WESTERN SCALE CO. LIMITED

OPERATION MANUAL

MODEL DF3500

CONVEYOR/RATE FEEDER INDICATOR

REVISION A

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DF3500 CONVEYOR INDICATOR

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SECTION 1 - GENERAL INFORMATION

1.1 INTRODUCTION

The DF3500 Conveyor Indicator weighs a continuous load on a running belt to display flow rate and total delivered weight. This manual will lead you through all the steps required to set up and operate the conveyor indicator.

1.2 FEATURES

The DF3500 features include:

- backlit LCD with 1 inch high digits.
- field programmable site parameters.
- automatic pushbutton calibration; no pots or switches.
- flow rate, delivered weight or belt speed display.
- pulse encoder, idler or switched motion detection.
- nonvolatile totalizer and zero registers.
- rate and total setpoints with presets.
- mechanical counter pulse output including clear.
- serial communication to printer, host computer or remote display.
- optional 4-20 ma rate output.

1.3 SPECIFICATIONS

Table 1-1 gives the DF3500's specifications.

DF3500 SPECIFICATIONS	
CHARACTERISTIC	SPECIFICATION
Flow Rate	9999 TON/HR or TONNE/HR maximum 999.9 TON/HR or TONNE/HR maximum 99.99 TON/HR or TONNE/HR maximum 9.999 TON/HR or TONNE/HR maximum 9999 lb/hr or kg/hr maximum
Total Delivered	999999 TON or TONNE maximum 99999.9 TON or TONNE maximum 9999.99 TON or TONNE maximum 999.999 TON or TONNE maximum 999999 lb or kg maximum
Scale Weight Capacity	Unrestricted lb or kg
Belt Speed	999.9 ft/min or m/min maximum
Sample Frequency	Approximately 10/sec depending on scale calibration
Display Update Rate	0.2 secs to 8.2 secs
Encoder Frequency	4 KHz to 20 KHz maximum inversely proportional to update rate
Belt Motion Detection	1 pulse/update or switched
Load Cell: Type Excitation Voltage Current Capacity	 2 - 3 mV typical 10V typical 125 mA maximum 4 - 350 ohm load cells
Full Scale Input	8 mV to 35 mV
Maximum Dead Load	Full scale setting
Serial Port: Baud Rate Modes	RS-232C Compatible; 0V and +5V 75 - 9600 Baud Printer, strobed, polled or continuous
Temperature: Operating Storage	 -10 to +40 degrees C -40 to +85 degrees C
Relative Humidity	0 to 90% non-condensing
Power Requirements: AC	 0.125A @ 117VAC/220 VAC
Dimensions: Width Length Height	 8 inches (203mm) 10 inches (254mm) 6 inches (152mm)

TABLE 1-1

1.4 GENERAL DESCRIPTION

The DF3500 Conveyor Indicator provides flow rate and total delivered weight displays. Scale weight and belt speed readouts may also be selected. Units are selectable between lb-TON and kg-TONNE. Linear measurement may be in feet or meters.

A test weight is used for static calibration of the scale. A tachometer is used to set the speed of a variable speed belt while an encoder will set the speed of a fixed speed belt.

The belt running is detected using a pulse encoder, idler or switched input. A pulse encoder must be used on variable speed belts. On belts running at fixed speeds, either a single pulse per revolution or a centrifugal force switch may be used.

The display update rate is automatically determined from the encoder input rate. A minimum number of pulses is required per calculation to get an accurate flow rate reading. The flow rate is averaged for a steady display.

The flow rate is spanned by running a known amount of product across the scale and adjusting the total delivered weight.

Two setpoints are provided for each rate and total. Pulse outputs for a mechanical counter with clear are available.

Nonvolatile memory is used to store the following:

- calibration
- total weight delivered
- scale zero register
- belt running zero average
- setpoints.

NOTE: This allows the Conveyor Scale to continue running after momentary power failure.

Flow rate and total delivered weight may be sent to a RS-232C compatible printer, host computer or remote display.

1.5 EQUIPMENT REQUIRED

EQUIPMENT REQUIREMENTS	
External Equipment	120VAC Power Source Pulse encoder, idler pulsed switch or centrifical force switch Weigh bridge with load cell(s) Motor Drive, conveyor belt, etc.
Optional Equipment	Mechanical counter Tape printer, host computer or remote display RS-232C level interface board
Test Equipment	Digital Multimeter Function generator Load Cell simulator Terminal (RS-232C compatible)

TABLE 1-2

SECTION 2 - INSTALLATION GUIDE

2.1 LOCATION

The DF3500 indicator should not be exposed to direct sunlight, excessive mechanical abuse, vibration or moisture.

2.2 POWER SUPPLY

The DF3500 conveyor indicator requires 110V AC or 220V AC @.125A power. Jumpers on board 111050 must be set for appropriate line voltage. See Figure 2-1 for AC wiring.

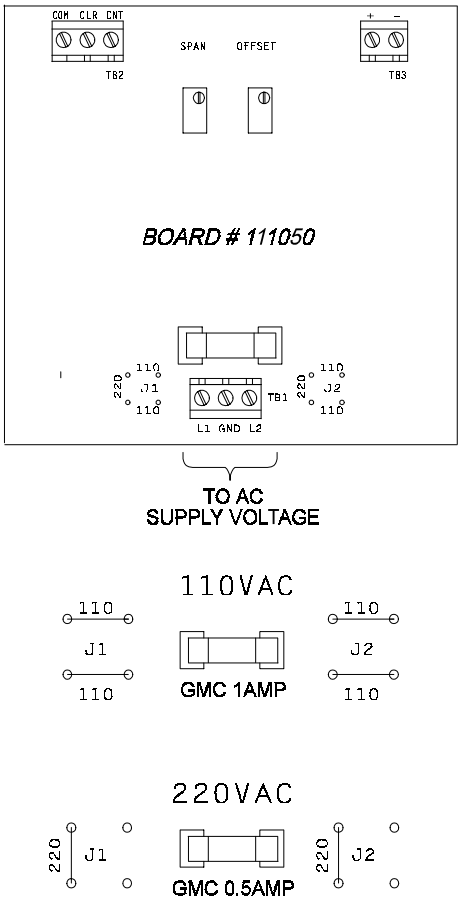

FIGURE 2-1. AC POWER WIRING

2.3 LOAD CELL

Connect load cell(s) to TB2 on the CPU/Analog Board; see Figure 2-2. Refer to Table 2-1 for load cell wiring by manufacturer.

CAUTION: To prevent shorting, any exposed length of shield wiring should be insulated with heat shrink tubing or tape.

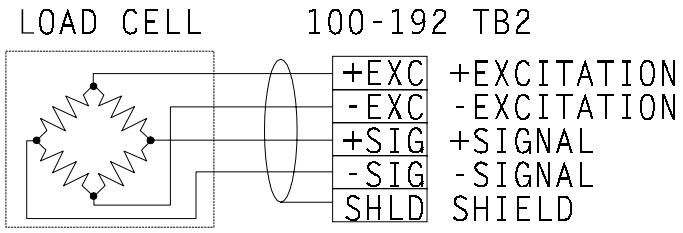

FIGURE 2-2. LOAD CELL TERMINATION

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

TABLE 2-1.

2.4 BELT RUNNING DETECTION

The pulse encoder, pulsed idler or centrifugal force switch connections are shown in Figure 2-3.

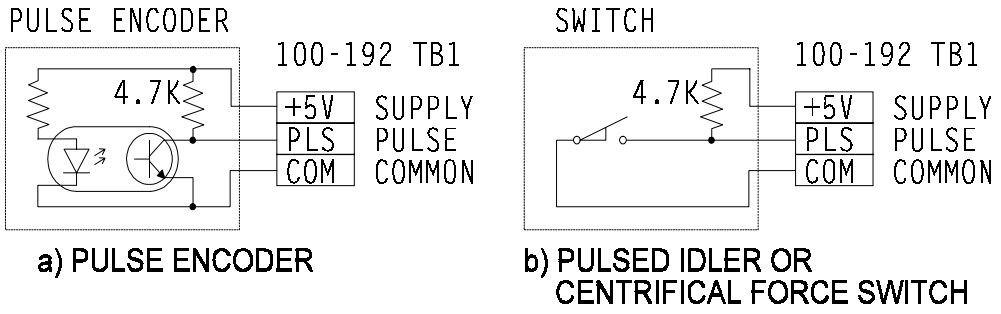

FIGURE 2-3. MOTION DETECTION CIRCUITS

2.5 ANALOG OUTPUT

An optional 4-20 ma analog rate output is available on TB3 of Board 111050. See Figure 2.4

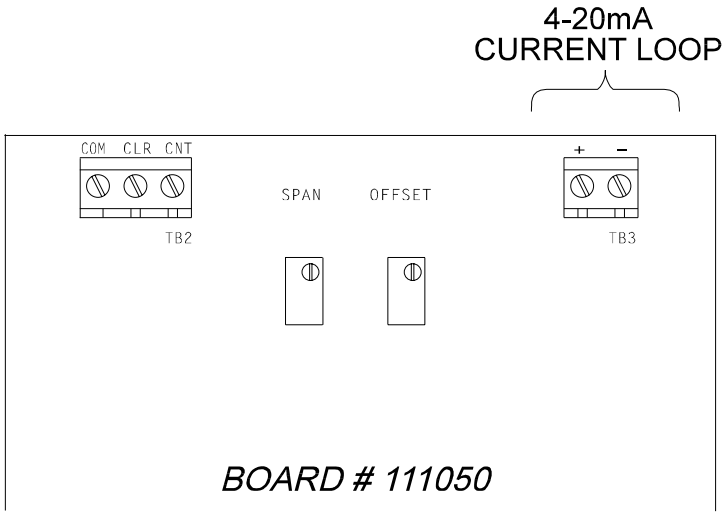

FIGURE 2-4. ANALOG OUTPUT WIRING

2.6 SERIAL PORT

A cable for serial communication to a printer, computer or remote display may be connected to terminal block TB3 on the 100556 Board - see Figure 2-5. Table 2-2 gives common hook-up examples.

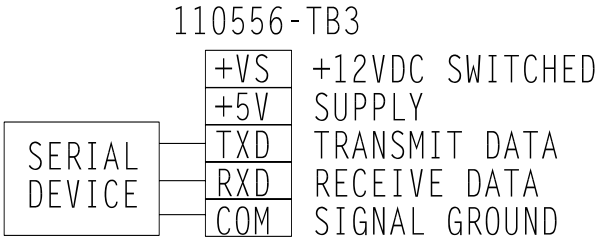

FIGURE 2-5. SERIAL INTERFACE

SERIAL CABLE CHART

DEVICE	TXD	RXD	COM	TIE TOGETHER
Printer	3	20	7	
PC-DB25	3	2	7	4,5,6,8
PC-DE9	2	3	5	1,6,7,8
RD2000	2	3	1	

TABLE 2-2.

2.7 SETPOINTS

Wire setpoints and mechanical counter as per Table 2-3:

PARAMETER	DESCRIPTION	PIN# (TB2 on 110556)
	+5 Volts Output	+5V
51	Rate Setpoint 1	SP0
52	Rate Setpoint 2	SP1
53	Total Setpoint 1	SP2
54	Total Setpoint 2	SP3
	Total Counter Pulse	SP4
	Total Counter Clear	SP5
	Signal Ground	COM

TABLE 2-3

NOTE: Maximum drive current of each setpoint is **5 mA**. This will drive a Solid State relay directly, however, any other form of contacts will require additional drive circuitry.

2.8 MECHANICAL COUNTER OUTPUT

A higher current DC output to drive a mechanical totalizer counter is available on TB2 of board 111050. See Figure 2.6 for wiring.

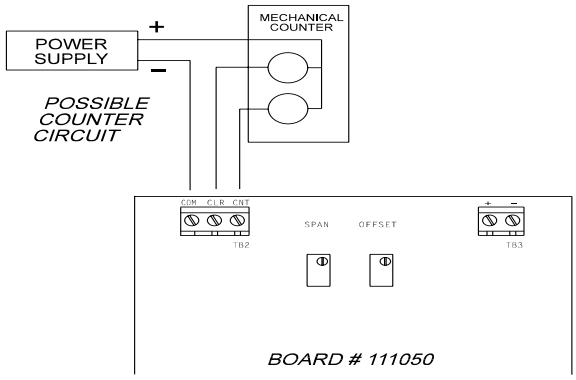

FIGURE 2-6 MECHANICAL COUNTER WIRING

SECTION 3 - OPERATION INSTRUCTIONS

3.1 ANNUNCIATORS

The DF3500 indicates the current display mode and conditions using annunciators shown in Table 3-1.

ANNUNCIATOR LIST	
INDICATOR	FUNCTION
1	Flow rate display.
2	Total delivered display.
MOTION	Belt running.
OVER	Scale error.
ZERO	Zero range.
NET	Scale weight display.
CAL	Calibrate mode.
'rrrrrr'	Power on reset warning.
'0' flashing	Zero average routing running.

TABLE 3-1

3.2 KEYPAD LAYOUT

The DF3500 functions are selected using a four button keypad. Figure 3-1 illustrates the pushbuttons.

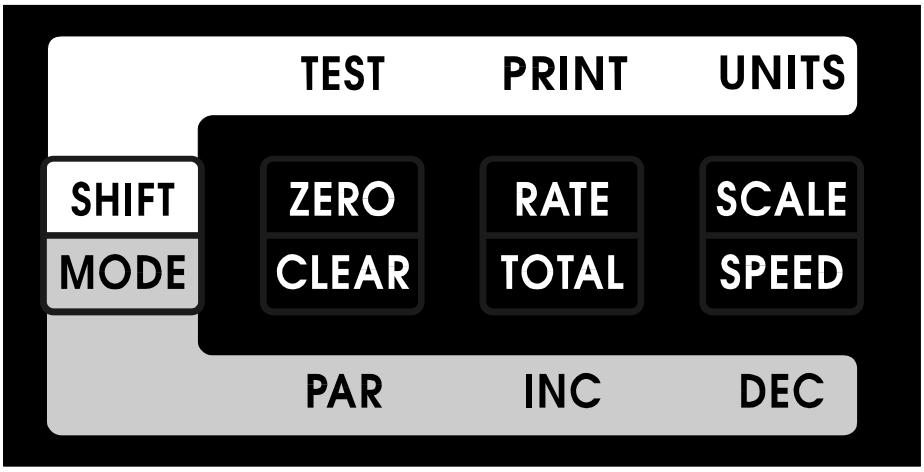

FIGURE 3-1 KEYPAD PUSHBUTTONS

3.3 SHIFT/MODE

The [SHIFT] key is used to access the functions listed above the remaining three keys. To select a shift function, first press the [SHIFT] button, the display will flash, then press the button under the function. There is a 10 second time out.

Press the [MODE] button twice to enter the setpoint parameter mode, see Section 3.10. To exit this mode, press [MODE] again.

3.4 ZERO/CLEAR

The [ZERO] key works differently depending on the current display mode.

While displaying the flow rate, '1' annunciator on, press and hold the [ZERO] key to activate the zero average routine. For this to happen, the scale weight must be within the zero range - see Section 5.5, as indicated by the 'ZERO' annunciator. The zero average routine will run for 5 belt revolutions with a flashing 'O' in the left most digit. The only way to cancel this routine is to press the calibrate pushbutton inside the indicator.

While displaying the scale, 'NET' indicator on, press the [ZERO] key to zero the scale static weight. The 'MOTION' annunciator must be off and scale must be within the zero window - see Section 5.21. Also use the [ZERO] key to clear the power on reset warning display, 'rrrrrr'.

Press and hold the [CLEAR] key while in total display, '2' annunciator on, to clear the total. This will also clear the mechanical counter if the clear signal is hooked up.

3.5 RATE/TOTAL

Press [RATE] to display the flow rate at any time. The '1' annunciator will be on.

To display the total delivered weight, first press [RATE] and then press [TOTAL]. The '2' annunciator will be on.

3.6 SCALE/SPEED

Press [SCALE] to display the scale weight at any time. The 'NET' indicator will be on.

To display the conveyor belt speed, press [SCALE] and then [SPEED]. The '1', '2' and 'NET' indicators are off.

3.7 TEST

To test the scale display, press [SHIFT] and then [TEST]. All segments are turned on momentarily followed by a diagnostic weight display.

3.8 PRINT

To send the rate or total, depending on display mode, out of the serial port press [SHIFT] and then [PRINT].

NOTE: The transmission mode must be set to '1' - see Section 5.32.

3.9 LB/KG

If the total is clear, press the [SHIFT] then [LB/KG] to alternate between pounds and kilograms. The corresponding units' annunciator will turn on.

3.10 SETPOINTS

Table 3-2 lists the setpoints by parameter number. The setpoints may be preset during calibration - see Sections 5.51 to 5.54, or during 'run' mode by pressing the [MODE] key twice. Select the parameter number by pressing the [PAR] key. To increment or decrement the setpoint value, press the [INC] or [DEC] keys respectively. Hold these keys down for repeat and hyper repeat. Press the [MODE] key to exit.

SETPOINT PARAMETERS	
PARAMETER	SETPOINT
51	Rate 1
52	Rate 2
53	Total 1
54	Total 2
80	Flowrate*

*Flowrate for rate feeder operation

TABLE 3-2.

3.11 ERROR MESSAGES

The following Error Messages may appear:

'Err 20' - Parameter Memory Write Error. Indicator requires service.

'Err 21' - Parameter Checksum Error. (Parameters have been lost.)

'Err 22' - Program Check Fault. Indicator requires service.

'Lo bAt' - Power supply input voltage is low.

SECTION 4 - CALIBRATION INSTRUCTIONS

4.1 CALIBRATE MODE

To enter calibration mode, press the pushbutton inside the indicator marked 'S1'. This is located on the bottom left corner of the 100-193 display board. To exit the calibration mode, see Section 4.99.

4.2 ZERO/CLEAR

The [ZERO] and [CLEAR] functions work as in 'run' mode. While in rate display, the [ZERO] key activates the zero average routine. In scale display, it zeros the static weight. In total display, the [CLEAR] key clears the accumulated total.

4.3 RATE/TOTAL

The [RATE] and [TOTAL] functions work as in 'run' mode. To display flow rate, press the [RATE] key. To display total delivered weight, press the [RATE] key followed by [TOTAL].

4.4 SCALE/SPEED

Press [SCALE] to see the scale weight. Press [SCALE] again to see internal counts. A flashing 'A' in the leftmost digit indicates internal counts displayed.

The speed display is not available in calibrate mode.

4.5 SHIFT/MODE

The shift functions are not accessible in calibrate mode.

Press the [MODE] key to see calibration parameters. The parameter display flashes 'P' followed by the parameter number alternately with the parameter's value.

4.6 PAR

While in the parameter display, press the [PAR] key to increment the current parameter number.

4.7 INC

Press [INC] to increment the parameter's value. This key has auto repeat by holding it down. Pushing this key for an extended period of time will initiate hyper repeat for large values.

4.8 DEC

Pressing [DEC] decrements the parameter's value. Has repeat as above.

4.10 STATIC CALIBRATION

To calibrate the indicator, the following parameters MUST be set first:
(See the corresponding subsections in Section 5 for details.)

P 01 Factory Reload - starting point

P 02 Scale Decimal Point - e.g. 2 for 0.01 kg grads

P 03 Graduation Size - Overweight/5000 minimum

P 04 Overweight - 5000 * grad size maximum

P 05 Push to Zero Window - 20% typical

P 06 Power On Units - as required

P 07 Displayed Units - same as test weight

P 08 U.S.A. Display Flag - U.S.A. only

P 09 Power On Reset Warning - should be on.

NOTE: The following subsection numbers correspond to the parameter numbers.

4.11 SETTING FULL SCALE OUTPUT

NOTE: The following parameter must be set BEFORE adjusting the Dead Load or Span.

This is the coarse span adjustment for the scale. It must be matched with the working range of the load cell to get the rated performance from the scale.

P 11 Load Cell Full Scale Output - in millivolts

You may use the Formula Method or the Trial & Error Method to determine the value of this parameter:

FORMULA METHOD

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

$$\frac{Load\ Cell\ Used}{Load\ Cell\ Capacity}\ x\ Rated\ mV\ Output\ x\ 9$$

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

$$\frac{400\ lb}{1000\ lb}\ x\ 3\ x\ 9\ =\ 11$$

TRIAL & ERROR METHOD

Follow these steps to set the output value of the load cell:

1. Display the internal counts by pressing [SCALE] until a flashing 'A' appears in the leftmost display digit. Make sure the scale is clear of weight and note the counts value.

e.g. Internal counts = 3431.

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

   e.g. Scale capacity = 50.00 kg
   Apply 10.00 kg (1/5 of capacity)
   Internal counts = 11223.
   Change in reading is 11223 - 3431 = 7782

   The indicator has 60,000 internal counts available, for maximum performance, the internal counts must be between 50,000 and 60,000 at scale capacity.

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

   Increment Parameter 11 to decrease the change in counts.
   Decrement Parameter 11 to increase the change in counts.

   e.g. Parameter 11 must be decremented until the above procedure gives a change of between 10,000 and 12,000 internal counts.

If the internal counts are less than 50,000, the displayed weight readings will tend to be unstable. If the counts exceed 60,000, the indicator will overrange at capacity. Make sure the counts at capacity will fall between these limits. Some load cells will not reach 50,000 counts. As close as possible is adequate.

4.12 SCALE DEAD LOAD

Remove all weight from the scale. To set the automatic dead load compensation, select parameter 12 and press [INC] then [MODE]. The indicator now enters a routine to zero the deadload (a flashing 'd' will appear in the leftmost display digit). See Section 5.12 for details.

P 12 Set Dead Load - automatic dead load.

4.13 SPAN VALUE

Set parameter 13 to the test weight value being used to calibrate the scale. Use test weights equivalent to at least two-thirds of the static weight capacity of the scale. See Section 4.17 for setting span.

P 13 Span Value - test weight >= 2/3 capacity.

4.17 SET SPAN

Zero the scale using the [ZERO] key. Place the test weight on the scale. Make sure you have previously entered the test weight value in parameter 13. Select parameter 17 and press [INC] then [MODE]. This will span the indicator. Remove the test weight and check zero. Re-apply the weight and repeat this step if necessary.

P 17 Set Span - new span setting.

4.18 WEIGH BRIDGE LENGTH

NOTE: ALL LINEAR MEASUREMENTS MUST BE IN THE SAME UNITS.

Set the Weigh Bridge Length according to Figure 4-1.

P 18 Weigh Bridge Length - as determined.

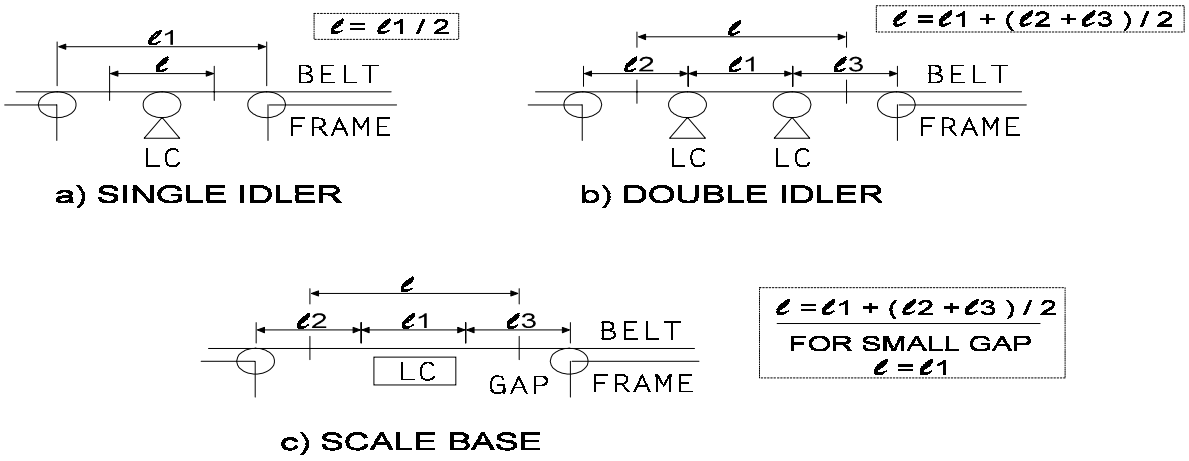

FIGURE 4-1. WEIGHBRIDGE LENGTH

4.19 BELT LENGTH

NOTE: ALL LINEAR MEASUREMENTS MUST BE IN THE SAME UNITS.

Set to the total Belt Length.

P 19 Belt Length - distance for 1 revolution.

4.20 FLOW RATE/TOTAL DELIVERED WEIGHT UNITS

Set this flag to '1' for a TON-TONNE display, otherwise, set it to '0' for a lb-kg display.

P 20 TON/TONNE Flag - as above.

4.21 CONVEYOR DECIMAL POINT

Enter the decimal point position, for the TON-TONNE Flow Rate and Total Delivered Weight displays. This value is ignored if running in lb-kg - see Section 4.20.

P 21 Conveyor Decimal Point - 0 to 3 - right to left.

4.22 FIXED BELT SPEED

If using an encoder to measure belt travel (Variable Speed), this parameter should be '0', otherwise, set it to '1' for a Fixed Speed belt. See Section 5.22 for more details.

P 22 Fixed Belt Speed Flag - motion detection.

4.23 MOTION DETECTION

If you are not using a speed encoder to detect belt motion, set this flag to '1' for level or '0' for pulse sensitivity. For example, set to ‘1’ if using a ‘belt run’ contact or set to ‘0’ if using a pulsed idler switch.

P 23 Motion Detection Flag - depending on sensor.

4.24 ZERO RANGE

With the belt stationary, display the scale weight and push the [ZERO] key. Run the belt with no material and watch the scale weight display. Set the zero range to a value greater than the largest plus or minus fluctuation. The zero annunciator will stay on after this procedure.

P 24 Zero Range - belt running; no material.

4.25 SAMPLE RATE

To set the Sample Rate automatically, run the belt at least 75% of full speed, access parameter 25 and push [INC]. Check parameter 70 sample rate value.

P 25 Set Sample Interval - belt speed >= 75%.

4.26 ENCODER

For a variable speed belt, the Encoder Value may be entered here. If this value is not known, skip this step. This value is calculated automatically when parameter 27 (below) is set to a known belt speed.

P 26 Encoder Value - pulses per unit distance.

4.27 BELT SPEED

NOTE: ALL LINEAR MEASUREMENTS MUST BE IN THE SAME UNITS.

While the belt is running, set this parameter to show the actual speed. Actual speed can be a calculated value or one measured with a tachometer.

P 27 Belt Speed - distance per minute.

4.28 RESET RATE/TOTAL

This parameter may be used to reset the flow rate and total delivered weight displays back to theoretical if total delivered has been previously spanned using Parameter 29. See Section 5.28 for details.

P 28 Reset Rate/Total - to see theoretical.

4.29 TOTAL SPAN

Start belt and allow it to limber up for 5 minutes. Set speed to at least 75% of maximum for a variable speed belt. Switch to the Flow Rate display by pressing [RATE].

With the zero annunciator on, press and hold the [ZERO] key until a flashing '0' appears in the leftmost digit of the display. The indicator is now in a zero averaging routine.

When the average zero has been obtained, the display will indicate the Flow Rate.

Run material over the scale. The displayed Flow Rate should be accurate to within 10% of actual.

Set the display to Total Delivered Weight. Zero the totalizer by pressing the [ZERO] key. Run a fixed amount of material over the scale into a weighing vessel at 70 to 100 percent of belt capacity. Compare the displayed total weight with the actual weight.

Access Parameter 29 and adjust the value to indicate the actual delivered weight. Run more product until the desired accuracy is achieved. * Note, when adjusting the total value in parameter 29, you may have to press and hold the adjust key for many seconds until the value changes. This is due to internal calculations being performed to compute a new total.

P 29 Total Span - actual delivered weight.

4.30 D/A CAPACITY

This is the flow rate capacity for the optional 4-20mA output.

P 30 D/A Capacity - flow rate capacity.

4.87 CORRECTION RATE

For rate feeder applications, where the 4-20mA output controls the motor speed, enter a value greater than 0. This is the number of samples between error corrections.

4.99 EXIT CALIBRATION

Exit Calibration by selecting parameter 99 and pressing [INC] then [MODE].

P 99 Exit Calibration - saves parameters.

SECTION 5 - CALIBRATION PARAMETERS

NOTE: The parameter number is the subsection number. The factory setting is contained within brackets.

5.1 FACTORY RELOAD

NOTE: Setting this function resets ALL parameter values. All values other than factory values will have to be re-entered where required.

Resets the calibration parameters to factory values. When you have selected this function, press [INC].

5.2 SCALE DECIMAL POINT (2)

Select scale decimal point position to correspond with graduation size.

5.3 GRADUATION SIZE (2 (lb)/1 (kg))

Select one of the following graduation sizes:

lb Mode: 2, 5, 10
kg Mode: 1, 2, 5.

5.4 OVERWEIGHT (150.02lb/68.05kg)

Must be 5000 or less displayed graduations and greater than 1 graduation.

5.5 PUSH TO ZERO WINDOW (20%)

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.

5.6 POWER ON UNITS (1)

Selects the displayed units active when power is applied to the indicator as follows:
0 = lb-TON
1 = kg-TONNE.

5.7 DISPLAYED UNITS

Allows you to calibrate in pounds or kilograms as follows:

0 = lb-TON
1 = kg-TONNE.

5.8 U.S.A. DISPLAY (0)

Setting the U.S.A flag to '0' gives the standard display. Setting the flag to '1' causes the following display changes:

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'.

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.

5.9 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 '1' and the RAM is not battery backed, then the weight display will show 'rrrrrr' on power up until an initial push to zero occurs.

5.11 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.

In order to achieve the rated performance from the indicator, this parameter must be set accurately. Refer to Section 4.11 to determine the value of this parameter.

If the following error occurs, simply access this parameter and adjust the range as below:

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

5.12 SET DEAD LOAD

This function automatically compensates for the scale dead load. When you have selected this function, press [INC] then [MODE]. The indicator enters a routine to zero the dead load. While this routine is in progress, a flashing 'd' will appear in the leftmost display digit. Upon completion of the dead load routine, the weight display will be at or near zero.

The automatic dead load routine will not work if the dead load is greater than the value entered for Load Cell Full Scale Output - see Section 5.11.

If one of the following error messages appears, adjust the value of parameter 11 accordingly:

'Err 44' - Cannot do Dead Load Calculation, input signal is greater than Parameter 11.

'Err 45' - Cannot do Dead Load Calculation, input signal is too negative.

5.13 SPAN VALUE

This value represents the test weight size used for static calibration. Refer to Section 4.13 on how to set the span.

5.14 RESET DEAD LOAD

Returns the indicator to the no dead load setting. To perform this function, press [INC]. Then [MODE].

5.15 RESET SPAN TABLE

Clears the span table except for the first entry. This will clear any previous calibration. Do this before calibrating the indicator. When you have selected this function, press [INC]. Then [MODE].

5.16 SET SPAN POINTER

Allows you to make a second span adjustment to correct a scale linearity error. Moves the span pointer between the first and second entry points.

5.17 SET SPAN

To set the span using the Parameter 13 value, place test weights on scale, then press [INC] then [MODE]. While the indicator is setting span, a flashing 'S' will appear in the leftmost digit. The following error messages may appear:

'Err 10' - Cannot Span a Negative Value (adjust value of Parameter 13)
'Err 11' - Span table full. (reset span table - see Section 5.14)

5.18 WEIGHBRIDGE LENGTH (10.00)

Enter the weigh bridge length in feet or meters.

5.19 BELT LENGTH (100.00)

This is the total belt length in feet or meters.

5.20 TON/TONNE FLAG (1)

Setting this flag to '1' runs the indicator in TON or TONNE depending on units selected. With this flag set to '0', the rate and total are in lb or kg with no decimal point.

5.21 CONVEYOR DECIMAL POINT (2)

Select the decimal point position for flow rate and total delivered weight. The conveyor decimal point is ignored if the TON/TONNE flag is '0'.

5.22 FIXED BELT SPEED FLAG (0)

Selects fixed belt speed operation when set to '1' and variable belt speed (encoder) operation when set to '0'. Motion detection uses 1 pulse per revolution or a level input when this flag is set to '1' - see Section 5.23.

5.23 MOTION DETECTION FLAG (0)

NOTE: This parameter applies to fixed belt speed mode only. (No encoder)

The motion detection sensitivity works as follows:

0 = Pulse (eg. idler roller switch, 1 pulse per revolution)
1 = Level. (eg. belt running signal from motor starter)

5.24 ZERO RANGE (1.10lb / 0.50kg)

Enter a weight value to determine the zero range. The flow rate and total delivered weight calculations ignore any value within zero range. Weight fluctuations, due to belt motion which fall within the zero window, are also ignored.

5.25 SET SAMPLE RATE

To set the Sample Rate based on the present belt speed (belt must be running), press [INC]. See Parameter 70 for actual value.

5.26 ENCODER VALUE (1000 pulses per unit distance)

This is the number of pulses per foot or meter output by the encoder. This value changes when the belt speed is set using parameter 27.

5.27 BELT SPEED

This is the current Belt Speed (belt must be running) which can be adjusted up or down to match a tachometer or calculated reading. The Encoder Value is affected by this change - see Section 5.26.

5.28 RESET RATE/TOTAL

Press [INC] to reset the rate/total span value - for actual span value see Section 5.71.

5.29 SPAN TOTAL

Adjust the total delivered weight up or down to match the actual delivered weight. The total

span correction factor value is changed (see par. 71) when you adjust the total with parameter 29. Note: You may have to press and hold the adjust key for many seconds before the displayed value changes.

5.30 D/A CAPACITY (10.00 TONNE/HR)

This is maximum capacity of the optional 4-20 mA Flow Rate Output. (Proportional mode only)

5.31 BAUD RATE

Selects one of the following baud rates for the serial port:

75, 150, 300, 600, 1200, 2400, 4800 or 9600.

5.32 SERIAL MODE

Selects the operating mode of the serial data port - see Section 7.1 for more details:

1 = Output only when [PRINT] button is pressed.
2 = Output when Strobe = 1.
3 = Output when Strobe = 0.
4 = Output when poll character is received.
5 = Continuous output.
6 = Remote rate setpoint.
7 = RD2000 (To operate a remote display).
8 = 4-20mA I/O.

5.41 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.

5.42 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.

5.43 AVERAGE SHIFT VALUE 3 (1000)

When the internal 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.

5.44 NUMBER OF AVERAGES (20)

Selects the size of the Average Register as 10, 20, 50 or 100 shifts.

5.45 HOLD OFF DELAY 1 (15)

Sets the number of integrater 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.

5.46 HOLD OFF DELAY 2 (30)

Sets the number of integrater 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.

5.47 CONVEYOR SHIFT 1 (0.03)

The system has a register which averages 10 or more flow rate readings. When the flow rate reading changes less than Conveyor 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 Conveyor Shift 1 is 3 counts.

5.48 CONVEYOR SHIFT 2 (5.00)

When the flow rate reading changes more than Conveyor Shift 1 counts and less than Conveyor 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 Conveyor Shift 2 is 500 counts (for rate feeder applications set to 50 counts).

5.49 CONVEYOR SHIFT 3 (10.00)

When the flow rate reading changes more than Conveyor Shift 2 counts and less than Conveyor 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 Conveyor Shift 3 is 1000 counts (for rate feeder applications set to 100 counts)

5.50 OUTPUT MASK (000000)

Used to control the active level of the setpoints. The 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, left to right, for each of the following:

- total counter clear
- total counter pulse
- total setpoint 2
- total setpoint 1
- rate setpoint 2
- rate setpoint 1.

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. For the counter outputs, a '1' inverts the signals.

5.51 RATE SETPOINT 1 (0.00)

This is the rate setpoint 1 preset.

5.52 RATE SETPOINT 2 (0.00)

This is the rate setpoint 2 preset.

5.53 TOTAL SETPOINT 1 (0.00)

This is the total setpoint 1 preset.

5.54 TOTAL SETPOINT 2 (0.00)

This is the total setpoint 2 preset.

5.60 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.

5.61 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.

5.62 SPAN FACTOR 3

As above.

5.63 SPAN FACTOR 4

As above.

5.64 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.

5.65 ACTION POINT 2

As above.

5.66 ACTION POINT 3

As above.

5.70 SAMPLE RATE (64)

This is the time in 32.77mS intervals required to quantitize the data and determine the update rate. This value is automatically set using parameter 25. (Values above 200 will produce relatively slow display updates and/or rate feeder responses. Speeding up the encoder will usually correct this.)

5.71 TOTAL SPAN

This factor is used to adjust the total delivered weight and flow rate to reflect actual values. Re-entering this value will restore calibration.

5.80 FLOW RATE SETPOINT (0.00)

This is the default rate setpoint for rate feeder applications.

5.81 ERROR 1 (1.00)

When the difference between the flow rate setpoint and the actual flow rate is less than ERROR 1, the 4-20mA output remains unchanged. If the error is between ERROR 1 and ERROR 2, CORRECTION 1 is applied. (Rate feeder application only)

5.82 ERROR 2 (2.00)

When the flow rate error is between ERROR 2 and ERROR 3, CORRECTION 2 is applied. (Rate feeder application only)

5.83 ERROR 3 (3.00)

When the error is greater than ERROR 3, CORRECTION 3 is applied. (Rate feeder application only)

5.84 CORRECTION 1 (10)

Is the number of steps the 4-20mA output is changed either up or down when the error is betwen ERROR 1 or ERROR 3. (Rate feeder application only)

The resolution is of the DAC is 1 in 4096. The allowable range for this setting is 0 to 255.

5.85 CORRECTION 2 (20)

As above, but for errors between ERROR 2 and ERROR 3. (Rate feeder application only)

5.86 CORRECTION 3 (50)

As above, but for errors greater than ERROR 3. (Rate feeder application only)

5.87 CORRECTION RATE

When this value is 0, the 4-20mA output is proportional to the flow rate (standard conveyor scale). When set to a non-zero value for rate feeders, this is the number of updates between calculating the error used to determine the 4-20mA output step response.

5.91 LIGHT SENSOR THRESHOLD (0)

The Light Sensor Threshold is used to determine when the backlight will turn 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.

5.92 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.

5.99 EXIT CALIBRATION

Selecting this function and pressing [INC] then [MODE] will exit the calibration mode and return the indicator to normal operating mode. This operation must be completed before the power is disconnected or the calibration parameters will be lost.

SECTION 6 - SAMPLE CALCULATION

6.1 UPDATE TIME

Calculate the Update Time as below

$$Update\ Time = Sample\ Rate\ x\ 32.77\ msec/sample$$

$$= 57\ samples/update\ x\ 32.77\ msec/sample$$

$$= 1.87\ \text{sec}/update$$

6.2 BELT SPEED

Calculate the Belt Speed as below:

$$Belt\ Speed = \frac{Pulse\ Count\ x\ 60\ \text{sec/min}}{Encoder\ Value\ x\ Update\ Time}$$

$$= \frac{45000\ pulses/update\ x\ 60\ \text{sec/min}}{10000\ pulses/ft\ x\ 1.87\ \text{sec}/update}$$

$$= 144.4\ ft/\text{min}$$

6.3 ZERO AVERAGE TIME

Calculate the Zero Average Time as below:

$$Zero\ Average\ Time = \frac{Belt\ Length}{Belt\ Speed}\ x\ 5$$

$$= \frac{100.00\ ft}{144.4\ ft/\text{min}}\ x\ 5$$

$$= 3.5\ \text{min}$$

6.4 WEIGHT DELIVERED

Weight Delivered in one update is calculated as follows:

$$Weight\ Delivered = \frac{ScaleWeight}{Conversion}\ x\ \frac{PulseCount}{Weigh\ Bridge\ x\ Encoder\ Value}$$

$$= \frac{37.50\ kg}{1000\ kg/tonne}\ x\ \frac{45000\ pulses}{2.00\ ft\ x\ 10000\ pulses/ft}$$

$$= 0.0844\ tonne$$

6.5 FLOW RATE

Flow Rate is determined as follows:

$$Flow\ Rate = Weight\ Delivered\ x\ \frac{3600\ \text{sec}/hr}{Update\ Time}\ x\ Total\ Span$$

$$= 0.0844\ Tonne\ x\ \frac{3600\ \text{sec}/hr}{1.87\ \text{sec}}\ x\ 1.00000$$

$$= 162.5\ Tonne/hr$$

6.6 TOTAL DELIVERED

The Total Delivered is calculated as follows:

$$Total\ Weight = Total\ Weight + Weight\ Delivered$$

$$= 50.0000\ Tonne + 0.0844\ Tonne$$

$$= 50.0844\ Tonne$$

$$Total\ Delivered = Total\ Weight\ x\ Total\ Span$$

$$= 50.0844\ Tonne\ x\ 1.00000$$

$$= 50.1\ Tonne$$

6.7 D/A CONVERTER

The Flow Rate Output is determined as follows:

$$4\text{-}20\ mA\ Output = \frac{Flow\ Rate}{D/A\ Capacity}\ x\ 16\ mA + 4\ mA$$

$$= \frac{162.5\ Tonne/hr}{200.0\ Tonne/hr}\ x\ 16\ mA + 4\ mA$$

$$= 17.0\ mA$$

SECTION 7 - SUPPORT INFORMATION

7.1 SERIAL FORMAT

The DF3500 Serial port can talk to a printer, host computer or remote display. See Section 5.31 and 5.32 for selection of baud rate and operating mode. Section 2.6 gives wiring details.

The serial output is RS-232C compatible, but the voltage levels are 0 and +5 VDC. This works with all computers except portables.

The character format is:

8 bits, no parity, 1 stop bit.

Each data string output by the serial port is described below:

Printer (mode 1):

```
          1         2
12345678901234567890123456   6

RATE:  ddddd.dd rrrrrrrr<CR><LF>

TOTAL: ddddd.dd ttttt    <CR><LF>
```

Rate & Total (modes 2, 3, 4, 5 & 6):

```
              1         2
1    2345678901234567890123456789012345678   8

<STX>ddddd.dd rrrrrrrr ddddd.dd ttttt    <CR><LF>
```

Rate (mode 4):

```
                1            2
1    2345678901234567890   0

<STX>ddddd.dd rrrrrrrr<CR><LF>
```

Total (mode 4):

```
                1            2
1    2345678901234567890   0
<STX>ddddd.dd ttttt   <CR><LF>
```

d = data: leading zeros suppressed, decimal point suppressed if in position 0

r = rate units: LB/HR
KG/HR
TON/HR
TONNE/HR

t = total units: LB
KG
TON
TONNE

In mode 4, the poll characters are:

1 = Rate

2 = Total

3 = Rate and Total

In modes 6 and 8, the input strings are:

```
1 2 3 4 5 6
R S S S S <CR>
R $ x x x <CR>
```

S = the flow rate setpoint with decimal points supressed.
x = the flow rate setpoint as a 12 bit hexidecimal value spanned with D/A capacity.

7.2 LINEARITY ADJUSTMENT

The DF3500 allows for the correction of scale or load cell non-linearity with an extra span entry. The amount of correction is limited to +/- 3 graduations. Correcting an error greater than 3 grads will result in inaccurate weight readings. If there is non-linearity of more than 3 graduations, make a closer mechanical inspection of the scale and its installation or replace the load cell(s).

e.g. Indicator set for 5020 lb capacity with 5 lb graduations. Scale has been zeroed and the Span set with 1000 lb test weight.

The following test weights are applied and readings are taken:

- 2000 lb weight is 2000 lb display
- 3000 lb weight is 2995 lb display
- 4000 lb weight is 3995 lb display
- 5000 lb weight is 4990 lb display.

The error at capacity is -10 lb or -2 grad; the break point is near 1000 lb.

To correct this error increment the Span Pointer, Parameter 17 to 2 then set span at 5000 lb.

Test scale at 0, 1000, 2000, 3000, 4000 and 5000 lb.

7.3 TROUBLE SHOOTING

Table 7-1 describes possible difficulties encountered when installing or operating the indicator.

TROUBLE SHOOTING GUIDE

SYMPTOM	SOLUTION/CAUSE
The indicator will not turn on - no display	1. Check AC power source. 2. Check power connection - see Section 2.2.
Flow Rate is zero. Motion indicator off.	1. Bad sensor; check encoder or switch. 2. Sensor not wired correctly - see Section 2.4. 3. Parameters 22 and 23 are not set correctly - see Sections 4.22 and 4.23 respectively.
Flow Rate is zero. Motion indicator on.	1. Check scale display. 2. Parameter 22 is not set correctly - see Section 4.22.
Scale shows 'uuuuuu'.	1. Load cell(s) not wired correctly - see Section 2.3. 2. Dead Load has not been set - see Section 4.12. 3. Defective load cell.
Scale shows '888888'.	1. Scale is overloaded. 2. Overweight setting is not correct - see Section 5.4.
Scale shows 'EEEEEE'.	1. Scale is overloaded. 2. Dead Load or Span not set properly - see Sections 4.12 - 4.17. 3. Load cell(s) not wired correctly. 4. Defective load cell.
Scale shows 'rrrrrr'. Cannot zero scale.	1. Weight on scale is beyond Zero Window - see Section 5.24. 2. Dead load has not been set - see Section 4.12. 3. Scale has not been calibrated - see Section 4.
Display unstable.	1. Load cell cabling wet or damaged. 2. Defective load cell. 3. Load Cell Full Scale Output not set correctly - see Section 4.11. 4. Defective power supply.
No output to printer, host computer or scoreboard.	1. Interface cable disconnected. 2. Serial interface not wired correctly - see Section 2.6. 3. Output port not set up correctly - see Sections 5.31, 5.32 and 7.1.

TABLE 7-1.

APPENDIX A

ASCII CONVERSION TABLE

HEX	0	1	2	3	4	5	6	7
0	NUL	DLE	SP	0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{
C	FF	FS	,	,	L	\	l	|
D	CR	GS	-	=	M	]	m	}
E	SO	RS	.	>	N	^	n	~
F	SI	US	/	?	O	_	o	DEL

ADDENDUMS & BULLETINS

DF3500 CONVEYOR/RATE FEEDER INDICATOR

PROGRAM CHIP: DF3RF1.10

ADDENDUM TO DF3500 CONVEYOR/RATE FEEDERT OPERATING MANUAL

SECTION 5 - CALIBRATION PARAMETERS

5.72 TOTAL REVOLUTIONS

Is the number of belt revolutions the totalizer remains active after the total is cleared. This is used to calibrate the total span by running the belt with a static weight applied.

$$Total\ Delivered = Scale\ Weight\ x\ \frac{Total\ Revolutions\ x\ Belt\ Length}{Weigh\ Bridge}$$

Dealer Bulletin

DF3500 CONVEYOR/RATE FEEDER INDICATOR

NEW PROGRAM CHIP VERSION: DF3RF1.10

1. This program version corrects the bug in the remote totalizer output. On previous versions the output pulse would stop when the totalizer had overflowed. You can now use a remote totalizer counter with more than 6 digits.

2. A fixed integration time for calibration can now be set. Parameter 72 has been added to the calibration parameters. Set the value of Parameter 72 to the number of belt revolutions to be integrated.

   Example:

Belt Speed	=	100 M/Min
Belt Length	=	200 M
Weighbridge Length	=	2.4 M
Test Chain Weight	=	20 KG

   a) Set Parameter 72 to 2 (2 Belt Revolutions = 400M)

$$\text{Integration Time} = \frac{400\text{M}}{100\text{M/MIN}} = 4 \text{ MIN}$$

   b) Calculate Total Delivered

$$\text{TOTAL} = \text{Scale Weight} \times \frac{\text{TOTAL REV'S X BELT LENGTH}}{\text{WEIGH BRIDGE LENGTH}}$$

$$= 20 \text{ KG} \times \frac{2 \times 200\text{M}}{2.4\text{M}}$$

$$= 3333.3 \text{ KG}$$

$$= 3.33 \text{ TONNES}$$

DF3500 NEMA
(new board set)
EXTERNAL CONNECTIONS