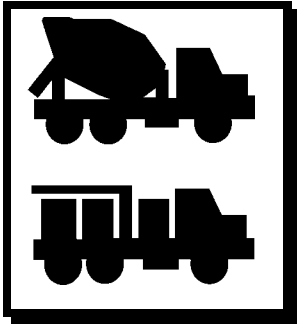




# Appendix C

## Scale Readout Manual



### Appendix C: Scale Readout Manual

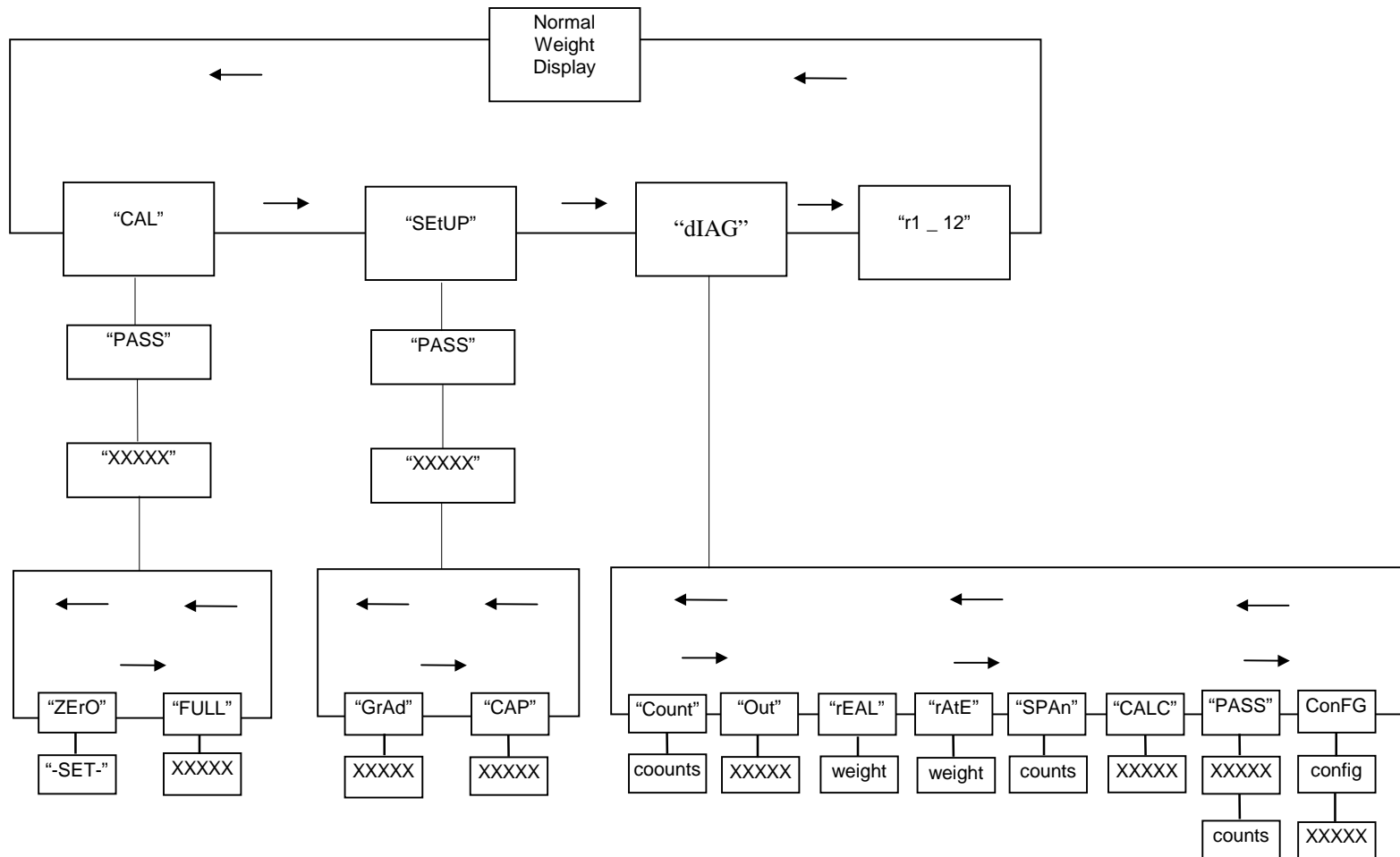
The Scale Readout Unit is a digital weight indicator that may be used for 1 to 3 scales. The interface to each scale may be load cells or scale pots (dial potentiometers). A 5 digit LED display is provided for each scale. Along with each display is a set of 3 pushbuttons that provide all of the control functions for the display.

The unit also provides an analog output voltage for each scale. These signals may be used by a batching computer to control the scale weighing operation.

Some of the features include password protection of all calibration data, motion detection, overload indication (weight exceeding 105% of capacity), digital filtering for stable readings, and output simulation for ease of calibrating external controllers.

This manual includes information describing the normal operation as well as all steps required to setup and calibrate the unit. Included is a Menu Map diagram that may be used as a guide to access the available functions.

Readout Menu Map



Note: 1. This is the Weight Added to the scale for calibration.  
 2. Enter the Old password here.  
 3. Enter the New password here.

## Menu Prompts

(see Readout Menu Map)

- 'CAL' Calibration Modes
  - 'PASS' Password protection from unauthorized calibrations
  - 'ZEro' Zero Calibration Mode
  - 'SEt' Used for setting the zero calibration point
  - 'FULL' Full Scale Calibration Mode
- 'SEtUP' Setup Scale Parameters
  - 'PASS' Password protection from unauthorized modifications
  - 'GrAd' Scale Graduations
  - 'CAP' Scale Capacity
- 'dIAG' Diagnostic Modes
  - 'Count' View the raw converter counts
  - 'Out' Simulated Output Mode (for calibrating external equipment)
  - 'rEAL' View the real weight (instead of normal tared weight)
  - 'rAtE' View the rate of change of weight (motion)
  - 'SPAN' View the number of counts available over the span of the scale.
  - 'CALC' Calculates the number of counts when adding weight for setting the gain.
  - 'PASS' To change the password
  - 'ConFG' View the Configuration DIP switch settings
- 'r1.12' Revision number (r1.12 = Revision 1.12)
- xxxxx Numeric Entry Required !

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## Pushbuttons

- Normal Weight Display Mode
  - ZERO used to re-zero the scale weight (limited to a range of -2% to +5% from the zero calibration set point).
  - SELECT used to enter the calibration modes.
  - ASTERISK used to view the actual weight (weight calculated from zero calibration set point) for approximately 1 to 2 seconds.
  
- Numeric Entry Mode
  - ZERO used as an escape key to exit without changing any data.
  - SELECT used to select digit to edit.
  - ASTERISK used to enter changed data.
  - To CHANGE Number:
    - Press the SELECT button to select which digit to change. As a digit becomes editable, it begins blinking.
    - To increment the digit, press the ASTERISK button. This will increment the digit from 0 to 9, then back to 0 if pressed repeatedly.
    - When final number is displayed, press the SELECT button until no digits are blinking.
  - To ENTER Number:
    - To enter the new number, press the ASTERISK button (with no digits blinking).
  - To EXIT (without saving changes):
    - Press the ZERO button to Escape back to the normal weight display mode.

- Other Modes

- ZERO used as an escape key to exit any function without changing any data.
- SELECT used to select between various functions.
- ASTERISK used as an enter key to enter a lower level in the menu structure.

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## Normal Weight Display Mode

The normal weight display mode has the basic function of displaying the weight on the scale. This weight is displayed in graduations (grads) of typically 0.1% of scale capacity (i.e. - 10 lbs for a 10,000 lb scale). The displayed weight is also adjusted for any tared weight. Additional information available in this mode:

1. The decimal point at the right side of the displayed number serves as an annunciator of motion detection. If motion detection is enabled (see Configuration Switch Settings), the LED will be on when motion is sensed.
2. If the ASTERISK button is pressed, the 'real' weight is displayed (that is, the weight calculated from the calibrated zero set point). The real weight is displayed for 1 to 2 seconds. During this time, all 5 of the decimal points will be illuminated.
3. If the range of the scale has been exceeded (105% of scale capacity), the prompt will indicate the overload condition 'oLOAD' (flashing display).

If above the upper limit of the display, the indication will be 'EEEE'. If below the lower limit of the display, the indication will be '-EEEE'. In either case, the display will be flashing.



Initial Hardware Setup

1. Make sure the wiring of each scale cable is correct. Refer to the enclosed cable drawings for the proper wiring (for load cell or scale pot connections).
2. Open the rear door of the enclosure for access to the printed circuit board as shown in Figure 2.
3. Each of the 3 scale channels uses a slide switch to select the use of either load cells (LC) or scale pots (SP). Move this switch to the proper setting (up for load cells or down for scale pots). Refer to Figure 2.
4. For each channel there is a rotary switch with a knob on top labelled 0 - 9. This is provided to adjust the gain of the circuit.

Knob Setting	Gain	Use
0	1	For Scale Pots
1 - 7	100 - 700	For Load Cells
8, 9	N/U	Not used

For load cells, the knob should be initially set to position 1. On the side of the rotary switch housing there is a mark that points to the number setting on the knob. Refer to Figure 2 below. Additional gain adjustment is provided by jumpers W1, W2, W3, one for each of the respective scales. When the jumper is installed, the gain is reduced by 1/3 (one-third). This allows for more precise gain adjustment when using load cells.

5. Connect the scale cables to the respective channel inputs and turn on power.

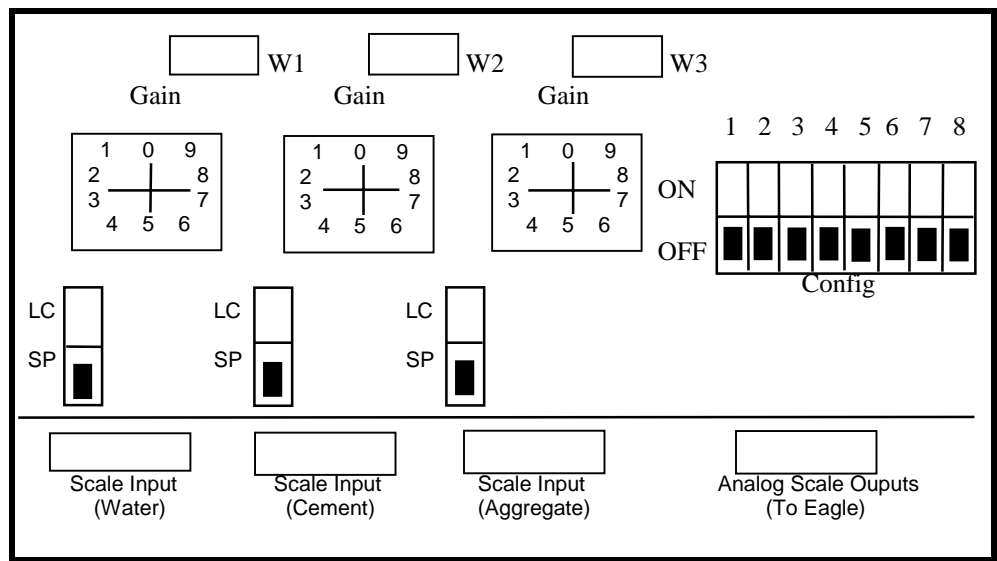


Figure 2- Calibration Controls (as viewed from rear of display unit). Shown set up for scale pots with Gain pointing to zero (0).

## Initial Calibration Setup

1. Refer to the Readout Menu Map diagram when stepping through the menu.
2. Press the SELECT button to enter the menu structure. The first prompt is 'CAL' which allows entering the calibration area.
3. To get a feel for the menus at this time, press the SELECT button a few times and see the prompts rotate between the possible settings.
4. Press the SELECT button until the prompt 'SEtUP' is displayed. This allows changing the setup parameters. Enter this menu by pressing the ASTERISK button. The prompt should now read 'GrAd'.

**Note:** If the display prompt reads 'PASS', then a password needs to be entered at this point. See "Password" section.

5. When 'GrAd' is displayed, press the ASTERISK button to enter the mode to change the graduation size. The present value is now displayed.
6. To change this value, press the SELECT button to select one digit at a time to be changed. The editable digit is blinking. As the digit is blinking, press the ASTERISK button to increment the digit from 0 to 9, then back to 0.

When all digits are correct, press the ASTERISK button to enter the value (when no digits are blinking).

**Note:** The display will then return to the normal weight display mode.

**Note:** Whenever stepping through the menus or changing values, if the ZERO button is pressed, the display will return to the normal weight display mode, and no changes will be made!

7. Repeat the process of pressing the SELECT button and stepping into the 'SEtUP' menu. Next, press the ASTERISK button. The display should now read 'GrAd'. Then press the SELECT button and the display should read 'CAP'. Next, press the ASTERISK button to enter the mode to change the value of scale CAPacity. As with the graduations, the present value is now displayed. Change the value by pressing the SELECT button and save it as described in step 6 (which set the graduation size).

Now that the initial setup is complete, we need to adjust the gain if using load cells.

## Gain Adjustment

(performed at installation time)

1. The initial knob setting for load cell gain should be 1 to prevent overdriving the amplifier. The jumpers W1, W2, and W3 should not be installed initially. If using scale pots, set the gain knob to 0, install the jumpers (W1,W2,W3) and skip these gain adjustment steps.

**Note:** Before proceeding to set the gain, a zero calibration must be done. See "Zero Calibration" section.

2. Referring to the Scale Readout Menu Map diagram, step to the 'dIAG' menu by pressing the SELECT button. Enter this menu by pressing the ASTERISK button. This menu allows you to view raw converter counts ('Count'), to simulate a scale weight output to the batching computer ('Out'), to view real weight ('rEAL') as compared to the normal weight which has been adjusted for Tare weight, the rate of change of the weight ('rAtE'), the counts over the scale span ('SPAn'), a function to calculate counts for setting the gain ('CALC'), or a password modification function ('PASS').
3. Enter the 'Count' display by pressing the ASTERISK button to view the raw counts. These counts have a range of 0 to 65535. The initial counts displayed with the load cell connected and at zero weight should be between 200 and 30000. If not, the load cell cable is incorrectly wired.
4. Now it is time to set the gain. This is done by adding a precise weight to the scale and reading the number of counts. The amount of precision weight depends on what is available (typically 500 to 2000 lbs). Use as much weight as possible (without exceeding the scale capacity). This weight will also be used for full scale calibration. The maximum number of counts for optimum performance may be calculated using the 'CALC' function. After entering the 'dIAG' menu, press the SELECT button until the prompt 'CALC' is displayed. Then press the ASTERISK button to enter the function. Now a number is displayed which should be changed to show the amount of precision weight to be added to the scale. This is done by pressing the SELECT button to select one digit at a time to be changed. The editable digit is blinking. As the digit is blinking, press the ASTERISK button to increment the digit to the correct value. When the value is correct (and no digits are blinking), press the ASTERISK button to enter this value. The display then shows the number of counts. Write this number down for use in the next step. Press any button to return to normal weight display mode.
5. Now add the precision weight and view the raw counts again (follow steps 2 and 3 above). If the counts exceed the calculated value, then the gain is set too high. You should set the gain so that the counts are as close as possible but less than this number. If the gain knob is set to '1', and the gain is still too high, install a jumper block on the respective jumper W1, W2, or W3.

**Note:** Every time the gain is changed, a zero calibration must be performed and the calculation must be repeated to arrive at a new count number. This is because the number of counts at zero weight will have changed. (Of course this means unloading and reloading the weight, but there is no other way!)

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## Zero Calibration

1. Remove all weight from the scale before performing this calibration.
2. Referring to the Scale Readout Menu Map diagram, step to the 'CAL' menu by pressing the SELECT button. Enter this menu by pressing the ASTERISK button.

<p><b>Note:</b> If the display prompt reads 'PASS', then a password needs to be entered at this point. See "Password" section.</p>
--

3. Now the prompt should read 'ZEro'. Press the ASTERISK button to enter the zero calibration mode. Now the prompt reads '-SEt-'. Be sure the scale is empty then press the ASTERISK button. Now the zero calibration is automatically performed, the data is saved, and the display returns to the normal weight display mode.

---

## Full Scale Calibration

1. This function is called full scale calibration, but since we can only hang a small percentage of the full scale weight (precision weights typically range from 500 to 2000 lbs), this is the most accurate point for calibration. Use as much weight as possible (without exceeding the scale capacity). Load the scale now with the precision weight.
2. Referring to the Scale Readout Menu Map diagram, step to the 'CAL' menu by pressing the SELECT button. Enter this menu by pressing the ASTERISK button.

<p><b>Note:</b> If the display prompt reads 'PASS', then a password needs to be entered. See "Password" section.</p>
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3. Press the SELECT button again until the prompt reads 'FULL'. Press the ASTERISK button to enter the full scale calibration mode. Now the last entered value of full scale calibration weight is displayed. Change this value to the amount added to the scale. This is done by pressing the SELECT button to select one digit at a time to be changed. The editable digit is blinking. As the digit is blinking, press the ASTERISK button to increment the digit to the correct value.

When the value is correct (and no digits are blinking), press the ASTERISK button to enter this value. Now the calculations are automatically performed, the data is saved, and the display returns to the normal weight display mode.

4. Check the calibration (and linearity of the scale system) by sequentially removing the precision weight, adding approximately that amount of material to the scale, then add the precision weight again. The graduation size can be changed at any time without affecting the calibration, so you may wish to reduce this number when checking the accuracy of the scale.

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## Simulated Outputs

1. The readout supplies an analog output signal to a batching control system for each of the 3 scales. The simulated mode is used to calibrate the batching control to the output signals by simulating any value of weight from zero to full scale capacity. This allows the batching control to be calibrated any time after the readout has been calibrated to the scale.
2. Referring to the Scale Readout Menu Map diagram, step to the 'DIAG' menu by pressing the SELECT button. Enter this menu by pressing the ASTERISK button.
3. Press the SELECT button until the prompt reads 'Out'. Press the ASTERISK button to enter the output simulation mode. Now the last entered value of simulated weight is displayed. Change this value to the desired simulated weight. This is done by pressing the SELECT button to select one digit at a time to be changed. The editable digit is blinking. As the digit is blinking, press the ASTERISK button to increment the digit to the correct value.

When the value is set as desired (and no digits are blinking), press the ASTERISK button to send this value out the analog output port. This simulates the value that will be sent out when the scale is reading this same weight. If an amount greater than the scale capacity is entered, the display reads 'HiErr' for one second and then returns to the normal weight display mode.

To return to the normal weight display mode, press any button.

<p><b>Note:</b> Be sure to exit the Simulate Output mode before using the scale.</p>
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## Error Messages

The following error messages may be encountered during calibration of the readout board. The messages are only displayed when data is entered from the front panel pushbuttons.

- 'LoErr'  
A Low Error indicates that with the present gain and calibration adjustment the scale cannot register 5 graduations below zero. (Either gain is too low, or the cable is wired incorrectly)
- 'HiErr'  
A High Error indicates that with the present gain and calibration adjustment the scale cannot register 105% of full scale capacity. (Gain is too high)
- 'GAin'  
A Gain Error indicates that with the present gain setting, the number of counts over the scale range is less than 32000. This will not give optimum performance. (Gain is too low). The actual number of counts over the span can be read by using the Span function in the Diagnostic menu.
- 'rAtE'  
A Rate Error indicates that there is too much motion on the scale (rate of change of the weight) to perform an accurate calibration. Motion detection is enabled by selecting the proper DIP switch settings. The actual motion may be viewed by entering the Rate function in the Diagnostic menu.
- 'Error'  
An 'Error' error can be caused by the following:
  - If the counts when Zero Calibrating are less than 600.
  - If the counts when Zero Calibrating are greater than the counts when the scale is at 75% of max capacity (according to previous calibration).
  - If the counts when Full Scale calibrating are less than 200 counts above the Zero calibrate point.

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## Passwords

When entering the 'CAL' menu or the 'SEtUP' menu, a password entry is required (unless passwords have been bypassed or locked out).

- **Entry**

If a password entry is required, the display reads 'PASS'. At this point press the ASTERISK key to enter this mode. Now the display should read '0'.

To enter a password, change this value to correct password number. This is done by pressing the SELECT button to select one digit at a time to be changed. The editable digit is blinking. As the digit blinks, press the ASTERISK button to increment the digit to the correct value.

When the value is correct (and no digits are blinking), press the ASTERISK button to enter this value. If the number entered is not correct, the display will return to the normal weight display mode. If correct, the prompt will then display either 'ZErO' or 'GrAd'. At this point any of the calibration functions or setup functions may be performed, respectively.

- **Bypass**

This password entry steps are bypassed if the password is set to zero. Also, after the correct password has been entered once, subsequent calibrations do not require the password to be entered again (until power is turned off).

- **Lock-Out**

The entire calibration menu is not available if an optional lock-out switch is turned on (or if CONFIG switch position 8 is ON. See Scale Lock Out). If locked out, password modifications are disabled also.

- **Modify**

To modify the password, step to the 'DIAG' menu by pressing the SELECT button (refer to the Scale Readout Menu Map). Enter this menu by pressing the ASTERISK button. Press the SELECT button until the prompt shows 'PASS', then press the ASTERISK button to enter the modify function.

First, a random number is displayed. Change this number to the old password (if unknown, call the factory for a temporary password). This is done by pressing the SELECT button to select one digit at a time to be changed. The editable digit is blinking. As the digit blinks, press the ASTERISK button to increment the digit to the correct value.

When the value is correct (and no digits are blinking), press the ASTERISK button to enter this value. After entering this password, the old password is displayed again and should be changed to the new password.

<p><b>Note:</b> Cycle power when done to establish the password protection.</p>
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## Configuration Switch Settings

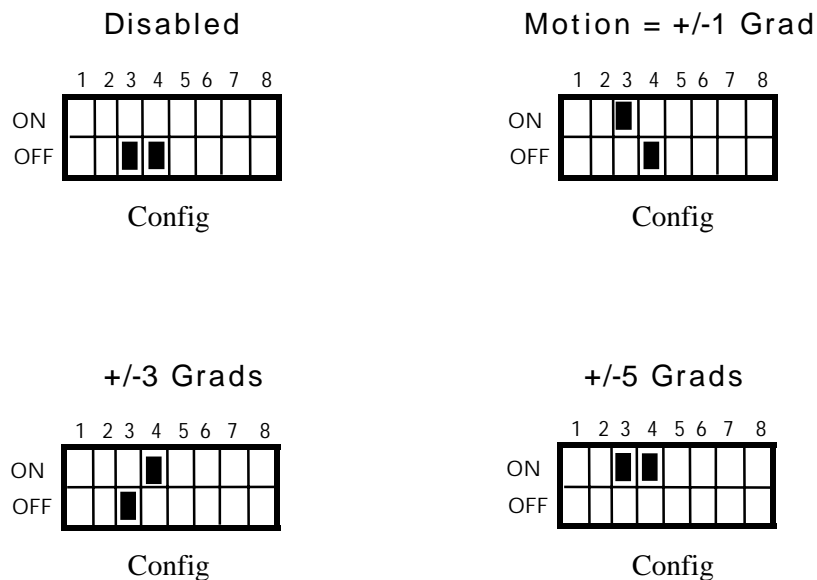
The CONFIG DIP switch as shown in Figure 2 controls various functions. There is an entry in the diagnostic area that allows the user to view the switch settings from the front panel display. This is needed when the back cover plate is sealed or otherwise inaccessible.

To view the settings from the display, enter the 'dIAG' menu (refer to the Scale Readout Menu Map diagram). Press the SELECT button until the prompt reads 'ConFG'. Then press the ASTERISK key to display the configuration. There is a series of 8 lights and each represent a corresponding DIP switch position (1 to 8, left to right). Each light can be up or down, just as the DIP switch appears when viewed from the rear of the unit (UP = ON, DOWN = OFF).

If a switch setting is changed, the new function is activated when power is cycled.

The functions presently available are listed as follows :

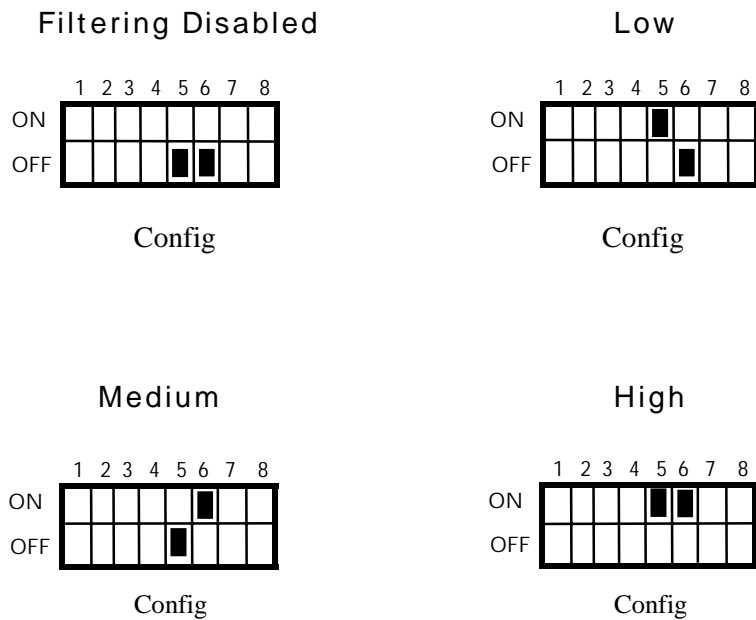
- Motion Detection



When motion is detected, the decimal point on the far right side of the display will be ON. This gives a constant indication of when motion is present. The amount of motion may be viewed as a rate of change in units (i.e. - pounds). This is found in the diagnostic menu as 'rAtE' (see Scale Readout Menu Map). When this mode is entered, the rate of change (+/-) is displayed until one of the 3 keys is pressed.

Scale calibrations are affected by motion detection. If motion is detected when attempting a zero calibration, or upon entering the full scale calibration mode, or when pressing the tare button, the action will not be performed. The error message 'rAtE' will be displayed.

- Digital Filtering



Digital filtering is active in the readout if the appropriate DIP switches are set. The figure above illustrates the switch settings necessary to get varying amounts of filtering. Use care when setting for medium to high filtering because it greatly increases the response time of the scale .

- Scale Lock Out



This feature is used to lock out the user from making unauthorized calibration changes. It also prevents the user from changing the scale capacity (which in turn changes calibrations).

### Scale Calibration Sealing Method

Disabling the DIP switch shown above allows the unit to be calibrated. There is a metal plate that must be removed to access the DIP switches. The plate is attached with 2 screws that have holes through them. A lead wire seal can be used to restrict access to these switches (refer to the diagram on the following page).

To assist you in managing your security we have included this password form. Remove it and copy freely and store the filled in table in a secure location.

Day	Month	Year	Password category	Person(s) issued to:	5 digits num. password
___	___	___	Setup and Calibration		___ _ _ _ _



