TI-500BW / TI-500SSB

Digital Indicator

Setup / Operation Manual

Revision 1.1
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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1:   INTRODUCTION TO THE TI-500BW/500SSB DIGITAL INDICATORS

The TI-500BW/500SSB Digital Indicator is a general-purpose, battery-powered industrial grade weight indicator. Two models are currently available, distinguishable by enclosure type. Table 1-1 shows the TI-500BW/500SSB product matrix.

Six (6) alkaline "C" cells or one (1) rechargeable lead acid battery pack can power the digital indicator. The indicator must be factory-ordered as one type or the other. An external power supply is included at no additional charge. This external power supply acts as a battery charger for the rechargeable battery type. The power supply may also be used as a main power supply for both types.

All models operate identically, can readout up to 50,000 display divisions and can supply enough current for up to 4-350Ω load cells. All setup parameters may be entered via the front panel keys, including calibration.

If your Model TI-500BW/500SSB Digital Indicator is part of a complete floor scale or has been installed for you, you may skip to

Chapter 7 for operating instructions. Prior to using the indicator, please read this chapter carefully and completely. Store the manual in a safe and convenient place so it will be available if you have questions concerning the operation of the scale.

If you are an installer, the indicator's installation and wiring instructions are found in Chapter 2. The indicator contains two main setup menus: The Setup ("F") menu that configures the indicator to your weigh platform and the User ("A") menu that configures the serial communication port and enables some user options. Chapter 3 gives an overview and explains how to use the five front panel keys to maneuver and save settings in both menus. Chapters 4 and 5 explain the Setup and User Menu options, respectively. Chapter 6 covers system calibration. Prior to installing the indicator, please read this manual carefully and completely. Store the manual in a safe and convenient place so it will be available if you have questions concerning the setup and operation of the scale.

MODEL	DISPLAY TYPE	ENCLOSURE TYPE
TI-500BW	LCD (liquid crystal display), 0.75" tall	ABS, NEMA 12 rated
TI-500SSB	LCD (liquid crystal display), 0.75" tall	Stainless Steel, NEMA 4X rated

TABLE 1-1: TI-500BW/500SSB Product Matrix
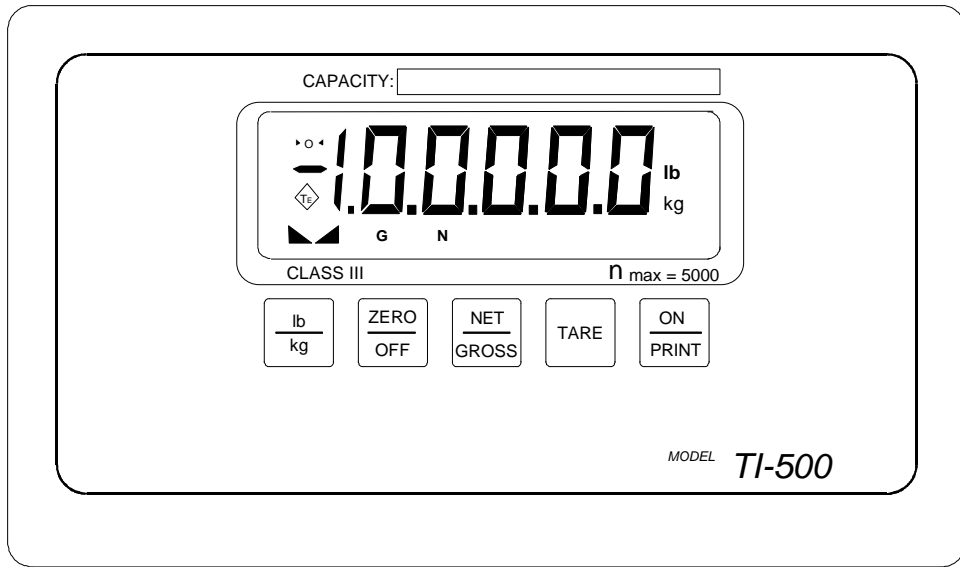
FIGURE 1-1: TI-500SSB Front Panel

CHAPTER 2: INSTALLATION

2.1   ABS ENCLOSURE (TI-500BW)

For indicators contained in the standard ABS enclosure, the rear panel contains all connectors necessary to make the appropriate connections to the weigh platform, printer, remote display and power supply.
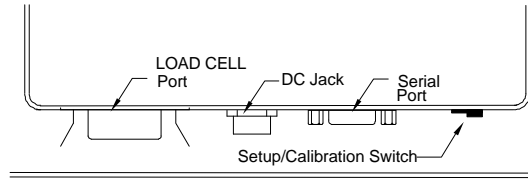
Figure 2-1: TI-500BW ABS Enclosure Rear Panel

2.1.1   CONNECTING THE WEIGH PLATFORM

The indicators mounted in an ABS enclosure ship with a 15 ft shielded load cell cable for connection to weigh platform's load cell(s) or junction box.

1.   Plug the cable's 14-pin Centronics-type connector into the load cell port on the rear panel of the indicator.

2.   Wire the bare wires and shield to the weigh platform's load cell(s) or junction box using the color codes shown in Figure 2-2.

Color	Wire Name
RED	+Excitation
BLK	- Excitation
GRN	+Signal
WHT	- Signal

Figure 2-2: Color Codes for Shielded Load Cell Cable

3.   If you do not wish to use the shielded load cell cable, you may use own, following the pin assignments shown in Figure 2-3. (A 14-pin Male Centronics-type connector is required).

Pin Nos.	Pin Name
1/8	+Excitation
3/10	- Excitation
5/12	+Signal
7/14	- Signal

Figure 2-3: Pin assignments for the Load Cell Port

2.1.2 CONNECTING THE SERIAL PRINTER, REMOTE DISPLAY OR COMPUTER

The TI-500BW indicator comes standard with one full duplex RS-232 serial port, designed for connection to either a PC or a serial printer. The same port may be also used as a simplex, RS-232 port designed for connection to a remote display.

Figure 2-4 shows the serial port pinout. Refer to Appendix B for some suggested cable diagrams. (A 9-pin pin Male D-type connector is required).

1. Plug the serial printer, remote display or computer communication cable (not included) directly into the DSUB9 serial port connector.

Pin No.	Pin Name	Signal Level
2	Receive Data	RS-232
3	Transmit Data	RS-232
5	Signal Ground	RS-232

Front View
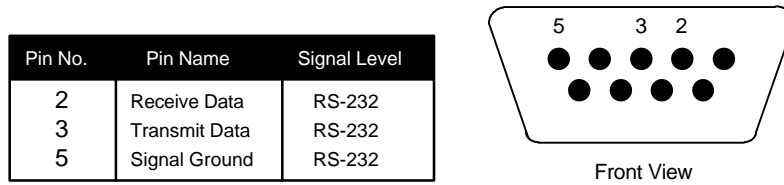
Figure 2-4: Pin assignments for the DSUB9 serial port connector

2.1.3 CONNECTING THE POWER SUPPLY

The TI-500BW rechargeable battery indicator ships with the battery pre-installed.

The TI-500BW alkaline battery indicator ships as a "batteries not included" unit.

1. Obtain six (6) alkaline "C" batteries and install in the battery compartment located at the rear of the unit.

The external power supply (included) can also be used to power both indicators. The adapter for the rechargeable battery unit acts as the battery charger. Because of this, the rechargeable indicator must use a 12 VDC, 800 mA adapter, while the alkaline indicator can use a 12 VDC, 500 mA adapter.

1. Simply plug the AC adapter into the indicator's DC Power Jack first, and then plug into a standard wall outlet. ***Make sure that the AC voltage appearing at the wall outlet matches the input voltage marked on the AC adapter.***

2.2 STAINLESS STEEL ENCLOSURE (TI-500SSB)

For indicators contained in a stainless steel enclosure, the rear cover must first be removed to make the appropriate connections to the weigh platform, printer, remote display and power supply. To remove the rear cover, simply remove the screws that secure it to the enclosure and set aside.

NOTE: The rear cover must remain off to access the Setup Menu and calibration procedures.
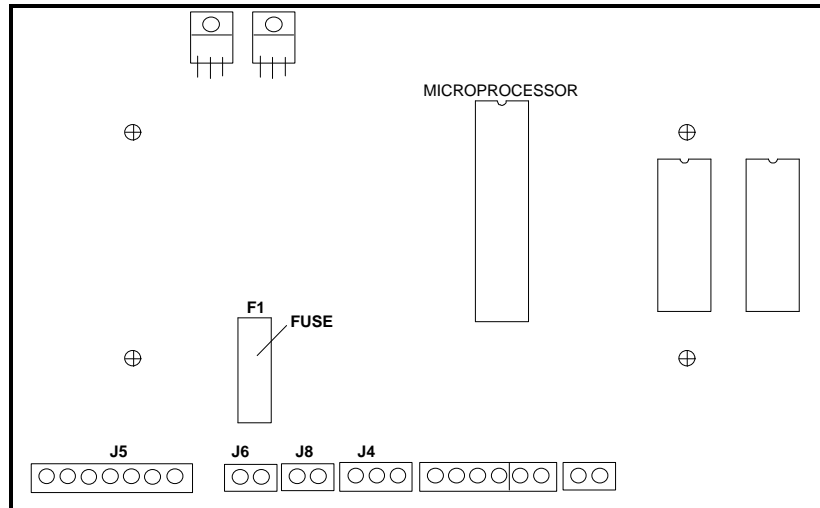
Figure 2-5: TI-500SSB Main Circuit Board Overview

2.2.1 CONNECTING THE WEIGH PLATFORM

1. Connect your shielded load cell cable (not included) to terminal J5 on the main board. Connection assignments for the Load Cell Terminal (J5) are shown in Figure 2-6.
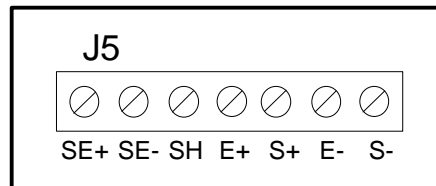
Figure 2-6: Connection assignments for the Load Cell Terminal (J5)

2.2.2 CONNECTING THE SERIAL PRINTER, REMOTE DISPLAY OR COMPUTER

The TI-500SSB indicator comes standard with one full duplex RS-232 serial port, designed for connection to either a PC or a serial printer. The same port may be also used as a simplex, RS-232 port designed for connection to a remote display.

For indicators housed in a Stainless Steel enclosure, this port is realized in J4. Connection assignments for all serial communication terminals are shown in Figure 2-7.
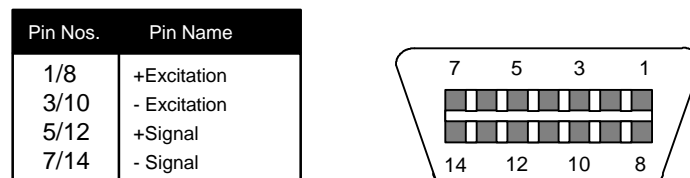
1. Connect your serial printer, remote display or computer communication cable (not included) to terminal J4 on the main board.

```
┌─────────────────────┐
│  J4                 │
│  ┌───────────────┐  │
│  │ ⊘   ⊘   ⊘    │  │
│  └───────────────┘  │
│  TXD  RXD  GND      │
└─────────────────────┘
```
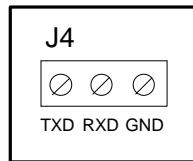
Figure 2-7: Connection assignments for the serial communication terminal

2.2.3 CONNECTING THE POWER SUPPLY

The TI-500SSB indicator ships with the rechargeable battery pre-installed.

The external power supply (included) can also be used to power the indicator. The adapter acts as the battery charger. Because of this, the rechargeable indicator must use a 12 VDC, 800 mA adapter.

1. Simply plug the AC adapter into the indicator's DC Power Jack first, and then plug into a standard wall outlet. ***Make sure that the AC voltage appearing at the wall outlet matches the input voltage marked on the AC adapter.***

CHAPTER 3: CONFIGURATION

3.1   CONFIGURATION OVERVIEW

The indicator contains two main setup menus: The Setup ("F") menu that configures the indicator to your weigh platform and the User ("A") menu that configures the serial communication port and enables some user options. The Setup and User menus consist of several menu selections, each with its own sub-menu of choices.

To set up the indicator, you must first enter the appropriate menu mode. Once there, four of the front panel keys become directional navigators to move around in the menus, and one key is used to save or SET the selections.

3.2   SETUP ("F") MENU

3.2.1   ENTERING THE SETUP MENU – ABS ENCLOSURE

1. Power off the indicator by pressing and holding the Zero key.
2. On the back cover, move the Setup/Calibration Switch to the opposite position.
3. Power on the indicator by pressing the On/Print key. The indicator shows " F   1" to indicate that you are in Setup Menu mode.

Note: Access to the Setup/Calibration Switch is inhibited if the indicator has been sealed for commercial use. For more information, please refer to Chapter 8.

3.2.2   ENTERING THE SETUP MENU – STAINLESS STEEL ENCLOSURE

1. Power off the indicator by pressing and holding the Zero key.
2. Remove the back cover and the two-position dipswitch.
3. Position the #1 dipswitch to the "OFF" position.

Note: On certain older models, the dipswitch position will be exactly the opposite.

4. Power on the indicator by pressing the On/Print key. The indicator shows " F   1" to indicate that you are in Setup Menu mode.

Note: Access to the back cover is inhibited if the indicator has been sealed for commercial use. For more information, please refer to Chapter 8.

3.2.3   NAVIGATING IN THE SETUP MENU

Use the directional keys shown in Figure 3-1 to move around in the Setup Menu Chart shown in Figure 3-2 on the following page.

1. To move to a new "F" heading, use the TARE (left) or PRINT (right) key to move right or left in the Setup Menu Chart.
2. To move to the selection level, press the ZERO (down) key once. The current saved selection is shown.
3. To view the available selections for the current "F" heading, use the TARE (left) or PRINT (right) key to move through the selection field.
4. To save a new selection, press the NET/GROSS (Set) key .To exit without saving, press the lb/kg (up) key to return to the current "F" heading.
5. Repeat Steps 1 through 4 until the Setup Menu is programmed.
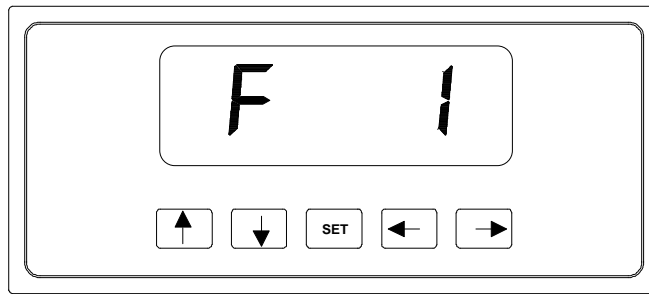
Figure 3-1: Setup Menu Key Assignments
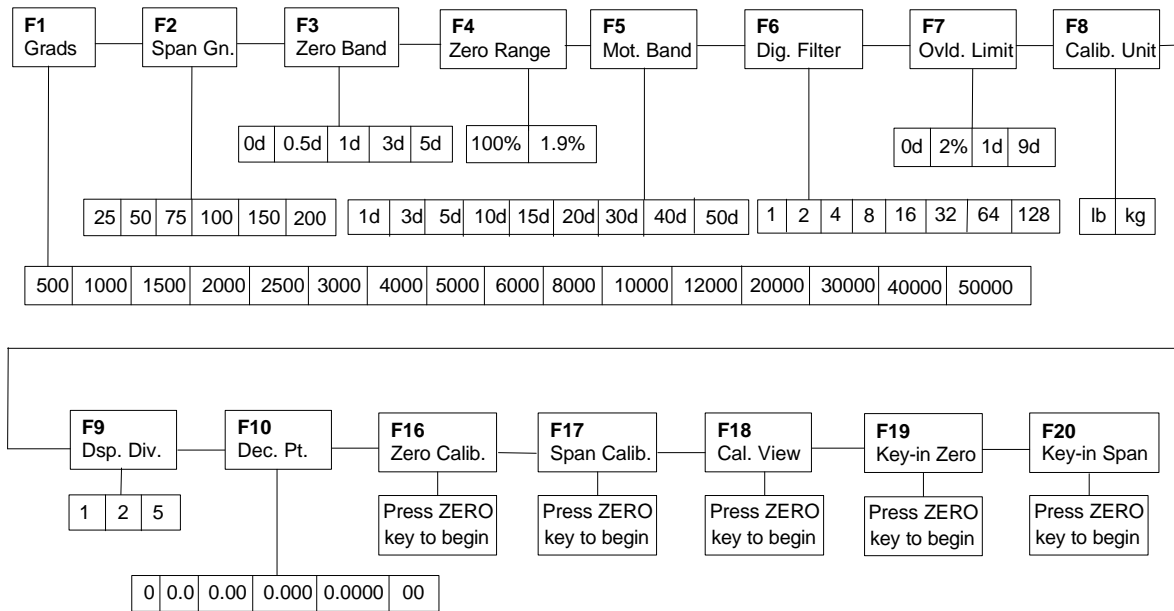
Figure 3-2: Setup Menu Chart

3.2.4 NOTES ON THE SETUP MENU

1. There is an **F21** sub-menu present that is for FACTORY USE ONLY!

2. Detailed descriptions of the setup menu parameters can be found in Chapter 4 of this manual.

3. The User ("A") menu sub-menus appear when scrolling left or right from the "F" menu.

3.2.5 EXITING THE SETUP MENU – ABS ENCLOSURE

1. Power off the indicator by pressing and holding the Zero key.

2. On the back cover, move the Setup/Calibration Switch back to its original position.

3. Power on the indicator by pressing the On/Print key. The display will go through a digit check, then settle into Normal Operating mode. All front panel keys will now return to their normal mode of operation.

3.2.6 EXITING THE SETUP MENU – STAINLESS STEEL ENCLOSURE

1. Power off the indicator by pressing and holding the Zero key.
2. Position the #1 dipswitch to the "OFF" position.

    Note: On certain older models, the dipswitch position will be exactly the opposite.
3. Power on the indicator by pressing the On/Print key. The display will go through a digit check, then settle into Normal Operating mode. All front panel keys will now return to their normal mode of operation.

3.3 USER ("A") MENU

3.3.1 ENTERING THE USER MENU

1. Enter the Setup ("F") menu by following the directions in Section 3.2.1 or 3.2.2.
2. Use the right or left directional keys shown in Figure 3-3 to move right or left in the Setup ("F") menu until the indicator shows " A   1".

Note: On certain older models, the User ("A") Menu is independent from the Setup ("F") Menu. To enter the User Menu on these models, first exit the Setup Menu Mode. Turn the unit off, then press and hold the lb/kg key while powering the unit back on. When the screen shows " A   1" you may release the lb/kg key.

3.3.2 NAVIGATING IN THE USER MENU

Use the directional keys shown in Figure 3-3 to move around in the User Menu Chart shown in Figure 3-4 on the following page.

1. To move to a new "A" heading, use the TARE (left) or PRINT (right) key to move right or left in the User Menu Chart.
2. To move to the selection level, press the ZERO (down) key once. The current saved selection is shown.
3. To view the available selections for the current "A" heading, use the TARE (left) or PRINT (right) key to move through the selection field.
4. To save a new selection, press the NET/GROSS (Set) key .To exit without saving, press the lb/kg (up) key to return to the current "A" heading.
5. Repeat Steps 2 through 5 until the User Menu is programmed.
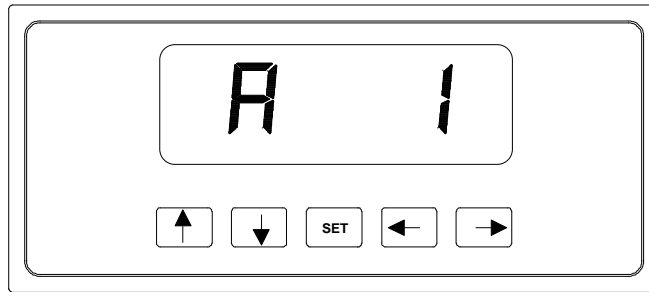
Figure 3-3: User Menu Key Assignments
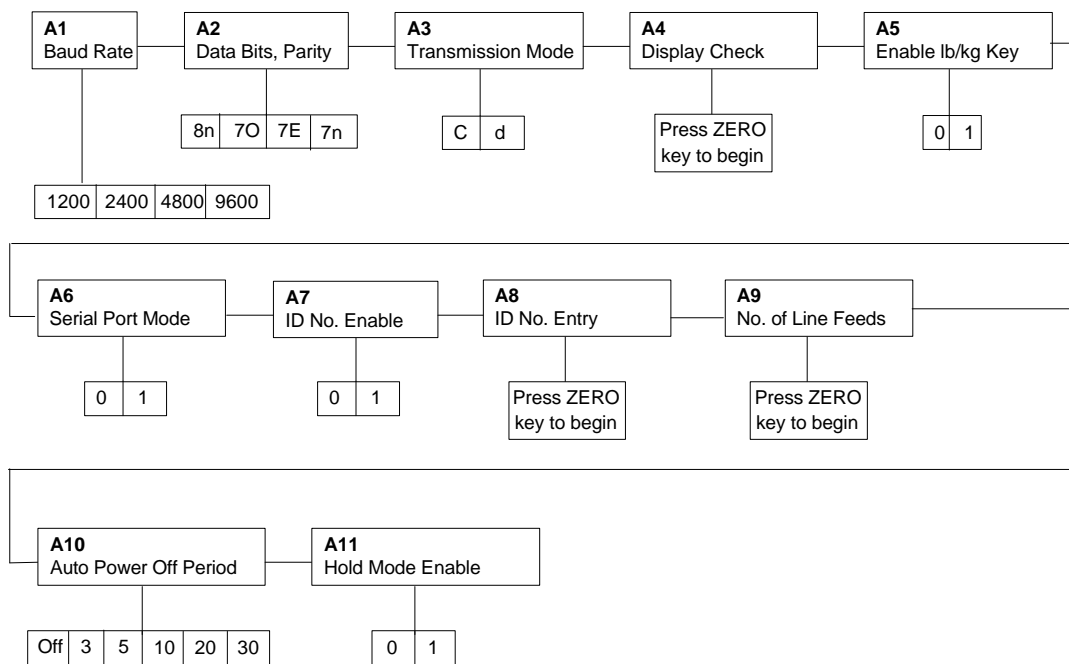
Figure 3-4: User Menu Chart

3.3.3 NOTES ON THE USER MENU

1. Detailed descriptions of the user menu parameters can be found in Chapter 5 of this manual.

3.3.4 EXITING THE USER MENU

1. Exit the User ("A") menu by following the directions in Section 3.2.5 or 3.2.6. The display will go through a digit check, then settle into Normal Operating mode. All front panel keys will now return to their normal mode of operation.

CHAPTER 4: SETUP MENU DESCRIPTIONS AND PROCEDURES

4.1   SETUP MENU DESCRIPTIONS

This section provides more detailed descriptions of the selections found in the Setup Menu Chart. Factory-set defaults are shown in bold with a checkmark (√).

Table 4-1 shows the selections that are <u>not</u> allowed for "Legal-for-Trade" applications:

NAME/CODE	DESCRIPTION	CODE/VALUE
F1 Graduations	Specifies number of full-scale graduations. Value should be consistent with legal requirements and environmental limits on the useful system resolution.	500 1,000 1,500 2,000 2,500 3,000 4,000 **5,000**√ 6,000 8,000 10,000 12,000 20,000 30,000 40,000 50,000
F2 Span Gain	Span Gain is related to A/D integration time. The larger the span gain, the higher the internal resolution, but the slower the update speed. Note that the scale must be re-calibrated whenever this parameter is altered. See Appendix C for more information.	25 50 **75**√ 100 150 200
F3 Zero Track Band	Selects the range within which the scale will automatically zero. Note that the scale must be in standstill to automatically zero. Selections are in Display Divisions.	0d **0.5d**√ 1d 3d 5d
F4 Zero Range	Selects the range within which the scale may be zeroed. Note that the indicator must be in standstill to zero the scale.	**100%**√ 1.9%
F5 Motion Band	Sets the level at which motion is detected by comparing the present display update with the previous one. If motion is not detected for two seconds or more, scale is in standstill and can process a Print or Zero command. Maximum value varies depending on local regulations.	**1d**√ 3d 5d 10d 15d 20d 30d 40d 50d
F6 Digital Filter	Averages weight readings to produce higher stability. The higher the filter setting, the greater the stability but the slower the indicator's response time. Choose 8 unless a very fast response is needed.	1 2 4 **8**√ 16 32 64 128
F7 Overload Limit	Selects the desired formula which determines the point at which the indicator shows overload. All selections are based on the primary unit selected in F8. "FS" = Full scale in primary units.	FS **FS + 2%**√ FS + 1d FS + 9d
F8 Calib. Unit	Selects the primary base unit to be used in the calibration process. Also the default unit for normal operation. "1" = primary unit is lb. "2" = primary unit is in kg.	**1**√ 2

NAME/CODE	DESCRIPTION	CODE/VALUE
F9 Display Divisions	Determines the desired weight increments. Value should be consistent with legal requirements.	**1**√ 2 5
F10 Decimal Pt.	Determines location of the decimal point.	**0**√ 0.0 0.00 0.000 0.0000 00
F16 Zero Calibration	Places indicator into the zero calibration routine. Scrolling down with the **ZERO** key one level begins the procedure.	Press **ZERO** key to begin sequence
F17 Span Calibration	Places indicator into the span calibration routine. Scrolling down with the **ZERO** key one level begins the procedure.	Press **ZERO** key to begin sequence
F18 View Calibration	Actuates the function that allows you to view both the zero and span calibration value. The values displayed in this function are valid only after Calibration (F16 & F17) has been successfully completed. Scrolling down with the **ZERO** key one level begins the procedure.	Press **ZERO** key to begin sequence
F19 Key-in Zero	Allows you to key-in known zero calibration value in case of memory loss in the field. Scrolling down with the **ZERO** key one level begins the procedure.	Press **ZERO** key to begin sequence
F20 Key-in Span	Allows you to key-in a known span calibration value in case of memory loss in the field. Scrolling down with the **ZERO** key one level begins the procedure.	Press **ZERO** key to begin sequence
F21 Factory Reset	This sub-menu will reset all parameters in the "F" and "A" menu to the default settings. USE WITH CAUTION!	Press the **ZERO** key twice to execute.

SUB-MENU	TITLE	SELECTIONS
F1	Graduations	6,000 8,000 10,000 12,000 20,000 30,000 40,000 50,000
F3	Zero Tracking Band (SAZSM)	0d 5d
F5	Motion Band	3d 5d 10d
F6	Digital Filter	1 2 4

Table 4-1: Invalid Setup Menu selections for commercial applications

CHAPTER 5: USER MENU DESCRIPTIONS AND PROCEDURES

5.1   USER MENU DESCRIPTIONS

This section provides more detailed descriptions of the selections found in the User Menu Chart. Factory-set defaults are shown in bold with a checkmark ($\sqrt{}$).

NAME/CODE	DESCRIPTION	CODE/VALUE
A1 Baud Rate	Selects the baud rate for data transmission through the serial port.	1200 **2400**$\sqrt{}$ 4800 9600

A2
Data Bits and Parity
	Selects the number of data bits and parity of serial transmission.
	    "8n" = 8 data bits with no parity bit and one stop bit
	    "7O" = 7 data bits with odd parity bit and one stop bit
	    "7E" = 7 data bits with even parity bit and one stop bit
	    "7n" = 7 data bits with no parity bit and two stop bits
		8n$\sqrt{}$
		7O
		7E
		7n

A3
Mode of Serial Transmission
	Selects when data will be sent out of the serial port to a printer or computer:
	    "C" = Continuous mode; send data continuously
	  "d" = Demand mode; send data when a PRINT command is issued
	    from the printer, computer, or indicator.
		C
		d$\sqrt{}$

A4 Display Check	Actuates the function that illuminates all digit segments, decimal points, and LCD annunciators in a test sequence. Pressing the **ZERO** key to scroll down one level begins the test sequence.	Press **ZERO** key to begin sequence
A5 Disable the lb/kg Key	Allows the lb/kg key to be disabled so that an operator cannot accidentally press the key and change the displayed units. "0" = Disable the lb/kg key "1" = Enable the lb/kg key	0 **1**$\sqrt{}$

A6
Serial Port Mode
	Selects the mode of the RS-232 serial port: Refer to Appendix B for more information.
	        "0" = Full Duplex Mode
	        "1" = Print Ticket Mode
		0$\sqrt{}$
		1

A7 ID No. Enable	Allows the ID number to be disabled in the Print Ticket mode. Valid only when **A6** is set to "1". "0" = Disable the ID No. "1" = Enable the ID No.	**0**$\sqrt{}$ 1
A8 ID No. Entry	Actuates the function that allows entry of a new ID No. Valid only when **A6** is set to "1". Pressing the **ZERO** key to scroll down one level begins the sequence.	0 - 199999 **123456**$\sqrt{}$
A9 No. of Line Feeds	Actuates the function that allows entry of the desired number of line feeds to be printed in Print Ticket Mode. Valid only when **A6** is set to "1". Pressing the **ZERO** key to scroll down one level begins the sequence.	0 - 99 **5**$\sqrt{}$

NAME/CODE	DESCRIPTION	CODE/VALUE
A10 Auto Power Off Period	Selects the auto off time period in minutes: "Off" = Disabled (Always ON)	**Off**√ 3 5 10 20 30
A11 Hold Model Enable	Activates the "Hold" mode where weight of the object on the platform is frozen on the display until the applied weight is decreased to one-half of the memorized weight. This is used in conjunction with the Motion Band setting (F5) to capture an unstable load, such as livestock. "0" = Disabled, "1" = Enabled	**0**√ 1

5.2 USER MENU PROCEDURES

This section provides instructions for all of the User Menu procedures.

5.2.1 ID Number Entry (A8)

1. While in the User Menu mode, scroll to "**A 8**", then scroll down once using the ZERO key to enter the ID Number menu.

2. The display will momentarily show "**ID NO**", followed by a value with one flashing digit. This value will be the current ID number value.

3. Use the four directional keys (shown in Figure 5-1 below) to adjust the displayed value to the actual ID Number value. Increase the flashing digit by pressing the lb/kg key. Decrease the flashing digit by pressing the ZERO key. Pressing the PRINT key or the TARE key will change the position of the flashing digit.

```
┌─────────────────────────────────────┐
│       USER MODE KEY FUNCTIONS        │
│                                      │
│  ┌─────┐ ┌─────┐ ┌─────┐ ┌─────┐ ┌─────┐
│  │lb/kg│ │ZERO │ │ NET │ │TARE │ │PRINT│
│  └─────┘ └─────┘ │GROSS│ └─────┘ └─────┘
│                  └─────┘             │
│     ↑      ↓      SET    ←──   ──→    │
└─────────────────────────────────────┘
```

Figure 5-1: User Menu Key Assignments

4. After setting the exact value, press the NET/GROSS key to save the ID Number value. The display will show "**SET**" momentarily, then revert back up to A8.

5.2.2   LF (Line Feeds) Number Entry (A9)

1.   While in the User Menu mode, scroll to "**A 9**", then scroll down once using the ZERO key to enter the Line Feeds menu.

2.   The display will momentarily show "**LF**", followed by the current line feeds value.

3.   Use the four directional keys (shown in Figure 5-1 above) to adjust the displayed value to the actual line feeds value. Increase the flashing digit by pressing the lb/kg key. Decrease the flashing digit by pressing the ZERO key. Pressing the PRINT key or the TARE key will change the position of the flashing digit.

4.   After setting the exact value, press the NET/GROSS key to save the line feeds value. The display will show "**SET**" momentarily, then revert back up to A9.

CHAPTER 6: CALIBRATION

6.1   CALIBRATION OVERVIEW

The indicator is calibrated by following the procedures embedded in F16 (Zero) and F17 (Span) of the Setup Menu. Each procedure enters a value into the indicator's non-volatile memory - F16 the zero value (deadweight) and F17 the span value (test weight). The minimum test weight that can be used is 1% of full-scale capacity. After the two calibration procedures are executed successfully, you should record both calibration values in Table 6-1 using the F18 View procedure.

In the unlikely event that either value is lost while in the field, the setup menu makes provisions for re-entering these values via F19 and F20, thus eliminating the need for re-calibration with test weights.

NOTE: This chapter assumes that the indicator is in Setup ("F") Menu mode. If the indicator is not in Setup Menu mode, refer to Chapter 3 for instructions.

6.2   ZERO CALIBRATION (F16)

1.   While in the Setup mode, scroll to "**F 16**", then scroll down once using the ZERO key to enter zero calibration menu. The display will momentarily show "**C 0**" followed by a value. This value is the internal A/D count and can prove useful when trying to troubleshoot setup problems.

2.   After making sure that there are no test weights on the platform, press the ZERO key again to zero out the displayed value.

3.   Press the NET/GROSS key to save the zero point value. The display will show "**EndC0**" momentarily, then revert back up to F16. At this time, proceed to the F17 span calibration to complete indicator calibration.

6.3   SPAN CALIBRATION (F17)

1.   While in the Setup mode, scroll to "**F 17**", then scroll down once using the ZERO key to enter span calibration menu.

2.   The display will momentarily show "**C 1**" for the span calibration, followed by a value with one flashing digit. This value will be zero with the Decimal Point parameter selected in F10. Place the test weight on the weighing mechanism.

3.   Use the four directional keys (shown in Figure 6-1 below) to adjust the displayed value to the actual test weight value. Increase the flashing digit by pressing the lb/kg key. Decrease the flashing digit by pressing the ZERO key. Pressing the PRINT key or the TARE key will change the position of the flashing digit.
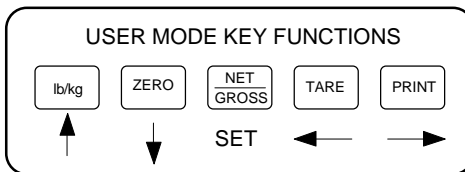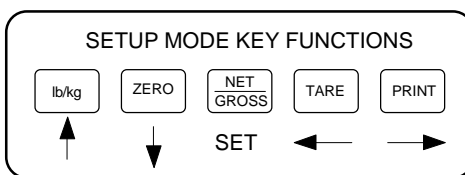

Figure 6-1: Setup Menu Key Assignments

4. After setting the exact value, press the NET/GROSS key to save the value.

5. If the calibration was successful, the display will show "**EndC1**" momentarily, then revert back up to F17. At this time it is suggested that the calibration values be recorded for future use (see Section 6.4).

6. If the calibration was *not* successful, one of the error messages below will appear. Take the indicated action to correct the problem, then perform a new calibration.

"**Err0**" - The calibration test weight or the adjusted keyed-in weight is larger than the full capacity of the scale. Change the calibration test weight or check the input data.

"**Err1**" - The calibration test weight or the adjusted keyed-in weight is smaller than 1% of the full capacity of the scale. Change the calibration test weight or check the input data.

"**Err2**" - The internal resolution of the scale is not high enough to accept the calibration value. Select a larger parameter for the Span Gain (F2). SEE APPENDIX C FOR MORE INFORMATION.

6.4   VIEW CALIBRATION VALUES (F18)

Note: The values displayed in this procedure are valid only after a successful calibration has been performed using F16 and F17.

1. While in the Setup mode, scroll to "**F 18**", then scroll down once using the ZERO key to enter View calibration menu.

2. The display will momentarily show "**CAL 0**" followed by a value. This value is the **zero calibration value** and should be recorded in the table below. Press any key to continue.

3. The display will momentarily show "**CAL 1**" followed by another value. This value is the **span calibration value** and should also be recorded in the table below. Press any key to return to upper level (F18).

INDICATOR	ZERO CALIBRATION VALUE	SPAN CALIBRATION VALUE
S/N:		

Table 6-1: Calibration Value Table

6.5   KEY-IN ZERO CALIBRATION VALUE (F19)

Note: This procedure is intended for emergency use only in the case of non-volatile memory loss. A valid zero calibration value, obtained from a successful F16 calibration procedure, must be used.

1. While in the Setup mode, scroll to "**F 19**", then scroll down once using the ZERO key.

2. The display will momentarily show "**CAL 0**", followed by a flashing zero. Use the four directional keys (shown in Figure 6-1) to adjust the displayed value to the zero calibration value.

3. After setting the exact value, press the NET/GROSS key to save the value.

4. The display will show "**E CAL 0**" momentarily, then revert back up to F19.

6.6   KEY-IN SPAN CALIBRATION VALUE (F20)

Note: This procedure is intended for emergency use only in the case of non-volatile memory loss. A valid span calibration value, obtained from a successful F17 calibration procedure, must be used.

1. While in the Setup mode, scroll to "**F 20**", then scroll down once using the ZERO key.

2. The display will momentarily show "**CAL 1**", followed by a flashing zero. Use the four directional keys (shown in Figure 6-1) to adjust the displayed value to the span calibration value.

3. After setting the exact value, press the NET/GROSS key to save the value.

4. If the entered value is greater than zero, the display will show "**E CAL 1**" momentarily, then revert back up to F20. If a value of zero is entered, the indicator will briefly show "**Err 5**", then revert back to the screen described above in Step # 2.

CHAPTER 7: OPERATION

7.1 DISPLAY

The Model TI-500BW/500SSB indicator utilizes a 5-1/2 digit LCD (Liquid Crystal Display) to display the weight and system information Liquid crystal displays are typically used for outdoors applications. Table 7-1 summarizes both types of display annunciators.

7.1.1 LIQUID CRYSTAL DISPLAY (LCD)

Figure 7-1 shows the display detail of the TI-500BW/500SSB LCD.

FIGURE 7-1: TI-500BW/500SSB LCD Detail

LCD Annun-ciator	MEANING
➔0←	Better known as the "Center of Zero" annunciator, this light is active whenever the displayed weight is within ± 0.25 divisions of true zero.
N	Indicates that the indicator is displaying net weight.
G	Indicates that the indicator is displaying gross weight.
◇T_E	Indicates that a tare weight has been established in the system.
lb, kg	Indicates the unit of the displayed weight.
◣◢	This light is on whenever the scale is stable.

TABLE 7-1: TI-500BW/500SSB Annunciator Definitions

7.2 KEYBOARD

The keyboard is composed of five function keys. Refer to Figure 7-2 for the overall layout and key locations.

| lb / kg | ZERO / OFF | NET / GROSS | TARE | ON / PRINT |

FIGURE 7-2: Function Keys Layout

7.2.1 FUNCTION KEYS

lb/kg – This key toggles the indicator between lb and kg units if enabled in the User ("A") Menu. See Chapter 5 for more information.

Zero/Off – When held for five seconds shuts the unit off. Otherwise, this key sets the indicator to display zero provided the following conditions are met:
1. The indicator is displaying Gross weight.
2. The displayed weight is within the zero reset range that is programmed in F4 of the Setup ("F") Menu.
3. The scale is not in motion.
4. The scale is not in overload (see Appendix D for error codes).

Net/Gross - This key toggles the indicator between Gross weight and Net weight only if a Tare has been established.

Tare - This key is used to establish a Tare provided the following conditions are met:
1. The indicator is not at or below Gross zero.
2. The scale is not in motion.
3. The scale is not in overload (see Appendix D for error codes).

ON/Print – When the unit if off, turns the unit on. Otherwise, this key is used to send weight information out to the serial port provided the following conditions are met:
1. The scale is not in motion.
2. The scale is not in overload (see Appendix D for error codes).

7.3 GENERAL SCALE OPERATION

7.3.1 WEIGHING AN ITEM

1. Select the desired weighing unit by pressing the lb/kg key until that unit is indicated on the display.

2. If necessary, press the ZERO key to obtain a weight reading of zero.

3. Place the object to be weighed on the scale's platter and allow the weight indication to stabilize. If the item weight exceeds the scale's weight capacity, it displays "⊐⊐⊐⊐⊐".

4. Read the weight shown on the display.

7.3.2 TARING AN ITEM

To weigh an item in a container, the weight of that container must first be subtracted from the overall weight to obtain an accurate weight reading. This is known as taring.

1. Select the desired weighing unit by pressing the lb/kg key until that unit is indicated on the display.

2. If necessary, press the ZERO key to obtain a weight reading of zero.

3. Place the empty container on the scale's platter and allow the weight indication to stabilize.

4. Press the TARE key. The display shows zero weight and turns the NET annunciator on.

5. Place the material to be weighed in the container and allow the weight indication to stabilize.

6. Read the weight shown on the display.

7. You may toggle between the gross weight and the net weight by pressing the NET/GROSS key.

CHAPTER 8: LEGAL FOR TRADE SEALING

8.1   ABS ENCLOSURE

The TI-500BW indicator in the ABS enclosure can be sealed for commercial (Legal for Trade) applications as follows.

1. Power off the indicator by pressing and holding the Zero key.

2. On the back of the indicator, locate the Setup/Calibration Slide Switch Cover Plate (see illustration below).

3. Thread a wire security seal through both drilled head screws securing the calibration switch cover.

Figure 8-1: TI-500BW ABS Rear Panel

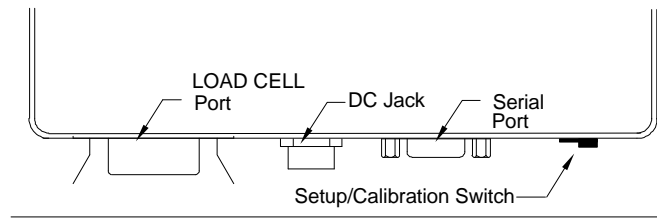### 8.2   STAINLESS STEEL ENCLOSURE

The TI-500SSB indicator in the stainless steel enclosure can be sealed for commercial (Legal for Trade) applications as follows.

1. Power off the indicator by unplugging the power source.

2. Locate the two adjacent drilled head screws securing the rear cover.

3. Thread a wire security seal through both drilled head screws securing the rear cover.

APPENDIX A: SPECIFICATIONS

ANALOG SPECIFICATIONS

Full Scale Input Signal	30mV, including dead load
Minimum Sensitivity - Non H-44	0.4 µV / grad
Minimum Sensitivity - H-44	1.0 µV / grad
Input Impedance	30MΩ, typical
Internal Resolution	Approximately 130,000 counts
Display Resolution	50,000 display division max
Measurement Rate	10 Meas/sec, nominal
System Linearity	Within 0.02% of FS
Calibration Method	Software Calibration, with long term storage in EEPROM
Excitation Voltage	+5VDC, 4 x 350Ω load cells

DIGITAL SPECIFICATIONS

Microcomputer	Intel 80C32	
	Program Memory:	32K x 8, external to µC
	EEPROM:	64 x 16, external to µC
Digital Filtering	Software selectable	

SERIAL COMMUNICATIONS

Serial Port	Full Duplex, 1200, 2400, 4800, 9600 Baud
	8 data bits, no parity, 1 stop bit
	7 data bits, odd parity, 1 stop bit
	7 data bits, even parity, 1 stop bit
	7 data bits, no parity, 2 stop bits

OPERATOR INTERFACE

Display - TI-500	0.75" (19 mm) 7-segment, Liquid Crystal, 5½ Digit
Additional Symbols	Net, Gross, Stable, Tare, lb, kg, Zero
Keyboard	5-key flat membrane panel

POWER

Alkaline Batteries	6 x "C" Size Cells
Rechargeable Battery	6 VDC, 3.0 Ah lead acid
AC Adapter - Alkaline Batteries	12 VDC, 500mA Female
AC Adapter - Rechargeable Battery	12 VDC, 800mA Female
Power Consumption	80mA + 30mA per 350Ω Load Cell

ENVIRONMENTAL

Operating Temperature	−10° to +40° C
Storage Temperature	-25° to +70° C

MECHANICAL

Overall Dimensions – ABS	8.1" x 11.8" x 3.9" (205mm x 300mm x 100mm)
Overall Dimensions – Stainless	9.0" x 5.5" x 2.9" (229mm x 140mm x 73mm)

APPROVALS

NTEP	COC # 94-080A2

APPENDIX B: SERIAL PORT INFORMATION

B.1   SERIAL PORT MODES

B.1.1 FULL DUPLEX MODE

The Full Duplex Mode provides a Demand serial transmission mode and is selected by setting A3 to "d" and A6 to "0". The Demand mode allows control from a host device, usually a PC, and can be activated by pressing the PRINT key on the indicator's front panel. Figure B-1 shows a suggested cable diagram for interface to a PC. Figure B-2 shows the serial data format for the Demand Mode.
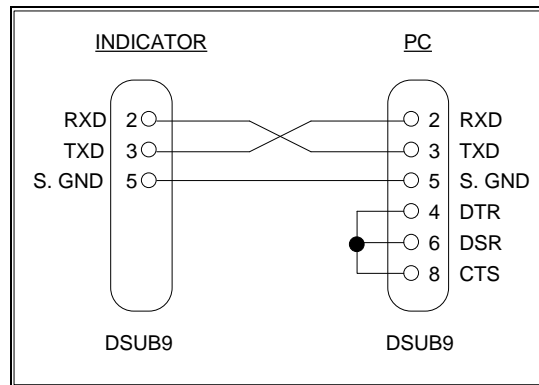

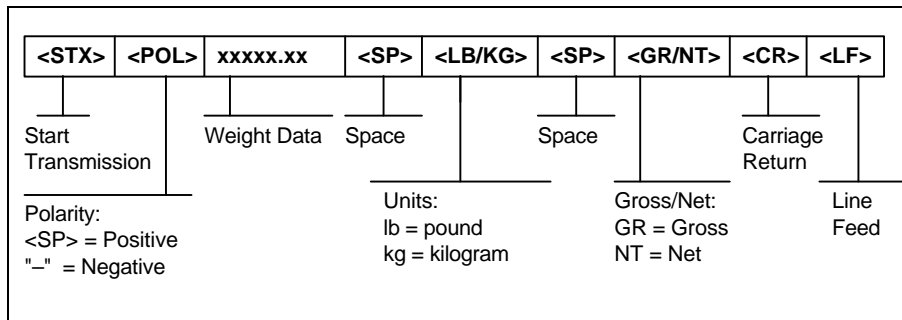**FIGURE B-1. Cable Diagram for Indicator to IBM PC**

FIGURE B-2. Consolidated Controls Demand Mode

B.1.1.1 RECOGNIZED HOST COMMANDS

"P" - This command is sent to the indicator to print the indicated display. The indicator will not respond if the scale is in motion, positive overload or negative overload.

"Z" - This command is sent to the indicator to zero the scale. The indicator will not respond if the scale is in motion, positive overload or negative overload. The indicator will also not respond if it is not in gross mode or within the zero range specified in F4 of the Setup Menu.

"T" - This command is sent to the indicator to tare the scale. The indicator will not respond if the scale is in motion, positive overload or negative overload. The indicator will also not respond if it displaying a negative gross value.

"G" - This command is sent to the indicator to revert to gross mode. The indicator will not respond if the scale is in motion, positive overload or negative overload. The indicator will also not respond if it is not in net mode.

"N" - This command is sent to the indicator to revert to net. The indicator will not respond if the scale is in motion, positive overload or negative overload. The indicator will also not respond if it is not in gross mode or a tare has yet to be established.

"C" - This command is sent to the indicator to toggle among the configured units.

B.1.2 PRINT TICKET MODE

The Print Ticket Mode is designed specifically for a serial printer and is selected by setting A6 to "1". Figure B-3 shows the fixed format of the print ticket.

For printers with limited buffers, this mode supports DTR pin handshaking. The DTR pin from the serial printer is wired to the indicator's RXD pin, which then functions as a CTS pin. Figure B-4 shows a suggested cable diagram for interfacing to a serial printer. Refer to the printer's user manual to confirm which pin is the DTR pin.

NOTES:

1. The TARE and NET fields are not printed unless a tare has been established in the system.

2. The ID number field is not printed if it is disabled in A7 of the User Menu.


```
ID. NO.     123456
GROSS        25.00 LB
TARE          1.48 LB
NET          23.52 LB
```

FIGURE B-3. Print Ticket
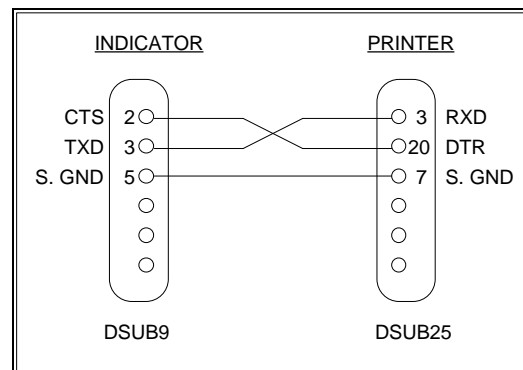
FIGURE B-4. Cable Diagram for Indicator to Printer

B.1.3 SIMPLEX MODE

The Simplex Mode provides a continuous serial transmission mode and is selected by setting A3 to "C" and A6 to "0". The Continuous mode is used to interface to computers, scoreboards, and other remote devices requiring constant data updating. The transmission occurs at the end of each display update. Figure B-5 shows the serial data format for Continuous Mode.

<STX>	<POL>	xxxxx.xx	<L/K>	<G/N>	<STAT>	<CR>	<LF>

Start Transmission

Weight Data

Gross/Net:
G = Gross
N = Net

Carriage Return

Polarity:
<SP> = Positive
"–" = Negative

Units:
L = pound
K = kilogram

Line Feed

Status:
<SP> = Valid
M = Motion
O = Over/under range

FIGURE B-5. Consolidated Controls Continuous Mode

APPENDIX C: DETERMINING PROPER SPAN GAIN (F2)

C.1   SPAN GAIN OVERVIEW

The Span Gain parameter found in F2 of the Setup Menu is directly related to the ADC (Analog to Digital Converter) integration time. This means that the lower the setting, the higher the number of measurements per second. A span gain setting of **25** produces about 25 to 30 measurements per second, while a span gain of **200** produces only about 3 or 4 measurements per second.
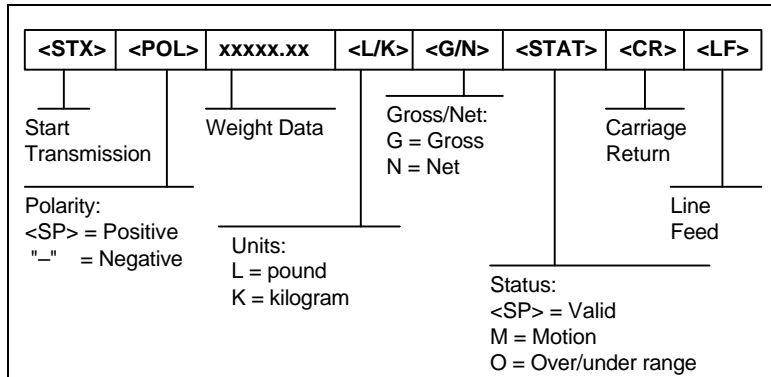
There is really no wrong setting for span gain – except in two cases. Using a low setting for a high resolution, low output system could yield instability. Using a high setting in a high output system could yield non-linearity.

C.2   SETTING THE INITIAL VALUE FOR SPAN GAIN

1. Determine the number of desired external graduations and choose the corresponding value listed in Table C-1 under the number closest to your full-scale input range in millivolts.

2. Enter the Setup Menu and save this number for the Span Gain parameter in F2.

3. Perform a system calibration. If the calibration proves unsuccessful, or you wish to view the internal counts, proceed to the next set of instructions.

C.3   VIEWING THE INTERNAL COUNTS

1. Enter the zero calibration menu (F16) and follow steps 1 to 3, ***but do not save the zero point.***

2. After pressing **ZERO** to zero the offset, place the test weight(s) on the platform. The displayed count is the internal count. If the count remains on zero, check your load cell connections.

3. At full scale, the displayed count should be a minimum of 2 times the desired external graduations. However, for maximum stability, a ratio of 6:1 or higher is recommended.

4. If the displayed count is large enough, remove the test weight(s), re-zero the indicator if necessary, and proceed with the calibration. If the displayed number is *not* large enough, increase the Span Gain to the next highest choice in the Setup Menu and re-calibrate.

# of External Grads	Full Scale Input Range (mV/V)														
	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
500	75	50	25	25	25	25	25	25	25	25	25	25	25	25	25
1,000	150	75	50	50	25	25	25	25	25	25	25	25	25	25	25
1,500	200	100	75	50	50	50	25	25	25	25	25	25	25	25	25
2,000	–	150	75	75	50	50	50	50	25	25	25	25	25	25	25
2,500	–	200	100	75	75	50	50	50	50	50	50	25	25	25	25
3,000	–	200	150	100	75	75	50	50	50	50	50	50	50	25	25
4,000	–	–	150	150	100	75	75	75	50	50	50	50	50	50	50
5,000	**–**	**–**	**200**	**150**	**150**	**100**	**100**	**75**	**75**	**75**	**75**	**50**	**50**	**50**	**50**
6,000	–	–	–	200	150	150	100	100	75	75	75	75	75	50	50
8,000	–	–	–	–	200	150	150	150	100	100	100	75	75	75	75
10,000	–	–	–	–	–	200	200	150	150	150	150	100	100	100	75
12,000	–	–	–	–	–	–	200	200	150	150	150	150	150	100	100
15,000	–	–	–	–	–	–	–	–	200	200	200	150	150	150	150
20,000	–	–	–	–	–	–	–	–	–	–	–	200	200	200	150
30,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
40,000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table C-1: Minimum Recommended (6:1) Span Gain Table

APPENDIX D: DISPLAYED ERROR CODES

CODE	MODE	MEANING / POSSIBLE SOLUTION
□□□□□□	Normal Operating Mode	Gross Overload. A weight greater than the rated capacity has been applied to the scale. Remove the weight from the platter or try re-calibrating the scale. Otherwise, check for a bad load cell connection or possible load cell damage due to overloading.
Flashes "bAtt"	Normal Operating Mode	Indicates that the battery voltage is too low for normal operation. For alkaline battery units, replace the batteries. For rechargeable battery units, re-charge the battery.
Err 0	Span Calibration Mode (F17)	Keyed-in weight value is larger than full scale capacity. Use a smaller test weight or check keyed-in value.
Err 1	Span Calibration Mode (F17)	Keyed-in weight value is less than 1% of full scale capacity. Use a larger test weight or check keyed-in value.
Err 2	Span Calibration Mode (F17)	There is not enough load cell signal to produce the internal counts necessary to properly calibrate the scale. First check all load connections. Use F16 mode to view internal counts. See Appendix C for more information.
Err 3	All Modes	Non-volatile memory read error. One or more setup parameters have been lost.
Err 4	All Modes	Non-volatile memory write error. Indicator needs service.
Err 5	Key-in Span Calibration Mode (F20)	You have attempted to enter a zero value for C1. Enter a known calibration value greater than zero.
Err 7	Initialization	No reading from the ADC. Make sure there is a load cell(s) connected to the indicator at start-up.
Err 9	Normal Operating Mode	Span calibration value has been lost. Re-calibrate the scale.