WESTERN SCALE CO. LIMITED

OPERATION MANUAL

MODEL DF2000

DIGITAL WEIGHT INDICATOR

Revision A-3

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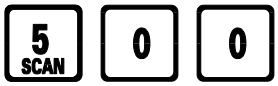
About This Manual

This manual has been revised to reflect improvements made to the DF2000 Digital Indicator. This revised edition is applicable only to indicators with a serial number greater than ‘2500'.

Throughout this manual some standards are used to show you what to enter on the indicator keypad. When you are to enter a value on the number keypad, the numbers will be surrounded by [ ]. If you are to press a key, the name of the key will be surrounded by [ ].

e.g. When instructed to enter [500], press 

e.g. When instructed to press [zero], press 

SECTION 1 - INSTALLATION AND WIRING

Physical Installation

The DF2000 indicator can be located wherever convenient. It is not advisable to locate the indicator where it would be exposed to direct sunlight, excessive mechanical abuse or moisture.

Power Requirements

If you are using your own power supply, please note that the indicator requires a 12 VDC input. It will operate satisfactorily over an input range from 11 VDC to 17 VDC. Although the indicator has built-in voltage regulation, it is most desirable that the input voltage be stable over the stated input range. Ensure that a fuse is installed and is of the correct size - AGC1 (1 amp fast blowing). No other fuse should be used.

Wiring Of Power

Connect 12 VDC power to terminal board as shown below.

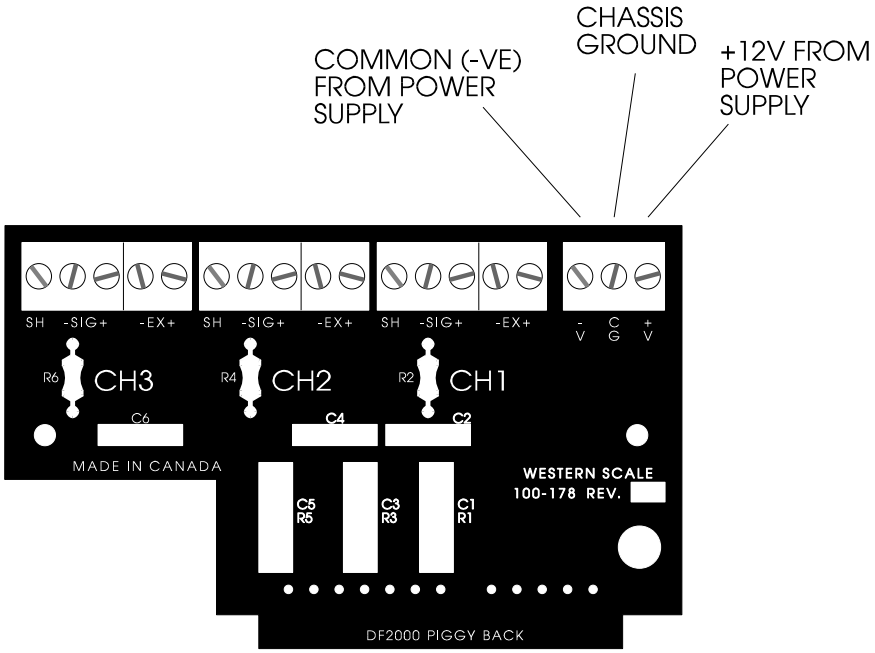


FIGURE 1 - 12VDC POWER CONNECTION

Wiring of Load Cells

Connect load cells to the DF2000 Piggy Back board as shown below.

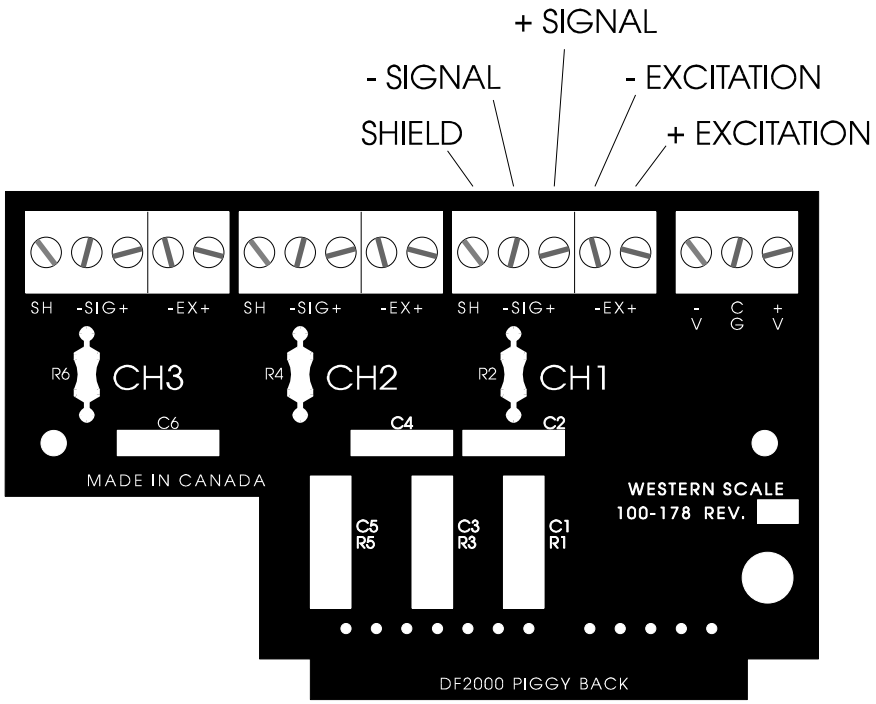


FIGURE 2 - LOAD CELL CONNECTIONS

Check the Load Cell Wiring Guide for the colour code of your load cells.

Note: If you are using only one scale or load cell, it must be connected to Channel 1 (Channel 2 and 3 must be disabled). Additional scales may be connected to either Channel 2 or 3.

Note: Ensure that the Shield wire is not left bare when attaching it to the terminal. Insulate the Shield wire with shrink tubing or tape to prevent the possibility of it shorting to the circuit board.

Load Cell Wiring Guide					
	Excitation (+)	**Excitation (-)**	**Signal (+)**	**Signal (-)**	**Shield**
Revere	Green	Black	White	Red	Orange
BLH	Green	Black	White	Red	Yellow
HBM	Green	Black	White	Red	Bare
Tedea	Green	Black	Red	White	Bare
Transducers	Red	Black	Green	White	Orange
Interface	Red	Black	Green	White	Bare
Genisco	Red	Black	Green	White	Bare
LeBow	Red	Black	Green	White	Bare
Ametek	Red	Black	Green	White	Bare
Sensortronics	Red	Black	Green	White	Bare
Celesco	Red	Black	Green	White	Bare
Strainsert	Red	Black	Green	White	Bare
Pesage Promotion	Blue	White	Red	Black	Yellow

USE THIS HANDY GUIDE TO HELP CROSS REFERENCE THE WIRING OF THE LOAD CELLS LISTED.

Wiring of Output Connector

The output connector for Printer/Data Comm or Setpoint is at the back of the indicator as shown below.

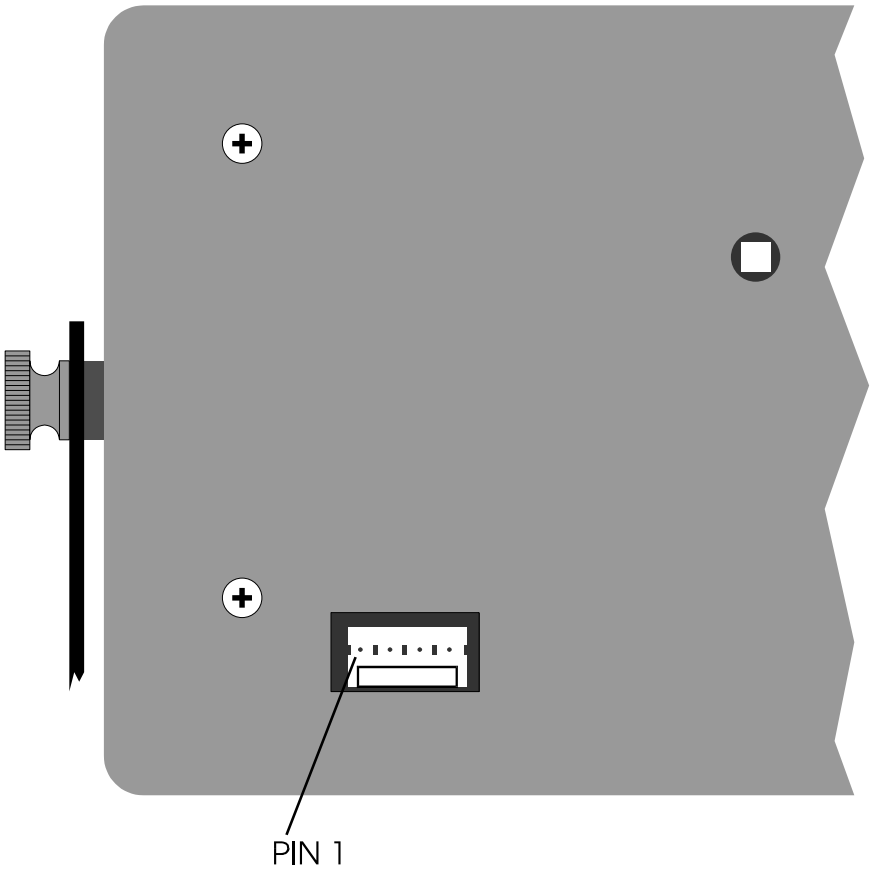


FIGURE 3 - OUTPUT CONNECTOR

OUTPUT CONNECTOR - PRINTER/DATA COMM MODE

1	2	3	4
GND	RX	TX	+5V
Data Ground	Receive Data (Data In)	Transmit Data (Data Out)	+5VDC

OUTPUT CONNECTOR - SETPOINT MODE

1	2	3	4
GND		SP	+5V
Ground		Setpoint Output	+5VDC

Using terminals SP and GND will result in the output signal being normally HIGH (+5V) and going LOW (0V) when setpoint weight is reached. This output will source 2mA, suitable only for driving an electronic circuit.

Using terminals SP and +5V will result in the output signal being normally LOW (0V) and going HIGH (+5V) when setpoint weight is reached. This output will sink 20mA, suitable for driving a solid state relay (CRYDOM TD120 or equivalent). See Section 1 for a description on how to operate the setpoint feature.

An optional setpoint board (100-174) may be plugged into the output connector to provide four isolated setpoints.

SECTION 2 - GETTING STARTED

Introduction

The DF2000 Digital Indicator is an easy to use, fully featured digital weight indicator. This manual will lead you through all of the steps required to set up and operate the indicator.

The DF2000 features three channels and has a maximum displayed resolution of 5,000 graduations per channel. Each channel is calibrated and setup separately and can be calibrated for different graduation sizes and different capacities from other channels. The indicator can also be operated in the Total mode, totalize all active channels, if the graduation sizes of the channels are the same.

The indicator features a full set of error messages to assist you in troubleshooting problems during operation and calibration. These messages are detailed in Section 5.

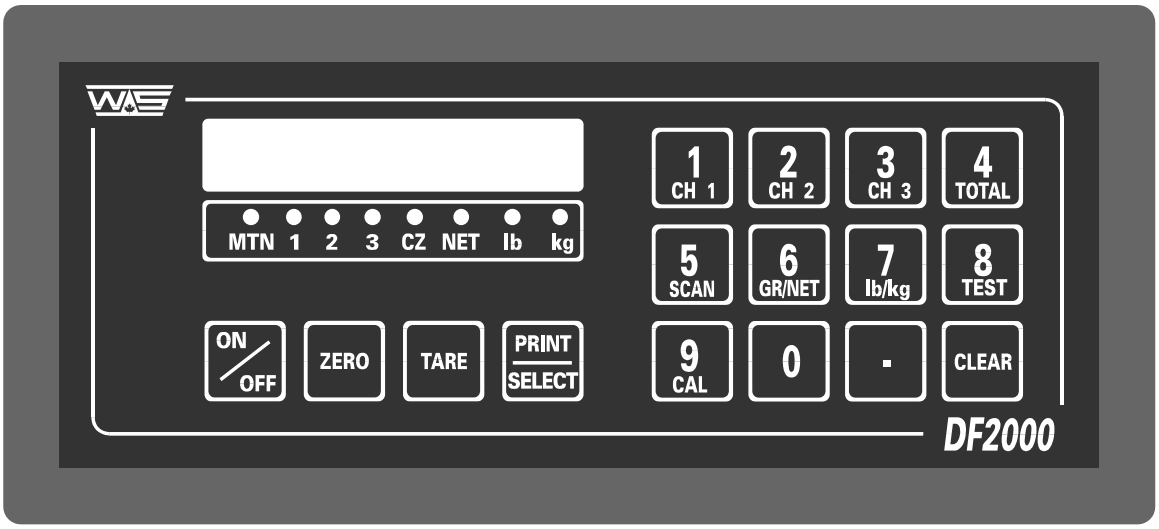


FIGURE 4 - DF2000 KEYPAD

Operation

The DF2000 has many functions, all of which are selected via the front panel keypad. The keypad is illustrated on the opposite page.

To begin, turn the indicator on:

Press 

Once you have done this, the unit will display the pattern 'dF2000'. This is the normal startup display. After a few seconds the display will show 'rrrrrr' (see note). This is a normal condition. To clear the display:

Press 

Note: If you are unable to zero indicator, or 'EEEEEE' or 'uuuuuu' is displayed, please see Section 6.

Note: Each scale channel is independent and you must zero each channel when you select it.

The Keyboard

Pressing once will turn the indicator On.
Pressing again will turn the indicator Off.

.

This key is used for zeroing the indicator. Note each channel must be zeroed independently.

This is a two function key. It can be used for taring whatever is applied to the scale platform.

e.g. Place tare weight on scale and press [TARE].

This key can also be used for inputting a known tare value.

e.g. If 500 lbs. of tare is required, when used in 'Net' mode (special function 6), pressing [500] [TARE] will subtract 500 lbs. from the gross weight. Note indicator lamp.

This key will clear a tare value that has been previously entered (see TARE key operation).

Is described throughout the manual. When used in sequence with other keys, this key selects special functions as well as entering Calibration functions and Parameters.

When used by itself, this key operates a one item totalizer. Each time the SELECT key is pressed, the displayed weight (gross or net) will be accumulated in the totalizer. The display will flash 'Add' and return to the displayed weight. See special functions 10 and 11 for displaying and clearing the accumulated total. Note that the totalizer accumulates any displayed weight. Do not switch between ‘lbs’ and ‘kg’ while totalizing, otherwise, the total will be incorrect.

If an optional printer is connected, operation of the SELECT key will cause the displayed weight to be printed. (See also special function 10).

Special Keypad Functions

All of the special keypad functions are selected using a two step procedure. The special functions are shown on the number keypad. Please note that there are many functions which are not listed on the keypad. These will be explained further on.

To select a special function, press key sequence shown. All of the special functions are described below.

Selects the display to show Channel 1.

Selects the display to show Channel 2.

Selects the display to show Channel 3.

4 TOTAL PRINT SELECT — Selects the display to show the sum of any channels which are in use. The indicator lamps will show which channels are being summed.

5 SCAN PRINT SELECT — Selects the display to cycle between the individual channels. Each channel will be displayed for three seconds. To stop the scanning, select a single channel.

e.g. Press 1 CH 1 PRINT SELECT

When Parameter 70 has a grading value in it, this function is used to toggle the grade display on and off.

6 GR/NET PRINT SELECT — Selects between the gross weight (actual scale weight) and net weight (gross weight minus entered tare value). The 'NET' indicator lamp will be on when the net weight is being displayed.

7 lb/kg PRINT SELECT — This key alternates between weight being displayed in pounds or kilograms. Each press of the key toggles the display. The 'lb' or 'kg' indicator lamps will show which units the display is in.

8 TEST PRINT SELECT — The Test mode allows the verification of the indicator display. Each time Test is selected, the display will momentarily show '888888' and all the status indicator lamps will be on.

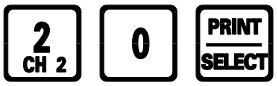
9 CAL PRINT SELECT — Selects the Calibration mode. Operation of this mode is described in detail in Section 3.

Special Functions Not Listed on Keypad

1 CH 1 0 PRINT SELECT — Displays the accumulated total when the indicator is used in the accumulating mode (see SELECT key). This function also causes the accumulated total to be printed on any optional recording device.

1 CH 1 1 CH 1 PRINT SELECT — Clears the accumulated total (see SELECT key).

1 CH 1 3 CH 3 PRINT SELECT — Displays the current stored tare value (see TARE key).



This function is used for setting a setpoint value. The setpoint is a signal sent from the output port of the indicator to open or close a gate or to turn on or off some external device.

To store a setpoint value, press [20] [SELECT] then enter the desired setpoint value and press [SELECT] again.

e.g. To set a setpoint at 1000:

Press [20] [SELECT], press [1000] [SELECT].

To check the setpoint value that you have entered, press [20][SELECT] again.

Note: When checking the values for these setpoints make sure you press CLEAR after each value is displayed, otherwise, the next selection will be interpreted as the value entry for the previously selected setpoint.

Note: This setpoint operates on the displayed weight, regardless of the scale channel selected.

Channel 1 Setpoint.

Channel 2 Setpoint.

Channel 3 Setpoint.

These three setpoints are only available with the optional 100-174 Setpoint Board. These setpoints are independent and are operative regardless of which weight channel is being displayed. Setpoint values are stored in a similar manner to that described above.

SECTION 3 - CALIBRATION

How to Enter the Calibration Mode

The Calibration Mode is accessed as follows:

To calibrate Channel 1, press 

To calibrate Channel 2, press 

To calibrate Channel 3, press 

The display will now flash 'PrESS', asking you to press the push button accessed through the small hole at the back of the indicator.

You must press this button within 30 seconds of selecting Calibration Mode. If the button is not depressed in time, the indicator will return to the previous display and you must repeat the above procedure.

When the Calibration Mode has been enabled, a flashing 'C' will appear in the far left display digit.

Note: **In Calibration Mode, key functions change as follows:**

becomes ‘WEIGHTS/COUNTS’ to select between display of scale weight or internal counts. A flashing 'A' in the leftmost digit indicates internal counts displayed.

becomes ‘ENTER’ to allow entry of any change in parameters and calibration values.

Setup Parameters

In order to calibrate the indicator, certain parameters must be set up first before weights are applied on the scale. Setup parameters in the order they appear. The reason for this is, if the deadload is set or the span is calibrated and one of the indicated parameters is changed afterwards, the span or the deadload might change as well.

To check the value of a parameter, press the number for that parameter followed by the SELECT key. For example:

To check 'Graduation Size' (Parameter 3): Press 

To check 'Push to Zero Window' (Parameter 21): Press 

When you have accessed a parameter via the above procedure, the indicator will then display the current value for that parameter. If you wish to change the value, check the Parameter List (Section 4) for valid entries and enter a new value by pressing the appropriate number(s) followed by the TARE key.

Reload Factory Values.

A set of factory values for all parameters is available to make the indicator easier to use initially. After you have selected this function, press [1] [TARE] and the factory values will be loaded. **Note that this will clear any previous calibration**.

Decimal Point Position.

Set the decimal point position to correspond with the graduation size. Please note that if 'kg' graduation size is approximately half of 'lb' graduation size and therefore may require and additional decimal position.

e.g. For a .05 kg graduation size, press [2] [TARE].
For a 1 kg graduation size, press [0] [TARE].

Graduation Size.

Set the graduation size from the Parameter List, (Section 4), making sure that the graduation size is appropriate for the displayed units (lb/kg). (To change the displayed units, select Parameter 7).

e.g. For .05 kg grad size, press [.05] [TARE].
For 10 kg grad size, press [10] [TARE].

Overweight.

Set to one graduation over the maximum capacity of the scale. This number must be less than 5,000 displayed graduations.

e.g. For 2 kg grad size and a maximum capacity of 5,000 kg, press [5002] [TARE].

Motion Window.

Set to two times the graduation size. Note this value is automatically set when you set the graduation size.

e.g. For .05 kg grad size, press [.1] [TARE].
For 10 kg grad size, press [20] [TARE].

Power On Units.

Set to the units (lb/kg) that you wish the unit to be in whenever it is powered up.

e.g. To power up in ‘kg’ mode, press [1] [TARE].
To power up in ‘lb’ mode, press [0] [TARE].

U.S.A. Display Flag.

Set this parameter to '0' for Canada and to '1' for U.S.A.

e.g. To make the indicator ‘Legal for Trade’ in the United States, press [1] [TARE].

Power On Reset Warning.

This parameter should be set to '1' for a ‘Legal for Trade’ scale.

Push to Zero Window.

Set this parameter to '2' for a ‘Legal for Trade’ scale. This value represents the percentage of scale capacity that can be zeroed by the Zero key.

Auto Zero On-Off.

If you wish to turn off the automatic zero tracking function, press [0] [TARE]. To restore auto zero, press [1] [TARE].

Auto Zero Window.

Set this parameter to '60' for a ‘Legal for Trade’ scale. This value represents a percentage of one graduation, the maximum amount of weight change per 1/4 second that will be automatically zeroed.

Motion Settle Time.

Enter the number of ¼ second intervals for which motion will remain asserted after the scale stabilizes to within the Motion Window (Parameter 5). Factory set to 16 (4 seconds).

e.g. To set to 2 seconds, press [8] [TARE].

Calibration with Weights

Note: You must set the following Parameters before initially adjusting the deadload or span.

Set Load Cell Full Scale Output.

This parameter represents the output of the load cell, in millivolts, at maximum scale capacity. This entry acts as a coarse span or span range adjustment for the indicator, matching it with the working range of the load cell. This value must be set accurately to achieve the rated performance from the indicator.

You may use one of two methods for determining the value of this parameter - the formula or the trial and error method:

Formula:

The formula for determining the output of the load cell is as follows:

$$\frac{Amount\ of\ Load\ Cell\ Used}{Load\ Cell\ Capacity}\ x\ Rated\ Millivolt\ Output\ of\ Load\ Cell\ at\ Capacity\ x\ 9$$

Example:

Using a 1,000 lb. load cell of 3 mV/V range and estimating you are using 40% of the cell capacity, you would obtain the formula:

$$\frac{400\ lbs}{1{,}000\ lbs.}\ x\ 3\ x\ 9\ =\ 10.8$$

Round this off to the nearest integer number, 11, and enter this value, press [11] [ENTER].

Note: Only integer numbers from 8 to 35 may be entered. for this value.

Trial and Error Method

In this method you will try various values for this parameter and see what the resultant scale readings are.

1. Press the ON/OFF key to enter Counts Mode. The flashing 'C' in the leftmost display digit will be replaced by a flashing 'A' and a number should appear. The indicator is now in the Counts mode. Make sure the scale is clear of weight and note the value of this number. This number represents the internal raw counts. If a number does not appear and the display shows 'uuuuuu', check Troubleshooting (Section 6).

   Example:

   Scale clear of weight - internal raw counts are 3431.

2. Apply a known weight on the scale that represents a fraction of scale capacity and note the change in the reading.

   Example:

   Scale capacity is 5,000 lbs.
   Apply 1,000 lbs. (1/5 of capacity) -
   Internal Raw Counts are 11223.

   Change in reading is 11223 - 3431 = 7782.

   The indicator has 60,000 internal raw counts available and, for maximum performance, you want the internal raw counts to be between 50,000 and 60,000 at scale capacity. Therefore, at 1/5th capacity (above example), the change in the internal raw counts should be between 10,000 and 12,000 counts.

   Checking the current value for Parameter 11:
   [11] [SELECT] → displayed value = '14'

   You must change this value until the above procedure gives you a change in internal raw counts of between 10,000 and 12,000 counts.

   In this example you must decrease the value of Parameter 11.

Note:

Decrease Parameter 11 to increase the change in counts.

Increase Parameter 11 to decrease the change in counts.

Example:

Press [11] [SELECT] → displayed value = '14'
Change to '12', press [12] [TARE].

Repeat the test:	Press [ON/OFF] for Counts mode.
Scale clear of weight:	internal raw counts are 4587.
Place 1/5th capacity on scale:	internal raw counts are 13690.

Change in reading is 13690 - 4587 = 9103.

Try to improve this by entering a lower value for Parameter 11.

Example:

Press [11] [SELECT] - displayed value = '12'.
Change to '10', press [10] [TARE].

Repeat the test:	Press [ON/OFF] for Counts mode.
Scale clear of weight:	internal raw counts are 6300.
Place 1/5th capacity on scale:	internal raw counts are 17046.

Change in reading is 17046 - 6300 = 10746 counts, which is an acceptable reading.

Thus, in this example, the correct value for Parameter 11 [Load Cell Full Scale Output) is 10 mV.

Note in the above example the calculated raw counts at capacity would be:

10,746 x 5 = 53,730 counts - which falls between the limits of 50,000 and 60,000.

Press [ON/OFF] to return to Calibration mode.

If the counts are less than 50,000, the displayed weight readings tend to be more unstable. If the counts exceed 60,000, the indicator will over range at capacity. Make sure your calculated counts will fall between these limits. With some load cells, you will be unable to reach even 50,000 counts. As close as possible is adequate with the exception of exceeding 60,000 counts.

Remember:

1) Display must be in 'Counts' mode (flashing 'A' in leftmost digit).
2) Decrease Parameter 11 to increase change in counts.
3) Increase Parameter 11 to decrease change in counts.
4) Parameter 11 can have an integer value from 8 to 35.
5) Remove weight from scale after you change Parameter 11 and take a new initial counts reading before re-applying weights.

Set Deadload

The indicator features an automatic compensation for the scale deadload. When you have selected this function, press [1] [TARE], the indicator will enter a routine to automatically zero the deadload. While this routine is in progress, a flashing 'd' will replace the flashing ‘C’ in the leftmost digit. Upon completion of the routine, the flashing ‘C’ will return and the weight display will be at or near zero.

Setting the Span

To set the span, follow these steps:

1. Make sure you have set Parameter 11 (load cell full scale output) to the correct value.
2. Make sure you have set the deadload.
3. Zero the indicator.

   Press [ZERO].

4. Place a known weight on the scale. Displayed weight may be too high, too low, or display ‘EEEEEE’.

   e.g. Place 1,000 kg on scale → scale reads '990' kg.

5. Select the span set function.

   Press [13] [SELECT] → display flashes '1' and returns to '990'.

6. Enter correct weight, if incorrect.

   Press [1000] [TARE] → display flashes '990' and then reads '1000'

7. Remove weight and check zero.
8. Re-apply weight and repeat procedures 5 through 7, if necessary.
9. The scale indicator is now calibrated.

This completes the basic Calibration procedures.

To exit the Calibration mode - press [99] [SELECT].

Note: If you are also using Channels 2 and 3, calibrate them with the same procedures.

SECTION 4 - PARAMETERS

Note: In order to change the parameters of the indicator, you must be in the Calibration mode (flashing 'C' in the far left digit) - See Section 3.

Parameter No. Description - (Default)

1. Reload Factory Values.

   Calibrates the scale with commonly used values. When you have selected this function, press [1] [TARE].

   Note: This will clear any previous calibration.

2. Decimal Point Position. (0)

   0, 1, 2, 3 or 4. Set the decimal position to correspond with the gradutation size. Please note that if 'kg' graduation size is approximately half of 'lb' graduation size and therefore may require and additional decimal position.

   e.g. Set to 1 for .5 kg grads, set to 0 for 10 kg grads.

3. Graduation Size. (2 lb/1 kg)

   Select one from this table:

   lb .0002 / .0005 / .0010 / .002 / .005 / .010 / .02 / .05 .10 / .2 / .5 / 1 / 2 / 5 / 10 / 20 / 50 / 100 / 200

   kg .0001 / .0002 / .0005 / .001 / .002 / .005 / .01 / .02 .05 / .1 / .2 / .5 / 1 / 2 / 5 / 10 / 20 / 50 / 100

4. Overweight. (15002 lb/6805 kg)

   Must be less than 5,000 displayed graduations and greater than 1 graduation.

5. Motion Window. (4 lb/2 kg)

   Enter a weight to determine motion sensitivity. A typical value is 2 times the graduation size. Note the motion window is set automatically when the grad size (Parameter 3) is changed.

6. Power On Units. (0)

Determines which units are selected when indicator is turned on.

1 selects ‘kg’; 0 selects ‘lb’.

7. Change Displayed Units. (lb)

Allows you to calibrate in pounds or kilograms. Each time this parameter is selected, the displayed units will toggle.

8. U.S.A. Display Flag. (0)

The U.S.A. display flag can be set to '0' or '1'. The flag must be set to ‘1' for the indicator to be ’Legal for Trade’ in the U.S.A. Setting the flag to '0' gives the standard display. Setting the flag to '1' causes the following display changes:

a) Dead Zeros

The active digit will always be displayed at zero.

e.g. For a grad size of 10, the zero display will be 00'.

b) Dead Zeros behind decimal points

For grad sizes under 1.0 lb/.5 kg, the extra dead zero shown in the ‘lb’ mode will be blanked. This is only effective for decimal positions greater than '0'.

9. Power On Reset Warning. (1)

The Power On Reset Flag allows designation of the power push to zero mode. If this flag is set to '0', the indicator will start with its push to zero register cleared and the weight display active. If this flag is set to '1', then the weight display will show 'rrrrrr' on power up until an initial push to zero occurs. To be legal for trade, this flag must be set to '1'.

11. Load Cell Full Scale Output. (14 mV)

This parameter represents the output of the load cell, in millivolts, at maximum scale capacity. The range of entries allowed is from 8 mV to 35 mV. This entry acts as a coarse span or span range adjustment for the indicator, matching it with the working range of the load cell.

Note: **In order to achieve the rated performance from the indicator, this parameter must be set accurately. Please refer to Calibration (Section 3) for information on how to determine the value of this parameter for your scale.**

12. Set Deadload.

The DF2000 features an automatic compensation for the scale deadload. When you have selected this function, press [1] [TARE]. The indicator will then enter a routine to zero the deadload. While this routine is in progress, a flashing 'd' will replace the flashing 'C' in the far left display digit. Upon completion of the deadload routine, the flashing 'C' will return and the weight display will be at or near zero.

Note: **The automatic deadload routine will not work if the deadload is greater than the value entered for Load Cell Full Scale Output (Parameter 11).**

13. Set Span.

This function is used to set the fine span for this indicator. Please refer to Calibration (Section 3) for information on how to set the span.

14. Reset Deadload.

Returns the indicator to the factory deadload setting. When you have selected this function, press [1] [TARE] to perform this operation.

15. Reset Span Table.

Clears the span table except for the first entry. Do this before calibrating the indicator. When you have selected this function, press [1] [TARE].

Note: **This will clear any previous calibration.**

16. Increment Span Pointer.

Allows you to make a second span adjustment to correct a scale linearity error. When you have selected this function, press [1] [TARE]. See Appendix II for information on how to use the second span adjustment.

Note: **The span pointer can not be incremented past 2. The DF2000 span pointer is not incremented automatically each time Set Span (Parameter 13) is selected.**

17. Decrement Span Pointer.

Brings the span pointer back to the first span adjustment. When you have selected this function, press [1] [TARE].

Note: **The span pointer can not be decremented past 1.**

21. Push to Zero Window. (2)

Represents the percentage of scale capacity that can be zeroed by the Zero key. The allowable range is 0 to 99 (%) of overweight value. This should be set to 2 (%) in most cases.

22. Auto Zero On-Off. (1)

Controls the automatic zero tracking function. Set to (1) to enable auto zero; set to (0) to disable auto zero. When this function is enabled, the 'CZ' light will be on when the scale is at zero.

Note: **You must disable the auto zero to accurately check scale sensitivity at zero.**

23. Auto Zero Window. (60)

Determines the amount of change that can be tracked by the Auto Zero function. The allowable range is from 0 to 99 (%) of 1 graduation per ¼ second. This should be set to 60 (%) in most cases.

24. Motion Settle Time. (16)

Determines the number of ¼ second intervals for which 'Motion' will remain asserted after the scale reading stabilizes to within the Motion Window tolerance (Parameter 5). A typical value is 16 (4 seconds). The allowable range is from 1 to 255.

25. Offset Value. (0)

Allows the entry of a tare offset value. At scale zero, the 'CZ' indicator lamp will be on, but the weight display will be at the tare offset value.

26. Offset Flag. (0)

Controls the operating mode of the tare offset.

0 = Offset Disabled.
1 = 'Legal for Trade' mode - Indicator display can not be put in 'NET' if no value has been set for the tare. If a tare is entered, the offset value is included in the 'NET' display.
80 = Not 'Legal for Trade' mode - Allows gross/net switching at zero tare. If 'NET' is selected, the offset value is subtracted from the displayed 'GROSS' weight.

27. Freeze Threshold Value. (0)

This is the weight that must be achieved before the highest value is frozen after motion ceases. Use this feature to display the weight when the transducer signal decreases after the load is applied. Set to zero for 'Legal for Trade' applications.

31. Serial Port Speed. (2)

Selects the Baud Rate of the Serial Data Port:

1 = 9600 Baud
2 = 1200 Baud
3 = 300 Baud

32. Serial Port Mode. (4)

Selects the operating mode of the Serial Data Port:

1 = Output only when 'PRINT' key is pressed.
2 = Output when Strobe = 1.
3 = Output when Strobe = 0, or continuous output.
4 = Output when ASCII poll character is received.
6 = Setpoint mode.
7 = For RD2000 use.

Note: See Section 1 for information on wiring the output connector block for the various modes. See Appendix I for the Output Format.

41. Average Shift Value 1. (3)

The system has a register which averages 10 or more scale readings. When the raw scale reading changes less than 'Average Shift 1' counts, no new readings are shifted into the register, resulting in a very stable display. The allowable range for this parameter is from 1 to 50 (counts). A typical value for Average Shift 1 is 3 (counts) - approximately 1/2 display graduation. See Appendix III.

42. Average Shift Value 2. (500)

When the raw scale reading changes more than Average Shift 1 counts and less than Average Shift 2 counts, the new reading is shifted into the register once. The averaged reading changes slowly over 10 or more readings. The allowable range for this parameter is from 1 to 5000 (counts). A typical value for Average Shift 2 is 500 (counts) - approximately 2 display graduations. See Appendix III.

43. Average Shift Value 3. (1000)

When the raw scale reading changes more than Average Shift 2 counts and less than Average Shift 3 counts, the new reading is shifted into the register five times. The averaged reading changes quickly over two readings. The allowable range for this parameter is from 1 to 10,000 (counts). A typical value for Average Shift 3 is 1000 (counts) - approximately 8 display graduations. See Appendix III.

44. Number Of Averages. (1)

Selects the size of the Average Register.

1	=	10 shifts.
2	=	20 shifts.
5	=	50 shifts.
10	=	100 shifts.

A typical value for this parameter is 1. See Appendix III.

45. Hold Off Delay 1. (3)

Sets the number of integrated cycles that the indicator remains in full update mode even though the rate of change of the raw scale readings has reached a point where the averaging system would take over. The greater the number of delay cycles, the faster the indicator display reaches the target weight.

The range of adjustment of Hold Off Delay 1 is from 0 to 30 (cycles). See Appendix III.

46. Hold Off Delay 2. (3)

Sets the number of integrated cycles that the indicator remains in half update (Average Shift 3) mode even though the rate of change of the raw scale readings has reached a point where the averaging system would take over. The greater the number of delay cycles, the faster the indicator display reaches the target weight.

The range of adjustment of Hold Off Delay 2 is from 0 to 30 (cycles). See Appendix III.

50. Display Setpoint Value. (0)

The Display Setpoint operates on the displayed weight regardless of the scale channel selected.

51. Channel Setpoint Value. (0)

The setpoint value for the channel being calibrated.

52. Setpoint Control Mask (0)

Used to control the operating mode of the setpoints. Each of the four setpoints can be set to energize if the weight is less than its setpoint or energize if the weight is greater than or equal to the setpoint.

The Setpoint Control Mask contains 4 digits, one for each of the four setpoints.

A '0' sets the setpoint to energize when the weight is greater than or equal to the setpoint. A '1' sets the setpoint to energize when the weight is less than the setpoint.

Typical Setpoint Control Mask

1	0	1	0
CHANNEL 3 SP WEIGHT < SP	CHANNEL 2 SP WEIGHT >= SP	CHANNEL 1 SP WEIGHT < SP	DISPLAY SP WEIGHT >= SP

Note: When the Setpoint Control Mask is displayed, leading zeros are blanked.

e.g. If the Mask is configured as '0011', it is displayed as '11'.

60. Span Factor 1

This value is computed by the indicator whenever a set span (Parameter 13) is performed. This number determines the span calibration and can be recorded for future reference. An indicator can be restored to its previous calibration by re-entering this number.

61. Span Factor 2

62. Span Factor 3

63. Span Factor 4

These values are computed by the indicator whenever a linearity correction (a second Span entry) is performed. Re-entering these values will restore the previous calibration.

64. Action Point 1

65. Action Point 2

66. Action Point 3

These points are computed by the indicator whenever a linearity correction is made. Re-entering these values will restore the previous calibration.

70. Grade Compare Value 1. (0)

71. Grade Compare Value 2. (0)

72. Grade Compare Value 3. (0)

73. Grade Compare Value 4. (0)

74. Grade Compare Value 5. (0)

75. Grade Compare Value 6. (0)

76. Grade Compare Value 7. (0)

77. Grade Compare Value 8. (0)

78. Grade Compare Value 9. (0)

79. Grade Compare Value 10. (0)

These values are the switching points between each of the 10 grades respectively. The following table is an example.

Parameter	Parameter Value	Weight Difference	Grade Display
		0.00	0
70	1.00	1.50	1
71	2.00	2.35	2
72	2.50	2.75	3
73	3.00	3.12	4
74	3.50	3.50	5
75	4.00	4.67	7
76	4.50	4.75	7
77	5.00	5.01	8
78	6.00	5.99	8
79	7.00	10.00	10

98. Channel Enable. (1)

Set to '1' to enable the channel.
Set to '0' to disable the channel.

Note: **You can not disable channel 1. If you have not connected scales to channel 2 or 3, make sure that these channels are disabled.**

99. Exit Calibration Mode.

Selecting this function will exit the calibration mode and return the indicator to the normal operating mode.

SECTION 5 - ERROR MESSAGES

1 Invalid tolerance selection.

2 ‘Graduation Size’ invalid.

3 ‘Decimal Point Position’ invalid (0-4).

4 ‘Flag Select’ must be 0 or 1.

5 ‘Push to Zero Window’ must be 0 - 99.

6 ‘Auto Zero’ must be 0 - 99.

7 Only value 1 will reset parameters.

8 Only value 1 will reset Span Table.

9 Span exceeds maximum capacity and/or entry too small.

10 Can not span a negative value.

12 ‘Motion Settle Time’ out of range (1 - 255).

13 ‘Power On Units’ may only be 0 = lb, 1 = kg.

14 ‘Average Shift Value’ out of range (1 = 1-50, 2 = 1-5000, 3 = 1-10000).

15 ‘Overweight’ out of range.

16 ‘Motion Window’ out of range.

17 ‘Increment Span Pointer’ commands are 0 = No Incr., 1 = Incr.

18 ‘Decrement Span Pointer’ commands are 0 = No Decr., 1 = Decr.

19 Span Table can not be decremented past 1.

20 Parameter memory write error. Indicator requires service.

21 Parameter checksum error. Parameters have been lost.

22 Program check fault. Indicator requires service.

23 Serial port speed setting range is 1 - 3.

24 Serial port mode setting range is 1 - 7.

25 Can not Increment Span Table past 2.

26 Entered offset larger than capacity.

27 U.S.A. Display flag is 0 = Off, 1 = On.

28 Power On Reset Warning is 0 = Off, 1 = On.

29 Channel enable is 0 = Off, 1 = On.

30 Only value 1 will set deadload.

31 Average Register Select is 1, 2, 5 or 10.

32 Hold Off Delay range is 0 - 30.

34 Load cell input value out of range (8 - 35 mV).

35 Invalid load cell value found in table. Reload this parameter.

37 Channel 1 can not be disabled.

38 Invalid function selection.

40 Channel not active.

41 Pushbutton Tare is invalid (Over/Under/Motion).

42 Keyboard Tare to one channel only.

43 Tare greater than capacity.

44 Can not do deadload calculation. Input signal is greater than parameter 11.

45 Can not do deadload calculation. Input signal is too far negative.

SECTION 6 - TROUBLE SHOOTING GUIDE

The following is a list of problems you may encounter when installing or operating your indicator.

SYMPTOM	POSSIBLE CAUSE	ACTION
Indicator will not turn on, no display	Blown fuse in power supply	Replace fuse
	Bad power connection	Check all connections
	No AC power to supply	Check power at supply
Display shows ‘uuuuuu’	Load cells not wired correctly	See Section 1
	Defective Load cell	Obtain service
	Deadload has not been set	See Parameter 12
Display shows ‘EEEEEE’	Scale is overloaded	Remove weight
	Overweight setting is not correct	See Parameter 4
	Deadload or Span not set properly	See Parameter 12 and Span setting in Section 3
	Load Cells not wired correctly	See Section 1
	Defective load cell	Obtain service
	Unused scale channels not disabled	See Parameter 98
Display shows ‘rrrrrr’	Deadload has not been set	See Parameter 12
	Weight on scale is beyond Zero Window	See Parameter 21
	Scale has not been calibrated	See Section 3
SYMPTOM	**POSSIBLE CAUSE**	**ACTION**

Display unstable	Defective load cell	Obtain service
	Load cell cabling wet or damaged	Inspect cables
	Load Cell Full Scale Output not set Correctly	See Parameter 11
	Defective power supply	Check power output
No output to Printer	Output port not setup correctly	See Section 1 and Appendix I
Setpoint not working	Output port not setup correctly	See Section 1 and Appendix I

APPENDIX I - TECHNICAL INFORMATION

Serial Output Port Set-Up

The DF2000 Serial Output Port can be set up for the following functions:

1) Operate a printer for weight/total print-out.
2) Provide a setpoint signal to control material feed.
3) Interface with a computer for two-way communication.

To set up the Port, go to Calibration Mode and select Parameters 31 and 32.

To enter Calibration Mode --> Press [1] [9] [SELECT] and press 'Calibrate" button at back of indicator.
(Flashing 'C' indicates Calibration Mode.)

Go to Parameter 31
Serial Port Speed --> Press [31] [SELECT].

If you are using the port for a printer or for data communications, set the appropriate Baud Rate:

1 = 9600 Baud
2 = 1200 Baud (Factory Setting)
3 = 300 Baud

e.g. To set the Port Speed to 300 Baud press [3] [TARE].

Go to Parameter
32 Serial Port Mode --> Press [32] [SELECT].

Set the operating mode from the following list:

1 = Output only when [PRINT] key is pressed.
2 = Output when Strobe = 1.
3 = Output when Strobe = 0, or continuous output.
4 = Output when ASCII poll character is received.
6 = Setpoint Mode.
7 = for RD2000 use.

e.g. To operate a Printer --> press [1] [TARE].

To operate the port as a setpoint control --> press [6] [TARE].

Note: Make sure that you have wired the port correctly. See Installation and Wiring (Section 1) for a description of the signal pins.

Serial Output Format

TTL Polarity is the same as RS232 standard, but voltage levels are 0 VDC and +5 VDC. The output is idle at 0 VDC and active at +5 VDC.

Data Word Configuration: 1 Start Bit
7 Data Bits
1 Parity (Held zero)
1 Stop Bit

Poll Characters

The port accepts ten possible ASCII poll characters in Mode 4. The polls are:

?	-	Send current displayed weight.
1	-	Set to Channel 1 and send displayed weight.
2	-	Set to Channel 2 and send displayed weight.
3	-	Set to Channel 3 and send displayed weight.
4	-	Set to total and send displayed weight.
T	-	Set tare on current channel.
C	-	Clears stored tare weight.
G	-	Switches to gross mode.
N	-	If tare weight stored, switches to net mode.
Z	-	Zero's indicator if weight is valid and is within zero window.

Note: The last six poll characters are not available on units manufactured before 1992.

The serial output is organized as follows: (Mode 4)

Byte

0	"02" (Start of Text)	
1	Polarity (Space or -)	
2	Space	
3	Data MSD)	
4	Data)	
5	Data)	Weight Including Decimal Point
6	Data)	
7	Data)	
8	Data LSD)	
9	Space	
10	K or L	
11	G or B	
12	Channel Information*	
13	G or N	
14	R or T	
15	Space	
16	Status (Space=Valid Weight, 0 = Over, M = Motion, - = Minus)	
17	Carriage Return	
18	Line Feed	

* Channel Information Code:

1	=	Channel 1
2	=	Channel 2
4	=	Channel 3
3	=	Sum of Channels 1 and 2
5	=	Sum of Channels 1 and 3
7	=	Sum of Channels 1, 2 and 3

APPENDIX II - LINEARITY ADJUSTMENT

The DF2000 features the provision for an extra span entry to allow for the correction of scale or load cell non-linearity. The amount of correction is limited to plus or minus three graduations. Attempting to correct an error greater than three grads will result in inaccurate weight readouts. If you have a non-linearity of more than three graduations, you should make a closer mechanical inspection of the scale and its installation.

Four Calibration Mode functions are used for linearity adjustments:

[15]	RESET SPAN TABLE	Clears the span table except for the first entry. Do this before setting the span. This will clear any previous calibration.
[16]	INCREMENT SPAN POINTER	Moves the span pointer to the second entry point.
[17]	DECREMENT SPAN POINTER	Returns the span pointer to the first entry point.
[13]	SET SPAN	Sets the span. Pay particular attention to the number that flashes briefly after you have pressed [13] [SELECT].

The following example will illustrate the use of the Linearity Adjustment.

Scale set for 5 lb graduations -

Scale overweight is set for 5020 lb. DF2000 indicator is in Calibrate Mode. Scale has been zeroed and then Span has been set with 1000 lbs. test weights (as per example in Section 3 Calibration).

Scale clear of weights	-->	scale reading 0 lb
1000 lbs applied	-->	scale reading 1000 lb
5000 lbs. total weight applied	-->	scale reading 4990 lb
- Error at capacity is -10 lbs	=	-2 grad.

To correct this error:

1) Increment the span pointer to the second position:
Press [16] [SELECT] [1] [TARE]

5000 lbs. on scale --> scale reading 4990 lb

2) Set Span: Press [13] [SELECT]

Display will flash '2' (second span entry) and return to '4990' lb.

3) Enter correct weight: Press [5000] [TARE]. Display will then flash old weight (4990) and then read new correct weight, scale reading 5000 lb

4) Retest scale at 0, 1000 and 5000 lbs. If readings are okay, exit Calibration Mode.

Note: If reading at 1000 is no longer correct, you must re-enter the first span point --> decrement the span pointer: [17] [SELECT] [1] [TARE]. Set span at 1000 lbs and then repeat the above procedure. The position of the span pointer can always be checked by pressing Set Span ([13] [SELECT]) and observing the number that momentarily flashes.

The span pointer can not be incremented past 2 and can not be decremented past 1.

APPENDIX III - WEIGHT STABILIZATION SYSTEM

The DF2000 indicator features an internal resolution of 60,000 raw counts. Since the displayed resolution is limited to 5000 graduations, the indicator can utilize up to 12 internal raw counts per weight graduation (60,000/5000). This high ratio of raw counts to graduations allows the indicator to employ a number of software functions to produce a stable weight display under less than optimum conditions. The parameters for these functions can be varied by the user. The stability, sensitivity and the speed of response to applied load can be adjusted in order to "tune" the indicator to handle difficult weighing situations.

Average Shift Values 1, 2 and 3 (Parameters 41, 42, and 43)

The DF2000 performs 5 analog to digital conversions per second - the process by which the signal from the load cell is converted from voltage into a number value. Each conversion or update produces a new internal raw count reading. The actual displayed weight is computed from the average of 10 raw count readings stored in a register. After every update, the new raw count reading is compared with the average reading. The amount of difference between the new reading and the average reading determines the rate at which the new reading is shifted into the averaging register - and thus the rate at which the displayed weight will change. The Average Shift Values 1, 2 and 3 are used to set this rate.

e.g. Averaging register with 10 internal count readings.

1	2	3	4	5	6	7	8	9	10
512	512	514	512	513	512	511	512	513	514

- assume the scale has been calibrated so that 10 counts represent a 1.0 lb graduation.

- average of 10 internal counts = 513 counts = 51 lb (displayed weight).

Average Shift Value 1 - Assume that the Average Shift Value 1 has been set to 4 counts (slightly less than ½ graduation in this example). As long as the difference between a new internal count reading and the current average reading (513) is less than 4 counts, the new reading will not be shifted into the register and computed into a new average. Thus the displayed weight will remain stable.

Average Shift Value 2 - The average shift value 2 has been set to 500 counts. If the difference between a new internal count reading and the current average reading is less than 500 but more than 4 counts (average Shift Value 1), the new reading will be shifted into the register once.

Following is an example of what happens when a small change in weight occurs.

An extra weight is applied to the scale. The new internal counts reading is 550. This reading is 37 counts greater than the current average (513). 37 falls between Average Shift Value 1 (4) and Average Shift Value 2 (500). Thus the new reading is shifted once into the register and reading #10 is shifted out.

1st Cycle - new reading:

1	2	3	4	5	6	7	8	9	10
550*	512	512	514	512	513	512	511	512	513

Old reading of register 10 shifted out

- average of 10 registers = 516 counts = 51 lb (disp. wt.)

Now remember that the DF2000 updates the internal counts reading 5 times per second. Thus on the second update the new internal count reading is still higher than the new average and is shifted in once again.

2nd Cycle - New Reading:

1	2	3	4	5	6	7	8	9	10
552	550*	512	512	514	512	513	512	511	512

Old reading of register 10 shifted out

- average of 10 registers = 520 counts = 52 lb (disp. wt.)
- Since the new internal counts readings are consistently higher than average, they are continually shifted in one at a time.

After a total of 10 readings and 10 shifts, the averaging register looks like this:

10th Cycle:

1	2	3	4	5	6	7	8	9	10
553	550	554	551	552	550	555	553	552	550*

- average of 10 registers = 552 counts = 55 lb. (disp. wt.)

In this example it took 10 readings and 10 shifts for the weight display to update from 51 lb. At 5 times per second, this took 2 seconds.

Average Shift Value 3 - The average Shift Value 3 has been set to 1000 counts. If the difference between a new internal count reading and the current average reading is less than 1000 but more than 500 counts (Average Shift Value 2), the new reading will be shifted into the register 5 times (½ update).

Following is an example of what happens when a larger change in weight occurs:

Initial

1	2	3	4	5	6	7	8	9	10
512*	512	514	512	513	512	511	512	513	514

Initial stable weight reading:

- average of 10 registers = 513 counts = 51 lb. (disp. wt.)

- now a larger weight is applied. The first new internal count reading is 1250 counts. The difference between it and the current average (513) is 737 counts. This value falls between 500 (average Shift 2) and 1000 (Average Shift 3). Therefore the new reading is shifted in 5 times.

1st Cycle - New Reading:

1	2	3	4	5	6	7	8	9	10
1250	1250	1250	1250	1250	512*	512	514	512	513

Old readings of registers 6 - 10 shifted out

- average or 10 registers = 881 counts = 88 lb (disp. wt.)

The next new internal count reading is 1410 counts. This reading is 529 counts higher than the current average (881). Therefore this new reading is also shifted into the register 5 times.

2nd Cycle - New Reading:

1	2	3	4	5	6	7	8	9	10
1410	1410	1410	1410	1410	1250	1250	1250	1250	1250

Old readings of registers 6 - 10 shifted out

- average of 10 registers = 1330 = 133 lb (disp. wt.)

The next internal count reading is 1413 counts. The difference between it and the current average (1330) is 73 counts. This value falls between Average Shift 1 (4) and Average Shift 2 (500). Therefore, the new value is shifted in once.

3rd Cycle - New Reading:

1	2	3	4	5	6	7	8	9	10
1413	1410	1410	1410	1410	1410	1250	1250	1250	1250

Old reading of register 10 shifted out

- average of 10 registers = 1346 counts = 134 lb. (disp. wt.)
- The next 4 new readings all fall within the same range as the scale has reached stability after the application of the weight.

After 4 more cycles and 4 more shifts the register looks like this:

7th Cycle

1	2	3	4	5	6	7	8	9	10
1411	1412	1411	1412	1413*	1410	1410	1410	1410	1410

- Average of 10 registers = 1411 counts = 141 lb. (disp. wt.)

From the above example note the rapid change in the average counts reading over the first two cycles and the slower change over the subsequent cycles as the average counts approaches the correct reading.

If a change in weight on the scale is large enough to make the difference between the current average and the new internal counts reading to be greater than 1000 counts (Average Shift register 10 times in one cycle (full update). In this mode no averaging takes place since all 10 registers record the same reading. This full update mode will continue until the change in the internal counts reading falls into the range of values below that set by Average Shift Value 3. Then the averaging system will take over the and the weight display will update more slowly as it approaches the correct reading.

In Summary

RATE OF CHANGE OF DISPLAYED WEIGHT		
	No Registers Loaded	No Update
Average Shift Value 1		
	Load 1 Register	Averaging
Average Shift Value 2		
	Load ½ of Registers	½ Update
Average Shift Value 3		
	Load All Registers	Full Update

Guidelines For Setting Average Shift Value 1, 2 and 3 Parameters 41, 42 and 43.

Average Shift Value 1 (Parameter 41) - factory set at 3 counts.

This parameter should be set for no more than 1/2 of a graduation. If set too low then the scale display will appear unstable. If set too high then the sensitivity will be reduced and the display may not respond to a one graduation change in applied weight.

e.g. If a scale has been set for 5000 graduations at 60,000 counts, then 12 counts = 1 graduation. In this case Average Shift Value 1 should be set for 4 or 5 counts.

Average Shift Value 2 (Parameter 42) - factory set at 500 counts.

This parameter should be set to two times the amount of change caused by normal motion while load is on the scale.

e.g. For a livestock scale observe the amount of change in raw counts as the livestock are being weighed and set the value for this parameter to twice the observed change.

Other examples would be change caused by liquid sloshing in tanker truck or change caused by truck engine running.

Average Shift Value 3 (Parameter 43) - factory set at 1000 counts.

This parameter should be set for approximately 2 times the value set for Average Shift 2.

Average Register Size (Parameter 44) - factory set at 1 (10)

In the previous examples the averaging register has been shown as containing 10 readings. The size can be changed for certain applications by changing this parameter.

Parameter 44:

1 = 10 shifts
2 = 20 shifts
5 = 50 shifts
10 = 100 shifts.

Changing the size of the averaging register will affect the speed of the averaging system when a single register is being loaded (when the change in raw counts is between Average Shift Value 1 and Average Shift Value 2).

An increase in the size of the register and perhaps slightly increasing the value for Average Shift 1 should result in a more stable weight display. If the register size is set too large there may however be an unacceptable delay in the indicator's response to a small change in weight. Use trial and error to find the optimum settings.

Hold Off Delay 1 and 2 (Parameters 45, 46)

The Hold Off Delay feature is designed to delay the start of the averaging system so that the indicator display will read the target weight sooner.

Without any Hold Off Delay, the averaging system (loading one register per cycle) is engaged when the rate of change of the internal raw counts falls below 500 (Average Shift 2). This would then require 10 or more cycles for the average to finally represent the correct weight (as in the example illustrated for Average Shift 2). Thus it would require 2 or more seconds for the display to read correctly after the weight had been applied. The Hold Off delays the averaging system for a specified number of cycles, speeding up the response of the scale display.

Hold Off Delay 1 holds the indicator in full update (load all registers) for a specified number of cycles.

Hold Off Delay 2 holds the indicator in ½ update (load ½ of all registers) for a specified number of cycles.

The following example will illustrate the effect of the Hold Off delay:

Note in the following example:

Hold Off Delays 1 and 2 set to 3 cycles.
Average Shift Values 1, 2, and 3 set to 3, 500 and 1000 counts.
Indicator initially stable at 10,000 counts, then a weight representing 5100 counts is applied.

Cycle #	Internal Counts	Change	Update Without Hold Off	Average	Update With Hold Off Delay	Average	
1	10,000	0	None	10,000	None	10,000	
2	15,000	5,000	Load All	15,000	Load All	15,000	
3	15,050	50	Load 1	15,005	Load All	15,050	Hold Off Delay 1
4	15,100	50	Load 1	15,015	Load All	15,100	
5	15,101	1	Load 1	15,025	Load All	15,101	
6	15,100	1	Load 1	15,035	Load ½	15,101	Hold Off Delay 2
7	15,102	2	Load 1	15,045	Load ½	15,101	
8	15,103	1	Load 1	15,055	Load ½	15,102	
9	15,101	2	Load 1	15,065	None	15,102	
10	15,102	1	Load 1	15,075	None	15,102	
11	15,103	1	Load 1	15,085	None	15,102	

In the above example, without a hold off delay, the average reading has still not reached the correct value after 10 cycles (2 seconds). With a hold off delay, the average reading approximates the correct value within 5 cycles.

In summary, the greater the number of hold of delay cycles, the faster the indicator display reaches the target weight.