

Co-Pilot / PW-LS STI Supplemental Manual

Revision: A



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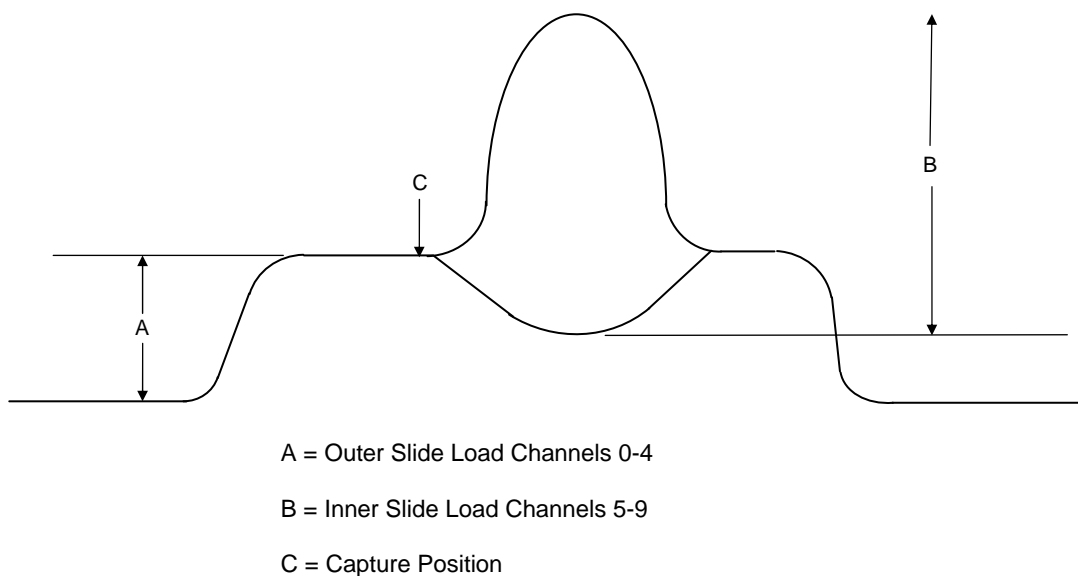
1: STI DESCRIPTION

Getting usable punch load information from a top-drive double action press has always been difficult. Because of the way these presses are designed, the outer slide load drops off as the punch does its work. This is a problem for standard load monitors because they cannot show this outer slide drop off and thus the true inner punch load. The Co-Pilot / PW-LS STI tonnage mode solves this problem by displaying the actual inner slide load and the actual outer slide load.

The STI tonnage mode is specially designed for top-drive double action stamping presses. Most tonnage monitors are used on underdrive presses. On these presses the only place to get usable signals is with sensors on the pull rods. With top-drive double action presses it is often impossible to find space on a moving member where the sensors can be mounted. The STI tonnage mode overcomes this problem by providing useful load information with just four frame-mounted sensors.

STI stands for Slide Tonnage Isolation. The signal on the frame of a top-drive double action press contains load information from both the outer slide (blankholder) and the inner slide (punch). This composite signal is separated electronically to faithfully isolate the inner slide signal from the outer slide signal. The Co-Pilot / PW-LS displays show the load distribution and total of the outer slide (channels 0-4), and the load distribution and total of the inner slide (channels 5-9). This allows you to see the actual inner punch load.

Figure 1.1: Typical Composite Load Signature



2: STI OPERATION

Most of the tonnage-related features of the Co-Pilot / PW-LS such as job storage, benchmark and setpoint learning, and alarms, may still be used while operating in STI tonnage mode.

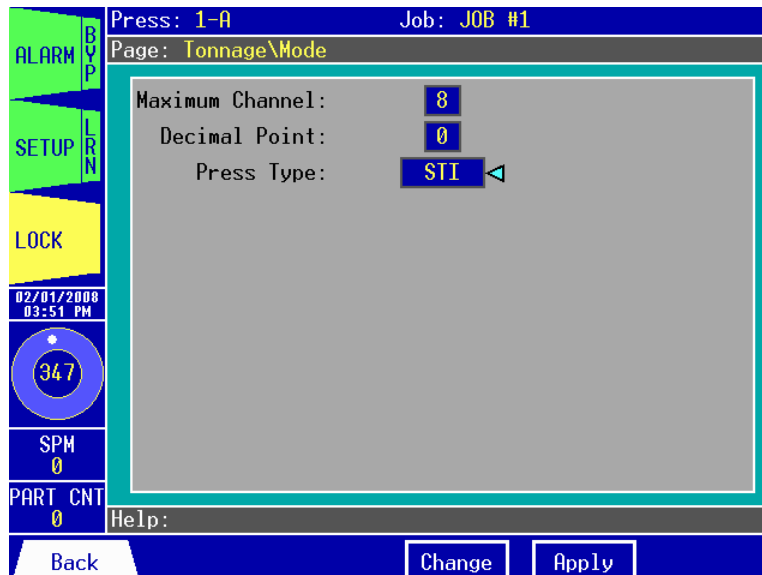
However, you should note the following exceptions:

- STI tonnage mode works best on presses with a maximum speed of 45 strokes per minute.
- Tonnage envelopes are not active for STI tonnage mode. As a result, the *Tonnage\Signature\Setpoint* page is not available and only the CCM alarms are active for signatures. All peak tonnage alarms are still active (Capacity, Hi/Lo Setpoint, and Reverse).

Enabling STI tonnage mode:

STI tonnage mode is selected on the *Tonnage\Mode* page. Simply change the **Press Type** to STI. The **Maximum Channel** will automatically be set to 8.

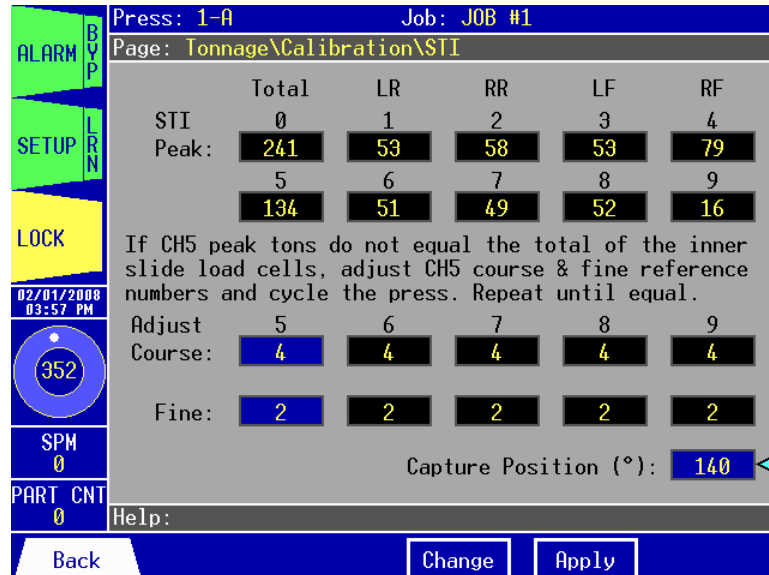
Figure 2.1: The Tonnage\Mode Page



Setting the capture position:

The capture position is the press angle where the blankholder is clamping, before the punch comes in. To set the capture position, navigate to the *Tonnage\Calibration* page and press the F2 (STI) button to enter the *Tonnage\Calibration\STI* page.

Figure 2.2: The Tonnage\Calibration\STI Page



Note: The *Tonnage\Calibration\STI* page will only be available when the press type is set to STI (see “Enabling STI tonnage mode” section).

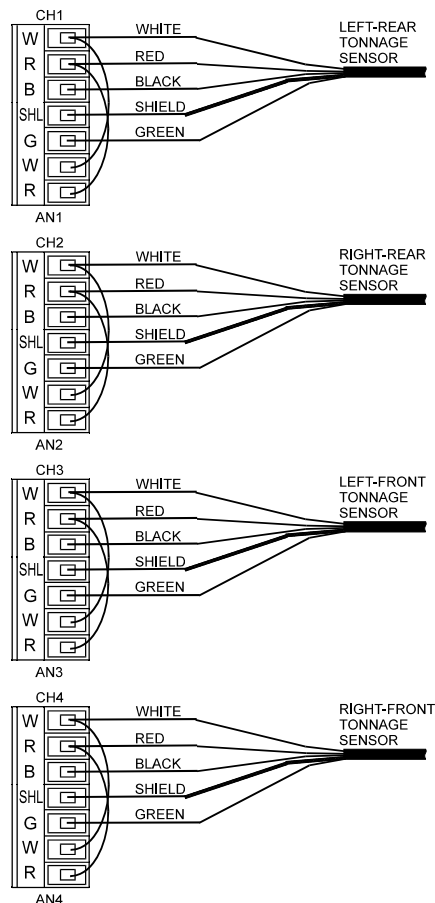
Move the cursor to **Capture Position** and change the angle as needed. 110° to 140° are typical values.

3: STI SENSOR INSTALLATION

Follow the installation instructions in the Co-Pilot / PW-LS Installation Manual to install the tonnage sensors. Then follow the steps below:

- 1) Wire the (4) sensors to the outer slide channels (CH1-4) according to the Installation Manual. The left-rear sensor should go to CH1, the right-rear sensor should go to CH2, the left-front sensor should go to CH3, and the right-front sensor should go to CH4.
- 2) Wire the CH1 red and white signal wires in parallel to the CH6/AN1 red and white terminals on the same plug. Follow the diagram below.
- 3) Repeat step #2 for each of the remaining channels.
- 4) If the unit has not been configured for 8 channels already, navigate to the *Tonnage\Mode* page and change the **Maximum Channel** to 8. The **Press Type** can be set to normal.
- 5) Navigate to the *Tonnage\Calibration* page and use **Auto-Zero** to balance all channels.
- 6) The unit can now be calibrated.

Figure 3.1: Sensor Wiring for STI Installation



4: CALIBRATION

In order to calibrate the Co-Pilot / PW-LS you will need stands, spacers, shims, and eight load cells in order to load both the inner and outer slides at the same time. Use the following steps for proper tonnage calibration:

1) Set Press Capacity

- A. In the HMI, use the unit’s keypad to navigate to the *Tonnage\Peak\Setpoint* page.
- B. Enter the press capacity in the **Total** field, as well as the capacity for each of the four corners (**LR, RR, LF, RF**). Refer to the *Tonnage\Peak\Setpoint* section in chapter 3 of the Operation Manual.
- C. Press *F6 (Toggle Slide)* to view the inner slide capacity and set it equal to the outer slide capacity.

Figure 4.1: Press Capacity Settings

Enter the press and corner capacities here.

| | Total | LR (1) | RR (2) | LF (3) | RF (4) |
|------------|-------|--------|--------|--------|--------|
| Capacity | 800 | 200 | 200 | 200 | 200 |
| Hi Setpt. | 402 | 93 | 98 | 93 | 120 |
| Peak Ton. | 343 | 92 | 96 | 91 | 92 |
| Benchmark | 241 | 53 | 58 | 53 | 79 |
| Lo Setpt. | 81 | 13 | 18 | 13 | 39 |
| High % | 20 | 20 | 20 | 20 | 20 |
| Low % | 20 | 20 | 20 | 20 | 20 |
| Reverse | -20 | -6 | -11 | -8 | -5 |
| Rev Setpt. | -80 | -20 | -20 | -20 | -20 |

2) Balance the Tonnage Sensors

- A. Make sure the press is under no load.
- B. Go to the *Tonnage\Calibration* page.
- C. Move the cursor to **Auto-Zero**.
- D. Press the *F5 (Apply)* key to begin the auto-zero process. Note that the “Auto-Zero” prompt changes to “Wait...” while the channels are being balanced.
- E. The channels are balanced to zero when the prompt returns to “Auto-Zero”.

Figure 4.2: Balance the Tonnage Sensors

When this field is set to “BALANCE” the values to the right represent the balance for each channel.

These are the balance values for each channel.

Select the Auto-Zero field and hit the *F5 (Apply)* key to balance the channels to zero.

The screenshot shows the 'Tonnage\Calibration' page with the following data table:

| Total | LR | RR | LF | RF |
|-------|----|----|----|----|
| 0 | 0 | 0 | 0 | 0 |
| 5 | 6 | 7 | 8 | 9 |
| 1 | -0 | 0 | 0 | 0 |

Below the table, there is an 'Auto-Zero' button and a 'Restore Defaults' button. The screen also displays 'Press: 1-A', 'Job: JOB #1', and 'Page: Tonnage\Calibration'.

3) Find the Shut Height of the Press

- A. Jog the press until the ram is at bottom dead center (BDC) or 180° without any load cells or the die in the press.
- B. Determine the amount of spacers needed with your load cells. Cycle the press without load cells to insure correct height.



4) Calibrate the Outer Slide (Channels 0-4)

For this section, the Press Type should be set to Normal (not STI) on the *Tonnage\Mode* page.

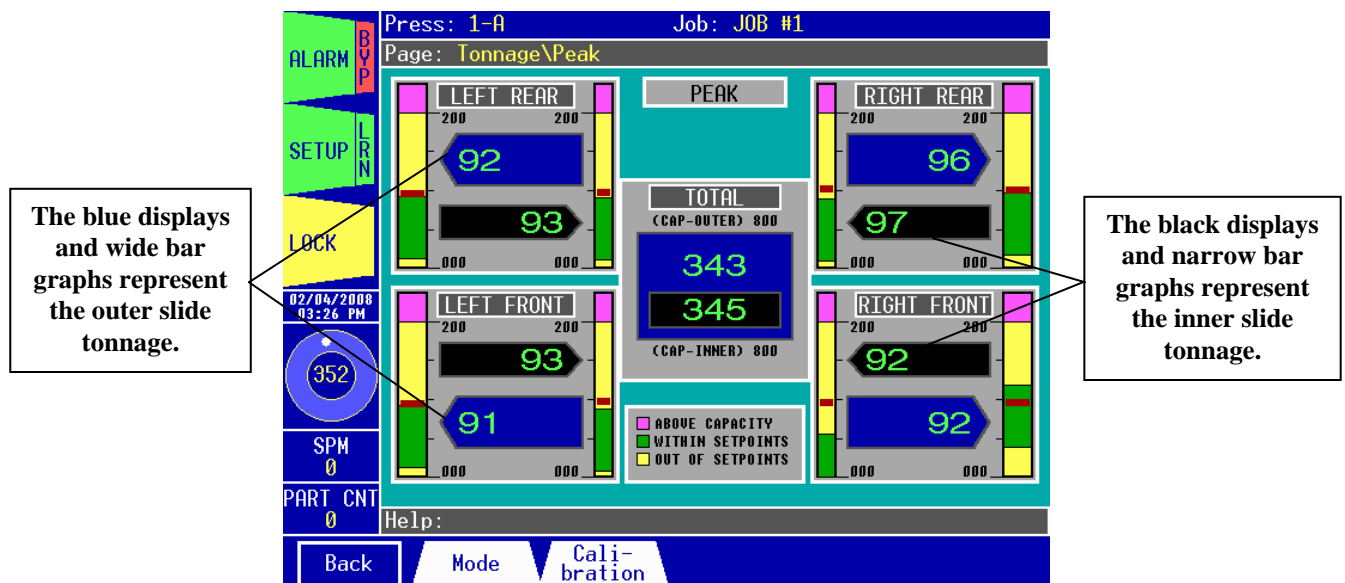
A. Place the Load Cells in the Correct Position in the Press

- i. Place a load cell under each corner of the **outer slide only**.
- ii. All load cells should be equal distance from the sides and front and rear. For example, 12” from side, 10” from front and rear. Load cells are typically placed at each corner of the press’s bed.
- iii. Cycle the press without hitting the load cells first.
- iv. Place cardboard on the top and bottom of the load cells.

B. Cycle the Press

- i. Go to the *Tonnage\Peak* page.

Figure 4.3: The Tonnage\Peak Page



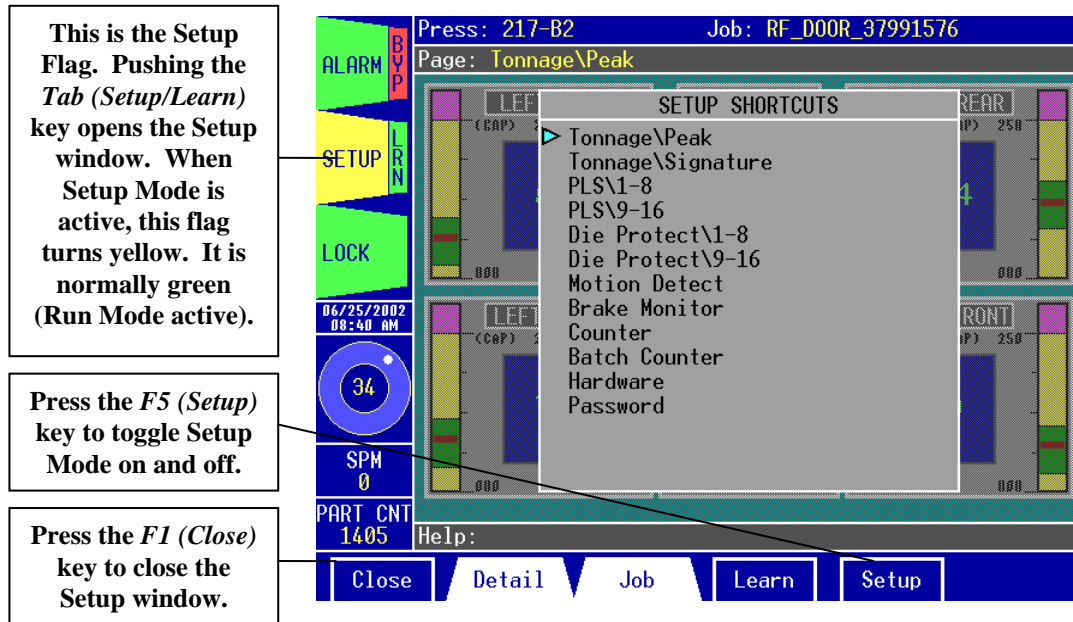
The blue displays and wide bar graphs represent the outer slide tonnage.

The black displays and narrow bar graphs represent the inner slide tonnage.

ii. Put the unit in Setup Mode:

- (1) Press the *Tab* (*Setup/Learn*) key to open the Setup window (see Figure 4.4).
- (2) Press the *F5* (*Setup*) key to enable Setup Mode.
- (3) Press the *F1* (*Close*) key to close the Setup window.

Figure 4.4: The Setup Window



- iii. Cycle the press once. Make sure the ram impacts the load cells. Add the four load cell values to determine the total load on the press.
- iv. Adjust the shut height and cycle the press until the press impacts the load cells (total load) at 100% of press capacity. See warning below.

WARNING

Depending on the press capacity and the size of the load cells being used, loading the press at capacity with load cells could indent the ram or bolster. To prevent this from happening, consider one of the following:

- Calibrate the press only up to 80% of capacity, or
 - Use larger load cells to increase the loading surface. For instance, to calibrate a 400-ton press, use (4) 250-ton load cells instead of (4) 100-ton load cells.
- v. Check the four load cells. Ideally, their load should match. If not, use shims on the load cells as needed until you get an evenly distributed load.

C. Gather, Record, and Enter Data

- i. Record the load cell numbers for each of the outer channels. These are the load values of the press corners.
- ii. Record the outer slide peak tonnage values from the *Tonnage\Peak* page.
- iii. Return to the *Tonnage\Calibration* page and select the **BALANCE** field. Hit *F4* (*Change*), use the up or down arrow keys to toggle the field to **CAL#**, then hit *F5* (*Apply*). This enables the shunt. The top set of values in the black boxes represents the current gain numbers for each channel. Record these numbers for channels 1-4.



Figure 4.5: Displaying and Entering Cal Numbers

The screenshot shows the 'Tonnage\Calibration' screen. At the top, it displays 'Press: 1-A' and 'Job: JOB #1'. The page title is 'Page: Tonnage\Calibration'. The screen is divided into two main sections for calibration data. The top section shows current gain values for channels 0-9. The bottom section shows correction values for channels 0-9. A 'CAL#' field is highlighted with a callout. A 'Set Cal#' button is also highlighted. A callout points to the correction values, stating 'Enter Cal# correction values here.' Another callout points to the 'CAL#' field, stating 'Change this field to CAL# to display the current gain for each channel.' A third callout points to the 'Set Cal#' button, stating 'Select this field and hit the F5 (Apply) key to set the current gain to the correction values.' A fourth callout points to the current gain values, stating 'These are the current gain values for each of the channels.'

| Total | LR | RR | LF | RF |
|-------|-----|-----|-----|-----|
| 0 | 1 | 2 | 3 | 4 |
| 797 | 199 | 200 | 201 | 200 |
| 5 | 6 | 7 | 8 | 9 |
| 799 | 200 | 199 | 201 | 200 |

| 0 | 1 | 2 | 3 | 4 |
|-----|-----|-----|-----|-----|
| 800 | 200 | 200 | 200 | 200 |
| 5 | 6 | 7 | 8 | 9 |
| 800 | 200 | 200 | 200 | 200 |

To change Cal#s, enter correction values below, select [Set Cal#] and press [Apply]. The values in both groups should match. If not, press [Apply] again.

Buttons: Back, Change, Apply, Set Cal#, Restore Defaults.

iv. Use the following formula to determine the new gain number:

$$\text{New Gain Number} = (\text{Load Cell reading} \div \text{Peak Tonnage reading}) \times \text{Current Gain Number}$$

- v. Repeat the calculation for each of the outer slide channels.
- vi. Enter the new gain numbers into the bottom set of blue boxes (channels 1-4). These new gain numbers are the Cal# correction values for each channel.
- vii. Select the **Set Cal#** field and hit the *F5 (Apply)* key to set the current gain for each channel to the Cal# correction values that you entered. The top and bottom sets of numbers should now match.
- viii. Set the **CAL#** field back to **BALANCE** and use **Auto-Zero** to re-adjust the zero balance (if needed).

D. Verify Results and Repeat

- i. Go to the *Tonnage\Peak* page and cycle the press.
- ii. Verify that the load cell values and the tonnage monitor's outer slide peak tonnage values are the same. If not, repeat step C until the values are the same.
- iii. This completes the outer slide calibration.

5) Calibrate the Inner Slide (Channels 5-9)

For this section, the Press Type should be set to Normal (not STI) on the *Tonnage\Mode* page.

A. Place the Load Cells in the Correct Position in the Press

- i. Place a load cell under each corner of the **inner slide only**.
- ii. All load cells should be equal distance from the sides and front and rear. For example, 12” from side, 10” from front and rear.
- iii. Cycle the press without hitting the load cells first.
- iv. Place cardboard on the top and bottom of the load cells.

B. Cycle the Press

- i. Go to the *Tonnage\Peak* page.
- ii. Put the unit in Setup Mode.
- iii. Cycle the press once. Make sure the ram impacts the load cells. Add the four load cell values to determine the total load on the press.
- iv. Adjust the shut height and cycle the press until the press impacts the load cells (total load) at 100% of press capacity. See warning below.

WARNING

Depending on the press capacity and the size of the load cells being used, loading the press at capacity with load cells could indent the ram or bolster. To prevent this from happening, consider one of the following:

- Calibrate the press only up to 80% of capacity, or
 - Use larger load cells to increase the loading surface. For instance, to calibrate a 400-ton press, use (4) 250-ton load cells instead of (4) 100-ton load cells.
- v. Check the four load cells. Ideally, their load should match. If not, use shims on the load cells as needed until you get an evenly distributed load.

C. Gather, Record, and Enter Data

- i. Record the load cell numbers for each of the inner channels. These are the load values of the press corners.
- ii. Record the inner slide peak tonnage values from the *Tonnage\Peak* page.
- iii. Return to the *Tonnage\Calibration* page and select the **BALANCE** field. Hit *F4* (*Change*), use the up or down arrow keys to toggle the field to **CAL#**, then hit *F5* (*Apply*). This enables the shunt. The top set of values in the black boxes represents the current gain numbers for each channel. Record these numbers for channels 6-9.
- iv. Use the following formula to determine the new gain number:

$$\text{New Gain Number} = (\text{Load Cell reading} \div \text{Peak Tonnage reading}) \times \text{Current Gain Number}$$

- v. Repeat the calculation for each of the inner slide channels.



- vi. Enter the new gain numbers into the bottom set of blue boxes (channels 6-9). These new gain numbers are the Cal# correction values for each channel.
- vii. Select the **Set Cal#** field and hit the *F5 (Apply)* key to set the current gain for each channel to the Cal# correction values that you entered. The top and bottom sets of numbers should now match.
- viii. Set the **CAL#** field back to **BALANCE** and use **Auto-Zero** to re-adjust the zero balance (if needed).

D. Verify Results and Repeat

- i. Go to the *Tonnage\Peak* page and cycle the press.
- ii. Verify that the load cell values and the tonnage monitor's inner slide peak tonnage values are the same. If not, repeat step C until the values are the same.
- iii. This completes the inner slide calibration.

6) Calibrate Both Slides Simultaneously

- A. Enable STI tonnage mode by changing the **Press Type** to **STI** on the *Tonnage\Mode* page.
- B. Navigate to the *Tonnage\Calibration\STI* page and enter a value for the **Capture Position**. This is the angle at which the blankholder is clamping, before the punch comes in. A typical value is 110°.
- C. Place all eight load cells on the bolster. Four under the outer slide and four under the inner slide.
- D. Cycle the press once. Make sure the ram impacts all eight load cells. Because the outer gives or dips during impact the inner tonnage may no longer be accurate. Next, you will set STI reference numbers to compensate for this inaccuracy.

About STI Reference Numbers: Each STI reference number consists of a course adjust and a fine adjust number. These adjust numbers range from 0 to 15. If both course and fine adjust numbers are set to zero, the STI reference number is disabled. Although each channel for the inner slide has its own STI reference number, the channel reference numbers are required to always be the same as the total (CH5). Therefore, only the Channel 5 reference number is adjustable.



Figure 4.6: Set STI Reference Numbers

Adjust the STI Reference numbers until the CH5 peak tonnage matches the total inner load cell tonnage.

These are the Course and Fine Adjust numbers.

| | Total | LR | RR | LF | RF |
|-------|-------|----|----|----|----|
| STI | 0 | 1 | 2 | 3 | 4 |
| Peak: | 241 | 53 | 58 | 53 | 79 |
| | 5 | 6 | 7 | 8 | 9 |
| | 134 | 51 | 49 | 52 | 16 |

If CH5 peak tons do not equal the total of the inner slide load cells, adjust CH5 course & fine reference numbers and cycle the press. Repeat until equal.

| Adjust | 5 | 6 | 7 | 8 | 9 |
|---------|---|---|---|---|---|
| Course: | 4 | 4 | 4 | 4 | 4 |
| Fine: | 2 | 2 | 2 | 2 | 2 |

Capture Position (°): 140

- E. From the *Tonnage\Calibration\STI* page, start by setting the CH5 Course and Fine Adjust numbers to 1.
- F. While still on the *Tonnage\Calibration\STI* page, cycle the press and observe the peak tonnage at the top of the page. At first, the tonnage in Channel 5 should be greater than the total load on the inner load cells.
- G. Increase the course adjust number, cycle the press, and observe the Channel 5 tonnage. Repeat this step until the Channel 5 load is less than the inner load cell total.
- H. Once the Channel 5 tonnage is less than the inner load cell total, reduce the course adjust number by 1.
- I. Increase the fine adjust number, cycle the press, and observe the Channel 5 tonnage. Repeat this step until the Channel 5 load is equal to the inner load cell total.
- J. This completes the calibration of both slides.

7) Make Linearity Check

- A. Raise the shut-height in .020 to .030 inch increments to decrease tonnage.
- B. Cycle the press and impact the load cells.
- C. Compare the tonnage applied to the load cells to the tonnage displayed on the *Tonnage\Peak* page. These values should be documented.



- 8) Document calibration details on the Calibration Sheet (Form #1224) provided with the Co-Pilot / PW-LS Manual and file it for future reference. Include the STI reference numbers.**

- 9) Record CAL#s and STI reference numbers on the calibration label located on the door inside the unit.**

- 10) Calibration Complete**

The calibration procedure is now complete. Contact Toledo Integrated Systems' Service Department for assistance if needed. Our Service Department can be reached at 419-867-4170, Monday through Friday, 8:00 AM to 5:00 PM.

