Model **ST-FT1**

DIGITAL FORCE / TORQUE INDICATOR

User's Guide

MesaLabs

Thank you…

Thank you for purchasing a Mesa Labs Model ST-FT1 digital force / torque indicator, designed for use with a remote torque sensor.

With proper usage, we are confident that you will get many years of great service with this product. Mesa Labs instruments are ruggedly built for many years of service in laboratory and industrial environments.

This User's Guide provides setup, safety, and operation instructions. Dimensions and specifications are also provided. For additional information or answers to your questions, please do not hesitate to contact us. Our technical support and engineering teams are eager to assist you.

Before use, each person who is to use a Model ST-FT1 indicator should be fully trained in appropriate operation and safety procedures.

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1 SAFETY / PROPER USAGE

Read through the following safety instructions thoroughly before using the ST-FT1 with a sensor:

1. Note the sensor's capacity before use and ensure that the capacity is not exceeded. **Producing a load greater than the indicated safe overload value can damage the sensor.** An overload can occur whether the indicator is powered on or off.

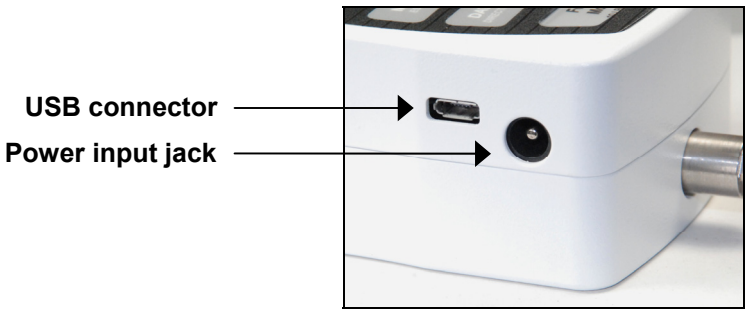
2. Ensure that the indicator is kept away from water or any other electrically conductive liquids at all times.

3. The sensor and indicator should be serviced by a trained technician only. AC power must be disconnected and the indicator must be powered off before the housing is opened.

4. Always consider the characteristics of the sample being tested before initiating a test. A risk assessment should be carried out beforehand to ensure that all safety measures have been addressed and implemented.

2 POWER

The ST-FT1 is powered either by an 8.4V NiMH rechargeable battery or by an AC adapter. Since these batteries are subject to self discharge, it may be necessary to recharge the unit after a prolonged period of storage. Plug the accompanying charger into the AC outlet and insert the charger plug into the receptacle on the indicator (refer to the illustration below). The battery will fully charge in approximately 8 hours.



Caution!

Do not use chargers or batteries other than supplied or instrument damage may occur.

If the AC adapter is plugged in, an icon appears in the lower left corner of the display, as follows: 

If the AC adapter is not plugged in, battery power drainage is denoted in a five-step process:

1. When battery life is greater than 75%, the following indicator is present: 
2. When battery life is between 50% and 75%, the following indicator is present: 
3. When battery life is between 25% and 50%, the following indicator is present: 
4. When battery life is less than 25%, the following indicator is present: 

5. When battery life drops to approximately 2%, the indicator from step 4 will be flashing. Several minutes after (timing depends on usage and whether the backlight is turned on or off), a message appears, "BATTERY VOLTAGE TOO LOW. POWERING OFF". A 4-tone audio indicator will sound and the indicator will power off.

The indicator can be configured to automatically power off following a period of inactivity. Refer to the **Other Settings** section for details.

If battery replacement is necessary, the battery may be accessed by loosening the two captive screws in the rear half of the housing and separating the two halves of the housing.

3 SETUP

3.1 Connecting a sensor

The sensor connector must be inserted into the receptacle as shown below:

When fully inserted, the connector will lock into place with a "click".

To release the connector, press both buttons on either side of the indicator housing to release the sensor. Pull the connector completely out of the indicator by holding the curved aluminum section. **DO NOT** pull on the cable or strain relief.

3.2 Mounting to a plate

The ST-FT1 can be mounted to a plate with four thumb screws fastened into the appropriate holes in the rear half of the housing. Refer to the **Dimensions** section for detailed hole information and locations.

3.4 Installing the USB driver

If communicating via USB, install the USB driver provided on the Resource CD.

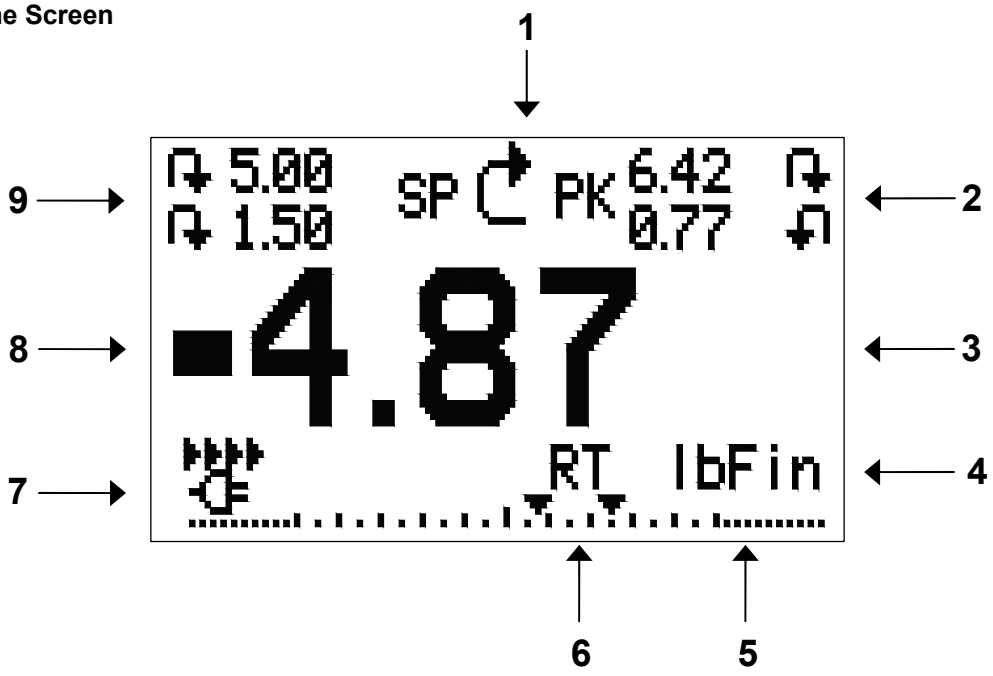
Caution!

Install the USB driver before physically connecting the indicator to a PC with the USB cable.

Further instructions for configuring and using the indicator's outputs are provided in the **Communications and Outputs** section.

4 HOME SCREEN AND CONTROLS

4.1 Home Screen



No.	Name	Description
1	**Measurement direction indicator**	↻ – indicates clockwise direction (for torque sensors) ↺ – indicates counter-clockwise direction (for torque sensors) These indicators are used throughout the display and menu.
2	**Peaks**	The maximum measured clockwise and counter-clockwise readings. These readings are reset by pressing **ZERO** or by powering the indicator off and on.
3	**Primary reading**	The current displayed load reading. See **Operating Modes** section for details. If a sensor is not plugged in, this value will be replaced by a message, as follows: SENSOR NOT CONNECTED
4	**Load bar**	Analog indicator to help identify when an overload condition is imminent. The bar increases either to the right or to the left from the midpoint of the graph. Increasing to the right indicates clockwise load, increasing to the left indicates counter-clockwise load. If set points are enabled, triangular markers are displayed for visual convenience. This indicator reflects the actual load, which may not correspond to the primary reading (depends on operating mode). The **ZERO** key does not reset the load bar. See **Operating Modes** section for details.
5	**Units**	The current measurement unit. Abbreviations are as follows: lbFin – Pound-inch ozFin – Ounce-inch kgFm – Kilogram-meter kgFmm – Kilogram-millimeter Nm – Newton-meter Ncm – Newton-centimeter **Note:** not all sensor models display all the above units. Refer to the capacity / resolution table for the respective sensor for details.
6	**Mode**	The current measurement mode. Abbreviations are as follows: RT – Real Time PCW – Peak Clockwise PCCW – Peak Counter-clockwise

		See **Operating Modes** section for details about each of these modes
7	**Battery / AC adapter indicator**	Either the AC adapter icon or battery power icon will be shown, depending on power conditions. Refer to the **Power** section for details.
8	**High / low limit indicators**	Correspond to the programmed set points. Indicator definitions are as follows: ▲ – the displayed value is greater than the upper load limit ■ – the displayed value is between the load limits ▼ – the displayed value is less than the lower load limit
9	**Set points**	The programmed load limit values. Typically used for pass/fail type testing. One, two, or no indicators may be present, depending on the configuration shown in the **Set Points** menu item.

4.2 Controls

Primary Label	Primary Function	Secondary Label	Secondary Function
⏻	Powers the indicator on and off. Press briefly to power on, press and hold to power off. Active only when the home screen is displayed.	**ENTER**	Various uses, as described in the following sections.
ZERO	Zeroes the primary reading and peaks.	▲ *(UP)*	Navigates up through the menu and sub-menus .
MENU	Enters the main menu.	**ESCAPE**	Reverts one step backwards through the menu hierarchy.
MODE	Toggles between measurement modes.	▼ *(DOWN)*	Navigates down through the menu and sub-menus.
DATA	Transmits the current reading to an external device via the USB port.	**DIRECTION**	Toggles between tension and compression (or clockwise and counter-clockwise) directions while configuring set points and other menu functions.

Note: Measurement units are configured through the menu. Refer to the **Changing The Units** section for details.

4.3 Menu navigation basics

Most of the indicator's various functions and parameters are configured through the main menu. To access the menu press **MENU**. Use the **UP** and **DOWN** keys to scroll through the items. The current selection is denoted with clear text over a dark background. Press **ENTER** to select a menu item, then use **UP** and **DOWN** again to scroll through the sub-menus. Press **ENTER** again to select the sub-menu item.

For parameters that may be either selected or deselected, press **ENTER** to toggle between selecting and deselecting. An asterisk (*) to the left of the parameter label is used to indicate when the parameter has been selected.

For parameters requiring the input of a numerical value, use the **UP** and **DOWN** keys to increment or decrement the value. Press and hold either key to auto-increment at a gradually increasing rate. When the desired value has been reached, press **ENTER** to save the change and revert back to the sub-menu item, or press **ESCAPE** to revert back to the sub-menu item without saving. Press **ESCAPE** to revert one step back in the menu hierarchy until back into normal operating mode.

Refer to the following sections for details about setting up particular functions and parameters.

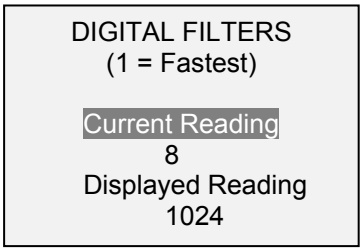
Note: The sensor connector retains all configuration and calibration data for the sensor, which includes menu settings. As such, a sensor must be connected in order for menu changes to be saved with that

particular sensor. If a sensor is not connected and the **MENU** key is pressed, it is possible to browse through the menu parameters and make changes, but changes will not be saved.

5 DIGITAL FILTERS

Digital filters are provided to help smooth out the readings in situations where there is mechanical interference in the work area or test sample. These filters utilize the moving average technique in which consecutive readings are pushed through a buffer and the displayed reading is the average of the buffer contents. By varying the length of the buffer, a variable smoothing effect can be achieved. The selection of 1 will disable the filter since the average of a single value is the value itself.

To access digital filter settings, select **Filters** from the menu. The display appears as follows:



Two filters are available:

Current Reading – Applies to the peak capture rate of the instrument.

Displayed Reading – Applies to the primary reading on the display.

Available settings: *1,2,4,8,16,32,64,128,256,512,1024.* It is recommended to keep the current reading filter at its lowest value for best performance, and the displayed reading filter at its highest value for best stability.

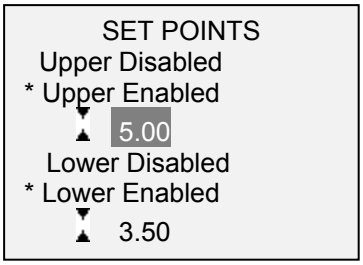
6 SET POINT INDICATORS

6.1 General Information

Set points are useful for tolerance checking (pass/fail). Two limits, high and low, are specified and stored in the non-volatile memory of the instrument and the primary reading is compared to these limits.

6.2 Configuration

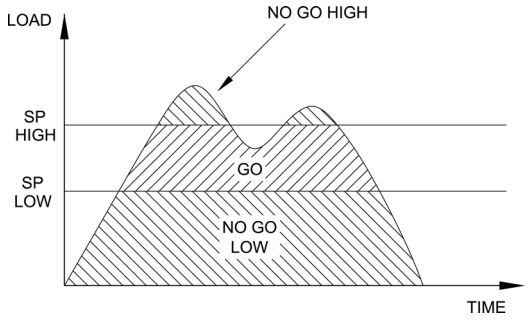
To configure set points, select **Set Points** from the menu. The screen appears as follows:



Either one, two, or none of the set points may be enabled. To toggle between clockwise and counter-clockwise directions, press the **DIRECTION** key.

If two set points have been enabled, they are displayed in the upper left corner of the display. If only one set point has been enabled, the word "OFF" appears in place of the value. If no set points have been enabled, the upper left corner of the display will be blank.

When set points are enabled, the following indicators are shown to the left of the primary reading:



▲ – the displayed value is greater than the upper load limit (NO GO HIGH)

■ – the displayed value is between the limits (GO)

▼ – the displayed value is less than the lower load limit (NO GO LOW)

Note: Set point indicators reference the displayed reading, not necessarily the current live load.

7 OPERATING MODES

Caution!

In any operating mode, if the capacity of the instrument has been exceeded by more than 110%, the display will show "OVER" to indicate an overload. A continuous audible tone will be sounded (if beeps are enabled) until the MENU key has been pressed or the load has been reduced to a safe level.

Three operating modes are possible with the ST-FT1 indicator. To cycle between the modes, press **MODE** while in the home screen.

7.1 Real time (RT)

The primary reading corresponds to the live measured reading.

7.2 Peak Clockwise (PCW)

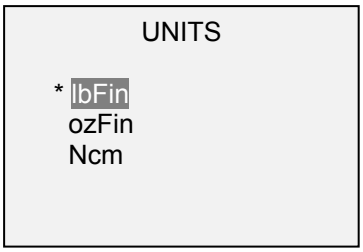
The primary reading corresponds to the peak clockwise reading observed. If the actual load decreases from the peak value, the peak will still be retained in the primary reading area of the display. Pressing **ZERO** will reset the value.

7.3 Peak Counter-clockwise (PCCW)

Same as above, but for counter-clockwise readings.

8 CHANGING THE UNITS

The ST-FT1 can display several measurement units, depending on the sensor. To change the unit, select **Units** from the menu. The display will list the available units, for example:



The indicator will always power on with the unit selected.

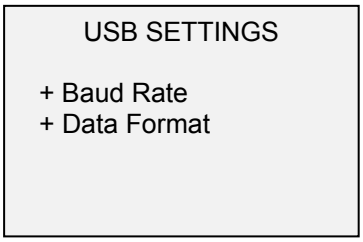
9 COMMUNICATIONS AND OUTPUTS

Communication with the ST-FT1 is achieved through the micro USB port located along the left side of the housing, as shown in the illustration in the **Power** section. Communication is possible only when the indicator is in the main operating screen (i.e. not in a menu or configuration area).

The current reading is transmitted from the indicator when the **DATA** key is pressed. For continuous output, the indicator also responds to the ASCII command '?' (no quotes), terminated with a Carriage Return character or with a Carriage Return/Line Feed combination. The indicator's responses are always terminated with a Carriage Return/Line Feed. Any detected errors are reported back by means of error code *10 (illegal command).

9.1 Communication Settings

To set up communication settings, select **USB Settings** from the menu. The screen appears as follows:



Communication settings are permanently set to the following:

Data Bits: **8**
Stop Bits: **1**
Parity: **None**

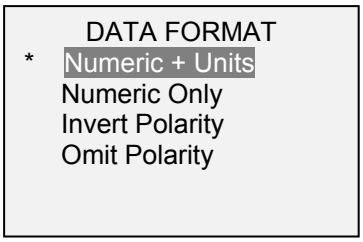
Other settings are configured as follows:

9.1.1 Baud Rate

Select the baud rate as required for the application. It must be set to the same value as the receiving device.

9.1.2 Data Format

Select the desired data format. The screen appears as follows:



Selection	Description
Numeric + Units	Output format includes the value and unit of measure. Clockwise values have positive polarity, counter-clockwise values have negative polarity.
Numeric Only	Output format includes the value only. Polarity same as above.
Invert Polarity	Clockwise values have negative polarity, counter-clockwise values have positive polarity. May be selected in addition to the Numeric + Units / Numeric Only selection.
Omit Polarity	Both directions are formatted with positive polarity. May be selected in addition to the Numeric + Units / Numeric Only selection.

Individual data points may be transmitted by pressing **DATA**.

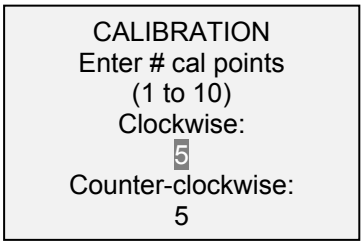
10 CALIBRATION

10.1 Initial Physical Setup

The sensor should be mounted vertically to a test stand or fixture rugged enough to withstand a load equal to the full capacity of the sensor. Certified deadweights, torque arms/wheels, and/or master load cells should be used, along with appropriate mounting brackets and fixtures. Caution should be taken while handling such equipment.

10.2 Calibration Procedure

1. Select **Calibration** from the menu. The display appears as follows:



   The sensor can be calibrated at up to 10 points in each direction. Enter the number of calibration points for each direction (clockwise and counter-clockwise). At least one point must be selected for each direction.

   It is recommended to calibrate the sensor at 5 or more even increments in both directions. For example, a torque sensor with capacity of 100 lbFin should be calibrated at 20, 40, 60, 80, and 100 lbFin loads in each direction.

2. To escape the **Calibration** menu at any time, press **ESCAPE**. The display appears as follows:

CALIBRATION
NOT COMPLETE

Cancel
Exit w/o saving

Selecting "Cancel" will revert back to the Calibration setup. Selecting "Exit w/o saving" will return to the menu without saving changes.

3. After the number of calibration points has been entered, press **ENTER**. The display appears as follows:

CALIBRATION
OFFSET

Place sensor
horizontally, then
press ZERO.

4. Place the sensor horizontally on a level surface free from vibration, then press **ZERO**. The indicator will calculate internal offsets, and the display appears as follows:

CALIBRATION
OFFSET

Please wait…

CALIBRATION
OFFSET

Sensor passed
Analog passed

If failed:

CALIBRATION
OFFSET

Sensor failed
Analog failed

5. The following screen appears after the offsets have been calculated:

CALIBRATION
CLOCKWISE

Attach necessary
weight fixtures,
then press ENTER.

Attach weight fixtures (brackets, hooks, etc), as required. Do not yet attach any weights or apply any calibration loads. Press **ENTER**.

6. The display appears as follows:

CALIBRATION
COUNTER-CLOCKWISE

Optionally exercise sensor, then press ENTER.

Optionally exercise the sensor several times (at full scale, if possible), then press **ENTER**.

7. The display appears as follows:

CALIBRATION
CLOCKWISE
Gain adjust
Apply full scale load
100.0 lbFin +/-20%,
then press ENTER.

Apply a load equal to the full scale of the sensor, then press **ENTER**.

8. After displaying "Please wait…" the display appears as follows:

CALIBRATION
CLOCKWISE

Ensure no load,
then press ZERO.

Remove the load applied in Step 8, leave the fixtures in place, then press **ZERO**.

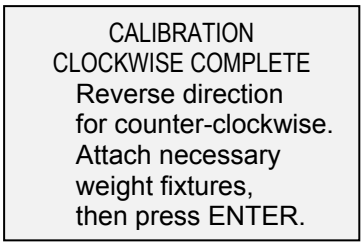
9. The display appears as follows:

CALIBRATION
CLOCKWISE
Apply load
1 OF 5
Enter load:
20.0 lbFin
Press ENTER.

Use the **UP** and **DOWN** keys to adjust the load value as required. The load values default to even increments, as indicated by the previously entered number of data points (even increments are recommended for best results). For example, if a 100 lbFin capacity sensor is calibrated, and 5 data points were selected, the load values will default to 20, 40, 60, 80, and 100 lbFin. Apply the calibration load. Then press **ENTER**.

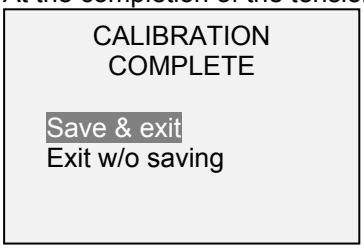
Repeat the above step for the number of data points selected.

10. After all the compression calibration points have been completed, the display appears as follows:



Press **ENTER**.

11. At the completion of the tension calibration, the display appears as follows:

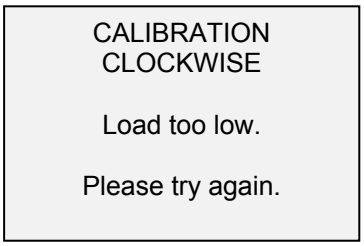


To save the calibration information, select "Save & exit". To exit without saving the data select "Exit without saving".

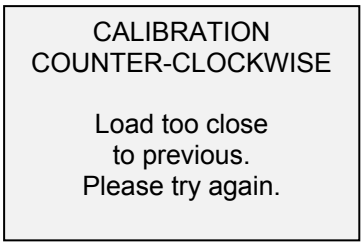
12. Any errors are reported by the following screens:

Displayed at the start of calibration if a disallowed unit is selected.

Ensure that the load is not swinging, oscillating, or vibrating in any manner. Then try again.



The calibration weight does not match the set value.

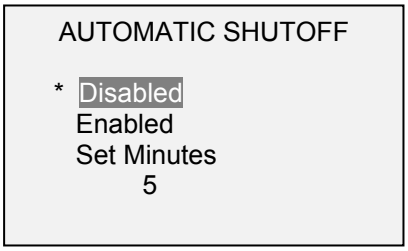


The entered calibration point is too close to the previous point.

11 OTHER SETTINGS

11.1 Automatic Shutoff

The indicator may be configured to automatically power off following a period of inactivity while on battery power. Inactivity is defined as the absence of any key presses or load changes of 100 counts or less. To access these settings, select **Automatic Shutoff** from the menu. The display appears as follows:

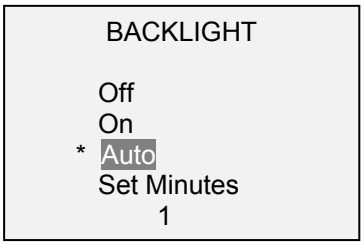


Select **Disabled** to disable automatic shutoff. Select **Enabled** to enable it. The length of time of inactivity is programmed in minutes via the **Set Minutes** parameter. Available settings: 5-30, in 5 minute increments.

Note: If the AC adapter is plugged in, the indicator will ignore these settings and remain powered on until the **POWER** key is pressed.

11.2 Backlight

There are several available initial settings (applicable upon powering on the indicator). To access these settings, select **Backlight** from the menu. The display appears as follows:

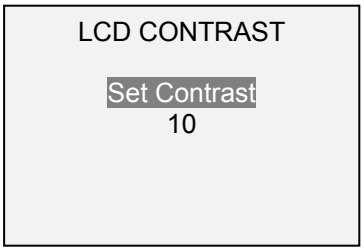


Selection	Description
Off	Backlight to be off upon powering on the indicator.
On	Backlight to be on upon powering on the indicator.
Auto	Backlight to be on upon powering indicator, but will shut off after a period of inactivity (as defined in the **Automatic Shutoff** sub-section). The backlight will turn on again when activity resumes. The length of time of inactivity is programmed in minutes via the **Set Minutes** parameter. Available settings: *1-10*, in 1 minute increments.

Note: If the AC adapter is plugged in, the indicator will ignore these settings and keep the backlight on. Selecting the **On** or **Off** setting in the **Backlight** menu will manually turn the backlight on or off.

11.3 LCD Contrast

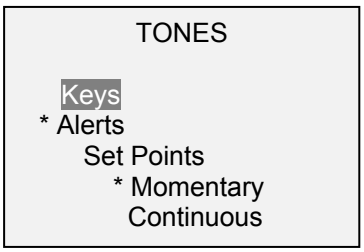
The contrast of the display may be adjusted. Select **LCD Contrast** from the menu. The screen appears as follows:



Press **ENTER** to modify the contrast. Select a value from 0 to 25, 25 producing the most contrast.

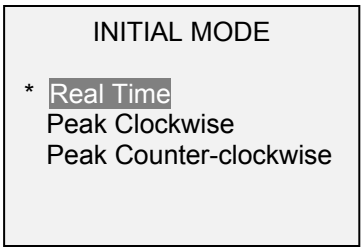
11.4 Tones

Audible tones can be enabled for all key presses and alerts, such as overload, set point value reached, etc. The Set Point alert can be configured to be either a momentary tone or a continuous tone (until the load is restored to a value between the set points). To configure the functions for which audible tones will apply, select **Tones** from the menu. The screen appears as follows:



11.5 Initial Mode

This section is used to configure the initial mode upon powering on the indicator. To access this parameter, select **Initial Mode** from the menu. The screen will display the available modes, which is determined by whether a force or torque sensor is connected. An example is as follows:



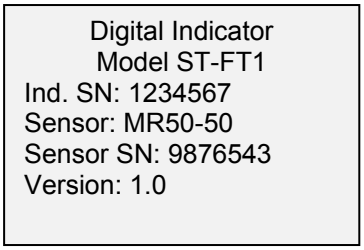
The default value is Real Time.

11.6 Restore Default Settings

Default factory settings can be restored by selecting **Restore Defaults** from the menu. The settings may be found in the **Specifications** section. The screen appears as follows:

11.7 Information / Welcome Screen

The following screen is displayed at power up and can be accessed at any time by selecting **Information** from the menu:



12 SPECIFICATIONS

12.1 General

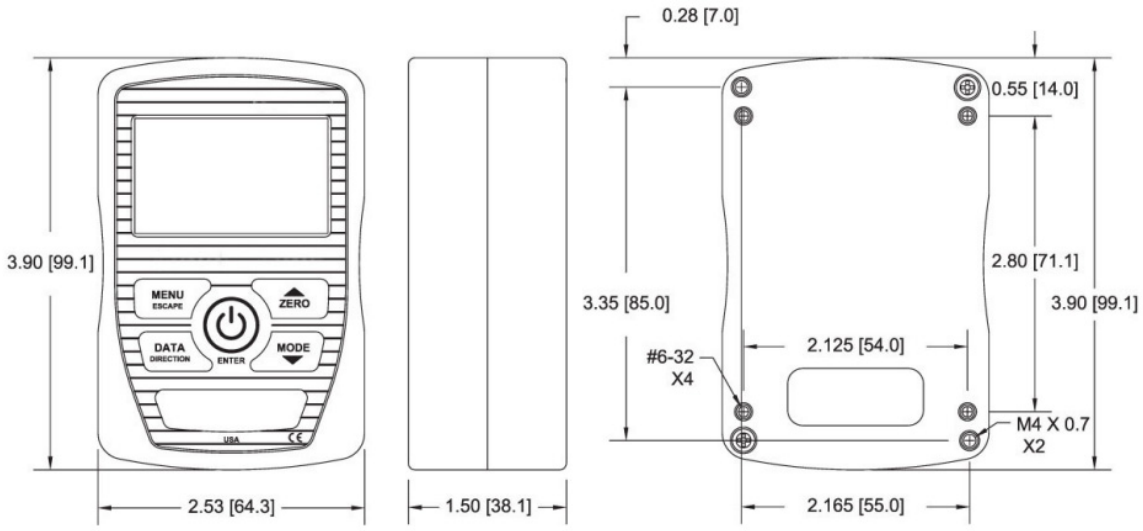
Accuracy:	±0.2% of full scale + sensor
Sampling rate:	2,000 Hz
Power:	AC or rechargeable battery. Low battery indicator appears when battery level is low, and indicator powers off automatically when power reaches critical stage.
Battery life:	**Backlight on:** up to 7 hours of continuous use **Backlight off:** up to 24 hours of continuous use
USB output:	Configurable up to 115,200 baud
Safe overload:	150% of full scale (display shows "OVER" at 110% and above)
Weight:	0.7 lb [0.3 kg]
Environmental requirements:	40 - 100°F, max. 96% humidity, non-condensating

12.2 Factory Settings

Parameter	Setting
Set points	
Upper	Disabled (defaults to 80% of full scale, CW, when enabled)
Lower	Disabled (defaults to 40% of full scale, CCW, when enabled)
Filters	
Current	8
Displayed	1024
Backlight	Auto
Minutes	1
USB Output	
Baud Rate	115,200
Data Format	Numeric + units
Automatic Shutoff	Enabled
Minutes	5
Tones	
Keys	Enabled
Alerts	Enabled
Set Points	Momentary
Initial Mode	Real Time
Units	Depends on sensor

12.3 Dimensions

IN [MM]



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