CAT® Lift Trucks

CCSS0001

Forklift Scale

Technical Manual

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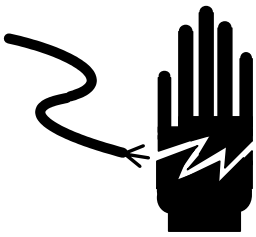
INTRODUCTION

This publication is provided solely as a guide for individuals who have received Technical Training in servicing the METTLER TOLEDO product.

METTLER TOLEDO RESERVES THE RIGHT TO MAKE REFINEMENTS OR CHANGES WITHOUT NOTICE.

Precautions

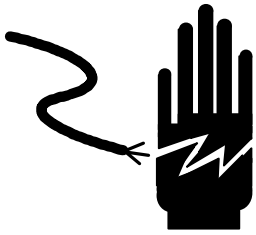
READ this manual BEFORE operating or servicing this equipment.



⚠ WARNING

PERMIT ONLY QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS, AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.

FOLLOW these instructions carefully.

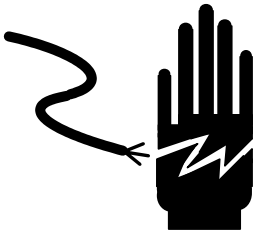


⚠ WARNING

FOR CONTINUED PROTECTION AGAINST SHOCK HAZARD, CONNECT TO PROPERLY GROUNDED OUTLET ONLY. DO NOT REMOVE THE GROUND PRONG.

SAVE this manual for future reference.

DO NOT allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this equipment.



⚠ WARNING

DISCONNECT ALL POWER TO THIS UNIT BEFORE INSTALLING, SERVICING, CLEANING, OR REMOVING THE FUSE. FAILURE TO DO SO COULD RESULT IN BODILY HARM AND/OR PROPERTY DAMAGE.

ALWAYS DISCONNECT this equipment from the power source before cleaning or performing maintenance.

⚠ WARNING

BEFORE CONNECTING/DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT, ALWAYS REMOVE POWER AND WAIT AT LEAST 30 SECONDS. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY HARM OR DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT.

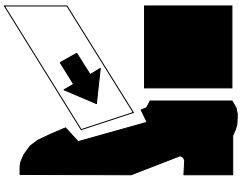
CALL METTLER TOLEDO for parts, information, and service.

⚠ CAUTION

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

⚠ CAUTION

BE SURE TO BLOCK THE LIFT BRACKET WHEN IT IS IN THE RAISED POSITION. OBSERVE ALL APPROPRIATE SAFETY PROCEDURES WHEN INSTALLING AND SERVICING THE SCALE.



⚠ DANGER

DO NOT REMOVE THE BOLTS FROM MORE THAN ONE FLEXURE AT A TIME WHILE THE CARRIAGE IS INSTALLED ON THE FORKLIFT. UNBOLTING MORE THAN ONE FLEXURE COULD RESULT IN BODILY HARM OR PROPERTY DAMAGE.

⚠ DANGER

IF USED IN A HAZARDOUS AREA, THE HAZARDOUS AREA MUST BE MADE SAFE PRIOR TO INSTALLATION, REPLACEMENT, OR TROUBLESHOOTING. FAILURE TO COMPLY COULD RESULT IN PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

⚠ CAUTION

CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY METTLER TOLEDO COULD VOID THE AUTHORITY TO OPERATE THIS EQUIPMENT.

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1 Introduction

The CCSS0001 forklift scale is designed for mounting on Cat® Lift Trucks. It is a fully electronic scale with a capacity of 5,000 lb (2,000 kg). The scale consists of two components: (1) a scale carriage, which is installed in place of the forklift truck's lift bracket, and (2) a scale controller, which is mounted on the forklift truck's head guard. The scale carriage and controller communicate by radio, so there are no wiring connections between them to limit the movement of the forks.

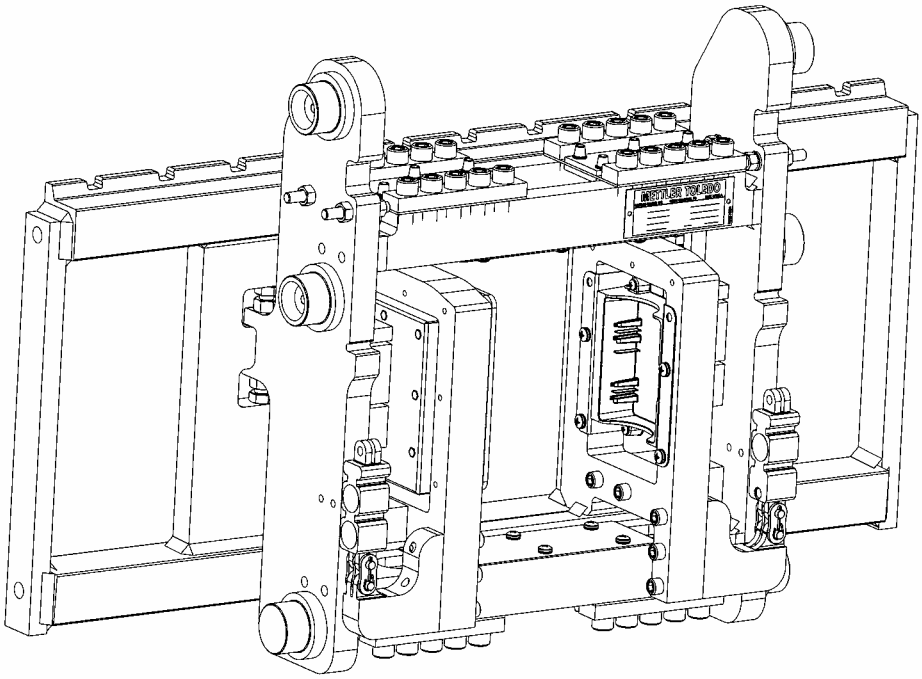

Figure 1-1: Forklift Scale Carriage

This manual explains how to install, operate, and service the CCSS0001 forklift scale. If any information in the manual is incorrect or missing, please use the Publication Suggestion Report at the back of the manual to tell us about it.

FCC Notice

Scale Carriage (FCC ID: RITTE0001)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Scale Controller (FCC ID: RITSC0001)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

⚠ CAUTION

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2 Installation

General

When you receive your forklift scale, check all items against the shipping bill of lading. If any items are missing, notify the carrier immediately. Inspect the packing container and scale for freight damage. If you find damage, contact your freight carrier immediately in order to collect damages.

Tools

The following tools are needed to install and calibrate a forklift scale:

Crane or lifting device (capacity 2,500 lb)

Torque wrench with 3/8-inch hex bit attachment (flexure bolts)

12-mm wrench (main roller bolts)

14-mm wrench (side roller assembly bolts)

24-mm wrench (chain anchor nuts)

3/4-inch wrench (bumper bolts and drag load cell mounting nuts)

10-mm wrench (bolts for mounting controller)

Install Scale Controller

1. Use a pair of U-bolts to attach the mounting bracket to the forklift truck's head guard. Position it so that the driver will be able to view the controller easily.
2. Bolt the controller to the mounting bracket, using four hexagonal head screws and washers (see Figure 2-1).
3. Wire the controller to the forklift truck's time-delay relay (cable is supplied).

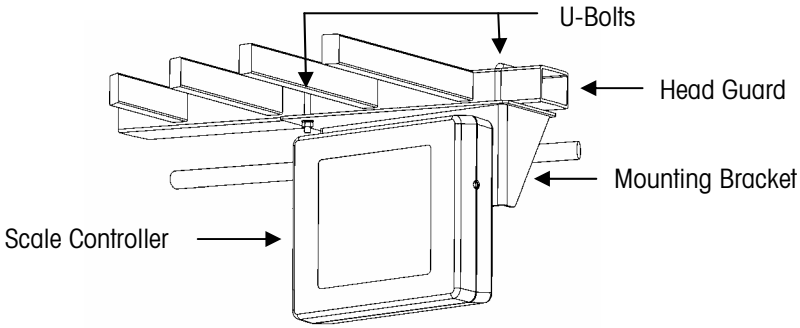


Figure 2-1: Scale Controller and Mounting Bracket

Remove the Forklift Truck's Lift Bracket

1. Park the forklift truck on a level surface, and make sure the mast is in the vertical position.
2. Remove both of the forks.
3. If the forklift truck is equipped with a load backrest extension, remove the load backrest extension.
4. Raise the mast so that the lift bracket is at a comfortable working height (3 or 4 feet off the ground).
5. Wrap a sling securely around the lift bracket's upper fork bar.
6. Attach the sling to a crane (or other lifting device with a capacity of at least 500 lb), and use the crane to raise the lift bracket so that the chains have some slack in them.

⚠ CAUTION

BE SURE TO BLOCK THE LIFT BRACKET WHEN IT IS IN THE RAISED POSITION. OBSERVE ALL APPROPRIATE SAFETY PROCEDURES WHEN INSTALLING AND SERVICING THE SCALE.

7. Disconnect the two chain anchors from the mast by removing the lower jam nut from each anchor (see Figure 2-2). Keep the nuts with the chain anchor to use them for installing the scale carriage.

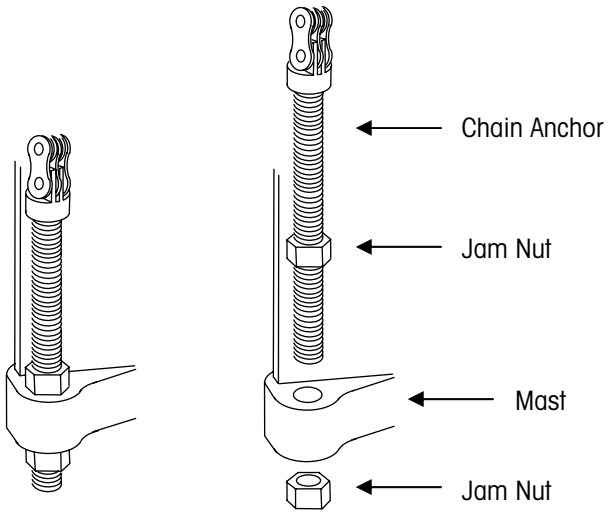


Figure 2-2: Chain Anchor Assembly

8. Remove the chains from the pulleys at the top of the mast. Then position the chains over the front of the lift bracket so that they will not interfere with removing the lift bracket from the mast.

9. Raise the bottom of the inner mast at least 2 feet off the floor to allow enough room to remove the lift bracket from the bottom of the mast.
10. Use the crane to lower the lift bracket to the floor and remove it from the bottom of the mast.
11. Place the lift bracket on a stable working surface, with the front side of the lift bracket facing downward to provide easy access to the rollers and chain mounts.
12. Disconnect the two chains from the lift bracket. Remove the cotter pin from the master link that is connected to the 90° joint in each chain (see Figure 2-3). Then take apart the master link, using a C-clamp or similar device to press the master link through the link plates. Do not use a hammer or other tool to strike the master link. It could damage the link. Keep the chains and master links to install on the scale carriage.

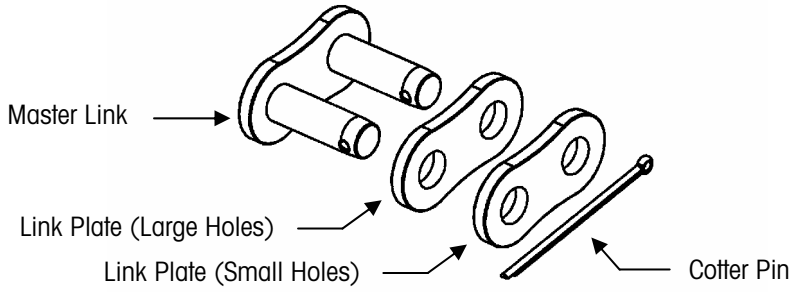


Figure 2-3: Master Link Assembly

13. Remove the six main rollers from the lift bracket (see Figure 2-4). The two top rollers on each side of the lift bracket are secured with screws. The bottom roller on each side of the lift bracket can be removed by hand. Save the rollers, screws, washers, and shims so that you can install them on the scale carriage.

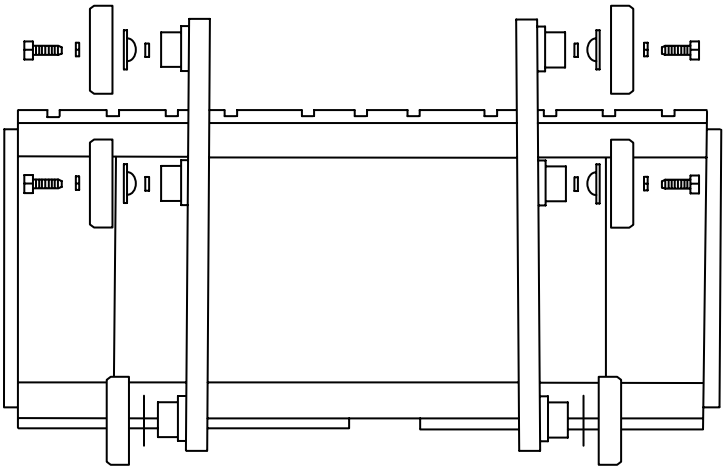


Figure 2-4: Remove Main Rollers

14. Locate the side roller on each side of the lift bracket. Remove the two bolts that secure each side roller assembly to the lift bracket (see Figure 2-5). Keep these assemblies together because you will need to install them on the scale carriage. Note the position of any shims used in the assemblies.

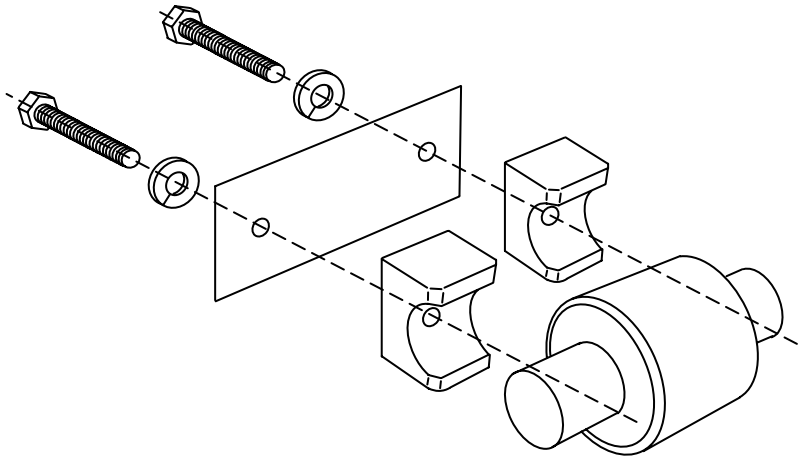


Figure 2-5: Side Roller Assembly

15. Set the lift bracket aside, and remove the sling from it.

Install the Scale Carriage

1. Park the forklift truck on a level surface, and make sure the mast is in the vertical position.
2. Place the scale carriage on a stable working surface, with the front side of the carriage facing downward to provide easy access to the rollers and chain load cells.
3. Install the two lower main rollers by sliding them onto the roller shafts at the bottom of each side of the scale carriage (see Figure 2-6). Be sure to install any shims that were removed from the forklift truck's lift bracket.
4. Install the other four main rollers on the scale carriage, securing them with the bolts that were removed from the lift bracket (see Figure 2-6).

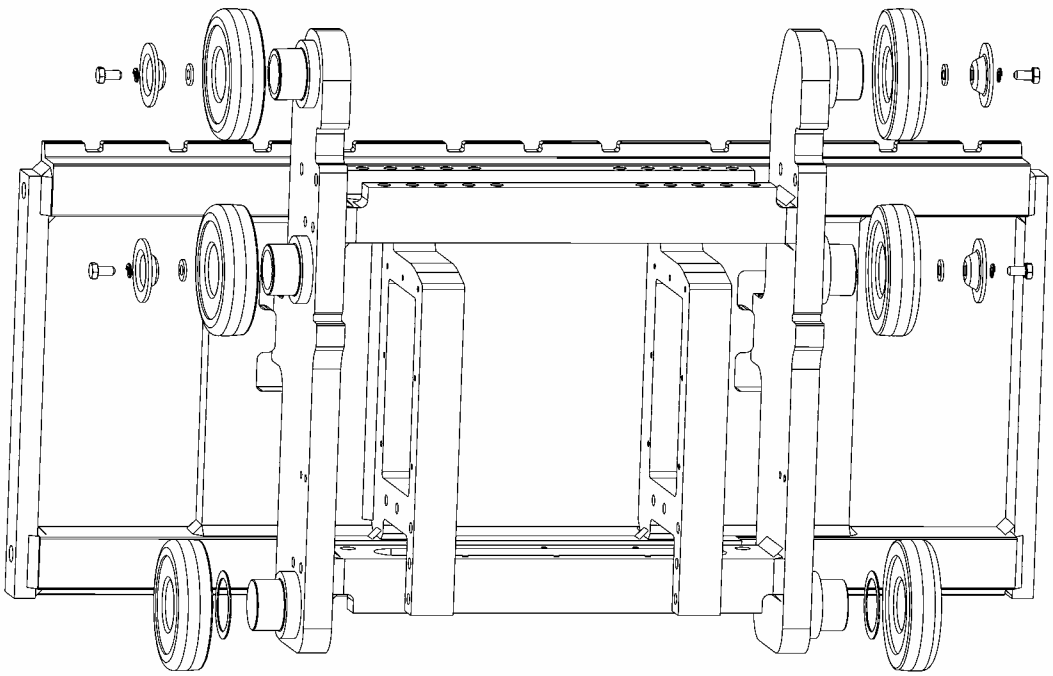


Figure 2-6: Install Main Rollers

5. Mount the two side roller assemblies (including shims) on the scale carriage (see Figure 2-7). Do not use the bolts that were removed from the lift bracket. Instead, use the studs and nuts provided with the scale carriage. Align the two holes in each side roller assembly with the holes located midway between the two bolted rollers on each side of the carriage. Insert the studs in the holes and screw them into the assembly. Then place the washers and nuts on the ends of the studs and tighten them against the carriage.

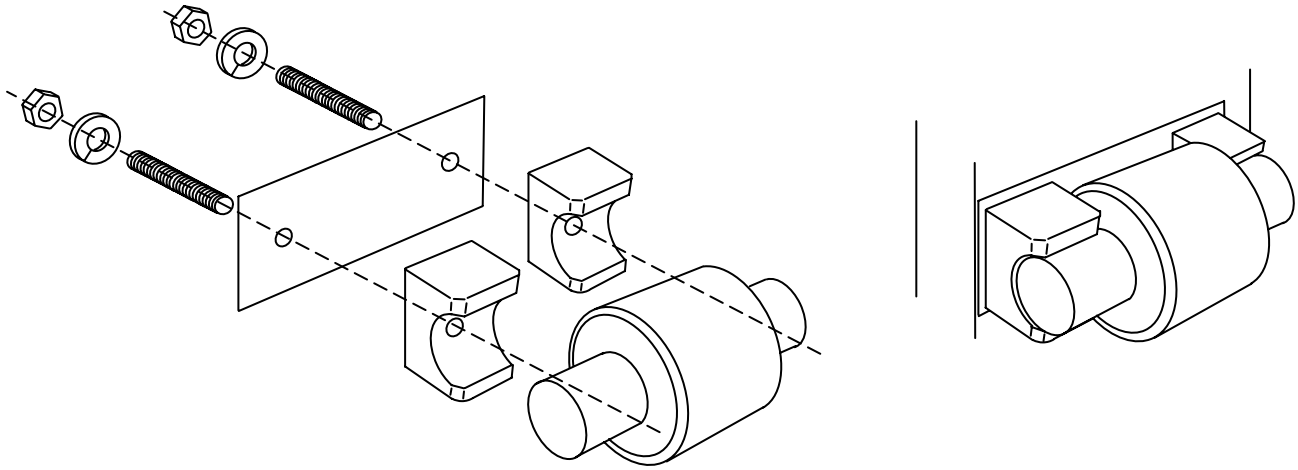


Figure 2-7: Side Roller Assembly

6. Use a master link to connect each chain to one of the chain load cells on the scale carriage. Assemble the master link as shown in Figure 2-8. Using a C-clamp or similar device, press the master link assembly together just enough so that you can insert the cotter pin in the holes. If the link is too tight, it can bind against the load cell and chain mount. If the link does not rotate freely on the load cell or chain, press the master link back through the link plates until it rotates freely.

   NOTE: When a forklift scale is installed, a standard chain should have 35 links (including master links). Add or remove links if necessary.

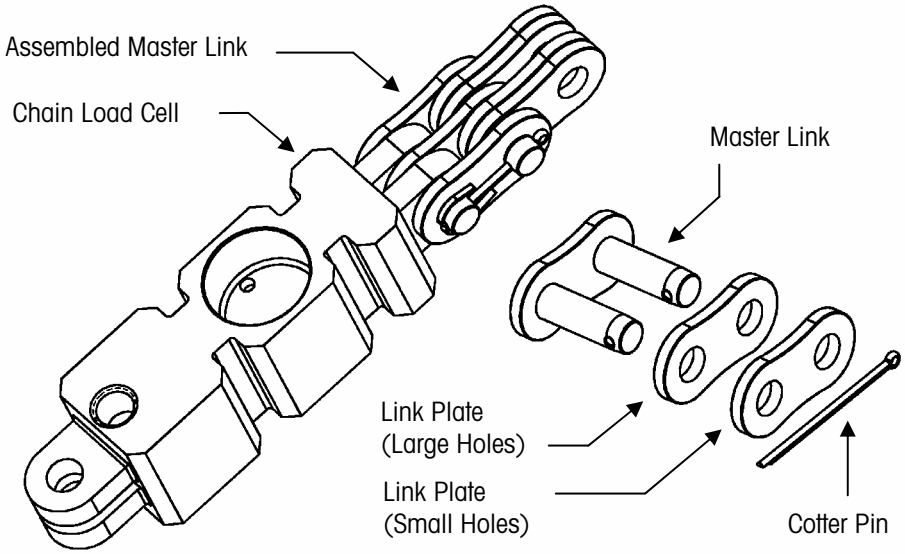


Figure 2-8: Connect Chain to Load Cell with Master Link

7. Position the chains over the front of the carriage so that they will not interfere when you install the carriage in the forklift mast.
8. Raise the bottom of the inner mast at least 2 feet off the floor to allow enough room to install the carriage from the bottom of the mast.
9. Wrap a sling securely around the upper part of the scale carriage.

10. Attach the sling to a crane (or other lifting device with a capacity of at least 500 lb), and use the crane to lift the scale carriage. Position the carriage so that its main rollers fit into the bottom of the mast channel. The chain load cells are located on the back side of the scale carriage.
11. Raise the carriage to a comfortable working position, keeping the main rollers aligned inside the mast channel. Move the carriage up and down several times to make sure that it moves freely within the mast. If the carriage fits too tightly within the mast, you might need to remove shims from the bottom rollers or side rollers.
12. Position two blocks of wood (3 inches high) on the floor under the carriage's lower fork bar. Lower the inner mast and carriage until the fork bar rests on the blocks.
13. Route the chains over the pulleys at the top of the mast.
14. Remove the lower nut from each chain anchor and insert the anchor into the hole in the mast, below and behind the chain pulleys. Place the lower nut on the threaded anchor and tighten it until both it and the upper nut are tight against the mast (see Figure 2-9). You will need to adjust the anchors later, so do not tighten the nuts too much. Make sure there is no slack in the chains, so that the carriage does not drop when you remove the sling.

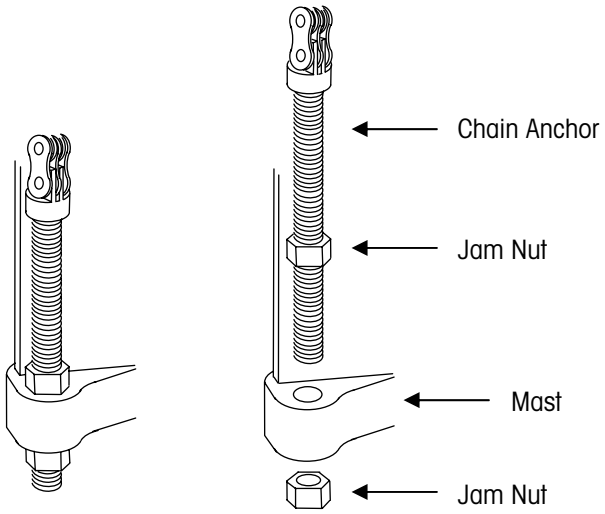


Figure 2-9: Chain Anchor Assembly

15. Remove the sling from the scale carriage.
16. Raise the carriage slightly. Put the forks back on the lift truck, positioning a fork at the next to last notch on each side of the carriage.
17. Lower the carriage to the floor so that the stages of the mast are completely collapsed.
18. Adjust the chain anchors so that each chain has 3/4 inch of slack. This will allow room for the chains to adjust when the mast is set at an angle. With the mast in the vertical position and the carriage fully lowered, the distance between the floor and the bottom of the scale carriage should be 76 to 80 mm (about 3 inches).
19. After installing the scale controller and scale carriage, place a pallet on the forks and exercise the scale to make sure that all components seat properly. Repeatedly place a test weight on the scale, positioning it on the center of the scale and at each corner of the scale.

Batteries

A 12-volt battery pack is used to power the scale's load cells and carriage radio. The scale is supplied with two batteries and a battery charger. New batteries must be charged before they can be used. A fully charged battery will allow you to operate the scale for up to 36 hours. The battery level indicator on the scale controller's main weighing screen alerts the driver when the battery's voltage level is low.

- To install a battery, insert it in the scale carriage's battery compartment. Position the battery so that the metal contacts on its side fit against the metal contacts in the battery compartment.
- To remove a battery, press the plastic tab toward the center of the battery and pull the battery out of the battery compartment.
- To charge a battery, insert it in the battery charger (see Figure 2-10). Then plug the battery charger into a standard electrical outlet (110 volts). It will take 12 to 16 hours to provide the initial charge for a new battery. Once a battery has been used, it should take no more than 3 to 4 hours to recharge it. A red light on the battery charger indicates that the battery is being charged. A green light indicates that the battery is fully charged. When a battery is fully charged, the charger goes into trickle mode, so there is no danger of damaging a battery by overcharging it.

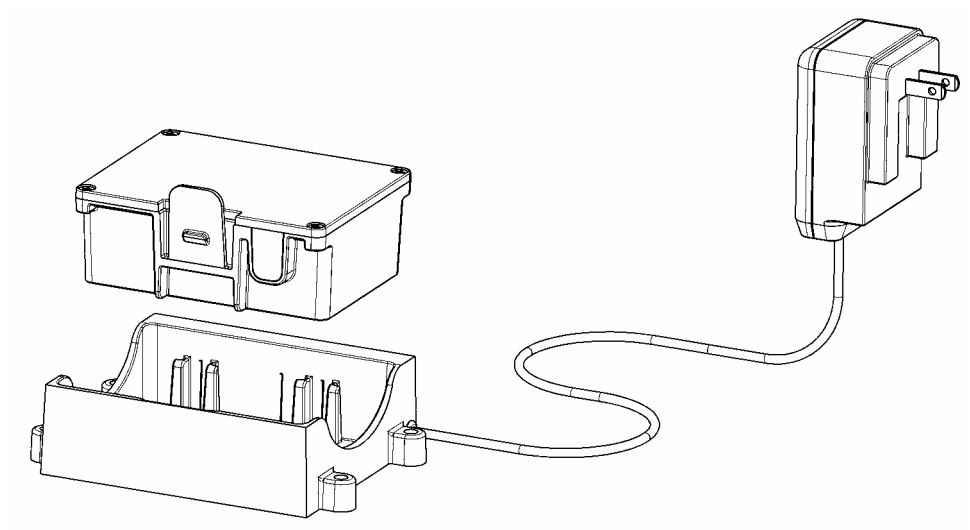


Figure 2-10: Battery and Batter Charger

Geo Index

To compensate for local gravitational forces, change the geo index to the setting for the location where the scale will be used. The factory default setting is 16 (the geo index for Worthington, Ohio, USA). To determine the geo index for a location, refer to the appendix (Chapter 9). You must know the geographical coordinate for the location and the elevation above sea level.

1. To change the geo index, enter the scale controller's setup mode by touching the **Setup** button on the main weighing screen.
2. Touch the **Scale** button, touch the **Calibration** button, and then touch the **Where Used** button.
3. A keypad is used to enter the geo index. Type a number in the data field by touching the numeric keys on the keypad (the range is 0 to 31). Touch the **Clear** button if you wish to clear the data field and start over.
4. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Shift Adjustment

Forklift scales are calibrated at the factory and should not need to be recalibrated when they are installed. You should, however, check the scale after installing it to see if it needs to be shift adjusted. A correctly adjusted scale will give you the same weight reading no matter where on the forks you place a test weight. If the weight readings at the shift test locations are out of tolerance, shift adjust the scale to correct the problem.

Park the forklift truck on a level surface, place a pallet on the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor. Then check the scale's repeatability by placing a test weight on the same location on the pallet several times to make sure that you get the same weight reading each time.

After verifying the scale's repeatability, check to see if the scale needs to be shift adjusted. For shift adjustments, we recommend using test weights equal to one half the scale's maximum weighing capacity. The test weights must meet the specified National Institute of Standards and Technology Handbook 44 accuracy requirements.

NOTE: When performing a shift adjustment, use the weight readings on the data screen instead of those on the main weighing screen. The weight readings on the data screen are displayed to two decimal places, although the number in the second decimal place might not be stable.

Shift Test Locations

Place a pallet or other flat surface (approximately 4 feet by 4 feet) on the forks and make sure that it is level. Figure 2-11 shows test weight locations (1, 2, 3, and 4) at the center of each quadrant of the pallet. Place the test weight at location 1 and record the weight reading. Then move the test weight to location 2 and record the weight reading. Continue until you have taken a weight reading at each of the four locations.

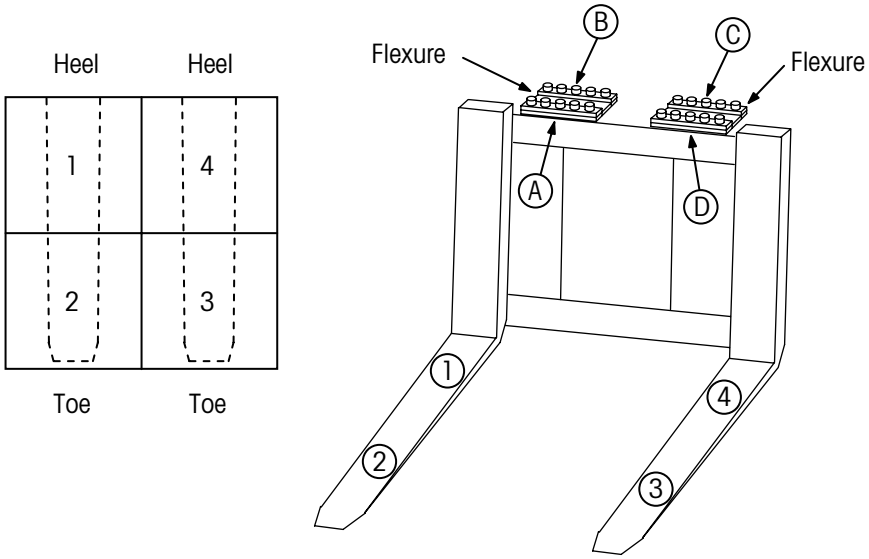


Figure 2-11: Shift Adjustment Locations

Ideally, the scale will give you the same weight reading at all four locations. The weight readings at the heel and toe of either or both forks should be within Handbook 44 tolerance requirements (±2.5 lb for weights up to 2,500 lb). If the weight readings are out of tolerance, you will need to shift adjust the scale. This is done by adding shims to the flexures at the locations shown in Figure 2-11. To determine where to add shims, refer to Table 2-1.

If weight reading 1 is greater than 2	→	Shim at location A
If weight reading 2 is greater than 1	→	Shim at location B
If weight reading 3 is greater than 4	→	Shim at location C
If weight reading 4 is greater than 3	→	Shim at location D

Table 2-1: Shim Locations

The shims adjust the differences between the weight readings at the heel and toe of an individual fork. Adjust the weight readings so that they are as near to equal as possible. If one weight reading is slightly higher, it should be the reading at the toe of the fork.

Shimming at the front of a flexure (location A) will increase the weight reading at the toe of the fork (location 2). Because the shim affects the entire fork, it will also slightly increase the weight reading at the heel (location 1).

Shimming at the back of a flexure (location B) will decrease the weight reading at the toe of the fork (location 2). Because the shim affects the entire fork, it will also slightly decrease the weight reading at the heel (location 1).

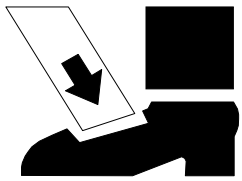
A pallet places load on both forks. So when a pallet is used, shimming under a flexure will affect the readings at all four test weight locations. For example, shimming at

location A or B will change the readings at locations 1 and 2, but it will also change the readings at locations 3 and 4 to a lesser extent.

Keep in mind that, in addition to balancing the weight readings at the heel and toe of each fork, you are also trying to balance the weight readings of the two forks.

Shimming Procedure

Do not remove the bolts from more than one flexure at a time. The flexures connect the two sections of the scale carriage. If you unbolt the two top or bottom flexures, the sections of the carriage could separate and cause injury or damage the flexures.



⚠ DANGER

DO NOT REMOVE THE BOLTS FROM MORE THAN ONE FLEXURE AT A TIME WHILE THE CARRIAGE IS INSTALLED ON THE FORKLIFT. UNBOLTING MORE THAN ONE FLEXURE COULD RESULT IN BODILY HARM OR PROPERTY DAMAGE.

1. Remove the bolts from the side of the flexure where shims will be added.
2. Loosen the bolts on the opposite side of the flexure.
3. Place a shim under the flexure, aligning the bolt holes in the shim with those in the flexure. We recommend starting with the thinnest shim and gradually increasing the shim thickness as needed to balance the weight readings.
4. Replace the bolts that were removed, and tighten all bolts (torque to 90 ft-lb).
5. Repeat steps 1-4 for the second flexure if needed.
6. Take new weight readings at all four test weight locations. If the weight readings are still not equal, repeat the procedure to add additional shimming.
7. When you have finished shift adjusting the scale, you should get approximately the same weight reading at all four test weight locations.

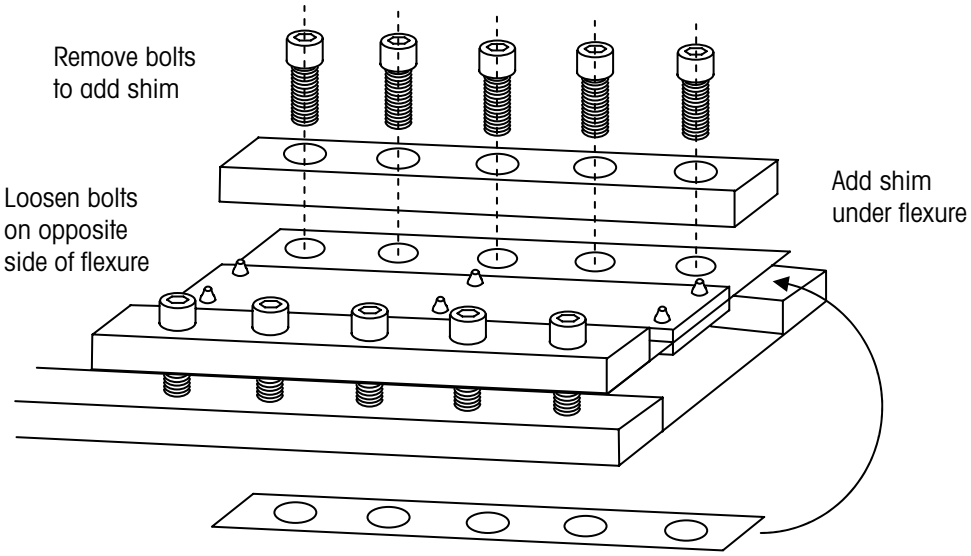


Figure 2-12: Shimming Procedure

3 Scale Operations

Power-up Sequence

Remove all load from the forks whenever you power up the scale controller. Start the forklift truck's motor, and then press the on/off button in the upper right-hand corner of the controller's front cover. During the controller's power-up sequence, it will display the version number and build number of the scale software. When the controller is fully powered up, it will display the main weighing screen.

Weighing Screen

All weighing operations can be performed from the scale controller's main weighing screen. In addition to displaying current weight data, the screen provides push buttons used to perform weighing operations and to enter setup mode.

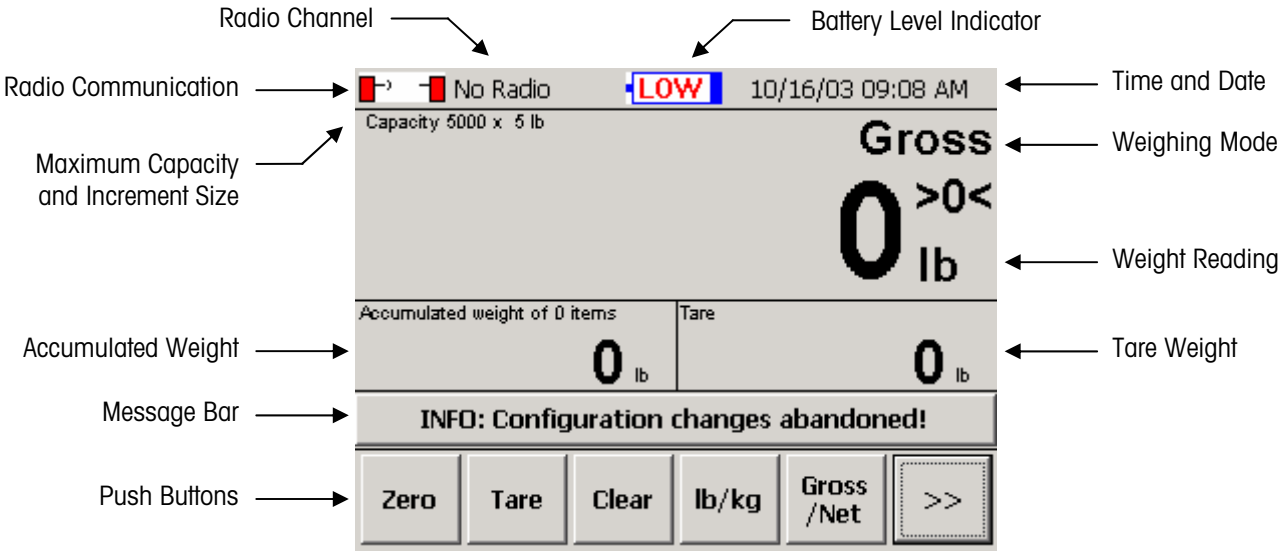


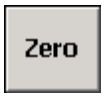
Figure 3-1: Main Weighing Screen

Radio Communication: When the indicator is green, the radios are communicating. When it is red, there is no communication.

Battery Level Indicator: The blue color indicates the battery level. The indicator will display a warning message when the battery level is low and when the battery needs to be changed. The battery discharge cradle has a low-voltage cutoff that shuts off power to the scale carriage when the battery voltage drops to the "change battery" level (approximately 10.5 volts).

Push Buttons

The push buttons at the bottom of the main weighing screen are used to perform weighing functions and to enter setup mode.



Zero

The **Zero** button is used to zero the scale manually. This feature can be used if the weight reading on the screen does not return to zero when all load has been removed from the scale. In order for this button to zero the scale manually, (1) the scale must be in gross weighing mode and (2) the weight reading on the screen must be within the range specified in the manual range setup feature. The scale also includes an automatic zero maintenance (AZM) feature. When AZM is enabled, the scale will be zeroed automatically if the weight reading is within a specified range.

Tare

The **Tare** button is used to assign the weight that is currently on the scale as a tare weight. The tare weight is the weight of an empty pallet or container. It is subtracted from the gross weight (weight of the loaded pallet or container) to determine the net weight (weight of the item on the pallet or the material in the container). The tare weight will be displayed in the Tare field. This button will work only if push button tare is enabled in scale setup.

Clear

The **Clear** button is used to remove a tare weight reading or accumulated weight reading that is displayed on the screen. To remove a tare weight reading, touch the **Clear** button and then touch the **Tare** button. To remove an accumulated weight reading, touch the **Clear** button and then touch the **Accum** button.

Accumulator

The **Accum** button is used to accumulate a series of weights and sum them to calculate a total weight. When you touch the **Accum** button, the gross or net weight that is displayed on the screen will be added to the weight reading in the Accumulated Weight field. This button will be available only if basic accumulate is enabled in application setup.

Gross/Net

The **Gross/Net** button is used to switch between gross and net weight readings on the screen. In order to switch to a net weight reading, you must first assign a tare weight. This button will work only if gross/net switching is enabled in scale setup.

>>

The double arrow button is used to display additional push buttons on the screen.

Setup

The **Setup** button is used to enter setup mode on the controller. For an explanation of the setup features and how to use them, refer to the "Scale Setup" section of this manual.

Keyboard Tare

The **Keybd Tare** button is used to enter a tare weight manually. The tare weight is the weight of an empty pallet or container. It is subtracted from the gross weight (weight of the loaded pallet or container) to determine the net weight (weight of the item on the pallet or the material in the container). When you touch the **Keybd Tare** button, a keypad will appear on the screen. Type the tare weight by touching the numerical keys on the keypad. Then touch the **Enter** button. The tare weight will be displayed in the Tare field. This button will work only if keyboard tare is enabled in scale setup.

Audit Log

The **Audit Log** button is used to view the scale's log that is required for Weights and Measures audits. The log lists all calibration and configuration changes.

Filter

The **Filter** button is used to adjust the vibration filtering for the scale. It lets you adjust filtering without entering setup mode. You can disable filtering or specify a filtering level (Light, Lt/Med, Medium, Med/Hvy, or Heavy). Any changes made using this button will be lost when the scale controller is shut off. At power-up, the scale will revert to the filter settings that are specified in setup mode.

lb/kg

The **lb/kg** button is used to switch between weight readings in pounds and kilograms. It changes the unit of measure for all weights displayed on the screen. This button will work only if unit switching is enabled in scale setup.

Pro Number

The **Pro# Print** button is used to enter a shipping number for a SmartWeigh transaction and create a record of the transaction. This button will be available only if advanced accumulate is enabled in application setup.

Employee ID

The **Employ ID** button is used to enter an Employee ID for a SmartWeigh transaction. This button will be available only if advanced accumulate is enabled in application setup. When you touch the button, a keypad will appear on screen. Type the Employee ID by touching the keys on the keypad. Then touch the **Enter** button.

Weighing Operations

This section describes the scale's basic weighing operations, which are performed from the controller's main weighing screen. You can display a gross weight, use a tare weight to determine a net weight, and use the accumulator to calculate the sum of a series of gross or net weights.

Gross Weighing

Use the following procedure to find the gross weight of an item:

1. Lift the item with the forklift.
2. The gross weight will be displayed in the Weight field.

Net Weighing with Push Button Tare

Push button tare must be enabled in scale setup. Use the following procedure to find the net weight of an item:

1. Lift the empty pallet (or container) with the forklift.
2. The weight will be displayed as a gross weight in the Weight field.
3. Touch the **Tare** button.
4. The weight of the pallet (or container) will be displayed in the Tare field. The reading in the Weight field will change to zero.
5. Lift the loaded pallet (or container) with the forklift. You can remove the pallet (or container) from the forklift to fill it or fill it while it is on the scale.
6. The net weight of the item will be displayed in the Weight field. If you wish to view the gross weight of the loaded pallet (or container), touch the **Gross/Net** button.
7. If auto clear is enabled, the gross/net weight and tare weight readings on the screen will automatically return to zero when the load is removed from the scale. Otherwise, the tare weight will remain on the screen and can be used to weigh another loaded pallet (or container). To clear the tare weight, touch the **Clear** button and then the **Tare** button.

Net Weighing with Keyboard Tare

Keyboard tare must be enabled in scale setup. Use the following procedure to find the net weight of an item:

1. Lift the loaded pallet (or container) with the forklift.
2. The weight will be displayed as a gross weight in the Weight field.
3. Touch the **Keybd Tare** button.
4. A keyboard will appear on the screen. Type in the tare weight of the pallet (or container) by touching the numerical keys on the keyboard. When the correct tare weight is displayed in the keyboard's data field, touch the **Enter** button.
5. The net weight of the item will be displayed in the Weight field. If you wish to view the gross weight of the loaded pallet (or container), touch the **Gross/Net** button. The tare weight will be displayed in the Tare field.
6. If auto clear is enabled, the gross/net weight and tare weight readings on the screen will automatically return to zero when the load is removed from the scale. Otherwise, the tare weight will remain on the screen and can be used to weigh another loaded pallet (or container). To clear the tare weight, touch the **Clear** button and then the **Tare** button.

NOTE: You can also use keyboard tare to enter a tare weight before lifting the loaded pallet (or container) with the forklift.

Accumulating Gross Weights

Basic accumulate must be enabled in application setup. Use the following procedure to accumulate gross weights:

1. Lift an item with the forklift.
2. The gross weight will be displayed in the Weight field.
3. Touch the **Accum** button.
4. The gross weight of the item will be displayed in the Accumulated Weight field. The text above the field will indicate the number of loads that have been accumulated: "Accumulated weight of 1 item."
5. Remove the item from the scale, and then lift the next item.
6. The gross weight of the item currently on the scale will be displayed in the Weight field.
7. Touch the **Accum** button.
8. The gross weight of the item will be added to the weight displayed in the Accumulated Weight field. The text above the field will indicate the number of loads that have been accumulated: "Accumulated weight of 2 items."
9. Repeat Steps 5 to 8 for each additional item to be weighed.
10. When you have finished accumulating weights, remove the load from the forklift. To clear the accumulated weight, touch the **Clear** button and then the **Accum** button.

Accumulating Net Weights

Basic accumulate must be enabled in application setup. Use the following procedure to accumulate net weights:

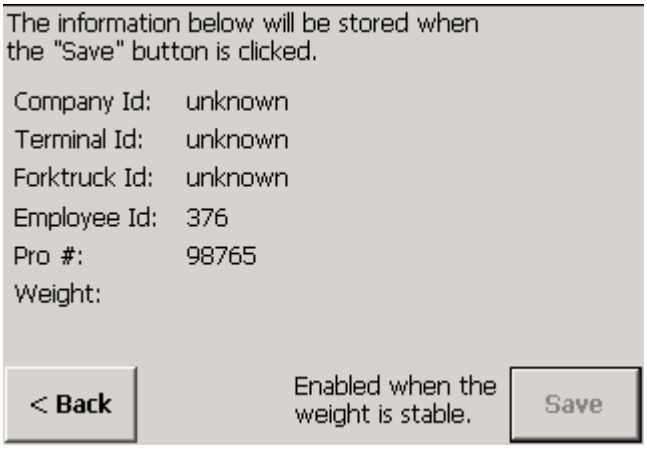
1. Display the net weight to be accumulated:
   - If you are using push button tare, lift the empty pallet (or container) and touch the **Tare** button. Then lift the loaded pallet (or container).
   - If you are using keyboard tare, lift the loaded pallet (or container) and touch the **Keybd** Tare button. Then enter the tare weight manually.
2. Touch the **Accum** button.
3. The net weight of the item will be displayed in the Accumulated Weight field. The text above the field will indicate the number of loads that have been accumulated: "Accumulated weight of 1 item."
4. Remove the item from the scale.
5. Display the next net weight to be accumulated:
   - If you are using pushbutton tare, lift the empty pallet (or container) and touch the **Tare** button. Then lift the loaded pallet (or container).
   - If you are using keyboard tare, lift the loaded pallet (or container) and touch the **Keybd Tare** button. Then enter the tare weight manually.
6. Touch the **Accum** button.

7. The net weight of the item will be added to the weight displayed in the Accumulated Weight field. The text above the field will indicate the number of loads that have been accumulated: "Accumulated weight of 2 items."
8. Repeat Steps 4 to 7 for each additional item to be weighed.
9. When you have finished accumulating weights, remove the load from the forklift. To clear the accumulated weight, touch the **Clear** button and then the **Accum** button.

SmartWeigh Transactions

The SmartWeigh option allows you to create records of weighing transactions. To use the SmartWeigh option, you must enable advanced accumulate in application setup. Use the following procedure to process a SmartWeigh transaction:

1. Lift the item with the forklift.
2. Touch the **Employ ID** button and then use the keypad to enter an Employee ID.
3. Touch the **Pro# Print** button and then use the keypad to enter a Pro number.
4. The SmartWeigh information screen will be displayed. It lists the weight and other information about the transaction. Touch the **Save** button to save a record of the transaction in a computer file.

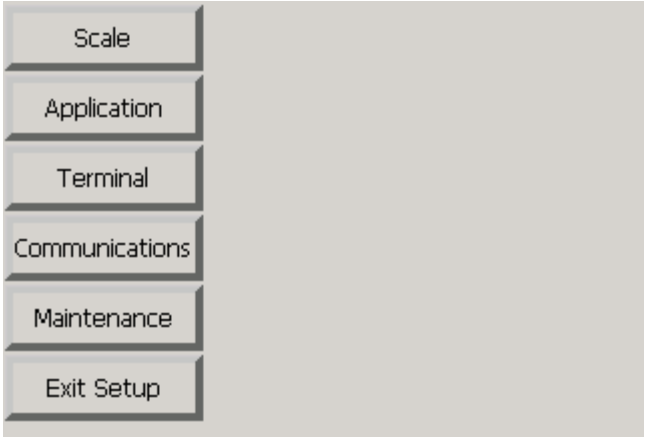


4 Scale Setup

Setup Screens

The scale controller's touch screen provides access to the scale's setup features. These allow you to calibrate the scale, change how the scale operates, assign passwords, set communication parameters, and perform diagnostic tests.

To use the scale's setup features, touch the **Setup** button on the scale controller's main weighing screen. If security-level passwords have been assigned, you will be prompted to enter a password.



Scale

The scale setup features are used to calibrate the scale and adjust the settings for the scale's weighing functions. Touch the **Scale** button to display buttons for the individual scale setup features.

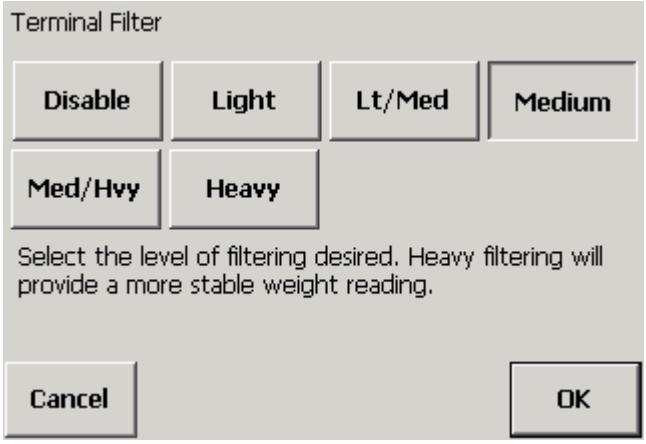
Filter

Filtering is used to compensate for environmental disturbances such as vibration and noise. Touch the **Filter** button to access the filtering features.

Terminal Filter

You can select a filtering level for the scale. Heavy filtering will provide a more stable weight reading, but it can cause the scale to take longer to stabilize. The default setting is Medium.

1. Touch the **Terminal Filter** button.

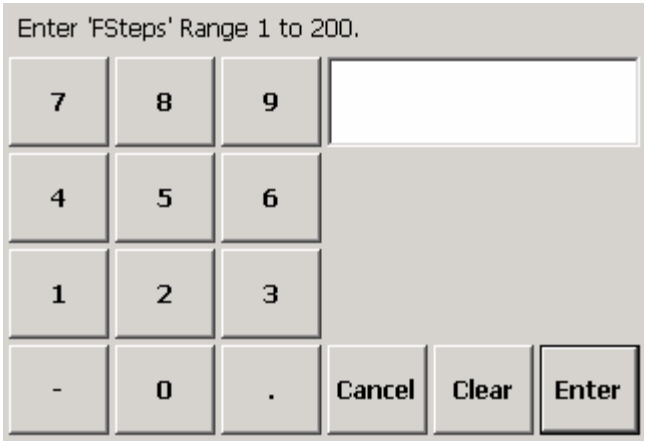


2. Touch a button to disable filtering or to select a filtering level (Light, Lt/Med, Medium, Med/Hvy, or Heavy).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Fsteps

The FSteps feature sets the filter constant used for on-board digital filtering. This is the maximum number of measurement samples that the filter will average. The default setting is 20. This constant is set at the factory and should not need to be adjusted.

1. Touch the **FSteps** button to display a keypad on the screen.

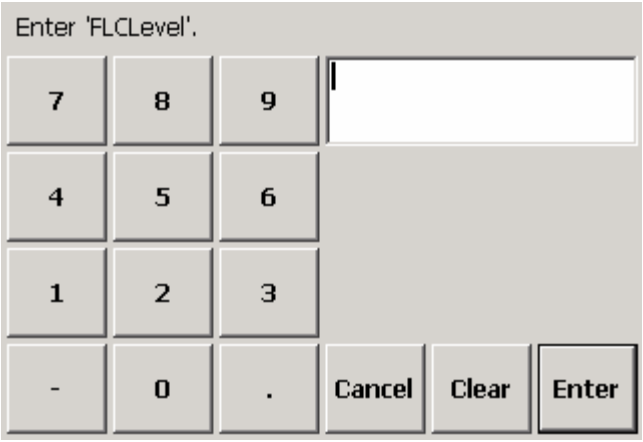


2. Type a number in the data field by touching the numeric keys on the keypad. Valid Fsteps settings are 1 to 200. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

FLCLevel

The FLCLevel is another constant used for on-board digital filtering. It represents the largest input step change for the load cells that will reset the filter steps. The default setting is 0.001. This constant is set at the factory and should not need to be adjusted.

1. Touch the **FLCLevel** button to display a keypad on the screen.

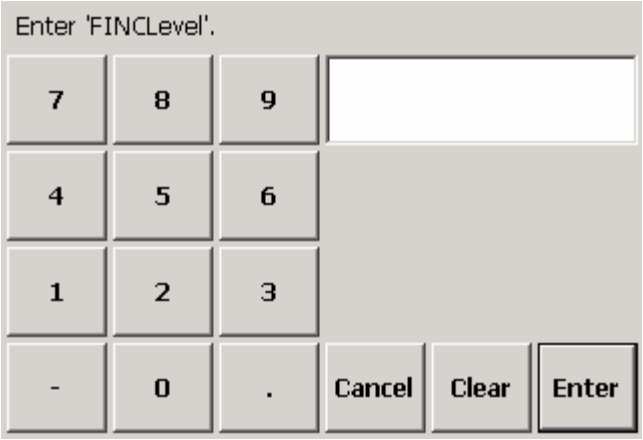


2. Type a number in the data field by touching the numeric keys on the keypad. Valid FLCLevel settings are 0.01 to 0.0001. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

FINCLevel

The FINCLevel is another constant used for on-board digital filtering. It represents the largest input step change for the inclinometers that will reset the filter steps. The default setting is 0.01. This constant is set at the factory and should not need to be adjusted.

1. Touch the **FINCLevel** button to display a keypad on the screen.



2. Type a number in the data field by touching the numeric keys on the keypad. Valid FINCLevel settings are 0.1 to 0.001. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Tare

The following tare setup features allow you to enable or disable functions for entering and clearing tare weights. Touch the **Tare** button to access the features.

Push Button Tare

Push button tare allows you to assign the weight that is currently on the scale as the tare weight by touching the **Tare** button on the weighing screen. The default setting is Enabled.

1. Touch the **Push Button** button.

2. Touch the check box to place a check mark in it (enabling the function) or to remove a check mark (disabling the function).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Keyboard Tare

Keyboard tare allows you to enter a tare weight manually by touching the **Keybd Tare** button on the weighing screen and then typing a weight. The default setting is Disabled.

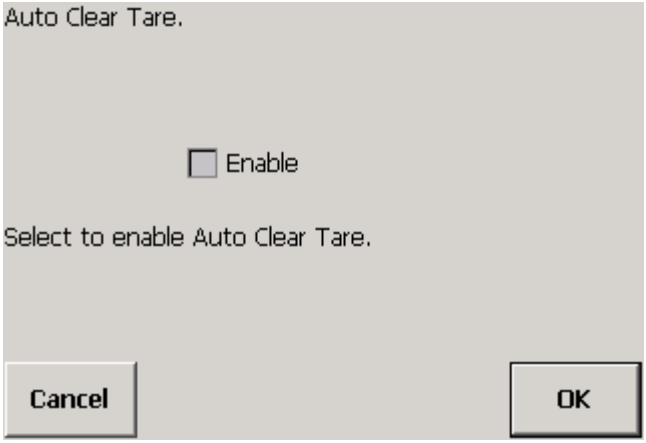
1. Touch the **Keyboard** button.

2. Touch the check box to place a check mark in it (enabling the function) or to remove a check mark (disabling the function).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Auto Clear

Auto clear automatically clears the tare weight from the terminal when a load is removed from the scale (the weight reading returns to zero). The default setting is Disabled.

1. Touch the **Auto Clear** button.



2. Touch the check box to place a check mark in it (enabling the function) or to remove a check mark (disabling the function).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

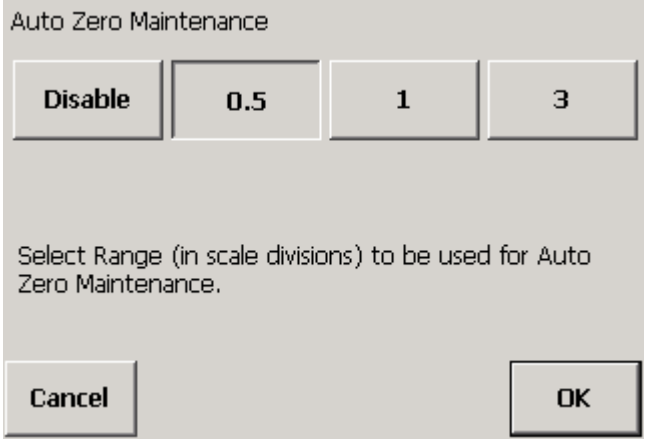
Zero

The zero setup features allow you to specify weight ranges for zeroing the scale. The zeroing function resets the weight reading for the empty scale to zero. It is used when temperature changes or material built up on a scale prevents the weight reading from returning to zero when the scale is emptied. Touch the **Zero** button to access the features.

Automatic Zero Maintenance (AZM)

AZM automatically adjusts the scale's weight reading to zero when the load is removed from the scale. In order for AZM to zero the scale, the weight reading on the scale must be within the range specified. The default setting is ±0.5 division (increment).

1. Touch the **AZM** button.

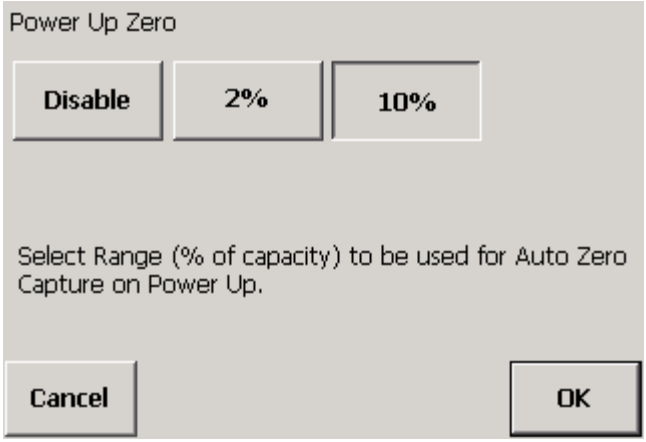


2. Touch a button to disable AZM or to select an AZM range (±0.5, ±1, or ±3 divisions).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Power-Up Zero

Power-up zero automatically adjusts the scale's weight reading to zero when the controller is powered up. In order to zero the scale automatically at power-up, the weight reading on the scale must be within the range specified. The default setting is ±10% of scale capacity.

1. Touch the **Power Up** button.

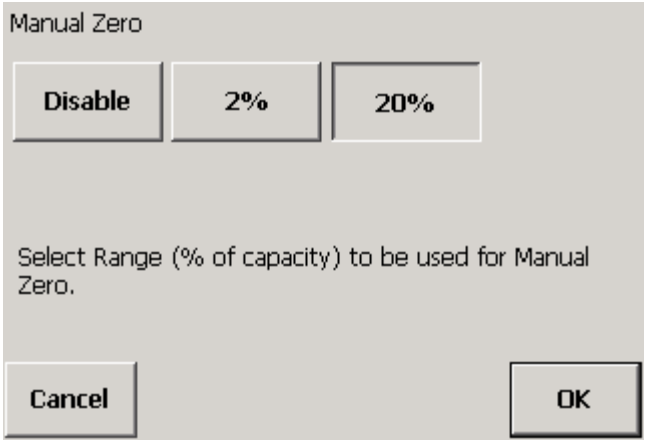


2. Touch a button to disable power-up zero or to select a range (2% or 10% of scale capacity).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Manual Zero Range

Manual zero allows you to zero the scale by using the **Zero** button on the weighing screen. In order for the manual zero function to zero the scale, the weight reading on the scale must be within the range specified. The default setting is ±20% of scale capacity.

1. Touch the **Manual Range** button.



2. Touch a button to disable manual zero or to select a range (2% or 20% of scale capacity).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

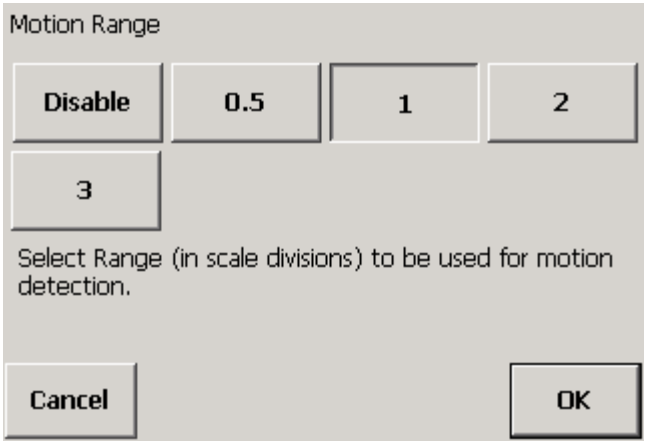
Stability

You can require the scale to stabilize before it can display a weight reading. The stability settings allow you to specify the conditions that the scale must meet in order to be considered stable. Touch the **Stability** button to access the features.

Motion Range

Motion range allows you to select the range to be used for motion detection. For the scale to be considered stable, it must produce several consecutive weight readings within that range. The default setting is ±1 division (increment).

1. Touch the **Motion Range** button.



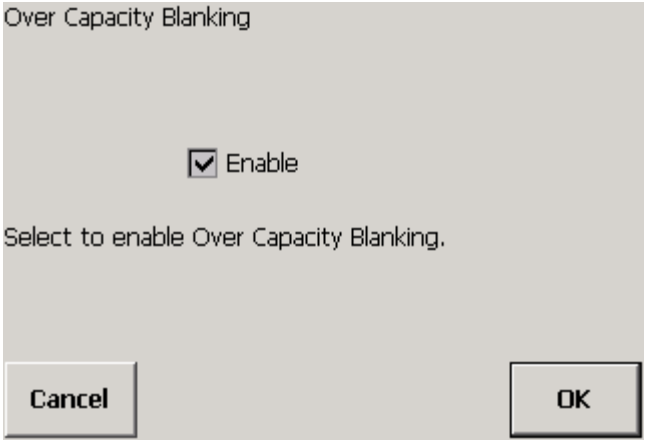
2. Touch a button to disable motion detection or to select a motion detection range (0.5, 1, 2, or 3 divisions).

3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Over Capacity

If over capacity is enabled, the display will go blank when the weight on the scale exceeds the maximum scale capacity. The default setting is Enabled.

1. Touch the **Over Capacity** button.

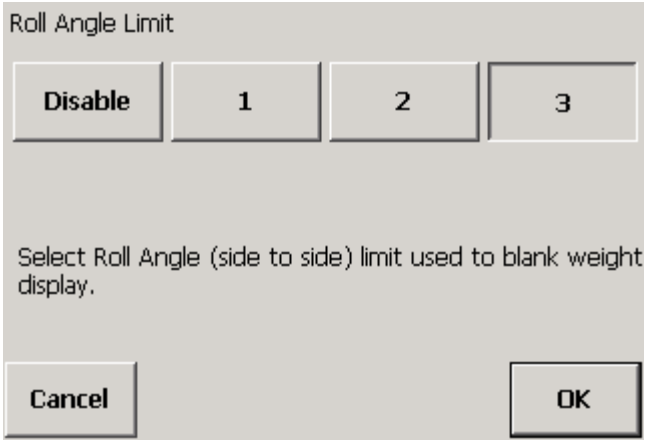


2. Touch the check box to place a check mark in it (enabling the function) or to remove a check mark (disabling the function).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Roll Angle Limit

The roll angle limit is the maximum side-to-side angle for the mast. If the mast roll exceeds that angle, the weight display will go blank. The default setting is 3 degrees.

1. Touch the **Roll Angle Limit** button.



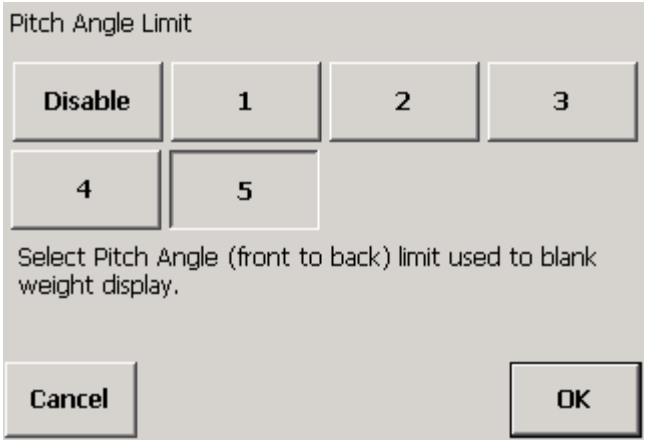
2. Touch a button to disable roll angle blanking or to select a maximum mast roll angle (1, 2, or 3 degrees).

3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Pitch Angle Limit

The pitch angle limit is the maximum front-to-back angle for the mast. If the mast pitch exceeds that angle, the weight display will go blank. The default setting is 5 degrees.

1. Touch the **Pitch Angle Limit** button.

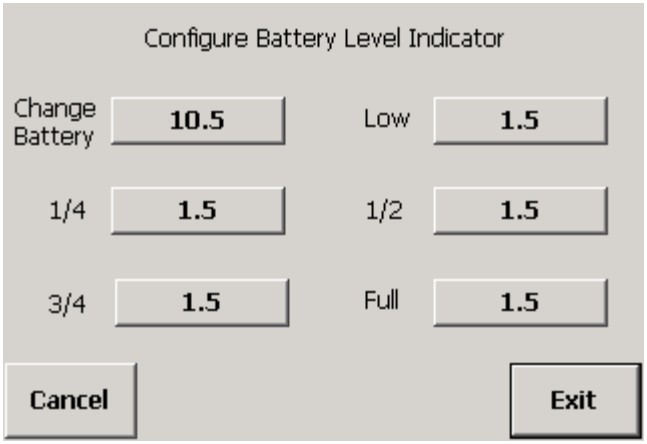


2. Touch a button to disable pitch angle blanking or to select a maximum mast pitch angle (1, 2, 3, 4, or 5 degrees).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Battery Levels

This screen shows the actual voltage levels that correspond to the battery level indicator settings on the main weighing screen. The default voltage levels were determined at the factory and should not need to be changed. Do not use a battery if the voltage level is below 10.5 volts.

1. Touch the **Battery Levels** button to display the current battery voltage settings.

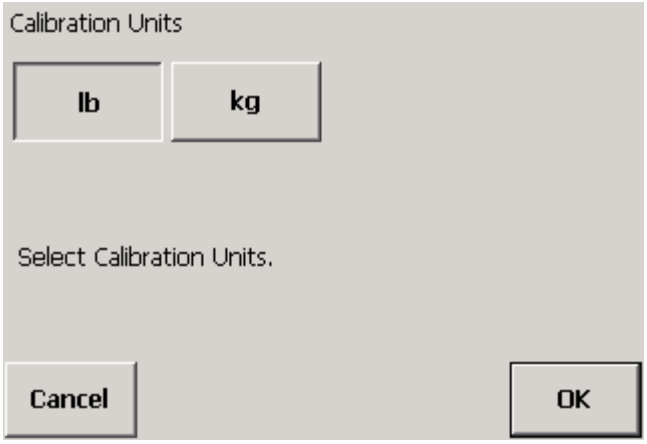


2. If you wish to change a voltage setting, touch the button that shows the current setting. A keypad will be displayed on the screen.
3. Type a voltage level in the data field by touching the numeric keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over.
4. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.
5. Touch the **Exit** button to enter the settings shown on the screen and close the screen. Touch the **Cancel** button to cancel any changes that you made.

Units

Select the weight unit to be used for the scale (pounds or kilograms). This calibration unit will be used when the scale is first powered up. If you change the calibration unit, you must recalibrate the scale. The default setting is pounds (lb).

1. Touch the **Units** button.

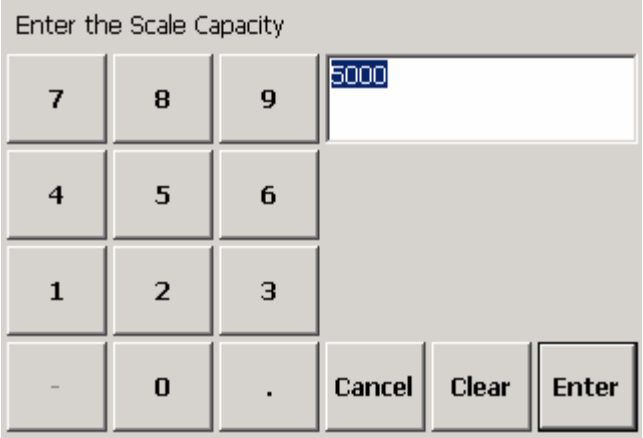


2. Touch a button to select the desired weight unit (lb or kg).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Capacity

Enter the total capacity of the scale. The capacity must be entered in the calibration unit specified for the scale. The default setting is 5000 lb (or 2000 kg).

1. Touch the **Capacity** button to display a keypad on the screen.

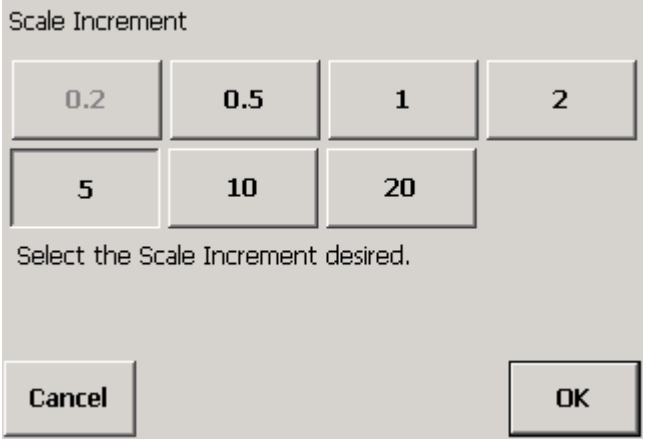


2. Type a weight in the data field by touching the numeric keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Increment

Select the increment (minimum weight unit to be displayed by the scale). The increment must correspond to the calibration unit specified for the scale. Larger increments will result in less weight precision but quicker weighing time. The default setting is 5 lb.

1. Touch the **Increment** button.



2. Touch a button to select an increment size (0.2, 0.5, 1, 2, 5, 10, or 20).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Gross/Net

Gross/net switching enables the controller to toggle between gross and net weight. Net weight will be available only after a tare weight has been established. The default setting is Enabled.

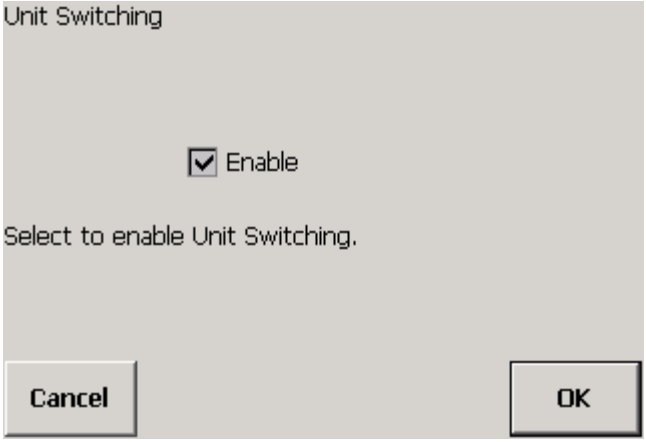
1. Touch the **Gross/Net** button.

2. Touch the check box to place a check mark in it (enabling the function) or to remove a check mark (disabling the function).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Unit Switching

Unit switching enables the controller to toggle between lb and kg. The default setting is Enabled.

1. Touch the **Unit Switching** button.



2. Touch the check box to place a check mark in it (enabling the function) or to remove a check mark (disabling the function).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Calibration

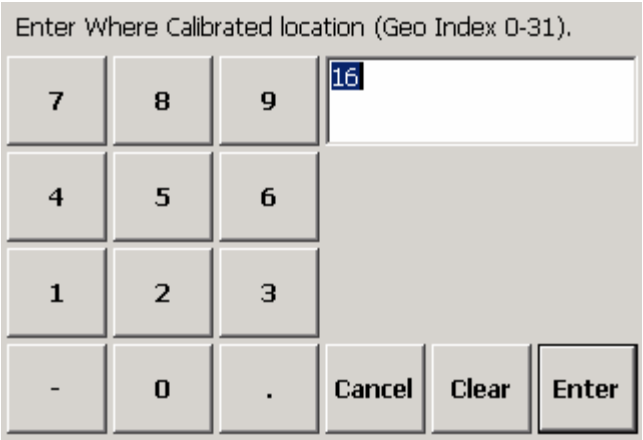
Only qualified service technicians should calibrate the scale. Touch the **Calibration** button to access the calibration features.

Where Calibrated

The scale controller can compensate for variations caused by gravitational forces. This feature shows the gravity factor (geo index) for the location where the scale was calibrated. The geo index is set to 16 at the factory (16 is the geo index for Worthington, Ohio, USA). Do not change this geo index unless you perform a full recalibration of the scale.

If you recalibrate the scale, use the following procedure to set the geo index for the calibration location.

1. Touch the **Where Calibrated** button to display a keypad on the screen.

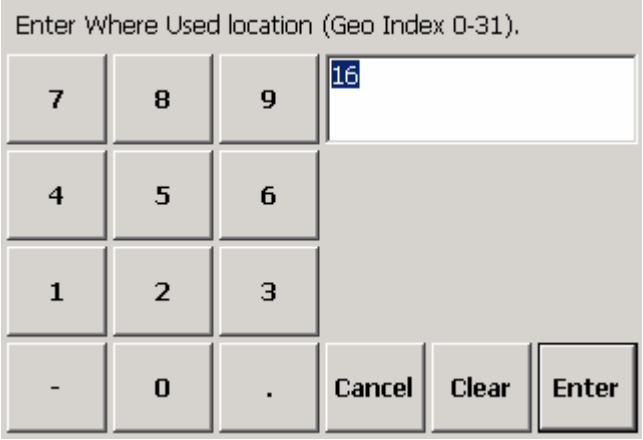


2. Type a number in the data field by touching the numeric keys on the keypad (the range is 0 to 31). Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Where Used

This feature shows the geo index for the location where the scale will be used. You can change the setting to compensate for local gravitational forces. To determine the geo index for a location, refer to Chapter 9. You must know the geographical coordinate for the location and the elevation above sea level.

1. Touch the **Where Used** button to display a keypad on the screen.

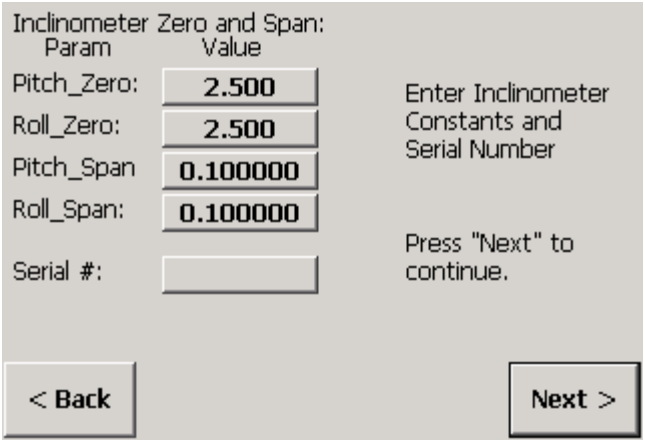


2. Type a number in the data field by touching the numeric keys on the keypad (the range is 0 to 31). Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Inclinometer

This feature is used to set the pitch and roll reference angles. The serial number, initial zero values, and initial span values are entered at the factory to match data provided by the manufacturer of the inclinometer.

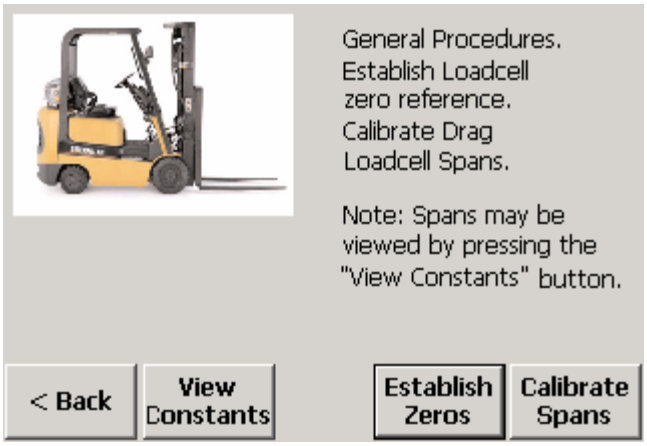
1. Touch the **Inclinometer** button to display the serial number, zero values, and span values for the inclinometer. A value can be changed manually by touching the button for the value and then using the keypad to enter a new value.



2. Park the forklift on a level surface, remove all load from the forks, raise the forks off the ground, set the mast to the vertical position, and shut off the forklift's motor.
3. Touch the **Next** button to continue (or touch the **Back** button to go back a step). The screen will display the active and indicated pitch and roll reference angles.
4. Touch the **Next** button to update the values (or touch the **Back** button to go back a step). The system will count down as it updates the values. The new pitch and roll reference angles will be displayed.
5. Touch the **Finish** button to accept the new values.

Loadcell

This feature is used to calibrate spans for the drag load cells and to establish a zero constant. Touch the **Loadcell** button.



To view the active load cell span constants, touch the **View Constants** button. A value can be changed manually by touching the button for the value and then using the keypad to enter a new value. To close the view constants screen without making any changes, touch the **Back** button.

Calibrate spans for the drag load cells:

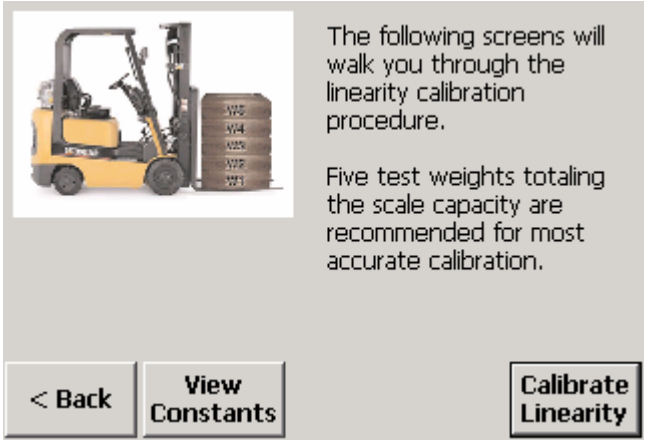
1. Touch the **Calibrate Spans** button to display the span values for the drag load cells.
2. Park the forklift truck on a level surface, remove all load from the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor.
3. Touch the **Next** button to capture zero. The system will count down as it updates the values.
4. For best results, raise and lower the carriage several times. Then position a block 15 inches high under the bottom roller on each side of the scale carriage, and lower the carriage onto the blocks. Shut off the forklift truck's motor.
5. Touch the **Next** button to calibrate the span values. The system will count down as it updates the values. The new load cell span constants will then be displayed.
6. Touch the **Finish** button to accept the new span values.

Establish zero for the scale:

1. Touch the **Establish Zeros** button to display the load cell zero constants.
2. Touch the **Next** button to update the constants. The system will count down as it updates the values.
3. The new zero constants will be displayed. A value can be changed manually by touching the button for the value and then using the keypad to enter a new value. Touch the **Finish** button to save the new constants.

Linearity

This feature is used to calibrate the scale's linearity. We recommend using five test weights of 1,000 lb each. You can also calibrate linearity using test weights equal to one half the scale capacity and full scale capacity. Touch the **Linearity** button.



To view the active linearity constants, touch the **View Constants** button. A value can be changed by touching the button for the value and then using the keypad to enter a new value. To close the view constants screen without making any changes, touch the **Back** button.

Check the scale's linearity to determine if calibration is needed:

- Park the forklift truck on a level surface, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor. Place a pallet on the forks, and use the weight of the pallet as the tare weight.
- Record the net weight with no test weight on the scale. Then add the five test weights one at a time, recording the net weight after each test weight is added. You should have weight readings for the following test weights: 0, 1000, 2000, 3000, 4000, and 5000 lb. Then remove the test weights from the scale one at a time, recording the net weight each time you remove a test weight.

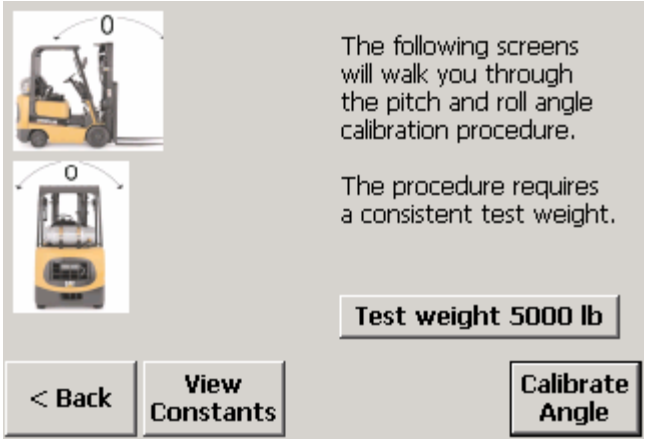
If the weight readings are out of tolerance, perform the following calibration procedure:

1. Park the forklift truck on a level surface, place a pallet on the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor.
2. Touch the **Calibrate Linearity** button to display the linearity test setup. For the default test setup, all six boxes will be checked and the following weight values will be listed on the buttons next to the boxes: 0, 1000, 2000, 3000, 4000, and 5000. If you plan to use a different range of weights, reconfigure the test setup to match those weights. You can select or deselect a step by touching the check box. You can change a weight value by touching the button to open a keypad that will allow you to enter a new weight value. When the correct weight values are displayed, touch the **Next** button to continue.
3. With zero test weight on the scale, touch the **Next** button. The system will count down as it updates the values.
4. Add test weight so that the total weight on the scale equals 1,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.
5. Add test weight so that the total weight on the scale equals 2,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.

6. Add test weight so that the total weight on the scale equals 3,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.
7. Add test weight so that the total weight on the scale equals 4,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.
8. Add test weight so that the total weight on the scale equals 5,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.
9. Touch the **Compute** button to calculate the new linearity constants.
10. The new linearity constants will be displayed. Touch the **Finish** button to accept the new constants.

Angle

The following screens will walk you through the procedure for calibrating pitch and roll angles for the mast. This procedure will compensate for any variation in weight readings that might occur when the mast is set at different angles. Touch the **Angle** button.



To view the active angle constants, touch the **View Constants** button. A value can be changed manually by touching the button for the value and then using the keypad to enter a new value. To close the view constants screen without making any changes, touch the **Back** button.

Determine if angle calibration is needed by checking the scale's accuracy with the mast set at several angles. Use the same test weight for each mast setting. The recommended test weight is full scale capacity (5,000 lb). To change the test weight amount, touch the test weight button on the angle calibration screen and then use the keypad to enter a new weight value.

- Park the forklift truck on a level surface, set the mast to the vertical position, and raise the forks 12 to 15 inches off the ground. The forklift truck's motor should be shut off when taking weight readings. Place a pallet on the forks, and zero the scale. Place the test weight on the scale, and record the weight.
- Check the mast pitch: Remove the test weight, set the mast 5 degrees backward, and zero the scale. Then place the test weight on the scale, and record the weight. Remove the test weight, set the mast 5 degrees forward, and zero the scale. Then place the test weight on the scale, and record the weight.

- Check the mast roll: Set the mast to the vertical position. Remove the test weight, position the forklift truck on a ramp so that the mast is angled approximately 3 degrees to the right, and zero the scale. Then place the test weight on the scale, and record the weight. Remove the test weight, position the forklift truck on a ramp so that the mast is angled approximately 3 degrees to the left, and zero the scale. Then place the test weight on the scale, and record the weight.

If the weight readings are out of tolerance, then calibrate the mast pitch angle or both the mast pitch and mast roll angles. Use the following procedure to calibrate the mast pitch angle:

1. Park the forklift truck on a level surface, place a pallet on the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor.
2. Touch the **Calibrate Angle** button.
3. Touch the **Next** button. The system will count down as it updates the zero load values.
4. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.
5. Remove the test weight from the scale.
6. Set the mast so that it is angled approximately 5 degrees backward. Shut off the forklift truck's motor.
7. Touch the **Next** button. The system will count down as it updates the zero load values.
8. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.
9. Remove the test weight from the scale.
10. Set the mast so that it is angled approximately 5 degrees forward. Shut off the forklift truck's motor.
11. Touch the **Next** button. The system will count down as it updates the zero load values.
12. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.
13. Touch the **Compute** button to calculate the new pitch angle constants, or touch the **Continue** button to continue calibrating both pitch and roll angles.

To calibrate the mast roll angle, continue with the following steps:

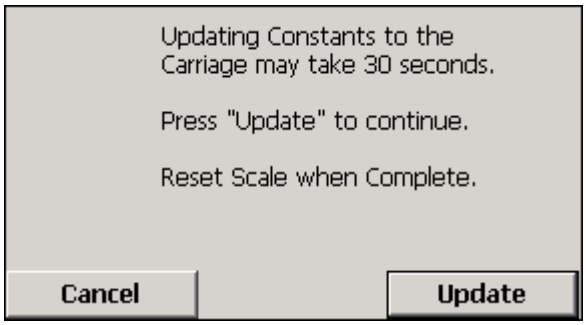
14. Remove the test weight from the scale, and set the mast to the vertical position.
15. Position the forklift truck on a ramp so that the mast is angled approximately 3 degrees to the right. Shut off the forklift truck's motor.
16. Touch the **Next** button. The system will count down as it updates the zero load values.
17. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.
18. Remove the test weight from the scale.
19. Position the forklift truck on a ramp so that the mast is angled approximately 3 degrees to the left. Shut off the forklift truck's motor.

20. Touch the **Next** button. The system will count down as it updates the zero load values.
21. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.
22. Touch the **Compute** button to calculate the new pitch and roll angle constants.
23. Touch the **Finish** button to accept the new constants.

Download Data

This feature downloads calibration constants from the controller. WARNING: This feature will overwrite all calibrated data. The only reason to download the constants is if you have replaced the circuit board in the telemetry enclosure.

1. Touch the **Download Data** button. A window will open, explaining that updating the constants might take 30 seconds and asking if you wish to continue.



2. Touch the **Update** button to proceed with the download or the **Cancel** button to keep the previous settings.

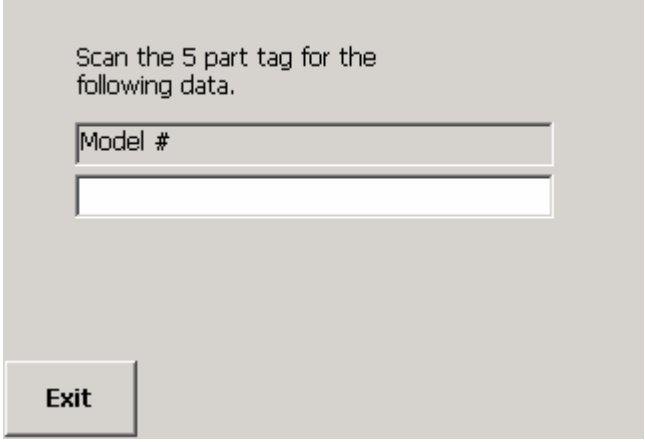
You will need to restart the scale controller to complete the procedure.

Factory Use

The following features are to be used only at the METTLER TOLEDO factory. Touch the **Factory Use** button to access the features.

Hardware Tests

Touch the **Hardware Tests** button to run the hardware tests. The controller will prompt you to connect it to a manufacturing line PC and then prompt you to scan the 5-part tag.



Use a bar code scanner or keyboard to enter the data. Continue through the memory, display resolution, display color, and calibrate touch tests. The tests are described in the terminal and maintenance setup sections.

Reset

The **Reset** button is used to reset the scale parameters to the factory default settings.

1. Touch the **Reset** button.
2. Touch the **Reset** button to restore the default scale parameters or the **Cancel** button to keep the current settings.

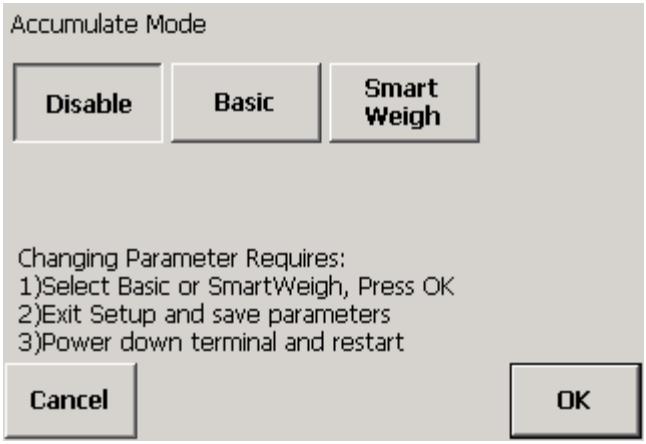
Application

The application setup features are used to adjust the settings for the system's accumulator and SmartWeigh functions. Touch the **Application** button to display buttons for the individual application setup features.

Accumulate

The scale can accumulate a series of weight readings and sum the readings to calculate a total weight. In order to use the accumulate function, you must enable it. The default setting is Disabled.

1. Touch the **Accumulate** button.



2. Touch a button to disable accumulation, enable basic accumulation, or enable SmartWeigh functions.
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

If you select SmartWeigh or disable SmartWeigh by selecting one of the other options, you will need to restart the controller in order for the change to take effect.

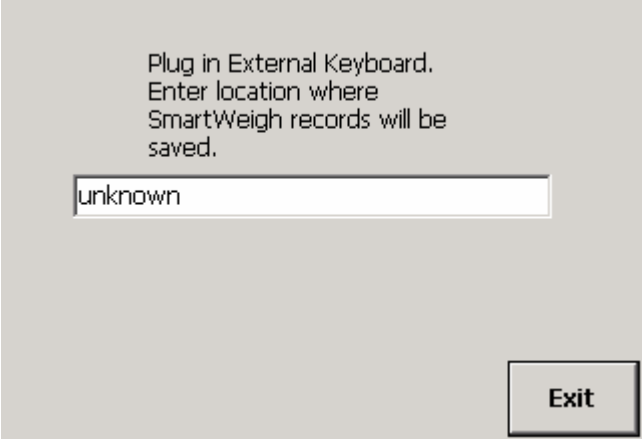
SmartWeigh

Touch the **SmartWeigh** button to access the features.

Save Path

Enter the path to be used when saving SmartWeigh data to a file. The default path is \DiskC\weighments.csv.

1. Touch the **Save Path** button to open the save path screen.

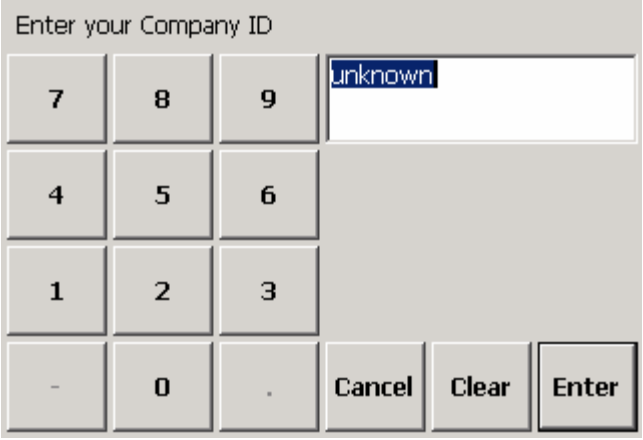


2. Type a path in the data field. You will need to connect a keyboard to the controller to type the path. Use the **Clear** key if you wish to clear the data field and start over.
3. Touch the **Exit** button to confirm your selection.

Company

Enter the ID for the company that is using the scale.

1. Touch the **Company** button to display a keypad on the screen.

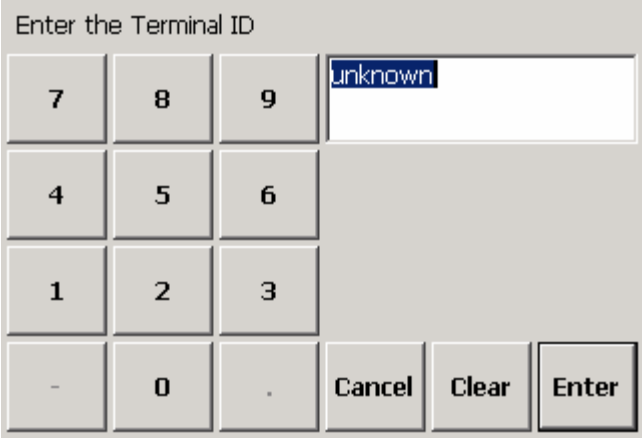


2. Type the Company ID in the data field by touching the numeric keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Terminal

Enter the ID for the shipping terminal where the scale is being used.

1. Touch the **Terminal** button to display a keypad on the screen.

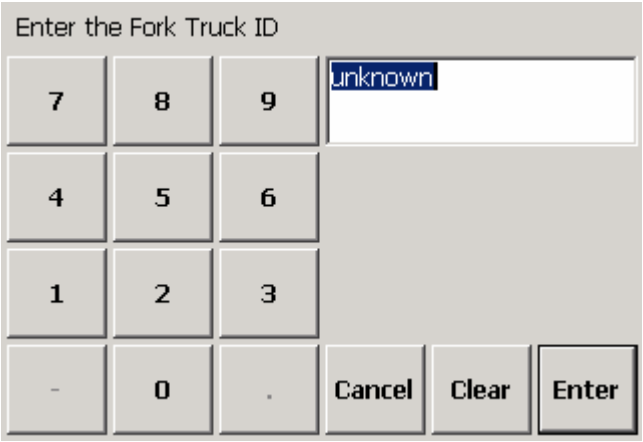


2. Type the Terminal ID in the data field by touching the numeric keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Forklift ID

Enter the ID for the forklift on which the scale is installed.

1. Touch the **Forklift ID** button to display a keypad on the screen.



2. Type the Forklift ID in the data field by touching the numeric keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

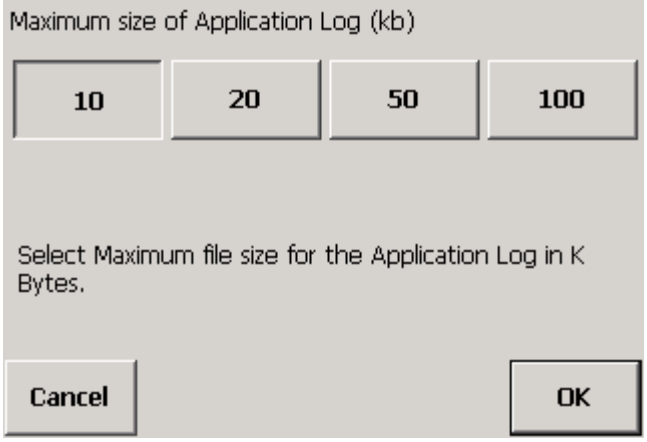
Memory

The application log lists communication errors and other notable events. The memory features allow you to define the maximum size of the log and specify the amount of detail included in each entry. Touch the **Memory** button to access the features.

Application Log Size

This feature allows you to specify the maximum amount of data (in kilobytes) that the log will store. When the log reaches the maximum, it will begin deleting the earliest entries as new entries are made. The default setting is 20.

1. Touch the **App Log Size** button.

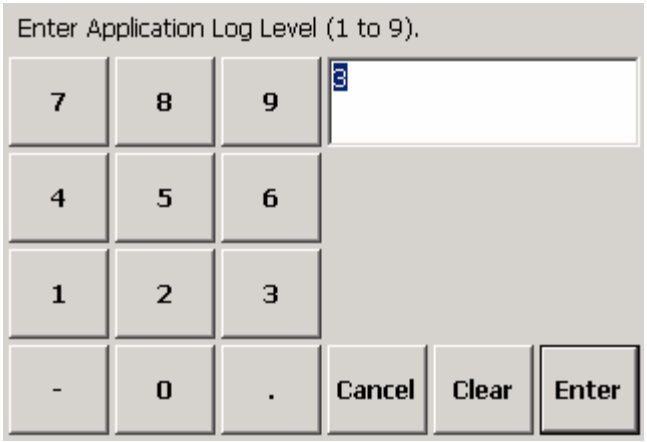


2. Touch a button to select the amount of data to be stored in the log (10, 20, 50, or 100).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Application Log Level

This feature allows you to specify the amount of detail included in each entry. You can select a level from 0 to 9, with 9 being the maximum amount of detail. The default is 2. The level that is specified affects both the application log and communications log.

1. Touch the **App Log Level** button to display a keypad on the screen.



2. Type a number in the data field by touching the numeric keys on the keypad. Touch the **Clear** button to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Reset

The **Reset** button is used to reset the application parameters to the factory default settings.

1. Touch the **Reset** button.
2. Touch the **Reset** button to restore the default application parameters or the **Cancel** button to keep the current settings.

Terminal

The terminal setup features are used to set date and time, assign passwords, and set other terminal functions. Touch the **Terminal** button to display buttons for the individual terminal setup features.

Date/Time

The date/time feature allows you to change the date and time that are displayed on the controller and to change the formats in which they are displayed. Touch the **Date/Time** button to access the features.

Set

Touch the **Set** button to change the date or time. To center the calendar on the screen, place your finger on the calendar's title bar and drag the calendar to a new position.

- To set the month, touch the arrows on either side of the month that is displayed or touch the month label to choose from a list of months.
- To set the date, touch a date on the calendar.
- To set the time, enter it in the Current Time field. Touch a part of the current time (hours, minutes, seconds, or AM/PM) and then use the up and down arrows to make changes.
- To set the time zone, select it from the combo box.

Touch the **Apply** button or **OK** button to accept the changes that you have made. Touch the **X** button to close the calendar without making changes.

Format

Touch the **Format** button to change the formats in which the date and time are displayed. To center the form on the screen, place your finger on the title bar and drag the form to a new position. There are five tabs on the form: Regional Settings, Number, Currency, Time, and Date. Touch the **Time** or **Date** tab to make changes.

Set the time format:

- To set the time style, select a format from the combo box: (h:mm:ss tt, hh:mm:ss tt, H:mm:ss, HH:mm:ss). A sample will be displayed on the tab.
- Combo boxes are also available for setting the format of the time separator (:), AM symbol, and PM symbol.

Set the date format:

- The short date format includes the date, month, and year. The long date format includes the day of the week, date, month, and year.

- To set the short date style, select a format from the combo box: M/d/yy; M/d/yyyy; MM/dd/yy; MM/dd/yyyy; yy/MM/dd; yyyy/MM/dd.
- A combo box is also available for setting the format of the separator (/).
- To set the long date style, select a format from the combo box: dddd, MMMM dd,yyyy; MMM dd, yyyy; dddd, dd MMMM, yyyy; dd MMMM, yyyy.

Touch the **OK** button to accept the changes that you have made. Touch the **X** button to close the form without making changes.

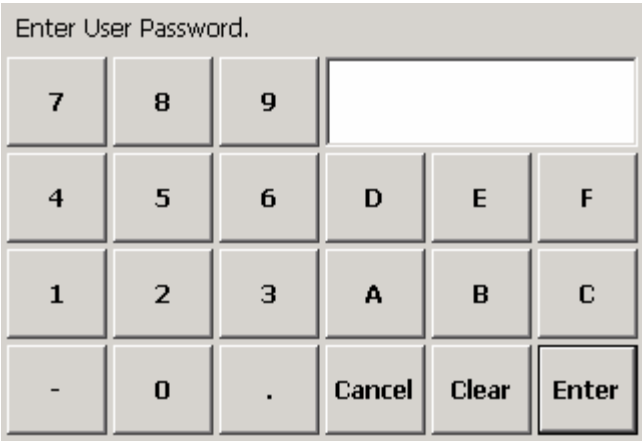
Passwords

You can assign passwords for three security levels: User, Supervisor, and Service. The default setting is no passwords. If passwords are assigned, you will need to enter a password when the controller is powered up (or when you try to enter setup or calibration). If no passwords are assigned, you will have access to all functions without entering a password. Touch the **Passwords** button to display the buttons for user, supervisor, and service passwords.

User

The user password allows access to the scale's weighing screen functions. If no other passwords are assigned, it will also allow access to setup functions.

1. Touch the **User** button to assign a password for users. A keypad will be displayed on the screen.



2. Type an alphanumeric password in the data field by touching the keys on the keypad. Passwords must be five characters long. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm the new password or the **Cancel** button to cancel any changes that you made.

Supervisor

The supervisor password allows access to the scale's weighing screen functions and setup functions. If a service password is assigned, supervisors will not be allowed access to the scale and communications setup functions.

1. Touch the **Supervisor** button to assign a password for supervisors. A keypad will be displayed on the screen.

2. Type an alphanumeric password in the data field by touching the keys on the keypad. Passwords must be five characters long. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm the new password or the **Cancel** button to cancel any changes that you made.

Service

The service password allows access to all scale functions.

1. Touch the **Service** button to assign a password for service personnel. A keypad will be displayed on the screen.
2. Type an alphanumeric password in the data field by touching the keys on the keypad. Passwords must be five characters long. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm the new password or the **Cancel** button to cancel any changes that you made.

NOTE: Security restrictions depend on which security levels are being used. If no password is assigned for a security level, the system will function as though that level does not exist. For example, if there is a user password but no supervisor or service passwords, then users will have access to setup and calibration functions. The same is true of access for assigning passwords. If no service password exists, then a supervisor will be able to assign one. But once a service password has been assigned, a supervisor will no longer have access to change the service password.

Calibrate Touch

This feature allows you to calibrate the touch screen so that the pointer automatically appears at any location where your finger touches the screen.

1. Touch the **Calibrate Touch** button to start the seven-point calibration procedure.
2. A circular target will appear on the screen. Touch the center of the target. When you touch it, the target will move to a new location on the screen.
3. Continue to touch the center of the target each time it moves until all seven points have been tested.
4. When the test is completed, the screen will close automatically.

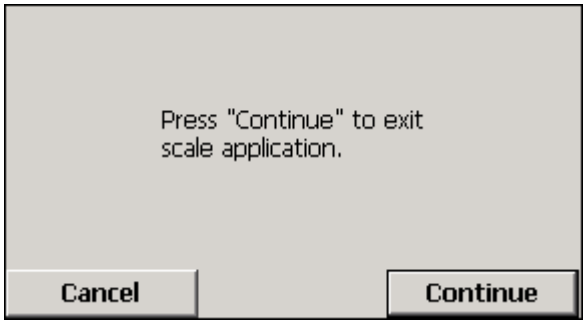
Operating System

Touch the **OS** button to access the operating system features.

Exit to Operating System

This button is used to close the scale application and display the computer desktop on the scale controller.

1. Touch the **Exit to OS** button.

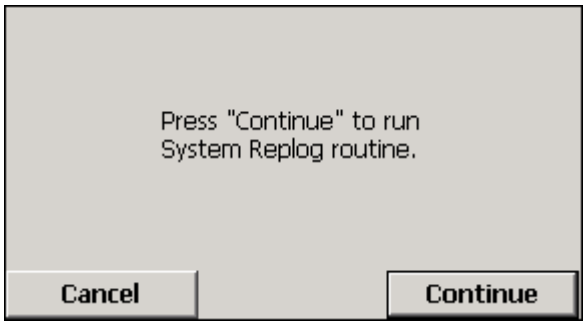


2. Touch the **Continue** button to close the scale application or the **Cancel** button to return to scale setup.

Launch Replog

This button is used to set up communication between the controller and a personal computer. You will need to use a cable to connect the controller to the computer.

1. Touch the **Launch replog** button.

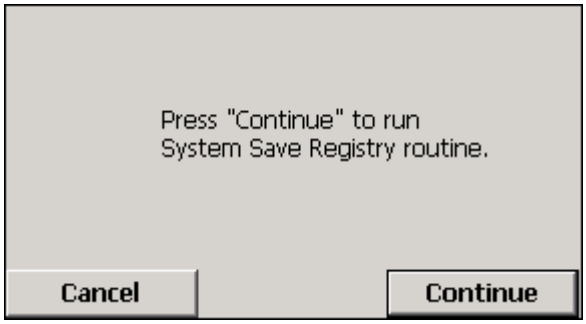


2. Touch the **Continue** button to launch the replog or the **Cancel** button to return to scale setup without launching the replog.

Save Registry

This button is used to save the Windows CE configuration.

1. Touch the **Save Registry** button.

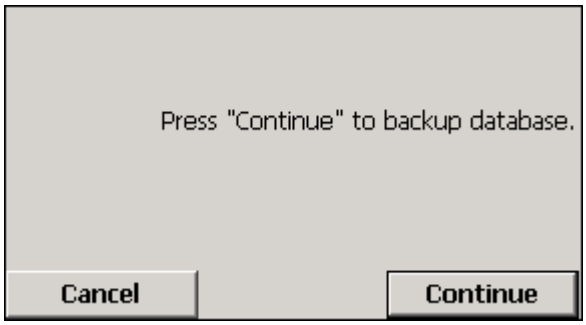


2. Touch the **Continue** button to save the registry or the **Cancel** button to return to scale setup without saving the registry.

Backup Database

This button is used to create a backup file containing the metrological setup data for the scale.

1. Touch the **Backup Database** button.

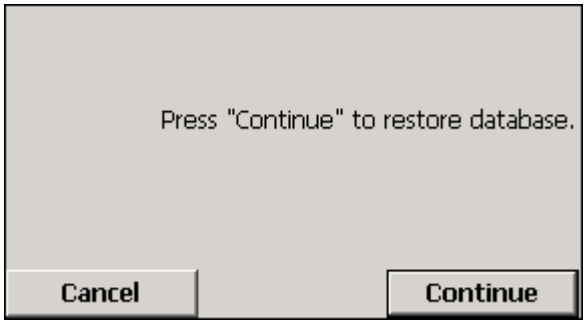


2. Touch the **Continue** button to back up the database or the **Cancel** button to return to scale setup without backing up the database.

Restore Database

This button allows you to replace the scale's metrological setup data with the data stored in a backup file.

1. Touch the **Restore Database** button.

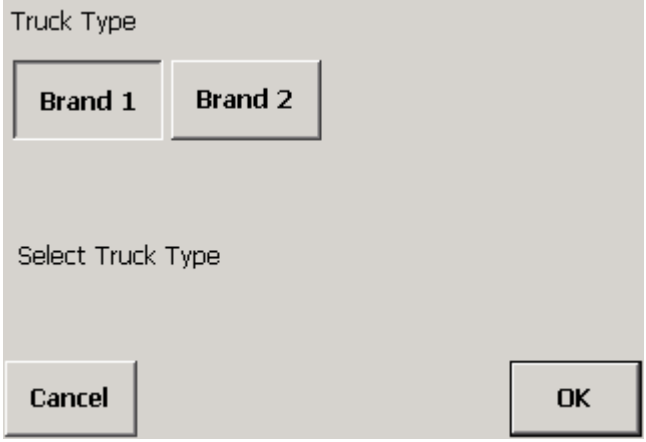


2. Touch the **Continue** button to restore the database or the **Cancel** button to return to scale setup without restoring the database.

Brand Setup

This feature is used to identify the brand of forklift truck on which the scale is installed.

1. Touch the **Brand Setup** button.



2. Select the brand by touching the **Brand 1** or **Brand 2** button.
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Reset

The **Reset** button is used to reset the terminal parameters to the factory default settings.

1. Touch the **Reset** button.
2. Touch the **Reset** button to restore the default terminal parameters or the **Cancel** button to keep the current settings.

NOTE: Using the **Reset** button will delete any passwords that you assigned.

Communications

The communications setup features are used to configure communications between the scale controller and carriage, as well as communications with other devices. Touch the **Communications** button to display buttons for the individual communications setup features.

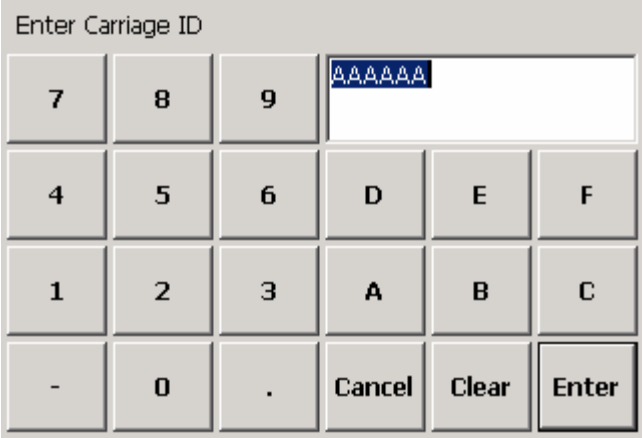
Scale Radio

You can configure communications between the scale carriage radio and controller radio. Touch the **Scale Radio** button to access the scale radio setup features.

Carriage ID

Enter an ID for the carriage radio. The default Carriage ID is 000001.

1. Touch the **Carriage ID** button to display a keypad on the screen.



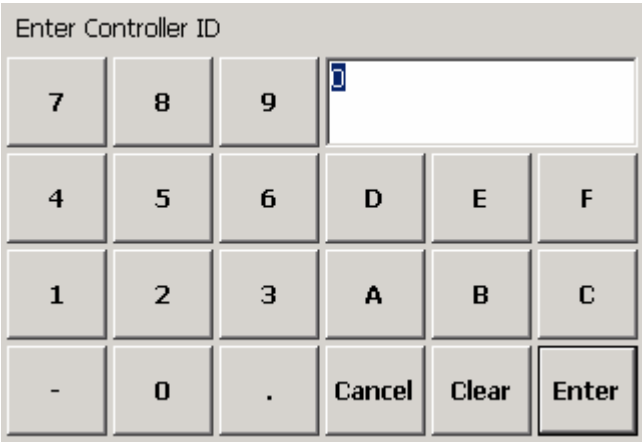
2. Type an alphanumeric ID in the data field by touching the keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

You must restart the scale controller to activate a new selection.

Controller ID

Enter an ID for the controller radio. The default Controller ID is 000001.

1. Touch the **Controller ID** button to display a keypad on the screen.



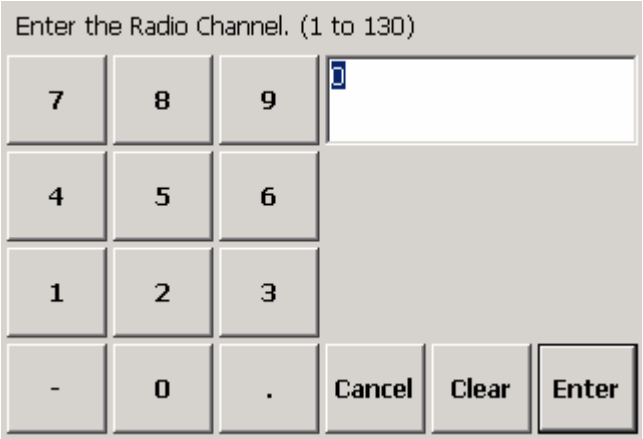
2. Type an alphanumeric ID in the data field by touching the keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

You must restart the scale controller to activate a new selection.

Radio Channel

This feature allows you to select the channel used for radio communication between the controller and carriage. The default channel is 65. If you are using more than one forklift scale at your facility, select a different channel for each scale.

1. Touch the **Radio Channel** button to display a keypad on the screen.



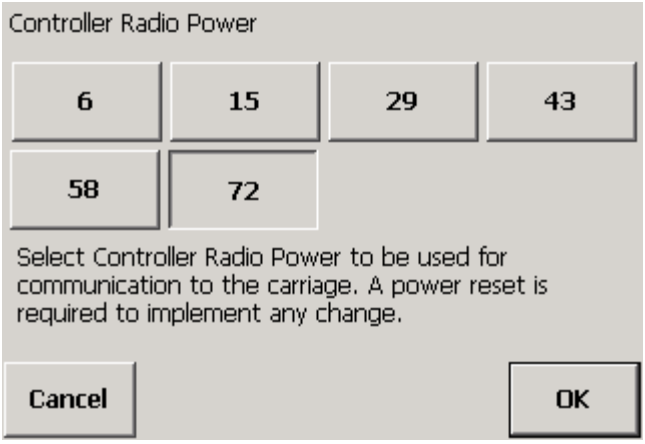
2. Type a number in the data field by touching the numeric keys on the keypad. Valid selections are 1 to 130. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

You must restart the scale controller to activate a new selection.

Controller Power

This feature allows you to select the power level for the controller radio. A high power level is recommended if the radio transmission experiences interference. The default setting is 72.

1. Touch the **Controller Power** button.



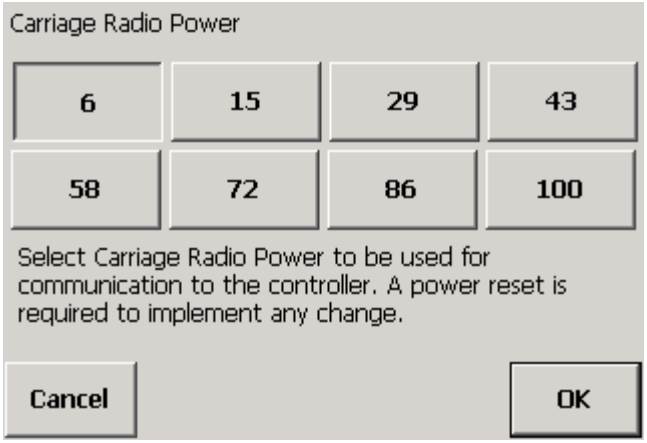
2. Touch the button for the desired power level (6, 15, 29, 43, 58, or 72). The numbers are approximate percentages of the maximum power.
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

You must restart the scale controller to activate a new selection.

Carriage Power

This feature allows you to select the power level for the carriage radio. A high power level is recommended if the radio transmission experiences interference. The default setting is 100.

1. Touch the **Carriage Power** button.



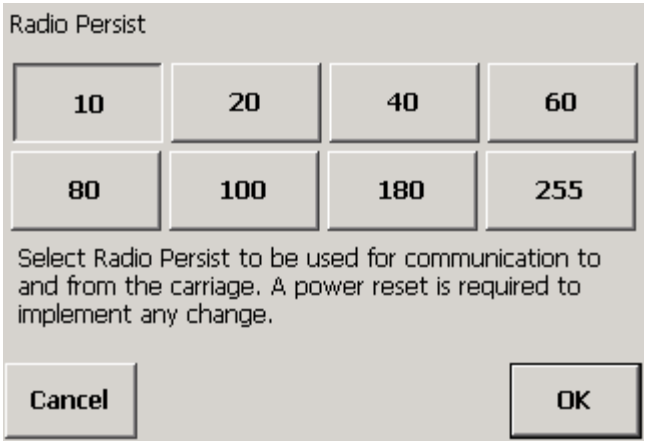
2. Touch the button for the desired power level (6, 15, 29, 43, 58, 72, 86, or 100). The numbers are approximate percentages of the maximum power.
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

You must restart the scale controller to activate a new selection.

Radio Persist

This feature allows you to select the fall-back time for the controller and carriage radios. If communication is disrupted, the system will pause (fall back) before continuing to transmit a signal. The default setting is 40.

1. Touch the **Radio Persist** button.



2. Touch the button for the desired fall-back time (10, 20, 40, 60, 80, 100, 180, or 255).

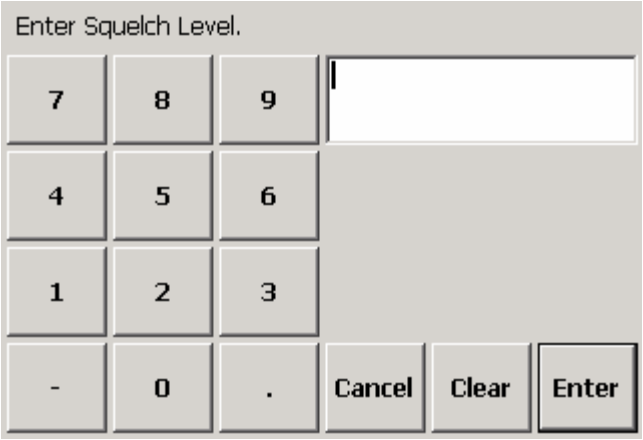
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

You must restart the scale controller to activate a new selection.

Squelch

The squelch feature is used to suppress background noise generated by the scale controller. A higher setting provides more noise suppression. The default setting is 39.

1. Touch the **Squelch** button to display a keypad on the screen.

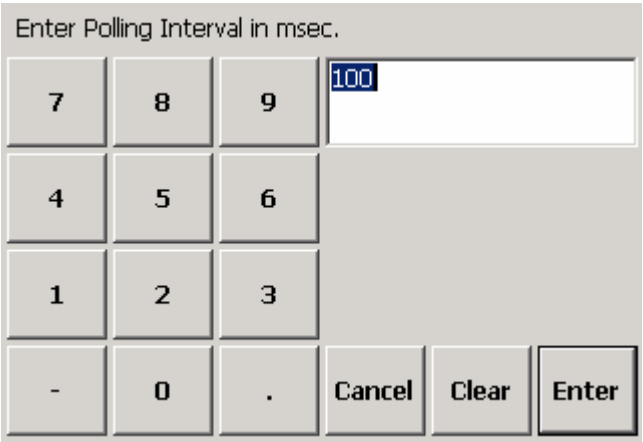


2. Type a squelch level in the data field by touching the numeric keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over.
3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Polling Interval

The polling interval is the time delay (in milliseconds) between a request for data and the scale's response. The default setting is 200 for radios operating at 5 Hz.

1. Touch the **Polling Interval** button to display a keypad on the screen.



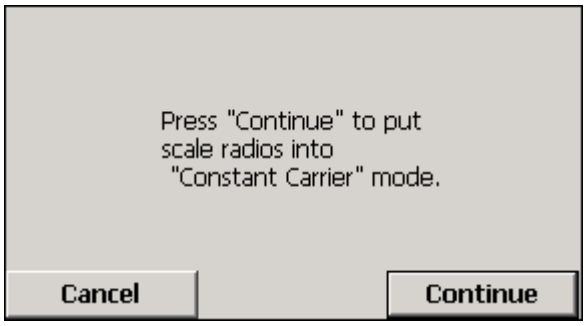
2. Type a polling interval in the data field by touching the numeric keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over.

3. Touch the **Enter** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Carrier On

This feature sets the controller and carriage radios so that they can broadcast in constant carrier mode. It is a diagnostics tool that allows you to use a frequency meter to check the broadcast frequency of the radios. To check the frequency of one radio, you will need to shut off power to the other radio. In order to return the radios to normal operating mode, you must restart them.

1. Touch the **Carrier On** button.



2. Touch the **Continue** button to set the radios to constant carrier mode or the **Cancel** button to return to scale setup without changing the radio mode.

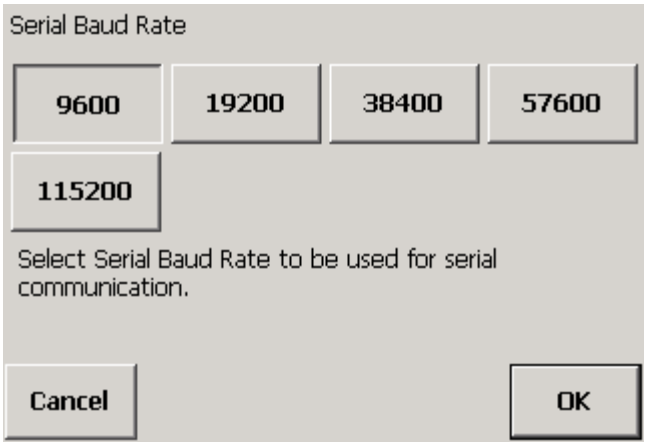
COM1

A serial communication port (COM1) is available so that the scale controller can be connected to printers and other serial devices. Touch the **COM1** button to view or change the serial communication settings.

Baud Rate

Specify the baud rate for serial communications. The default setting is 38400.

1. Touch the **Baud Rate** button.



2. Touch the button for the desired baud rate setting (9600, 19200, 38400, 57600, or 115200).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Parity

Specify the parity for serial communications. The default setting is Even.

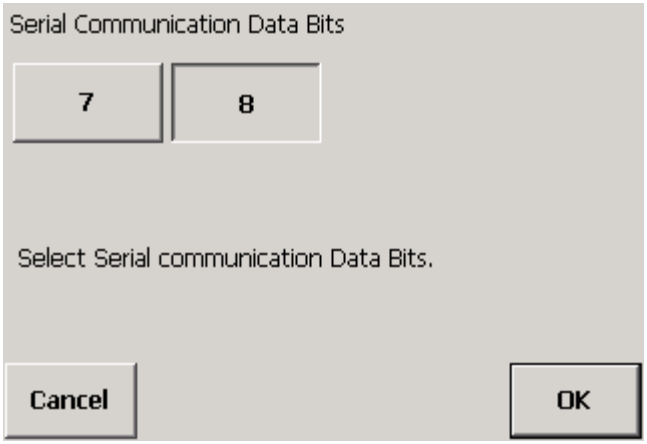
1. Touch the **Parity** button.

2. Touch the button for the desired parity setting (None, Odd, or Even).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Data Bits

Specify the number of data bits for serial communications. The default setting is 8.

1. Touch the **Data Bits** button.

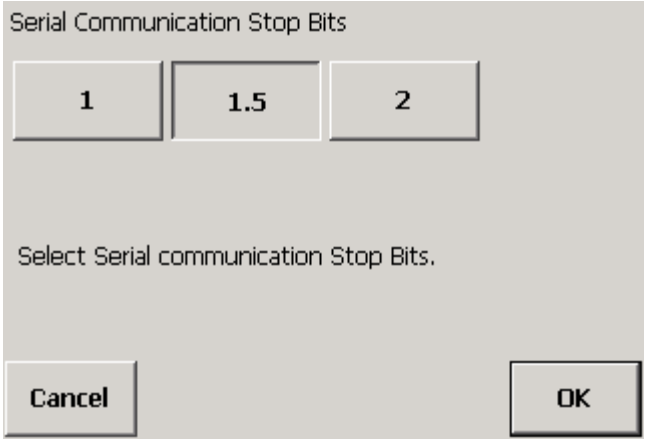


2. Touch the button for the desired data bit setting (7 or 8).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Stop Bits

Specify the number of stop bits for serial communications. The default setting is 1.

1. Touch the **Stop Bits** button.



2. Touch the button for the desired stop bit setting (1, 1.5, or 2).
3. Touch the **OK** button to confirm your selection or the **Cancel** button to cancel any changes that you made.

Reset

The **Reset** button is used to reset the communications parameters to the factory default settings.

1. Touch the **Reset** button.
2. Touch the **Reset** button to restore the default communications parameters or the **Cancel** button to keep the current settings.

Maintenance

The maintenance setup features are used to monitor and test the scale's operations. Touch the **Maintenance** button to display buttons for the individual maintenance setup features.

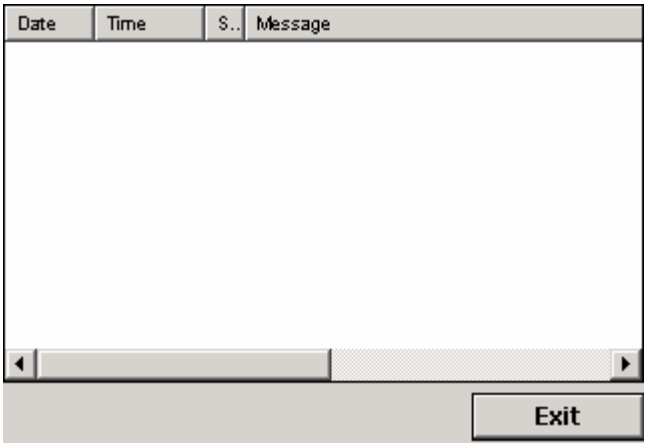
Log

The application log keeps a list of communication errors and other notable events. You can view the log or delete entries from the log. Touch the **Log** button to access the features.

View Application Log

This button opens the application log so that you can view the log entries.

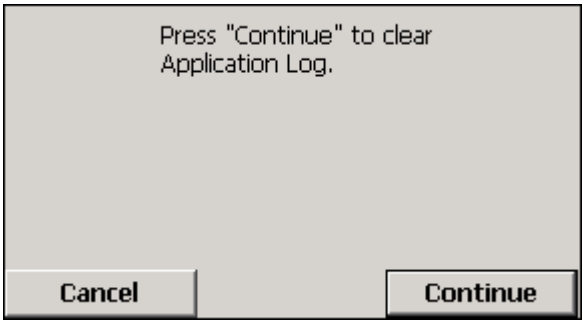
1. Touch the **View App Log** button.



2. Touch the **Exit** button to close the log.

Clear App Log

1. Touch the **Clear App Log** button.



2. Touch the **Continue** button to delete all existing log entries or the **Cancel** button to keep the current entries.

Diagnostics

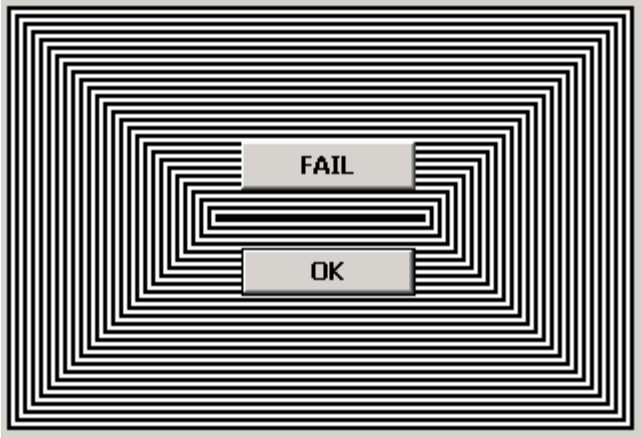
The diagnostics features are used to check system operations. Touch the **Diagnostics** button to access the features.

Memory

Touch the **Memory** button to test the compact flash memory. Touch the **Start** button to perform the test.

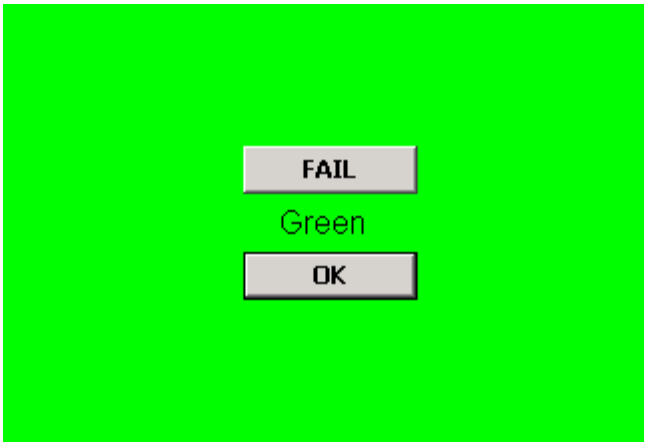
Display Resolution

Touch the **Display Resolution** button to test the screen's resolution at four settings. When all four resolutions have been displayed, touch the **OK** button to complete the test.



Display Color

Touch the **Display Color** button to test the screen's colors: black, red, green, blue, and white. When all five colors have been displayed, touch the **OK** button to complete the test.



Streaming Data

The streaming data log keeps track of the data transmitted between the controller and carriage radios. The amount of data recorded depends on the application log level (see application setup).

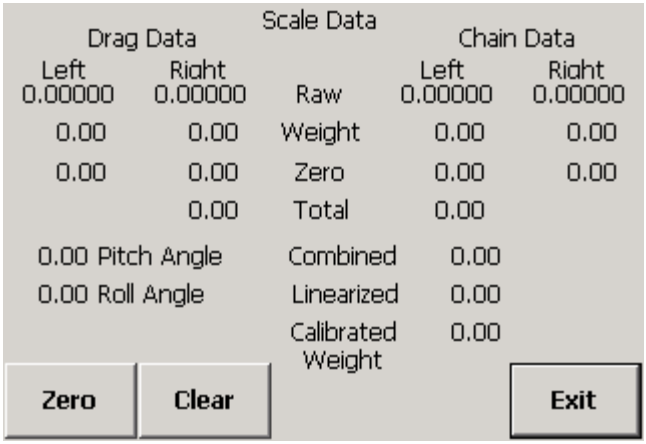
1. Touch the **Streaming Data** button to open the log.

2. Touch the **Pause** button to stop the system from displaying new entries so that you can read the log.
3. After viewing the log, touch the **Clear** button to delete all log entries or the **Exit** button to close the log.

Data Screen

The data screen displays data that is used to check the condition of the load cells. It also displays the pitch and roll angles for the mast.

1. Touch the **Data Screen** button.

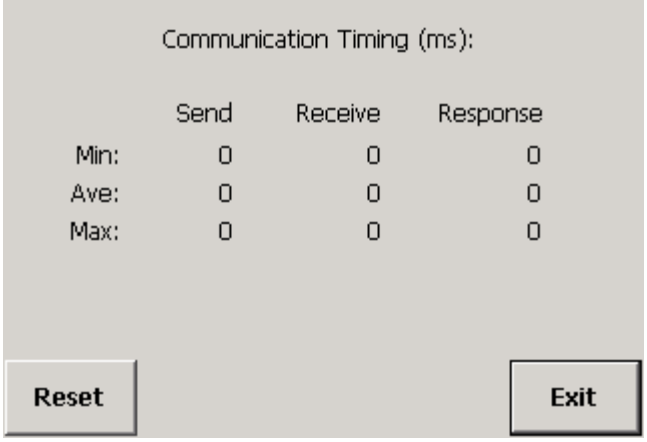


2. Touch the **Zero** button to establish the existing zero setting as a reference point. Touch the **Clear** button if you wish to clear the zero reference.
3. Touch the **Exit** button to return to the setup menu.

Communications Timing

This screen displays the system's communications timing data (in milliseconds). The system averages data from a series of communications. You can reset the data so that the system starts averaging from the current transmission.

1. Touch the **Comms Timing** button.

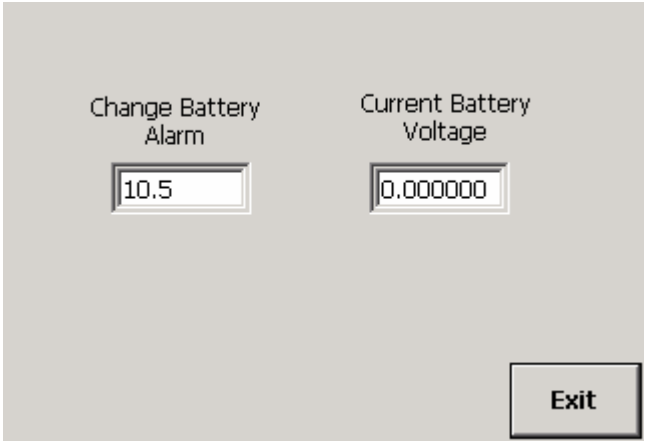


2. Touch the **Reset** button to start averaging a new series of data.
3. Touch the **Exit** button to close the screen.

Battery Voltage

This screen displays the current battery voltage level and the setting for the alarm used to signal that the battery needs to be changed.

1. Touch the **Battery Voltage** button to view the battery settings.

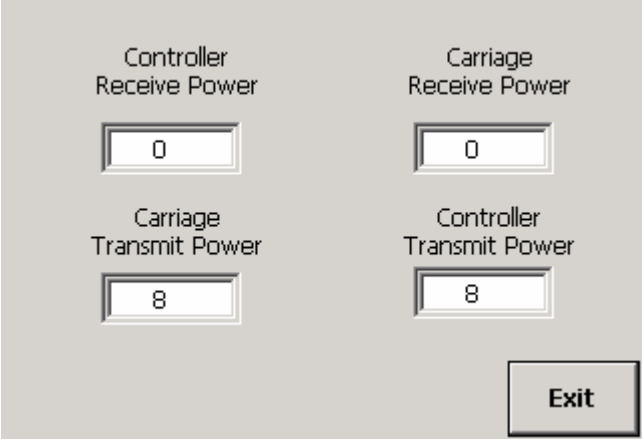


2. Touch the **Exit** button to return to the setup menu.

Radio Power

This screen displays the current receive and transmit power for the controller and carriage radios. The radio power level is set in communications setup.

1. Touch the **Radio Power** button.

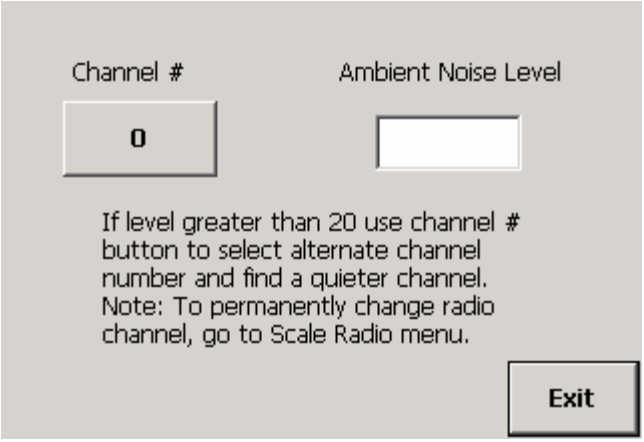


2. Touch the **Exit** button to return to the setup menu.

Ambient Noise

This screen is used to check the ambient noise level for the radio channels. Lower ambient noise levels provide better communication. For a forklift scale, you should select a radio channel with a noise level of 20 or lower.

1. Touch the **Ambient Noise** button. The noise level will be shown for the radio channel that is currently being used.



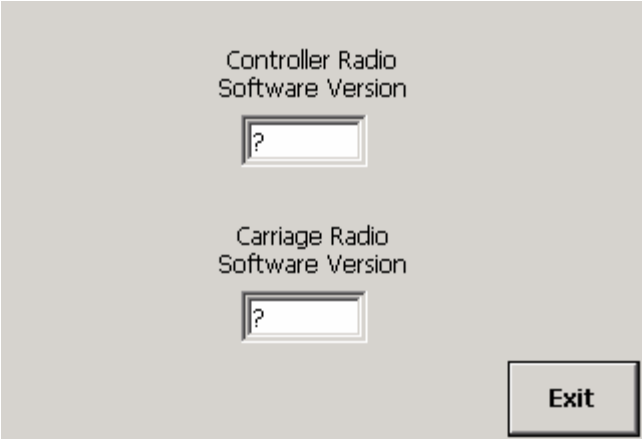
2. To view the noise level for another channel, touch the **Channel #** button. A keypad will be displayed on the screen.
3. Type in a number by touching the numeric keys on the keypad. Touch the **Clear** button if you wish to clear the data field and start over
4. Touch the **Enter** button to confirm your selection.
5. You can now view the ambient noise level for the new channel. Touch the **Exit** button to close the screen.

This feature is used to check the ambient noise levels on radio channels. To change the channel used for radio communication, go to the **Radio Channel** button in communications setup.

Radio Version

This screen displays the radio firmware version for the controller and carriage radios.

1. Touch the **Radio Version** button to view the version numbers.



2. Touch the **Exit** button to close the screen.

Reset

The **Reset** button is used to reset all setup parameters to the factory default settings.

1. Touch the **Reset** button.
2. Touch the **Reset** button to restore the default parameters or the **Cancel** button to keep the current settings.

Exit Setup

The **Exit Setup** button is used to exit setup mode and return to the scale's main weighing screen. You will be prompted to confirm any setup changes before exiting.

1. Touch the **Exit Setup** button.
2. Touch the **Save** button to save any configuration changes, or touch the **Cancel** button to cancel the changes and return to the previous settings.
3. The controller will return to the main weighing screen.

5 Routine Care and Maintenance

General

Once you have installed your scale, you should have an authorized METTLER TOLEDO representative periodically inspect and calibrate it. If the scale is used for legal-for-trade purposes, consult the local weights and measures authorities for minimum inspection requirements. Contact your local authorized METTLER TOLEDO service representative for information about periodic inspection and calibration services.

IMPORTANT: As part of the regular maintenance schedule, check the bolts that secure the two chain load cell mounts to the carriage (see Figure 5-1). Check the torque of the bolts after the first 100 hours that the forklift scale has been in use, and check it every 1,000 hours thereafter. All six bolts should be torqued to 50 ft-lb.

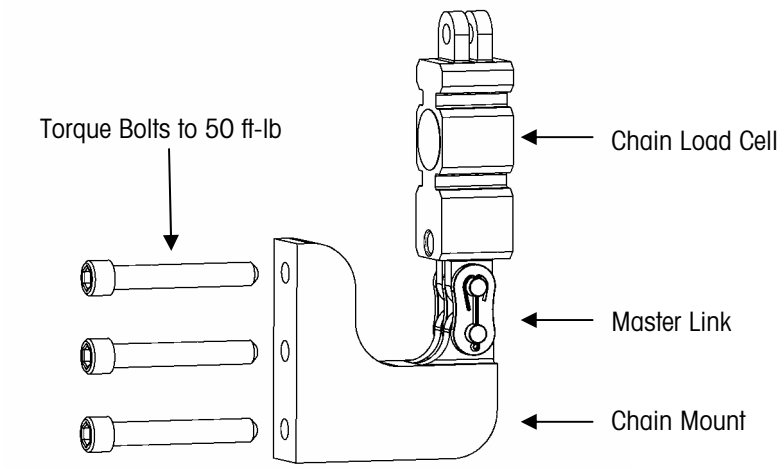


Figure 5-1: Chain Mount Assembly.

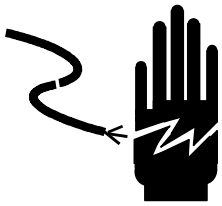
Cleaning

Clean the scale controller's cover with a soft, clean cloth that has been dampened with a mild window-type cleaner or detergent. DO NOT USE ANY TYPE OF INDUSTRIAL SOLVENT OR CHEMICALS. DO NOT SPRAY CLEANER DIRECTLY ONTO THE UNIT. DO NOT HOSE DOWN.

6 Troubleshooting

General

If a scale is not working properly, find out as much about the problem as possible. Try to determine whether the problem is constant or intermittent. Mechanical and electrical influences can cause malfunctions, so be patient and use sound logic when troubleshooting.



⚠ WARNING

PERMIT ONLY QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS, AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.

⚠ DANGER

IF USED IN A HAZARDOUS AREA, THE HAZARDOUS AREA MUST BE MADE SAFE PRIOR TO INSTALLATION, REPLACEMENT, OR TROUBLESHOOTING. FAILURE TO COMPLY COULD RESULT IN PERSONAL INJURY, DEATH, AND/OR PROPERTY DAMAGE.

⚠ WARNING

BEFORE CONNECTING/DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT, ALWAYS REMOVE POWER AND WAIT AT LEAST 30 SECONDS. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN BODILY HARM OR DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT.

Error Messages

The following messages are displayed in the message bar on the controller's main weighing screen.

Message	Remedy
ERR: Load is not stable – cannot take tare!	Wait for scale to stabilize and then capture tare weight.
ERR: Cannot take a negative tare!	Remove load from scale and zero scale.
ERR: Invalid mode – must be in Gross mode!	Switch scale to gross weighing mode.
ERR: Load is not stable – cannot take zero!	Wait for scale to stabilize and then capture zero.
ERR: Invalid mode – clear Tare to rezero!	Clear the tare weight and then capture zero.
ERR: Current weight %6.0f, > manual zero range!	Remove load from scale.
INFO: Configuration changes saved!	Message appears when you exit setup and save changes.
INFO: Configuration changes abandoned!	Message appears when you exit setup without saving changes.
ERR: Access to Setup not authenticated!	Check the password and enter it again.
ERR: No Tare, `Net' Invalid Mode	Capture a tare weight before switching to net weighing mode.
ERR: Load is not stable – cannot accumulate!	Wait for scale to stabilize and then accumulate.
ERR: AZM weight %6.0f, > manual zero range!	Remove load from scale.
SEND Radio Comm PID ERROR	System will resend data automatically.
READ Radio Comm PID ERROR	System will reread data automatically.

The following messages are displayed in pop-up windows on the scale controller.

Message	Remedy
Radio controller not communicating.	Check carriage battery. Make sure radio channel selected in setup matches channel indicated by blinking light in telemetry box.
WARN: Controller Radio ID does not match database. Do you want to update the database Controller ID?	Update Controller ID.
WARN: Controller Radio Power does not match database. Do you want to update controller power?	Update controller power.
WARN: Controller Radio Persist does not match database. Do you want to update controller persist?	Update controller persist.
WARN: Carriage Radio Power does not match database. Do you want to update carriage power?	Update carriage power.
WARN: Carriage Radio Persist does not match database. Do you want to update carriage persist?	Update carriage persist.
Carriage Calibration Constants do not match database. Updating the database will take about 30 seconds. Do you want to update the database?	Update database.
Failed to load Calibration Constants from Carriage Radio	Recycle power to scale controller.
No Scale Available	Check carriage battery. Make sure radio channel selected in setup matches channel indicated by blinking light in telemetry box.
WARN: Radio controller parameters do not match database. Controller Channel = %i. Database Channel = %i. Do you want to update the Controller Channel and Carriage Channel with the database values?	Update controller channel and carriage channel.
WARN: Radio controller parameters do not match database. Controller Channel = %i. Database Channel = %i. Do you want to update the Controller Channel with the database values?	Update controller channel.
Carriage Scale is not communicating.	Check carriage battery. Make sure radio channel selected in setup matches channel indicated by blinking light in telemetry box.
WARN: Carriage Radio ID does not match database. Carriage Radio ID = %i. Database ID = %i. Do you want to update the database?	Update database.
Force Calibration Constants to Carriage Radio: Updating Constants to the Carriage may take 30 seconds. Reset Scale when Complete.	Update constants. Then recycle power to scale controller.
Initialize Carriage parameters failed.	Try to initialize carriage parameters again.
Data is unstable.	Wait for scale to stabilize before each calibration step.
Battery Voltage Low. Replace Battery.	Replace battery in scale carriage.

Scale Controller

Make sure that the scale controller is receiving power and is communicating with the scale carriage.

- The controller is powered by the forklift truck's battery. When the forklift truck's motor is shut off, the controller will continue to operate until an internal time delay cuts off power. With the forklift truck's motor running, power up the controller by pressing the on/off button on the front cover. If the controller does not start, check the wiring that connects the controller to the battery to make sure that it is not damaged or loose.
- The controller communicates with the scale carriage by radio transmission. If there is a communication problem, the message "No Scale Communication" will be displayed on the controller's main weighing screen. Check the scale carriage battery to make sure that it is charged and that it is inserted into the battery compartment correctly. The battery compartment is wired to the PCB inside the telemetry enclosure. Make sure that the battery wire is not loose or damaged.
- If the scale carriage is sending a signal, the channel indicator on the telemetry box will be flashing. The flashing red light indicates which radio channel is being used. The sequence starts with five quick flashes, followed by a pause. Then there is a series of slower flashes for each numeral, with a pause between numerals. For example, five quick flashes, a pause, six slower flashes, a pause, and then 5 slower flashes indicates channel 65 (the default channel). Zero is indicated by ten flashes. Since you can use radio channels 1 to 130, a channel can consist of as few as one numeral or as many as three numerals.

Check Mechanical Components

Check the scale to make sure the mechanical components are not damaged, worn, or binding.

- Check the scale's flexures to make sure they are not bent or warped.
- Make sure that no scale components are loose. All bolts should be tightened securely.
- Make sure that the scale carriage moves freely when it is raised and lowered.
- Make sure that that scale is not binding. The only scale components that should be touching the mast are the rollers.

Check Overload Gaps

The overload bumpers are designed to protect the load cells and flexures from being damaged if an excessive load is placed on the scale. Use a feeler gauge to check the overload bumper gaps. All gaps should be set to 0.020 inch ±0.005 inch (see Figure 6-1).

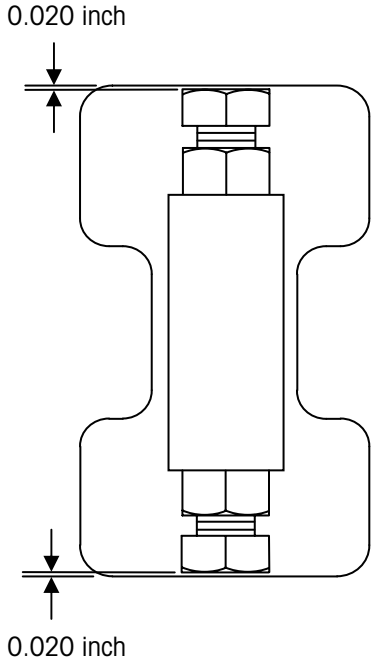


Figure 6-1: Overload Bumper Gaps

Check Wiring

1. Remove power from the system.
2. Remove the cover from the telemetry enclosure and check the interior for moisture or foreign material.
3. Make sure that all wiring connections are tight and that no insulation material is touching the terminal contacts.
4. Check all load cell connections to make sure they are wired correctly. The wiring color codes are shown in Figure 6-2.
5. Check the cable connections and cord grips. If the cord grips are loose, tighten the nuts on the cord-grip clamp bar. Use a nut driver to tighten the nuts. Be careful to tighten the nuts only to the point at which the cables will not slide through the cord grips. Do not overtighten the nuts.

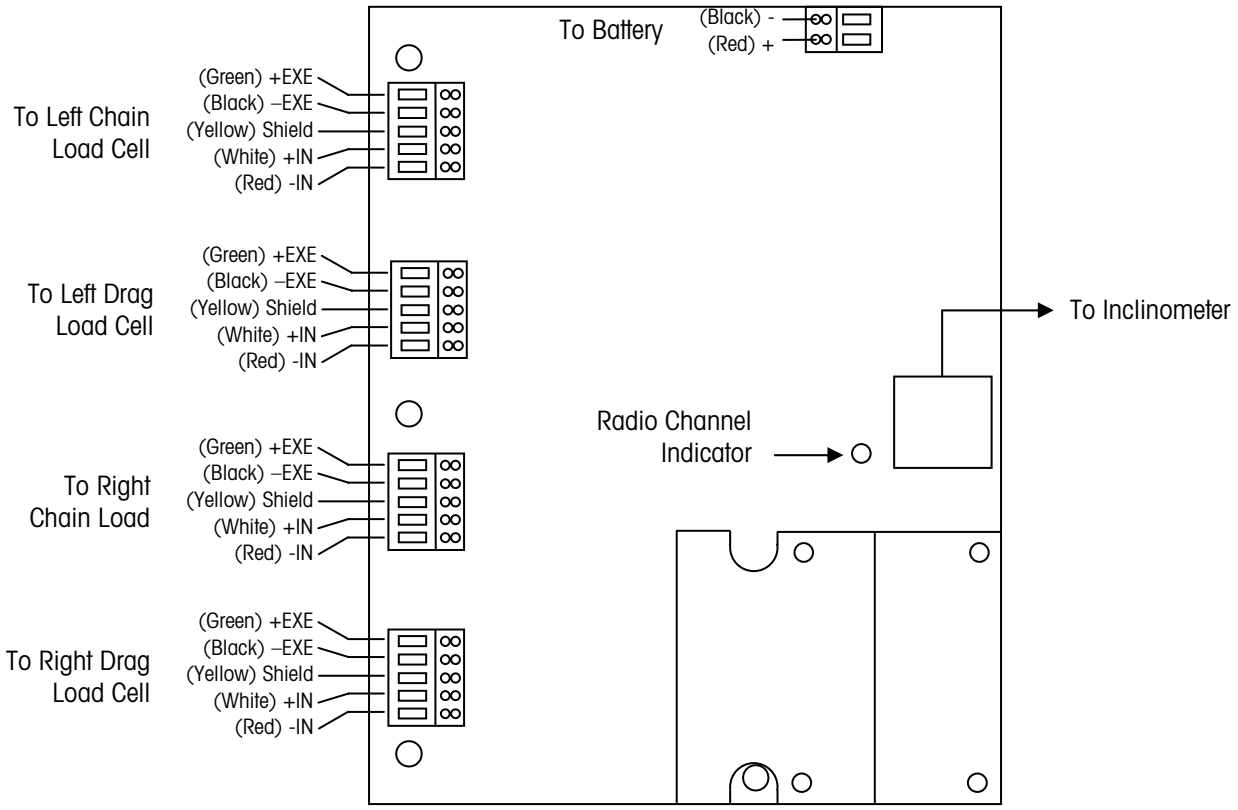


Figure 6-2: Load Cell Wiring Codes

Check Force Data

The force data being communicated to the scale controller provides a good indication of how the load cells are performing.

1. Power up the scale controller.

2. Touch the **Setup** button to enter setup mode.
3. Open the data screen by touching the **Maintenance** button, the **Diagnostics** button, and the **Data Screen** button.
4. Compare the force readings for the left drag load cell and the right drag load cell.
5. Compare the force readings for the left chain load cell and the right chain load cell.

If the force data is out of tolerance, check the load cells to make sure they are working properly. The "Weight" reading for each drag load cell should be approximately -60 lb (±40 lb). The "Weight" readings for the chain load cells should be approximately equal (±100 lb). The "Total" readings for the drag load cells and chain load cells should be opposite and approximately equal. For example, if the drag load cell total is -300, the chain load cell total should be approximately +300. The calibrated weight is the sum of those two numbers and should be approximately zero.

Check Load Cells

1. Remove power from the system. Fully disconnect each load cell and check for proper input/output resistances (see Table 6-1).

Measuring Points	Resistance
+Exc (Green) to -Exc (Black)	Greater than 1,000 ohms (typically 1,160 ohms)
+Sig (White) to -Sig (Red)	1,000 ±5 ohms

Table 6-1: Load Cell Measuring Points

2. If resistance is within specification, perform a shorted-signal symmetry test.
   - Short the signal leads together and place one multimeter lead on the shorted signals and one lead on the +Excitation wire. Note the resistance value.
   - Remove the lead from the +Excitation wire and place it on the –Excitation wire. The two resistance values should be approximately equal.
3. If the load cells pass the shorted-signal test, reconnect them and reapply power to the scale. Confirm that the proper excitation voltage is reaching the load cells by placing multimeter leads on the excitation positions of each load cell terminal.
4. If proper excitation voltage is reaching the load cells, check the output signal from each cell by disconnecting the signal leads and measuring voltage output. If one cell has a particularly high or low dead-load output, it is suspect. The maximum output possible from any cell is 30 mV at 15 VDC excitation and loaded to gross capacity.
5. If any load cell has an unusual signal, remove all load from that cell.
   - With the power on, measure the output from the suspect load cell. The no-load zero output should be ±1.5% of the full scale output. For example, if the excitation voltage is 15 VDC, then the full scale output would be 30 mV and the no-load zero output should be within ±0.45 mV.
6. If a load cell fails any of the above tests, replace it.

Load Cell Replacement

If tests indicate that a load cell is not working properly, remove the load cell and replace it with a new one.

Removing a Chain Load Cell

1. Raise the carriage to a height that will make it easy to reach the load cells and other scale components.
2. Shut off the forklift truck's motor.
3. Remove the battery by pressing the tab toward the center of the battery and pulling the battery from the battery compartment.
4. Remove the cover to the scale's telemetry enclosure. The cover is held in place by seven flat head cap screws. Leave the socket head screw in place. It attaches the enclosure to the carriage.
5. The load cell cables are wired to the four terminal strips on the printed circuit board (PCB) inside the telemetry enclosure. Locate the cable for the load cell that you are replacing. You should be able to identify it by the tag attached to the cable. Disconnect the cable's wires from the terminal strip by inserting the tip of a flat-blade screwdriver into the slot next to each wire and removing the wire from the terminal.
6. Remove the five Phillips head screws that attach the PCB to the enclosure. Move the PCB out of the way so that you have access to the cord-grip clamp bar (see Figure 6-3). In order to remove the PCB, you might need to disconnect the battery wires and unplug the inclinometer.

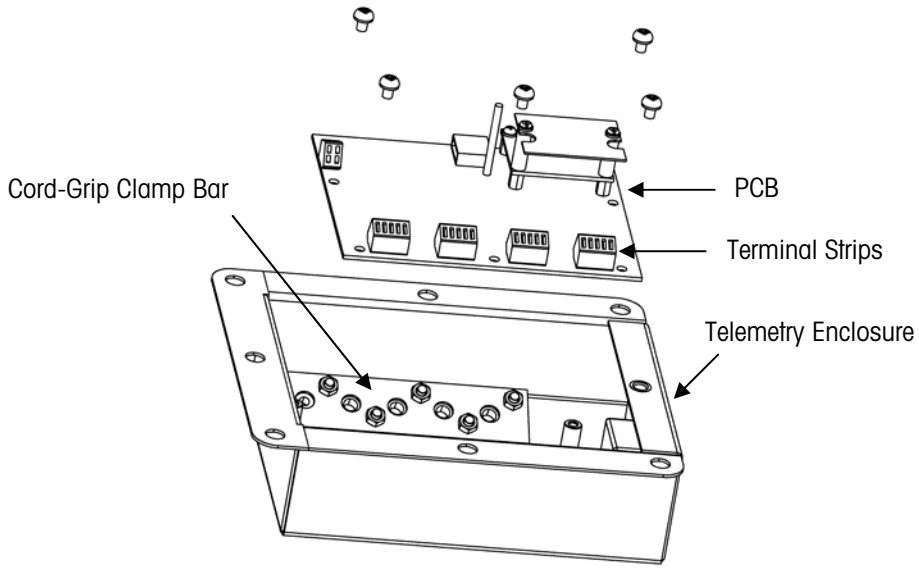


Figure 6-3: Telemetry Enclosure

7. Loosen the six nuts on the cord-grip clamp bar. This will loosen the cord grips so that you can remove the cable.
8. Remove the socket head screw that secures the telemetry enclosure to the carriage.
9. Pull the load cell cable through the cord grip to remove it from the telemetry enclosure.
10. The load cell cables are routed through the scale carriage under the cover plates located at the top and bottom of the carriage. Remove the cover plate that conceals the cable for the load cell you are replacing.
11. Disconnect the chain anchor from the mast by removing the lower nut from the threaded anchor (see Figure 6-4).

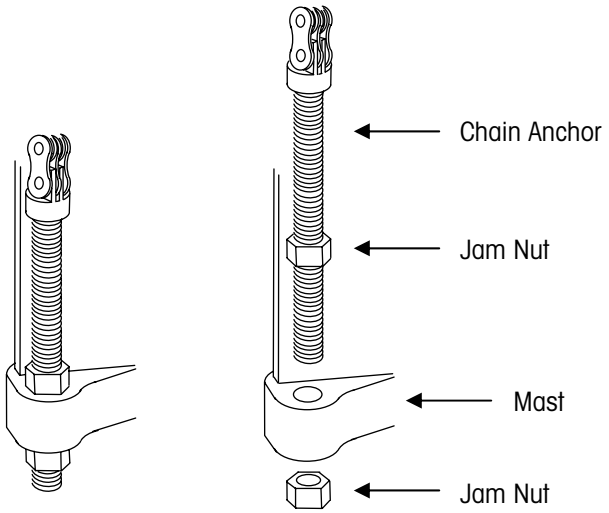


Figure 6-4: Chain Anchor Assembly

12. Pull the chain up and over the pulley.
13. Remove the three bolts that secure the chain mount to the carriage. Then remove the entire assembly (chain mount, load cell, and chain) from the carriage (see Figure 6-5).

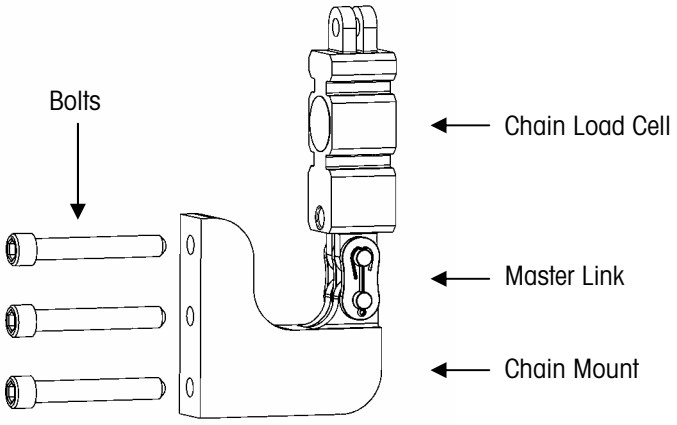


Figure 6-5: Chain Mount Assembly

14. Remove the cotter pin from the master link that secures the load cell to the chain mount (See Figure 6-6). Take apart the master link, using a C-clamp or similar device to press the master link through the link plates. Do not use a hammer or other tool to strike the master link. It could damage the link.

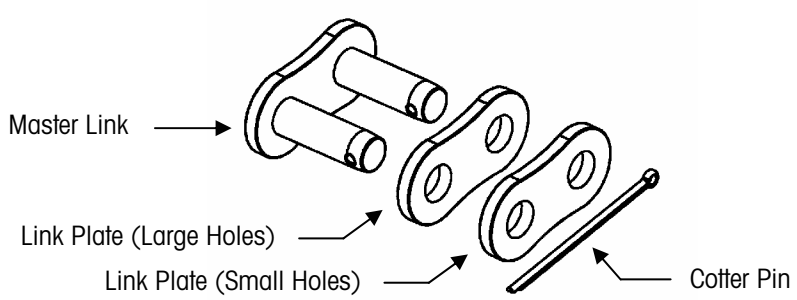


Figure 6-6: Master Link Assembly

15. Remove the cotter pin and master link that secure the load cell to the chain.

Installing a New Chain Load Cell

1. Use a master link to connect the new load cell to the chain. The chain should be connected to the top of the load cell (the end opposite the load cell cable). Assemble the master link as shown in Figure 6-6. Using a C-clamp or similar device, press the master link assembly together just enough so that you can insert the cotter pin in the holes. If the link is too tight, it can bind against the load cell and chain.
2. Use a master link to connect the other end of the load cell to the chain mount. Make sure that the load cell cable is facing away from the three bolt holes in the chain mount. Assemble the master link as shown in Figure 6-6. Using a C-clamp or similar device, press the master link assembly together just enough so that you can insert the cotter pin in the holes. If the link is too tight, it can bind against the load cell and chain mount.
3. Bolt the chain mount to the carriage, using the three bolts that were removed earlier (see Figure 6-5). Torque all three bolts to 60 ft-lb (or 120% of the prescribed torque value). Loosen all three bolts so that all torque is relieved. Retighten all bolts to the prescribed torque of 50 ft-lb. The application of a medium-grade thread locker is acceptable.
4. Route the chain up and over the pulley.
5. Remove the lower nut from the threaded chain anchor. Insert the threaded chain anchor into the mounting hole in the mast. Place the lower nut on the threaded anchor and tighten it until both it and the upper nut are tight against the mast (see Figure 6-4).
6. If the load cell is on the opposite side of the carriage from the telemetry enclosure, route the load cell cable through the scale carriage under the cover plate that you removed.
7. Insert the load cell cable through the cord grip into the telemetry enclosure.
8. Wire the load cell cable to the terminal strip on the printed circuit board (PCB) inside the telemetry enclosure. Connect the wires according to the wiring codes in Figure 6-2. To connect a wire, insert the tip of a flat-blade screwdriver into the appropriate slot in the terminal and insert the wire into the opening across from the slot.
9. Tighten the six nuts on the cord-grip clamp bar (see Figure 6-3). Use a nut driver to tighten the nuts. Be careful to tighten the nuts only to the point at which the cables will not slide through the cord grips. Do not overtighten the nuts.
10. Use the socket head screw to secure the telemetry enclosure to the carriage.
11. Replace the PCB in the enclosure and secure it with the five Phillips head screws. If you disconnected the battery wire and inclinometer from the PCB, reconnect them.
12. Coil any excess cable and store it in the open area of the carriage where the cover plate was removed. Replace the cover plate and secure it with six Phillips head screws.
13. Replace the cover on the telemetry enclosure and secure it with seven flat head screws.
14. Insert the battery in the battery compartment.
15. Power up the scale controller and enter its setup mode. Open the data screen and check the output for the two chain load cells. The output should be approximately equal (±100 lb). Adjust the tension on the chain connected to the new load cell until the outputs are within tolerance (refer to the "Adjust Load Cell Force" procedure in this chapter).

Removing a Drag Load Cell

1. Remove the forks from the lift truck.
2. Raise the inner mast high enough to allow room to slide the carriage down and out of the mast.
3. Shut off the forklift truck's motor.
4. Obtain a crane (or other lifting device) with a capacity of at least 500 lb. Wrap a sling securely around the upper part of the carriage. Use the crane to raise the sling high enough that it supports the weight of the carriage.
5. Remove the battery by pressing the tab toward the center of the battery and pulling the battery from the battery compartment.
6. Disconnect the two chain anchors from the mast by removing the lower nut from each threaded anchor (see Figure 6-4).
7. Pull the chains up and over the pulleys.
8. Use the crane to lower the carriage and remove it from the bottom of the mast.
9. Place the carriage on a stable working surface, with the front side of the carriage facing downward.
10. Remove the cover to the scale's telemetry enclosure. The cover is held in place by seven flat head cap screws. Leave the socket head screw in place. It attaches the enclosure to the carriage.
11. The load cell cables are wired to the four terminal strips on the printed circuit board (PCB) inside the telemetry enclosure. Locate the cable for the load cell that you are replacing. You should be able to identify it by the tag attached to the cable. Disconnect the cable's wires from the terminal strip by inserting the tip of a flat-blade screwdriver into the slot next to each wire and removing the wire from the terminal.
12. Remove the five Phillips head screws that attach the PCB to the enclosure. Move the PCB out of the way so that you have access to the cord-grip clamp bar (see Figure 6-3). In order to remove the PCB, you might need to disconnect the battery wires and unplug the inclinometer.
13. Loosen the six nuts on the cord-grip clamp bar. This will loosen the cord grips so that you can remove the cable.
14. Remove the socket head screw that secures the telemetry enclosure to the carriage.
15. Pull the load cell cable through the cord grip to remove it from the telemetry enclosure.
16. The load cell cables are routed through the scale carriage under the cover plates located at the top and bottom of the carriage. Remove the cover plate that conceals the cable for the load cell you are replacing.
17. Remove the top flexure on the side of the scale where you will be replacing the load cell. Note the position of any shims that are under the flexure so that you can replace them later.
18. Loosen the three nuts on the threaded rod that anchors the load cell to the upper carriage mount (see Figure 6-7). Be careful not to turn the load cell while loosening the nuts. Hold the load cell in position, and turn the nuts with a wrench.

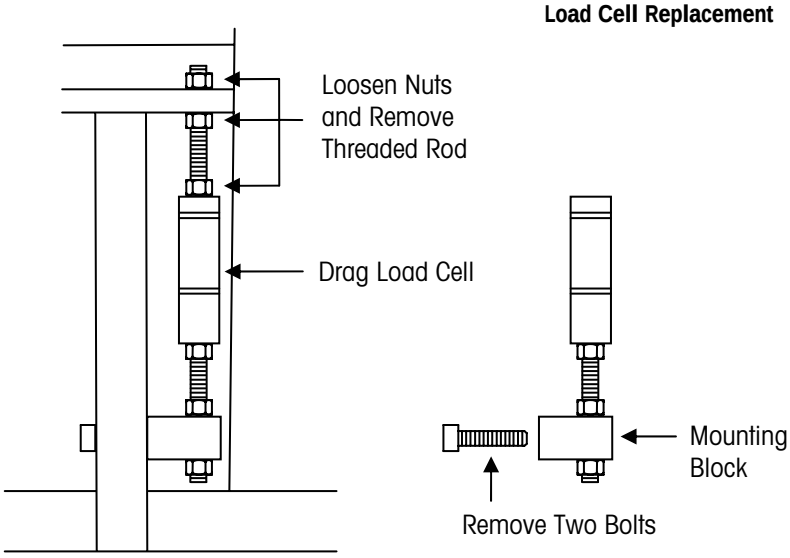


Figure 6-7: Drag Load Cell Assembly

19. Unscrew the threaded rod to remove it from the load cell.
20. Remove the two bolts that secure the lower mounting block to the carriage.
21. Remove the load cell and lower mounting block through the opening in the back side of the carriage.
22. Loosen the jam nut at the bottom of the load cell and unscrew the load cell from the threaded rod connected to the mounting block.

Installing a New Drag Load Cell

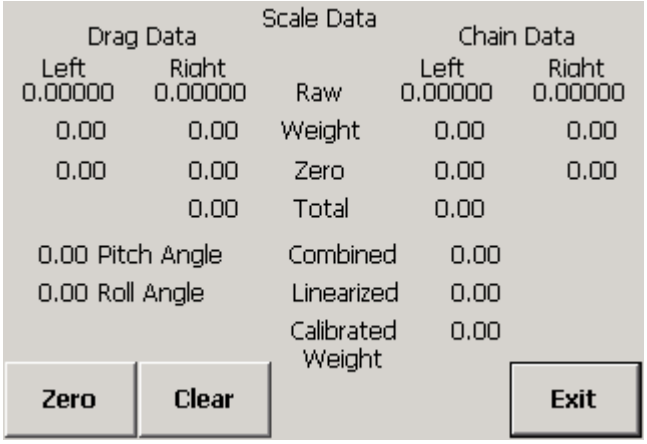
1. Screw the threaded rod that is connected to the lower mounting block into the hole at the bottom of the new load cell (see Figure 6-7). Make sure that the end of the threaded rod does not extend into the gap in the load cell.
2. Position the load cell below the upper carriage mount in the scale carriage. Make sure that the load cell cable faces the back of the carriage.
3. Insert the threaded rod through the hole in the upper carriage mount. Place a nut on the threaded rod above the carriage mount and two nuts below the carriage mount.
4. Screw the lower end of the threaded rod into the hole in the top of the new load cell. Again, make sure that the end of the threaded rod does not extend into the gap in the load cell.
5. Tighten the three jam nuts that secure the load cell to the upper carriage mount. Make sure that there is clearance between the sides of the load cell and the carriage.
6. Replace the top flexure, making sure to insert any shims in their original locations.
7. If the load cell is on the opposite side of the carriage from the telemetry enclosure, route the load cell cable through the scale carriage under the cover plate that you removed.
8. Insert the load cell cable through the cord grip into the telemetry enclosure.

9. Wire the load cell cable to the terminal strip on the printed circuit board (PCB) inside the telemetry enclosure. Connect the wires according to the wiring codes in Figure 6-2. To connect a wire, insert the tip of a flat-blade screwdriver into the appropriate slot in the terminal and insert the wire into the opening across from the slot.
10. Tighten the six nuts on the cord-grip clamp bar (see Figure 6-3). Use a nut driver to tighten the nuts. Be careful to tighten the nuts only to the point at which the cables will not slide through the cord grips. Do not overtighten the nuts.
11. Use the socket head screw to secure the telemetry enclosure to the carriage.
12. Replace the PCB in the enclosure and secure it with the five Phillips head screws. If you disconnected the battery wire and inclinometer from the PCB, reconnect them.
13. Coil any excess cable and store it in the open area of the carriage where the cover plate was removed. Replace the cover plate and secure it with six Phillips head screws.
14. Use the crane to lift the carriage and slide it up into the mast from the bottom of the mast. Block the carriage to hold it in position.
15. Route the chains up and over the pulleys.
16. Insert each chain anchor into its mounting hole in the mast, and screw a nut onto the bottom end of each threaded anchor (see Figure 6-4). Tighten the jam nuts against the mast to secure the chains.
17. Bolt the lower mounting block to the carriage and tighten the jam nuts (see Figure 6-7).
18. After the scale carriage is secured to the mast, carefully remove the sling and any additional blocking. Replace the forks on the carriage.
19. Insert the battery in the battery compartment.
20. Power up the scale controller and enter its setup mode. Open the data screen and check the output for the two drag load cells. The output should be approximately equal (the target is -60 lb ±40 lb). Adjust the load cells so that they are within tolerance (refer to the "Adjust Load Cell Force" procedure in this chapter).

Adjust Load Cell Force

After replacing a load cell, check the scale's force data to see if adjustments are needed.

1. Touch the **Setup** button on the scale controller to enter setup mode.
2. Open the data screen by touching the **Maintenance** button, the **Diagnostics** button, and the **Data Screen** button.



3. Park the forklift truck on a level surface, remove all load from the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor.
4. Touch the **Zero** button to reset the scale to zero.
5. Compare the weight readings for the left drag load cell and the right drag load cell. The reading for each load cell should be approximately -60 lb (±40 lb). If either load cell is outside this range, adjust the load cell until the reading is within the range.
   - Each drag load cell is connected to a lower mounting block by a length of threaded rod. Loosen the jam nut on the top side of the mounting block.
   - Then adjust the jam nut on the bottom side of the mounting block, tightening the nut to increase the force or loosening the nut to decrease the force. Do not turn the load cell.
   - After making the adjustment, tighten the upper jam nut against the mounting block.
6. Compare the weight readings for the left chain load cell and the right chain load cell. Each reading should be approximately equal (±100 lb). If necessary, adjust the chain anchors until both readings are within this range.
   - Loosen the jam nut on the top side of the carriage mounting block.
   - Then adjust the jam nut on the bottom side of the mounting block, tightening the nut to increase the force or loosening the nut to decrease the force. As the force on one load cell goes up, the force on the other load cell will go down.
   - After making the adjustment, tighten the upper jam nut against the mounting block.
7. Touch the **Exit** button to close the data screen.

7 Calibration

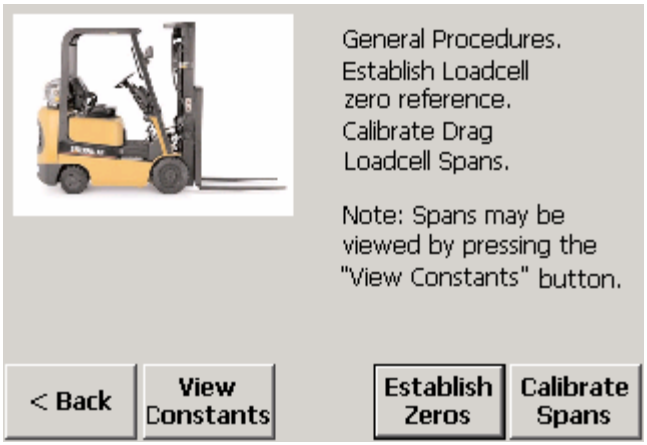
General

A forklift scale is calibrated at the factory and should not need to be recalibrated when it is installed. As part of the normal maintenance schedule, have a qualified service technician check the scale's calibration periodically. Calibration should also be checked whenever a load cell is replaced. If the scale is within accepted tolerances, there is no need to recalibrate it.

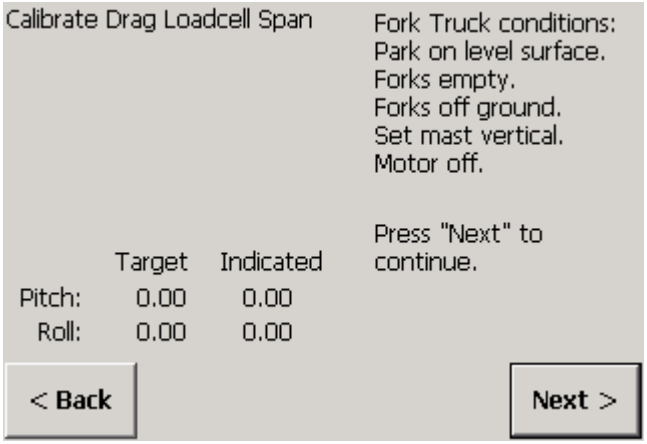
Calibrate Load Cells

Check the span values for the drag load cells. With the scale controller in setup mode, open the data screen. Set the mast to the vertical position, remove all load from the forks, and then raise an lower them several times to exercise the scale. Shut off the forklift truck's motor. Position a block 15 inches high under the bottom roller on each side of the scale carriage. Touch the **Zero** button, and then lower the carriage onto the blocks. The "Calibrated Weight" reading is the sum of the totals for the drag load cells and the chain load cells. It should be zero (±2 lb). If the reading is out of tolerance, perform the following calibration procedure:

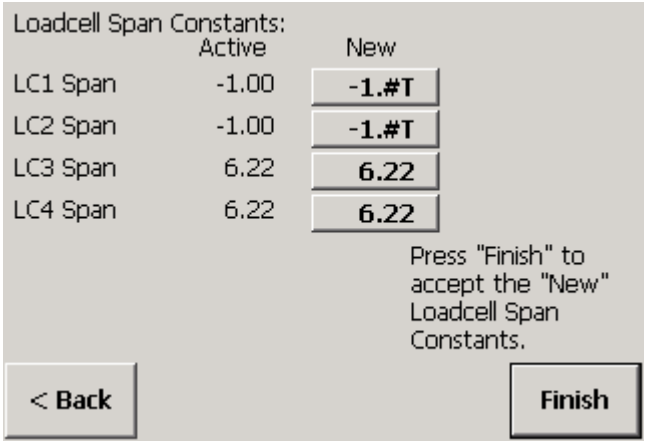
1. Touch the **Setup** button to enter setup mode.
2. Open the load cell calibration screen by touching the **Scale** button, the **Calibration** button, and the **Loadcell** button.



3. Touch the **Calibrate Spans** button.



4. Park the forklift truck on a level surface, remove all load from the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor.
5. Touch the **Next** button. The system will count down as it updates the values.
6. For best results, raise and lower the carriage several times. Then position a block 15 inches high under the bottom roller on each side of the scale carriage, and lower the carriage onto the blocks. Shut off the forklift truck's motor.
7. Touch the **Next** button. The system will count down as it updates the values. The new load cell span constants will then be displayed.



8. Touch the **Finish** button to accept the new span values.

Span Adjustment

A correctly adjusted scale will give you the same weight reading no matter where on the forks you place a test weight. If the weight readings at the shift test locations are out of tolerance, shift adjust the scale to correct the problem.

Park the forklift truck on a level surface, place a pallet on the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor. Then check the scale's repeatability by placing a test weight on the same location on the pallet several times to make sure that you get the same weight reading each time.

After verifying the scale's repeatability, check to see if the scale needs to be shift adjusted. For shift adjustments, we recommend using test weights equal to one half the scale's maximum weighing capacity. The test weights must meet the specified National Institute of Standards and Technology Handbook 44 accuracy requirements.

NOTE: When performing a shift adjustment, use the weight readings on the data screen instead of those on the main weighing screen. The weight readings on the data screen are displayed to two decimal places, although the number in the second decimal place might not be stable.

Shift Test Locations

Place a pallet or other flat surface (approximately 4 feet by 4 feet) on the forks and make sure that it is level. Figure 7-1 shows test weight locations (1, 2, 3, and 4) at the center of each quadrant of the pallet. Place the test weight at location 1 and record the weight reading. Then move the test weight to location 2 and record the weight reading. Continue until you have taken a weight reading at each of the four locations.

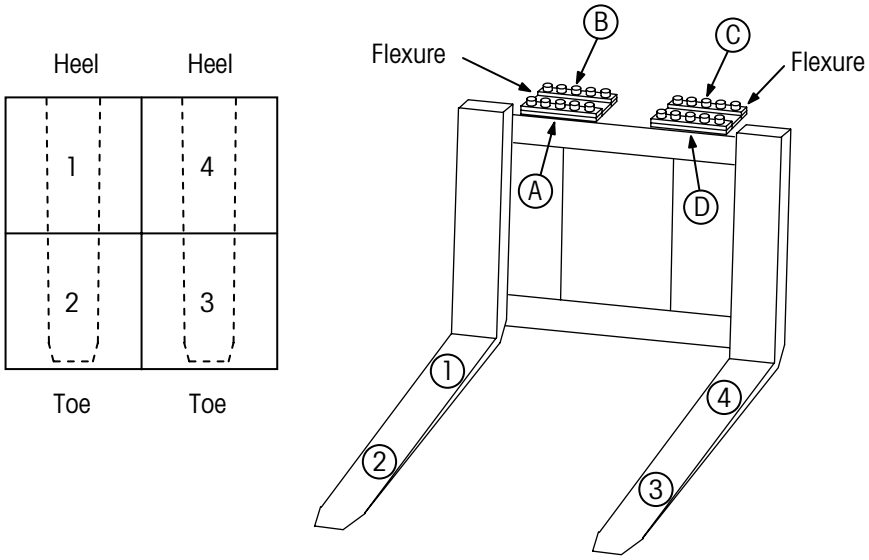


Figure 7-1: Shift Adjustment Locations

Ideally, the scale will give you the same weight reading at all four locations. The weight readings at the heel and toe of either or both forks should be within Handbook 44 tolerance requirements (±2.5 lb for weights up to 2,500 lb). If the weight readings are out of tolerance, you will need to shift adjust the scale. This is done by adding shims to the flexures at the locations shown in Figure 7-1. To determine where to add shims, refer to Table 7-1.

If weight reading 1 is greater than 2	→	Shim at location A
If weight reading 2 is greater than 1	→	Shim at location B
If weight reading 3 is greater than 4	→	Shim at location C
If weight reading 4 is greater than 3	→	Shim at location D

Table 7-1: Shim Locations

The shims adjust the differences between the weight readings at the heel and toe of an individual fork. Adjust the weight readings so that they are as near to equal as possible. If one weight reading is slightly higher, it should be the reading at the toe of the fork.

Shimming at the front of a flexure (location A) will increase the weight reading at the toe of the fork (location 2). Because the shim affects the entire fork, it will also slightly increase the weight reading at the heel (location 1).

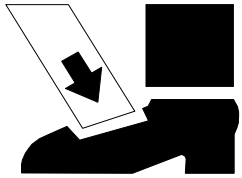
Shimming at the back of a flexure (location B) will decrease the weight reading at the toe of the fork (location 2). Because the shim affects the entire fork, it will also slightly decrease the weight reading at the heel (location 1).

A pallet places load on both forks. So when a pallet is used, shimming under a flexure will affect the readings at all four test weight locations. For example, shimming at location A or B will change the readings at locations 1 and 2, but it will also change the readings at locations 3 and 4 to a lesser extent.

Keep in mind that, in addition to balancing the weight readings at the heel and toe of each fork, you are also trying to balance the weight readings of the two forks.

Shimming Procedure

Do not remove the bolts from more than one flexure at a time. The flexures connect the two sections of the scale carriage. If you unbolt the two top or bottom flexures, the sections of the carriage could separate and cause injury or damage the flexures.



⚠ DANGER

DO NOT REMOVE THE BOLTS FROM MORE THAN ONE FLEXURE AT A TIME WHILE THE CARRIAGE IS INSTALLED ON THE FORKLIFT. UNBOLTING MORE THAN ONE FLEXURE COULD RESULT IN BODILY HARM OR PROPERTY DAMAGE.

1. Remove the bolts from the side of the flexure where shims will be added.
2. Loosen the bolts on the opposite side of the flexure.
3. Place a shim under the flexure, aligning the bolt holes in the shim with those in the flexure. We recommend starting with the thinnest shim and gradually increasing the shim thickness as needed to balance the weight readings.

4. Replace the bolts that were removed, and tighten all bolts. Torque the bolts to 90 ft-lb.
5. Repeat steps 1-4 for the second flexure if needed.
6. Take new weight readings at all four test weight locations. If the weight readings are still not equal, repeat the procedure to add additional shimming.
7. When you have finished shift adjusting the scale, you should get approximately the same weight reading at all four test weight locations.

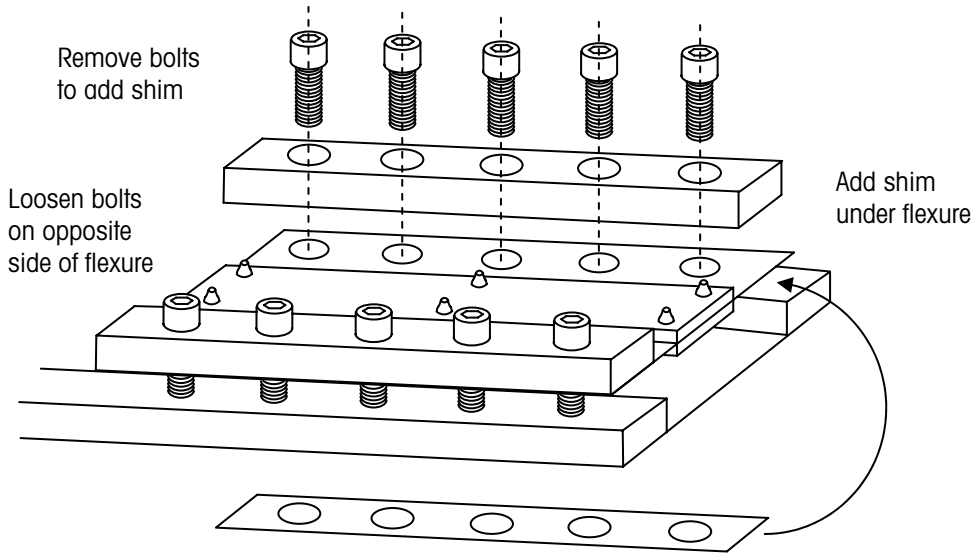


Figure 7-2: Shimming Procedure

Calibrate Linearity

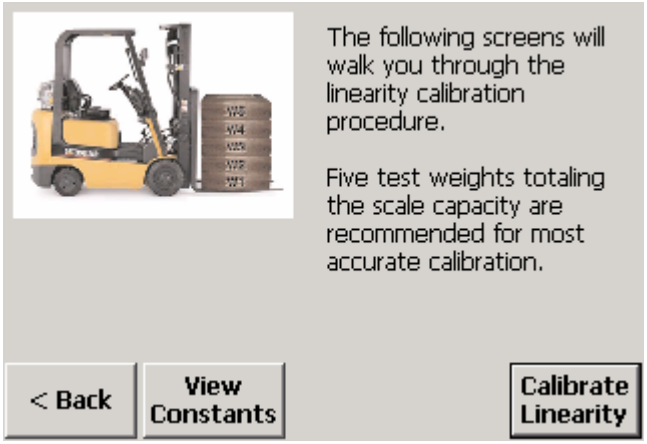
Check the scale for linearity errors. We recommend using five 1,000-lb test weights. Use the weight readings on the data screen instead of those shown on the main weighing screen. The weight readings on the data screen are accurate to two decimal places.

- Park the forklift truck on a level surface, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor. Place a pallet on the forks, and use the weight of the pallet as the tare weight.
- Record the net weight with no test weight on the scale. Then add the five test weights one at a time, recording the net weight after each test weight is added. You should have weight readings for the following test weights: 0, 1000, 2000, 3000, 4000, and 5000 lb. Then remove the test weights from the scale one at a time, recording the net weight each time you remove a test weight.

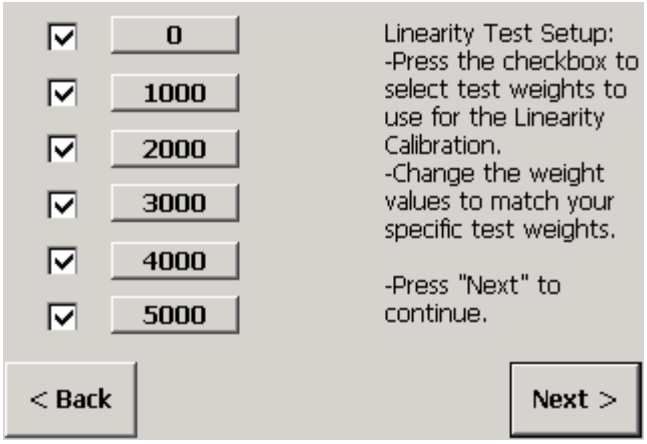
The weight readings should be within Handbook 44 tolerance requirements (±2.5 lb for weights up to 2,500 lb and ±5 lb for weights greater than 2,500 lb). If the weight readings are out of tolerance, perform the following calibration procedure:

1. Park the forklift truck on a level surface, place a pallet on the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor.

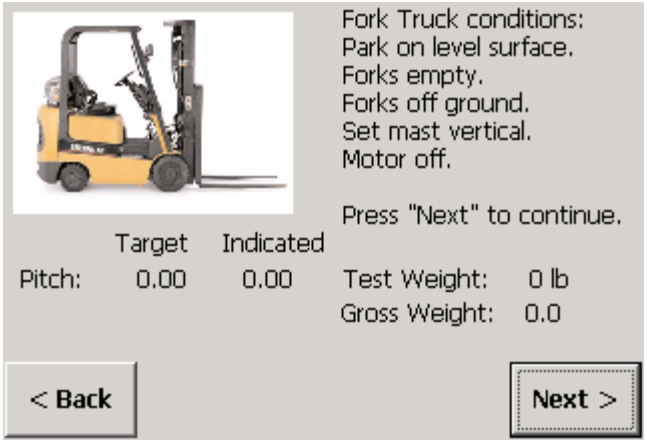
2. Touch the **Setup** button on the scale controller to enter setup mode.
3. Open the linearity calibration screen by touching the **Scale** button, the **Calibration** button, and the **Linearity** button.



4. Touch the **Calibrate Linearity** button to display the linearity test setup. For the default test setup, all six boxes will be checked and the following weight values will be listed on the buttons next to the boxes: 0, 1000, 2000, 3000, 4000, 5000. If you plan to use a different range of weights, reconfigure the test setup to match those weights. You can select or deselect a step by touching the check box. You can change a weight value by touching the button to open a keypad that will allow you to enter a new weight value.

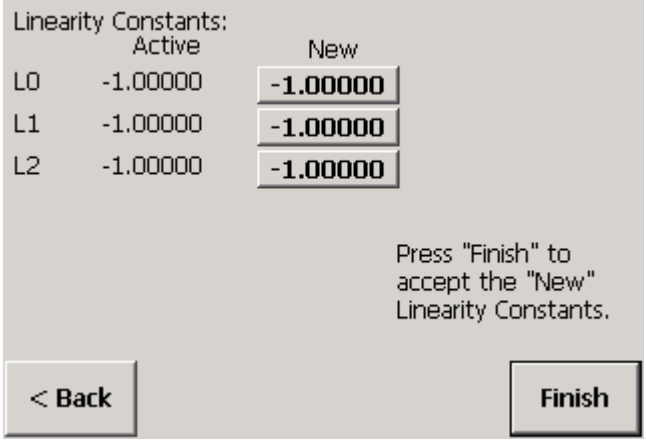


When the correct weight values are displayed, touch the **Next** button to continue.



5. With zero test weight on the scale, touch the **Next** button. The system will count down as it updates the values.
6. Add test weight so that the total weight on the scale equals 1,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.
7. Add test weight so that the total weight on the scale equals 2,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.
8. Add test weight so that the total weight on the scale equals 3,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.
9. Add test weight so that the total weight on the scale equals 4,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.
10. Add test weight so that the total weight on the scale equals 5,000 lb, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the values.

11. Touch the **Compute** button to calculate the new linearity constants.



12. The new linearity constants will be displayed. Touch the **Finish** button to accept the new constants.

Calibrate Angles

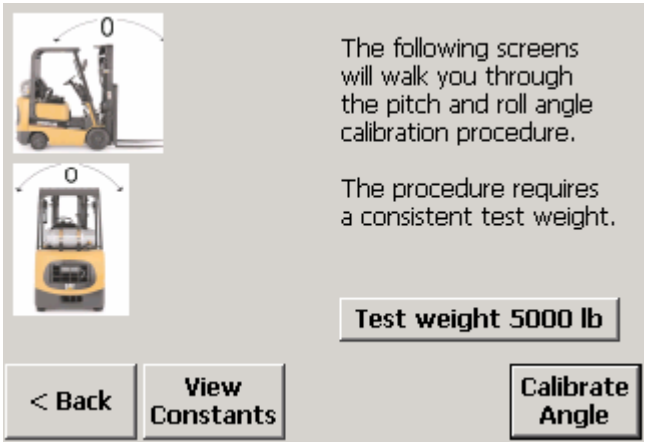
Determine if angle calibration is needed by checking the scale's accuracy with the mast set at several angles. Mast pitch and roll angles are shown on the data screen. Use the same test weight for each mast setting. The recommended test weight is full scale capacity (5,000 lb). To change the test weight amount, touch the test weight button on the angle calibration screen and then use the keypad to enter a new weight value. Use the weight readings on the data screen instead of those shown on the main weighing screen. The weight readings on the data screen are accurate to two decimal places.

- Park the forklift truck on a level surface, set the mast to the vertical position, and raise the forks 12 to 15 inches off the ground. The forklift truck's motor should be shut off when taking weight readings. Place a pallet on the forks, and zero the scale. Place the test weight on the scale, and record the weight.
- Check the mast pitch: Remove the test weight, set the mast 5 degrees backward, and zero the scale. Then place the test weight on the scale, and record the weight. Remove the test weight, set the mast 5 degrees forward, and zero the scale. Then place the test weight on the scale, and record the weight.
- Check the mast roll: Set the mast to the vertical position. Remove the test weight, position the forklift truck on a ramp so that the mast is angled approximately 3 degrees to the right, and zero the scale. Then place the test weight on the scale, and record the weight. Remove the test weight, position the forklift truck on a ramp so that the mast is angled approximately 3 degrees to the left, and zero the scale. Then place the test weight on the scale, and record the weight.

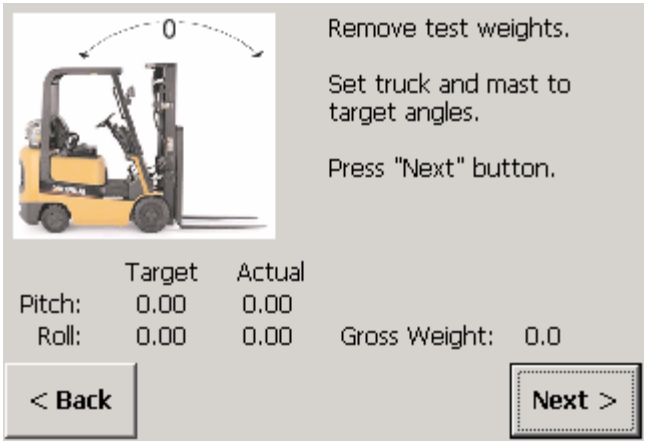
The weight readings should be within Handbook 44 tolerance requirements (±2.5 lb for weights up to 2,500 lb and ±5 lb for weights greater than 2,500 lb). If the weight readings are out of tolerance, perform the calibration procedures for mast pitch or for both mast pitch and mast roll. The angle calibration procedure compensates for any variation in weight readings that might occur when the mast is set at different angles. Use the same test weight for each mast setting. The recommended test weight is full scale capacity (5,000 lb).

Mast Pitch

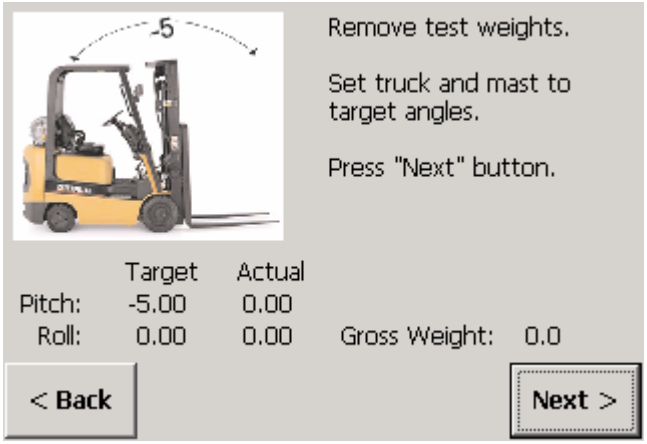
1. Park the forklift truck on a level surface, place a pallet on the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor.
2. Touch the **Setup** button on the scale controller to enter setup mode.
3. Open the angle calibration screen by touching the **Scale** button, the **Calibration** button, and the **Angle** button. Make sure that the test weight displayed on the screen equals the test weight being used for the calibration procedure. You can change the weight by touching the **Test Weight** button to open a keypad.



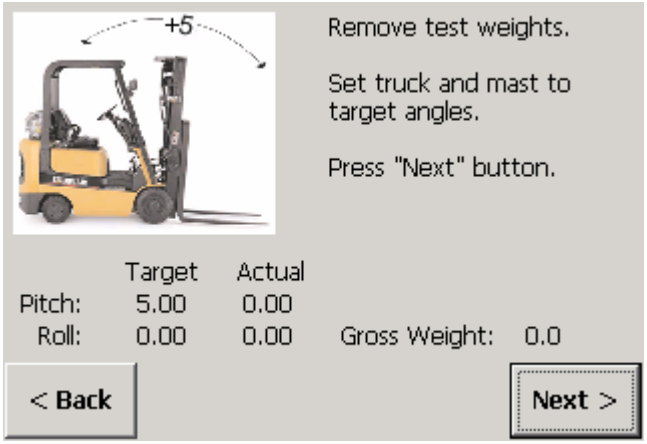
4. Touch the **Calibrate Angle** button.



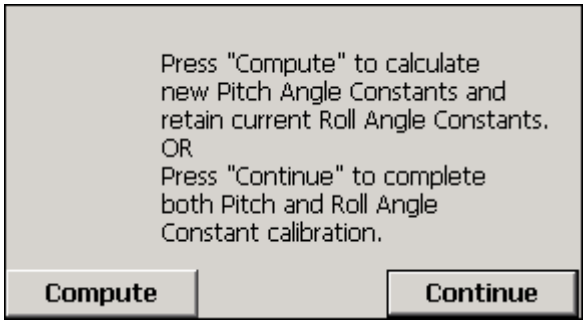
5. Touch the **Next** button. The system will count down as it updates the zero load values.
6. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.



7. Remove the test weight from the scale.
8. Set the mast so that it is angled approximately 5 degrees backward. Shut off the forklift truck's motor.
9. Touch the **Next** button. The system will count down as it updates the zero load values.
10. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.



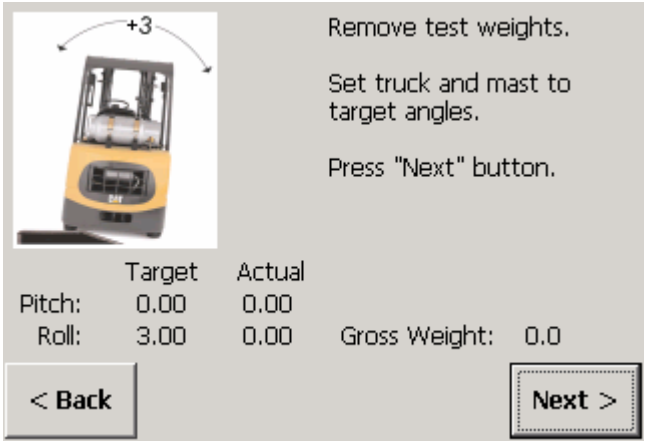
11. Remove the test weight from the scale.
12. Set the mast so that it is angled approximately 5 degrees forward. Shut off the forklift truck's motor.
13. Touch the **Next** button. The system will count down as it updates the zero load values.
14. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.



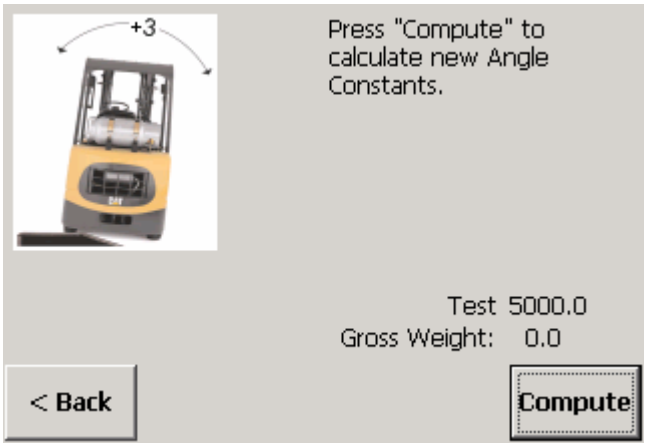
15. Touch the **Compute** button to calculate the new pitch angle constants, or touch the **Continue** button to continue calibrating both pitch and roll angles. If you touch the **Compute** button, go to Step 25.

Mast Roll

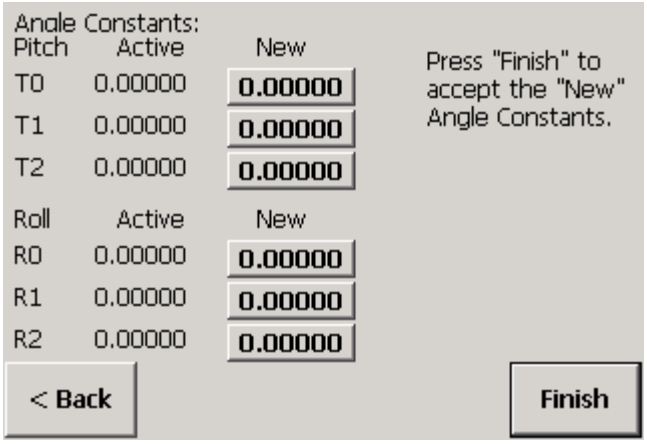
16. Remove the test weight from the scale.
17. Position the forklift truck on a ramp so that the mast is angled approximately 3 degrees to the right. Shut off the forklift truck's motor.
18. Touch the **Next** button. The system will count down as it updates the zero load values.
19. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.



20. Remove the test weight from the scale.
21. Position the forklift truck on a ramp so that the mast is angled approximately 3 degrees to the left. Shut off the forklift truck's motor.
22. Touch the **Next** button. The system will count down as it updates the zero load values.
23. Add the test weight, allow the scale to stabilize, and then touch the **Next** button. The system will count down as it updates the loaded values.



24. Touch the **Compute** button to calculate the new pitch and roll angle constants.

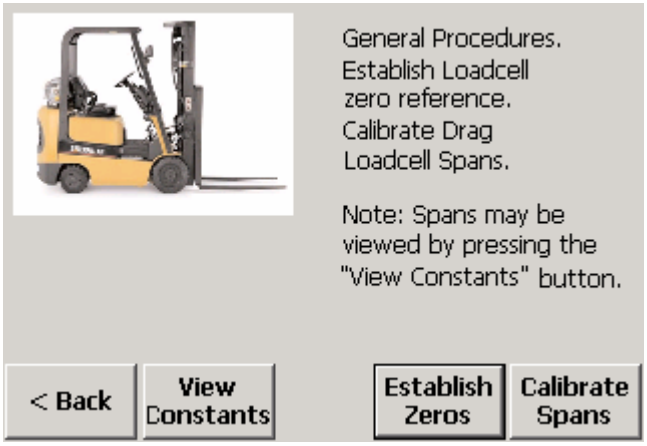


25. Touch the **Finish** button to accept the new constants.

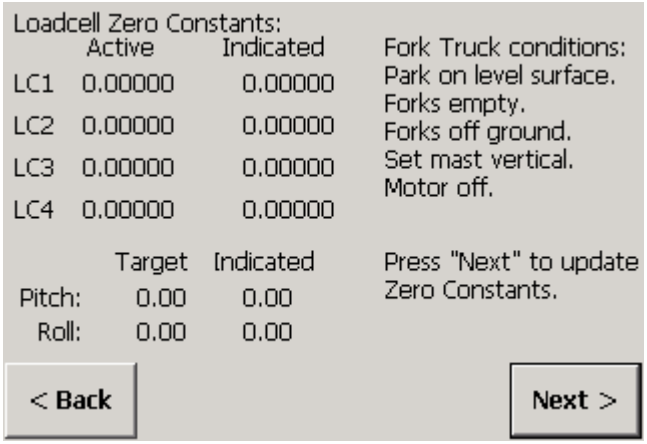
Establish Zero

After performing any of the calibration procedures, establish a zero constant for the scale. Park the forklift truck on a level surface, remove all load from the forks, raise the forks 12 to 15 inches off the ground, set the mast to the vertical position, and shut off the forklift truck's motor.

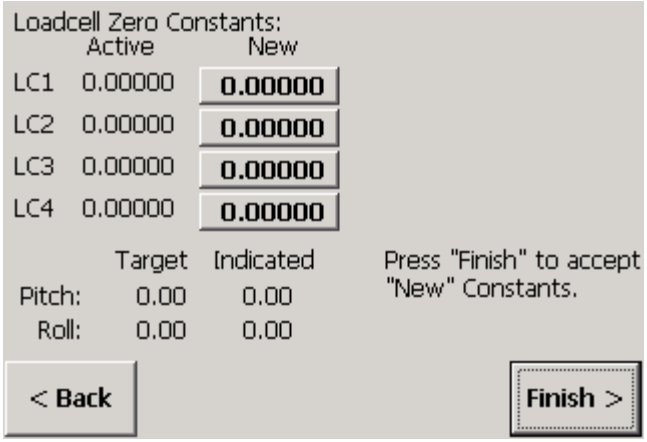
1. Touch the **Setup** button on the scale controller to enter setup mode.
2. Open the load cell calibration screen by touching the **Scale** button, the **Calibration** button, and the **Loadcell** button.



3. Touch the **Establish Zeros** button to display the load cell zero constants.



4. Touch the **Next** button to update the constants. The system will count down as it updates the values.



5. The new zero constants will be displayed. Touch the **Finish** button to save the new constants.

NOTE: Be sure to save the new calibration data when you exit setup mode.

8 Service Parts

Scale Controller

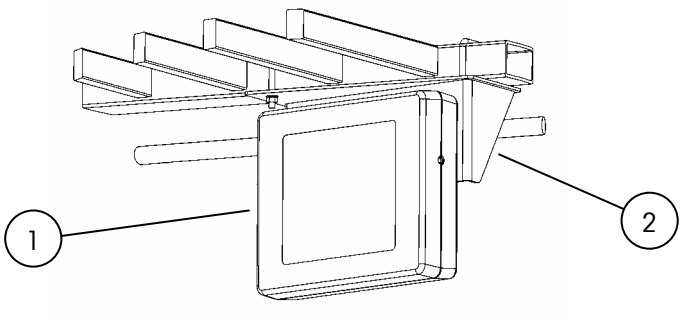


Figure 8-1: Scale Controller and Mounting Bracket

Ref. No.	Part Number	Description	Qty.
1	MCPC0001000	Scale Controller	1
2	TA205236	Mounting Bracket	1

Table 8-1: Scale Controller and Mounting Bracket

Scale Carriage

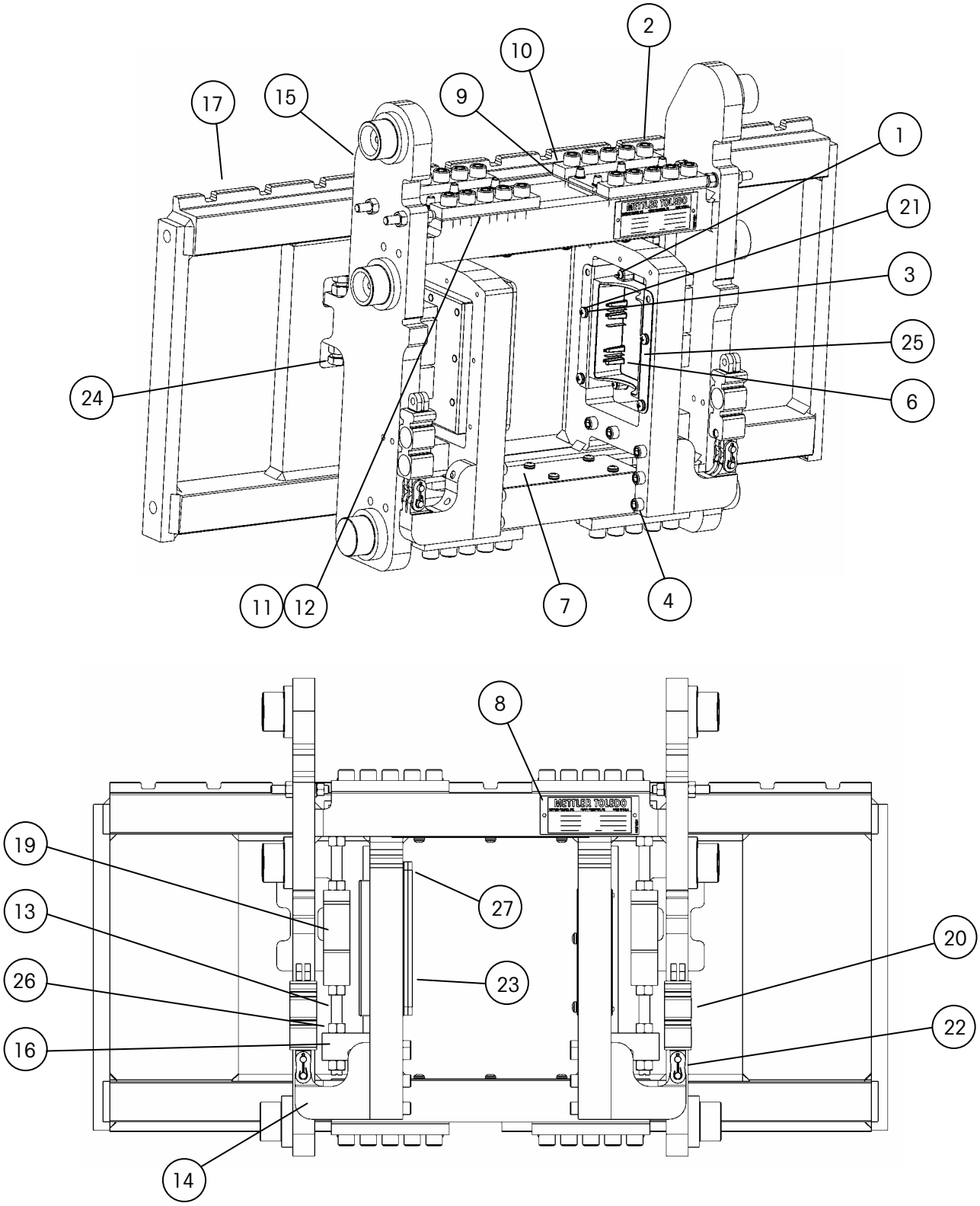


Figure 8-2: Forklift Scale Carriage

Ref. No.	Part Number	Description	Qty.
1	MZ0901010594	Round Phillips Head Machine Screw, 10-32 x 0.62, SS	4
2	MZ0901010592	Socket Head Cap Screw, 1/2-20 x 1.25	40
3	MZ0901010596	Round Phillips Head Machine Screw, 1/4-20 x 0.50, SS	16
4	MZ0901010591	Socket Head Cap Screw, 3/8-24 x 2.5	10
--	MZ0901010333	Socket Head Cap Screw, 5/16-18 x 1.5	2
6	TA205240	Discharge Cradle, Simplex (Atlas)	1
7	TN205216	Cover Plate, Simplex (Atlas)	2
8	MN31004	Data Label	1
9	TA205220	Flexure Assembly, Simplex (MCFA)	4
10	TA205221	Flexure Clamp Bar, Simplex (MCFA)	8
11	TA205224-001	Flexure Shim, 0.001 inch thick	4
12	TA205224-003	Flexure Shim, 0.003 inch thick	4
13	TN205208	Drag Cell Mounting Stud, FLT, MC, SG	4
14	TA205222	Chain Mount, FLT, MC, SG	2
15	TC205202	Carriage Frame, FLT, MC, SGL, DD	1
16	TA205213	Drag Mount, FLT, MC, SG	2
17	TC205214	Carriage Frame, FLT, MC, SGL, LV	1
--	TA205223	Anchor, FLT, MC, SGL, SD, SFTR	1
19	16771500A	Drag Load Cell, 1,250 lb, Double S, TSD	2
20	16771600A	Chain Load Cell, 5,000 lb, Clevis	2
21	MZ0901030081	Lock Washer, 1/4 Hel. Spring, SS	16
22	TN205252	Master Link, Kit of Parts	2
23	TB205230	Telemetry Enclosure Assembly, MCFA Simplex	1
24	TN205253	Bumper Bolt, MCSB	4
25	TA205237	Discharge Cradle Mounting Tray, Simplex	1
26	MZ0901020132	Nut, 1/2-20, ZN	16
27	MZ0901010595	Socket Head Cap Screw, 1/4-20 x 0.5, SS	1
--	TN205207	Side Stud, MCSB	4
--	MZ0901020016	Nut, 3/8-16, SS	4
--	MZ0901030076	Lock Washer, 3/8 Hel. Spring, SS	4
--	MZ0901020135	Nut, M10 x 1.25, SS	4
--	TB205247	Battery Pack	2
--	TA205241	Battery Charger	1

Table 8-2: Scale Carriage Assembly

9 Appendix

Geo Index

The scale controller can compensate for variations caused by gravitational forces. The geo index for the location where the scale is calibrated is programmed into the scale controller at the factory. When the scale is moved to a new location, the geo index for the new location should be entered in scale setup. Use the following table to determine the geo index for a location. Refer to Chapter 4 for information about entering a geo index.

Northern and southern latitude in degrees and minutes	**Height above sea level in meters**										
	0 325	325 650	650 975	975 1300	1300 1625	1625 1950	1950 2275	2275 2600	2600 2925	2925 3250	3250 3575
	Height above sea level in feet										
	0 1060	1060 2130	2130 3200	3200 4260	4260 5330	5330 6400	6400 7460	7460 8530	8530 9600	9600 10660	10660 11730
0° 0′ —5° 46′	5	4	4	3	3	2	2	1	1	0	0
5° 46′ — 9° 52′	5	5	4	4	3	3	2	2	1	1	0
9° 52′ — 12° 44′	6	5	5	4	4	3	3	2	2	1	1
12° 44′ — 15° 6′	6	6	5	5	4	4	3	3	2	2	1
15° 6′ — 17° 10′	7	6	6	5	5	4	4	3	3	2	2
17° 10′ — 19° 2′	7	7	6	6	5	5	4	4	3	3	2
19° 2′ — 20° 45′	8	7	7	6	6	5	5	4	4	3	3
20° 45′ — 22° 22′	8	8	7	7	6	6	5	5	4	4	3
22° 22′ — 23° 54′	9	8	8	7	7	6	6	5	5	4	4
23° 54′ — 25° 21′	9	9	8	8	7	7	6	6	5	5	4
25° 21′ — 26° 45′	10	9	9	8	8	7	7	6	6	5	5
26° 45′ — 28° 6′	10	10	9	9	8	8	7	7	6	6	5
28° 6′ — 29° 25′	11	10	10	9	9	8	8	7	7	6	6
29° 25′ — 30° 41′	11	11	10	10	9	9	8	8	7	7	6
30° 41′ — 31° 56′	12	11	11	10	10	9	9	8	8	7	7
31° 56′ — 33° 9′	12	12	11	11	10	10	9	9	8	8	7
33° 9′ — 34° 21′	13	12	12	11	11	10	10	9	9	8	8
34° 21′ — 35° 31′	13	13	12	12	11	11	10	10	9	9	8
35° 31′ — 36° 41′	14	13	13	12	12	11	11	10	10	9	9
36° 41′ — 37° 50′	14	14	13	13	12	12	11	11	10	10	9
37° 50′ — 38° 58′	15	14	14	13	13	12	12	11	11	10	10
38° 58′ — 40° 5′	15	15	14	14	13	13	12	12	11	11	10
40° 5′ — 41° 12′	16	15	15	14	14	13	13	12	12	11	11
41° 12′ — 42° 19′	16	16	15	15	14	14	13	13	12	12	11
42° 19′ — 43° 26′	17	16	16	15	15	14	14	13	13	12	12

Northern and southern latitude in degrees and minutes	Height above sea level in meters										
	0 325	325 650	650 975	975 1300	1300 1625	1625 1950	1950 2275	2275 2600	2600 2925	2925 3250	3250 3575
	Height above sea level in feet										
	0 1060	1060 2130	2130 3200	3200 4260	4260 5330	5330 6400	6400 7460	7460 8530	8530 9600	9600 10660	10660 11730
43° 26′ — 44° 32′	17	17	16	16	15	15	14	14	13	13	12
44° 32′ — 45° 38′	18	17	17	16	16	15	15	14	14	13	13
45° 38′ — 46° 45′	18	18	17	17	16	16	15	15	14	14	13
46° 45′ — 47° 51′	19	18	18	17	17	16	16	15	15	14	14
47° 51′ — 48° 58′	19	19	18	18	17	17	16	16	15	15	14
48° 58′ — 50° 6′	20	19	19	18	18	17	17	16	16	15	15
50° 6′ — 51° 13′	20	20	19	19	18	18	17	17	16	16	15
51° 13′ — 52° 22′	21	20	20	19	19	18	18	17	17	16	16
52° 22′ — 53° 31′	21	21	20	20	19	19	18	18	17	17	16
53° 31′ — 54° 41′	22	21	21	20	20	19	19	18	18	17	17
54° 41′ — 55° 52′	22	22	21	21	20	20	19	19	18	18	17
55° 52′ — 57° 4′	23	22	22	21	21	20	20	19	19	18	18
57° 4′ — 58° 17′	23	23	22	22	21	21	20	20	19	19	18
58° 17′ — 59° 32′	24	23	23	22	22	21	21	20	20	19	19
59° 32′ — 60° 49′	24	24	23	23	22	22	21	21	20	20	19
60° 49′ — 62° 9′	25	24	24	23	23	22	22	21	21	20	20
62° 9′ — 63° 30′	25	25	24	24	23	23	22	22	21	21	20
63° 30′ — 64° 55′	26	25	25	24	24	23	23	22	22	21	21
64° 55′ — 66° 24′	26	26	25	25	24	24	23	23	22	22	21
66° 24′ — 67° 57′	27	26	26	25	25	24	24	23	23	22	22
67° 57′ — 69° 35′	27	27	26	26	25	25	24	24	23	23	22
69° 35′ — 71° 21′	28	27	27	26	26	25	25	24	24	23	23
71° 21′ — 73° 16′	28	28	27	27	26	26	25	25	24	24	23
73° 16′ — 75° 24′	29	28	28	27	27	26	26	25	25	24	24
75° 24′ — 77° 52′	29	29	28	28	27	27	26	26	25	25	24
77° 52′ — 80° 56′	30	29	29	28	28	27	27	26	26	25	25
80° 56′ — 85° 45′	30	30	29	29	28	28	27	27	26	26	25
85° 45′ — 90° 00′	31	30	30	29	29	28	28	27	27	26	26

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