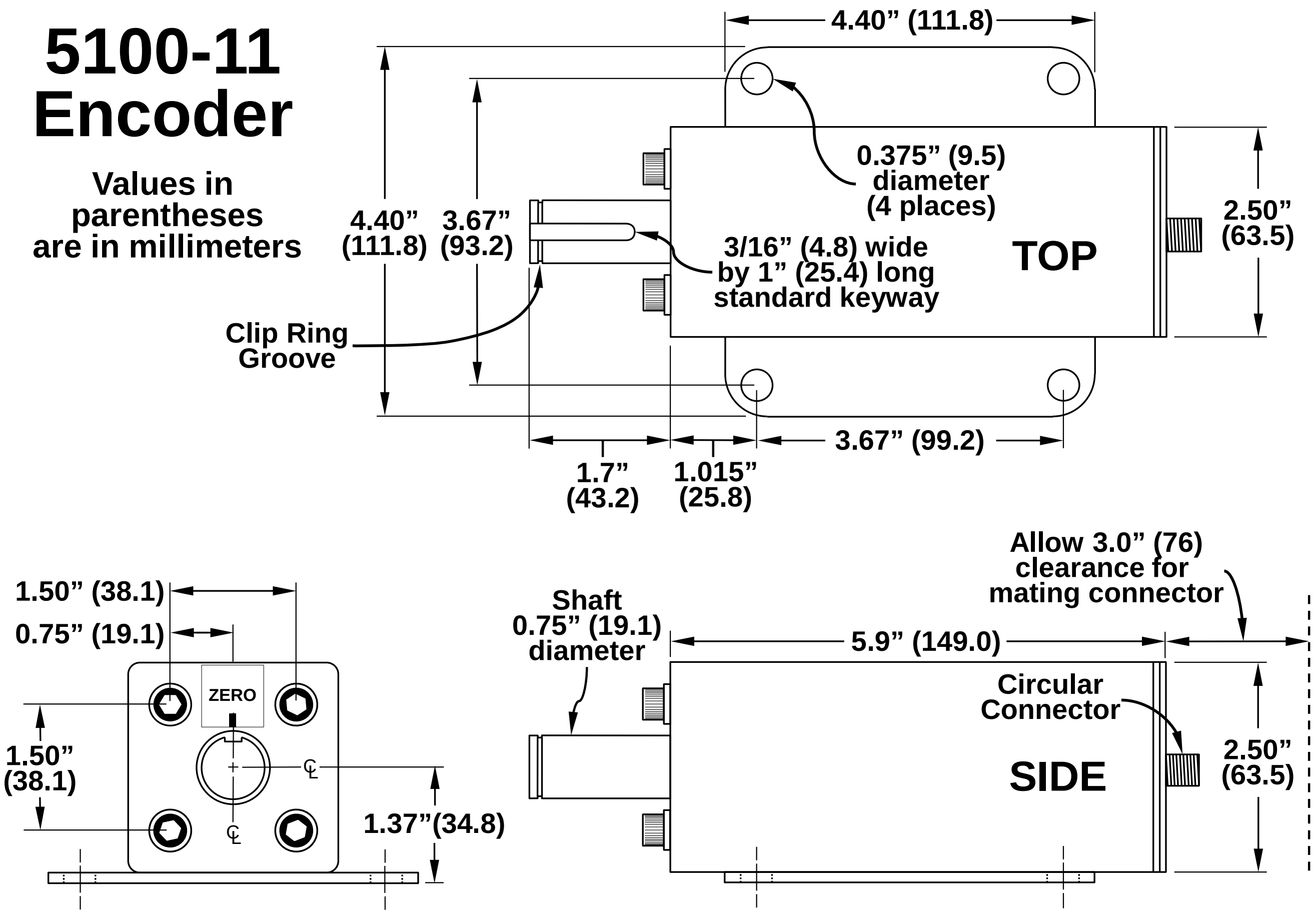

Figure 55: 5100-11 Encoder Dimensions

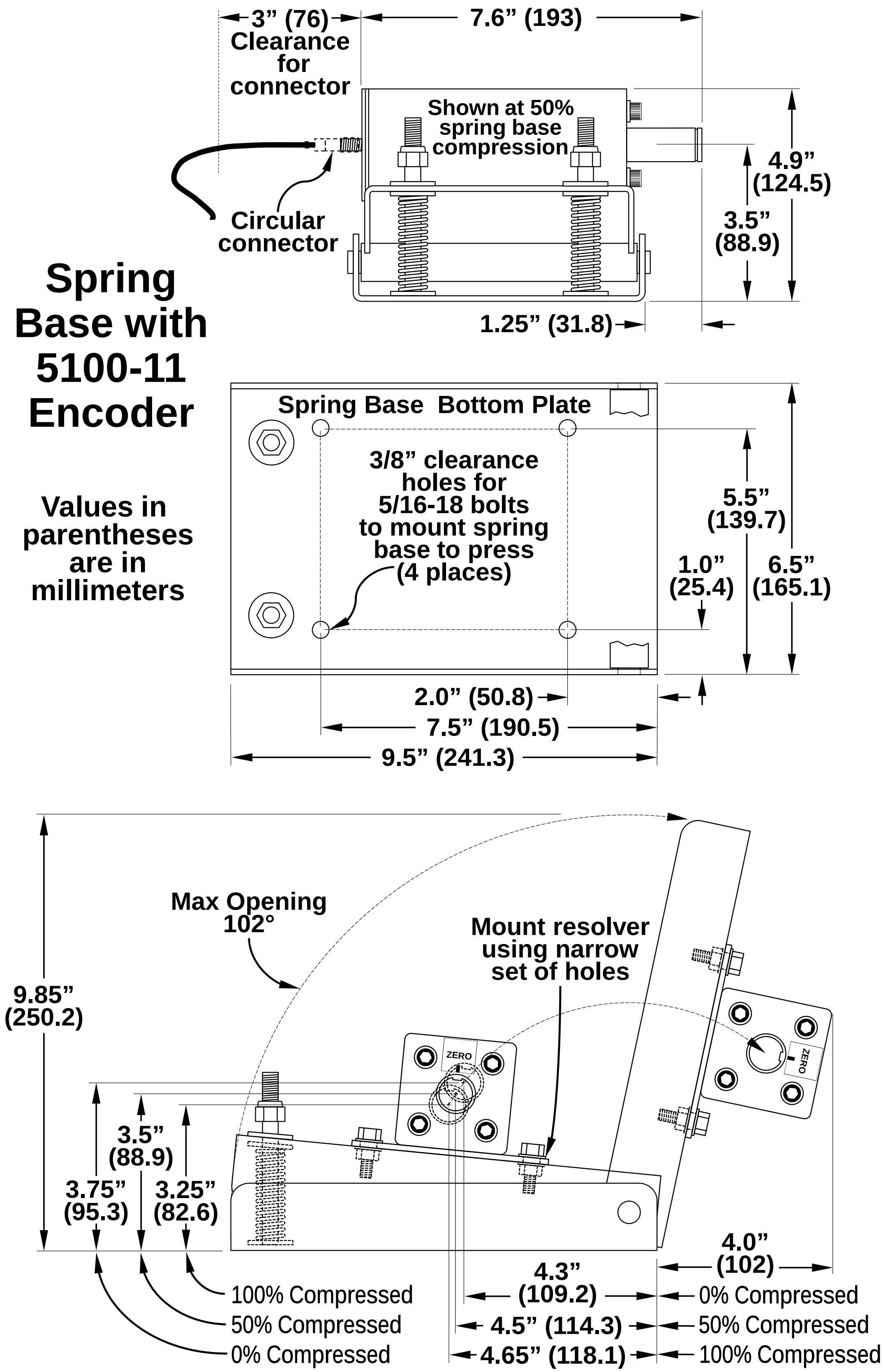

Figure 56: Spring Base with 5100-11 Encoder Dimensions

7.4 Installing the 805-3 Communications Card

The optional 805-3 communications board mounts on the 1200-1 circuit board (the board in the door of the System 1200) as shown in Figure 57. 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 1200 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 21 on page 48. 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.

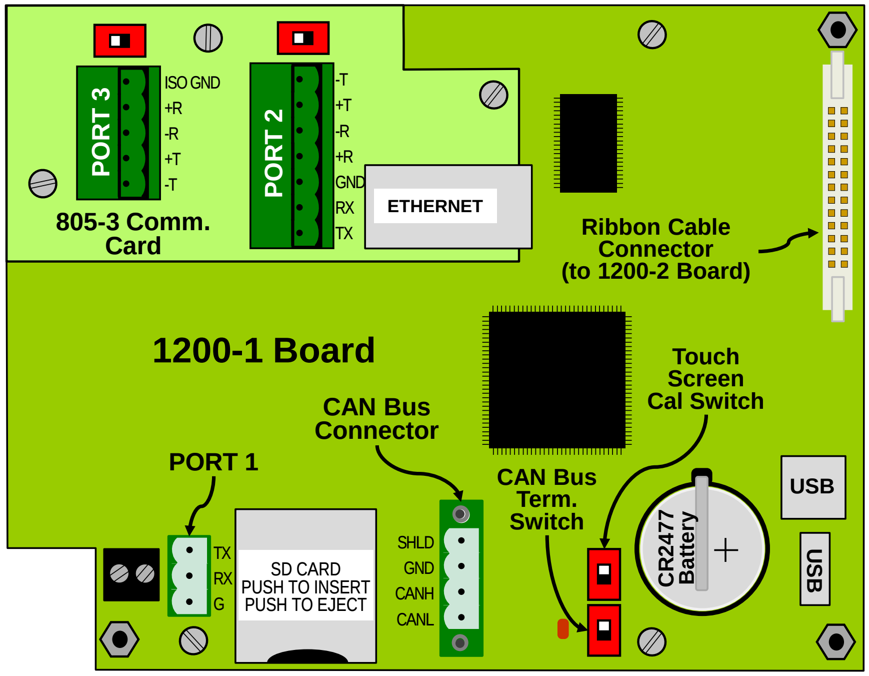

Figure 57: 805-3 Comm. Board Mounting

7.5 System Wiring

7.5.1 Conduit Runs

Wiring for the System 1200 should be run in conduit. The use of flexible liquid tight conduit with ground is suggested, but hard conduit can also be used. Figure 58 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 1200 are:

- Conduit from the 5100-11 encoder to the System 1200.
- Conduit for 120VAC or +24VDC to power the System 1200. 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 1200 and the press control can also go in that run.
- Conduit for the Top Stop and Immediate Stop connections between the System 1200 and the Press Control if run separately from the power.
- Conduit for low voltage connections between the System 1200 and the Press Control. This would be for connections such as cam zero and data window inputs, sensor based counting, and setup mode input. These are all optional connections and may not be used depending on application.
- Conduit from strain gages mounted on the press frame to the System 1200.
- Conduit for serial or Ethernet connections to the System 1200 for LinkNet or Modbus communications, if needed.

NOTE:	Do not run both 120VAC and lower voltage circuits in the same conduit from the System 1200 to the press control. If you have both 120VAC circuits and low voltage circuits, run them in separate conduits as shown in Figure 58.

NOTE:	The conduit for the strain gages should be dedicated for strain gage wiring only. Do not run wiring other than strain gage wiring in this conduit without consulting the factory.

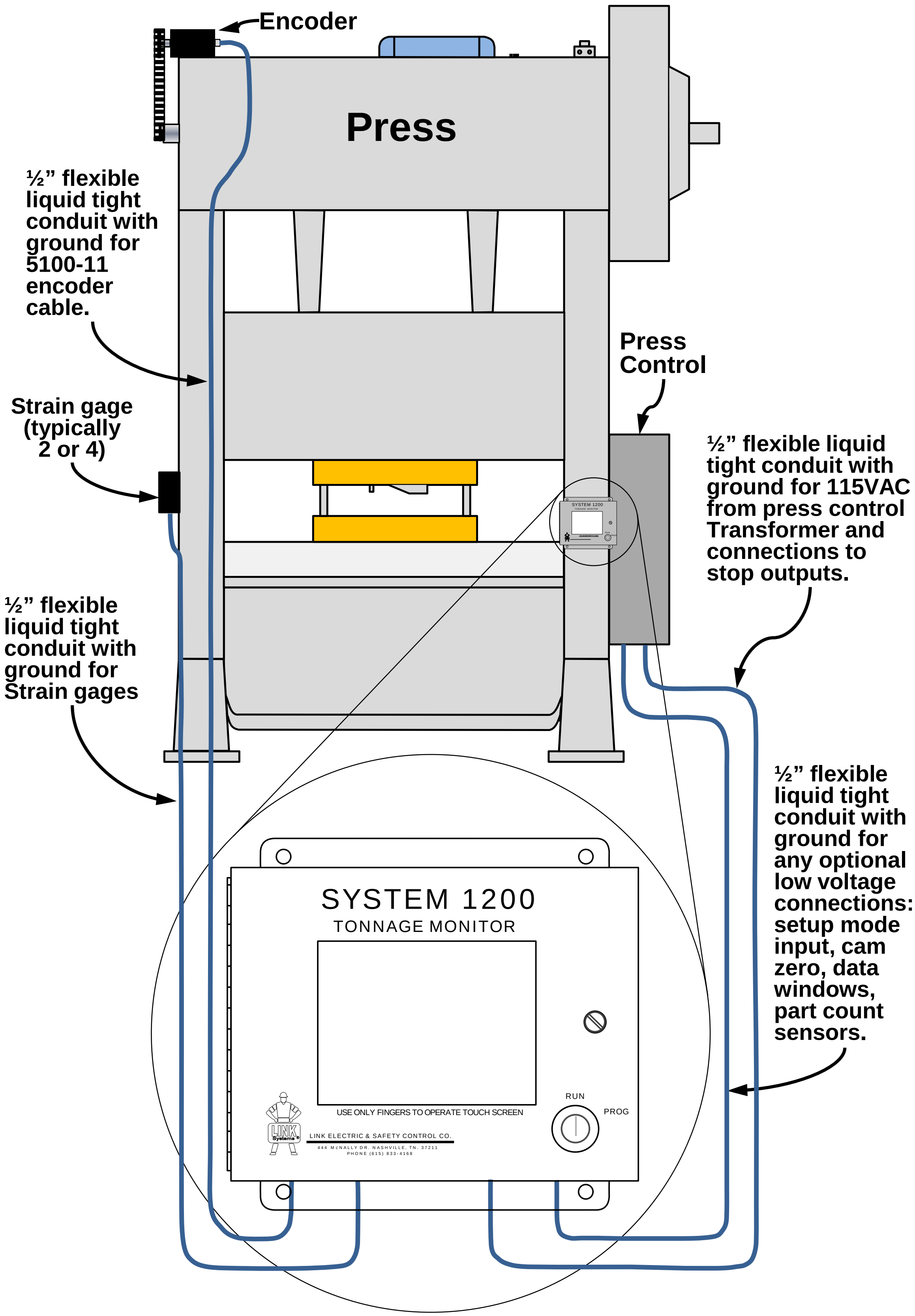

Figure 58: General View of Wiring Runs for Installation

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 1200 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 1200 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 1200. 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 1200 can be powered from **EITHER** 100-240VAC **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.

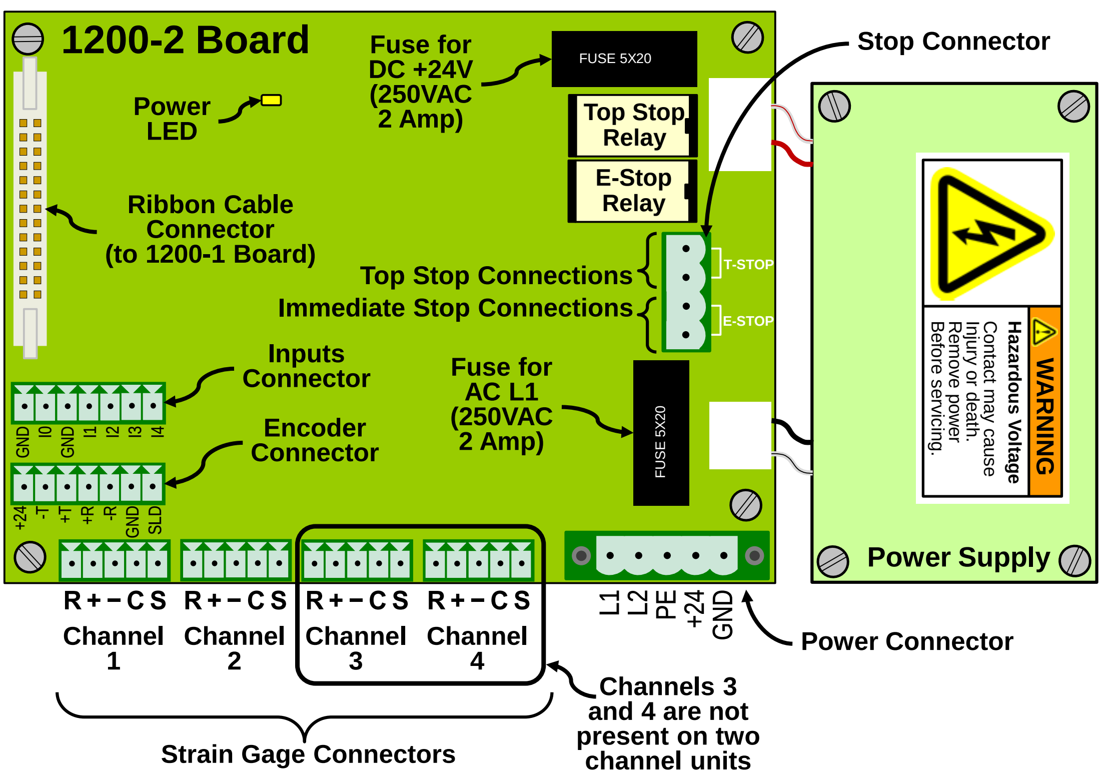

Figure 59: 1200-2 Board Connections

When using AC Power, use the L1, L2 and PE terminals (See Figure 59).

When using +24 VDC 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 1200 (See Figure 59 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	+24 VDC +/- 10% Input Power (0.4 Amps)
GND	Ground - +24VDC Return

7.5.3 Wiring the Stop Outputs

Normally open relay contact outputs are provided for sending stop signals to the press control. See the "Stop Connector" on Figure 59 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 60 shows the connector pint numbers of the stop connector and the way the relay contacts are arranged.

Pull the wires in the appropriate conduit (low or high voltage depending on the stop circuit voltage) between the System 1200 enclosure and the press control.

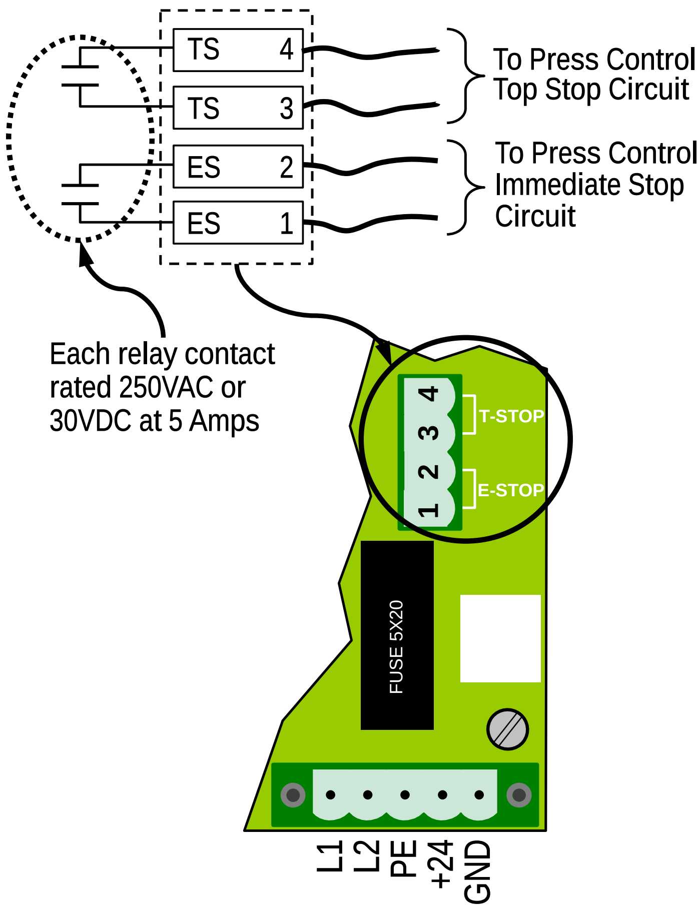

Figure 60: Breakaway of Stop Connector

7.5.4 Wiring the 5100-11 Rotary Transducer

The 5100-11 encoder can optionally be used with the System 1200 to provide crankshaft angle and speed.

This enables features such as tonnage reference waveforms, internal setting of data window angles, press crankshaft speed readout, distance to bottom readouts, and certain servo press specific features.

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

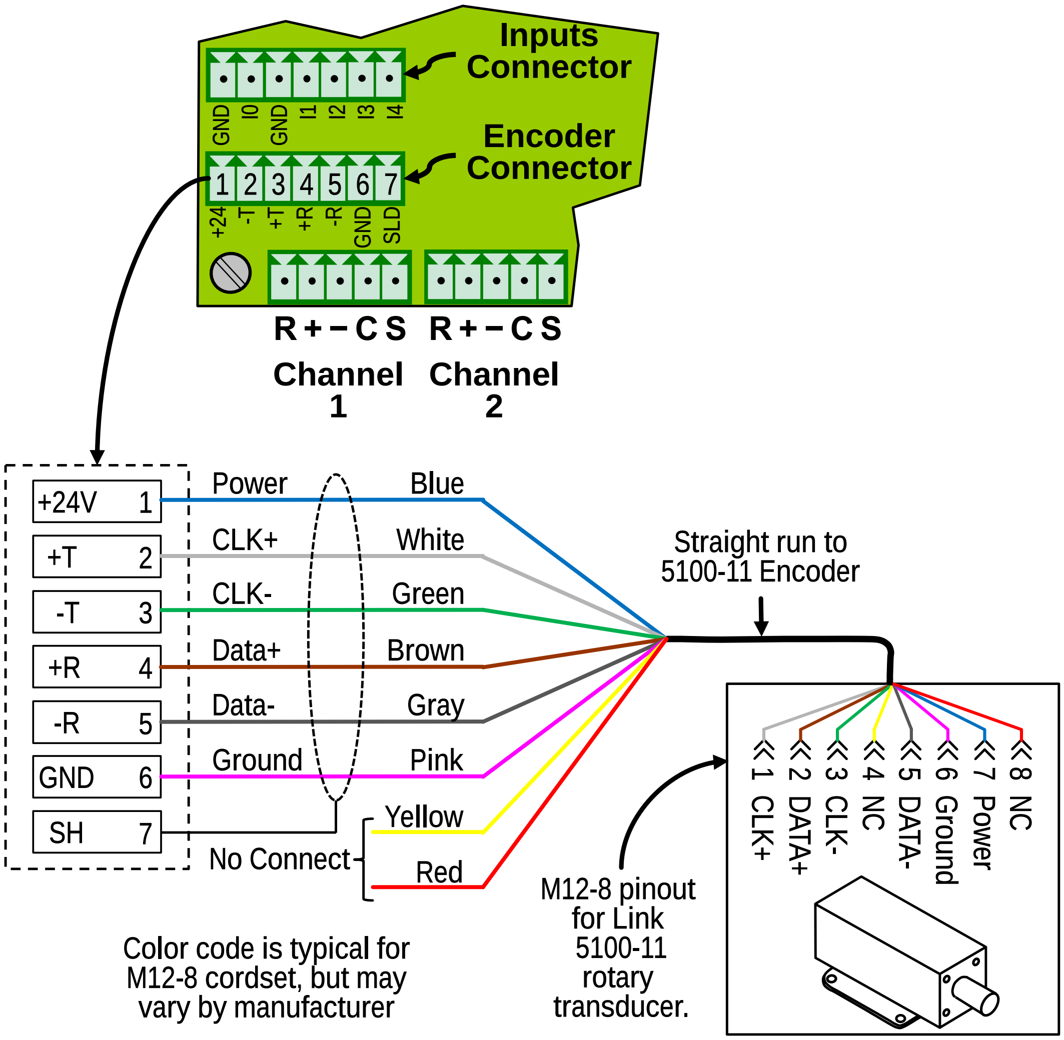

Figure 61: 5100-11 Encoder Connections

Figure 61 shows how the M12-8 cordset should be wired to the System 1200 encoder connector.

7.5.5 Wiring the CAN Bus Connector

If a System 2600 Die Protection and PLS unit is installed on the same press, then the crankshaft encoder connected to the System 2600 can be shared with the System 1200 by connecting the CAN Bus connectors of the two units as shown in Figure 62.

Note that this connector is on the circuit board that is on the door of each unit.

The wiring is the same on both units and the termination switch on both units should be ON, which can be verified by the termination LED being lit.

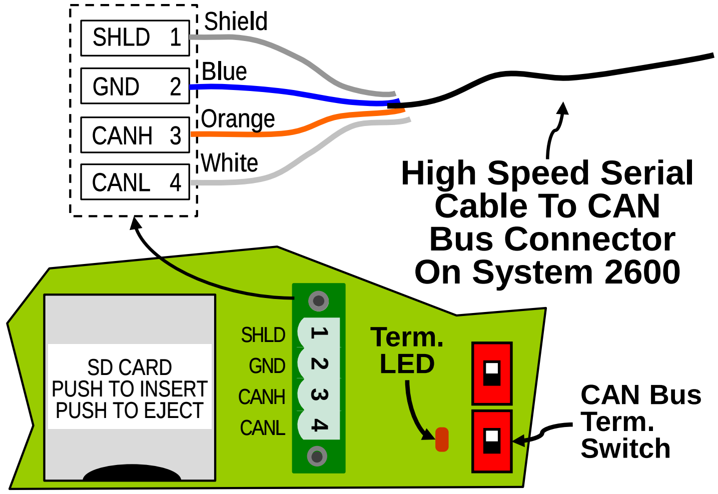

Figure 62: CAN Bus Connections

CAN Bus Connections	
SHLD	Shield (Bare Wire)
GND	Blue
CANH	Orange
CANL	White

> **NOTE:** ***Always*** use the cable specified by Link Systems for the CAN bus connection! This cable has been chosen to optimize communication speed and distance. Use of any other cable may result in communication faults that can cause nuisance stops of your press production system. ***DO NOT*** splice together cable sections between devices. Use only unbroken runs of cable between devices.

7.5.6 Wiring the Discrete Inputs

Inputs 0, 1, 2, 3, and 4 are internally pulled up to the internal +24vdc power supply. An input is switched "On" when it is connected to ground. Two ground terminals are provided for field connections.

A typical use for these inputs when the unit is not used with the optional 5100-11 encoder is for Cam Zero and Data Window inputs. Figure 63 shows typical connections assuming those inputs are driven by programmable limit switches or rotary cam switches. Note that the Cam Zero input should be closed around the top of the stroke where there is no tonnage. Put the other way, it should open around the bottom of the stroke where tonnage occurs (typically open at 100 degrees and close at 260 degrees). The data windows, on the other hand, should close around the feature to measure. For instance, if there is a local peak from a punch at 165 degrees, the data window input used to capture it might close at 160 degrees and open at 170 degrees

If not all of the data windows are used or if the 5100-11 encoder is being used, then inputs become available for other functions. This could be setup mode active or for driving sensor based part and scrap counters. The same principles apply – an input is "On" when grounded. Figure 64 illustrates the connection when using an NPN diffuse reflective sensor for part counting. Note that any NPN sensor such as an inductive proximity sensor would be connected in the same way – the sensor grounds the input when activated.

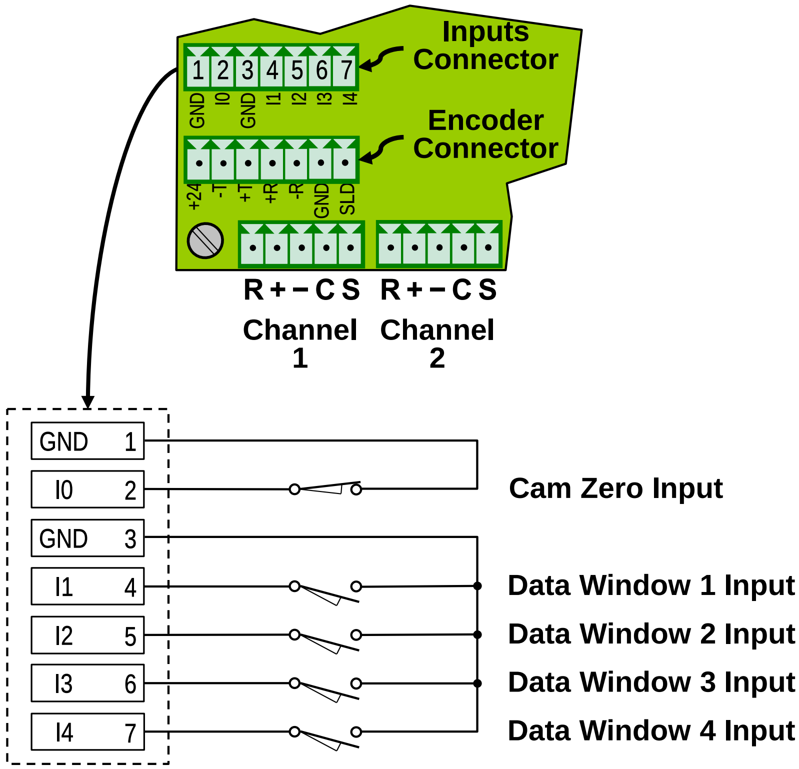

Figure 63: Inputs driven by Cam Zero and Data Windows

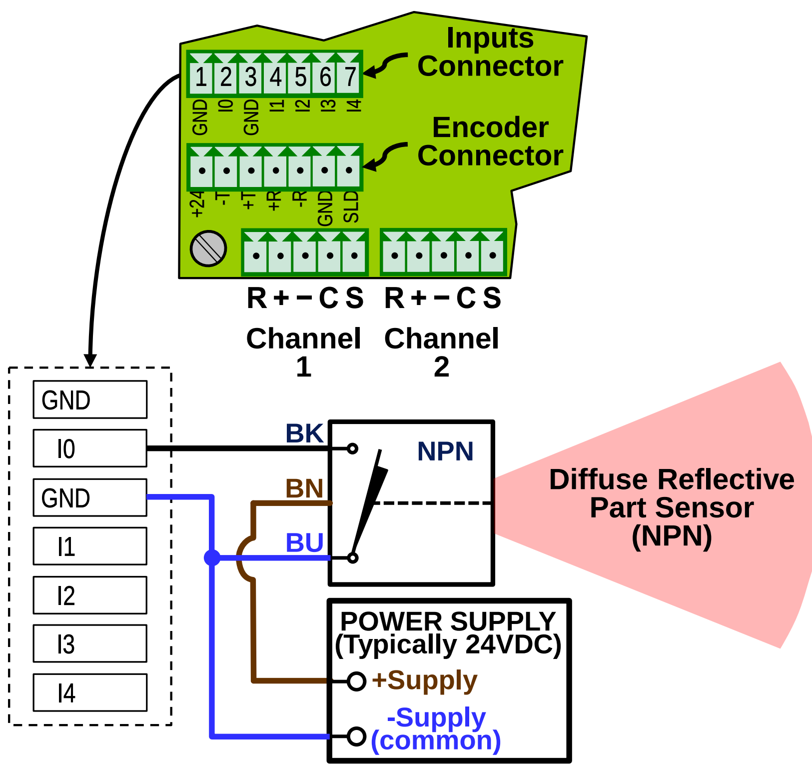

Figure 64: Inputs driven by NPN sensor

7.5.7 Wiring the Strain Gage Connections

The 1200-2 board is labeled for the connectors that provide for field connections as shown in Figure 59 on page 85. The CH 1, CH 2, CH 3, and CH 4 connectors are strain gage inputs. At a minimum, one or more strain gages must be connected for proper operation.

Depending on the mechanical configuration of the press and how the gages are mounted, the gages may be put in tension (stretched) as the press exerts tonnage or may be put in compression as the press exerts tonnage. Figure 65 shows the connections for both situations. Section 7.6 goes into detail on gage mounting considerations.

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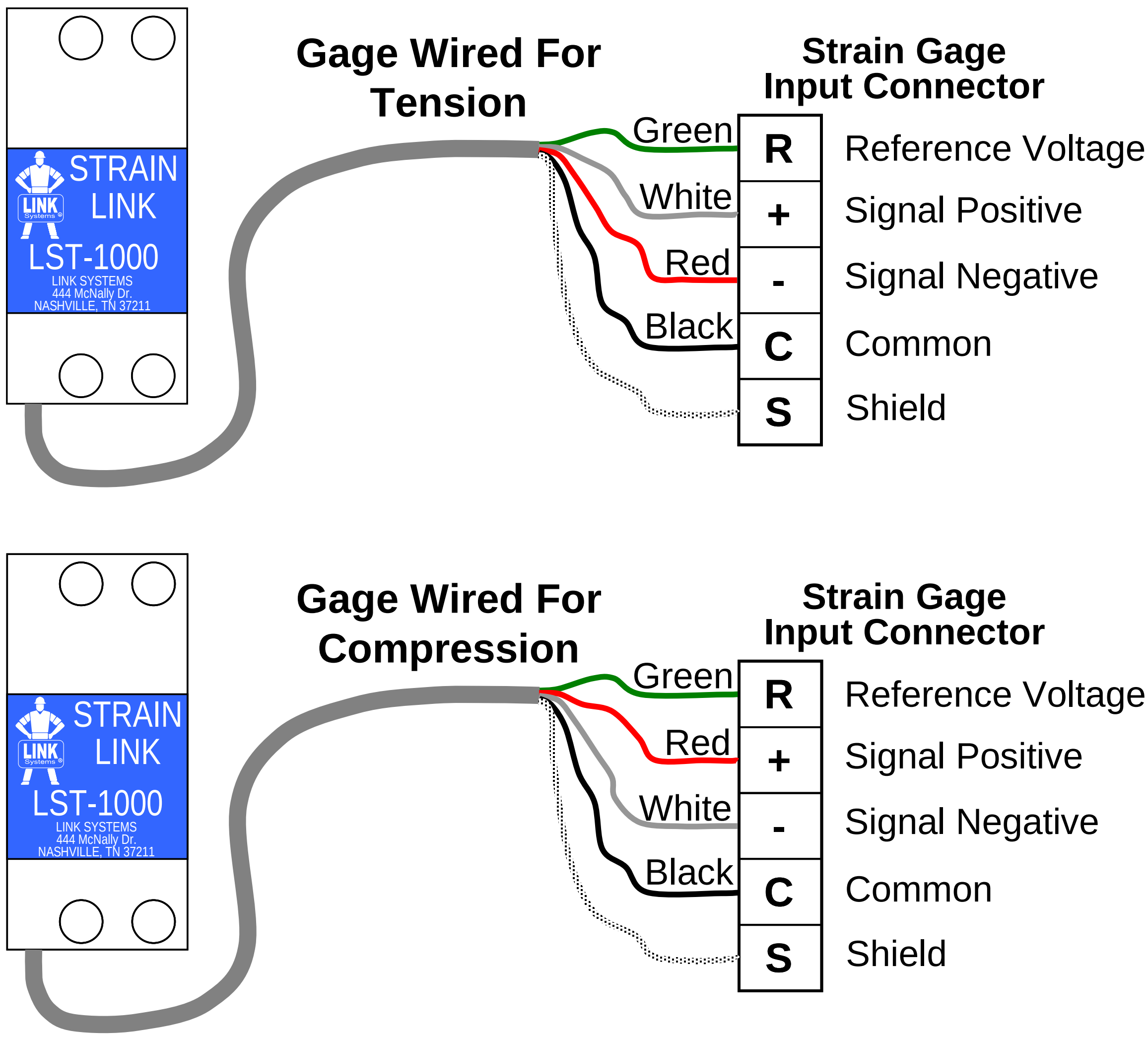

Figure 65: Strain Gage Wiring

7.6 Strain Gage Locations

7.6.1 "C" Frame Machines

Machines with "C" frame configurations, such as OBI and GAP frame presses, should be installed with one strain gage mounted to each side frame member and the tonnage monitor configured for 2 channel operation.

Choices of strain gage mounting locations are illustrated in Figure 66. The preferred mounting locations are near the middle of the front of the "C" frame. The forces that occur at the front of the machine frame are tensile forces. The compression forces that occur at the "acceptable" locations at the rear of the "C" frame can be accompanied by nonlinear buckling (bending) on the thin web side frames of some machines.

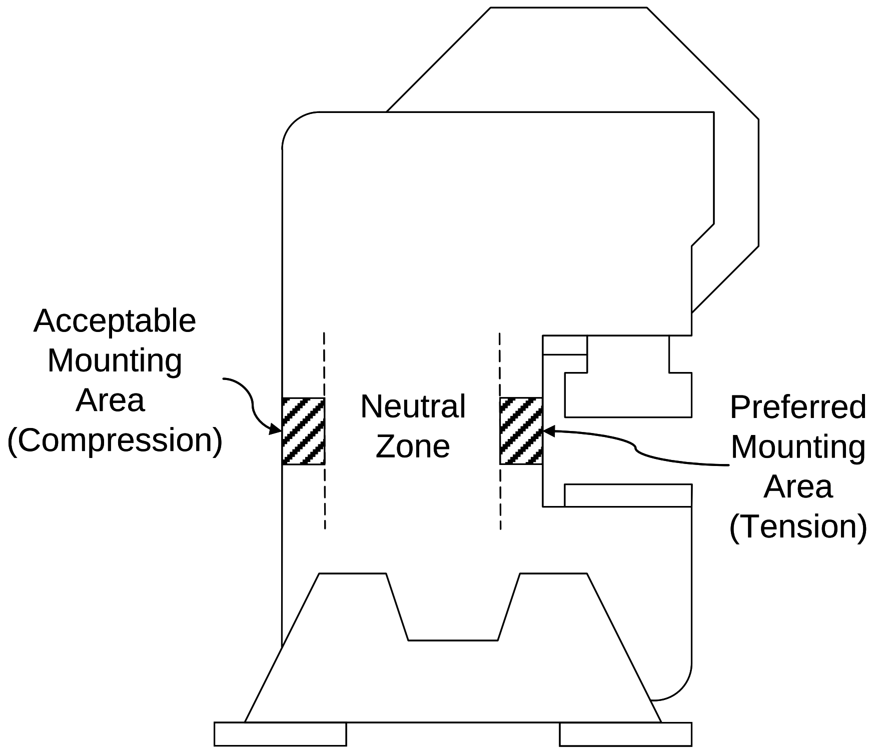

Figure 66: "C" Frame Machine Gage Locations

Do not mount strain gages near the curves at the front of the "C" frame. The curvature of the frame produces nonlinear strain signals. Also, on presses with increased cross sections near the front of the frame, avoid mounting sensors next to the change of cross section to avoid nonlinear strain signals. The center portion of the front face of the "C" frame is an excellent sensing location, but sensors are susceptible to damage from die setting operations.

7.6.2 Straight Side Machines

Straight side presses should be monitored with one strain gage on each corner of the frame and the tonnage monitor module configured for 4 channel operation. On machines with tie rod through hollow upright (column) construction, strain gages may be mounted on either the tie rods or the uprights, although ease of installation usually dictates mounting the strain gages on the uprights. On solid frame straight side machines, the uprights are also the best strain gage locations.

The best strain gage locations are below gibs and at least 12 inches above where the upright joins the machine bed. Locating the strain gage in the gib region can cause excessive bending moments to be translated through the gibs into the upright as the slide tries to "cock" for some conditions of off-center loading. Locations too near the bottom of the upright may produce a non-uniform strain field. Do not mount strain gages on any side of an upright that has a tie rod access opening. When holes are present in the desired upright mounting location, avoid mounting strain gages any closer than three diameters of the hole directly above or below the hole or any closer than one diameter of the hole to the side of the hole. Don't mount strain gages in recessed panel areas in uprights.

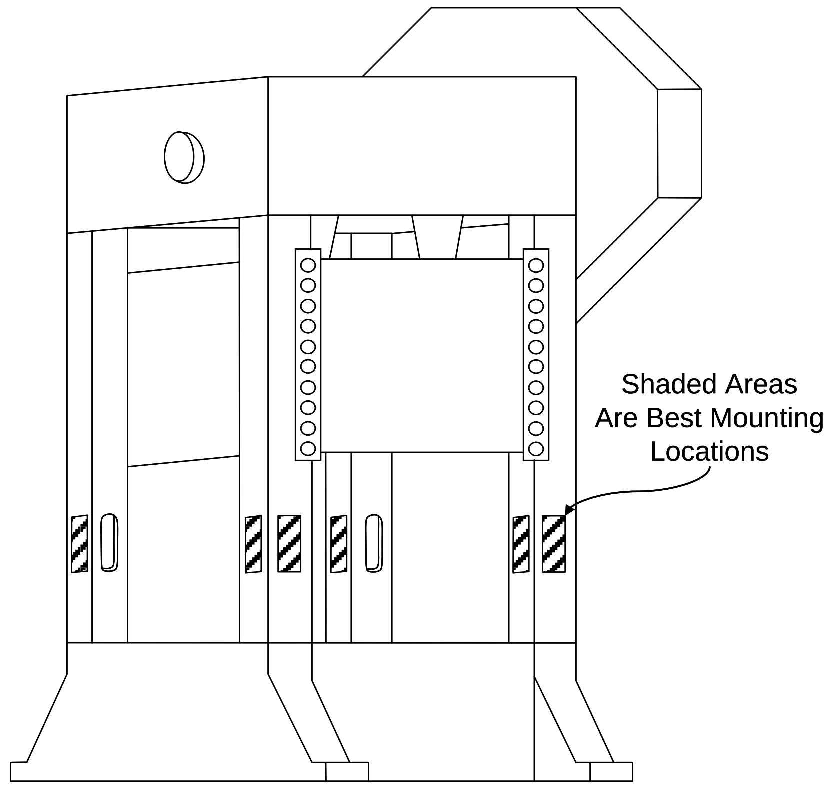

Figure 67: Straight Side Machine Gage Locations

Stay away from corners of uprights as strain gage mounting locations. The best locations on the upright for strain gages on machines of tie rod construction are generally on the centerline of the tie rod. Avoid any mounting locations where uprights have internal reinforcements or other change of section. As far as possible, strain gages should be mounted in conditions of geometric symmetry on uprights and at the same vertical height on each upright. Figure 67 illustrates mounting locations for straight side machines of tie rod construction.

Figure 68 shows areas to avoid on the uprights of straight side machines of tie rod construction. The cross-hatched areas should be avoided.

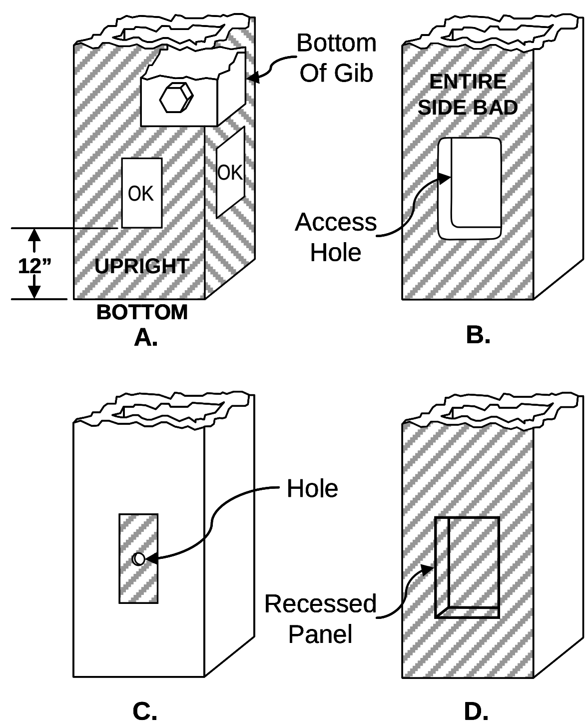

Figure 68: Upright Areas to Avoid

On solid frame straight side machines, the preferred strain gage mounting location is inside the "windows" under the ends of the crankshaft. A strain gage should be mounted on the inside face of each column forming the "windows" as shown in Figure 69.

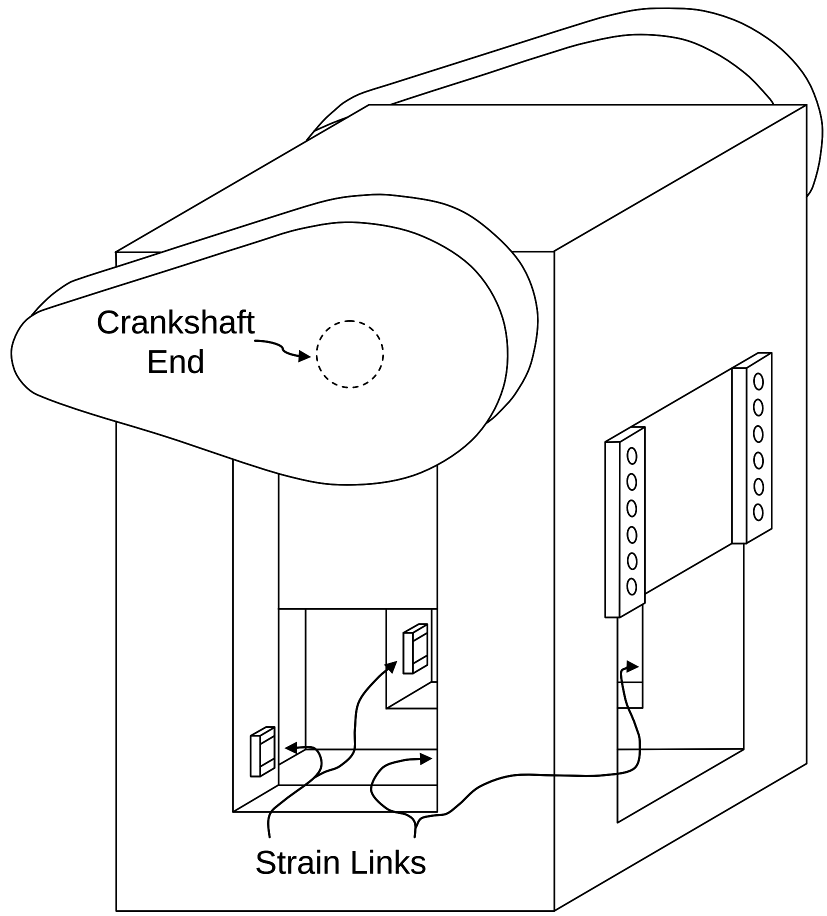

Figure 69: Solid Frame Machine Gage Locations

7.7 Strain Gage Mounting

Strain gages may be bolted directly to the machine or bolted to intermediate pads welded or adhered to the machine.

7.7.1 Direct Machine Mounting

1) Select the desired mounting locations for the strain gages.

2) Remove paint, oil, grease, etc., to obtain a bare metal surface slightly larger than the LST-1000 strain gage. The metal surface must be flat and smooth so that the strain gage is not warped and contacts the surface area evenly when mounted. A mounting surface that is flat to within .0025 inches and with a 250 micro-inch or less finish will give best results. Grind the surface if necessary.

3) Scribe a line on the metal surface on which the strain gage is to be mounted in the direction of tension or compression of the structural member. This will be a vertical line on columns or tie rods of straight side presses and "C" frame machines that are not inclined. On inclined presses, the scribe marks should follow the inclined angle.

4) Place the hardened drill fixture provided with the direct mounting strain gage kit in position adjacent to the scribed line. Use a number 3 drill to drill a 5/8" deep hole in the mounting surface through the center hole position of the drill fixture. Tap the hole for a 1/4 x 28 thread. Bolt the drill fixture securely to the mounting area, as shown in Figure 70.

5) Use a number 3 drill bit to drill 5/8" deep holes in the mounting surface through the remaining four holes in the drill fixture. Tap the holes for a 1/4 x 28 thread after removing the drill fixture.

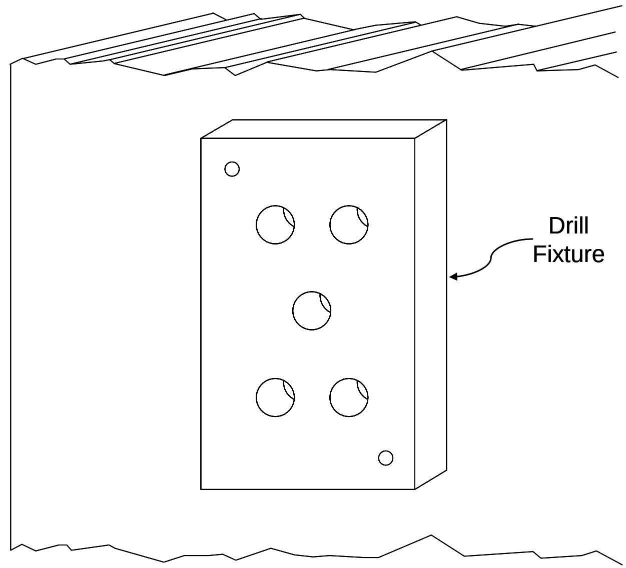

Figure 70: Strain Gage Drill Fixture

NOTE:	Do not attempt to locate and drill mounting holes without using the drill fixture. The hole pattern must be precise.

6) De-burr the mounting holes and wipe the mounting area with a clean rag.

7) Mount the strain gage as shown in Figure 71. Make certain that the washers provided with the strain gage kit are placed ***over*** the strain gages, ***not under them***. Torque the 1/4 x 28 bolts to 150 in-lbs. A calibrated torque wrench is the preferred tool to torque the bolts.

8) Mount the protective cover box provided in the strain gage kit, if used, centrally over the strain gage. It is important to mount the cover box before calibration begins. The cover box mounting holes may slightly change the strain sensed by the strain gage.

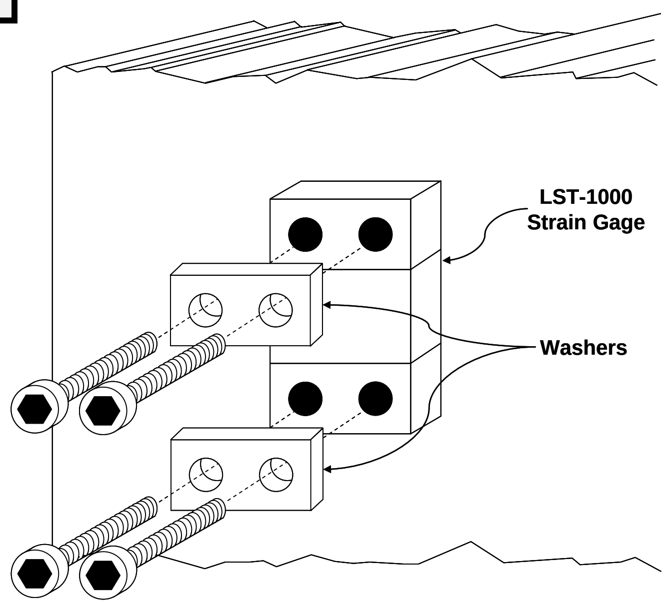

Figure 71: LST-1000 Strain Gage Mounting

7.7.2 Intermediate Weld Pad Mounting

1) Select the desired mounting locations for the strain gages.

2) Remove paint, oil, grease, etc., to obtain a bare metal surface slightly larger than the LST-1000 strain gage.

3) Clean the mounting surface with a solvent, removing all contaminants.

4) Assemble the intermediate pads to the alignment/clamping fixture using the 1/4 x 28 bolts provided, as shown in Figure 72.

5) Hold the alignment/clamping fixture firmly on the mounting area in the direction of tension or compression of the structural member or, alternatively, drill a 5/8" deep hole through the center hole of the alignment/clamping fixture, tap for 1/4 x 28 threads, and bolt the alignment/clamping fixture to the mounting area through the center hole. Tack weld both sides of each intermediate pad to the mounting surface first, then continuously weld the outer ends and sides of the intermediate pads to the mounting surface, as shown in Figure 73.

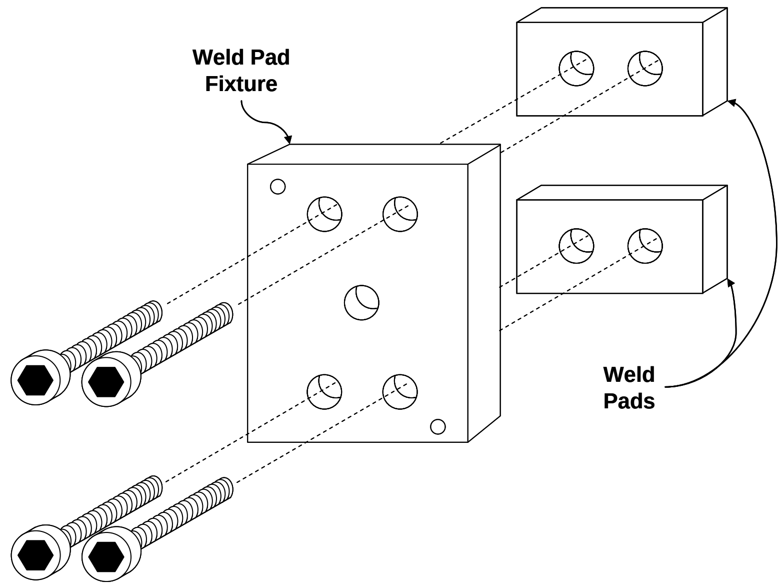

Figure 72: Weld Pad Mounting Fixture

6) Remove the alignment/clamping fixture. Do not weld with the fixture removed.

7) Bolt the LST-1000 strain gage to the pre-tapped holes in the intermediate pads. Make certain that the washers provided with the strain gage kit are placed ***over*** the strain gages, ***not under them***. Torque the 1/4 x 28 bolts to 150 in-lbs. A calibrated torque wrench is the preferred tool to torque the bolts.

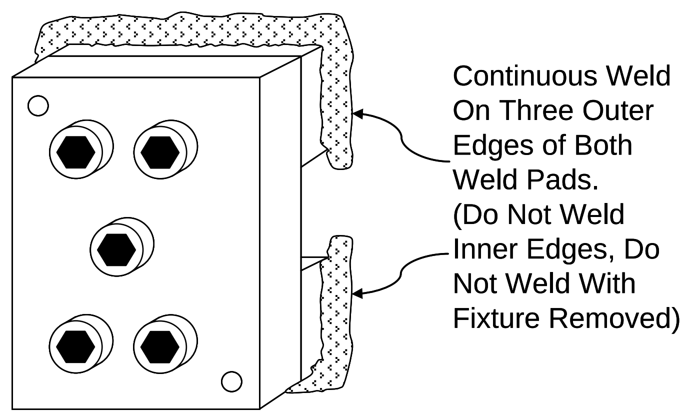

Figure 73: Weld Pad Welding Technique

8) Mount the protective cover box provided in the strain gage kit, if used, centrally over the strain gage. It is important to mount the cover box before calibration begins. The cover box mounting holes may slightly change the strain sensed by the strain gage.

7.8 Strain Gage Wiring

1) Run flexible or rigid conduit from the strain gage protective boxes to the enclosure that contains the tonnage monitor. Entry into the enclosure should be as close as possible to the tonnage monitor module.

2) Pull the strain gage cables through the conduit from the strain gage locations to the enclosure. Once inside the enclosure route the strain gage cables away from all other voltage sources as

much as possible. Run cables to the channel connectors on the front of the tonnage monitor module and cut the excess cable lengths off.

3) Strip about 2 ½ inches of cable insulation off of the braided wire shield. Remove the four conductor wires from the shield, taking care to leave the shield wire length connected to the cable.

4) Wire the channel connectors as shown in Figure 74. Cover or tape the shield, to avoid accidental shorting to any other point.

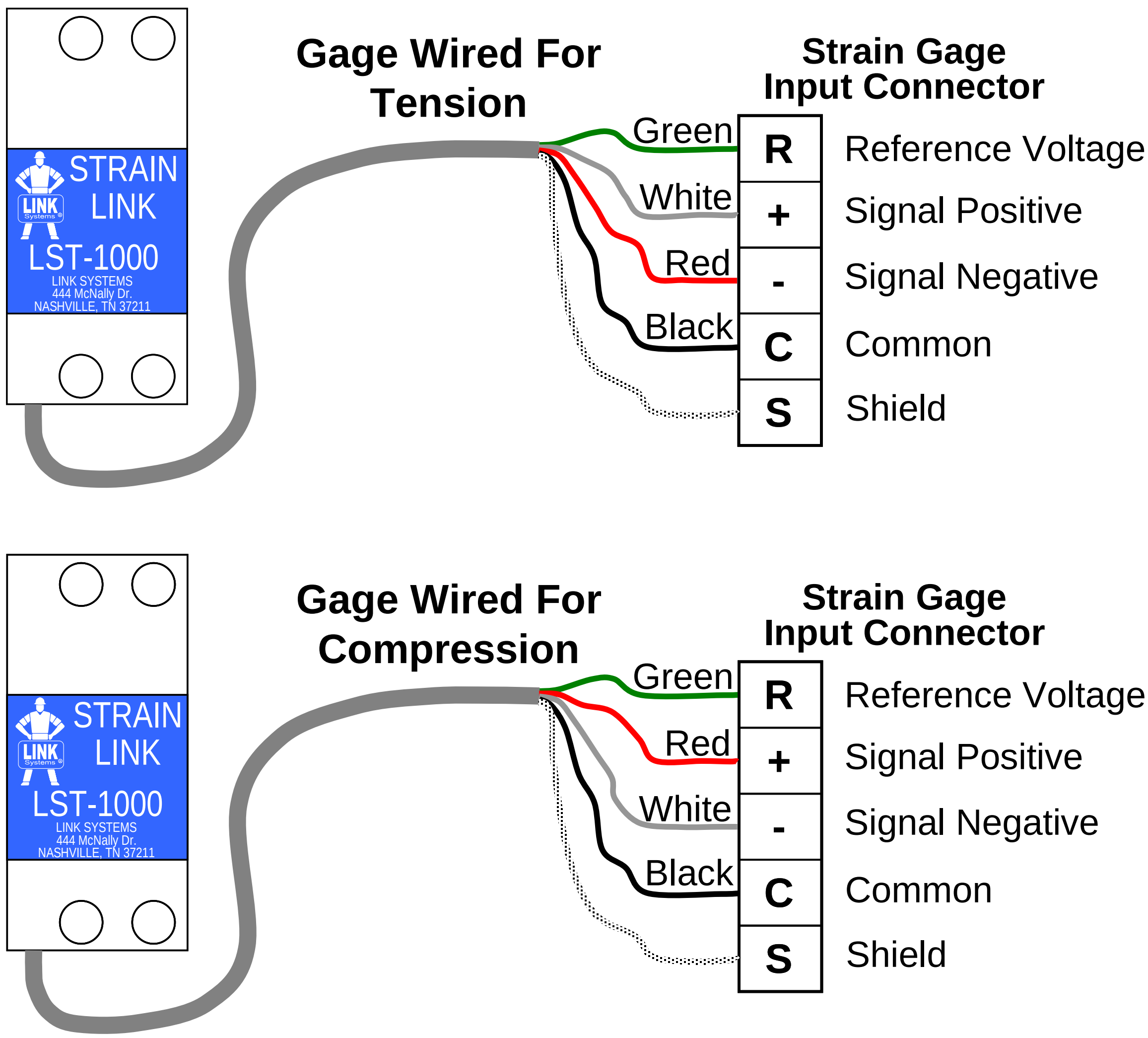

Figure 74: Strain Gage Wiring

8 CALIBRATION

Calibration of the tonnage monitor consists of achieving a known load on the machine and adjusting the installed monitor so that the known load is displayed correctly. The known load used during calibration should be at least 50% of rated machine load and preferably 100% of rated machine load. On straight side machines with tie rod construction, it is advisable to use loads of 100% of machine rating in calibration when strain links are mounted on the uprights (compressed by the tie rods). False load readings can be generated if a tie rod loses enough tension that the upright is released from compression before full load is reached. This condition can be detected during calibration if 100% of machine rating load is used.

Load cell(s) are generally used to provide the known load for calibration. The load cell(s) are placed in the machine point of operation (normally with tooling absent) and a combination of shimming and shut height adjustment is used to generate the desired load to be used for calibration. The machine must be cycled, so that the slide strikes the load cells at the bottom of the stroke to generate the load.

Single or multiple load cells can be used to load the machine to the value used for calibration. When a single load cell is used for calibration, it should be centrally located under the machine slide. When multiple load cells are employed for calibration, they should be located in a geometrically symmetrical pattern with respect to the center of the machine slide. The preferred procedure is to place a single load cell directly under each connection to the slide from the crankshaft.

WARNING: Do not exceed the point loading of the ram specified by the press manufacturer! It is recommended that steel plates at least one inch thick and of at least 2 inches greater lateral dimension than the load cell contact surfaces be placed both under and over the load cell to help distribute the load and avoid load cell impressions in the slide or bolster material. All plates or parallels should be symmetrically placed relative to the centerline of the load cells, and plates and parallels used for each load cell stack should be similar in dimension to those used in other stacks.

When multiple load cells are used, each load cell should be of the same physical dimensions and load rating. The load cells must be shimmed as necessary to provide equal loads on each cell. The combination of geometrically symmetrical location and equal loading for load cells will produce a total machine load equal to the sum of the loads on each individual load cell and will simulate a single central load.

NOTE: Incorrect gib adjustments, and/or severe bearing wear in the slide drive system can cause the slide to cock and generate significant forces against linear guides or gibs. These non-symmetrical forces can void the assumption of central loading and introduce some error in the calibration procedure.

WARNING:	Extreme care should be used in calibration procedures for tonnage monitors. Severe damage to the machine being calibrated or the calibration equipment can result from incorrect shut height adjustments. Injury to personnel calibrating the machine or to others in the machine area can result from poorly implemented load cell or hydraulic jack stacks that fly out of the machine under load. ***NEVER*** place hands between load cell or hydraulic jack stacks and the machine slide! Link Systems provides calibration services at a reasonable charge. These services should be used if there is doubt that customer employees can correctly and safely calibrate a machine.

8.1 Dynamic Calibration with Load Cells

1) Check to see that the tonnage monitor is installed as per the installation instructions of this manual.

2) Turn on the power to the system. Observe that the tonnage monitor displays zero. If the tonnage displays fail to zero within 40 seconds or an error occurs, check that the strain gages are wired correctly into the channel connectors and refer to error conditions listed in this manual.

3) Before calibration can proceed, verify that all configuration parameters are properly set.

NOTE:	The number of channels and the machine rating must be set correctly before calibration and not changed afterward. Changing the number of channels or the machine rating number after calibration will result in incorrect tonnage readings.

4) If error conditions relating to setpoint limits occur, correct the invalid conditions and press the Reset softkey.

5) Set the high setpoint for each channel of the tonnage monitor to about 10% greater than the tonnage expected on each channel when the machine is loaded at rated tonnage. The expected tonnage for a two channel machine at full load is one-half (½) the rated tonnage of the machine. For a four channel machine, the expected tonnage for each channel is one-fourth (¼) the rated tonnage of the machine. For example, if a machine is rated at 200 tons the high setpoint limits for each channel should be set to 110 tons (10% over ½ of 200 tons) if two channels are used, or 55 tons (10% over ¼ of 200 tons) if four channels are used.

6) Set the low limits for each channel to zero (0).

7) Set the reverse limits for each channel to -10% of channel rating.

8) Bring the machine slide or ram to the bottom of the stroke and turn off power to the machine. Place the load cell(s) to be used for calibration into position in the machine. Load cell(s) of similar capacity and dimension are preferably centered under each drive connection to the slide

or ram of the machine. Also place any parallels or similar thickness plates on or under the load cells as necessary to reduce the gap between slide and bolster so that the "stack" of load cells and parallels can be contacted at the bottom of the machine stroke.

It is recommended that steel plates at least one inch thick and of at least 2 inches greater lateral dimension than the load cell contact surfaces be placed both under and over the load cell to help distribute the load and avoid load cell impressions in the slide or bolster material. All plates or parallels should be symmetrically placed relative to the centerline of the load cells, and plates and parallels used for each load cell stack should be similar in dimension to those used in other stacks.

On mechanical power presses with shut height adjustments, the stack height should be greater than the minimum shut height, and the machine shut height must be adjusted so that clearance between the machine slide and the load cell stack(s) is provided.

WARNING: If the load cell(s) stack height is greater than the machine shut height, as adjusted, cycling the machine may result in severe damage to the machine and to load cells!

9) Check to assure that the load cell stack(s) are correctly located and that the machine shut height or other bottom of stroke adjustment provides clearance between the ram or slide and the load cell stack(s) as per the instructions of the previous step of this calibration procedure.

10) Turn on the power to the machine and bypass the tonnage monitor (see section 3.5.1 on page 37). Return the slide to the top of stroke position.

11) Make single strokes of the machine, adjusting the shut height or other bottom of stroke adjustments downward 0.002" to 0.004" between successive strokes until any of the load cell(s) give a reading, indicating that contact is being made with one or more load cell stacks.

12) If a single load cell is used for calibration, continue to single stroke the machine and adjust shut height or other bottom of stroke adjustment until the rated capacity of the load cell or the machine, ***whichever is less***, is reached.

    The rated tonnage capacity of the load cell should be at least 50% of the rated tonnage capacity of the machine being calibrated. Adjustment distance should be restricted to less than 0.001" between strokes as rated machine tonnage is approached.

    If two or more load cells are used for calibration, adjust the shut height or other bottom of stroke adjustment until about 20% of rated machine tonnage capacity is displayed on the total of the load cell readings. If load cell tonnages are not equal, add shim stock to the stack of load cells with lower readings. Make a single stroke of the machine and observe the new tonnage readings of each load cell channel. Repeat this process until all load cell readings are equal to within 2%.

When load cell tonnages are equalized, again repeat the cycle of single stroking the machine with shut height or other bottom of stroke adjustment between strokes and continue to observe the tonnage on each load cell. It may be necessary to re-shim certain load cell stacks to equalize tonnage on all load cells as rated tonnage capacity of the machine is neared. Rated machine capacity of the machine is reached when individual tonnage on load cells equals the rated machine tonnage divided by the number of load cells used to calibrate the machine. For example, if four load cells are used to calibrate a 200 ton mechanical power press, the press is loaded to capacity when each of the four load cells is loaded to 50 tons. When rated machine tonnage, or a lesser tonnage at which the machine is to be calibrated is reached, lock shut height adjustments and proceed to the next step.

Do not exceed rated tonnage capacity of the machine or load cells during the calibration process by more than five or ten percent.

Vibratory motion in the machine often introduces stroke to stroke variations of one or two percent in the load cell tonnage readings. When this happens, it is impractical to try to refine the load on the machine any closer than within one or two percent of rated tonnage.

13) After loading the machine to the tonnage at which it is to be calibrated as per the previous step of this calibration procedure, go to the tonnage monitor tonnage calibration screen (see section 4.8 on page 61).

<u>For a two channel tonnage monitor:</u>

Turn the RUN/PROG keyed selector switch to the RUN position and make single strokes of the machine. The display will update the channel and total tonnage display each stroke on the calibration screen. Between strokes, switch the RUN/PROG keyed selector switch to the PROG position and enter Cal. #s for both channels until channel 1 and channel 2 tonnages are within one or two percent of one-half (½) the sum of the load cell readings.

<u>For a four channel tonnage monitor:</u>

Turn the RUN/PROG keyed selector switch to the RUN position and make single strokes of the machine. The display will update the channel and total tonnage display each stroke on the calibration screen. Between strokes, switch the RUN/PROG keyed selector switch to the PROG position and enter cal. #s for all channels until all four channel tonnages are within one or two percent of one-fourth (¼) the sum of the load cell readings

14) Copy down the calibration numbers so that periodic checks for calibration can be made. It is suggested that a copy of these numbers be retained inside the control enclosure and that a second copy be kept in files.

15) Reduce the load gradually, and verify that the tonnages displayed by the tonnage monitor "track" within one or two percent of those of displayed on the load cells. Failure of this indicates a non-linearity which could be due to incorrect strain gauge location, improper strain gauge mounting, or incorrect tie rod tension (in frames of this construction).

16) Return to the tonnage monitor main operator screen.

17) Remove the load cells and associated "stack" elements from the machine.

Calibration is complete.

8.2 Static Calibration with Hydraulic Jacks

1) Check to see that the tonnage monitor is installed as per the installation instructions of this manual.

2) Turn on the power to the system. Observe that the tonnage monitor displays zero. If the tonnage displays fail to zero within 40 seconds or an error occurs, check that the strain gages are wired correctly into the channel connectors and refer to error conditions listed in this manual.

3) Before calibration can proceed, verify that all configuration parameters are properly set.

> **NOTE:** The number of channels and the machine rating must be set correctly before calibration and not changed afterward. Changing the number of channels or the machine rating number after calibration will result in incorrect tonnage readings.

4) If error conditions relating to setpoint limits occur, correct the invalid conditions and press the Reset softkey.

5) Set the high setpoint for each channel of the tonnage monitor to about 10% greater than the tonnage expected on each channel when the machine is loaded at rated tonnage. The expected tonnage for a two channel machine at full load is one-half (½) the rated tonnage of the machine. For a four channel machine, the expected tonnage for each channel is one-fourth (¼) the rated tonnage of the machine. For example, if a machine is rated at 200 tons the high setpoint limits for each channel should be set to 110 tons (10% over ½ of 200 tons) if two channels are used, or 55 tons (10% over ¼ of 200 tons) if four channels are used.

6) Set the low limits for each channel to zero (0).

7) Set the reverse limits for each channel to -10% of channel rating.

8) Turn on power to the machine and bypass the tonnage monitor. Place the machine ram or slide at the bottom of stroke position.

9) Turn off machine drive motor and place the jack(s) to be used in calibration under the machine ram or slide.

   If a single jack is used, directly center the jack under the ram or slide.

If multiple jacks are used, the jacks should be placed in a geometrically symmetrical pattern relative to the center of the ram or slide. On machines with multiple connections to the slide, it is preferable to use a jack directly under each connection.

It is recommended that steel plates at least one inch thick and of at least 2 inches greater lateral dimension than the jack contact surfaces be placed both under and over the jacks to help distribute the load and avoid impressions in the slide or bolster material. All plates or parallels should be symmetrically placed relative to the centerline of the jacks, and plates and parallels used for each jack stack should be similar in dimension to those used in other stacks.

On mechanical power presses with shut height adjustments, the stack height should be greater than the minimum shut height, and the machine shut height must be adjusted so that clearance between the machine slide and the jack stack(s) is provided.

WARNING: If the jack stack(s) height is greater than the machine shut height, as adjusted, cycling the machine may result in severe damage to the machine and to jack(s)!

10) Access the tonnage monitor configuration menus and select Tonnage Calibration. With the RUN/PROG keyed selector switch in the PROG position enter a calibration number of 400 into each channel.

11) Turn the RUN/PROG keyed selector to the RUN position and press the Static Cal. On/Off softkey to enter Static Calibration mode. Verify that the channel and total tonnage displays read between ±1% of rated tonnage of the machine. If not, then use the Static Cal. On/Off softkey to turn static calibration mode off and back on to command a re-zero.

12) Use the hydraulic jack(s) equipped with suitable pressure gauge(s) to exert the tonnage at which the machine is to be calibrated, preferably rated tonnage of the machine but a tonnage of at least 50% of rated machine tonnage. When more than one jack is used for calibration, each jack pressure should be adjusted to exert equal forces (±1%) on the ram or slide of the machine.

<u>For a two channel tonnage monitor:</u>

Turn the RUN/PROG keyed selector switch to the PROG position and enter Cal. #s for both channels until channel 1 and channel 2 tonnages are within one or two percent of one-half (½) the sum of the load cell readings.

<u>For a four channel tonnage monitor:</u>

Turn the RUN/PROG keyed selector switch to the PROG position and enter cal. #s for all channels until all four channel tonnages are within one or two percent of one-fourth (¼) the sum of the load cell readings

13) Release the pressure of the jack(s) and remove the jack(s) and associated stack materials from the machine.

14) Retain the calibration numbers so that periodic checks for calibration can be made. It is suggested that a copy of these numbers be kept inside the control enclosure and that a second copy be kept in files.

15) Press the EXIT softkey to return to the Main Tonnage Monitor screen.

Calibration is complete.

8.3 Replacing System 1000/1100 Tonnage Monitors

If the tonnage monitor is replacing a System 1000 or System 1100 Tonnage Monitor that is already installed on the machine and calibrated, the calibration numbers from the System 1000/1100 can be transferred to the new tonnage monitor. Each System 1000/1100 calibration number should be multiplied by 1.11 and entered in the tonnage calibration screen (see section 4.8.4 on page 61). For instance, if the channel 1 calibration number on a System 1100 tonnage monitor is 200, then the calibration number for channel 1 of the 1200 tonnage monitor would be 222 (200 X 1.11 = 222).

8.4 Replacing System 5000 or System 5100 Tonnage Monitors

If the tonnage monitor is replacing a System 5000 or System 5100 Tonnage Monitor that is already installed on the machine and calibrated, the calibration numbers from the System 5000 or System 5100 can be transferred to the new tonnage monitor. The calibration numbers are the same and no adjustment is necessary.

8.5 Incorrect Tie Rod Tension

Straight side machines of tie rod construction are designed for tie rods to be in tension such that the bed and crown or the machine are held to the uprights (columns) with a force of from 150% to 200% of rated machine tonnage. The tension forces in the tie rods produce equal compression forces in the uprights.

When strain gauges are mounted on uprights, the tonnage exerted by the machine tooling stretches (strains) the tie rod by an amount proportional to load and releases the compressive forces in the uprights proportional to the load. If the tension on a tie rod places a compressive force on the upright that is less than the force released by the load, all compressive force will be removed from the upright (it will have stretched back out to its original length), and the signal from the strain gauge on the upright will no longer be proportional to load.

A loose tie rod condition can be detected during calibration of a straight side machine when strain gauges are mounted at approximately the same location on the uprights. If, at rated tonnage, the calibration number associated with one or more channels must be much higher than the other channels in order to produce equal tonnage readings, improper tension in the tie rod may exist. To determine if tie rod tension is the actual cause, reduce the load on the load cells during calibration until the sum of the load cell tonnages is equal to about 1/4 of rated machine tonnage, while making sure that approximately equal loads are on the load cells. If the channels with much higher calibration numbers now give tonnage readings much larger than the channels with lower calibration numbers improper tie rod tension is indicated.

Another way to check for loose tie rods is to check the tonnage graph when hitting load cells at near machine rating. Figure 76 shows a tonnage graph of a typical load cell hit on a machine with tie rods that are in proper tension. There is a characteristic "hump" shape with a rounded top. Actual hits may not be quite as smooth but should have the same general shape. Figure 75 shows the characteristic shape for a channel on an upright with a loose tie rod. The "hump" flattens out at around 50 tons. This means that instead of the 105 tons of preload the tie rod should have, it had only 50 tons of preload. Not only does this result in the inability of the tonnage monitor to read the proper tonnage on that channel, but this can cause all kinds of machine, tooling, and quality problems because whenever the channel exceeds 50 tons, the upright is actually separating from the bed and crown of the press. This can cause hit to hit variation in the alignment of the press itself. Note that the flattening of the "hump" can occur at almost any level depending on how loose tie rods are.

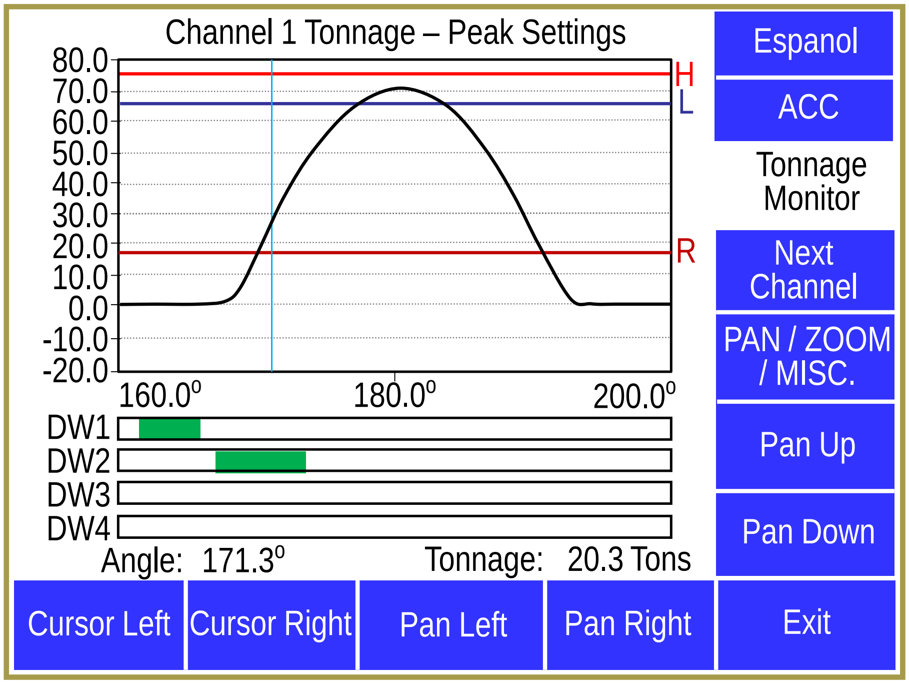

Figure 76: Load Cell Hit with Good Tie-Rod Tension

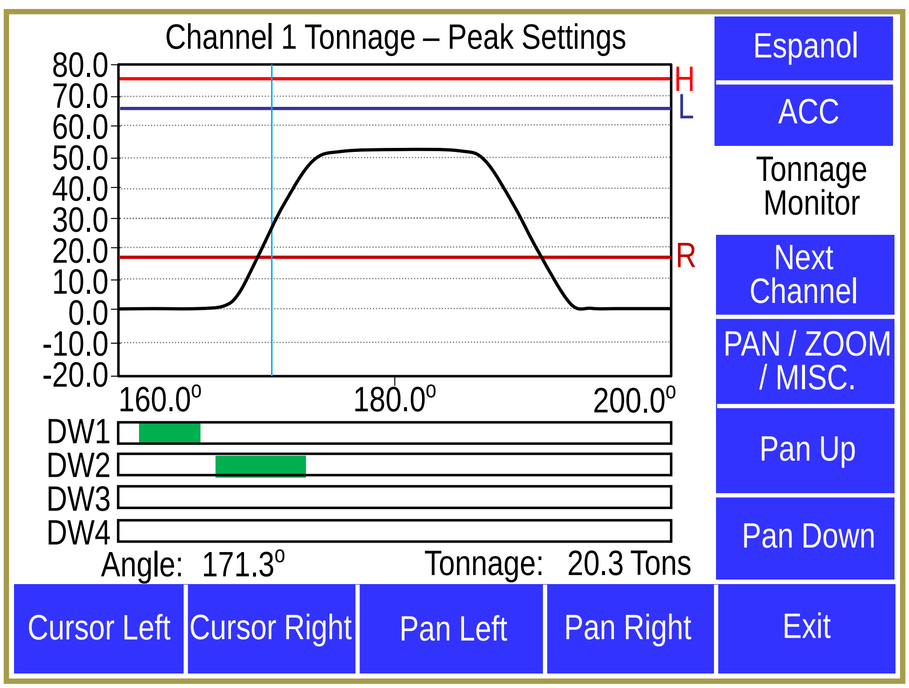

Figure 75: Load Cell Hit with Bad Tie-Rod Tension