# Chapter 7
# Calibration Mode

## 7.1 Calibration Mode (Initial Stage)

1. The Calibration Mode can be entered in one of two ways:

   A. From the **Weigh** Mode by pressing:

   **(Using a Model 450)**
   **[ZERO] + [SELECT]** simultaneously.

   Then press the following keys separately:

   **[SELECT] [ZERO] [PRINT] [UNITS] [ENTER]**

   Proceed to make the necessary parameter adjustments in P110 through P119, then press **[ZERO]**.

   **(Using a Model 455)**
   **[1 0 0] [SELECT] [2 3 6 4 0] [ID] [ENTER]**

   B. From the **Setup** Mode by pressing **[ZERO].**

2. The indicator will prompt you to calibrate the meter by displaying **ENTER =CAL!** Press **[ENTER]** to proceed. Pressing **[CLR]** will let you exit the Setup Mode without calibration.

> **NOTE:**
> Pressing the **[CLR]** key at any point in the calibration routine will back you up one step.

3. When the calibration mode is entered, the following message is displayed:

   **"New Zero?"**

   This is one of five selections. Press **[SELECT]** or up arrow to scroll through each of the five selections. All five calibration selections are stated below. Press **[ENTER]** *when viewing* the desired selection. If load cell linearization is enabled (P119), the calibration modes accessible are identified by an asterisk (*****). The following calibration modes are defined in the subsequent sections. Each of these modes is an *intermediate* stage to the full calibration of the system. Chose *one* and refer to its respective section number.

> **NOTE:**
> If you key in a cal weight and press **[ENTER]** without adding any weight since the last calibration weight, the indicator will prompt you to **Add CalWT**. Add the weight and press **[ENTER]**.

Section:
- **7.1.1) "New Zero?" ***
- **7.1.2) "Last Zero?"**
- **7.1.3) "Temp Zero?"**
- **7.1.4) "Only Zero?" ***
- **7.1.5) "Cal Reset" ***

**Entering Numeric Values:**

Where appropriate, numeric values may be entered using the up arrow and right arrow keys, **[PRINT]** and **[UNITS]** on a 450.

By convention, pressing the **[PRINT]** key or up arrow will initiate numeric entry. The first character displayed is a decimal point "**.**". Continually pressing the up arrow key will scroll through characters 0 through 9 and "**-**" & "**.**". Once the desired character is displayed, press **[UNITS]** or right arrow to move to the next digit location. In other words, once the entry mode has begun, the up arrow will increment the entry and the right arrow will move right one character.

To decrement the character press both the up arrow and the right arrow simultaneously **[PRINT] + [UNITS]**. There is no key to move left one character. If an error is made in entry, the **[ZERO] "clr"** key will clear the entry.

The 455 has access to a numeric keypad and a dedicated **[CLR]** key.

### 7.1.1 New Zero? (Intermediate Stage)

**New calibration (Establishing the first or a new calibration)**

The indicator will display the dead load (which may not be in precise units) that is present on the scale. The indicator is assuming a "NO LOAD" condition. At this point the indicator requests that you remove any extraneous load. Do so, then press **[ENTER]**. After **[ENTER]** is pressed a new zero is established and this is reflected on the main display along with the following prompt:

**"Adj'g Zero"**

Immediately followed by the following prompt.

**Keyin CalWT**

The indicator is waiting for the actual calibration value to be entered as it prompts "**KeyIn CalWt** ". At this point you can place the calibration weight on the platform, key in the weight value and then press **[ENTER]**.

### 7.1.2 Last Zero? (Intermediate Stage)

**Re-Cal (with cal weight already applied)**

This capability allows a re-calibration to be performed without removing the applied weight, if, during a calibration check, the calibration is found to be out of tolerance. This is especially beneficial when the 450 is used with large capacity applications such as tank weighing.

This operation is achieved by pressing the **[ENTER]** key at the "**Last Zero?**" prompt during the calibration procedure.

The scenario where this feature would be used is as follows:

a) A scale is to be checked for compliance with local weights and measures regulations.

b) The 450 indicator is zeroed with a press of the **[ZERO]** key.

c) The necessary load is applied to verify accuracy.

d) The weight indication is found to be out of tolerance.

e) The calibration mode is accessed, either using the method described above for Quick Cal or

by the normal method. Note that the calibration weight is still applied!

f) At the "Last Zero?" prompt, the **[ENTER]** key is pressed.

g) The instrument briefly displays the message: "Using Last0", followed by the usual: "Units = xx" indicating the proper units for the keying in of the calibration weight. The indicator is using the zero established with the last use of the **[ZERO]** key during the weigh mode as the new calibration zero.

h) Next the display prompts: "Keyin CalWt".

i) The operator keys in the currently applied weight, such as **50000 [ENTER]**. The indicator then adjusts the calibration parameters to bring the system into calibration.

j) Next the display prompts "Cal OK?". The weight may then be removed and if necessary re-applied to assure the inspector that the calibration has properly adjusted.

k) Once the inspector is satisfied with the calibration press the **[ENTER]** key to save the calibration.

l) Next the usual prompt "Save Mods?" followed shortly by "Enter = Save" is displayed. Press **[ENTER]** to save the new calibration factors.

m) The next prompt, "Enter = Exit" is similarly responded to by the **[ENTER]** key and the indicator returns to the weigh mode.

### 7.1.3 Temp Zero? (Intermediate Stage)

**Re-Cal (without establishing new zero)**

In some applications it is desirable to perform a calibration without removing the currently applied load. This is particularly useful in tank weighing applications where it might be a particularly time consuming and costly ordeal to completely drain the tank being weighed.

Pressing the **[ENTER]** key at the "Temp Zero?" prompt during the calibration procedure causes the indicator to temporarily zero the displayed weight so that additional weight may be added to assure the calibration of the indicator. The zero determined during the previous calibration is not affected.

For example, with a tank containing an unknown amount of material:

a) Access the calibration mode, ie:

**[ZERO] + [SELECT]**

Then press:

**[ZERO] [PRINT] [UNITS] [ENTER]**

**Note:** Accessing the calibration mode with a remote keyboard or a 455:

**100 [SELECT]**
**54321 [ID] [ENTER]**

b) Toggle to the “Temp Zero?” routine with the **[SELECT]** key.

c) At the "Temp Zero?" prompt press:

**[ENTER]**

The displayed value is zeroed out.

**NOTE:**
If you key in a cal weight and press **[ENTER]** without adding any weight since the last calibration weight, the indicator will prompt you to **Add CalWT**. Add the weight and press **[ENTER]**.

d) Apply the calibration weight to the tank.

e) Key in the value of the calibration weight:

**1000 [ENTER]**

f) The numeric display should show the entered value.

g) Remove the calibration weight from the tank. The display should return to zero. If the display reads as specified, at the "Cal OK?" prompt press:

**[ENTER]**

Otherwise, to repeat the calibration process, press

**[CLR]**

and then repeat steps (b) through (g).

h) To save the newly determined calibration weight, at the "Enter = Save" prompt, press:

**[ENTER]**

i) Then to return to the weighing modes, at the "ENTER = EXIT" prompt, press:

**[ENTER]**

and the indicator will return to the weigh mode.

### 7.1.4 Only Zero? (Intermediate Stage)

**(Calibration Re-zeroing:)**

If it is desired to only re-establish the calibration zero of the indicator without affecting the established gain, this may be done during the calibration process by pressing the **[ENTER]** key at the "Only Zero?" prompt. After doing so, the display will flash the calibration units message and then "Adj Zero!" for one second. Then the display will advance to the "Cal OK?" prompt.

This may be useful in tank weighing applications where the re-zero parameter **(P118)** is set very low in order to prevent inadvertent re-zeroing. A build-up of sludge

may be zeroed out in this manner.

For example, with the connected scale platform cleared of any extra weight:

a) Access the calibration mode, ie:

**[ZERO] + [SELECT]**

Then press:

**[ZERO] [PRINT] [UNITS] [ENTER]**

**Note:** Accessing the calibration mode with a remote keyboard or a 455:

**100 [SELECT]**
**54321 [ID] [ENTER]**

b) Toggle to the “Only Zero?” routine with the **[SELECT]** key.

c) At the "Only Zero?" prompt press:

**[ENTER]**

The displayed value is zeroed out.

The display will briefly flash: "Adj Zero!" and then: "CAL OK?"

Press **[ENTER]** to accept the newly established zero or **[CLR]** to re-do the calibration. Following the proceeding prompts to exit and save all changes.

The indicator's calibration zero is now set to establish the platform's gross zero at the current input signal from your scale platform.

**NOTE:**
If the keyed in weight exceeds Full Scale by +4% or falls below 0.1% of Full Scale, an error message will be displayed. If you forgot to add the calibration weight before pressing **[ENTER]**, the indicator will prompt you to do so. In this case, place the calibration weight on the scale and press **[ENTER]**.

If an overload exists or the previously set instrument gain is too high, the indicator will display an overload message. In this case, press **[CLR]** and the indicator will reduce the current instrument gain and return you to step 2 in section 7.1 so you can re-start the calibration.

### 7.1.5 Cal Reset (Intermediate Stage)
**(Not in firmware dated before 072095)**

A Cal Reset option is included in the calibration routine. When at the **New Zero?** prompt in the Cal mode, press **[SELECT]** repeatedly until Cal Reset is displayed. The Cal Reset adjusts the zero and gain factors of the amplifier on the A/D. The parameters being adjusted are listed below.

| | |
|---|---|
| P61101 | Cal Factor |
| P61104 | CZero |
| P61106 | CGain |

When reset, these parameters are adjusted to normal values.

Normally a Cal Reset is performed if the amplifier is locked in at extremely high gain factors and will not allow a new calibration to be performed. If an over or under load condition exists while in the Cal mode, press **[CLR]** to perform a Cal Reset. This has the same effect as pressing the **[ENTER]** key at the Cal Reset prompt. After a Cal Reset is performed, the unit goes back to the New Zero? prompt. The **[SELECT]** key will toggle to the desired calibration routine.

After performing a Cal Reset, a re-calibration should be performed before exiting the calibration or setup modes. The reset will not be saved unless a re-calibration is performed and changes are saved.

### 7.1.6 Save Calibration (Final Stage)

During the final stage of the calibration procedure the indicator will perform the necessary internal operations in executing the actual calibration, display the value of the calibration weight and prompt you by displaying **CAL OK?** At this point, the accuracy of the calibration can be checked by weight without leaving the Calibration Mode.

A. If the calibration was accurate, press **[ENTER]**.

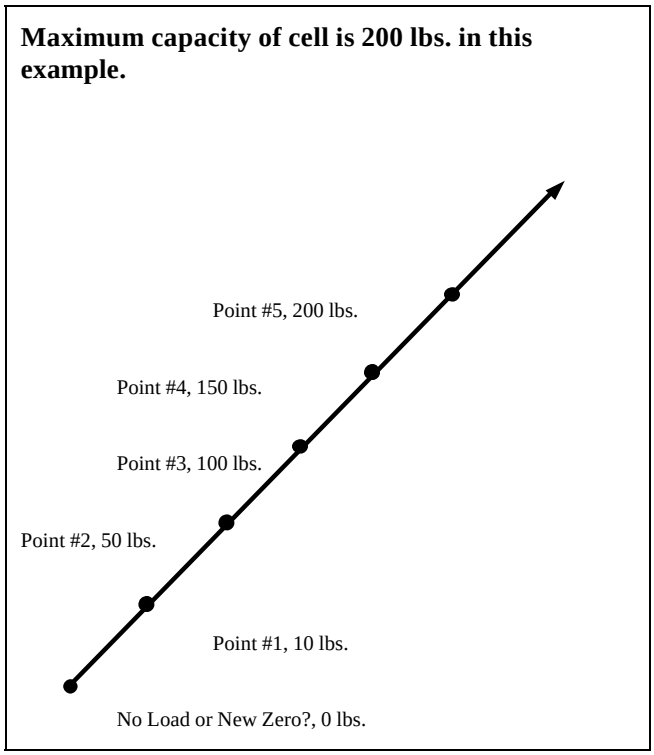


*Figure 7-1 Five Point Linearization Graph*

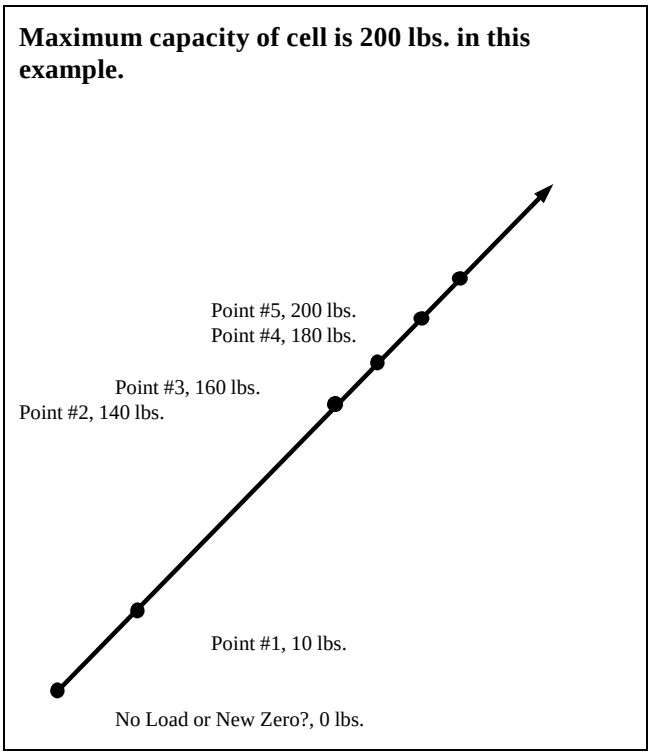


*Figure 7-2 Five Point Linearization Graph (high*

The indicator will prompt you to save the new calibration plus any other changes that were made. Press **[ENTER]** to save and then **[ENTER]** to exit.

B. If the calibration is not accurate, press **[CLR]**. The indicator will return to the **NO LOAD?** prompt. Proceed as described in step 3 of section 7.1.

**NOTE:**
If the calibration weight was less than 5% of capacity or if there was a large change in the calibration, the indicator will prompt you with the message **ReCal Req'd**. Press **[ENTER]**and you will be returned to step 2 of section 7.1, or press **[CLR]** to obtain the **CAL OK?** prompt as described in this section (7.1.6) and override the re-calibration requirement. However, we recommend you perform a re-calibration in order to avoid any serious inaccuracy.

## 7.2 Multi-Point Linearization

If the load cell signal input to the indicator has good repeatability and stability, then using multi-point linearization during calibration may significantly improve the ultimate accuracy of the data displayed by the indicator. Setup Mode parameter **P119** enables or disables this feature. Initially, the same basic procedures as a normal calibration are used to perform a multi-point linearization. All of the prompts provided will be exactly the same as a standard calibration for each cal point up to the **CAL OK?** prompt. (Section 7.1 thru 7.1.6)

At this point, the indicator will prompt you with **Keyin Pnt 2** which will instruct you to key in the second calibration point. Simply add the weight which you want to use for the next calibration point, then key in the total applied weight and press **[ENTER]**. You may wish to add weight until the displayed weight differs from the actual applied weight and then perform the next calibration at that point.

Up to five calibration points may be established using this procedure. However if fewer calibration points are

required, simply press **[ENTER]** without entering a value at the **KeyinPntX** prompt. Refer to figure 7-1 for a 5 point calibration example graph. The values demonstrated here are keyed in at each successive calibration point as a calibrated weight is been applied onto the platform (load cell).

If items are consistantly being weighed on either the high or low end of the cell capacity, the points of calibration can be skewed to either end of the spectrum. Multi-point linearization can compensate for a cell that is non-linear. Refer to figure 7-2.

After the last point is established, the indicator will prompt with **CAL OK?**. Press the **[ENTER]** key to accept the calibration or press **[CLR]** to backup and redo the last point as described below.

If you make a mistake at any point in the linearization process, simply press the **[CLR]** key. The indicator will backup one step in the procedure to the previous linearization point.

After the linearization has been completed, the changes must be saved by pressing **[ENTER]** at the **ENTER = SAVE** prompt. Otherwise the previous calibration data will remain in effect.

### 7.2.1 Examining Calibration Results

Information Mode parameters **P61130** through **P61139** may be used to review the data established during the multi-point linearization. For each point, you may review the calibration weight and the established linearization factor.

### 7.2.2 Linearization Data

If Multi-Point Linearization is enabled (P119), the ten Parameters **P61130** thru **P61139** show the calibration weights used and the resulting calculated factors. Otherwise the message **Not Used** is displayed. Refer to Chapter 4 for functional details on Parameters **P119** and **P61130** thru **P61139**.

### 7.2.3 Memory Storage Requirements

When you enable Multi-Point Linearization, the indicator reserves 41 bytes of storage space. If less than 5 calibration points are used, then the unused storage memory (8 bytes per unused point) is made available for other features after the calibration is performed.

## 7.3 Quick Calibration

**Quick Cal Introduction**

In order to round out the 450's capabilities, a few variations to the calibration process have been made available. For the **standard** calibration operation, the **[ZERO]** key is pressed to exit the parameter setup mode to enter the calibration mode. An alternate method has been devised for quick access to the calibration routines.

To enter the **Quick Cal** mode from the weigh modes, press the following keys:

**(with a 450)**
**[ZERO] + [SELECT]** simultaneously then press:

**[ZERO] [PRINT] [UNITS] [ENTER]**.

**(with a 455)**
**[100] [SELECT] [54321] [ID] [ENTER]**

The display will briefly read: "Quick Cal!" and then the following selections will appear, starting with "**New Zero?**".

Section: **7.1.1) "New Zero?" ***
**7.1.2) "Last Zero?"**
**7.1.3) "Temp Zero?"**
**7.1.4) "Only Zero?" ***
**7.1.5) “Cal Reset” ***

The **[SELECT]** key will toggle through the available selections. Press **[ENTER]** when viewing the desired selection. Refer to the first part of this chapter for a detailed explanation of each selection.

Another variation of the calibration process is the linearization procedure. Linearization can be quite useful in improving the absolute accuracy of larger capacity systems which often exhibit poor linearity. This feature is documented elsewhere.

### 7.3.1 Other Quick Cal methods

In order to provide a somewhat faster method of accessing the calibration mode of the 450 indicator, an alternate method is available. From the weigh modes, the following data stream should be received through the COMM port:

**100%s54321%i%e**

The display will briefly read: "Quick Cal!" and then the following selections will appear, starting with "**New Zero?**".

Section: **7.1.1) "New Zero?" ***
**7.1.2) "Last Zero?"**
**7.1.3) "Temp Zero?"**
**7.1.4) "Only Zero?" ***
**7.1.5) "Cal Reset" ***

Refer to the first part of this chapter for a detailed explanation of each selection.

## 7.4 Quick Calibration Personal Access Code

**P401— QCAL**

The Model 450 indicator offers the ability to personalize the access code for entering the **Quick Calibration** mode. The factory default method for entering the **Quick Cal** mode is listed below.

**(with a 450)**
**[ZERO]** + **[SELECT]** simultaneously then press:

**IMPORTANT NOTE:**

Once the new code is entered and all changes are saved when exiting back out to the weigh mode, this code is the new Quick Cal access code. The GSE factory access code for the Quick Cal mode will no longer be valid at this point. Non-authorized parties will not be allowed to enter the Quick Cal mode without the new code. Make sure this code is not lost. Note that this code can be changed easily unless the instrument access code is changed at P400.

**[ZERO] [PRINT] [UNITS] [ENTER]**.

**(with a 455)**
**[100] [SELECT] [54321] [ID] [ENTER]**

The display will briefly read: "**Quick Cal!**" and then the following selections will appear, starting with "**New Zero?**".

a) "**New Zero?**"
b) "**Last Zero?**"
c) "**Temp Zero?**"
d) "**Only Zero?**"

Parameter **P401** allows a **new code** to be entered for gaining access to the **Quick Cal** mode. The **ARROW** keys allow for entering in the new code. This code can be alpha-numeric and up to 5 characters in length.

Pressing the **UP ARROW** key will scroll through the numeric values. The **RIGHT ARROW** key will move to the next digit. The **[ENTER]** key will enter your keyed in digits as the new Quick Cal access code.

If an alpha-numeric code is necessary, press the **RIGHT ARROW** key before any other keys. This will put the indicator in the alpha-numeric entry mode. The letter **"A"** will appear at the start of each character entry. The **UP ARROW** key will scroll through the ASCII character set. The **RIGHT ARROW** key will move to the next character. The **[ENTER]** key will enter your keyed in characters as the new Quick Cal access code.

Exiting the unit while saving all changes will validate the new Quick Cal code.

To enter the Quick Cal mode after a new code is entered, press the following keys.

**(with a 450)**
**[ZERO]** + **[SELECT]** simultaneously then press:

**[Personalized Code]** use ARROW keys. Then press **[ENTER]**.

**(with a 455)**
The **[UNITS]** and **[TARGET]** keys double as **Up** and **Down** arrow keys respectively. While having accessed any mode or parameter which requires a character entry, the **[UNITS]** key will scroll through a set of ASCII characters. The **[TARGET]** key will scroll through the

set in reverse. The **[TARE]** key or Right Arrow when pressed will move over to the next character position. The **[ID]** key or Left Arrow will backup to the previous character.

**(with a 455)**
**[100] [SELECT] [Personalized Code]**. Then press **[ENTER]**.

### 7.4.1 Clearing New Quick CAL Access Codes

The Quick Cal access code only allows access to the Quick Cal mode. It does not lock out access to the setup mode or the standard calibration mode. Refer to Parameter P400 for locking out these modes (Chapter 23 Personal Identification Number). This means that parameter P401 can be accessed and changed by non-authorized parties if parameter P400 is not personalized.

If for any reason the Quick Cal access code is to be changed, press the following key combination at parameter P401.

**(with a 450)**
**[ZERO] + [TARE]** simultaneously

**(with a 455)**
**[CLR]**

then press the **[ENTER]** key and the GSE factory default code will be reinstated.

## 7.5 Dual Range

P320 and P321 have been added to provide a dual range function. The upper limit of the low range is set at P320. To disable the dual range feature, enter an upper limit of zero (0) at P320. The division size of the low range is set at P321.

As an example of a dual range application, a 300,000 pound capacity railroad scale might use 20 pound graduations up to 200,000, then switch to 50 pound graduations to full capacity. This can be accomplished with the following setup:

P110 F.S.= 300.K
P111 1 div 50.
P320 Rng 1 200.K
P321 Div 1 20.