805-5 Tonnage Monitor

Installation and Operating Manual

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Tonnage Monitor

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1 INTRODUCTION

The 805-5 Tonnage Monitor is available as an option for the OmniLink 805 Operator Terminal. Its primary purpose is to measure and display the force being applied to the frame of a mechanical 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 same Operator Terminal as all other System 5100 settings. Additional options (detailed below) can be added to provide even more capabilities.

1.1 Features

- The 805-5 Tonnage Monitor provides four strain link connections for use on two or four channel machines.

- The crankshaft angle is supplied to the tonnage monitor via communication with the System 5100 Press Control. Position dependent parameters such as the working portion of the stroke are entered directly into the tonnage monitor and require no external cam switches.

- The same communication link allows the tonnage monitor to instruct the control to “Top Stop” or “Immediate Stop” (depending on the type of tonnage alarm that occurred) without additional wiring.

- 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.

- If desired, additional limits can be placed on the total tonnage that reflects the maximum allowable total tonnage at specific positions in the stroke.

- Limits can be programmed manually, automatically calculated by the tonnage monitor, or recalled along with all other Link equipment settings 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.

1.2 Specifications

Size:	3.5" wide, 4.50" high (circuit board installs in OmniLink 805 Operator Terminal)
Input Power:	Supplied from OmniLink 805 Operator Terminal
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 6.3 and 6.4 starting on page 34 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.

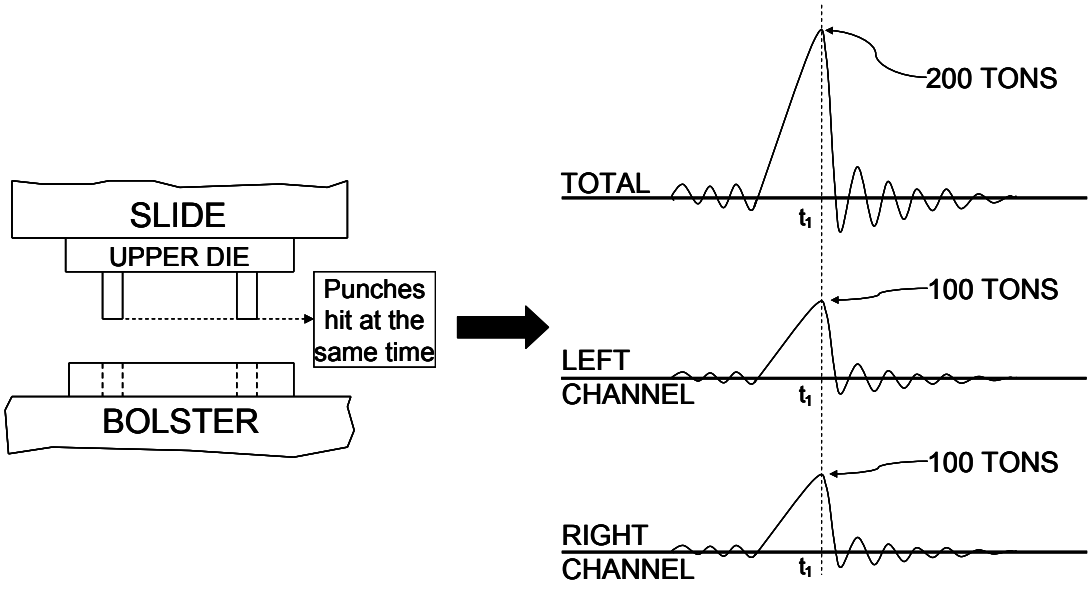


Figure 1: Example Die 1 with Signature

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.

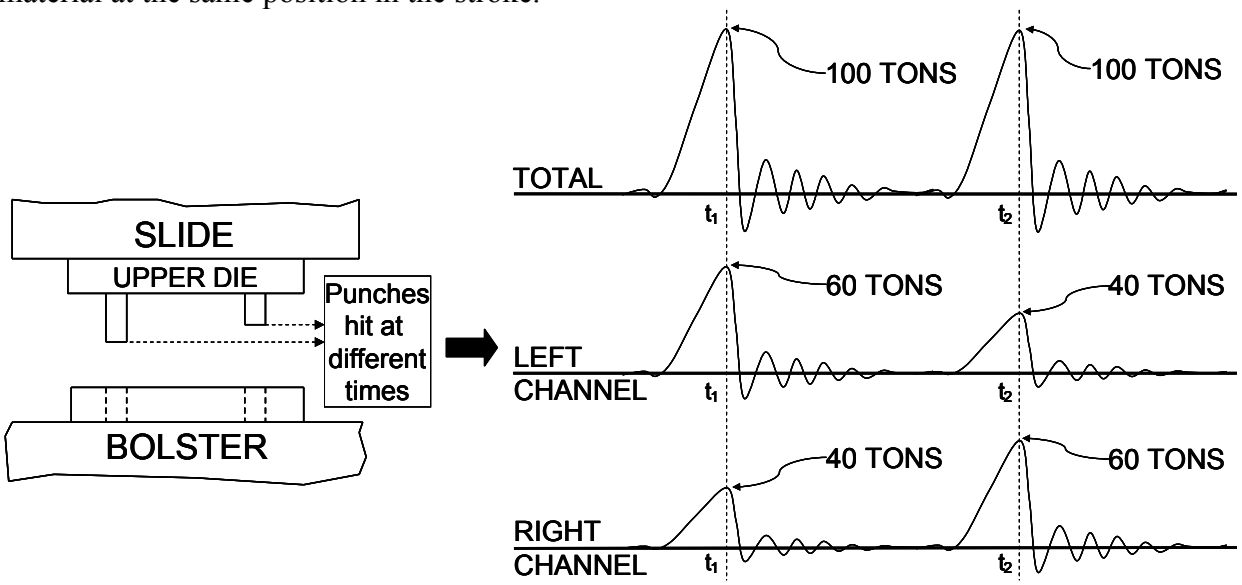


Figure 2: Example Die 2 with Signature

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 Limits

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

2.2.1 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.***

2.2.2 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 can not be set greater than or equal to that channels' high limit.

2.2.3 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, Top Stop, or Intelli-Stop) is issued.

2.2.4 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. 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.

2.2.5 Total Tonnage Limit

There is only one limit that can be applied to the total tonnage. If so configured (see section 4.7 on page 29 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.

2.3 Stops

There are three 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.

2.3.1 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.

2.3.2 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 can not stop at top in the time left when it receives the stop command, it will make an additional stroke. Many high speed presses take more than 1 full stroke to stop regardless of where the stop occurs.

2.3.3 Intelli-Stop

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

3 OPERATION

3.1 Main Operator Terminal Screen

The operator terminal main screen shown in Figure 3 provides the current status of the tonnage monitor and indicates if attention is required.

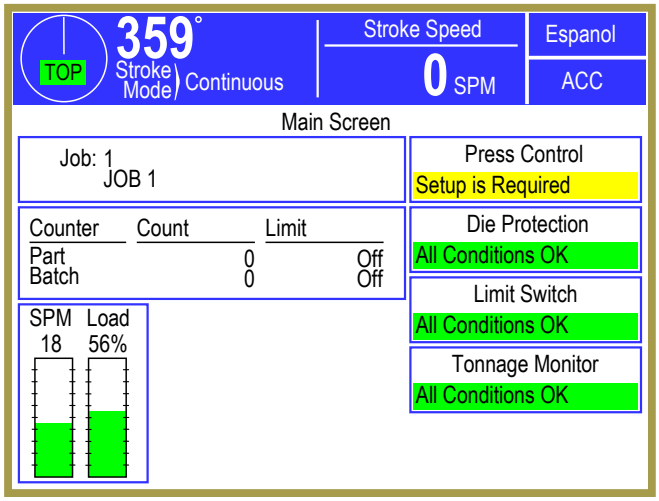


Figure 3: Operator Terminal Main Screen

The status of the tonnage monitor module 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.

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

"***Option Not Installed"*** The control has not been configured to recognize the module.

"Auto-Setup Active" The tonnage monitor is collecting data to automatically set alarm levels. During this process High, Low, and Reverse limits are bypassed.

3.2 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 module, and a graphical representation of the limits that apply to each channel.

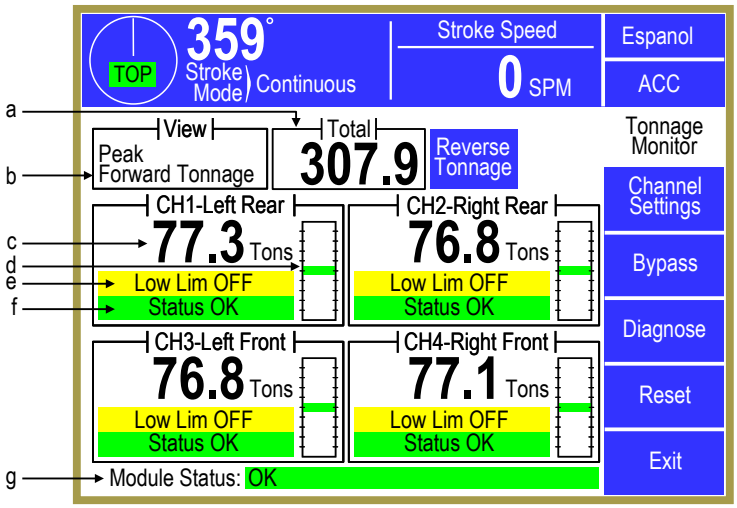


Figure 4: Tonnage Monitor Main Screen Showing Peak Forward Tonnage

Peak forward tonnage and peak reverse tonnage can be selected for viewing. Figure 4 is an example of a peak forward tonnage view, and Figure 5 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 4, the various parts of the screen are:

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

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

c) Tonnage Reading — The numeric tonnage reading for this channel and view. In the example screen of Figure 4, this is the peak forward tonnage for channel 1.

d) 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.

e) 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 3.4 on page 21 for more information on bypassing the tonnage monitor.

f) Channel Status Each channel also has a status that indicates any alarms conditions or other problems related to just that channel.

g) Module Status The overall status of the tonnage monitor.

Bypass *Softkey* Press this softkey to go to the tonnage monitor bypass screen where various bypass options can be configured. See section 3.4 on page 21 for more information on the bypass screen.

Reverse Tonnage *Softkey* This softkey changes the tonnages displayed to peak reverse tonnage (see Figure 5: Tonnage Monitor Main Screen Showing Reverse Tonnage). This key is only present when viewing peak forward tonnage. See section 3.2.1 on page 14 for more information.

Reset *Softkey* This softkey is used to reset tonnage alarms and fault conditions. See section 3.2.2.7 on page 16 and section 3.2.3.3 on page 17 for more information on resetting alarm and error conditions.

Diagnose *Softkey* This softkey brings up the tonnage monitor diagnostics screen. See section 3.5 on page 23 for more information on this screen.

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 3.3 on page 18 for more information on this screen.

Figure 5 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 **Reverse Tonnage** softkey has also changed to **Forward Tonnage** to allow switching back to the forward tonnage view.

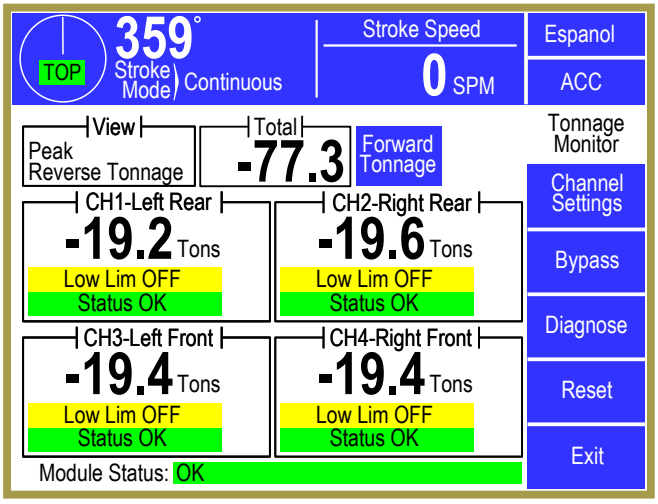


Figure 5: Tonnage Monitor Main Screen Showing Reverse Tonnage

3.2.1 Showing Forward and Reverse Tonnage

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

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

3.2.2 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 Present Running Status in the Press Control screen will show “Tonnage Monitor Stop”. If, for example, a die protection channel issued a stop at 100 degrees and then a tonnage alarms occurred at 170 degrees, then the Present Status would read “Die Protection Stop” even though there is also a tonnage alarm.

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.

3.2.2.1 Low Alarm

A Channel Status message that reads “Low Peak Alarm” indicates the maximum tonnage recorded during the last stroke did not reach the Low Limit setting.

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. When the condition is detected on any channel, a Top Stop is issued.

3.2.2.2 High Alarm

A Channel Status message that reads “High Peak Alarm” indicates the maximum tonnage recorded during the last stroke exceeded a High Limit setting.

When the condition is detected on any channel, a stop is issued. A peak high alarm will issue a stop as configured by the “High Limit Stop Type” setting. See section 0 on page 27 for details on this setting.

3.2.2.3 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.

3.2.2.4 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 4.3.1 on page 25 for details). When the condition is detected on any channel, an Immediate Stop is issued.

3.2.2.5 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 4.3.2 on page 25 for details). When this condition is detected on any channel, a Top Stop is issued.

3.2.2.6 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 4.7 on page 29 for how this de-rate curve is programmed).

3.2.2.7 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.

3.2.3 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 4) and some are reported for a particular channel in the channel status area (see "b" in Figure 4).

3.2.3.1 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.

"No Resolver Info" No resolver information (for the crankshaft angle) was received from the press control for an excessive length of time. This is usually the result of an intermittent connection of the high speed bus wiring.

"Total Alarm" A "total alarm" has been tripped. See section 3.2.2.6 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.

3.2.3.2 Channel Errors

In addition to tonnage alarm conditions (see section 3.2.2), the following errors can be indicated in the channel status for an individual channel:

"Zero Error" The tonnage monitor can not 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.

3.2.3.3 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 8 on page 50 for details), the operator will also require an access code to reset the tonnage monitor.

3.3 The Tonnage Monitor Channel Settings Screen

The channel settings screen can be selected by pressing the **Channel Settings** softkey in the tonnage monitor main screen (See Figure 4 on page 12). 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.

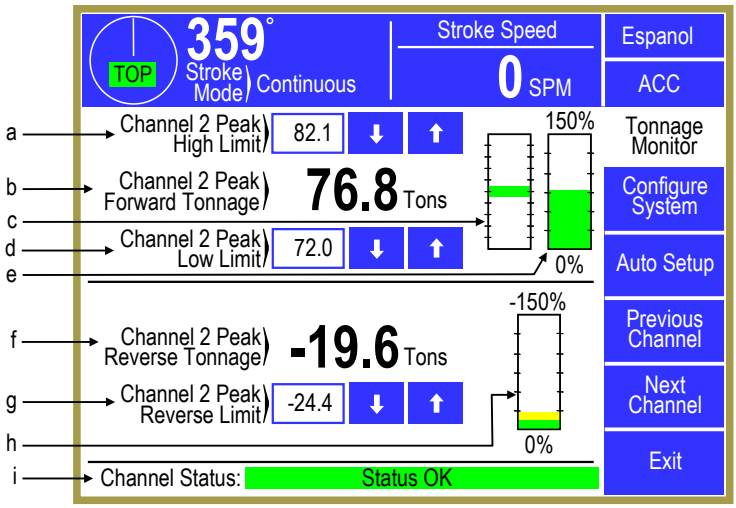


Figure 6: Tonnage Monitor Channel Settings Screen

Items on this screen include:

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

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

g) Reverse Limit The reverse limit for the currently displayed channel.

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.

i) Channel Status The status of the currently displayed channel

Configure System ***Softkey*** This softkey brings up the tonnage monitor system configuration screen. The system configuration area is where parameters that control the system as a whole (and are not related to jobs) are set up. This includes setting the number of channels, channel calibration, maximum limits, and other settings. Note that it is only present when the RUN/PROG key switch is in the PROG position. In addition, the system configuration code is required to gain access to these screens. See section 4.2 on page 24 for more information.

Auto Setup ***Softkey*** This softkey brings up the Auto Setup screen. See section 3.3.1.4 on page 20 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.

Previous Channel ***Softkey*** This softkey will display the previous channel.

3.3.1 Setting Limits

As can be seen in Figure 6, 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.

> **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 8 on page 50.

3.3.1.1 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 4.3.3 on page 25 for details).

3.3.1.2 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.

3.3.1.3 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.

3.3.1.4 Automatically Setting Limits

The **Auto Setup** softkey brings up a screen that can initiate an automatic calculation of tonnage limits based on the tonnages that the tool is currently reading. 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 8 on page 50 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 3.4.4 on page 22 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.

3.4 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 4 on page 12).

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 4.4 on page 26 for information on these parameters).

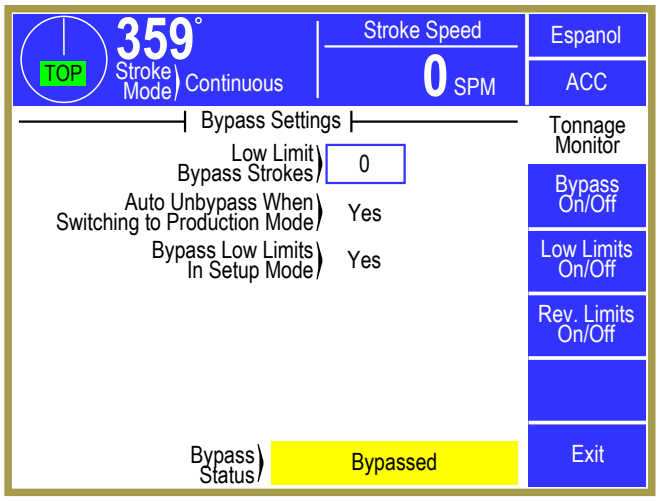


Figure 7: Tonnage Monitor Bypass Screen

3.4.1 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 8 on page 50 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.

3.4.2 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 8 on page 50 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.

3.4.3 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 8 on page 50 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.

3.4.4 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.

3.5 The Tonnage Monitor Diagnose Screen

Pressing the **Diagnose** softkey in the main tonnage monitor screen will bring up the diagnostic screen shown in Figure 8.

Note that the alarms counters on this screen can only be reset from the Alarm Levels screen in the tonnage monitor configuration area (see section 4.4.3 on page 26 for details).

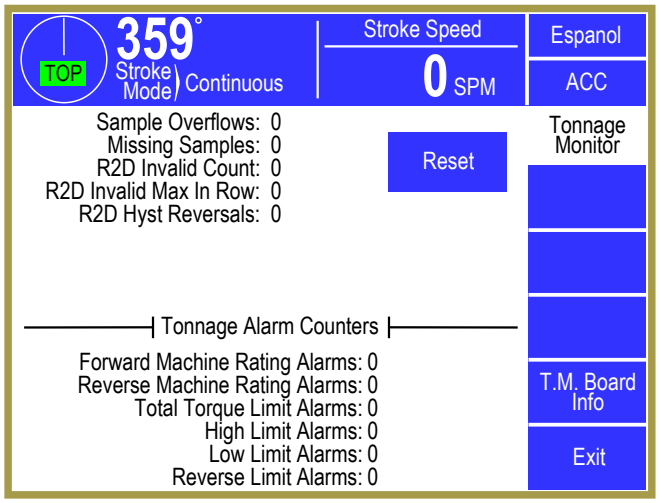


Figure 8: Tonnage Monitor Diagnostic Screen

Items on this screen include:

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

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.

4 CONFIGURATION

4.1 Turning the Tonnage Monitor ON in Device Config

Before anything can be configured on the tonnage monitor, the operator terminal must be made aware that it is installed. Press the **ACC** softkey (near the upper right corner of the display) to display the "Quick Access" screen. With the RUN/PROG key in the PROG position, the lower left hand softkey should show as **Device Config**. Press this softkey and enter the system configuration code to gain access to the device config screen. This screen contains a list of the options that can be used with the operator terminal. The option name for this tonnage monitor is "805 Tonnage Monitor". The screen should look similar to Figure 9.

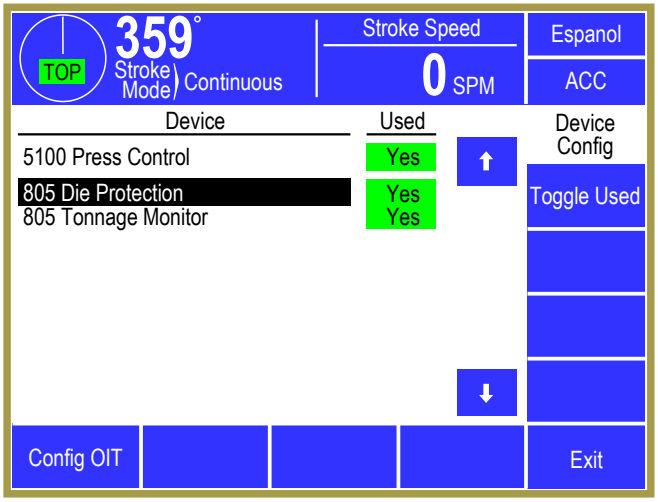


Figure 9: Device Config Screen

Using the arrow keys, highlight "805 Tonnage Monitor". If the "Used" column by the tonnage monitor does not already say "Yes", press the **Toggle Used** softkey to change it.

4.2 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 3.3 on page 18) 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 10.

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

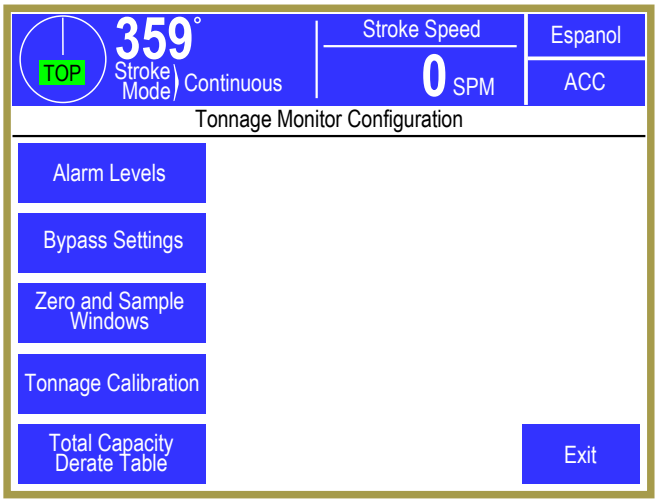


Figure 10: Tonnage Configuration Screen

NOTE:	The tonnage monitor screen will not be available until the tonnage monitor is turned on in the Device Config screen as explained in section 4.1.

4.3 The Tonnage Monitor Alarm Levels Configuration Screen

Press the **Alarm Levels** softkey in the tonnage monitor configuration screen as shown in Figure 10 to display the screen shown in Figure 11.

The following sections describe the settings in this screen.

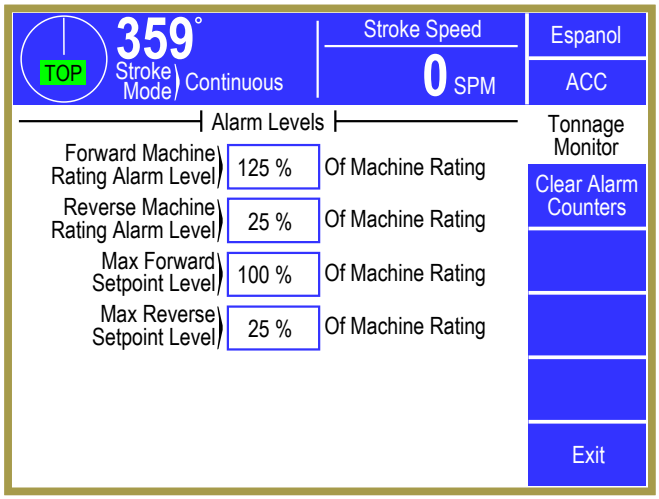


Figure 11: Alarm Levels Configuration Screen

4.3.1 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.

4.3.2 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.

4.3.3 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.

4.3.4 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.

4.4 The Tonnage Monitor Bypass Settings Configuration Screen

Press the **Bypass Settings** softkey in the tonnage monitor configuration screen as shown in Figure 10 to display the screen shown in Figure 12.

The following sections describe the settings in this screen.

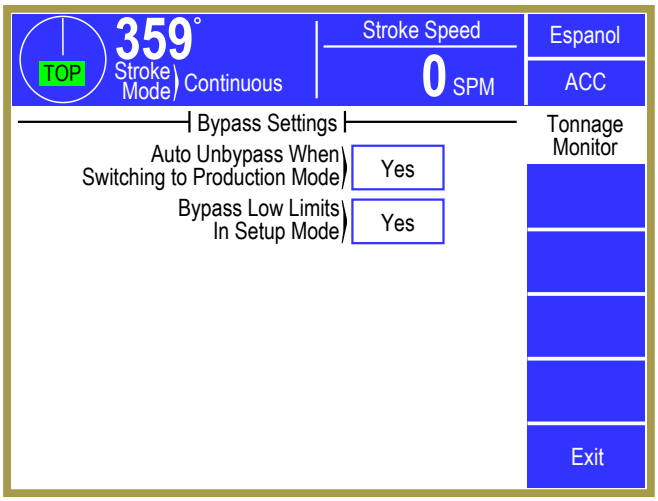


Figure 12: Bypass Settings Configuration Screen

4.4.1 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.

4.4.2 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. 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.

4.4.3 Resetting Alarm Counters

The alarm counters that are displayed in the Tonnage Monitor Diagnose screen (see section 3.5 on page 23) can be reset by pressing the **Clear Alarm Counters** softkey. The OIT will ask for confirmation before clearing the counts.

4.5 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 10 to display the screen shown in Figure 13. The following sections describe the settings in this screen.

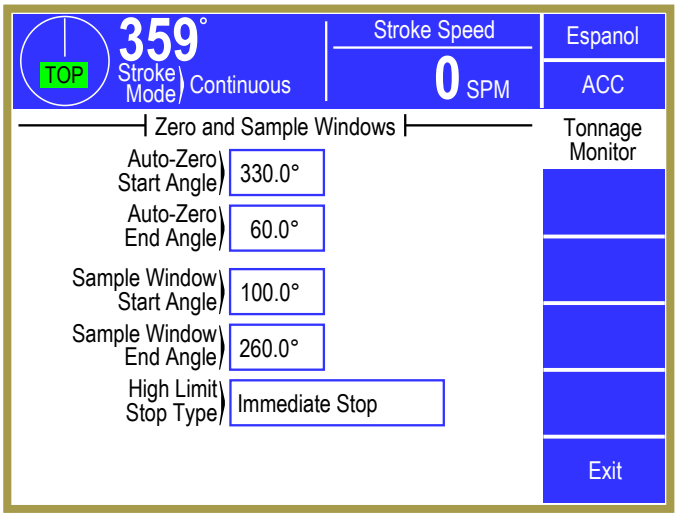


Figure 13: Zero and Sample Windows Configuration Screen

4.5.1 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.

4.5.2 Auto-Zero End Angle

See Auto-Zero Start Angle for information on Auto-Zero. The suggested default value for this parameter is 60 degrees.

4.5.3 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.

4.5.4 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.

4.5.5 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, Intelli-Stop and Top Stop.

4.6 The Tonnage Monitor Tonnage Calibration Configuration Screen

Press the **Tonnage Calibration** softkey in the tonnage monitor configuration screen as shown in Figure 10 to display the screen shown in Figure 14.

The following sections describe the settings in this screen.

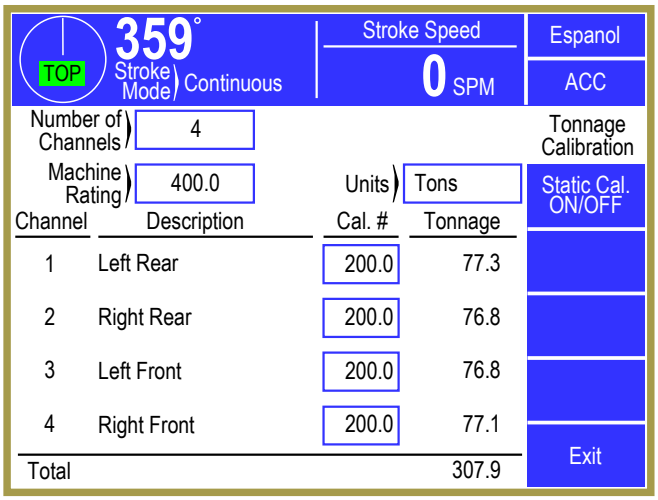


Figure 14: Tonnage Monitor Tonnage Calibration Screen

4.6.1 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.

4.6.2 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.

4.6.3 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.

4.6.4 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 7 on page 42 for calibration procedures.

4.7 The Tonnage Capacity Derate Table Screen

Press the **Total Capacity Derate Table** softkey in the tonnage monitor configuration screen as shown in Figure 10 to display the screen shown in Figure 15.

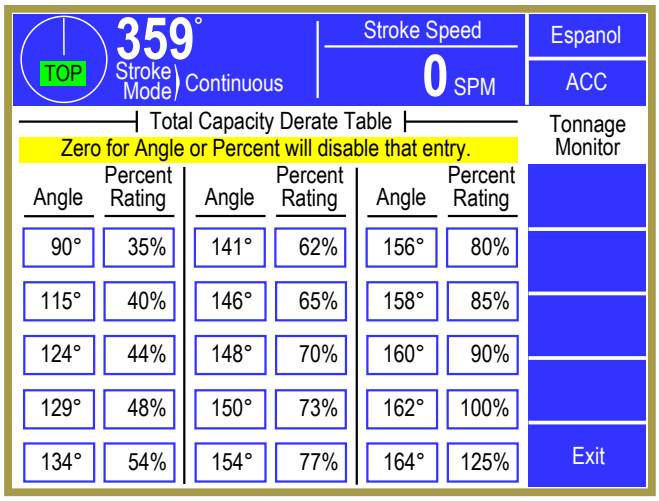


Figure 15: Tonnage Monitor Total Capacity De-rate Screen

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 4.3.1 on page 25 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 16 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.

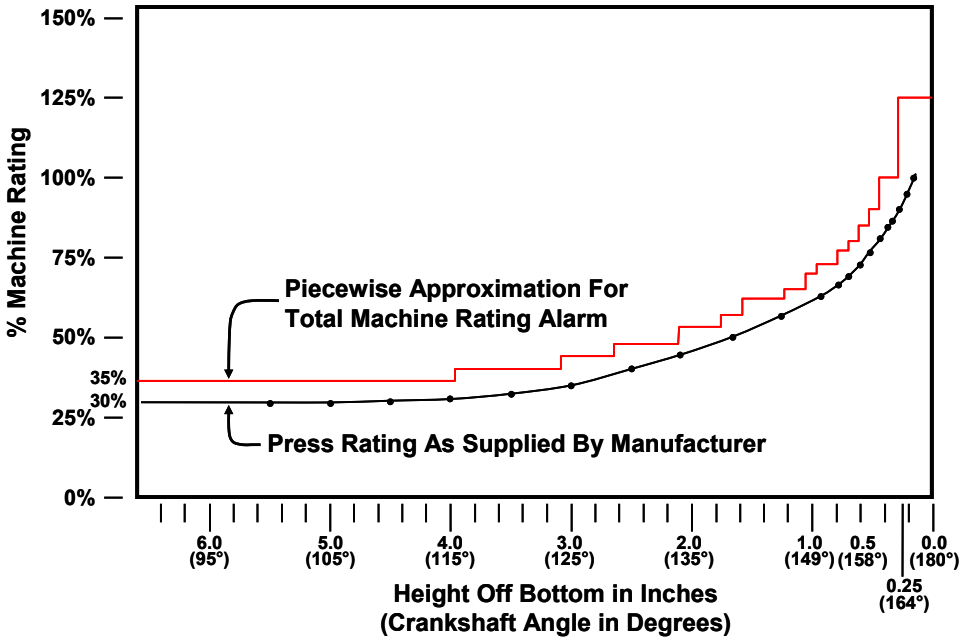


Figure 16: Example Tonnage De-rate Curve

Figure 15 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.

5 JOB SETUPS

In the operator terminal, all pertinent information for the current job such as programmable limit switch setpoints, automatic feed settings, and tonnage monitor limits can be stored for later use as a block of information called a "job setup". Since this programmed data may change from job to job or as machine dies are changed, saving a job setup prevents the operator from having to manually change all this information when dies are changed. The operator can simply recall the appropriate job setup which he previously stored and the press is ready to run. Information on storing, recalling, or erasing job setups is in the operator terminal manual.

All setup data for the tonnage monitor will be stored or recalled when the operator stores or recalls a job setup. This includes all programmed information such as the low limits, high limits, reverse limits, and so on. The operator need not perform any additional or separate operations to store or recall tonnage monitor information - simply follow the standard procedure for job setups listed in the operator terminal manual and the setup change is done automatically.

All tonnage monitor settings (including calibration) are stored in the operator terminal. If necessary, tonnage monitor boards can be swapped freely between presses and will still receive the proper settings for that press.

> **NOTE:** If the tonnage monitor is installed as an option after the rest of the system has been in operation, any job setups stored in the operator terminal will not have settings for the tonnage monitor. In this case, when a previously stored job is recalled from memory by the operator, the tonnage monitor will not be able to find any information stored for it, or the information will consist of default values. A message may be displayed on the job setup screen which reads "No Tonnage Monitor Settings". The operator should select to continue the recall operation and allow all other system parameters to be recalled. The tonnage monitor settings will remain unchanged from what they were prior to the recall. The operator MUST program the correct tonnage monitor settings for the job. Once the tonnage monitor settings are set correctly, the operator should store the job. The correct settings for the tonnage monitor will then be available the next time the job is recalled.

5.1 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 4.4.2 on page 26). 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 INSTALLATION

The 805 tonnage monitor board can be used ONLY with the OmniLink 805 Operator Terminal. The board is installed directly into the operator terminal.

6.1 Mounting the Board

If the tonnage monitor board was not installed at the factory, it will need to be installed into the OmniLink 805 Operator Terminal (OIT).

The board mounting location is shown in Figure 17 highlighted in yellow. Four 6-32 X 1/4" screws with lock washers are required to mount the board to the indicated mounting standoffs. Also note the indicated board connector in the figure. The tonnage monitor mating connector must line up correctly with this connector. If the mounting holes do not seem to line up correctly after plugging in the board, remove the board and correct the alignment.

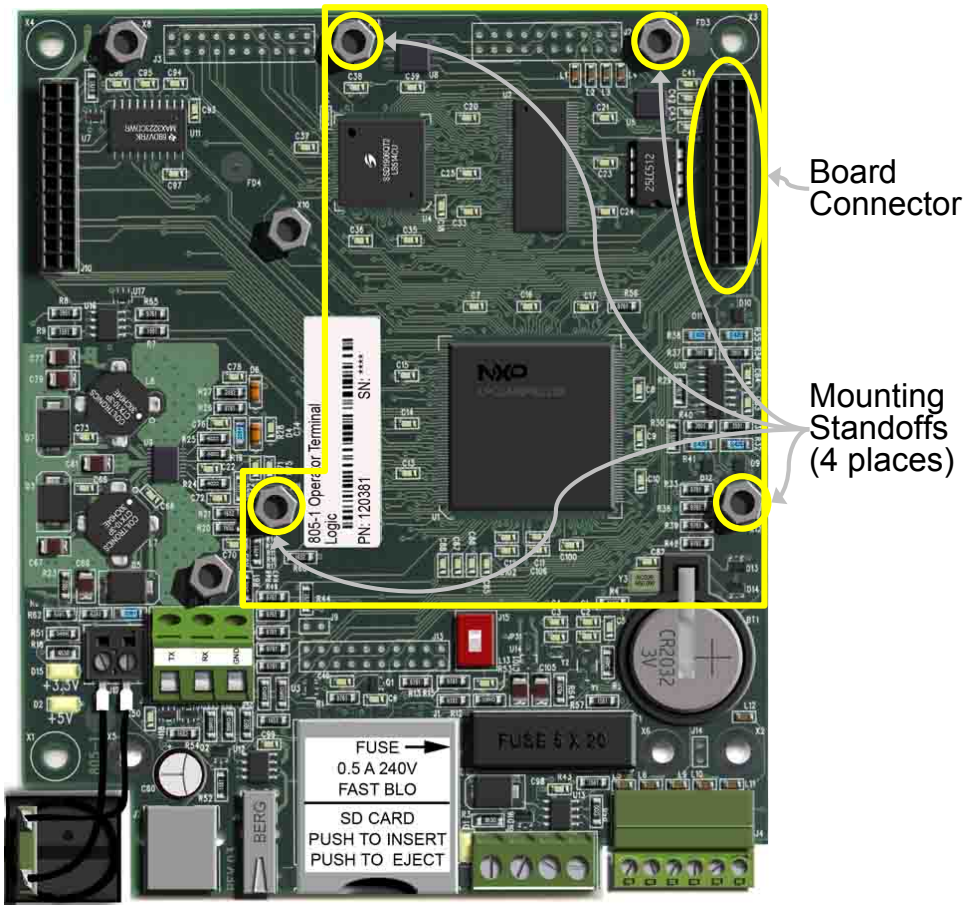
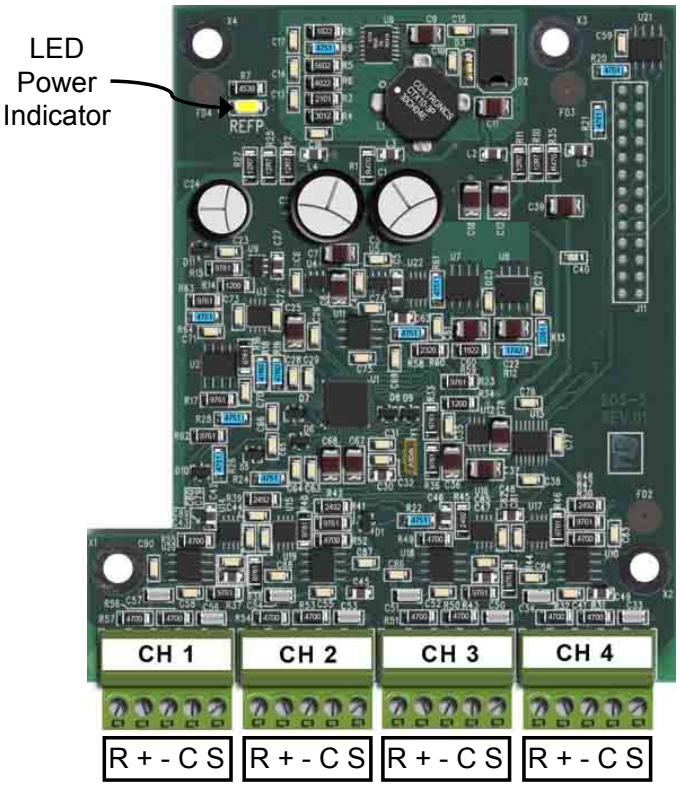


Figure 17: Mounting Location of Board in the OIT

6.2 Connections and Indicators

The tonnage monitor board is labeled for the connectors that provide for field connections as shown in Figure 18. The CH 1, CH 2, CH 3, and CH 4 connectors are strain gage inputs. There is also one amber LED indicator which indicates that an internal power supply is functioning. This indicator should always be lit as long as power is on. At a minimum, one or more strain gages must be connected for proper operation. See Figure 27 on page 39 for information on how to wire the strain gage to the channel connectors.



Strain Gage Wiring (4 Channels)		
R	= VRef	= Reference Voltage
+	= SIG+	= Signal Positive
-	= SIG-	= Signal Negative
C	= GND	= Common
S	= SHLD	= Shield

Figure 18: Tonnage Monitor Board

6.3 Strain Gage Locations

6.3.1 "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 19. 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.

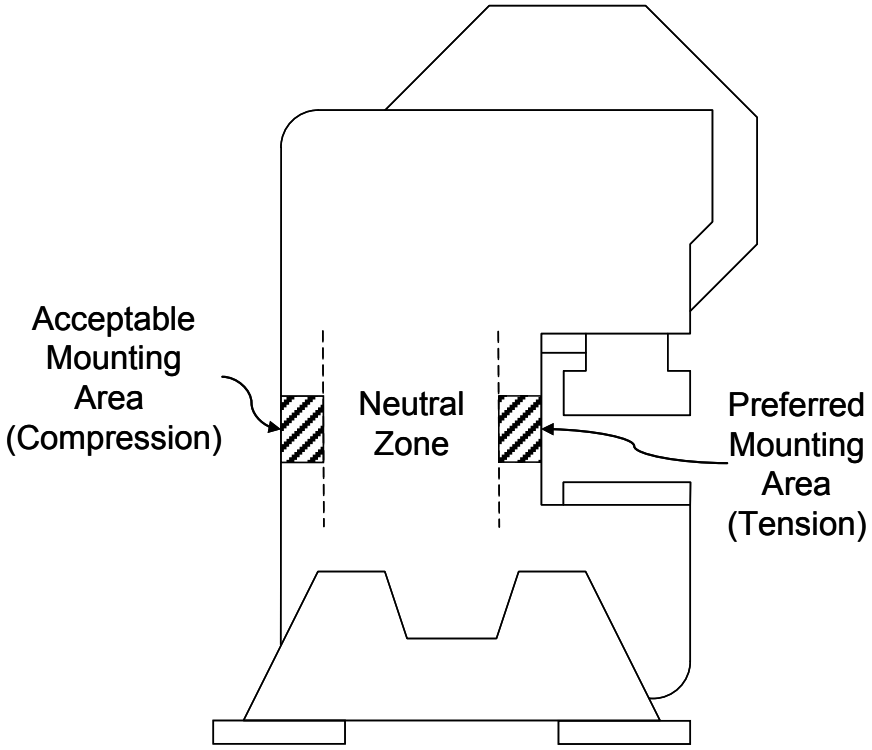


Figure 19: "C" Frame Machine Gage Locations

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.

6.3.2 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.

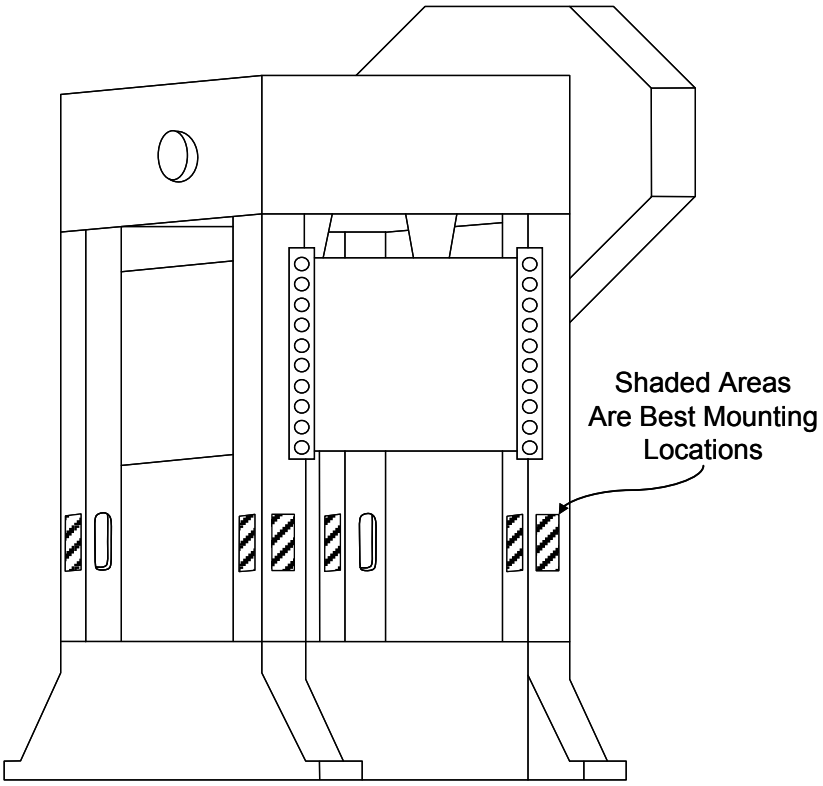


Figure 20: Straight Side Machine Gage Locations

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 20 illustrates mounting locations for straight side machines of tie rod construction.

Figure 21 shows areas to avoid on the uprights of straight side machines of tie rod construction. The cross-hatched areas should be avoided.

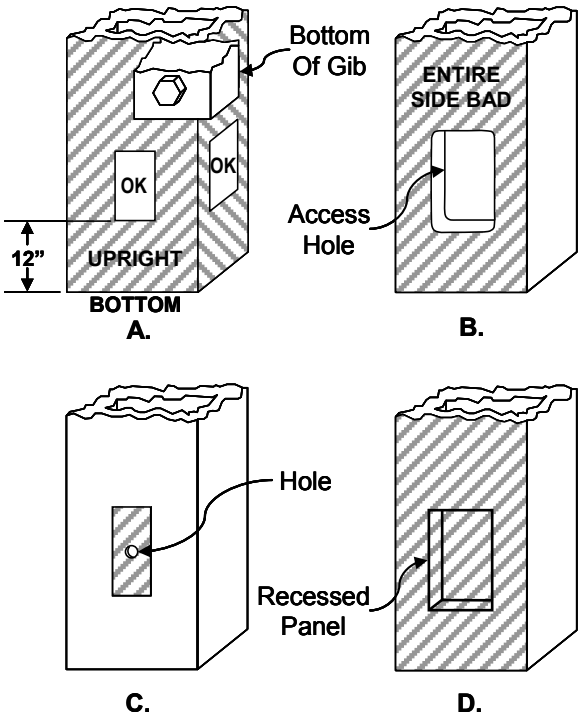


Figure 21: Upright Areas to Avoid

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 22.

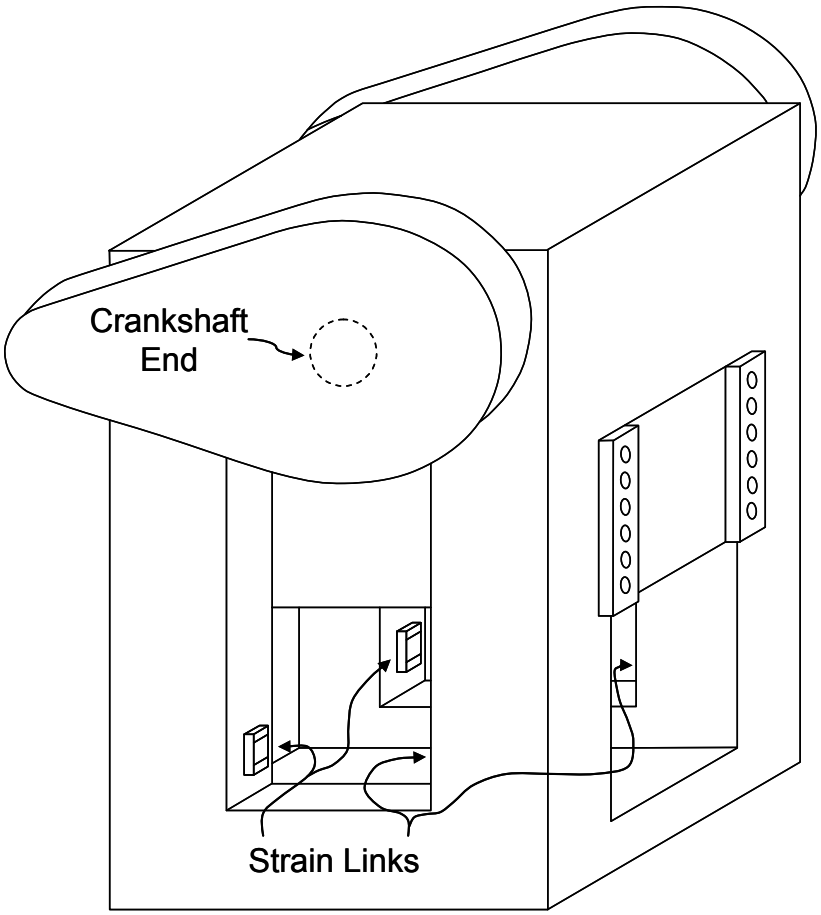


Figure 22: Solid Frame Machine Gage Locations

6.4 Strain Gage Mounting

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

6.4.1 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 23.

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.

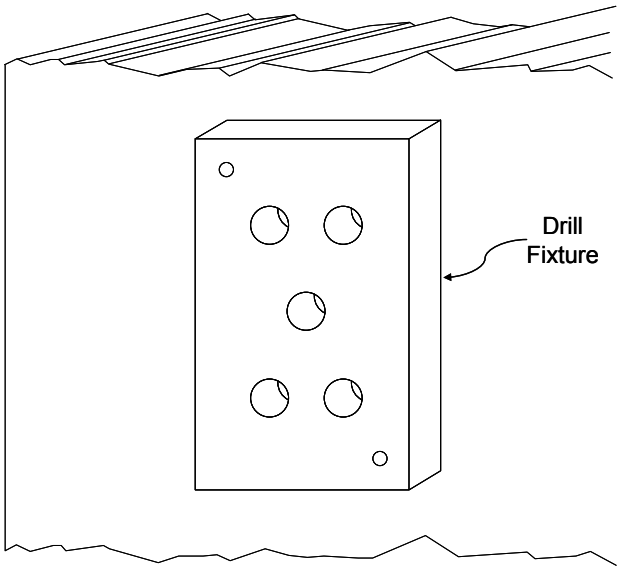


Figure 23: Strain Gage Drill Fixture

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 24. 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.

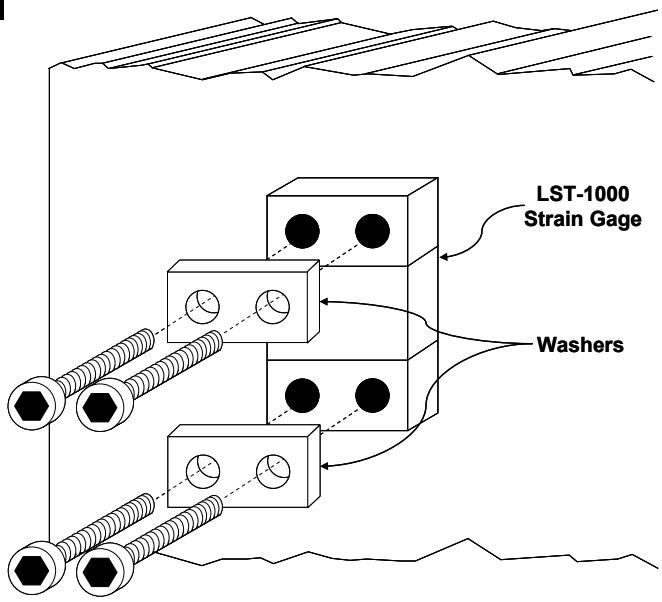


Figure 24: LST-1000 Strain Gage Mounting

6.4.2 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 25.

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 26.

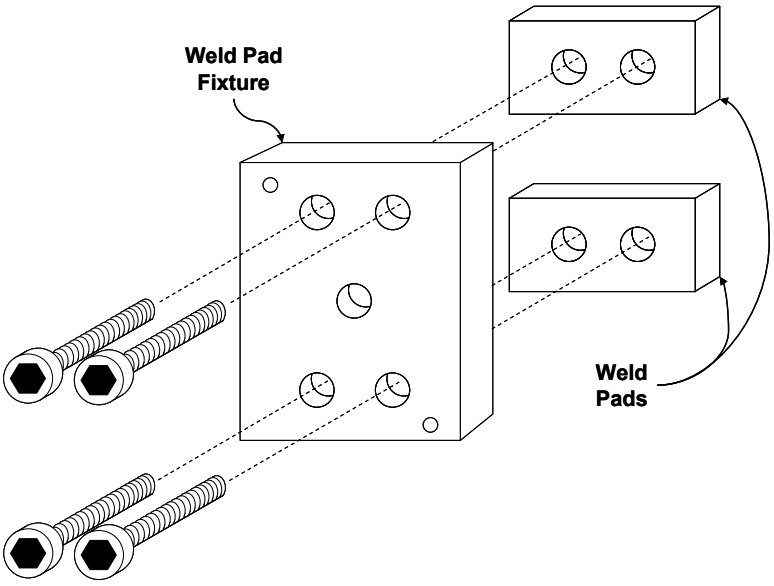


Figure 25: Weld Pad Mounting Fixture

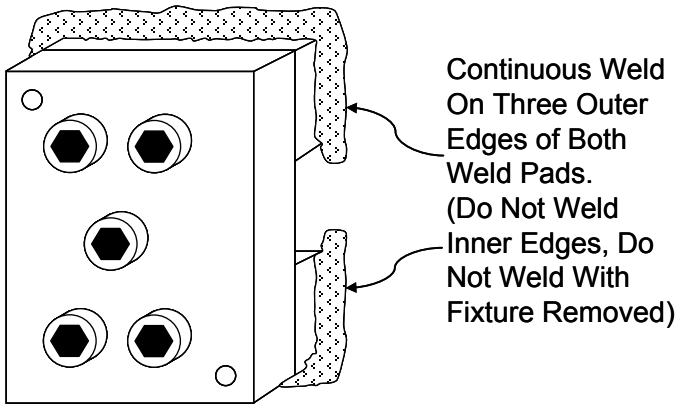


Figure 26: Weld Pad Welding Technique

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.

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.

6.5 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 27. Cover or tape the shield, to avoid accidental shorting to any other point.

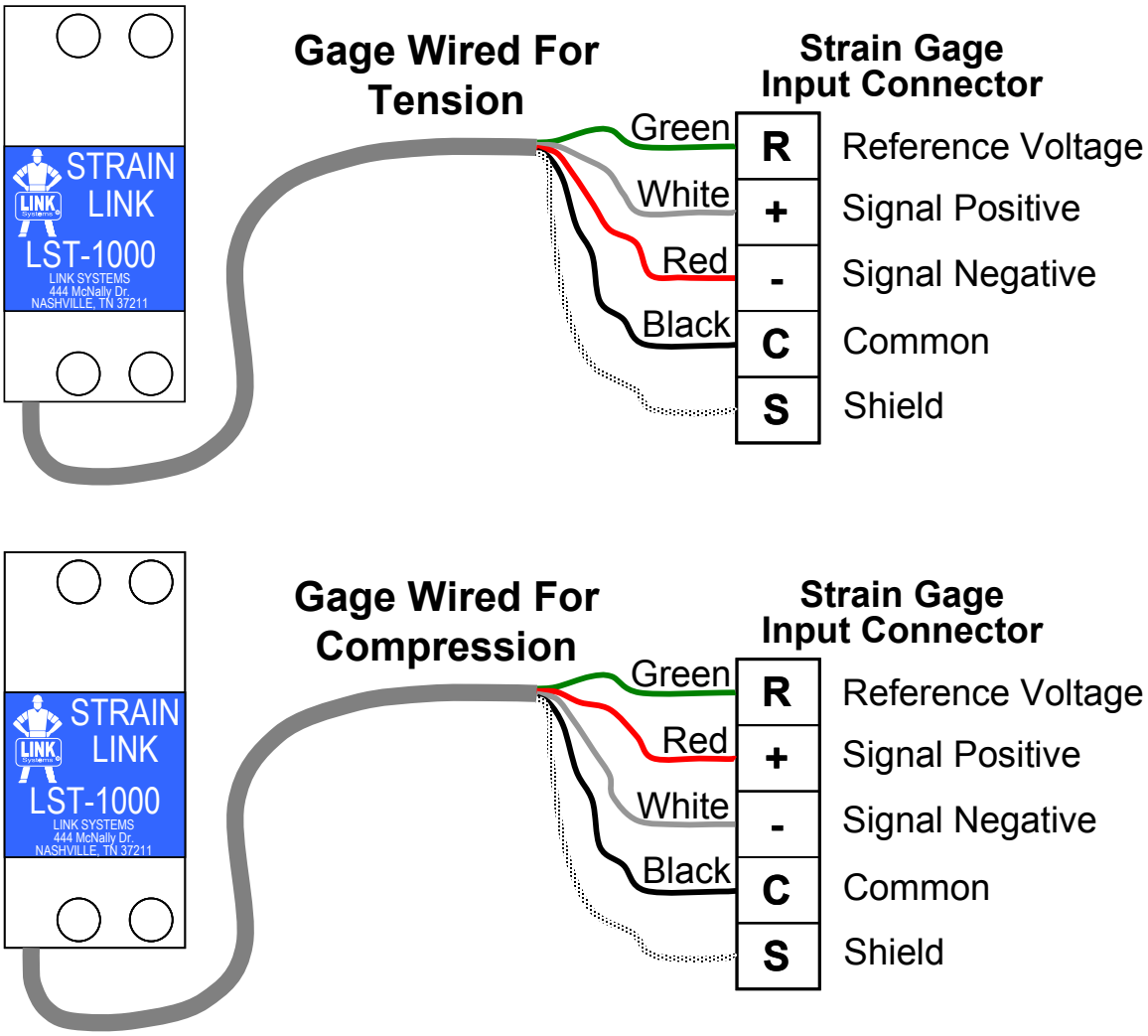


Figure 27: Strain Gage Wiring

6.6 Installation Procedure

1) Position the press at the top of the stroke, turn power to the machine off, and install the tonnage monitor board in the operator terminal, if not already installed (see section 6.1 on page 32).

> **NOTE:** If this installation is replacing a System 1000, System 1100, or System 5000 tonnage monitor already installed on the machine, then write down the present machine rating and cal. numbers before turning power OFF. In addition to moving the strain gage wires to the new unit, for System 1000 and System 1100 tonnage monitors the stop signal from the old unit must be removed and/or rerouted.

2) Locate and mount the strain gages, if not already installed on the machine (see section 6.3 on page 34 and section 6.4 on page 36).

3) Route conduit from the strain gages into the control enclosure that contains the tonnage monitor board.

> **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.

4) Wire the strain gages to the connectors on the tonnage monitor board (see section 6.5 on page 38).

5) Power up the press control and use the press control configuration menus to turn the tonnage monitor option ON (see section 4.1 on page 24).

6) Exit to the Main Menu and go to the tonnage monitor main screen. Verify that the channel status indicates no errors for all channels.

7) With the RUN/PROG switch in the PROG position, press the **Channel Settings** softkey to go to the channel settings screen. Now press the **Configure System** softkey and enter the configuration code.

8) Press the **Alarm Levels** softkey and set the desired values as documented in section 4.3 on page 25 (the default values will usually work fine). You may want to reset the alarm counters while in this screen.

9) Exit back to the main tonnage monitor configuration screen and press the **Bypass Settings** softkey. Set the desired values as described in section 4.4 on page 26.

10) Exit back to the main tonnage monitor configuration screen and press the **Zero and Sample Windows** softkey. Set the desired values as described in section 4.5 on page 27 (the default values will usually work fine).

11) Exit back to the main tonnage monitor configuration screen and press the **Tonnage Calibration** softkey (refer to section 4.6 on page 28 for more information on this screen). Always set the number of channels, the units, and the machine rating first! Calibrate the tonnage monitor (see section 7 on page 42 for the calibration procedure).

> **NOTE:** Changing the number of channels or the machine rating after the press has been calibrated will invalidate the calibration! ***Always change these parameters to their proper values before calibration!*** The units can be freely changed at any time, including after calibration will no problems.

12) Exit back to the main tonnage monitor configuration screen and press the **Total Capacity Derate Table** softkey (refer to section 4.7 on page 29 for more information on this screen). If desired, using data from the press manufacturer, enter the total capacity derate table values.

13) Exit back to the tonnage monitor operator screens and enter high, low, and reverse limits. Alternatively, run an auto-setup to have the tonnage monitor set the limits for you.

7 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.

7.1 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 3.4.1 on page 21). 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 4.6 on page 28).

<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.

7.2 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.

7.3 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 4.6.4 on page 28). 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 805-5 tonnage monitor would be 222 (200 X 1.11 = 222).

7.4 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.

7.5 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.

8 PARAMETER ENTRY AND ACCESS CONTROL

8.1 Parameter Entry

Throughout the operator terminal, 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.

8.1.1 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 28.

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.

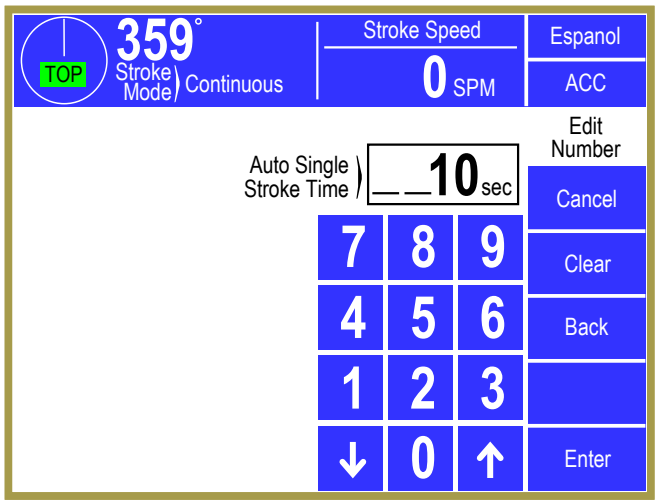


Figure 28: Example Numeric Entry Screen

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.

8.1.2 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 29. 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.

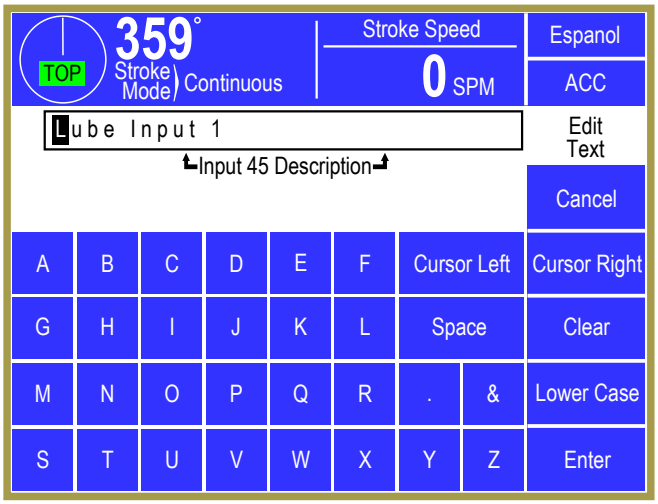


Figure 29: Example Text Entry

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.

8.1.3 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 30.

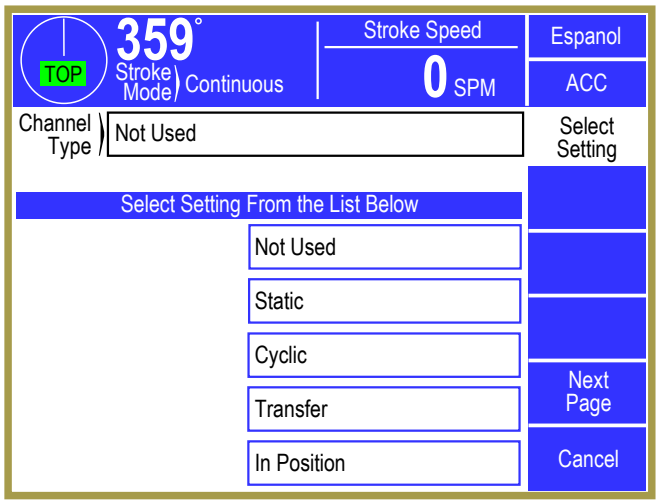


Figure 30: Example List Selection

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

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

8.2 Configuration Code

The configuration code to get into the Device Config screen and tonnage monitor Configure System screen is the same configuration code used in other areas of the operator terminal. The default code is supplied with the system and can be changed by the user.

8.3 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.

8.3.1 Key Only Mode

The "Key Only" mode is the least complex of the four modes. This mode employs the RUN/PROG key as the 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.

8.3.2 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.

8.3.3 Password Only Mode

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

The example listed above indicated that setup personnel required access to all restricted 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.

8.3.4 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.

8.4 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.

8.4.1 RUN/PROG Key Switch Operation

The RUN/PROG key switch is located on the lower right side of the operator terminal. 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.

8.4.2 Password System Operation

Figure 31 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.

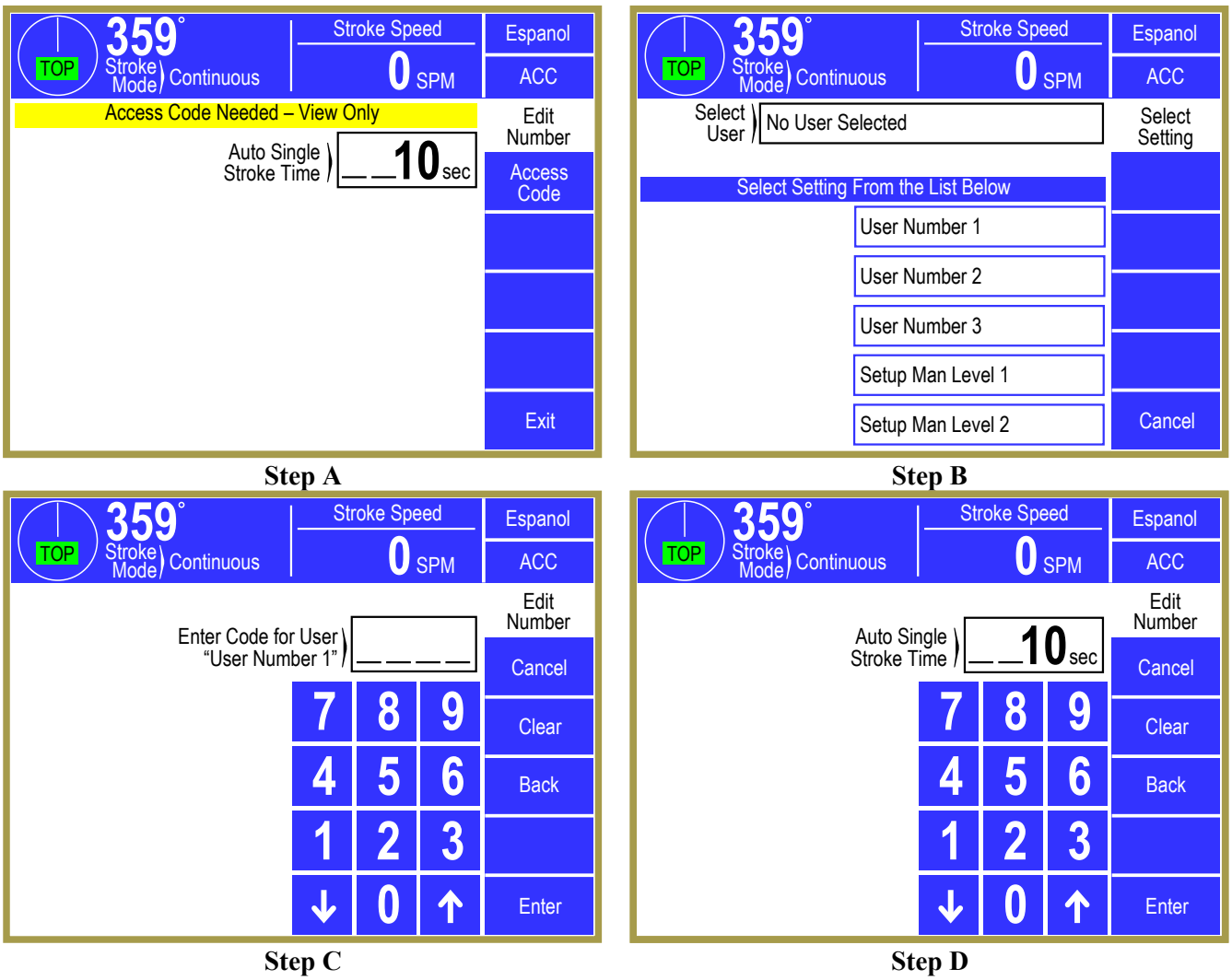


Figure 31: Example Password Entry Sequence

Step A: Select the restricted item. In the example shown in "Step A" of Figure 31 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 31, 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 31. 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.

8.5 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 the operator terminal manual for details on how to set up restrictions.

Tonnage Monitor Restricted Items/Functions	
Name	**Function**
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.

8.6 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.

Tonnage Monitor Unrestricted Items/Functions	
Name	**Function**
TM Reset	Reset tonnage monitor faults.