TI-1000

DIGITAL INDICATOR

SETUP / OPERATION MANUAL

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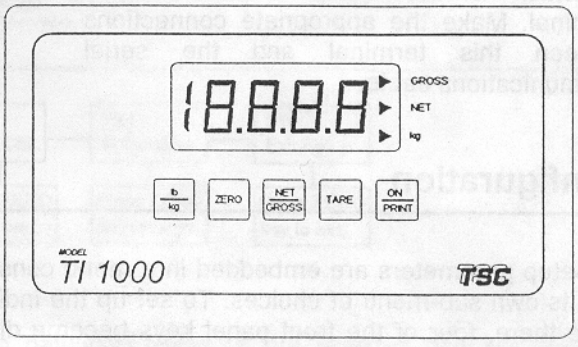
Introduction

The TI-1000 is a general purpose low cost digital indicator with a NEMA 4X stainless steel enclosure for use in washdown environments. It comes with an oversize (1") LCD screen for easy readout of up to 5,000 display divisions, and supplies enough current for up to 4-350Ω load cells. The primary and secondary displayed units may be altered to fit the required application. All setup parameters may be entered via the front panel keys, including calibration.

The TI-1000 uses full duplex RS-232 serial format for communication with many types of attached support equipment. The unit can transmit data on demand, or continuously in a popular data protocol to match a wide variety of printers, remote displays, or personal computers. Wiring diagrams to connect extra equipment will be found on page 2 of this manual.

The setup parameters are altered through the Setup menu. A graphical road map of the Setup menu is found on page 3 of the manual. The Configuration section of the manual, found on page 2, explains how to enter the Setup menu. In this mode, the five front panel keys become directional navigators to maneuver and save settings.

Keyboard Functions



TI-1000 Front Panel

lb / kg — Toggles between primary and secondary units if enabled in the Setup Menu.

ZERO — When touched briefly, sets indicator to display "0" when in Gross mode, and within zero band range. When held for a few seconds, shuts unit off.

NET / GROSS — Toggles between Gross and Net weight display.

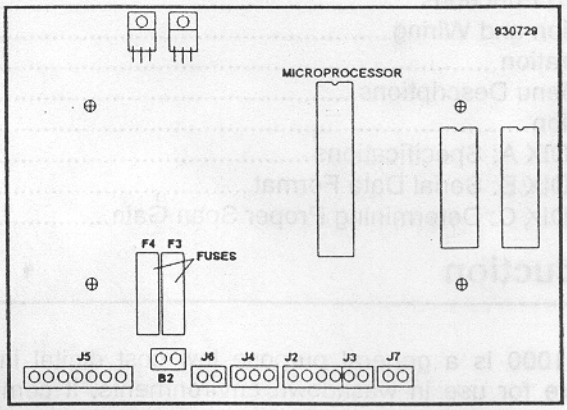
TARE — Is used to zero a weight indication in Net mode when the indicator is not in motion.

ON / PRINT — When unit is off, turns indicator on. When indicator is on, sends "Print" data to printer if weight is stable and not an overload.

Installation and Wiring

OVERVIEW OF TI-1000 CIRCUIT BOARD

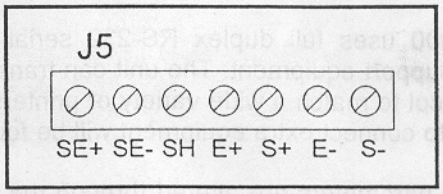
Shown at right is an overview of the TI-1000 Circuit Board showing the major landmarks as well as the terminal blocks used for the various inputs and outputs.



These consist of a Load Cell Feed (J5), a DC Power Supply feed (pre-wired) (J6), and a Serial Communications Terminal (J4), and a Set Point Output Terminal (J2). Terminal block J3 is not implemented at this time. Terminal J7 supplies +5 VDC to an external I/O Module or Solid State Relay.

CONNECTING THE LOAD CELL OR JUNCTION BOX

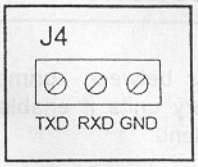
Shown at right is a close-up of terminal block J5 which is the main load cell feed to the circuit board. The connections marked "SE" refer to Sense Wires and the connection marked "SH" refers to a Shield Wire, if applicable. To connect the load cell or junction box, simply make the appropriate connections to this terminal block.



JUMPER E+ TO SE+
E- TO SE-

CONNECTING THE SERIAL COMMUNICATIONS CABLE

Shown at right is a close-up of terminal block J4 which is the Serial Communications Terminal. Make the appropriate connections between this terminal and the serial communications cable.



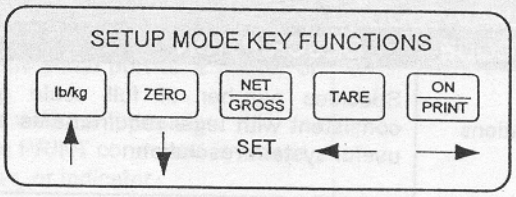
Configuration

All Setup parameters are embedded in a menu consisting of 18 separate menu selections, each with its own sub-menu of choices. To set up the indicator, you must first enter the Setup 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.

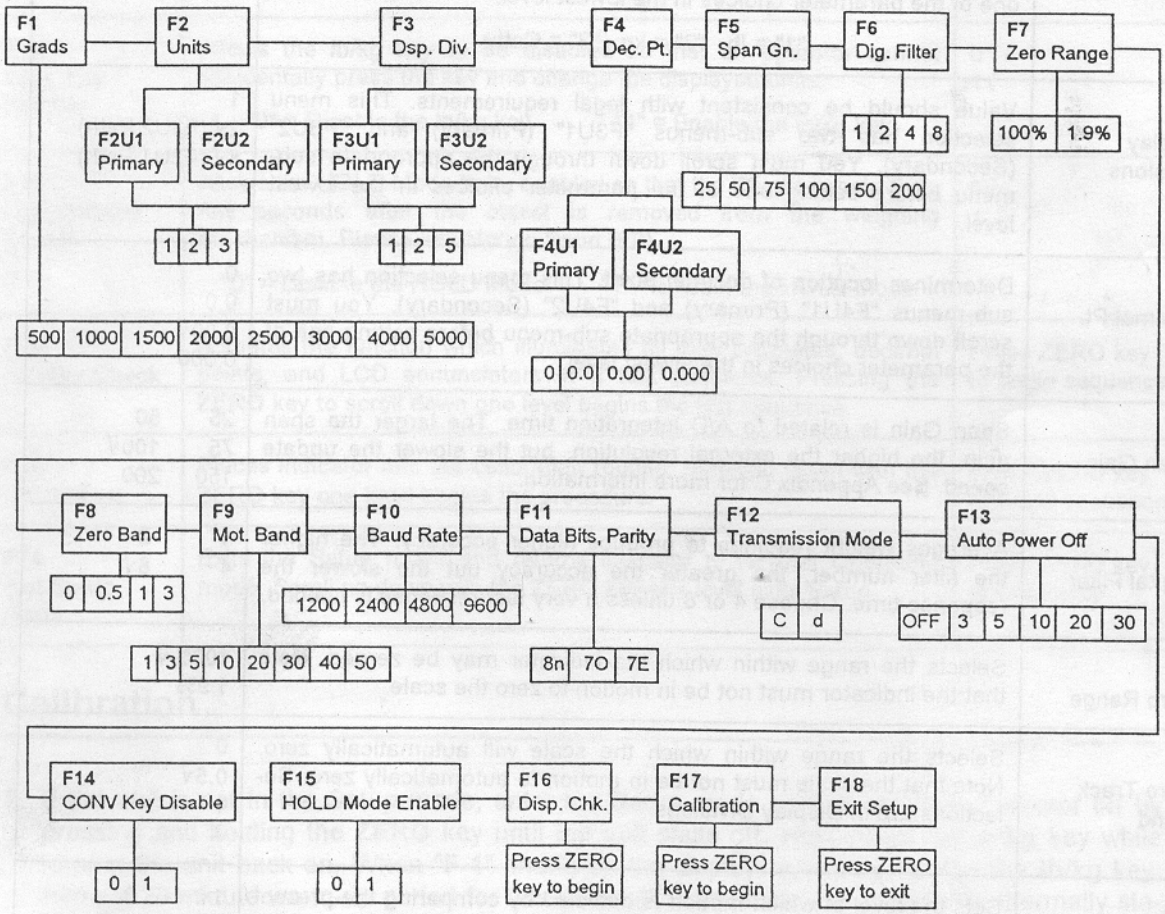
To place the unit in Setup mode:

1. Turn indicator off by pressing and holding the **ZERO** key for about three seconds.
2. While holding down the **lb/kg** key, turn the indicator on.

3. When the display shows "**F1**", the unit is in Setup mode, and you can release the **lb/kg** key. Shown at right are the directional and SET key assignments.



SETUP MENU CHART



Notes on the menu chart:

1. The F2, F3, and F4 sub-menus have two pathways down to the level of choices. Both pathways have the same choices, but are separate.
2. Detailed descriptions of the menu parameters begin on the next page of this manual.

To place the unit back into the NORMAL OPERATING mode:

1. If in Setup mode, scroll to F18 and press the **ZERO** key.
2. The display will go through a digit check, then settle into Normal Operating mode.
3. All front panel keys will now return to their normal mode of operation.

Setup Menu Descriptions

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
F2 Unit Selection	Specifies the primary and secondary units. This menu selection has two sub-menus "F2U1" (Primary) and "F2U2" (Secondary). You must scroll down through the appropriate sub-menu before setting one of the parameter choices in the lowest level. "1" = lb "2" = kg "3" = Catty	**1√** (F2U1 Path) **2√** (F2U2 Path) 3
F3 Display Divisions	Value should be consistent with legal requirements. This menu selection has two sub-menus "F3U1" (Primary) and "F3U2" (Secondary). You must scroll down through the appropriate sub-menu before setting one of the parameter choices in the lowest level.	1 **2√** (F3U2 Path) **5√** (F3U1 Path)
F4 Decimal Pt.	Determines location of decimal point. This menu selection has two sub-menus "F4U1" (Primary) and "F4U2" (Secondary). You must scroll down through the appropriate sub-menu before setting one of the parameter choices in the lowest level.	0 0.0 **0.00√** 0.000
F5 Span Gain	Span Gain is related to A/D integration time. The larger the span gain, the higher the external resolution, but the slower the update speed. See Appendix C for more information.	25 50 75 **100√** 150 200
F6 Digital Filter	Averages weight readings to produce higher accuracy. The higher the filter number, the greater the accuracy but the slower the response time. Choose 4 or 8 unless a very fast response is needed.	1 2 4 **8√**
F7 Zero Range	Selects the range within which the indicator may be zeroed. Note that the indicator must not be in motion to zero the scale.	**100%√** 1.9%
F8 Zero Track Band	Selects the range within which the scale will automatically zero. Note that the scale must not be in motion to automatically zero. Selections are in Display Divisions.	0 **0.5√** 1 3
F9 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. When used in conjunction with the HOLD Mode (F15), must be large enough to "trip" the HOLD, but small enough to prevent false triggering.	**1√** 3 5 10 20 30 40 50
F10 Baud Rate	Selects the baud rate for data transmission through the serial port.	1200 **2400√** 4800 9600
F11 Data Bits and Parity	Selects the number of data bits and parity of serial transmission. "8n" = 8 data bits with no parity bit "7O" = 7 data bits with odd parity bit "7E" = 7 data bits with even parity bit	8n **7O√** 7E

Setup Menu Descriptions / Continued

NAME/CODE	DESCRIPTION	CODE/VALUE
F12 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√
F13 Auto Power Off Period	Selects the auto off time period in minutes: "OFF" = Disabled	OFF√ 3 5 10 20 30
F14 lb/kg Key Disable	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√
F15 HOLD Mode Enable	Allows the HOLD Mode to be enabled so that the weight is held for a few seconds after the object is removed from the weighing mechanism. Please see Motion Band (F9). "0" = Disable the HOLD Mode "1" = Enable the HOLD Mode	0√ 1
F16 Display Check	Actuates the function which 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
F17 Calibration	Places indicator into the calibration routine. Scrolling down with the ZERO key one level begins the procedure.	Press ZERO key to begin sequence
F18 Exit Setup Mode	Exits the Setup mode and returns indicator to Normal Operating mode. Scrolling down with the ZERO key one level exits Setup.	Press ZERO key to exit Setup

Calibration

1. If the unit is not in the Setup mode, enter the Setup mode as follows: Turn indicator off by pressing and holding the **ZERO** key until the unit shuts off. Hold down the **lb/kg** key while turning the unit back on. When "**F 1**" shows on the display, you may release the **lb/kg** key. Allow a 20 minute warm-up period for the load cell(s) and indicator to become thermally stable. ***NOTE***: The auto power off is not enabled in Setup mode.
2. While in the Setup mode, scroll to "**F 17**", then scroll down once using the **ZERO** key to enter calibration menu.
3. The display will momentarily show "**C 0**" followed by a value. Press **ZERO** to zero the value, then press the **NET/GROSS** key to save the zero point value.
4. 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 F3. Place the test weight on the weighing mechanism.
5. Use the four directional keys 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. The position of the flashing digit may be changed by pressing the **ON/PRINT** key or the **TARE** key.

6. After setting the exact value, press the **NET/GROSS** key to save the value.
7. If the calibration was successful, the display will show **"ECAL"** momentarily, then revert back up to F17. Exit the Calibration menu and enter the Normal Operating mode by scrolling to F18, then pressing the **ZERO** key.
8. 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 adjust keyed-in weight is smaller than 10% 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 (F5).

APPENDIX A: Specifications

ANALOG SPECIFICATIONS

Full Scale Input Signal	30V, including dead load
Input Impedance	30MΩ, typical
Internal Resolution	Approximately 100,000 counts
Display Resolution	5,000 dd
Measurement Rate	10 Meas/sec
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
RFI Protection	Signal and excitation lines protected by LC Low Pass Filter

DIGITAL SPECIFICATIONS

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

SERIAL COMMUNICATIONS

Printer Port	Full Duplex at 1200, 2400, 4800, or 9600 Baud. Data bits and parity selectable.

OPERATOR INTERFACE

Display	1" (25.4mm) 7-segment, Liquid Crystal, 4½ Digit
Additional Symbols	Net, Gross, kg, neg weight
Keyboard	5-key flat membrane panel

POWER

AC Adapter	12 VDC @ 800mA
Power Consumption	110mA, with 4 x 350Ω Load Cells

APPENDIX A: Specifications / Continued

ENVIRONMENTAL

Operating Temperature	0° to +40° C
Storage Temperature	-25° to +70° C

MECHANICAL

Overall Dimensions	9.0" x 5.5" x 2-7/8" (229mm x 140mm x 73.2mm)
Weight	1.1 kg (2.4 LB)
Enclosure Classification	NEMA 4X SS

APPENDIX B: Serial Data Format

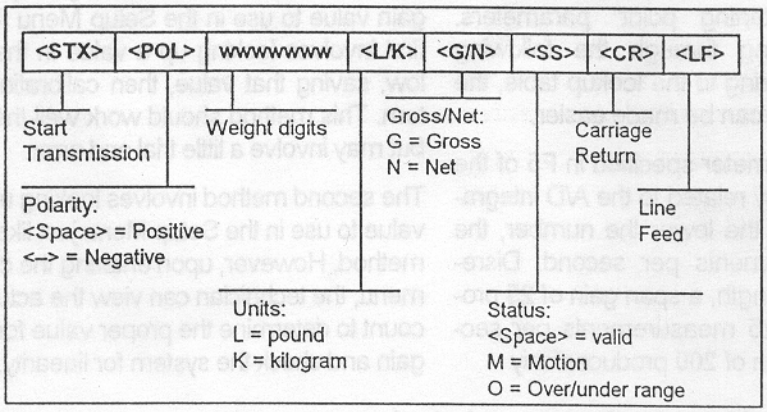
OVERVIEW

The TI-1000 is equipped with a full duplex ASCII compatible RS-232 serial communications terminal which may be wired to any type of serial output connector. The serial data format is compatible with most printers, scoreboards, and other remote devices.

As shown in the SETUP MENU CHART, the terminal may be configured for Continuous or Demand data transmission.

CONTINUOUS MODE SERIAL TRANSMISSION

This mode is used primarily to interface to computers, scoreboards, and other remote devices requiring constant data updating. This transmission occurs at the end of each display update.

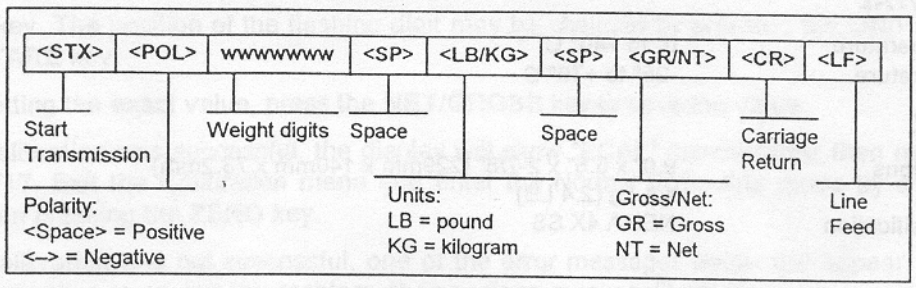


Continuous Mode Serial Data Format

DEMAND MODE SERIAL TRANSMISSION

Primarily designed to interface to printers, this format makes use of the **ON/PRINT** key present on the TI-1000 front panel. The indicator will respond with the following data provided it is not in motion, overloaded, or under zero, in which case the unit does not respond.

APPENDIX B: Serial Data Format / Continued



Demand Mode Serial Data Format

The unit also responds to the following commands issued from an external controlling device:

"P"	Print
"C"	Convert Units - same as pressing **lb/kg** key
"Z"	Zero the present weight indication - same as pressing the **ZERO** key
"T"	Tare the present weight indication - same as pressing the **TARE** key
"N"	Change to Net mode
"G"	Change to Gross mode

APPENDIX C: Determining Proper Span Gain

Possibly the hardest part of configuring an indicator to the specified weighing element is determining the "starting point" parameters. Hopefully, by reading through the following information and referring to the lookup table, the scale technician's job can be made easier.

The Span Gain parameter specified in F5 of the Setup Menu is directly related to the A/D integration time. Therefore, the lower the number, the higher the measurements per second. Disregarding digital filter length, a span gain of **25** produces about 20 to 25 measurements per second, while a span gain of **200** produces only about 3 or 4 measurements per second. There are two methods for determining the proper span gain value to use in the Setup Menu for F5. The first involves looking up a value in the table below, saving that value, then calibrating the system. This method should work well the first time, but may involve a little trial and error.

The second method involves looking up an initial value to use in the Setup Menu just like the first method. However, upon entering the calibration menu, the technician can view the actual internal count to determine the proper value for the span gain and check the system for linearity.

To determine the initial value for span gain in the setup menu:

1. Determine the number of desired external graduations and choose the corresponding value 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 F5.
3. Perform a system calibration. If the value you chose for Span Gain was too low, you will get an "**Err2**" message. Enter the next highest choice in the F5 menu and repeat the calibration.

To view the internal count during the calibration procedure:

1. Follow steps 1 and 2 in the procedure above.
2. Proceed to the calibration menu (F17) and follow steps 1 to 3, ***but do not save the zero point.***

APPENDIX C: Determining Proper Span Gain / Continued

3. After pressing ZERO to zero the offset, you may place the test weight(s) on the weighing mechanism.

4. The displayed count is the internal count. At full scale, the displayed count should be a minimum of 5 times the desired external graduations. Since the display cannot show numbers over 19,999, refer to the diagram at right to determine the displayed value.

5. 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							
	2.0mV	2.5mV	4.0mV	5.0mV	6.0mV	7.5mV	8.0mV	10.0mV
500	25	25	25	25	25	25	25	25
1000	50	50	25	25	25	25	25	25
2000	100	75	50	50	50	25	25	25
2500	100	100	50	50	50	50	25	25
3000	150	100	75	50	50	50	50	25
4000	200	150	100	75	75	50	50	50
5000	200	200	100	100	75	75	50	50

Recommended Minimum Span Gain Table