WESTERN SCALE CO. LIMITED

OPERATION MANUAL

MODEL DF3000

DIGITAL WEIGHT INDICATOR

REVISION A-1

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SECTION I - GETTING STARTED

Introduction

The DF3000 Digital Indicator is an easy to use, fully featured digital weight indicator. This manual will lead you through all the steps required to set up and operate the indicator.

If you are setting up the indicator for the first time, refer to Sections II and III - Installation and Calibration.

The DF3000 features two channels and has a maximum displayed resolution of 5000 graduations per channel. Each channel is calibrated and set-up separately and may be set for different graduation sizes and capacities. The unused channel must be disabled in order to obtain a correct reading.

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

Operating The Indicator

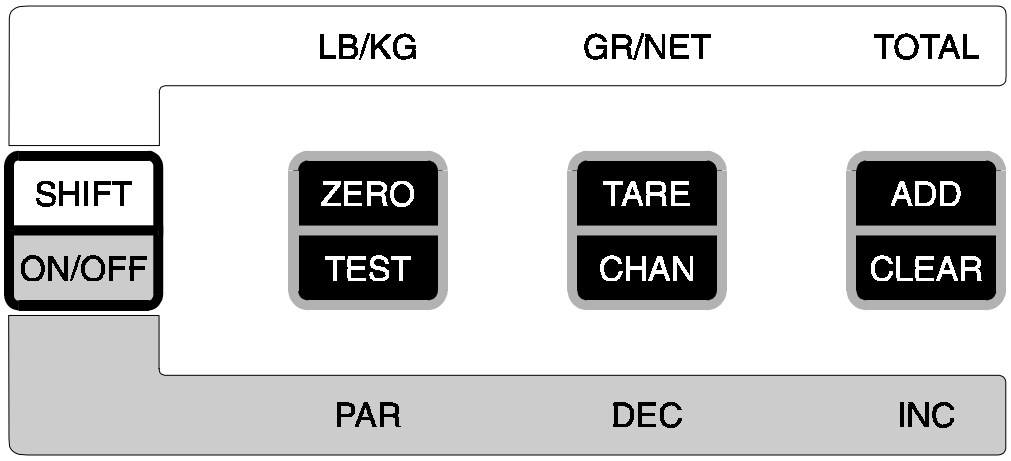


Figure 1 DF3000 Keypad

The DF3000 is equipped with 4 buttons. Due to the fact that the indicator features several modes of operation, each of the buttons performs several functions.

Therefore some of them have a label above,

LB/KG **GR/NET** **TOTAL**

each button has two labels on the button itself,

SHIFT,ON/OFF **ZERO,TEST** **TARE,CHAN** **ADD,CLEAR**

and there are labels below:

PAR **DEC** **INC**.

Throughout this manual some standards are used to show which buttons to push. When you are to push a button, the name of the function which the button is performing in the respective mode will be shown surrounded by [ ].

For example, every one of the following functions is achieved by pressing the third button:

[TARE] [DEC] [GR/NET] [CHAN]

To begin, let's turn the indicator on:

PRESS - [ON/OFF]

This instruction is telling you to press the button marked ON/OFF.

Once you have done this, the unit will display the pattern 'DF3000'. This is the normal start-up display. After a few seconds the display will show 'rrrrrr'. This is a normal condition.

To clear the display :

PRESS - [ZERO]

Main Key Functions

[ON/OFF] Pressing once will turn the indicator On. Pressing twice consecutively will turn the indicator

[ZERO] This key is used for zeroing the indicator. The tare value that has been previously captured will also be cleared (see Tare key operation).

[TARE] Push this button to tare off a weight applied to the scale, e.g. place an empty container on the scale and press [TARE]. The 'NET' annunciator comes on.

When the Average Counter is not zero (Parameter 47), push this button to start display averaging. The letter 'A' will flash in the leftmost position while the averaging routine runs. After, the average value locks on the display along with the letter 'A'. To clear the locked average, press any other key or return the scale to within zero range.

[ADD] This button operates a one item totalizer. Each time the [ADD] button 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 shift and hold functions for displaying and clearing the accumulated total. Note that the totalizer accumulates any displayed weight. Do not switch between lb and kg while totalizing otherwise the total will be incorrect.

Shift Functions

All of the shift functions are selected using a two-step procedure. To select a shift function, first press the [SHIFT] button, the display will flash, then press the button for the function. For example, to change the indicator's units:

PRESS - [SHIFT] [LB/KG]

All of the shift functions are described below. Do not forget to press [SHIFT] before pressing the button for the function you wish to operate.

[ON/OFF] Pushing this button will turn the indicator Off.

[LB/KG] This button alternates between weight being displayed in pounds of kilograms. Each press of the button toggles the display. The 'lb' or 'kg' annunciators will show which units the display is in.

[GR/NET] Selects between the gross weight (actual scale weight) and net weight (gross weight minus tare value). The 'NET' annunciator will be on when the net weight is being displayed.

[TOTAL] Displays the accumulated total when the indicator is used in the accumulating mode (see [ADD] key).

Hold Functions

The following functions require you to hold the button down and wait for the display to change.

[ON/OFF] Press and hold this key to enter parameter mode. This allows you to change some values outside of calibrate. See Parameter Display Functions in Section III - Calibration and Section IV - Parameters.

[TEST] The Test mode allows the verification of the indicator displays. Each time Test is selected the display willmomentarilyy show '888888' with all decimal points and status annunciators on. Followed by a diagnostic weight display.

[CHAN] Toggles the display between the channels if both are enabled.

[CLEAR] Clears the accumulated total (see [ADD] and [TOTAL] buttons). The display will show ' Add ' and 'CLEAr ' consecutively.

SECTION II - INSTALLATION AND WIRING

Physical Installation

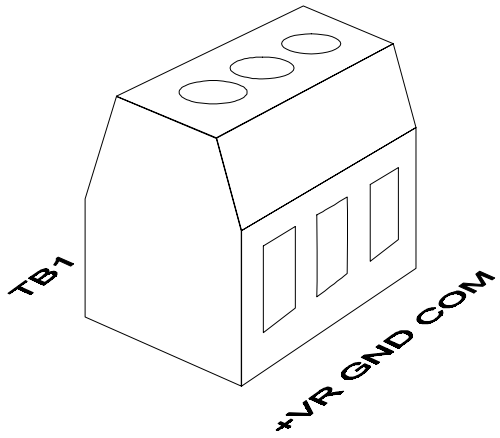
The DF3000 indicator can be located wherever convenient. It is not advisable to locate the indicator where it would be exposed to direct sunlight, excessive mechanical abuse or moisture unless it is mounted in an enclosure suited for such a purpose.

Power Requirements

The DF3000 crane-scale model has an internal battery pack which requires 16 D-size cells. If you are using a power supply, it must output 8-16 VDC. Although the indicator has built-in voltage regulation, it is most desirable that the input voltage be stable.

Wiring Of Power

Connect 12 VDC power to terminal block TB1 on Display Board - see fig. 2.



+VR = 12 Volt DC (+ Power)

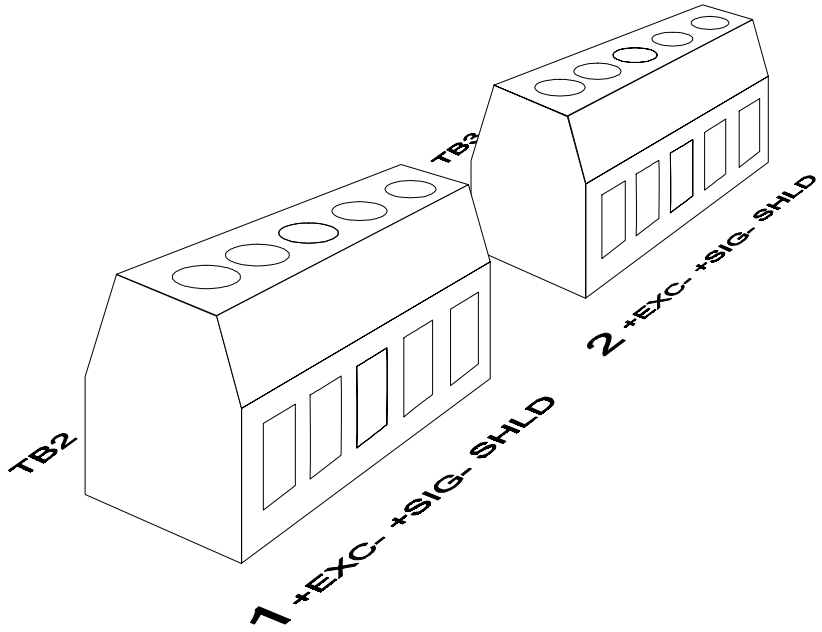
GND = Chassis Ground

COM = Common (- Power)

Figure 2 Power Supply Terminal Block

Wiring Of Load Cells

Connect load cells to the terminal blocks TB2 and TB3 marked 1 and 2 respectively on CPU / Analog Board - see fig. 3.



+ EXC - = Excitation

+ SIG - = Signal

SHLD = Shield

Figure 3 Load Cell Terminal Blocks

If you are using only one scale or load cell, it must be connected to channel 1. An additional scale may be connected to channel 2.

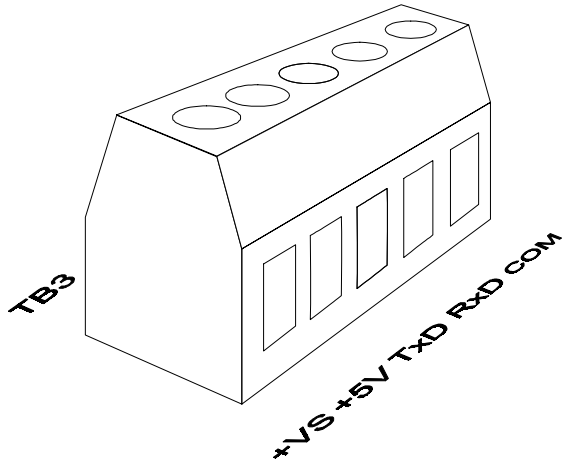
Ensure that the shield wire is not left bare when attaching it to the terminal. Insulate the shield wire with shrink tubing or tape to prevent the possibility of it shorting to the circuit board.

Load Cell Wiring Guide					
	Excitation (+)	**Excitation (-)**	**Output (+)**	**Output (-)**	**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 GUIDE TO HELP CROSS REFERENCE THE WIRING OF THE LOAD CELLS LISTED.

Wiring Of Serial Interface

A cable for serial communication between the DF3000 and a printer, computer or remote display is connected to terminal block TB3 on the Display Board - see Figure 4.



+VS = 12 Volt DC Switched

+5V = 5 Volt DC Switched

TXD = Transmit Data

RXD = Receive Data / Strobe

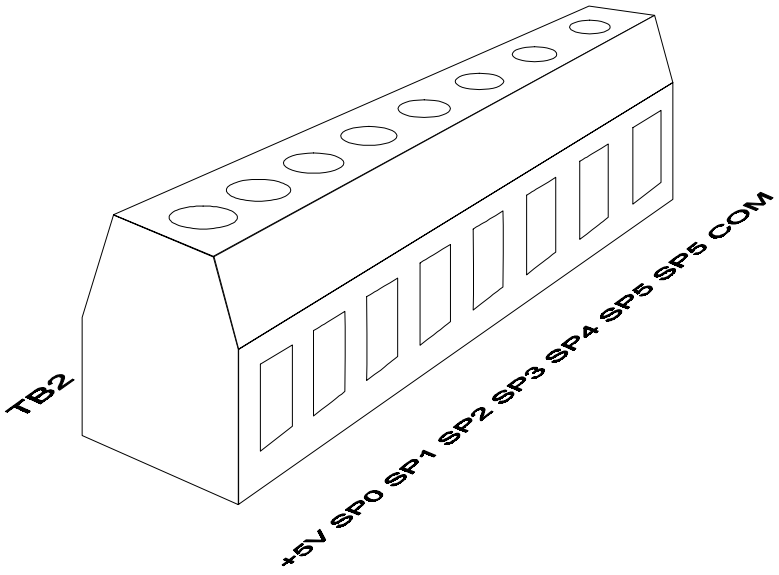
COM = Signal Ground

Figure 4
Printer/Data Communications Terminal Block

The DF3000 supports different serial output modes and communication speeds. The desired values must be selected during calibration.
See Section IV - Parameters (‘P 31' ,‘P 32') for descriptions.

Depending on the chosen output mode, the RxD terminal acts either as data receive input or as strobe input.
Terminals +VS and +5V are usually not used.

Wiring Of Setpoints



+5V = 5 Volt DC

SP0 = 1st setpoint for Channel1

SP1 = 2nd setpoint for Channel1

SP2 = 1st setpoint for Channel2

SP3 = 2nd setpoint for Channel2

SP4 = 1st display setpoint

SP5 = 2nd display setpoint

COM= Common

Figure 5
Setpoints Terminal Block

The DF3000 features six setpoint outputs. For a description on how to use them refer to Section IV - Parameters (‘P 50' .. ‘P 54').

SECTION III - CALIBRATION

How to Enter the Calibration Mode

The calibration mode is accessed by pressing the pushbutton inside the indicator. On the Crane Scale model this is done thru a plug on the right side of the face plate. The 'CAL' annunciator will turn on while in the Calibration Mode.

The Keypad In Calibration Mode

In calibration mode the pushbuttons have two different functions depending on the display status.

[SHIFT] Toggles between **scale display** and **parameter display**. The parameter display flashes 'P' followed by the parameter number alternately with the parameter's value.

Scale Display Functions

While in the scale display mode the remaining keys function as follows:

[ZERO] This key is used for zeroing the indicator.

[CHAN] Toggles between channel 1 and channel 2 as shown by annunciators '1' and '2' respectively.

[ADD/CLEAR] Selects between display of scale weight or internal counts. A flashing 'A' in the leftmost digit indicates internal counts displayed.

Parameter Display Functions

While in the parameter display mode the keys have the following functions:

[PAR] Selects the current parameter by incrementing the parameter number.

[DEC] Decrements the parameter's value. This key has auto repeat by holding it down. Holding this key down for an extended period of time will kick in the hyper repeat on potentially large values.

[INC] Increments the parameter's value. Has repeat as above.

Set-Up Parameters

In order to calibrate the indicator, certain parameters must be set up first before weights are applied on the scale. The indicator should first be set up for graduation size, overweight, motion window, push to zero range, etc. The reason for this is, if the dead load is set or the span is calibrated and one of the indicated parameters is changed afterwards, the span or the dead load might change as well.

To check a parameter, press the mode key if a 'P' is not flashing in the leftmost digit. Make sure the 'CAL' annunciator is on if this does not work. Select the parameter by pressing the [PAR] key until you see the parameter number.

When you have accessed a parameter via the above procedure, the indicator will display the parameter's value when the 'P' disappears. If you wish to change the value, check the Parameter List, Section IV, and enter a new value by press either the [DEC] or [INC] key. Examples of this procedure are given in the following steps.

'P 01' 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 [INC] and the factory values will be loaded.
Note: this will clear any previous calibration.

'P 02' Decimal Point Position. Set the decimal point position to correspond with the graduation size. For example, for a .05 lb graduation size set this value to 2; for a 10 lb graduation size set it to 0.

'P 03' Graduation Size. Set the graduation size from the Parameter List, Section IV, making sure that the displayed units (lb/kg) are appropriate for the graduation size you select. (To change the displayed units, lb/kg, select parameter 7.)

'P 04' Overweight. Set to one graduation over the maximum capacity of the scale. Maximum capacity cannot be more than 5000 displayed graduations. For example: For 2 lb grad size and a maximum capacity of 5000 lb, select 5002.

'P 05' Motion Window. Set to 2 times the graduation size. Note this value is automatically set when you set the graduation size.

'P 06' Power On Units. Set to the units (lb/kg) that you wish the unit to be in whenever it is powered up. For example:
To power up in kg mode, select 1. To power up in lb mode, select 0.

'P 08' U.S.A. Display Flag. Set parameter to '0' for Canada and to '1' for the U.S.A.

'P 09' Power On Reset Warning. This parameter should be set to '1' for a "Legal for Trade" scale.

'P 21' 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.

'P 22' Auto Zero On-Off. If you wish to turn off the automatic zero tracking function, select 0. To restore auto zero, select 1.

'P 23' 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.

'P 24' Motion Settle Time. Enter the number of .1 second intervals for which motion will remain asserted after the scale stabilizes to within the motion window ('P 5'). Factory set to 40 (4 seconds). For example: To set to 2 seconds, select 20.

Calibration with Weights

Note: You must set the following Parameters before initially adjusting the Dead Load or Span.

'P 11' 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 Method

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

(Amount of Load Cell Used / Load Cell Capacity) x Rated Millivolt Output x 9

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

(400 lb / 1000 lb) x 3 x 9 = 10.8

Round this off to the nearest integer value, i.e. 11.

Note: Only integer values from 8 to 35 may be selected for this parameter.

Trial and Error Method

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

1. First make sure that the scale and load cells are wired up correctly. Then press the [WEIGHT/COUNTS] key. The flashing 'A' should appear in the leftmost display digit. The indicator is now in the counts mode. Make sure the scale is clear of weight and note the counts value. This number represents the internal raw counts. If a number a number does not appear and the display shows 'uuuuuu', check the Troubleshooting Section VI. For example:

   Scale clear of weight - internal raw counts = 3431.

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

   Scale capacity is 5,000 lb
   Apply 1,000 lb (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 this value to be between 50,000 and 60,000 at scale capacity. For above example:

   At 1/5 capacity, the change in the internal raw counts should be between 10,000 and 12,000 counts.

   Checking the current value for parameter 11: 'P 11 ' --> 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.

   If the counts are less than 50,000, the displayed weight readings tend to be more unstable. If the counts exceed 56,000, the indicator will overrange 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 56,000 counts.

'P 12' Set Dead Load. The indicator features an automatic compensation for the scale deadload. When you have selected this function press [INC] [SHIFT], the indicator will enter a routine to automatically zero the deadload. While this routine is in progress, a flashing 'd' will appear in the leftmost digit. Upon completion of the routine, the weight display will be at or near zero.

'P 13' Span Value. Set the span value to the weight being used to calibrate the scale.

'P 17' Set Span. Zero the indicator. Place the known weight on the scale. After selecting this function press [INC] [SHIFT] this will span the indicator. Remove the weight and check zero. Re-apply the weight and repeat the Set Span procedure if necessary.

This completes the basic Calibration procedures.

'P 99' Exit Calibration. To exit the Calibration Mode, select this unction and press:

[INC] [SHIFT]

Note: If you are also using Channel 2, calibrate it with the same procedures.

SECTION IV - PARAMETERS

Note: In order to change the parameters of the indicator, you must be in the Calibration mode ('CAL' annunciator on - see Calibration Section III).

In the following list of parameters, the Factory Preset Value will be indicated in ( ).

Parameter No Description

00 Keyboard Tare Value (0)
Automatic lb/kg conversion of tare value which may be set.
Note: This Parameter is not available during calibration.

01 Reload Factory Values.
Calibrates the scale with commonly used values. When you have selected this function, press [INC]. Note this will clear any previous calibration.

02 Decimal Point Position. (0)
0, 1, 2, 3 or 4. Select to correspond with graduation size, e.g. set to 1 for .5 kg grads, set to 0 for 10 kg grads.

03 Graduation Size. (2 lb / 1 kg)
Select one from this table:
lb 2, 5, 10
kg 1, 2, 5

04 Overweight. (15002 lb / 6805 kg)
Must be less than 5000 displayed graduations and greater than 1 graduation.

05 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.

06 Power On Units. (0)
Selects the displayed units active when power is applied to the indicator.
1 selects kg; 0 selects lb.

07 Change Displayed Units. (0)
Allows you to calibrate in pounds or kilograms.
1 selects kg; 0 selects lb.

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

The U.S.A. display flag can be set to '0' or '1'. Setting the flag to '0' give 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, i.e. for a grad size of 10, the zero display will be '00'.

b) Dead Zeros behind decimal point - For grad sizes of .0010, .010, .10, 1.0 in lb, the extra dead zero shown is blanked. This is only effective for decimal positions greater than '0'.

The U.S.A. flag must be set to '1' for the indicator to be "Legal for Trade" in the U.S.A.

09 Power On Reset Warning. (1)

The Power On Reset Flag allows designation of the power on 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'.

10 Load Cell Full Scale Output. (14 mV)

This parameter represents the output of the load, in millivolts, at maximum scale capacity. The range of entries allowed is from 8 to 35. 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 Section III Calibration for information on how to determine the value of this parameter for your scale.

12 Set Dead Load.

This function automatically compensates for the scale deadload. When you have selected this function, press [INC] [SHIFT]. The indicator will then enter a routine to zero the deadload. While this routine is in progress, a flashing 'd' will appear in the leftmost display digit. Upon completion of the deadload routine, 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 Span Value.
This function is used to set the fine span for the indicator. Please refer to Section III Calibration for information on how to set the span.

14 Reset Dead Load.
Returns the indicator to the factory deadload setting. When you have selected this function, press [INC] 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 [INC]. Note this will clear any previous calibration.

16 Set Span Pointer.
Allows you to make a second span adjustment to correct a scale linearity error. See Appendix I for information on how to use the second span adjustment.

17 Set Span.
To set the span using the Parameter 13 value, press [INC] [SHIFT]. While the indicator is setting span, a flashing 'S' will appear in the leftmost digit.

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

22 Auto Zero On-Off. (0)
Controls the automatic zero tracking function. Set to '1' to enable auto zero; set to '0' to disable auto zero.
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 0.25 seconds. This should be set to 60 % in most cases.

24 Motion Settle Time. (40)
Determines the number of 0.10 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 40 (4 seconds). The allowable range is 1 to 255.

25 Offset Value. (0)
Allows the entry of a tare offset value. At scale zero the 'ZERO' annunciator will be on but the weight display will be 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 cannot 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.

31 Serial Communications Speed (1200)
This Parameter sets the speed (Baud Rate) of the serial communications interface. Possible Settings are:
75, 150, 300, 600, 1200, 2400, 4800, 9600

32 Serial Communications Mode (4)
1 = Output only when ‘Add’ or ‘Total’ button is pressed (strobe must be 1)
2 = Output when strobe = 1
3 = Output when strobe = 0
4 = Output when poll character is received
5 = Continuous output
7 = RD2000 mode continuous output

Note: For a more detailed explanation of the above two parameters, see Appendix III - Serial Output Port Setup.

41 Average Shift Value 1. (3)
The system has a register which averages 10 or more internal scale readings. When the internal 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.

Note: For a more detailed explanation of this and the following five parameters, see Appendix II - Weight Stabilization System.

42 Average Shift Value 2. (500)
When the internal scale reading changes more than Average Shift 2 counts, the new reading is shifted into the register once. The averaged reading changes slowly over ten 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 II.)

43 Average Shift Value 3. (1000)
When the internal scale reading changes more than Average Shift 3 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 II.)

44 Number of Averages. (2)
Selects the size of the Average Register.
1 = 10 shifts.
2 = 20 shifts.
5 = 50 shifts.
10 = 100 shifts.

45 Hold Off Delay 1. (15)
Sets the number of integrator cycles that the indicator remains in full update even though the rate of change of the internal 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 255 cycles. (See Appendix II.)

46 Hold Off Delay 2. (30)
Sets the number of integrator cycles that the indicator remains in half update (Average Shift 3) mode even though the rate of change of the internal scale reading 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 255 cycles. (See Appendix II.)

47 Average Counter. (0)
Set the number of measurements made when running the push to average routine. When this value is set to zero, push to average is disabled for legal applications. To enable this feature, a value other than zero must be set.

50 Setpoint Mask. (000000)
Used to control the operating mode of the setpoints. Each of the 6 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 Mask contains 6 digits, one for each of the 6 setpoints:
A '0' sets the setpoint to energize when the weight is greater than or equal to the setpoint. A '1' set the setpoint to energize when the weight is less than the setpoint.

51 Channel Setpoint 1 Value. (0)
The Setpoint 1 Value for the channel being calibrated.

52 Channel Setpoint 2 Value. (0)
The Setpoint 2 Value for the channel being calibrated.

53 Display Setpoint 1 Value. (0)
The Display 1 Setpoint operates on the displayed weight regardless of the scale channel selected.

54 Display Setpoint 2 Value. (0)
As above but for Display 2 Setpoint.

60 Span Factor 1.
This value is computed by the indicator whenever a set span (Parameter 17) 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.
This value is computed by the indicator whenever a linearity correction (a second Span entry) is performed. Re-entering these values will restore the previous calibration.

62 Span Factor 3.
As above.

63 Span Factor 4.
As above.

64 Action Point 1.
This point is computed by the indicator whenever a linearity correction is made. Re-entering these values will restore the previous calibration.

65 Action Point 2.
As above.

66 Action Point 3.
As above.

91 Light Sensor Threshold. (0)
The Light Sensor Threshold is used to determine when the backlight will come on. As the value increases, the sensor will become more sensitive. The range is '0' to '255' where '0' is off and '255' is on.

92 Light Sensor Delay. (0)
This is the time in seconds that the backlight will remain on after the 'MOTION' annunciator goes off or a pushbutton is pressed. A value of '0' disables the timer; the maximum time is '255' seconds.

93 Power Off Timeout. (0)
The Power Off Timeout is the value in minutes before the indicator shuts itself off after motion ceases or a button has been pushed. The range is '0' to '255' minutes where '0' is timeout disabled.

98 Channel Enable. (1)
Set to '1' to enable the channel.
Set to '0' to disable the channel.
Note: If you have not connected a scale to channel 2, make sure that these channels are disabled.

99 Exit Calibration Mode (0)
Selecting this function and pressing [INC] [SHIFT] will exit the calibration mode and return the indicator to normal operating mode.
Note: This operation must be completed before the power is disconnected or else the calibration parameters will not be saved.

SECTION V - ERROR MESSAGES

10 Cannot Span a Negative Value.

11 Span table full.

20 Parameter Memory Write Error. Indicator requires service.

21 Parameter Checksum Error. (Parameters have been lost.)

22 Program Check Fault. Indicator requires service.

34 Load Cell Input Value out of Range (8 - 35 mV).

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

44 Cannot do Dead Load Calculation, Input Signal is greater than Parameter 11.

45 Cannot do Dead Load Calculation, Input Signal is too far Negative.

SECTION VI - TROUBLE SHOOTING GUIDE

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

Symptoms	Possible Cause
The indicator will not turn on, No display	- Check fuse in power supply - Check for AC power to supply and all power connections.
Display shows 'uuuuuu'	- Load cells not wired correctly (see Section II) - Defective load cell. - Dead load has not been set (see Section III)
Display shows 'EEEEEE'	- Scale is overloaded. - Overweight setting is not correct (see Parameter 4). - Dead load or Span not set properly (see Section III). - Load Cells not wired correctly (see Section III). - Defective load cell. - Unused scale channels not disabled (see Parameter 98).
Display shows 'rrrrrr',	- Dead load has not been set (see Section III). - Weight on scale is beyond Zero Window (see Parameter 21). - Scale has not been calibrated (see Section III).
Display Unstable	- Defective load cell - Load cell cabling wet or damaged - Parameter 11 not set correctly (see Section III) - Defective Power supply
No output to Printer,	- Output connector not wired correctly (see Section II)
Setpoint not working	- Output port not set-up correctly (see Appendix I).

APPENDIX I - LINEARITY ADJUSTMENT

Linearity Adjustment Functions

The DF3000 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 (3) 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, or you should replace the load cell(s)..

Four Calibration Mode functions are used for linearity adjustments:

'P 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.
'P 16'	SET SPAN POINTER	Moves the span pointer to the second entry point.
'P 17'	SET SPAN	Sets the span. Pay particular attention to the number that flashes briefly after you have pressed [INC] [SHIFT].
'P 13'	SPAN VALUE	Sets the value used for 'set span'.

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

Example for Linearity Adjustment

Scale set for 5 lb graduations -

e.g. Scale overweight is set for 5020 lb. DF3000 indicator is in Calibrate Mode. Scale has been zeroed and then Span has been set with 1000 lb test weights (as per example in Section III 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:
Select ‘P 16' and press [INC].

5000 lbs on scale --> scale reading 4990 LB

2) Select span value ‘P13' and set to 5000.

3) Set span: ‘P 17' [INC] [SHIFT].
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: ‘P 16' [DEC].
Set span at 1000 lbs and then repeat the above procedure. The position of the span pointer can always be checked by selecting ‘P 16' and observing its value.

Note: The span pointer can neither be incremented past 2 nor decremented past 1.

APPENDIX II - WEIGHT STABILIZATION SYSTEM

The DF3000 indicator features an internal resolution of 56,000 raw counts. Since the displayed resolution is limited to 5000 graduations, the indicator can utilize up to 11 internal raw counts per weight graduation (55,000/5000). 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 weighting situations.

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

The DF3000 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.

eg: 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.
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

--> 514 out
- average of 10 registers = 516 counts = 51 lb (disp. wt.)

Remember that the DF3000 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

--> 513 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 to 55 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).

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 reading 6 - 10 out --> (lost).

- 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 reading 6 - 10 out --> (lost)

- 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

1250 out --> (lost)

- 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 previous 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 Value 3) then the new reading is shifted into the averaging 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 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 1/2 OF REGISTERS	1/2 UPDATE
Average Shift Value 3		
	---LOAD ALL REGISTERS	FULL UPDATE

Guidelines For Setting Average Shift Value 1, 2 and 3

Average Shift Value 1 (‘P 41') - factory set at 3 counts.

This parameter should be set for no more than 1/2 of a graduation, i.e. If a scale has been set for 5000 graduations at 55,000 counts, then 11 counts = 1 graduation. In this case Average Shift Value 1 should be set for 4 or 5 counts. 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.

Average Shift Value 2 (‘P 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. i.e. 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 applications - change caused by liquid sloshing in tanker truck, change caused by truck engine running.

Average Shift Value 3 (‘P 43') - factory set at 1000 counts.

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

Average Register Size (‘P 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, i.e. when the change in raw counts is between Average Shift Value 1 and Average Shift Value 2. For example, if the scale is subject to repeated small vibrations, their effect can be "filtered" out by increasing the size of the register and perhaps slightly increasing the value for Average Shift 1. This should result in a more stable weight display.

If the register size is set too large there may, however, be an unacceptably long 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.

Hold Off Delay Example

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
4	15,100	50	Load 1	15,015	Load All	15,100 Off
5	15,101	1	Load 1	15,025	Load All	15,101 Delay 1
6	15,100	1	Load 1	15,035	Load ½	15,101<-- Hold
7	15,102	2	Load 1	15,045	Load ½	15,101 Off
8	15,103	1	Load 1	15,055	Load ½	15,102 Delay 2
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 cycles, the faster the indicator display reaches the target weight.

APPENDIX III - Serial Communications

The Format of the Serial Output String

The serial output string is organized as follows:

Byte#	Name	Meaning	Content
1	<STX>	The “Start of Text” marker.	Always hexadecimal 02
2	Polarity	Indicates positive/negative weight.	Space = positive, - = negative
3			Always space
4 - 9	Weight	The numerical value of the weight including an optional decimal point. The weight is always right aligned. Spaces are in place of leading zeroes.	Space,0,1,2,3,4,5,6,7,8,9 or .
10			Always space
11,12	Units	The units of measure.	KG = Kilograms, LB = Pounds
13	Channel	The currently displayed channel.	1 = ch1, 2 = ch2, A = ch1+ch2
14,15	Mode	Gross weight or Net weight.	GR = Gross, NT = Net
16			Always space
17	Status	The weight status indicator.	O = over weight, M = in motion, - = stable negative weight, Space = stable positive weight
18	<CR>	“Carriage Return” character.	Always hexadecimal 0D
19	<LF>	“Line Feed” character.	Always hexadecimal 0A

Poll Mode Command Characters

If serial communications mode 4 is selected, the indicator can perform certain functions triggered by command characters that are received at the RxD terminal.

Command Character	Function
?	Poll for the displayed weight
A	Add the displayed weight to the accumulated weight
C	Clear the accumulated weight
E	Test the display
G	Toggle Gross / Net display
H	Put indicator in shift mode
N	Tare the scale
S	Toggle Ch1 / Ch2 display
U	Units, toggles KG / LB
Z	Zero the scale
T	Display the total accumulated weight
1	Switch to displaying ch1+ch2 (if currently displayed channel is 2)
2	Switch to displaying ch1+ch2 (if currently displayed channel is 1)

The above commands, with the exception of the last three, will cause the indicator to transmit a serial output string (see previous page) containing the displayed weight.
'T' will send a serial output string containing the total accumulated weight instead.
‘1' and ‘2' will not return anything at all.