

Larson Systems Inc.



Tiger Free-Length Spring Gage User Manual

Version 1.0.7



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About This Manual

This manual could contain technical inaccuracies or typographical errors. Changes are periodically made to the information contained herein. These changes will be incorporated in new editions of the manual.

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1 INTRODUCTION TO THE TIGER FREE-LENGTH GAGE

The Tiger® Free-Length Spring Gage is the latest generation of Spring Gages manufactured by Larson Systems Inc. Based on the Lion Precision line of non-contact spring length testers, the Tiger is smaller than the previous Lion, Lynx and Panther versions, but offers greater accuracy and speed. It is designed to help spring manufacturers adjust their coilers to produce springs at the desired length. We've also made it easier to use.

Tiger Spring Gages use a temperature-stable probe that is completely interchangeable with all other Larson spring gages. The advanced design of the probe virtually eliminates drift from set-up points. Tiger gages work with older Larson probes.

The Tiger line includes the **Tiger Cub**, the **Tiger** and the **Super Tiger**.

- The Tiger Cub is an electronic upgrade that retrofits into the 300-9 Series Lion spring gage case and is set for 3-way sorting. It has no printing capabilities.
- The Tiger is the mid-range model, has more features than the Lynx and can do 3-way or 5-way fixed range sorting.
- The Super Tiger has more features than the Panther and can run 2-, 3- or 5-way adjustable range sorting operations. Both the Tiger and the Super Tiger attach to a printer through a standard USB cable.

2 UNPACKING AND INSTALLING YOUR TIGER GAGE

2.1 Unpacking and inspection

The Tiger Gage has been shipped to you in protective packaging. Take care when you remove it from its packaging to prevent damage or loss of contents. A packing slip listing all the items in the package is included with the shipment. Make sure you have received everything listed. Make a thorough inspection of the gage as you unpack it to make sure it has not been damaged during shipment. If there are any damages, notify the carrier immediately to file a claim for the damaged merchandise. Contact Larson Systems Inc. for a replacement. Note: Do not attempt to operate a damaged instrument.

2.2 Installing the Tiger Gage on Your Coiler

The Tiger spring gage should be placed in a location where it's easy to see and adjust and convenient to an input power outlet. (Power requirements are listed on the back of the unit.) Typically, operators place the gage on top of the spring machine. Follow this quick-start guide:

1. Plug the Tiger into an electrical outlet.
2. Plug the probe into the back of the Tiger.
3. Connect the probe to the coiler.
4. Press the power button on the back of the Tiger.
5. Position the probe in front of the coiler.
6. Wind a spring to cutoff.
7. Move the probe toward the coiler until the tip is approximately 0.04" to 0.5" (1 mm-20 mm) from the end of the spring.
8. Go to the Probe Setup Menu on the Tiger.

9. Press F2 to zero the probe. Move the probe, using the micrometer, and press F3 or F4 to set the appropriate sorting points. Press F5 to save your information.
10. Start making springs!

NOTE: The shutdown signal is active for a few milliseconds when the gage is first turned on. The coiler may shut down when the Tiger is activated. To avoid shutdown, turn the Tiger on prior to coiler setup.

2.3 Using the Tiger Gage with a CNC Controller

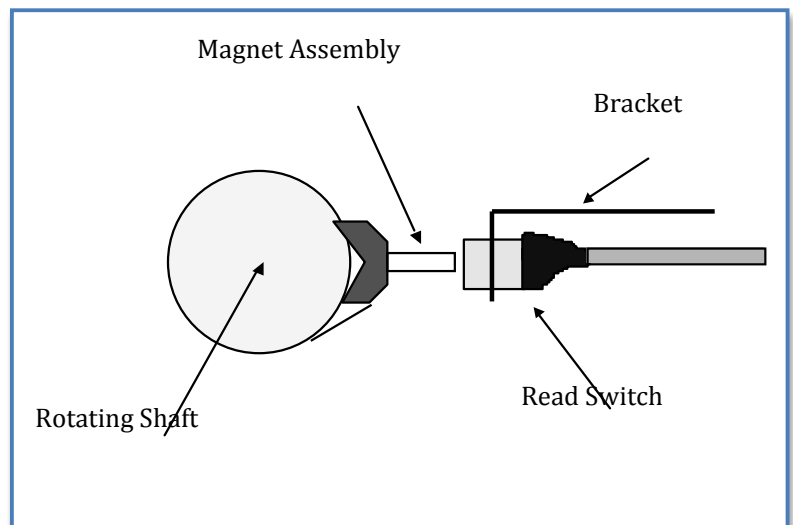
The Tiger Gage can be used with a CNC coiler. The CNC controller signals trigger the gage to read and implement the adjustment output from the gage to adjust spring length. A CNC connector is located on the upper left corner of the gage's rear panel. With a standard mechanical coiler, the Tiger gage turns a motor to adjust the pitch. Using the CNC these values must be rescaled as pitch table multipliers or offsets by the CNC software. CNC connector pinouts are listed in Section 17.4. The sorter may be controlled by the CNC using signals from the Tiger or by the Tiger sorter cable directly.

3 INSTALLING THE READ SWITCH

The Read Switch triggers the gage to measure the spring length, sort the spring, and adjust the pitch rod if necessary. The system consists of two basic parts—the read switch, and the magnet that triggers it. System accuracy can be affected by improper positioning of the read switch. Please confirm the proper position before operating.

Install as follows:

1. Install magnet assembly on the coiler's camshaft. It can also be installed on any rotating part that turns once per cycle.
2. Mount the read switch so the magnet passes within 0.1 inch of the switch each revolution.
3. Position the magnet on the shaft so it triggers the read switch after the wire stops feeding and before the cutoff tool touches the spring. The read switch should be triggered as soon as possible after the wire feed stops. This allows maximum time for the reading to be taken before the cutoff tool touches the spring.
4. Connect the read switch cable to the appropriate connector on the back of the Tiger.



4 INSTALLING A SHUTDOWN CABLE

To use the shutdown feature a contactor device must be installed on the coiler. Installing a shutdown cable between the coiler and the Tiger is the same as installing a shutdown cable between the coiler and a Panther. **Shutdown Cable installation should only be done by a**

qualified electrician. Improper installation can result in injury and or damage to the coiler and gage!

The relay inside the Tiger is not capable of handling the coiler power lines directly! The gage provides one set of normally closed contacts and one set of normally open contacts. The normally closed contacts can be wired in series with the contactor de-activation circuit. When a shutdown condition occurs the contacts will open, causing the contactor to remove power from the coiler. The normally open contacts can be used to activate an alarm or beacon if desired.

The current rating for each set of contacts is 5A @ 125/250 VAC.

Once the coiler has been wired for a shutdown cable, a normally closed set of contacts is required to run the coiler. The Larson Shutdown Cable Bypass (P/N A014-6180) can be used to run the coiler without a gage.

The shutdown cable contains four wires and has a connector that mates to the SHUTDOWN connector on the rear of the gage. The wiring diagram and schematic are shown below. The letters indicate the pins of the connector.

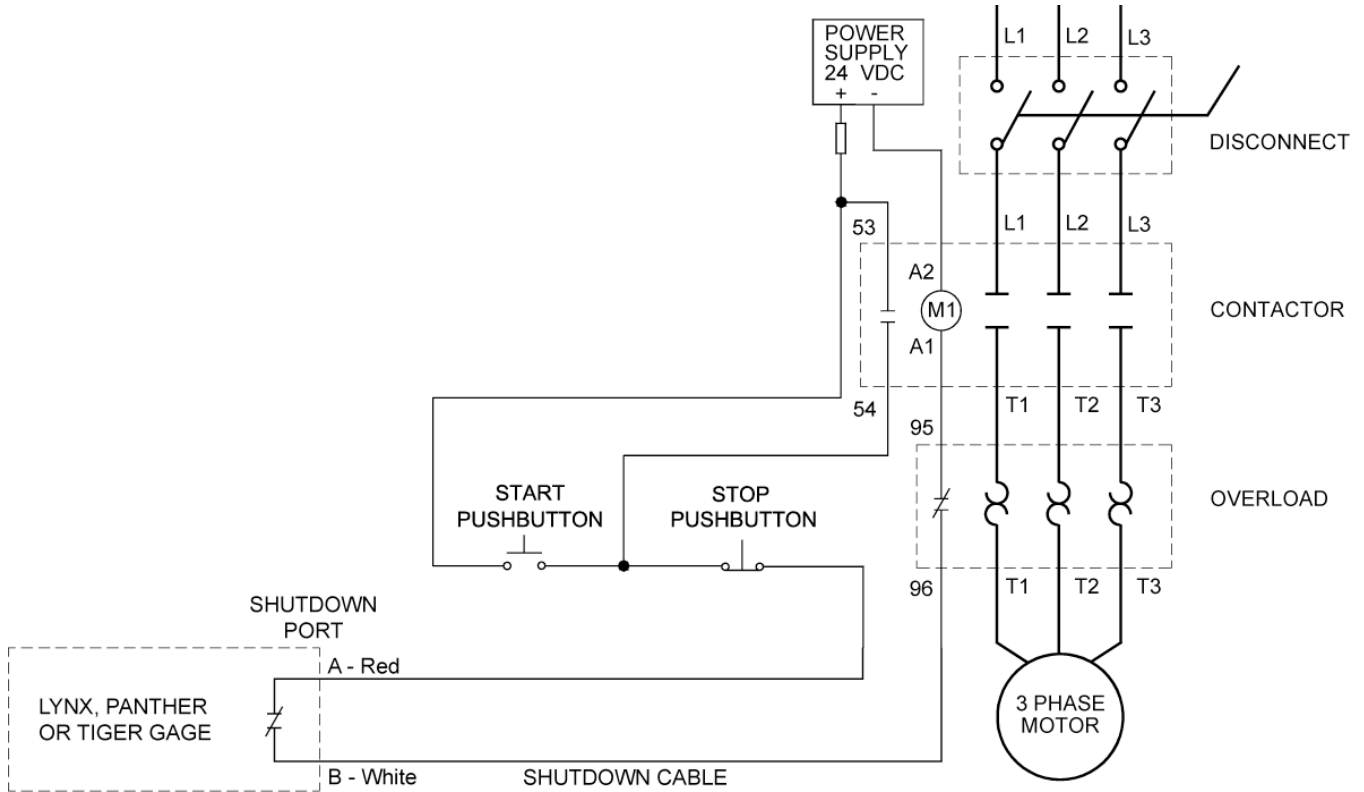
Normally Closed Contact



Normally Open Contact



The illustration below includes a schematic of a typical contactor box with shutdown installed.



Typical Installation Procedure:

1. Cut the wire in line with the stop switch.
2. Connect the one of the cut ends of the wire to the **Red** shutdown wire
3. Connect the other cut end to the **White** Shutdown Wire

! WARNING !

Confirm coiler and contactor manufacturers' instructions before proceeding.

5 PROBE SELECTION

Spring Coil Diameter	Regular Tip Size	Extended Tip Size
0.125 in. (3.1 mm) and smaller	Use probe without tip	1/8 in. (3 mm)
0.250 in. (6.3 mm) – 0.125 in. (3.1 mm)	1/4 in. (6 mm)	1/4 in. (6 mm)
0.375 in. (9.5 mm) – 0.250 in. (6.3 mm)	5/8 in. (16 mm)	3/8 in. (10 mm)
0.625 in. (15.9 mm) – 0.375 in. (9.5 mm)	5/8 in. (16 mm)	5/8 in. (16 mm)
1 in. (25.4 mm) – 0.625 in. (15.9 mm)	1 in. (25 mm)	1 in. (25 mm)
1.5 in. (38.1 mm) – 1 in. (25.4 mm)	1 1/2 in. (38 mm)	None
2 in. (50.8 mm) – 1.5 in. (38.1 mm)	2 in. (51 mm)	None

The diameter of the probe tip should be equal to or slightly greater than the diameter of the spring to be monitored. If the probe tip is too large, problems may arise with short springs. A probe tip that is too small may have to be positioned off-center to be effective. Short springs may require the use of a guarded probe tip.

Probe tips are available from LSI in diameters up to 2 inches.

6 RECOMMENDED PROBE STANDOFF DISTANCES

The best gap between the probe tip and the spring will vary for different size springs and different tolerances. This gap should be small enough to provide adequate sensitivity, but it should be large enough so that larger, over-size springs do not hit or hang up on the probe tip. Achieving the proper spring-to-tip gap enables you to have enough meter deflection to operate the trip relays yet keep springs away from the probe.

Recommended Standoff Distances		
Spring Diameter	Tip Size	Initial Standoff
0.062-1.25" (1.6-3.2 mm)	1/8" (3.17 mm)	.065" (1.65 mm)
0.125-.250" (3.2-6.4 mm)	1/4" (6.35 mm)	.125" (3.17 mm)
0.250-.375" (6.4-9.5 mm)	3/8" (9.52 mm)	.200" (5.08 mm)
0.375-.500" (9.5-12.7 mm)	1/2" (12.7 mm)	.275" (6.98 mm)
0.500-.625" (12.7-15.9 mm)	5/8" (15.9 mm)	.350" (8.89 mm)
0.625-.750" (15.9-19.1 mm)	3/4" (19.1 mm)	.450" (11.4 mm)
0.625-1.00" (15.9-24.4 mm)	1" (25.4 mm)	.650" (16.5 mm)

Use the chart at left as a guide when you set up your probe. These are only recommendations—your standoff distances may differ greatly.

7 THE TIGER: BASIC OVERVIEW

The Tiger Gage is a digital control unit that measures the length of springs as they are made and provides output to pitch adjusters and sorters according to predetermined tolerances. The gage measures springs when they have completed the winding cycle, but before they are cut. Springs are sorted into Long, Good and Short lengths with accessory chutes or air solenoids.

The Super Tiger also provides on-screen Statistical Process Control (SPC) analysis of free length measurements. It operates via a simple menu that even a first-time user can learn quickly and easily. It features:

- 2-way, 3-way and 5-way spring sorting
- Pitch adjustment feedback to the coiler for length correction
- Coiler shutdown under certain conditions
- Supplies power and feedback control signals to probe, sorters, and coiler
- On-screen SPC charts
- Monitor up to 70,000 springs per hour
- Compatibility with older accessories, including sorting chutes and pitch controllers

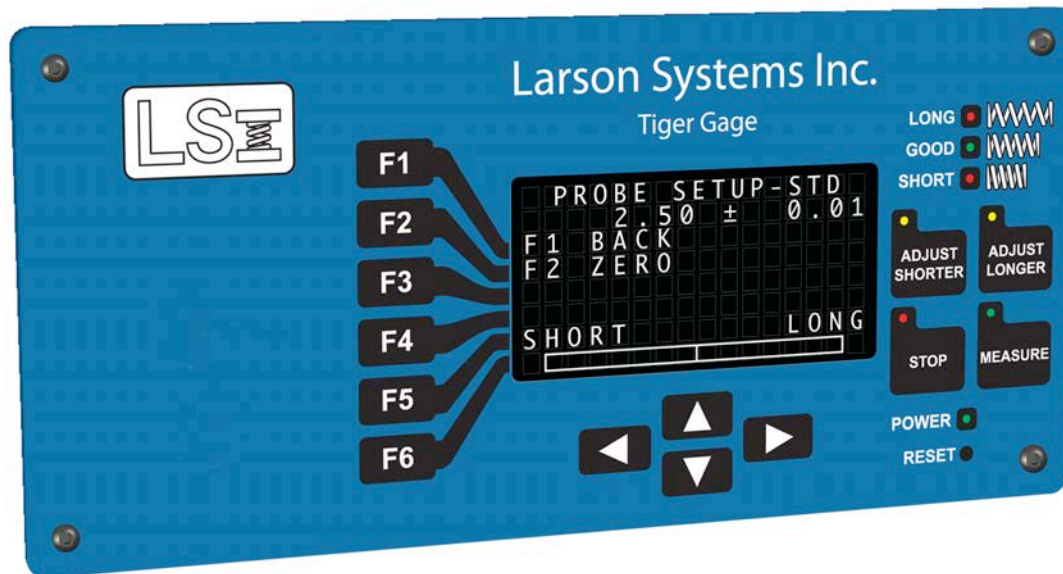


Tiger Upgrade with a future



Tiger & Super Tiger

8 CONTROL PANEL



The Tiger control panel includes six function keys, LED indicators for Long, Good and Short springs, two buttons for adjusting spring length, a button to measure individual springs and a stop button. An LED shows when Power is on, and another lights up when you reset the gage.

The center of the control panel features an LCD screen that you will use to set up the gage, diagnose problems and monitor job progress.

With Super Tiger software, the screen also displays Xbar and R charts and histograms for statistical process control (SPC). You can also perform a machine capability study (MCS) with the Super Tiger.

The temperature-stabilized probe plugs into the back of the tester.

8.1 Sort Indicator

The sort indicator is located in the upper right corner of the control panel. When the coiler produces a spring that is longer than specified, the LED next to the illustration of a long spring lights. Good and Short springs are indicated by the LED lights next to the Good and Short illustrations.

8.2 Adjust Buttons

Use these buttons to adjust spring length at the coiler. To shorten a spring, press Adjust Shorter. To lengthen a spring, press Adjust Longer.

8.3 Measure

Push this button to measure springs as they come off the coiler.

8.4 Stop

Press the Stop button to shut down the coiler. The Tiger screen will show



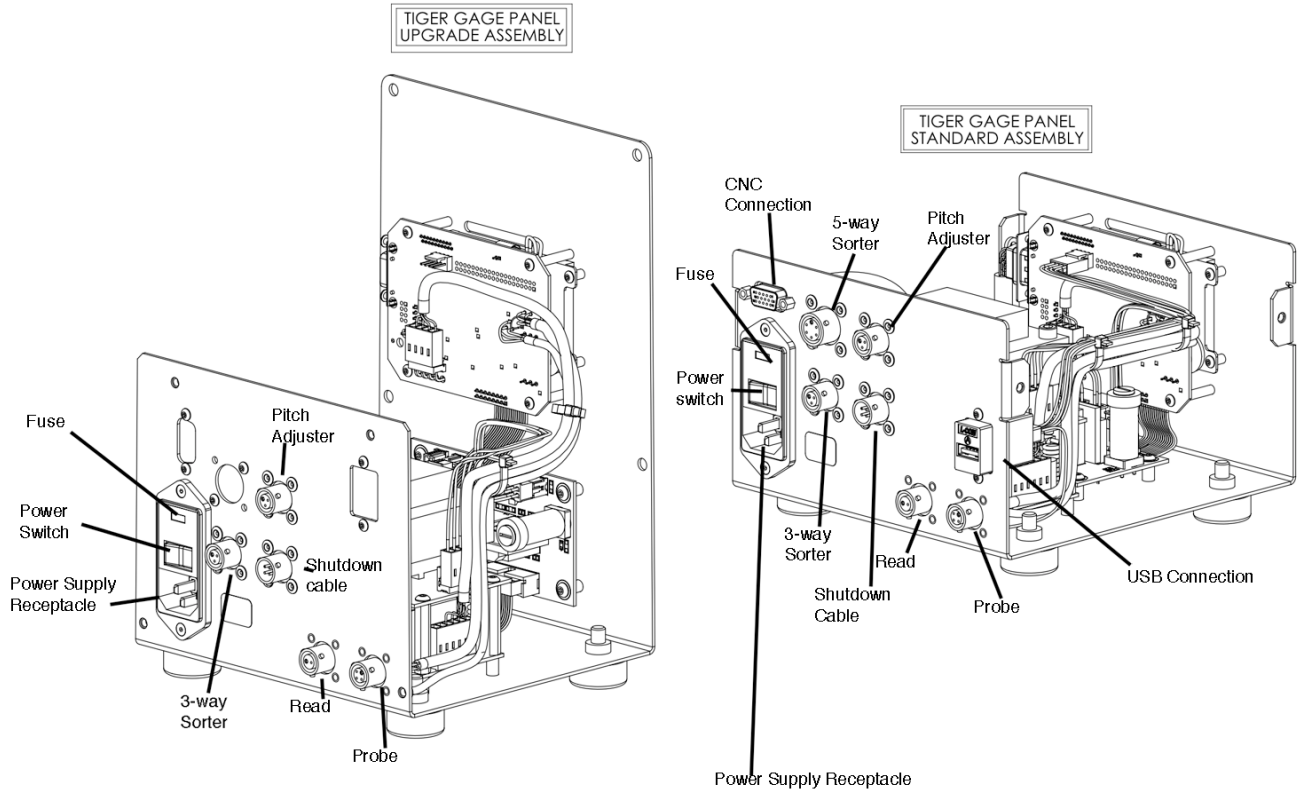
8.5 Arrow Keys

There are four arrow keys at the bottom center of the control panel—up, down, left and right. Depending on the sub-menu you are in, you will use these keys to enter numbers or letters into the Tiger.

8.6 Power Indicator

When this LED is lit, the power is on.

9 BACK PANEL CONNECTIONS



9.1 Power Switch

The electrical power switch for the Tiger is located on the back panel, just above the power supply receptacle. The switch is a toggle switch. Push the side marked “**I**” to supply power to the Tiger. Push the side marked “**O**” to turn off the power. A circuit breaker is located above the push button.

9.2 Probe

The Tiger can be used with any Larson spring gage probe. It is designed to take advantage of the PX595G Temperature Stable Probe (P/N 025-0000-0658-02 (English) or 025-0000-0658-02 (Metric)). Plug the probe into this connector.

9.3 Read Switch

Any standard Larson magnetic read switch for non-CNC coilers can be connected here. See Installing the Read Switch (Section 3) for details.

9.4 CNC Connection

This connection is for use with CNC coilers. It is a high-density 9-pin D-sub connector. The connector carries all the signals used on the various mechanical coiler control cables. With CNC coilers a read signal must be sent to the Tiger to tell the gage when to read the spring length. The Tiger sends signals to the coiler that the CNC software interprets and uses to pitch adjust the spring length. The shutdown and sorter signals are there if the CNC coiler manufacturer chooses to use them, but generally these functions are controlled with the separate cables directly from the Tiger to the sorter or to shut down the coiler. See Section 17.4, for pinout details. (Connector is an option with Tiger 300 upgrade.)

9.5 Sorter Controls

The Tiger has connections for 3-Way and 5-Way sorters. These connect to any sorting chute or air solenoid. The outputs are 115 VAC, 24 VAC, or 24 VDC. (5-way sort connector is an option of the Tiger 300 upgrade.)

9.6 Pitch Adjuster

The Tiger has a separate connection for the Pitch Adjuster.

9.7 Shutdown Cable

This connector is for a Larson automatic shutdown cable (P/N 025-1000-0426). It provides a set of normally closed relay contacts and a set of normally open relay contacts that switch when a shutdown occurs. See Installing a Shutdown Cable, Section 4, for specific details.

9.8 USB Connection

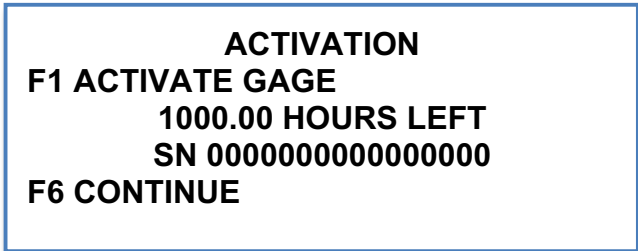
The Tiger has a USB connection in case you would like to connect your tester to a computer or printer. (The USB connector is an option if you bought a Tiger 300 upgrade.) Version 1.0 software does not include a computer interface to the USB print connection.

10 ACTIVATION CODE

Each Tiger gage is shipped requiring an activation code. LSI will provide an activation code to you when full payment for the gage has been received.

This is the first screen you will see. To begin using the gage immediately, press F6 Continue to get to the Main Menu. The Activation screen allows you 1,000 hours of use. Without an activation code, the gage will cease to function after 1,000 hours of use.

To enter your activation code, press F5 from the Main Menu to go to the Settings menu. Press F2 to go to the Configuration menu. Press F3 to enter the code. Use ▲ or ▼ to scroll through the character list. Use the left or right arrow to move the cursor from side to side.



NOTE: F2 Enter Password is for factory use only.

SETTINGS

- F1 MAIN MENU**
- F2 CONFIGURATION**
- F3 COMPANY NAME**
- F4 DEFAULT RUN SCREEN**

CONFIGURATION

- F1 BACK**
- F2 ENTER PASSWORD**
- F3 ACTIVATION CODE**

V1.07 SN 11111111111111

11 MAIN MENU/FUNCTION KEYS

When you plug any Tiger Gage into an electrical outlet and press the Power button, you will see the Main Menu. This is where you will select the operating outputs you want to watch. Various functions are available to you, depending on the software package you have purchased. The Super Tiger offers the most functions.

MAIN MENU

- F2 MONITOR**
- F3 SETUP**
- F4 DIAGNOSTICS**
- F5 SETTINGS**

Because there are subtle differences between the Tiger Cub, Tiger and Super Tiger software programs and the way they affect tester function, we have split this section into three subsections, according to tester model.

11.1 Cub: Main Menu

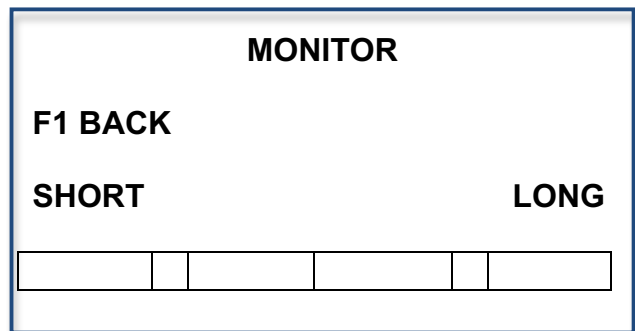
When you access the main menu of the Cub, you are given three functions: Monitor, Setup and Diagnostics. Press F2 to access the Monitor menu.

MAIN MENU

- F2 MONITOR**
- F3 SETUP**
- F4 DIAGNOSTICS**
- F5 SETTINGS**

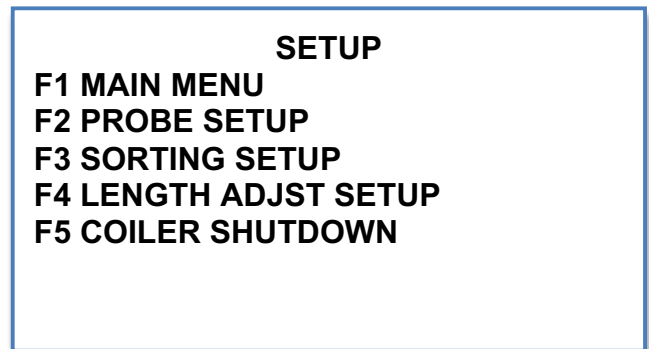
11.1.1 Cub: Monitor Menu

This screen acts like the needle in a scale. If the springs are too short, the “needle” displays on the Short side of the scale. If the springs are too long, the needle displays on the Long side of the scale. If the springs are within tolerance, the needle will appear between the two extremes. Press F1 to return to the Main menu.



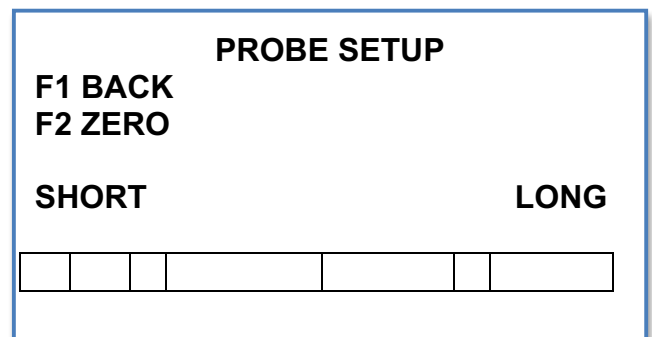
11.1.2 Cub: Setup Menu

Use this menu to set up your production runs, your probe, length adjustment, and sorting operations. You can also shut down the coiler through the Setup menu. From the Main menu, press F3 to reach the Setup menu. You will see the following choices: Probe Setup, Sorting Setup, Length Adjust Setup, and Coiler Shutdown.



11.1.2.1 Cub Setup Menu: Probe Setup

This screen is used to set up the probe. The Tiger uses an internal digital bar to imitate the meter on an analog screen. Access this screen by pressing F2 on the Setup screen. See Section 5, for Probe Selection, and Probe Setup—STD, Section 12.3, for standard setup procedures and recommendations.



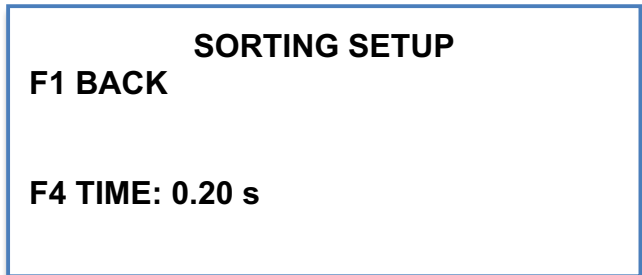
To zero the probe, press F2. An audible beep will sound, then the Set Sort option will become available on-screen.

To set Long and Short sort points, rotate the gage on the probe to the left or right until you reach the desired specification. Press F3 to set the sort.

WARNING: Entering the Probe Setup screen will disable the Read Switch and cause current gaging activities to cease.

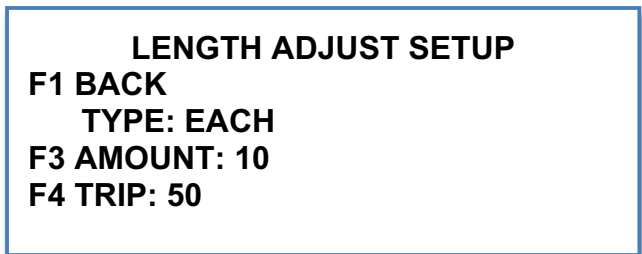
11.1.2.2 Cub Setup Menu: Sorting Setup

From the Setup menu, press F3 to get to the Sorting Setup menu. The Tiger Cub offers only 3 Way sorting. However, you can change the sorting interval (the length of time the sorting chute is held open). Press F4 Time. The cursor will blink. To increase a number, press ▲. To decrease a number, press ▼. To move the cursor one digit to the right, press the right arrow. To move the cursor to the left, press the left arrow. To Accept the Sort Time, press F1. Press F1 again to return to the Setup menu.



11.1.3 Cub Setup Menu: Length Adjust Setup

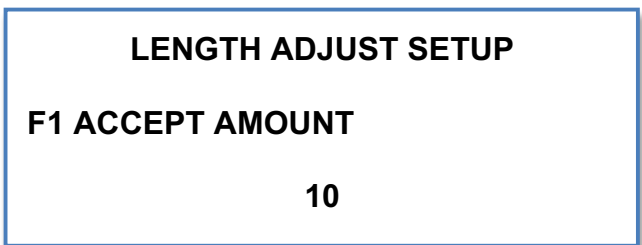
This screen displays the length adjustment type, the amount of time the motor will turn when activated and the tripping points at which the adjuster is activated. The Tiger Cub is set to the EACH mode, which makes an adjustment each time a spring is produced that exceeds the TRIP POINT.



11.1.3.1 Amount

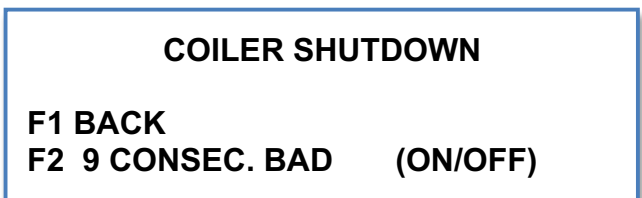
Press F3 to go to the Amount screen. Use the arrow keys to change the amount of time the motor turns. To move the cursor to the left or right, press the left or right arrow. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the adjustment amount and return to the Length Adjust Setup screen, press F1.

Press F4 to change the trip points to a percentage of the sort points that were set during probe setup. Possible percentages range from 5 to 95 percent, in 5 percent increments.



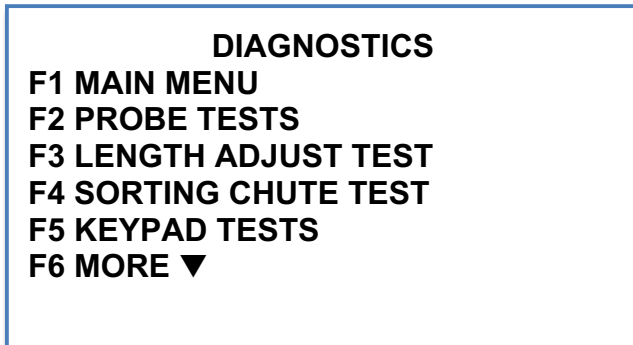
11.1.4 Cub Setup Menu: Coiler Shutdown

The Tiger Cub will trigger an automatic shutdown of the coiler when nine (9) consecutive bad springs have been produced. To set this feature, press F5 in the Setup menu. Toggle F2 to turn this feature on or off.



11.2 Cub: Diagnostics Menu

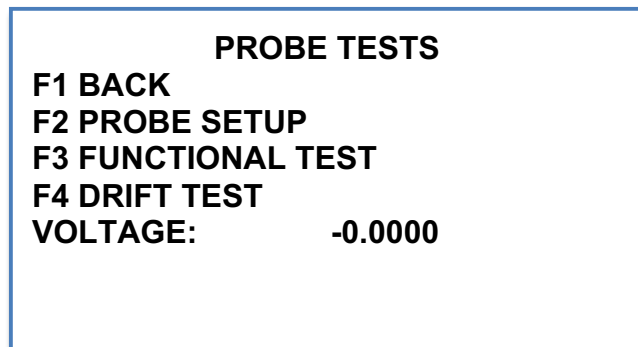
You can perform routine tests on the coiler/probe interface with the Tiger Cub. Access the Diagnostics menu by pressing F4 in the Main menu.



11.3 Cub Diagnostics: Probe Tests

Tests

Press F2 in the Diagnostics menu to access the Probe Tests screen. From this screen, you will be able to perform various diagnostic tests, including probe setup, function and drift.



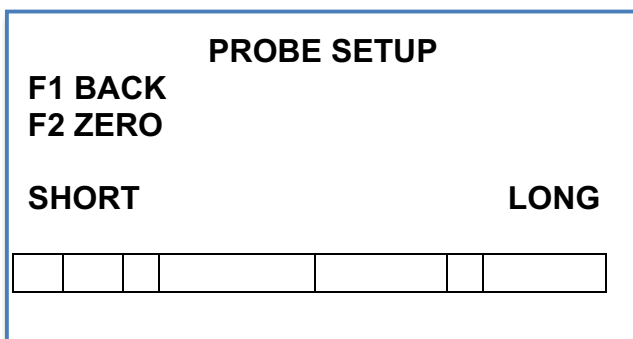
Press F2 to go to the Probe Setup Screen.

11.3.1.1 Cub Diagnostics: Probe Setup

This is the same setup procedure outlined in Section 12.3. To zero the probe, press F2. An audible beep will sound, then the Set Sort and Set Control options will become available on-screen. To set Long and Short Lengths, rotate the gage on the probe to the left or right until you reach the desired specification. Press F3 to Set the sort. Press F1 to return to the Probe Tests menu.

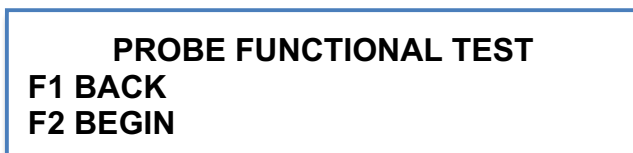
11.3.1.2 Cub Diagnostics: Probe Functional Test

As the name implies, this test is a check of the functionality of the probe. Press F3 in the Probe Tests menu to access this screen. Press F2 to begin testing the probe. You will get immediate feedback on the status of the probe, as shown on the following page.



There are three possible outcomes:

- Probe function passes
- The probe and/or its tip is not working
- Tiger electronics may need repair.



If a failure is found, you will be prompted to disconnect the probe from the gage. Contact LSI regarding repairs.

If the probe status passes, press F1 to return to the Probe Test screen.

11.3.1.2.1 Cub Diagnostics: Probe Gain

Gain values represent the difference in probe readings between two different, yet known, zeroed points, i.e., the probe is zeroed, and a reading is taken. The difference between the two zeroed points is the gain.

PROBE FUNCTIONAL TEST
F1 BACK
ZERO: PASS
PROBE GAIN = 1.000
STATUS: PASS

11.3.1.3 Cub Diagnostics: Probe Drift Test

Perform this test if you are concerned about temperature drift. The drift test provides long-term monitoring of the probe output and length measurement. Always allow the probe to warm up for ten minutes before starting this test.

The screen shows the maximum and minimum voltage used by the probe. "CUR" is a real-time reading of the voltage passing through the probe and the reading will fluctuate. The Tiger automatically runs a continuous test on the probe. Test the probe as long as you want; press F2 to restart. Press F1 to return to the Probe Test screen

PROBE DRIFT TEST
F1 BACK
F2 RESTART 00:03:44
VOLTAGE
MAX 0.0117
CUR 0.0058
MIN 0.0000

11.3.2 Cub Diagnostics: Length Adjust Test

From the Diagnostics menu, press F3 to access the length adjust test. Press F2 to make the spring pitch shorter, F3 to make it longer. The Adjust Count number will change accordingly. When you press F1 to go back to the Diagnostics menu, the pitch adjust will return to its initial position.

LENGTH ADJUST TEST
F1 BACK
F2 ADJUST SHORTER
F3 ADJUST LONGER
COUNT: 0

11.3.3 Cub Diagnostics: Sorting Chute Test

Use this test to make sure your sorting chutes are operating correctly. The Cub does only 3 way sorting; only F2 and F6 send signals to the sorting chutes. Press F2 to test the Short chute; the Bad Short light lights up. Press F4, the Good LED lights. Press F6, the Long LED lights. To return to the Diagnostics screen, press F1.

SORTING CHUTE TEST

F1 BACK
F2 BAD SHORT
F3 5-WAY SHORT
F4 GOOD
F5 5-WAY LONG
F6 BAD LONG

11.3.4 Cub Diagnostics: Keypad Tests

Ensure that your keypad is functioning properly. Select F5 from the Diagnostics menu. Press any key on the keypad. The on-screen display should correspond to the key you pushed. If you pressed F2, for example, you should see F2 on the screen. Press F6 move down to return to the Diagnostics screen.

KEYPAD TESTS

F1 BACK
Press A Key

Press F1 to return to the Diagnostics screen. F6 gives another screen with “more” diagnostic options. You will see two additional Diagnostics tests: Audible Beep and Hour Meter.

11.3.5 Cub Diagnostics: Audible Beep

To make sure this alarm is functional, Press F5 in the More Diagnostics menu. You should hear an audible beep. Press F1 to return to the Main menu.

11.3.6 Cub Diagnostics: Hour Meter

Press F6 to display the Tiger gage’s hour meter. This display tells you how many hours the Tiger has been in operation.

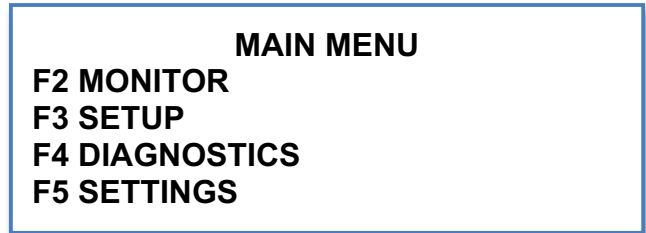
HOUR METER

F1 BACK

75.22 HOURS

11.4 Tiger: Main Menu

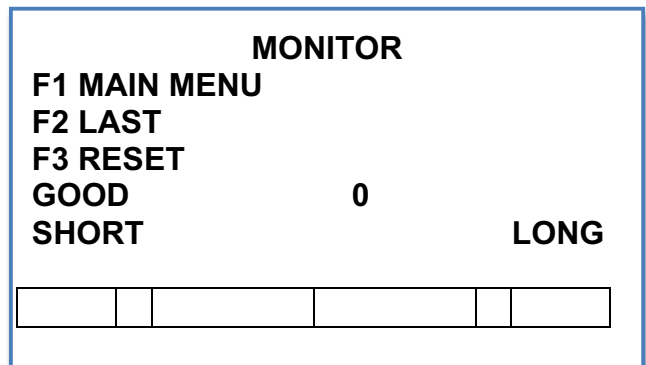
When you access the Main menu of the Tiger, you are given three functions: Monitor, Setup and Diagnostics. Press F2 to access the Monitor menu.



11.4.1 Tiger: Monitor Menu

When you press F2, you can get one of three instant reports, displayed in a digital bar chart on the lower portion of the screen:

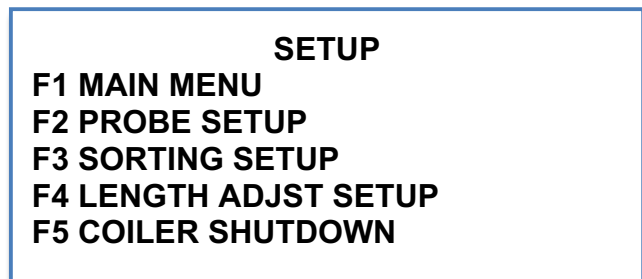
- The length of the last spring manufactured
- The mean of the last 5 springs produced
- The length of the last 5 springs made



You will also see the number of Good springs made. Press F3 to reset the counter. Press F1 return to the Main menu.

11.4.2 Tiger: Setup Menu

Use this menu to set up your production runs. This is where you set up your probe, length adjustment, sorting operations and activate the coiler shutdown option. From the Main menu, press F3 to reach the Setup menu. You will see the following choices: Probe Setup, Sorting Setup, Length Adjust Setup, and Coiler Shutdown.



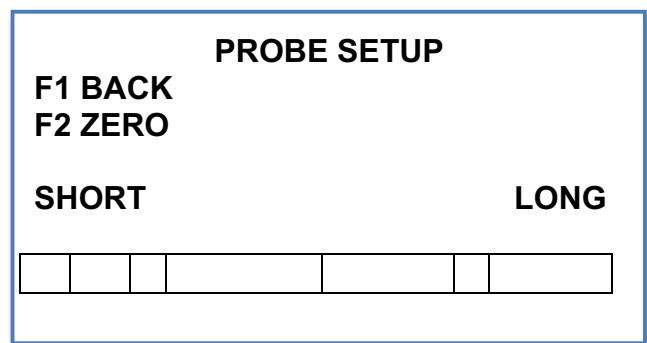
11.4.2.1 Tiger Setup Menu: Probe Setup

This screen is used to set up the probe. The Tiger uses an internal digital bar to imitate the meter on an analog screen. Access this screen by pressing F2 on the Setup screen. See Section 5, for Probe Selection, and Section 12.3, Probe Setup—STD for standard setup procedures and recommendations.

To zero the probe, press F2. An audible beep will sound, and the Set Sort option will become available on-screen.

To set Long and Short Lengths, rotate the gage on the probe to the left or right until you reach the desired specification. Press F3 once to set the sort for short springs and once for long springs.

WARNING: Entering the Probe Setup screen will disable the Read Switch and cause current gaging activities to cease.

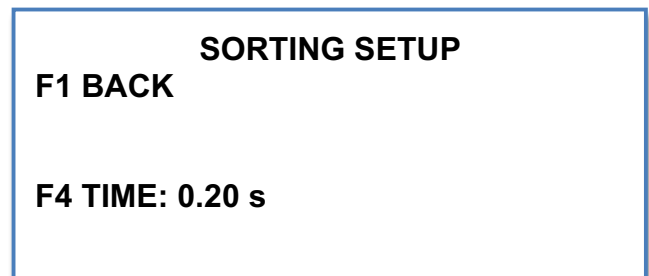


11.4.2.1 Tiger Setup Menu: Sorting Setup

3-way sorting is the traditional method of sorting where the shorts and longs as determined in your Job Setup values are shunted to opposite sides of the sorter and the good springs fall straight through the center.

5-way sorting separates the reject longs and reject shorts the same way, but divides the good springs into three equal divisions: long good, good, and short good. The 5-way points are set at 33% of the tolerance set in Job Setup.

From the Setup menu, press F3 to get to the Sorting Setup menu. The Tiger offers 3- or 5-way sorting according to the connector used on the back panel. You can change the sorting interval to increase or decrease the amount of time the sorting gage stays open. Press F4 Time. The cursor will blink. To increase a number, press ▲. To decrease a number, press ▼. To move the cursor one digit to the right, press the right arrow. To move the cursor to the left, press the left arrow. To accept the Sort Time, press F1. Press F1 again to return to the Setup menu.



11.4.2.2 Tiger Setup Menu: Length Adjust Setup

This screen displays the current length adjustment type, the amount of time the motor will turn when activated, and the tripping point at which the adjuster is activated. Access this screen by pressing F4 in the Setup menu.

Press F2 to change the adjustment type. You can choose from EACH, NONE, or AVERAGE. The Tiger Cub is set to the EACH mode, which makes an adjustment each time a spring is produced that exceeds the TRIP POINT. Press F4 to change the trip points to a percentage of the sort points that were set during probe setup. Possible percentages range from 5 to 95 percent, in 5 percent increments.

LENGTH ADJUST SETUP		
F1 BACK		
F2 TYPE: EACH		
F3 AMOUNT: 10		
F4 TRIP: 50%		
:		:

11.4.2.2.1 Type

11.4.2.2.2 None

11.4.2.2.3 Average

This mode uses a length-predicting system to anticipate the length of the spring being produced. The amount of adjustment is based on this calculation and the adjust amount setting. This setting turns Length Adjust off. If there is a problem in the setup that should be corrected, adjusting length can cover it up. For maximum yield, setup and wire should be as good as possible without adjusting length. Length adjustment is designed to compensate for natural variances in the process, not bad setup or bad wire.

11.4.2.2.4 Each

The EACH mode makes an adjustment each time a spring is produced that exceeds the TRIP POINT. When you reach the EACH screen, you can also adjust the amount of time the motor turns and the tripping point at which the motor will start.

11.4.2.2.5 Amount

Enter a value from 0-99 to change the length of time the pitch adjust motor runs. Press F3 to go to the Accept Amount screen. To move the cursor to the left or right, press the left or right arrow. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the adjustment amount and return to the Length Adjust Setup screen, press F1 twice.

11.4.2.2.6 Trip

Press F4 to change the trip points to a percentage of the sort points that were set during probe setup. Possible percentages range from 5 to 95 percent, in 5 percent increments.

11.4.2.3 Tiger Setup Menu: Coiler Shutdown

The Tiger has the ability to shut down the coiler under certain conditions. To use the shutdown function, the coiler must be connected to the gage with an automatic shutdown cable (P/N 025-1000-0426-00). See **Installing a Shutdown Cable**, Section 4, for installation instructions.

<p style="text-align: center;">COILER SHUTDOWN</p> <p>F1 BACK</p> <p>F2 CONSECUTIVE BAD</p> <p>F3 NO CUTOFF</p>

When shutdown occurs, an audible alarm sounds and the Shutdown screen is displayed. The screen will flash, SHUTDOWN SHUTDOWN and display the reason for the shutdown. Silence the alarm by pressing F6, or cut power to the Tiger by turning off the switch on the back of the tester. The alarm will shut off by itself in five minutes. Because many coilers will continue to produce springs while the motor coasts to a stop, the short side sorter will activate for 20 seconds when a shutdown occurs.

With the Tiger, there are two shutdown conditions: CONSECUTIVE BAD, and NO CUTOFF.

11.4.2.3.1 Consecutive Bad

When the number of bad springs reaches its limit, the Tiger shuts down the coiler. The number at the bottom of the screen indicates the number of bad springs. A value of 0 disables the Consecutive Bad check.

If you want to change the number, press F2 to bring up the Accept Consecutive Screen. You will see a blinking cursor at the bottom of the screen. Use the arrow keys to move the cursor. The left and right arrow keys move the cursor to the left and right. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the number and return to the Coiler Shutdown screen, press F1.

11.4.2.3.2 No Cutoff

No Cutoff, when on, stops the coiler the instant a non-cutoff spring touches the probe tip. A spring that contacts the tip after the cutoff will not cause a shutdown. To enable or disable No Cutoff, press F3 on the Coiler Shutdown menu. To return to the Setup menu, press F1.

WARNING!

When you exit the shutdown screen, the shutdown relay will immediately re-close. If the shutdown cable is not wired correctly through a contractor box, the coiler could start unexpectedly.

from the gage. Contact LSI regarding repairs.

If the probe status passes, press F1 to return to the Probe Test screen.

11.4.3.1.3 Probe Gain

Gain values represent the difference in probe readings between two different, yet known, zeroed points, i.e., the probe is zeroed, and a reading is taken. The difference between the two zeroed points is the gain.

11.4.3.2 Tiger Diagnostics: Probe Drift Test

Perform this test if you are concerned about temperature drift. The drift test provides long-term monitoring of the probe output and length measurement. Always allow the probe to warm up for ten minutes before starting this test.

The screen shows the maximum and minimum voltage output by the probe. "CUR" is a real-time reading of the voltage passing through the probe and will fluctuate.

The Tiger will automatically run a continuous test on the probe. You can test the probe for as long as you want; press F2 to restart. Press F1 to return to the Probe Test screen. Press F1 to return to the Main menu.

PROBE DRIFT TEST

F1 BACK
F2 RESTART 00:03:44
VOLTAGE
MAX 0.0117
CUR 0.0058
MIN 0.0000

11.4.3.3 Tiger Diagnostics: Length Adjust Test

From the Diagnostics menu, press F3 to access the length adjust test. Press F2 to make the spring pitch shorter, F3 to make it longer. The Adjust Count number will change accordingly. When you press F1 to go back to the Diagnostics menu, the pitch adjust will return to its starting number.

LENGTH ADJUST TEST

F1 BACK
F2 ADJUST SHORTER
F3 ADJUST LONGER

COUNT: 0

11.4.3.4 Tiger Diagnostics: Sorting Chute Test

Use this test to make sure your sorting chutes are operating correctly. The Tiger is capable of 5 way sorting.

Press F2 to test the Bad Short chute; the Short light lights up. Press F3 to test the 5 Way sort on Short springs. Press F4 to test the Good chute; the Good LED lights. Press F5 to test the 5 Way sort on Long springs. Press F6 to test the chute for Bad Long springs; the Long LED lights. To return to the Diagnostics screen, press F1.

SORTING CHUTE TEST

F1 BACK
F2 BAD SHORT
F3 5-WAY SHORT
F4 GOOD
F5 5-WAY LONG
F6 BAD LONG

11.4.3.5 Tiger Diagnostics: Keypad Tests

Ensure that your keypad is functioning properly. Select F5 from the Diagnostics menu. Press any key on the keypad and see if the on-screen display corresponds to the key you pushed. If you pressed F2, for example, you should see F2 on the screen. When finished, press F1 to return to the Diagnostics screen. F6 gives another screen with “more” diagnostic options.

KEYPAD TESTS

F1 BACK
Press A Key

11.4.3.6 Tiger Diagnostics: Audible Beep

To make sure this alarm is functional, Press F6 in the Diagnostics menu. You should hear an audible beep. Press F1 to return to the Main menu.

11.4.3.7 Tiger Diagnostics: Hour Meter

Press F6 to display the Tiger gage’s hour meter. This display tells you how many hours the Tiger has been in operation.

HOUR METER

F1 BACK

75.22 HOURS

11.5 Tiger Settings

11.5.1 Configuration

This screen grants access for entering passwords and activation codes.

F2 is for Factory use only; users cannot enter a password here.

F3 is used to gain access for you to enter an Activation code. The Tiger is shipped requiring an activation code. LSI will provide an activation code to you when full payment for the gage has been received.

CONFIGURATION

F1 BACK
F2 ENTER PASSWORD
F3 ACTIVATION CODE

V1.07 SN 1111111111

Press F1 to return to the Settings Screen.

11.5.2 Activation code

See Section 10

11.5.3 Company Name

Future versions of the Tiger may include this feature.

12 SUPER TIGER: MAIN MENU

Press F2 to access the Monitor menu. As you can see, the Super Tiger is designed to provide you with several types of production information to help you fine-tune your spring-making operation. Press F2 to access the Monitor Menu.

**MAIN MENU
SUPER TIGER**

**F2 MONITOR
F3 SETUP
F4 DIAGNOSTICS
F5 SETTINGS**

12.1.1 Super Tiger: Monitor Menu

This menu gives you access to Job Summary (F2), Strip Charts (F3), the Production Monitor (F4), Statistical Process Control (SPC, F5) and Machine Capabilities Study (F6) menus.

MONITOR

**F1 MAIN MENU
F2 JOB SUMMARY
F3 STRIP CHARTS
F4 PRODUCTION MONITOR
F5 SPC
F6 MCS**

12.1.1.1 Super Tiger: Job Summary

To access a summary of the job press F2. The Job Summary screen shows

- Spring length specifications
- The length of the last spring produced
- The mean of the last 50 springs produced
- The CpK of the last 50 springs produced

After you have viewed this screen, press F1 to return to the Monitor menu.

JOB SUMMARY

**F1 BACK
F2 JOB SUMMARY**

0.5 in +- 0.01
LAST: 0.50
MEAN: 0.50
CPK: 0.00

12.1.1.2 Super Tiger: Strip Charts

Strip charts give you an easy, graphic way to track trends during the spring manufacturing process.

The Super Tiger has five different strip chart screens. When you press F3 in the Monitor menu, you will immediately go to one of four (4) Strip Charts. Press F2 or F3 to scroll

forward or backward through the list. The gage will “remember” the chart that was last used and return to it when you press F3 from the Monitor menu.

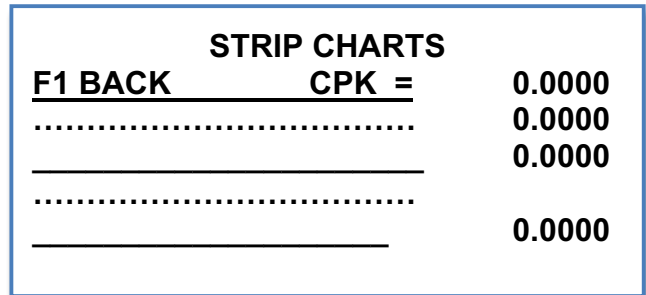
1. Strip chart shows last 50 reads only.
2. Strip chart displays last 40 reads with Good and Bad counts displayed at the right.
3. Strip chart displays last 40 reads, with a histogram on the right side.
4. Strip chart displays last 40 reads with Length Adjust displayed on the right.
5. Strip chart displays last 40 reads with the tolerance specification number displayed on the right side.

Each of these five strip charts has a job status display line at the top of the screen. This line shows one of four job status possibilities. Press F4 or F5 to scroll through the list.

1. Rt = Production Rate- pph
2. X = last read value
3. \bar{x} = mean of the last 50 springs
4. CpK = process capability index of the last 50 springs

12.1.1.2.1 Specifications

Displays the nominal and tolerance numbers that were entered in Job Setup.

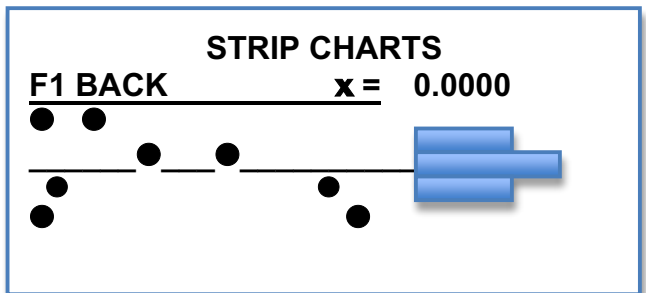


Specifications

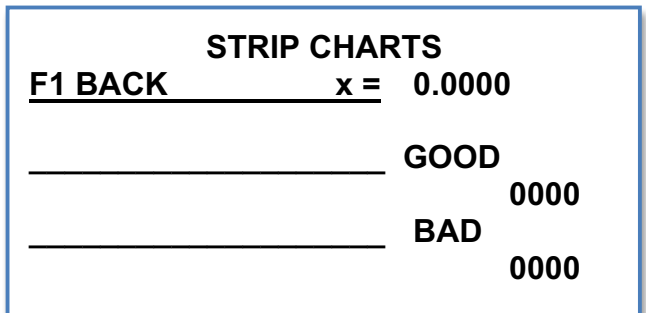
12.1.1.2.2 Histogram

To quickly track the number of Good and Bad springs produced, press F2 or F3 to access the Good/Bad screen.

NOTE: You can continue to see these statistics when you Press F4 or F5 to view job status numbers.



Histogram

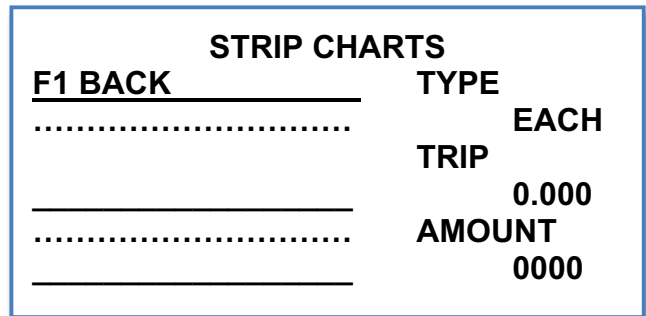


Good/Bad

12.1.1.2.4 Length Adjust

To view the Length Adjust screen, press F2 or F3. Here you can see the type of Adjustment Mode (Each, None, Average or Centering) that has been set, the Trip point and the Amount of time the pitch adjust motor runs. (See Section 12.5, Length Adjust Setup for more information on these settings).

Length Adjust can be changed on this screen. Press ▼ or ▲ to select the item to be changed. Press the right or Left arrows to change the value. The changes will take effect immediately.



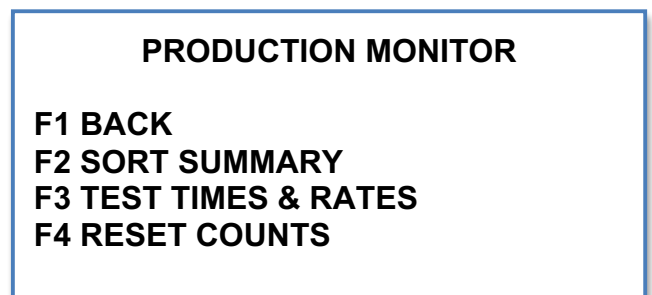
Length Adjust

To change the Trip point when the adjustment Type is set to Each, push ▼ to go to the numerical Trip setting. To increase the amount, press the right arrow. To decrease the amount, press the left arrow. To accept the amount, press ▼ or ▲.

Press ▼ or ▲ to scroll to the Amount setting. To increase the amount, press the right arrow. To decrease the amount, press the left arrow. Changes take effect immediately.

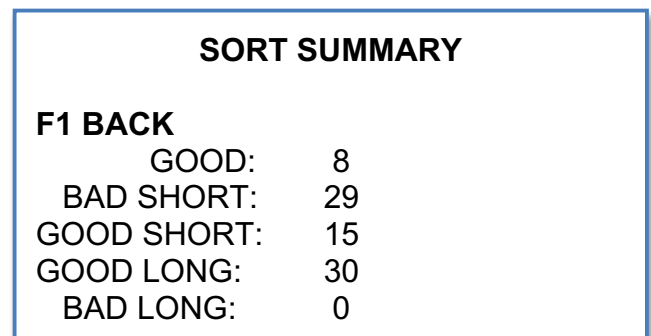
12.1.1.3 Super Tiger: Production Monitor

This screen allows you to see how many parts you're making each hour. Access it by pressing F5 in the Main Menu. To return to the Main Menu, press F1.



12.1.1.4 Sort Summary

Press F2 to access the Sort Summary Screen, which shows you how many of the springs just produced are within specifications, and how many are too short or too long. Press F1 to return to the Production Monitor menu.



12.1.1.4.1 Test Times & Rates

Press F3 to access the Test Times & Rates screen.

INST RATE (Instantaneous Rate) measures the time, in seconds, between the production of the last two springs.

AVG RATE is the average rate of part production.

CYCLE TIME is the total time, from beginning to end, of the spring-making process, defined in seconds.

SINCE LAST is the amount of time, in seconds, elapsed since the last spring was made.

Press F6 to reset the gage. Press F1 to return to the Production Monitor screen.

TEST TIMES & RATES	
F1 BACK	
INST RATE	0.0 pph
AVG RATE	0.0 pph
CYCLE TIME	0.00 s.ss
SINCE LAST	0.00 s.ss
F6 RESET	

12.1.1.4.1.1 Reset Counts

Press F6 from the Main Menu to access this screen. To clear all counts and data, press F6. This will also initiate a new machine capability study. To return to the Main Menu, press F1 twice.

RESET COUNTS	
F1 BACK	
	WARNING!
	This will clear ALL counts to zero and clear ALL SPC data!
F6 CONFIRM	

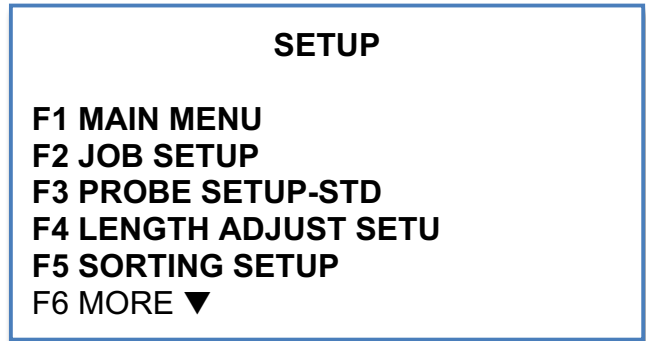
12.1.1.5 Statistical Process Control (SPC)

Press F5 in the Monitor Menu to access the SPC Monitor Screen. Here you will find all the functions you need to run an SPC program. For more complete information on SPC, see Section 15. For SPC setup instructions, see Section 12.8. For information on Machine Capability Studies see Section 14.

SPC MONITOR	
F1 BACK	
F2 DATA	
F3 X BAR CHART	
F4 R CHART	
F5 SAMPLE HISTOGRAM	
F6 TOTAL HISTOGRAM	

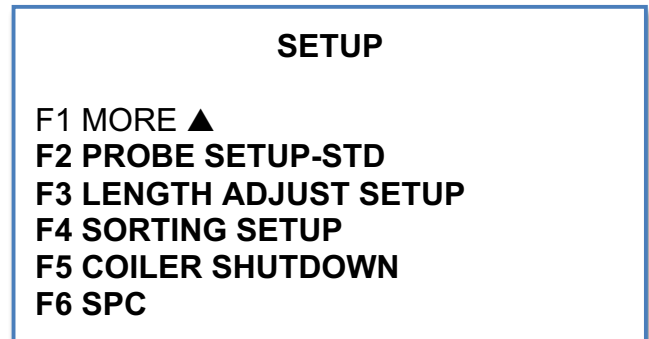
12.2 Super Tiger: Setup Menu

Use this menu to set up your production runs, your probe, length adjustment, and sorting operations. You can also shut down the coiler through the Setup menu. Press F3 on the Main Menu to get to the Setup menu.



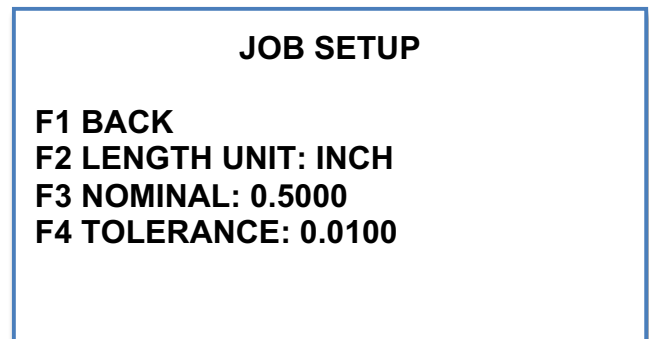
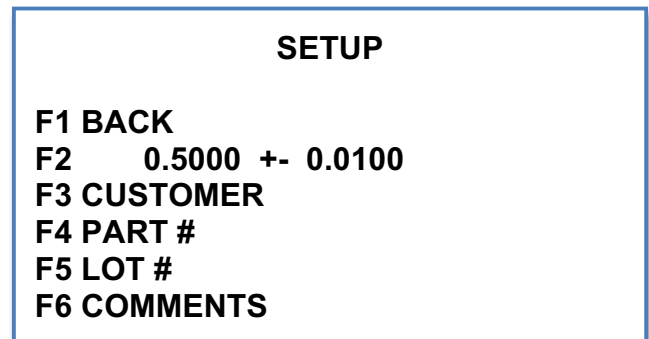
12.2.1 Super Tiger: Job Setup

When you press F2, you will be taken to the Job Setup menu. Press F2 again, and you can set the unit length, nominal length and tolerance.



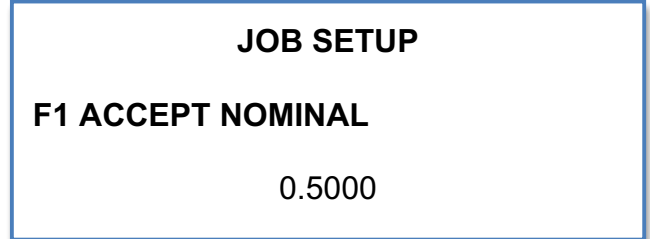
12.2.1.1 Length Unit

Choose the unit of measurement you wish to use. Toggle F2 for inches or millimeters (mm). Note: The actual numbers don't change, just the units and the way they're expressed. Press F1 to return to the Job Setup menu.



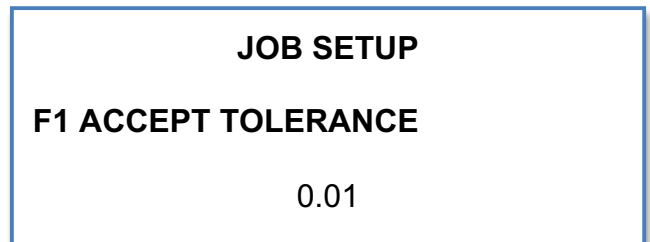
12.2.1.2 Nominal

Press F3 to go to the nominal spring length setting. Use the arrow keys to change numbers. Press the left or right arrows to move the cursor to the left or right. Press the ▲ arrow key to increase the length. Press the ▼ arrow to decrease length. Press F1 to accept your chosen setting and return to the Job Setup menu.



12.2.1.3 Tolerance

Press F4 to set or change spring length tolerance. Press the left or right arrows to move the cursor to the left or right. Press the ▲ arrow key to increase a number; press the ▼ arrow to decrease a number. Press F1 to accept your chosen setting and return to the Job Setup menu.

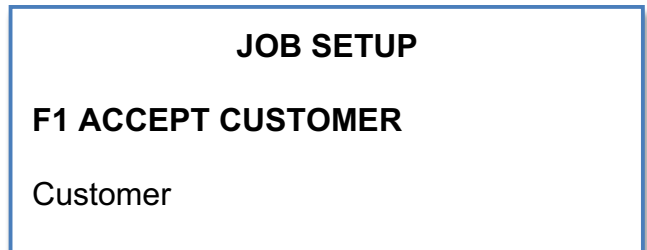


Spring length tolerance can be changed at any time without resetting the probe. The SPC Histogram X-axis is calculated when the first spring is measured. If the tolerance change is more than 20-30 percent, we recommend that you reset the probe to maintain maximum accuracy. To recalculate the Histogram X-axis, spring counts must be reset to zero.

12.2.1.4 Accept Customer

When you press F3 in the Job Setup menu, you'll go to this screen. Use this screen to add your customer's name to the job printout. You'll have 40 alpha-numeric characters to do so.

To move the cursor to the right or left, press the right or left arrows. The ▲ and ▼ arrows help you scroll up and down through the alphabet to change the customer's name. When you have finished entering the customer's name, press F1 to accept the customer and return to the main Job Setup menu.



12.2.1.5 Part

Press F4 to reach this screen, which allows you to enter a part number into the job. You can enter up to 20 alpha-numeric characters.

To move the cursor to the right or left, press the right or left arrows. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the number and return to the main Job Setup menu, press F1.

JOB SETUP

F1 ACCEPT PART #

9999999

12.2.1.6 Lot

Press F5 to go to the Lot # screen. Here, you can enter the Lot number of the job, up to 20 alpha-numeric characters.

To move the cursor to the right or left, press the right or left arrows. To increase a number, press the ▲ arrow.

To decrease a number, press the ▼ arrow. To accept the number and return to the main Job Setup menu, press F1.

JOB SETUP

F1 ACCEPT LOT #

9999999

12.2.1.7 Comments

Press F6 to reach the Comments screen. Here, you can make note of special job requirements or out-of-the-ordinary specifications. You have 40 alpha-numeric characters to do so.

JOB SETUP

F1 COMMENTS

Full run 01/27/08.

To move the cursor to the right or left, press the right or left arrows. To scroll forward through the alphabet, press the ▲ arrow. To move backward, press the ▼ arrow. To accept the comment and return to the main Job Setup menu, press F1.

When you're finished with the Job Setup menu, press F1 to return to the Main Menu.

12.3 Super Tiger: Probe Setup-STD

This screen is used to set up the probe. Press F5 to proceed to the Probe Setup screen, or F6 to return to the Main Setup menu.

The Super Tiger uses an internal digital bar to imitate an analog meter. The entered specifications for **SPRING LENGTH** and **TOLERANCE** are displayed across the top. (These values were set in the Job Setup menu, Section 12.2.1.) In the center is a box with a “needle” and a line marking the center. In the center is a ZERO indicator for zeroing the probe. The **SHORT** and **LONG** settings will not activate until the probe has been zeroed.

Remember these **important points** when performing a probe setup:

- The probe shipped with the Tiger has a built-in heater to stop temperature drift. Allow a 10-minute warm-up time after power-up before setting the probe.
- Move the probe the same amount as the tolerance listed at the top of the screen.
- The Tiger automatically “remembers” the probe setup. If power is turned off, the probe will return to its previous setting when power is turned back on (wait for warm-up).
- At each step in probe setup, a double beep will sound when that step is complete. If a step fails or is set incorrectly, a triple beep will sound.

1. Plug the probe into the Tiger Gage.
2. Position the probe so it faces the coiler.
3. Wind a spring to cutoff.
4. Move the probe toward the coiler until the tip is approximately 0.04” to 0.500” (1mm to 20mm) from the end of the spring. The distance depends on the diameter of the spring and tip, and the tolerance that will be set for sorting. Larger diameters and tolerances can use larger initial gaps. Make sure that the gap between the probe and the spring is wide enough so that the spring does not get hung up on the probe, but passes through to the sorter.

WARNING!
Entering probe setup will disable read switch & gaging will stop.
Proceed?

F5 YES
F6 NO

PROBE SETUP—STD
0.5000 +- 0.0100

F1 BACK
F2 ZERO

F4 RUN MODE
SHORT **LONG**

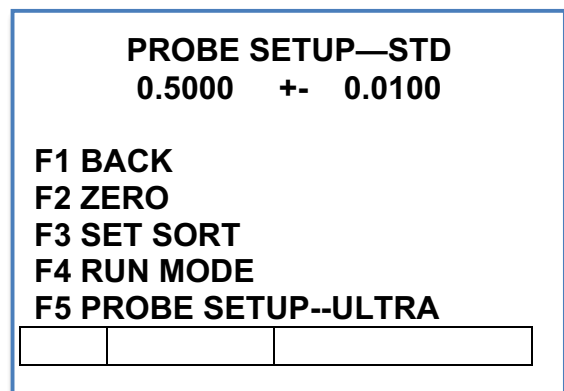
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5. At the bottom of the Probe Setup—STD screen is a graphic that shows the short sorting point on the left, the nominal spring length in the middle, and the long sorting point on the right. When you press F2 (Zero), Set Sort becomes active.
6. Press F2. Zero will flash on the screen, and the probe will mark this as the zero point.
7. Move the probe to a sort point. To set the Short value, move the probe AWAY from the coiler. To set the Long value, move the probe TOWARD the coiler. *Be sure to move the probe the same amount as the tolerance listed at the top of the screen!*
8. Press F3 to set the Short limit. Press F3 again to set the Long limit.
9. Press F4, the Tiger goes to user-defined default Monitor screen.

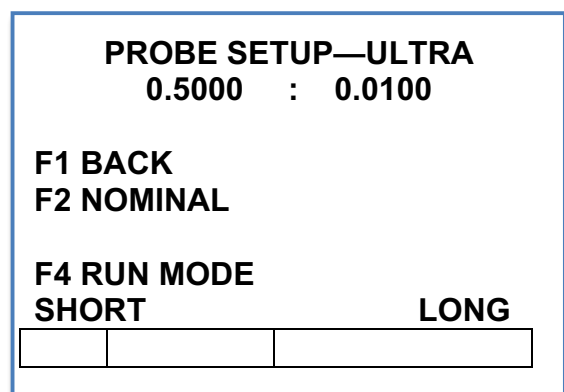
12.4 Super Tiger: Probe Setup—UltraCal

UltraCal is an additional probe setup option that removes measurement errors created by proximity of the coiler on shorter springs. The UltraCal probe setup is optional. For most springs, the traditional probe setup can be used.

The UltraCal setup is done the same way as standard setup, except there is *no spring in the cutoff position*. This is because a probe in UltraCal mode is extremely sensitive to everything around it. A no-spring setup allows the probe to see the difference between a spring and no spring so that it can ignore everything except the spring.



1. Set up the probe as described in Section 12.3, steps 1-6.
2. To set the Short value, move the probe AWAY from the coiler. To set the Long value, move the probe TOWARD the coiler. *Be sure to move the probe the same amount as the tolerance listed at the top of the screen!*
3. Press F3 to the limit for Short spring. Press F3 again to set the limit for Long springs.
4. F5 Probe Setup-Ultra becomes available at the bottom of the screen.
5. Press F5 to go to the UltraCal setup screen.
6. Press F2 to go to the nominal spring length setting. Press F3. Set Sort will appear Press F3 again. The percentage shown on the right of the screen is the amount of correction applied. If the number is less than 10 percent, UltraCal is unnecessary. If the number is less than 99 percent, the probe will be in UltraCal mode and it will now stay in UltraCal mode until a standard probe setup is done. If the number is more than 95 percent, accurate spring measurement is unlikely under any circumstances with any gage. If it is over 99 percent, UltraCal will automatically disable.



7. Press F4 to go to user-defined default Monitor screen.

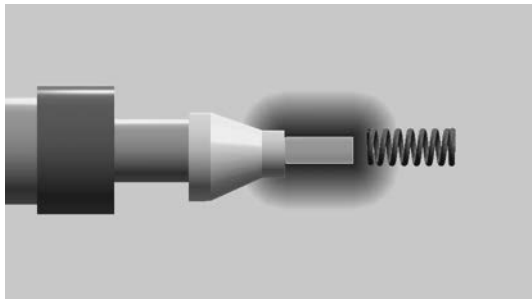
12.4.1 UltraCal Warnings

In normal setup, small length changes in short springs are lost in all the background metal of the coiler. To read these springs accurately, the signal from the probe must be amplified. With amplification, the range of the probe increases, making it sensitive to changes further away than usual. This is only a part of what UltraCal does, but it is this fact that requires that UltraCal to be used carefully.

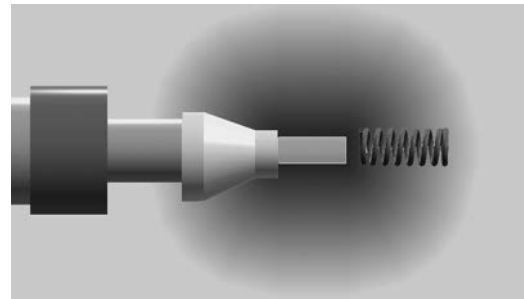
UltraCal is best used for small, short springs that are difficult to measure.

As the percentage of correction displayed on the UltraCal screen increases, so does:

- Sensitivity to other objects around the spring
- Sensitivity to the operator's hand catching springs
- Temperature Drift



With a normal setup, the effective measurement area of the probe is the tip.



With a high-percentage UltraCal setup, this area of sensitivity can increase to near 12 inches.

12.4.1.1 Other Objects

During UltraCal setup, objects in the area of the spring (tooling, sorting devices, etc.) must be in the exact same position and location as they are when the read switch triggers the gage. In normal setup, the probe senses only objects within one or two inches of the tip. With a high-percentage UltraCal setup, this area of sensitivity can increase, up to 12 inches.

12.4.1.2 Operator's Hand

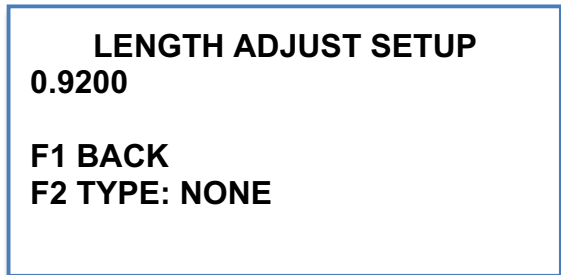
At high-percentage UltraCal setups, the operator's hand can be sensed as far as a foot from the tip. When catching springs for testing, keep your hands far from the probe tip.

12.4.1.3 Temperature Drift

The amplified probe signal also amplifies any temperature-related errors. The temperature drift of the Tiger probe is nearly non-existent with a normal setup. With a high-percentage UltraCal setup, however, the temperature drift of the probe, while still small, may become a factor in tight-tolerance springs. Expansion of tooling, probe holder and even spring wire can also affect the final result.

12.5 Super Tiger: Length Adjust Setup

This screen displays the current length adjustment type, the amount of time the motor will turn when activated, and the tripping point at which the adjuster is activated. Access this screen by pressing F4 in the Setup menu.

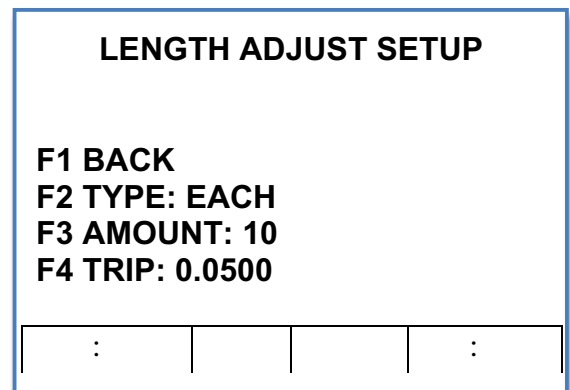


12.5.1 Type:

Press F2 to change the adjustment mode. You can choose from EACH, NONE, AVERAGE or CENTERING.

12.5.1.1 EACH

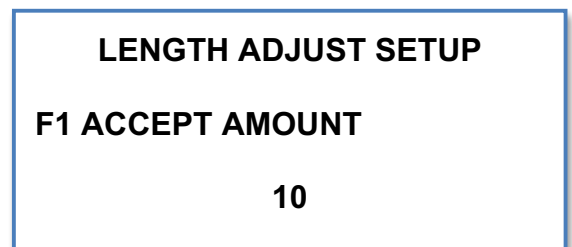
The EACH mode makes an adjustment each time a spring is produced that exceeds the TRIP POINT. When you reach the EACH screen, you can also adjust the amount of time the motor turns and the tripping point at which the motor will start.



12.5.1.1.1 Amount

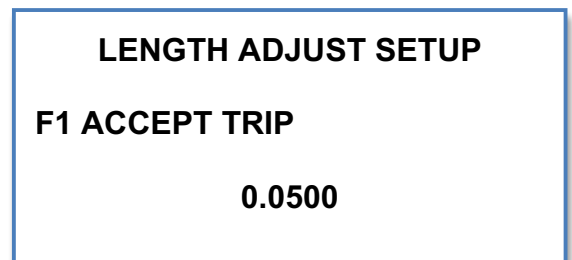
Enter a value between 0-99 to change the length of time the pitch adjust motor runs. Press F3 to go to the Accept Amount screen. Use the arrow keys to change the amount of time the motor turns.

To move the cursor to the left or right, press the left or right arrow. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the adjustment amount and return to the Length Adjust Setup screen, press F1.



12.5.1.1.2 Trip

The Trip point can be adjusted from 5-150 percent of tolerance. Press F4 to go to the Accept Trip screen. To move the cursor to the left, press the left arrow; press the right arrow to move the cursor to the right. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the trip setting and return to the Length Adjust Setup screen, press F1



12.5.1.2 NONE

Length Adjust is turned off. Using no control helps evaluate the quality of the setup. If there is a problem in the setup that should be corrected, adjusting length can cover it up.

For maximum yield, the setup and wire should be as good as possible without adjusting length. Length adjustment is designed to compensate for natural variances in the process, not bad setup or bad wire.

LENGTH ADJUST SETUP
0.9200

F1 BACK
F2 TYPE: NONE

12.5.1.3 AVERAGE

This mode uses a length-predicting system to anticipate the length of the spring being produced. The amount of adjustment is based on this calculation and the adjust amount setting. Press F3 to go to the Accept Amount screen. To move the cursor to the left or right, press the left or right arrow. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the adjustment amount and return to the Length Adjust Setup screen, press F1.

LENGTH ADJUST SETUP

F1 BACK
F2 TYPE: AVERAGE
F3 AMOUNT: 10

12.5.1.4 CENTERING

Centering makes adjustments to the coiling process, based on the average length of recent springs. The length of time the motor turns depends on the adjust amount setting and the amount of error in average length. The more error in the average spring length, the longer the motor turns. With centering, you can quickly adjust the amount of time the motor turns without over-controlling the coiler.

LENGTH ADJUST SETUP

F1 BACK
F2 TYPE: CENTERING
F3 AMOUNT: 10

Press F3 to go to the Accept Amount screen. To move the cursor to the left or right, press the left or right arrow. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the adjustment amount and return to the Length Adjust Setup screen, press F1.

12.6 Super Tiger: Sorting Setup

The Super Tiger does 2-, 3- or 5-way sorting.

- **2-Way Bad** triggers the sorter when bad springs come off the coiler. Whether the springs are short or long, the “Short” light remains lit, indicating that the sorter switch is activated.
- **2-Way Good** activates the sorter on good springs. As long as the springs are good, the “Short” light remains lit, indicating that the sorter switch is activated.
- **3-Way** sorting is the traditional method of sorting where the shorts and longs are shunted to opposite sides and the good springs fall straight through the center.
- **5-Way** sorting separates the reject longs and reject shorts the same way, but divides the good springs into three categories: long good, good, and short good. The five-way points are selectable as a percentage of the tolerance. For five-way sorting, the Super Tiger must be connected to a five-way sorting chute.

SORTING SETUP

F1 BACK
F2 MODE: 5 WAY
F3 25% TOLERANCE
F4 TIME: 0.20s

Access the Sorting Setup mode from the Setup Menu by pressing F5. NOTE: Tiger software does 5-way sorting based on a 1/3 split of good parts. It works only if a 5-way cable is attached. If a 3-way cable is attached, normal 3-way sorting is done.

12.6.1 Mode Selection

Your Mode Selection choices are 5-Way, None, 2-Way Bad, 2-Way Good, and 3-Way. Please note: When you select 5 Way, you also have the option to set tolerances.

12.6.1.1 Mode

Press F2 to change the sorting mode. If you select 5-way sorting, you will automatically be given the opportunity to set the tolerances.

12.6.2 Tolerance

Press F3 to go to the Accept Tolerance screen. Note that the tolerance is expressed in percentages. To move the cursor to the left or right, press the left or right arrow. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the adjustment amount and return to the Sorting Setup screen, press F1. Note: You can also change the tolerance without going through the Mode menu: press F3 in Sorting Setup menu and follow the above procedures.

SORTING SETUP

F1 ACCEPT TOLERANCE

25

12.6.3 Sort Time

Timed Sorting is the traditional method where the chute flapper or air solenoid is activated for a set period of time when a bad spring is produced. The Super Tiger can set a sorting flap to open from 0.05 to 9.95 seconds.

In order to minimize activating the same flapper several times in succession, you can set the sort time to the maximum setting of 9.95 seconds. The machine will keep the flap open until 9.95 seconds has elapsed, or it receives a different activation signal.

Press F4 to go to the Accept Sort Time screen. To move the cursor to the left or right, press the left or right arrow. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the sort time and return to the Sorting Setup screen, press F1.

12.7 Super Tiger: Coiler Shutdown

The Super Tiger has the ability to shut down the coiler under certain conditions. To use the shutdown function, the coiler must be connected to the gage with an automatic shutdown cable (P/N 025-1000-0426-00). See **Installing a Shutdown Cable**, Section 4, for installation instructions.

When shutdown occurs, an audible alarm sounds and the Shutdown screen is displayed. The screen will flash, SHUTDOWN SHUTDOWN and display the reason for the shutdown. Silence the alarm by pressing F6, or cut power to the Tiger by turning off the switch on the back of the tester. The alarm will shut off by itself in five minutes. Because many coilers will continue to produce springs while the motor coasts to a stop, the short side sorter will activate for 20 seconds when a shutdown occurs.

The Super Tiger recognizes five shutdown conditions: TOTAL GOOD (Lot Size), CONSECUTIVE BAD, CPK LIMIT, NO CUTOFF, and EXCESS ADJUST.

COILER SHUTDOWN	
F1	BACK
F2	CONSECUTIVE BAD 0
F3	NO CUTOFF OFF
F4	TOTAL GOOD
F5	CPK LIMIT 0.0000
F6	EXCESS ADJUST OFF

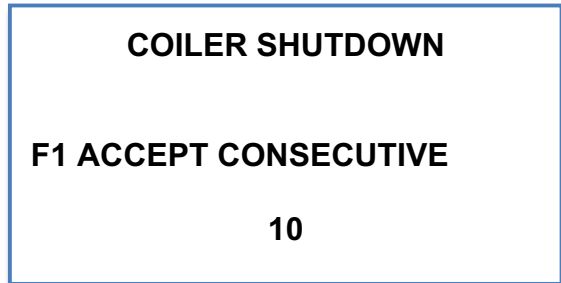
Warning!

When you exit the shutdown screen, the shutdown relay will immediately re-close. If the shutdown cable is not wired correctly through a contactor box, the coiler could start unexpectedly.

12.7.1 Consecutive Bad

When the number of bad springs reaches its limit, the Super Tiger shuts down the coiler. The number at the bottom of the screen indicates the number of bad springs. A value of 0 disables the Consecutive Bad check.

If you want to change the number, use the arrow keys. The left and right arrow keys move the cursor to the left and right. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the number and return to the Coiler Shutdown screen, press F1.



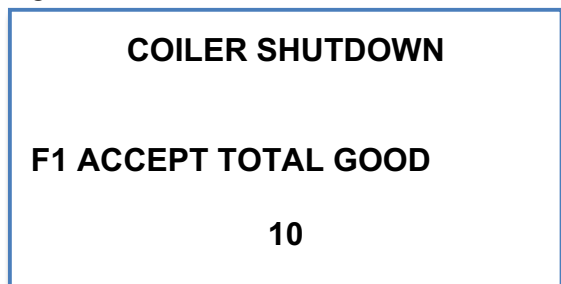
12.7.2 No Cutoff

No Cutoff, when on, stops the coiler the instant a non-cutoff spring touches the probe tip. A spring that contacts the tip after the cutoff will not cause a shutdown. To enable or disable No Cutoff, press F5 on the Coiler Shutdown menu.

12.7.3 Total Good (Lot Size)

Total Good on the Super Tiger is the same as Lot Size on the Panther gage. When the correct number of good springs has been produced, the Super Tiger will shut down the coiler. A value of 0 disables the Total Good shutdown check.

Access the Accept Total Good screen by pressing F2 in the Coiler Shutdown menu. At the bottom of the screen you will see the number of good springs in the lot. If you want to change the number, use the arrow keys. The left and right arrow keys move the cursor to the left and right. To increase a number, press the ▲ arrow. To decrease a number, press the ▼ arrow. To accept the number and return to the Coiler Shutdown screen, press F1.

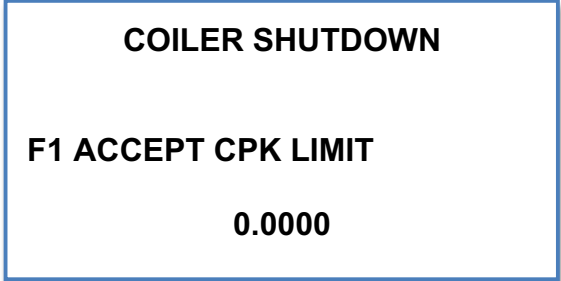


12.7.4 CpK Limit

Set process capability index limits (CPK) to make your spring-making process more efficient. If the CPK of the last 50 springs falls below the limit you set, the coiler will shut down. This shutdown mode can be very effective, since the process stops when something begins to go wrong, instead of waiting for bad springs to be made. A value of 0 disables the CPK Limit check.

After a CPK shutdown, the Super Tiger disables CPK shutdown for next 50 springs. This allows springs that caused the stoppage to clear the system before re-engaging the CPK shutdown.

The CPK limit is posted at the bottom of the screen. To change the number, use the arrow keys. The left and right arrow keys move the cursor left and right. To increase a number, press ▲. To decrease a number, press ▼. To accept the number and return to the Coiler Shutdown screen, press F1.



12.7.5 Excess Adjust

To prevent possible tool damage, Excess Adjust monitors the amount of adjustment and turns them off if the motor turns for too long in one direction. When Excess Adjust is triggered, it automatically turns the adjuster motor back to its original position, ensuring the pitch adjustment is reasonably close to correct when the coiler starts up again.

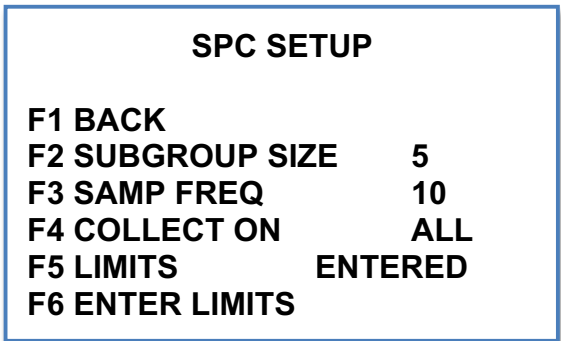
There are three Excess Adjust options: On, Off and Warn. When Excess Adjust is ON, the coiler will shut down the same as other shutdown functions. When Excess Adjust is OFF, the coiler will not shut down. When Excess Adjust is set to WARN, the coiler continues to run. Springs are gaged and sorted, but no more adjustments will be made. During this time, an alarm sounds and the Tiger screen flashes an "excess adjust" warning. This allows those without shutdown cables to prevent tool damage.

12.8 Super Tiger: SPC Setup

Press F6 on the Setup screen to access the SPC Setup menu. From this menu, you will be able to set the Subgroup Size, Sample Frequency, Collection parameters, and Limits.

12.8.1 Subgroup Size

Super Tiger subgroups range from 5 to 25 springs. To increase the subgroup size, press ▲. To decrease subgroup size, press ▼. To accept the subgroup size, press F1. You will return to the SPC Setup menu.



12.8.2 Sample Frequency

You can set your sample frequencies from 10 to 99,999. Use the arrow keys to set the sample frequency. Scroll to the left or right by pressing the left or right arrows. To increase a number, press ▲. To decrease a number, press ▼. To accept the sample frequency, press F1. You will return to the SPC Setup menu.

```
SPC SETUP
F1 ACCEPT SUBGROUP SIZE
5
```

12.8.3 Collect

Press F4 to choose between collecting All springs or Good springs only.

```
SPC SETUP
F1 ACCEPT SAMPLE FREQ
10
```

12.8.4 Limits

Press F6 to enter your Upper Control Limits (UCL) and Lower Control Limits (LCL). Use the arrow keys to set the Limits. Scroll to the left or right by pressing the left or right arrows. To increase a number, press ▲. To decrease a number, press ▼. To accept the Limit, press F1.

Press F5 to check that Limits have been entered and calculated.

Press F1 to return to the Setup menu.

```
SPC SETUP
F1 BACK
F2 SUBGROUP SIZE      5
F3 SAMP FREQ          10
F4 COLLECT ON         ALL
F5 LIMITS             ENTERED
F6 ENTER LIMITS
```

```
SPC SETUP
F1 ACCEPT UCL
```

For more information on Statistical Process Control, see p. 54.

12.9 Super Tiger: Diagnostics

The Tiger's Diagnostics menu allows you to perform routine tests on the coiler/probe interface and make adjustments to improve productivity. Access the Diagnostics menu by pressing F4 on the Main Menu.

12.9.1 Super Tiger Diagnostics: Probe Tests

The opening screen in the Probe Tests menu lists three functions you can test--setup, functionality and drift. It also gives a real-time voltage and length reading.

DIAGNOSTICS

F1 MAIN MENU
F2 PROBE TESTS
F3 LENGTH ADJUST TEST
F4 SORTING CHUTE TEST
F5 KEYPAD TESTS
F6 MORE ▼

12.9.1.1 Probe Setup

Assess the condition of the probe by pressing F2. This will take you to the Probe Setup screen. Follow the standard probe setup instructions in Section 12.3.

12.9.1.2 Probe Functional Test

This test checks the probe and its driving circuitry. Press F3 in the Probe Tests menu. Make sure the probe is not touching anything. Press F2 to begin.

- There are three possible outcomes:
- Probe function passes
- The probe and/or its tip is not functional
- Tiger electronics may need repair. *If a failure is found, you will be prompted to disconnect the probe from the gage. Contact LSI regarding repairs.*

If the Probe status passes, press F1 to return to the Probe Test screen.

PROBE TESTS

F1 BACK
F2 PROBE SETUP
F3 FUNCTIONAL TEST
F4 DRIFT TEST
VOLTAGE: 0.0176
LENGTH: .5000

12.9.1.2.1 Probe Gain

Gain values represent the difference in probe readings between two different, yet known, zeroed points, i.e., the probe is zeroed, and a reading is taken. The zeroed value is changed a known amount and a second probe reading is taken. The difference between the two zeroed points is the gain.

PROBE FUNCTIONAL TEST

F1 BACK
F2 BEGIN

12.9.1.3 Probe Drift Test

Perform this test if you are concerned about temperature drift. The drift test provides long-term monitoring of the probe output and length measurement. Always allow the probe to warm up for ten minutes before starting this test.

The screen shows the maximum and minimum voltage used by the probe. "CUR" is a real-time reading of the voltage passing through the problem and will fluctuate.

The Tiger will automatically run a continuous test on the probe. You can test the probe for as long as you want; press F2 to restart. Press F1 to return to the Probe Test screen.

PROBE DRIFT TEST		
F1 BACK		
F2 RESTART	00:03:44	
	VOLTAGE	LENGTH
MAX	0.0117	2.5096
CUR	0.0058	2.4975
MIN	0.0000	2.4906

12.9.1.3.1 Setting up a drift test

1. Position the probe holder so the probe faces a flat spot on the face of the coiler. This area should be clean and free of grease and dirt.
2. Adjust for probe position for a reading within 1 volt of 0, or reset the probe. Setting up the probe is not necessary unless you want accurate length numbers on the display. The spring length value for setup is not important, nor is tolerance critical. 0.005" is a typical value.

12.9.2 Super Tiger Diagnostics: Length Adjust Test

From the Diagnostics menu, press F3 to access the length adjust test.

Press F2 to make the spring pitch shorter, F3 to make it longer. The Count number will change accordingly. When you press F1 to go back to the Diagnostics menu, the pitch adjust will return to its starting number.

LENGTH ADJUST TEST	
F1 BACK	
F2 ADJUST SHORTER	
F3 ADJUST LONGER	
COUNT: 0	

12.9.3 Super Tiger Diagnostics: Sorting Chute Test

Use this set of tests to make sure your sorting chutes are operating correctly. Press F2 to test the Bad Short chute; F3 to test 5-Way Short; F4 to test the Good chute; F5 to test 5-Way Long, and F6 to test Bad Long.

When finished, press F1 to return to the Diagnostics screen.

SORTING CHUTE TEST	
F1 BACK	
F2 BAD SHORT	
F3 5-WAY SHORT	
F4 GOOD	
F5 5-WAY LONG	
F6 BAD LONG	

12.9.4

12.9.4 Super Tiger Diagnostics: Keypad Tests

Ensure that your keypad is functioning property. Select F5 from the Diagnostics menu. Press any key on the keypad and see if the on-screen display corresponds to the key you pushed. If you pressed F2, for example, you should see F2 on the screen. When finished, press F1 to return to the Diagnostics screen.

12.9.5 Super Tiger Diagnostics: Audible Beep

To make sure this alarm is functional, press F6 in the Diagnostics menu. You should hear an audible beep. Press F1 to return to the Main menu.

KEYPAD TESTS

F1 BACK
Press A Key

12.9.6 Super Tiger Diagnostics: Hour Meter

Press F6 to display the Tiger gage's hour meter. This display tells you how many hours the Tiger has been in operation.

13 SUPER TIGER SETTINGS

Access this menu from the Main menu to enter your company name. Press F5 to bring up the next screen.

SETTINGS

F1 MAIN MENU
F2 CONFIGURATION
F3 COMPANY NAME
F4 DEFAULT RUN SCREEN

MAIN MENU
SUPER TIGER

F2 MONITOR
F3 SETUP
F4 DIAGNOSTICS
F5 SETTINGS

13.1 Configuration

This screen grants access for entering passwords and activation codes.

F2 is for Factory use only; users cannot enter a password here.

F3 is used to gain access for you to enter an Activation code. The Super Tiger is shipped requiring an activation code. LSI will provide an activation code to you when full payment for the gage has been received.

CONFIGURATION

F1 BACK
F2 ENTER PASSWORD
F3 ACTIVATION CODE

V1.07 SN 1111111111

Press F1 to return to the Settings Screen.

13.2 Company Name

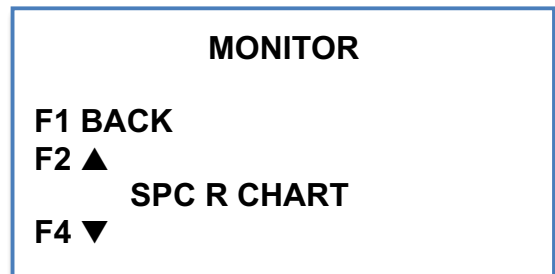
Press F3 to access the Company Name screen. To change the name on the screen, press F2.

The Super Tiger has 40 characters for entering your company name, including upper and lowercase letters, numbers and symbols. To scroll forward through the alphabet, press the ▲ arrow. To move backward through the alphabet, press the ▼ arrow. Press F1 to Accept the Customer and return Company Name. Press F1 to return to Settings.



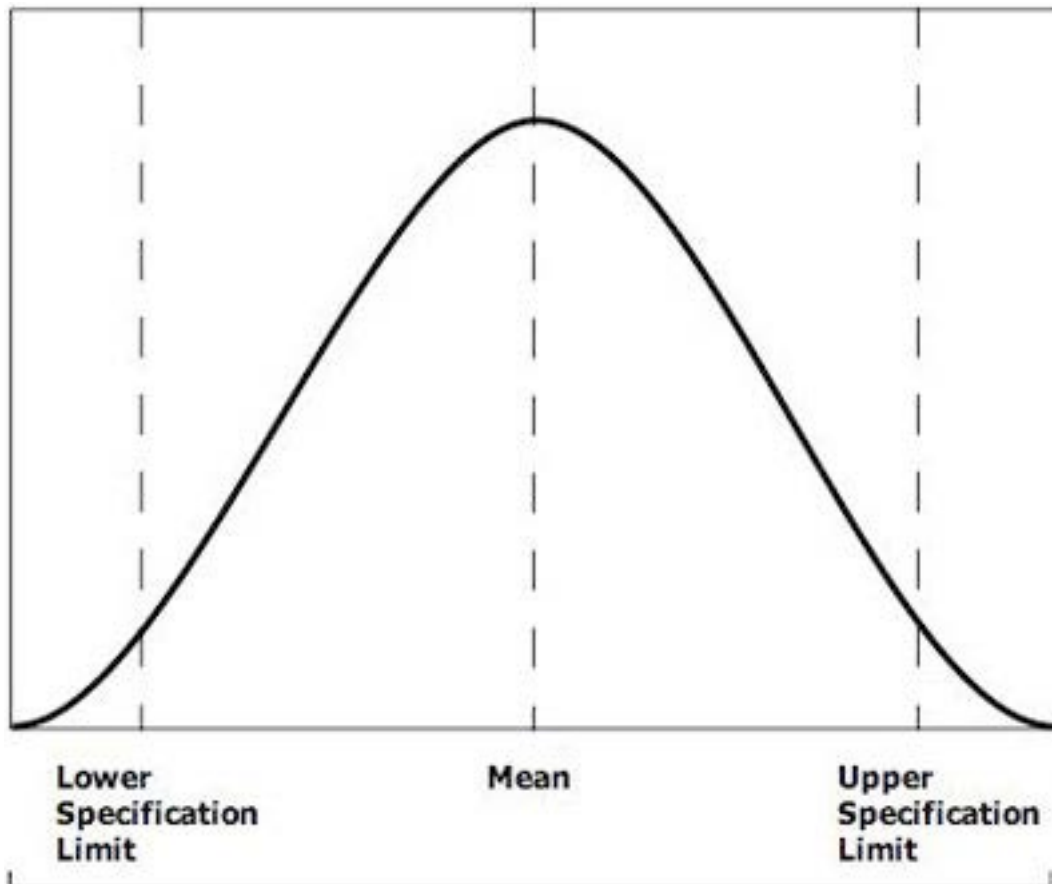
13.3 Default Run Screen

The Default Run Screen is a shortcut to the Monitor menu where you can choose the type of monitoring information you want to see. Your choices are Strip Chart-Histogram, Strip chart-Specs, Job Summary, SPC Total Histogram, SPC Sample History, SPC R Chart, SPC X Bar Chart, SPC Data, Test Times & Rates, and Sort Summary. Press F2 to scroll backward through the menu; press F4 to scroll forward. This shortcut is accessed from the Probe Setup menu F4.



14 PERFORMING A MACHINE CAPABILITY STUDY (MCS) WITH THE SUPER TIGER FREE LENGTH GAGE

A Machine Capability Study (MCS) tells you how your coiler is operating, and helps you match job tolerances to your machine with more precision. This helps you produce better springs more efficiently, and can reduce scrap.



With every coiler, there is variation in the spring production process. Some springs may be too long; others may be too short. In a world where close tolerances are becoming the norm, you want to minimize the number of rejected springs in each batch. By running a machine capability study, you can use the MCS statistics to adjust your coiler so that more springs are producing within tolerance levels.

The study that you can perform with Super Tiger software samples 100 springs and calculates the values used for the SPC charts. *Machine capability studies are started from MCS setup or when counts are cleared.* A Machine Capability Study should be done before you begin charting Statistical Process Control.

14.1 Machine Capability Study (MCS) terms

- Start:** The spring count at which the last study started
- Good:** The number of good springs produced during the study
- Bad:** The number of bad springs produced during the study
- Mean:** The average length of springs produced during the study
- Sigma:** The standard deviation of springs produced during the study
- CPK:** The CPK of springs produced during the study
- X UCL:** The upper control limit for the SPC X bar charts
- X LCL:** The lower control limit for the SPC X bar charts
- R MEAN:** The average range of springs produced during the study (used on R charts)
- R UCL:** The upper control limit for the SPC R charts (the R chart lower limit is always 0)

14.2 MCS, Step by Step

1. Plan. Are you making the study to determine the machine's capability or to diagnose a problem?
2. Measure. Make sure your Super Tiger gage is calibrated and working correctly before starting the study. Check afterward to make sure the gage did not drift during use.
3. Have the person who is most familiar with the coiler operate it during the study.
4. Sample size. The default sample size for the Super Tiger is 100 springs.
5. Data recording. The Super Tiger will give you data on the springs; you should also record feed rate, speed, cycle times, tool changes, ambient temperature—any factors that could have a bearing on your production.

Remember, a Machine Capability Study gives you short-term analysis. For long-term analysis, you should review long-term data gleaned from Statistical Process Control (SPC).

14.3 Using MCS

Access the MCS menu by pressing F6 in the Monitor menu.

MONITOR

F1 MAIN MENU
F2 JOB SUMMARY
F3 STRIP CHARTS
F4 PRODUCTION MONITOR
F5 SPC
F6 MCS

Pending % shows the percentage of springs measured so far. When the percentage reaches 100, you'll get a report on the spring count at the beginning of the study (Start), the number of good springs (Good), and the number of bad springs (Bad).

To view more information, press F6.

MACH CAPABILITY STUDY

F1 BACK
PENDING %
START
GOOD 0
BAD 0.0000
F6 MORE ▼

The next screen brings up the Mean, the average length of the springs made during the study.

This screen shows the process capability index limits (CPK) for this study.

MACH CAPABILITY STUDY

F1 BACK
PENDING %
F3 MORE ▲
MEAN
CPK 0.00
F6 MORE ▼

This screen shows the upper control limit for the SPC X bar charts.

MACH CAPABILITY STUDY	
F1 BACK	
PENDING %	
F3 MORE ▲	
CPK	0.00
X UCL	0.0000
F6 MORE ▼	

This screen shows the lower control limit for the SPC X bar charts.

MACH CAPABILITY STUDY	
F1 BACK	
PENDING %	
F3 MORE ▲	
X UCL	0.0000
X LCL	0.0000
F6 MORE ▼	

This screen shows the average range (R Mean) of springs produced during the study, which is displayed on R Charts. It also shows the R UCL, the upper control limit for the SPC R charts. (The R chart lower limit is always 0.)

To return to the Main menu, press F1.

MACH CAPABILITY STUDY	
F1 BACK	
PENDING %	
F3 MORE ▲	
X LCL	0.0000
R MEAN	0.0000
R UCL	0.0000

15 STATISTICAL PROCESS CONTROL WITH THE SUPER TIGER FREE-LENGTH SPRING GAGE

The Super Tiger is a complete statistical process control (SPC) data collection/analysis system. SPC is a great way to analyze the cause for scrap and to warn the operator if the scrap rate is about to increase.

15.1 The SPC Concept

When a spring coiler produces springs, it is impossible for the coiler to make all springs the same. Anyone who has ever operated a spring coiler is well aware of this fact. There are certain things that cause consecutive springs to differ. The wire may change a little, there's a little slop in the tooling, even changes in line voltage can affect spring quality. These are a part of the process of making a spring that we can't do much about. In SPC language, **things that affect the process that we can't do much about** are called **common causes**.

Sometimes other things affect spring quality. The de-reeler binds up, the wire tangles, or the tooling starts to come loose. In SPC language, **things that go wrong with the process that we can fix** are called **assignable causes**.

One of the main purposes of SPC, especially Xbar and R charts, is to separate assignable causes from common causes. Using SPC techniques, we can tell if the current scrap rate is just the nature of the job or if something has begun to go wrong with the process.

In order to separate assignable causes from common causes, we have to test the coiler setup to see how well it can make springs. This is called a **Machine Capability Study (MCS)** (see Section 14). This study samples 100 springs and calculates the values used for the SPC charts. *Machine capability studies are started from MCS setup or when counts are cleared.*

All SPC charting will use the values calculated during this machine capability study. For SPC charting to be useful, it is important that spring production proceeds normally during the study. If anything unusual occurs during the study, the study should be restarted.

The measured lengths of these 100 springs are used to calculate *control limits* for the Xbar and R charts. Control limit values are calculated so that **more than 99% of the springs made should fall between the control limits**.

SPC takes occasional samples from the length measurements of springs as they're produced. The average length of the samples and the range of the samples is calculated and charted. Each batch of spring lengths sampled is called a *subgroup*. The number of measurements in each batch is the *subgroup size*. How often the subgroups are taken is the *sample frequency*.

15.2 Xbar and R Charts

To make Xbar and R charts, the gage takes samples every so often and plots them on the chart. How often a sample is taken is called the *sample frequency*. The number of springs measured in a sample is called the *subgroup size* (usually 5). The average length of the springs in the sample is plotted on the Xbar chart.



The *range*, the difference between the longest and the shortest spring in the sample, is plotted on the R chart.

The Xbar and R charts have lines that mark the upper and lower control limits.

If the points on the Xbar and R charts are between the control limits, the process is proceeding normally, and the variation in spring length is due to common causes. If they are outside the control limits, there may be an assignable cause for reduced quality that can be fixed.

When the points are outside the control limits, SPC language says the process is *out of control*. This doesn't mean the job has gone wild, just that a point was outside the control limits and may have an assignable cause. When a point is outside the control limits, it does not necessarily indicate a bad part. **Xbar**



and R charts do not indicate good or bad parts. They only indicate if the process is operating normally.

All the Xbar and R charting is based on the machine capability study. For the Xbar and R charts to mean anything, the springs produced during the capability study must be typical for the setup. If anything out of the ordinary happens during the machine capability study, the study should be restarted.

Before charting SPC, you need to run a Machine Capability Study (see Section 14) to determine the coiler's ability to make good springs.

15.3 SPC Monitoring

Access the SPC Monitor menu by pressing F5 (SPC) on the Main Menu screen. This menu gives you five viewing options: Data, X Bar Chart, R Chart, Sample Histogram and Total Histogram.

15.3.1 Data

This screen displays current SPC data values. These are the values generated since the count was reset to 0.

These values include:

- **Good count:** Total good springs produced. Collecting data on all the springs is a better record of machine performance. Collecting data on the good springs gives the customer SPC data only on the springs they are receiving.
- **Bad percentage and count:** The percentage of bad springs produced and the total count.
- **Mean:** Average length of sampled springs.
- **Sigma:** Standard deviation of sampled springs.
- **CPK:** CPK of sampled springs, calculated as the lesser of subgroup size or sample frequency.
- **Subgroup Size:** The smallest subgroup is 5 and the largest is 25; 5 is by far the most common.
- **Sample Frequency:** The sample frequency is the number of springs produced between SPC samples. The smallest is 10 and the largest is 99,999.

To return to the Monitor screen, press F1 three times.

SPC MONITOR		
F1 BACK		
GOOD		0
BAD	0.0%	0
MEAN		0.0000
SIGMA		0.000
F6 MORE ▼		

SPC MONITOR		
F1 MORE		
MEAN		0.0000
SIGMA		0.000
CPK		0.00
SUBGROUP SIZE		0
SAMPLE FREQ		0

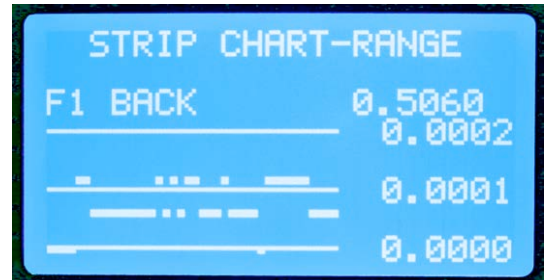
15.3.2 X-Bar Chart

To access this chart from the Monitor menu, press F3. This chart shows the last 40 samples taken, their nominal length, and the control limit values.



15.3.3 R Chart

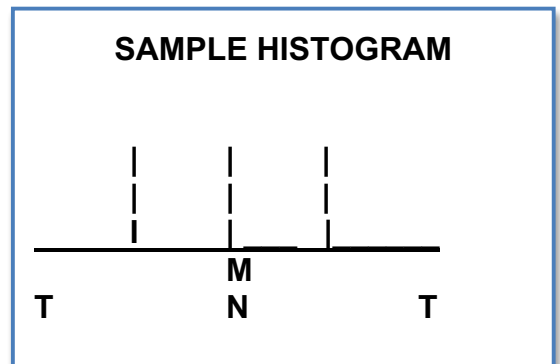
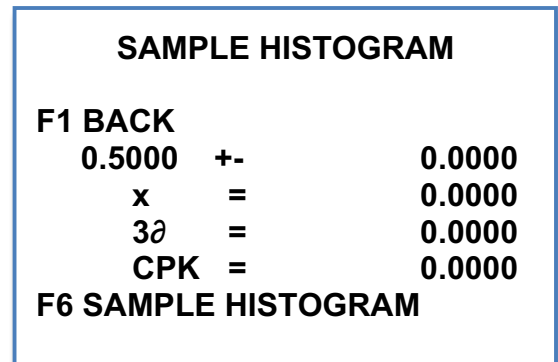
Press F4 to access this strip chart from the Monitor menu. This chart displays the range of the last 40 samples taken. The average R value from the machine study is represented by the center line.



15.3.4 Sample Histogram

Press F5 to access this screen from the Monitor menu. The first screen displays the statistics based on the sampled data. Press F6 to go to the next screen, which displays a histogram based on the sampled data.

To go back one screen, press F1. Press F1 again to return to the SPC menu.



15.3.5 Total Histogram

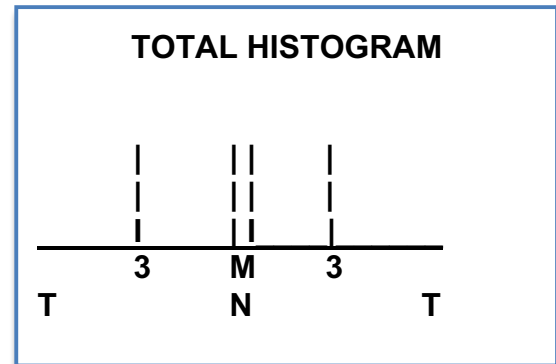
Press F6 to access this screen from the Monitor menu.

The first screen displays the statistics based on the sampled data. To view the histogram, press F6. The Mean value is marked by an 'M' and a vertical line.

The 3 Sigma points are marked by 3s and vertical lines.

The Total Histogram displays the histogram of all the springs produced. The statistics shown reflect the entire job and are based on the data presented in the histogram. Springs beyond the range of the histogram are not accounted for in the calculations. If a significant percentage of springs are beyond the range of the histogram, the statistics values will lose accuracy.

TOTAL HISTOGRAM		
F1 BACK		
0.5000	+ -	0.0000
x	=	0.0000
3σ	=	0.0000
CPK	=	0.0000
F6 TOTAL HISTOGRAM		



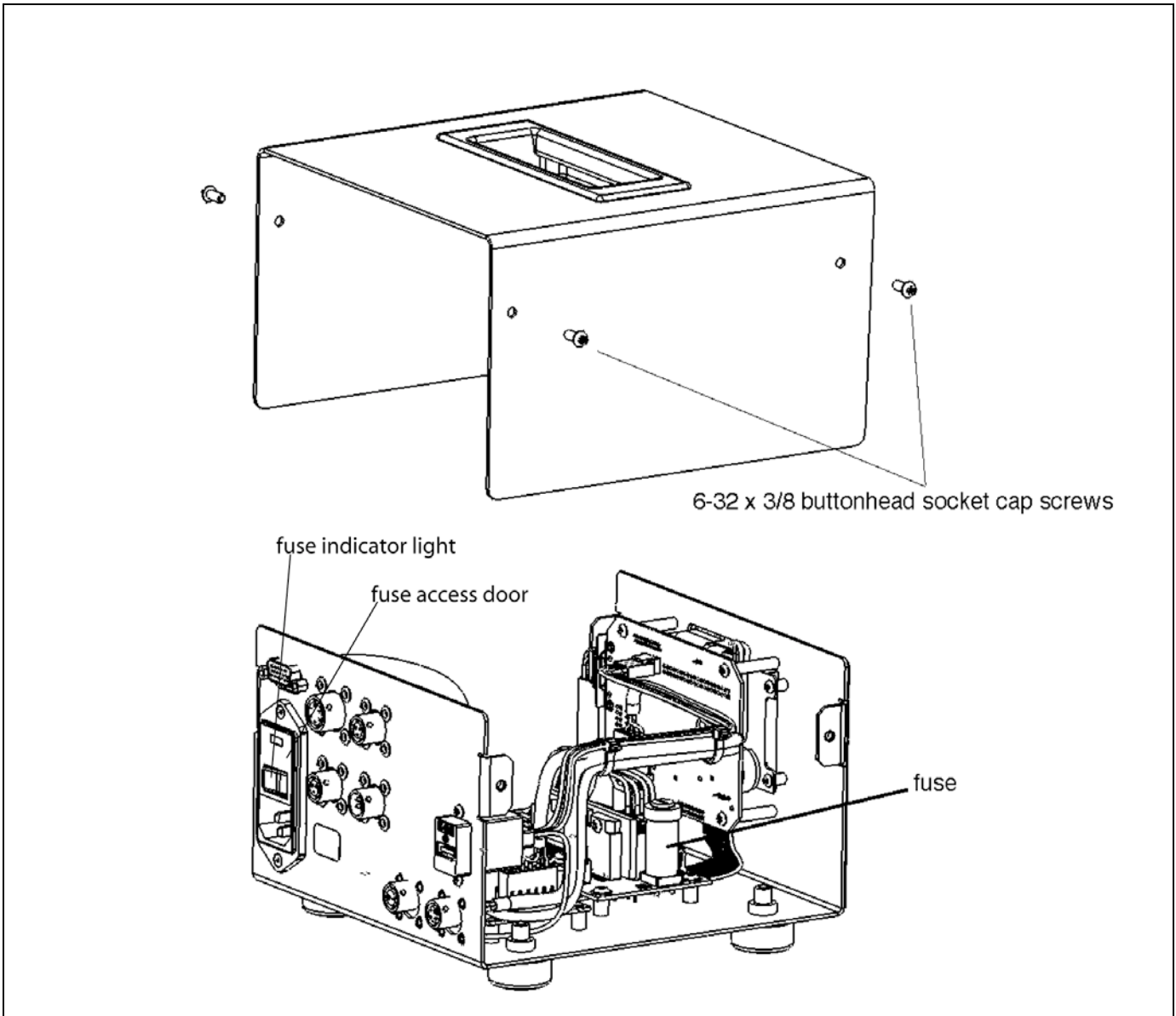
To move back one screen, Press F1. To return to the SPC menu, press F1 again.

16 TESTER MAINTENANCE

Many of the tubes and batteries inside the Lynx and Panther gages have been replaced with solid-state electronics. Thus, very little maintenance is required for the Tiger.

16.1 Removing the Cover

To remove the cover, loosen the 6-32 x 3/8 buttonhead socket cap screws on the sides of the tester and lift up.

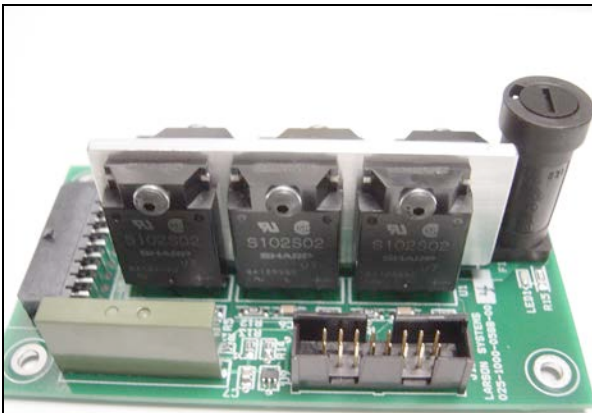


16.2 Changing a Fuse

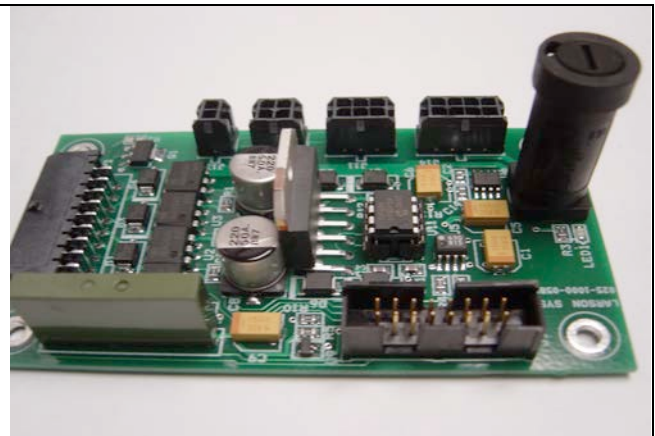
The Tiger uses standard 4-amp fuses in the AC and DC Relay Modules, which are the only user-serviceable parts on the Tiger. Occasionally, you may have to replace a fuse.

1. To access the fuses in the back panel (see the above diagram), disengage the fuse access door lock at the top of the door and let the door drop down. Pull the red fuse holder out and replace the fuses.
2. To access the internal fuses, follow the cover removal instructions above. There is one fuse in each fuse holder. The LED will glow if the fuse is good and power is applied correctly.
3. If the LED does not glow, take a straight-slot screwdriver and loosen the cap on the fuse holder. Replace the fuse and screw the cap back in place.
4. If you have replaced the fuse and the tester still does not work, the entire relay module must be replaced.

Contact LSI for the Tiger AC Relay PCB Assembly (P/N 025-100-0588-00) or Tiger DC Relay PCB Assembly (P/N 025-1000-0589-00).



AC Relay PCB Assembly



DC Relay PCB Assembly

Cylindrical fuse holders are in the upper right corner of the circuit board.

17 TIGER SPECIFICATIONS



Tiger & Super Tiger

Tiger Cub

17.1 Physical dimensions

Tiger Cub: 7 ¼" L x 10" H x 8 3/8" D (184.15 mm L x 254 mm H x 212 mm D)

Tiger, Super Tiger: 6 7/8" L x 4 7/8" H x 7 ½" D (174.63 mm L x 123.82 mm H x 190.5 mm D)

17.2 Weight

Tiger Cub 8.6 lbs. (3.9 kg)

Tiger, Super Tiger 3 lbs. (1.36 kg)

17.3 Electrical Specifications

Power In Tiger Cub Tiger Super Tiger	120 VAC (60 Hz) in/120 VAC out 120/240 (50/60 Hz) VAC in/24 VDC out 120/240 VAC in/ 24 VAC out 240 VAC (50 Hz)
Sort & Control Power Output	120 VAC (100W), 24 VAC (48W), 24 VDC (24W)
Shutdown Relay Contacts	5A AC or DC
Maximum Gaging Rate	70,000/hour

Sort Active Time	0.05-9.95 seconds
Control Active Time	.015-3.0 seconds
Length Measurements Resolution	(Actual values depend on setup) better than 0.0001 inches
Recommended Operating Temperature Range	50°F - 100°F (10°C – 37°C)
Display	Backlit LCD

17.4 Connector Pinouts

<i>Probe</i>	A Probe Drive (1 Mhz) B Probe Return C +15 VDC D Ground
<i>3-way sort</i>	A Over B Under C Common
<i>5-way sort</i>	A Over B Under C Under Good D Over Good E No Connection F Common
<i>Control</i>	A Over B Under C Common
<i>Read</i>	A Read signal B +15 VDC
<i>Shutdown</i>	A Norm Closed Contact 1 B Norm Closed Contact 2 C Norm Open Contact 1 D Norm Open Contact 2
<i>CNC</i> 2-7, 9 are digital inputs and outputs and are low active TTL.	1. Probe voltage ~+- 3VDC 2. Over Sort Active (Out) 3. Under Sort Active (Out) 4. Shutdown (Out) 5. Ground 6. Under Control Active (Out) 7. Over Control Active (Out) 8. Good Pulse (NPN Open collector output, 100mA max) 9. Read (In)

18 TIGER SOFTWARE PACKAGES

Description	Cub	Tiger	Super Tiger
Diagnostics			
Probe Tests - Probe Setup - Standard	*	*	*
Probe Tests – Functional Test	*	*	*
Probe Tests – Drift Test	*	*	*
Length Adjust Setup Test	*	*	*
Sorting Chute Tests	*	*	*
Keypad Test	*	*	*
Audible Beep Test	*	*	*
Settings			
Company Name	*	*	*
Setup			
Job Setup – Nominal & Tolerance			*
Job Setup – Customer Name			*
Job Setup – Part Number			*
Job Setup – Lot Number			*
Job Setup – Comments			*
Probe Setup – Standard	*	*	*
Probe Setup – UltraCal			*
Length Adjust Setup – Each	*	*	*
Length Adjust Setup – Centering			*
Length Adjust Setup– Averaging		*	*
Length Adjust Setup – None	*	*	*
Length Adjust Setup – Amount			*
Length Adjust Setup – Set Point for Each			*
Sorting Setup – 2 Way Good			*
Sorting Setup – 2 Way Bad			*
Sorting Setup – 3 Way	*	*	*
Sorting Setup – 5 Way with Percent of Tolerance		*	*
Sorting Setup - Timed		*	*
Sorting Setup- Non-release			*
Coiler Shutdown – Consecutive Bad	*	*	*
Coiler Shutdown – No Cutoff		*	*
Coiler Shutdown – Total Good			*
Coiler Shutdown - CpK			*
Coiler Shutdown - Excess Adjust			*
SPC - Subgroup Size			*
SPC - Sample Frequency			*
SPC – Collect on All/Good Only			*
SPC – Limits Calculated/Entered			*
Monitor – Cub & Tiger: Bar Graph Display; Super Tiger: Unique Graphical Touch-Screen Display			
Last Reading	*	*	
Last 5 Readings		*	

Last 5 Mean		*	
Good Count		*	*
Job Summary			*
Strip Charts – With Specs			*
Strip Charts – With Histogram			*
Production Monitor – Sort Summary			*
Production Monitor – Testing Times and Rates			*
SPC – Data			*
SPC – X-Bar Chart			*
SPC – R Chart			*
SPC – Sample Histogram			*
SPC – Total Histogram			*
Machine Capability Study			*

19 ACCESSORIES FOR THE TIGER FREE-LENGTH GAGE

Part No.	Part Name
	Tiger Software
050-1000-0050-05	Tiger Software: Super Tiger Package
	Free-Length Gage
025-0000-0711-03	Tiger Gage Standard 120 VAC in & 120 VAC out
025-0000-0711-05	Tiger 240 VAC in & 24 VAC out
025-0000-0711-04	Tiger 120/240 VAC in & 24 VDC out
	Probes
025-0000-0658-02	Temperature-Stable Heated Probe – PX595G (English)
025-0000-0658-03	Temperature-Stable Heated Probe – PX595G (Metric)
	Probe Tips
025-0000-0655-00	Extended Probe Tip – Kit (1 Base & 5 Tips)
018-0000-2535-00	Extended Probe Tip – 1/8 x 1", Threaded (3 x 25 mm)
018-0000-2531-00	Extended Probe Tip – 1/4 x 1", Threaded (6 x 25 mm)
018-0000-2535-00	Extended Probe Tip – 3/8 x 1", Threaded (9 x 25 mm)
018-0000-2533-00	Extended Probe Tip – 5/8 x 1", Threaded (16 x 25 mm)
018-0000-2534-00	Extended Probe Tip – 1 x 1", Threaded (25 x 25 mm)
025-0000-0654-00	Extended Probe Tip – Base Assembly, Threaded
025-0000-0655-01	Extended Probe Tip – Kit (5 single piece assemblies)
025-0000-0631-00	Probe Tip Assembly, 1/8 dia
025-0000-0631-01	Probe Tip Assembly, 1/4 dia
025-0000-0631-02	Probe Tip Assembly, 3/8 dia
025-0000-0631-03	Probe Tip Assembly, 5/8 dia
025-0000-0631-04	Probe Tip Assembly, 1 dia
025-0000-0597-03	Guarded Probe Tip – 5/8" Dia. (16 mm)
025-0000-0597-00	Guarded Probe Tip – 1.0" Dia. (25 mm)
025-0000-0597-01	Guarded Probe Tip – 1.5" Dia. (38 mm)
025-0000-0597-02	Guarded Probe Tip – 2" Dia. (52 mm)
	Probe Holders
025-0000-0640-00	PB309B: Fixed Probe Holder
025-0000-0679-00	Manual Swing-Away Probe Holder
025-0000-0573-00 A	PR2: Retractable Probe Holder
	Read Switches
025-0000-0648-00	RS2E- Read Switch Assembly
025-0000-0648-01	Magless: Read Switch Assembly
	Shutdown Control
025-1000-0426-00	Cable Assy: Shut Down, 4 pin
025-0000-0652-00	Shutdown Bypass Connector
	Pitch Control
025-0000-0589-00 B	AC336 Driver Assembly
025-0000-0590-00	AC336 Gear Box, 20:1
018-0000-2551-01	AC336 Adapter 10-32, W100A
018-0000-2551-02	AC336 Adapter 1/4-28, W10A
018-0000-2551-03	AC336 Adapter 3/8-24. W11A
018-0000-2515-01	AC336 Adapter Kit, 1/2-20, W115A

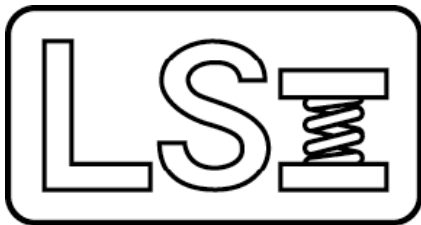
018-0000-2551-00	AC336 Adapter Blank (up to 3/8" or 10 mm thread)
018-0000-2515-00	AC336 Adapter Kit, Blank (1/4 – 1/2" or 6 – 12 mm thread)
013-5000-0151-00	AC336 Flex Shaft, 8" (200 mm)
	Heavy Duty Pitch Control
025-0000-0596-00 E	AC337 Heavy Duty Driver Assy
025-0000-05-95-00	AC337 Gear Box, 50:1
025-0000-0593-01	AC337 Adapter Kit, 3/8-24
025-0000-0593-03	AC337 Adapter Kit, 1/2-20
025-0000-0593-02	AC337 Adapter Kit, 5/8-18
025-0000-0593-00	AC337 Adapter Kit, 3/4-16
025-0000-0593-04	AC337 Adapter Kit, Blank (1/4-3/4" or 6-10 mm thread)
013-5000-0155-00	AC337 Flex Shaft, 12" (304 mm)
018-0000-2578-00	AC337 Anti-rotation Bracket
	Sorting Devices
025-0000-0600-00 A	ASR1 – 2 Way Air Jet, 120 VAC
025-0000-0566-00	MC34-2 – 2 Way Air Powered Sorter, 120 VAC
025-0000-0538-00 B	MC46-3 – 3 Way Air Powered Sorter, 120 VAC
005-0000-0537-00 D	MC46-5 – 5 Way Air Powered Sorter, 120 VAC
025-0000-0582-00	SC48-3AP – 3 Way Air Powered Sorter with Stand, 120 VAC
025-0000-0580-00	SC48-5AP - 5 Way Air Powered Sorter with Stand, 120 VAC
025-0000-0576-00	SC48-3 – 3 Way Electric Powered Sorter with Stand, 120 VAC
025-0000-0578-00	SC48-5 – 5 Way Electric Powered Sorter with Stand, 120 VAC

TITLE

Title to the described equipment shall remain in the seller until full, actual payment therefore shall have been made. In the event of a default, the seller shall have the right to repossess the said equipment and whatever monies shall have been paid on account shall be deemed to have been rental for the use thereof to the date of such repossession. The seller shall also have the right to hold the purchaser liable for a sum equivalent to the unpaid balance of the purchase price together with all expenses and damages that the seller may have sustained, the purchaser to receive credit however, for the net monies realized on the sale of the equipment. At the election of the seller, the seller may deem title to have passed to the purchaser, in which event the seller need not repossess the equipment, but may sue at law for the balance unpaid thereon.

WARRANTY

The Tiger Free-Length Spring Gage parts and labor are warranted against defects in material and workmanship to the consumer for a period of twelve months from the date of purchase. This warranty covers all parts, except consumable items. It applies only to machines and accessories which have been installed and operated in accordance with instructions in our reference manuals, have not been tampered with in any way, misused, suffered damage through accident, neglect or conditions beyond our control and have been serviced only by authorized personnel. Larson Systems Incorporated is not responsible for loss in operating performance due to environmental conditions, such as humidity, dust, corrosive chemicals, deposition of oil or other foreign matter, spillage or other conditions beyond our control. There are no other warranties expressed or implied, and Larson Systems Incorporated shall not be liable under any circumstances for incidental or consequential damage. Warranty service is conducted at LSI's facilities in Minneapolis, MN. Return the tester freight prepaid during the warranty period, and Larson Systems Incorporated will make a warranty determination, repair and return the tester freight collect. Shipments sent collect will be rejected.



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