CARDINAL®

SWIM
SLOW-SPEED IN-MOTION SCALES

WEIGH-IN-MOTION
VEHICLE SCALES

SWIM

Slow-Speed In-Motion Scale

Installation Manual

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Disclaimer

While every precaution has been taken in the preparation of this manual, the Seller assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained herein. All instructions and diagrams have been checked for accuracy and ease of application; however, success and safety in working with tools depend largely upon individual accuracy, skill, and caution. For this reason, the Seller is not able to guarantee the result of any procedure contained herein. Nor can they assume responsibility for any damage to property or injury to persons occasioned from the procedures. Persons engaging in the procedures do so entirely at their own risk.

FCC Compliance Statement

This equipment generates uses, can radiate radio frequency, and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been designed within the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference in which case the user will be responsible to take whatever measures necessary to correct the interference.

You may find the booklet “How to Identify and Resolve Radio-TV Interference Problems” prepared by the Federal Communications Commission helpful. It is available from the U.S. Government Printing Office, Washington, D.C. 20402. Request stock No. 001-000-00315-4.

Serial Number_____

Date of Purchase _____

Purchased From_____

_____

_____

RETAIN THIS INFORMATION FOR FUTURE USE

PRECAUTIONS

Before using this product, read this manual and pay special attention to all "NOTIFICATION" symbols:

DANGER!
WARNING!
CAUTION!

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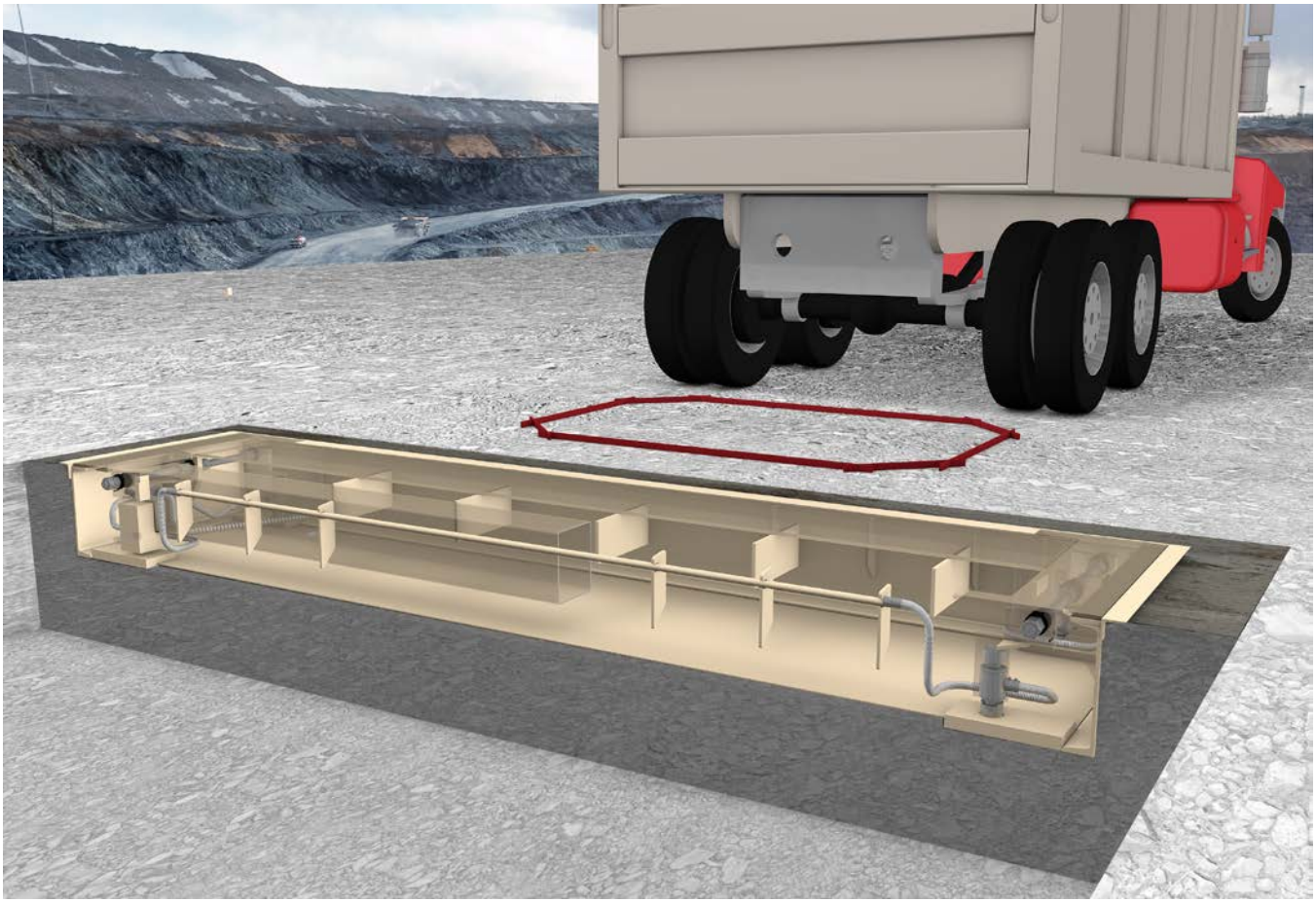
INTRODUCTION

The Cardinal SWIM series of Slow-Speed Weigh-In-Motion vehicle scales offer the ideal combination of accuracy and speed. The SWIM in-motion scale's welded steel platform is typically the length of a traffic lane and is contained within a single framework. Each platform is supported by four Cardinal AC series stainless steel compression load cells to weigh each axle of a vehicle as it travels across the scale. The weighing platform is 12 feet wide and 2.5 feet long and is constructed of a smooth steel plate. The scale frame is mounted in a pit less than 1.5 feet deep, so very little space is needed. The extremely stiff and rigid weighbridge, coupled with four 50K load cells, results in a higher resonant frequency allowing more efficient filtering of spurious weight signals and results in higher accuracy.



This manual must be used in conjunction with certified drawings of the scale being installed.

In case of conflict, the certified drawings will govern.

This manual should be studied thoroughly before attempting to install the Cardinal Slow-Speed Weigh In-Motion Scale. Safety should always be the prime consideration during all phases of the installation. Failure to comply with the instructions in this manual will void all warranty implied or stated.

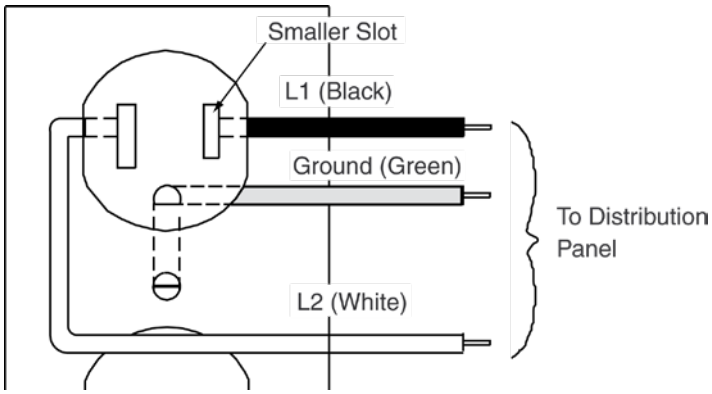
GENERAL SITE PREPARATION REQUIREMENTS

Your new scale, as with any precision measuring instrument, requires an acceptable environment to operate at its peak performance and reliability. The purpose of this section is to explain how the user can provide such an environment.

Electrical Power

Most Cardinal instrumentation is designed to operate at 115V AC, 50/60 Hz. Where required, the equipment may be ordered for operation at 230V AC, 50/60 Hz. Refer to your order confirmation copy or the equipment nameplate if you are not certain for which voltage level your scale is configured.

Power Outlet



Your weighing system will require one or more power outlets. Refer to Table A to determine the number of power outlets necessary for your system. These outlets should be of the grounded, polarized type as shown above. One additional outlet is recommended to allow a source of power for test equipment to be used during installation and service.

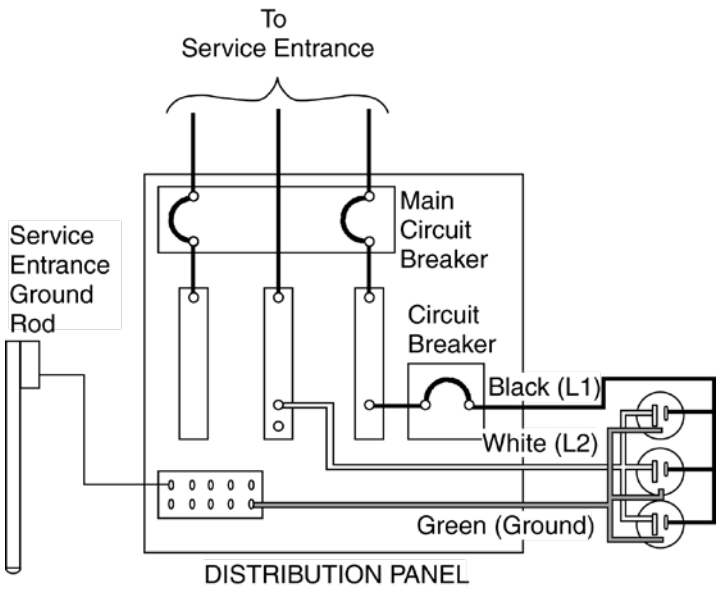
Table A – Power Outlet Requirements

Device	Outlets Required
Digital Weight Indicator	1
Printer	1
Traffic Control Console	1
Regulating Transformer*	1
Computer	1
*This piece of optional equipment eliminates the need for an outlet for the digital weight indicator, depending on the type of regulating transformer.	

The figure to the right illustrates typical wiring from the distribution panel to the power outlets used for the weighing system.

Power outlets should be on a separate circuit from the distribution panel. This circuit should be dedicated to the exclusive use of the weighing system. The power wiring should conform to local electrical codes. Services of a qualified contractor and approval by the local building inspector generally will assure compliance with this code.

To prevent electrical noise interference, make certain that all other wall outlets for use with vacuum cleaners, lighting, industrial machinery, and other equipment are on circuits separate from that used for the weighing system.



Typical Power Outlet Wiring

AC Power Fluctuations

Your Cardinal Weighing System uses one or more microcomputer systems. Many of the problems associated with computer operations are caused by fluctuations in the AC power system. Electrical noise, power interruptions, and lightning effects from the commercial power line may enter the weighing system and cause equipment failures.

Many of the disturbances that can seriously affect the operation of a weighing system originate within the building itself. These disturbances result from switching heavily inductive loads, such as welders, motors, and solenoids. These sources of disturbances must be identified, and steps are taken to prevent possible adverse effects on the operation of the weighing system. Examples of available alternatives include isolation transformers, power regulators, uninterruptible power supplies, or simple line filters.

Power Source

The power source should have sufficient capacity to supply the weighing system load. Consideration should be given to adding extra capacity to provide for the additional loads caused by the expansion of your system. Make certain this source is independent of other loads (i.e., air conditioning and heating equipment, convenience outlets, lighting, or office equipment, which can cause disturbances). A separate line back to the distribution panel usually provides suitable power. Make certain that a properly sized circuit breaker is installed in this line to safeguard against accidental short circuits.

Table B provides some basic guidelines in the selection of a power-conditioning device, should it be necessary to use one. Remember that this is only a guide and that a qualified technician should be consulted for the determination of the type of device suited to your application. All the types listed are available in various sizes from Cardinal Scale or may be purchased locally.

Table B – Power Conditioning Device

PROVIDES PROTECTION AGAINST				
Type	**Outages**	**Transients**	**Fluctuations**	**Cost**
Uninterruptible Power Supply	✓	✓	✓	High to Moderate
Voltage Regulator		✓	✓	Moderate
Isolation Transformer		✓		Low to Moderate
Line Filters		✓		Low

Voltage

Voltage (steady-state) variations shall not exceed plus (+) 10 percent or minus (-) 15 percent of the nominal value 115V AC (plus or minus 8 percent for 230V AC).

Transient variation (step or slope) changes of plus (+) or minus (-) 20 percent on the nominal value shall exist no longer than 0.1 seconds and occur no more than once every 10 seconds.

Frequency

The equipment is designed to operate at a nominal 50/60 Hertz unless specified otherwise on the equipment nameplate. The steady-state harmonic distortion should be equal to, or less than, 6 percent of the fundamental frequency amplitude.

Grounding

A ground wire must be included with the power conductors (phase or L1 and neutral or L2 wires) in the run from the distribution panel to the weighing system power outlets. The size of the ground wire must comply with The National Electrical Code or local electrical code. The ground conductor must be securely bonded to the building's grounding electrode conductor. Refer to Grounding Installation Instructions for the scale and instrument.

CAUTION! A broken or high resistance safety ground is a potentially lethal situation. Because of line-to-chassis voltage potential, it is possible to receive a shock by touching the equipment if the green wire ground is not intact. Please be sure proper grounding is connected!

AC Neutral

The AC neutral must not be confused with protective (equipment chassis) ground. As a protection for personnel, the protective equipment ground (the green wire in power line wiring) prevents the build-up of dangerous voltages on equipment. It ensures that a short circuit between L1 and the enclosure draws enough current to trip the circuit breaker immediately, rather than raising the voltage on the enclosure to a dangerous level. Do not substitute the neutral wire for the protective ground.

Safety Considerations

Safety must be a consideration in the selection of a location for your weighing system. **DO NOT** locate your system in an area where flammable or explosive materials are stored or processed unless your equipment is furnished in special explosive-proof enclosures. The equipment should be placed where it does not interfere with entry to or exit from the room. Periodic reviews should be made to make certain that the installation remains safe.

Lightning Protection

In areas subject to lightning strikes, certain steps must be taken by the customer to minimize the potential for lightning damage. These steps consist of the installation of lightning arresters as required by Article 280 of The National Electrical Code, the installation of a scale grounding system as described in Grounding Installation Instructions, and other surge arresting devices.

Heating and Cooling

Most standard Cardinal weighing system instrumentations are designed for the office environment. Such an environment is free of excessive dust and moisture and provides a comfortable temperature. In general, weighing equipment will perform well over a temperature range of 14° to 104° F. Some types of instruments and special systems will perform over a much wider range of temperatures.

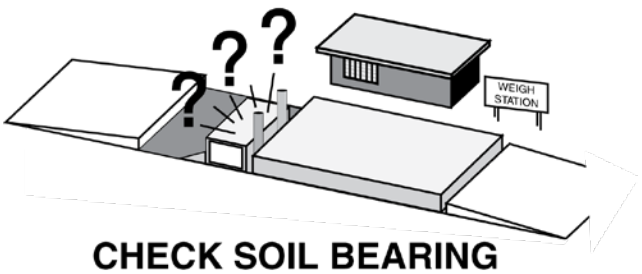
To keep equipment cooling requirements to a minimum, the equipment should be placed out of direct sunlight and in an area where the air is free to flow around all sides of the system enclosure(s). Make certain that the enclosure is not in line with a heating or cooling vent. Such a location will subject the instrument to sudden temperature excursions and may result in an unstable weight reading.

Care should be exercised by providing a relatively dust-free environment for the operation of the printer. Accumulations of dust and dirt within the printer act as abrasives; also, as insulators that reduce the dissipation of heat from internal components. Accumulated dust and dirt can result in premature failure.

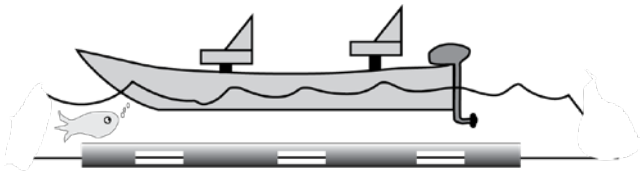
Scale Site

The site selected for installation of the scale should provide easy access, satisfactory soil bearing capacities, adequate drainage, and be within sight of the system operator. Refer to the foundation or pit drawings furnished for soil bearing requirements.

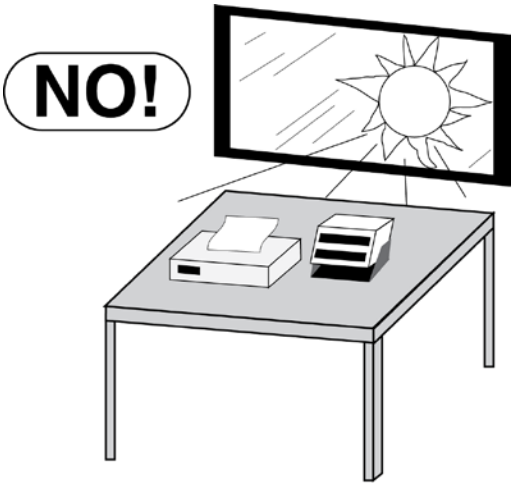
A common source of problems is the accumulation of water under and around the scale. Despite the best waterproofing techniques, prolonged exposure to water will result in erratic weight readings and may permanently damage the scale. In areas subject to water accumulation, an inexpensive alternative is to install a sump pump to remove excess water. Remember that power wiring for the sump pump must be contained in a conduit apart from the load cell conduit and separated from it a minimum of 24 inches.



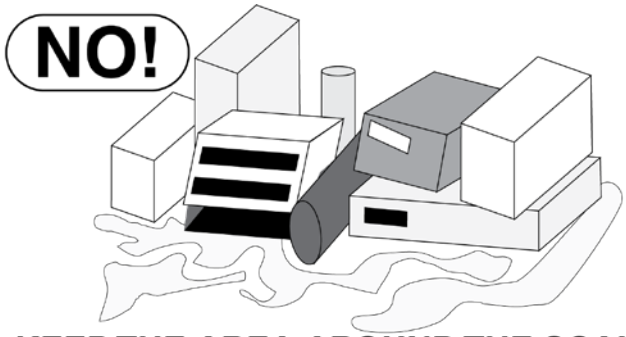
CHECK SOIL BEARING CAPABILITY



PROVIDE ADEQUATE DRAINAGE

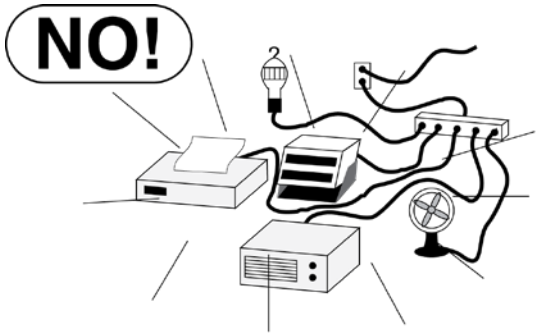


DON'T EXPOSE TO DIRECT SUNLIGHT

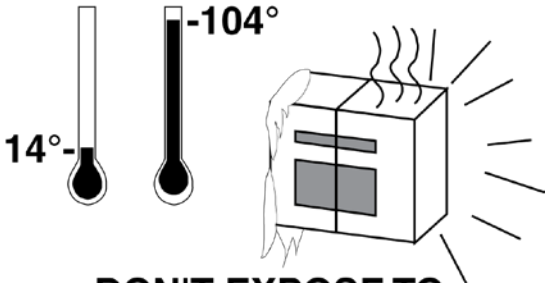


KEEP THE AREA AROUND THE SCALE CLEAR TO PROVIDE ADEQUATE AIR CIRCULATION

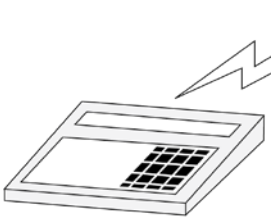
DON'T PLACE IN FRONT OF HEATING/COOLING VENTS



PROVIDE GOOD, SAFE GROUND AND CLEAN AC POWER



DON'T EXPOSE TO TEMPERATURE EXTREMES



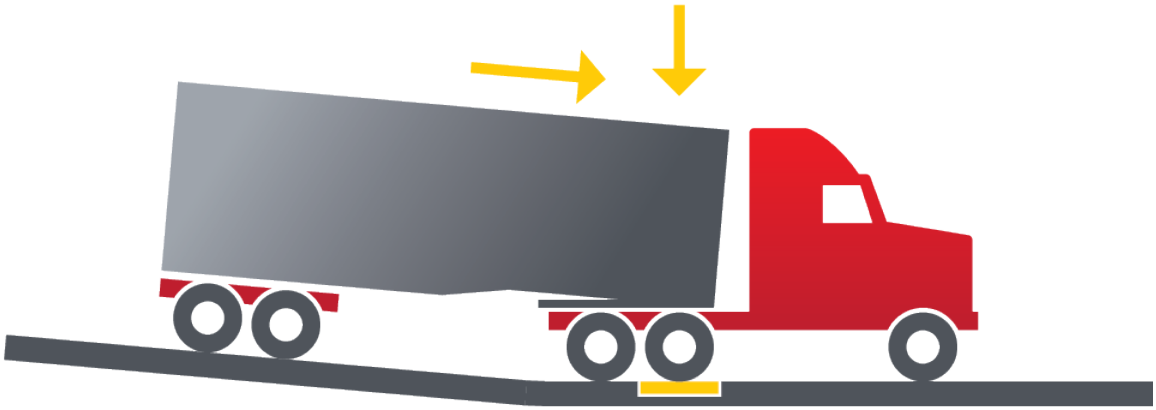
PROVIDE ADEQUATE PROTECTION TO MINIMIZE LIGHTNING DAMAGE

SWIM INSTALLATION SITE REQUIREMENTS

The accuracy of a WIM (Weigh-In-Motion) scale is greatly affected by the approach to the scale. Any vertical movement (bouncing) of the vehicle as it crosses the WIM scale will degrade the accuracy of the scale. For this reason, it is critical that the approach be as smooth as possible, and in accordance with ASTM specifications 1318-09.

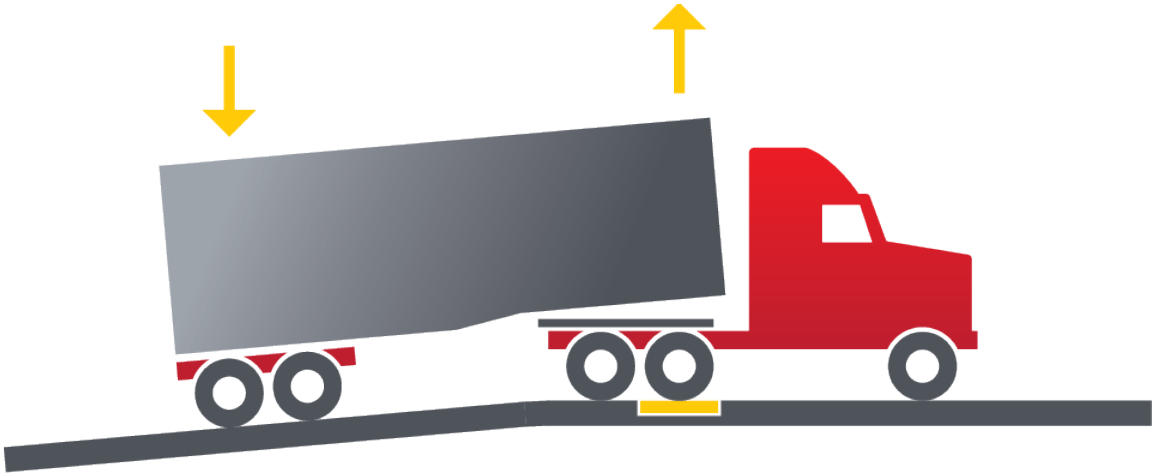
To achieve the highest accuracy, the following conditions should be met:

1. The vehicle needs to approach and exit the scale in a straight line. Turning the vehicle during the weighment should be avoided. A straight approach and exit of 75 feet (23 meters) should be dictated. **NOTE:** The approach and exit may need to be longer for certain vehicles.
2. All effort should be made to avoid conditions that would cause the vehicle to rock, sway, bounce, or have the suspension excited in any way. This requires pavement to be in good condition in advance and beyond the scale.
3. The vehicle should remain on a consistent grade during approach and exit from the scale. This does not mean it has to be level (up to 2% grade is acceptable), but all axles should remain on the same plane during the entire pass. **IMPORTANT!** We strongly recommend you avoid any change in the rising or falling of approaches for 75 feet (23 meters) *or longer for certain vehicles* on either side of the scale. This condition would shift the weight backward or forward onto axles unevenly during the pass.
4. The approach and exit to the scale should be solid, smooth, and in perfect alignment with the height and plane of the weighbridge. Concrete is preferred due to its resistance to rutting or deforming over time as asphalt would. If the site and the user's budget permit, then ideally the approach and exit to the scale would be paved for 75 feet (23 meters) on each side to accommodate the entire length of a tractor-trailer being on a consistent firm and level surface for the entire pass. However, approaches as short as 15 feet (4.6 meters) are acceptable if the transitions onto, and off of, the approaches are maintained and/or the vehicle travels at slower speeds of 1-3 mph (2-5 km/h).
5. The best three ways to improve accuracy are to (**a.**) maintain good approaches to prevent bouncing and/or (**b.**) slow the speed of the vehicle to reduce bouncing. While (**c.**) maintaining a consistent vehicle speed during the weighment pass.
6. Some examples of dynamic forces are illustrated in the following images.



MORE COMPRESSION = MORE LOAD

MORE COMPRESSION = MORE LOAD

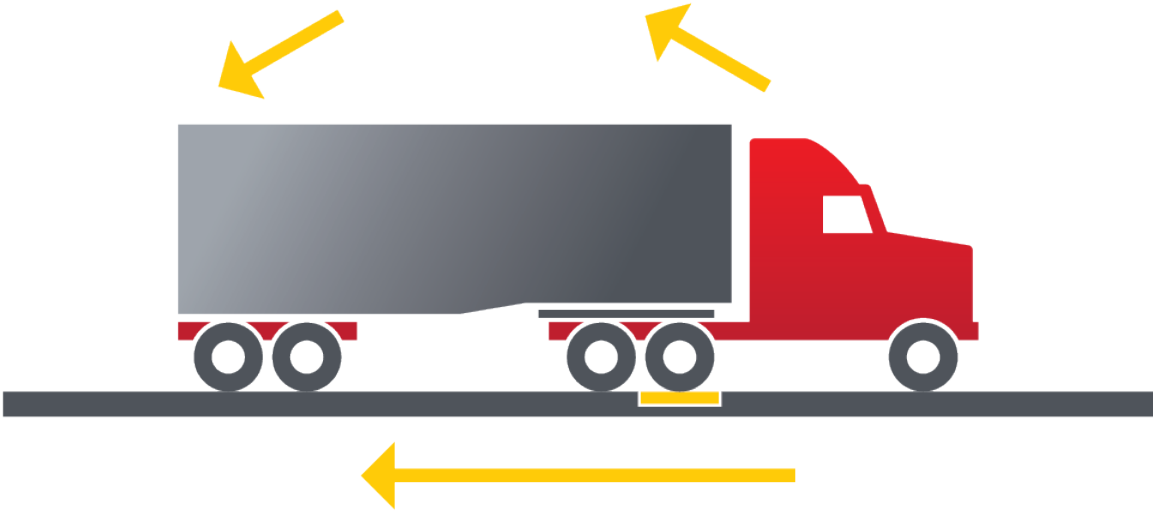


LESS COMPRESSION = LESS LOAD

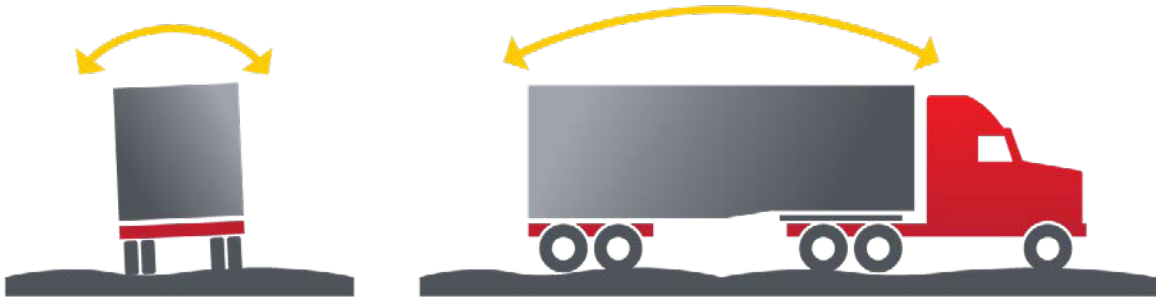
MORE COMPRESSION = MORE LOAD

LESS COMPRESSION = LESS LOAD

BRAKING



ACCELERATING



OSCILLATION = up to 5% ERROR at 6 mph (10 km/h)

MOUNTING FRAME INSTALLATION

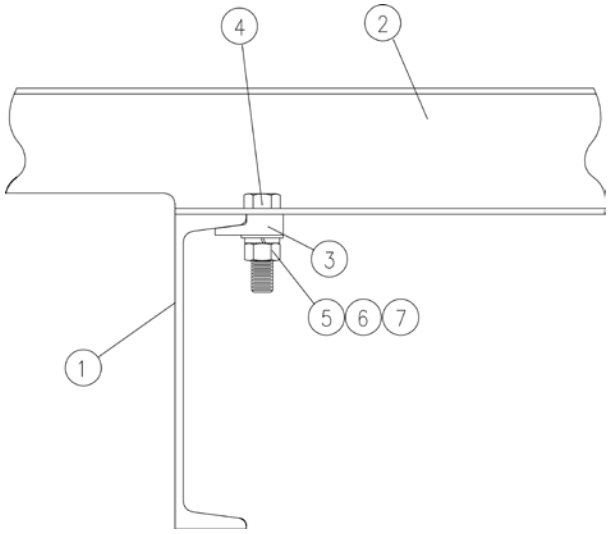
At this point, the pit should be completed as specified on the *certified* Pit Plan Slow-Speed In-Motion Scale drawing. Verify that the following items have been placed in the pit and have been properly located per the *certified* Pit Plan drawing:

- Transmission Cable Conduit
- Drain Pipe

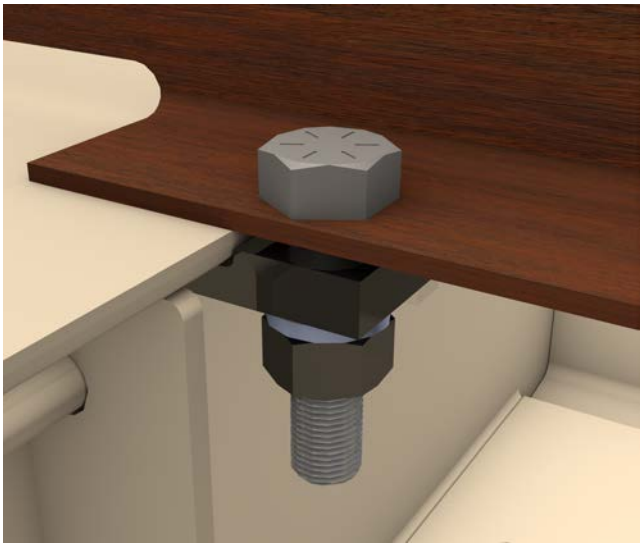
Mounting Frame Installation

Refer to the *certified* Mounting Frame Installation Kit S-WIM Scale drawing for details.

1. Attach the beams (2) to the mounting frame (1) using items beam clip (3), hex head bolt (4), lock washer (5), flat washer (6), and hex nut (7).



Tie Down Detail



Tie Down Installed

MOUNTING FRAME INSTALLATION KIT PARTS

Item	Part No.	Description	Qty.
1	0170-0106-0A	MOUNTING FRAME	REF
2	0170-0137-08	BEAM	4
3	0170-0138-08	BEAM CLIP	8
4	6007-0372	HEX HEAD BOLT, 1-8UNC-2A X 4”	8
5	6024-0060	LOCK WASHER, 1”	8
6	6024-0027	FLAT WASHER, 1”	8
7	6013-0165	HEX NUT, 1-8UNC-2B	8

2. Set the frame and beam assembly into the pit.

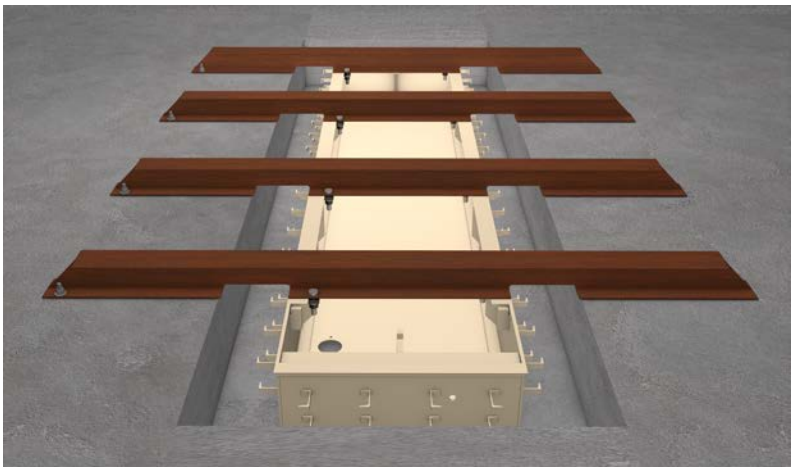
3. The top of the frame must be on the same plane as the roadway.

4. All load cell mounts must be within 1/16 inch of the same plane.

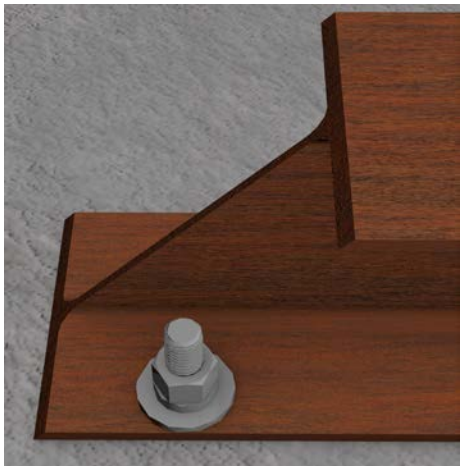
5. After the frame is positioned, drill and set the expansion anchors at the ends of the beams.

NOTE: ***The expansion anchors are not included in the installation kit*****.**

6. Attach the beams to the roadway using the expansion anchors.

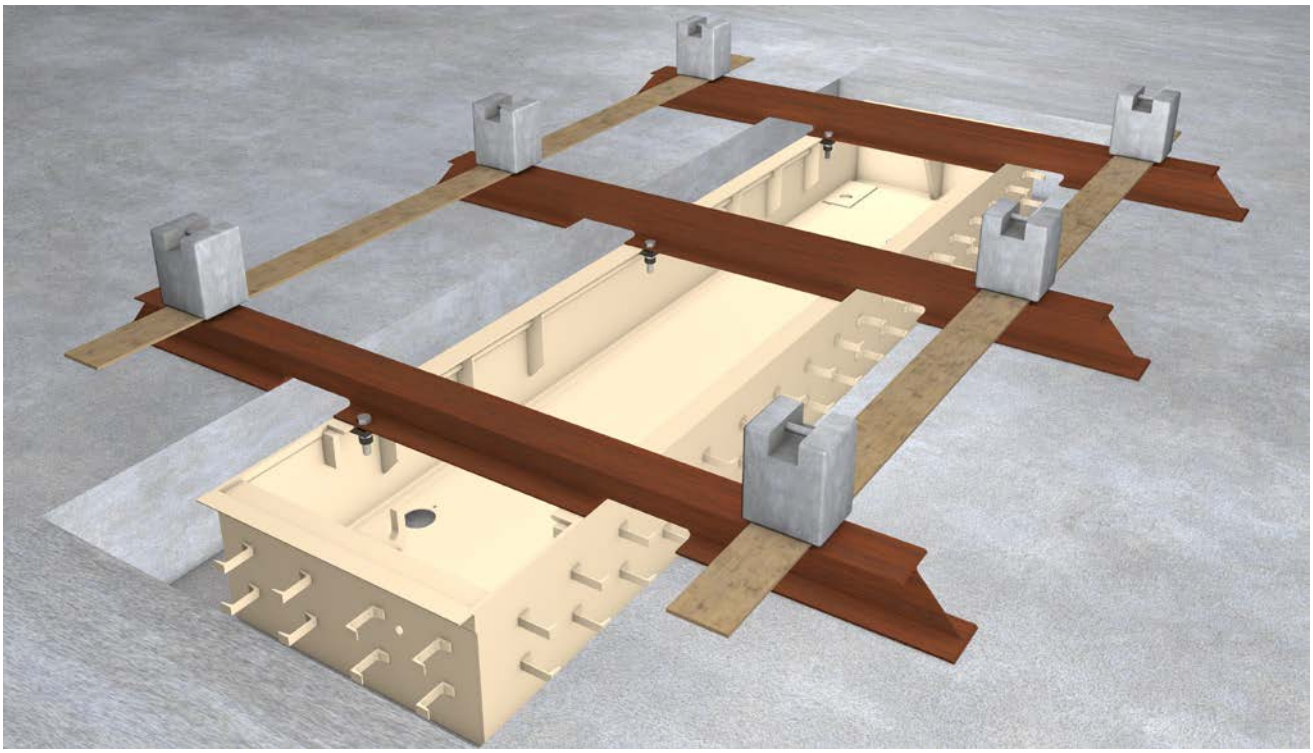


Set the frame assembly in the pit. Ensure the top of the frame is at the same elevation as the roadway.



Secure the beams with the expansion anchors.

7. Alternatively, for a cleaner and less labor-intensive method, weights can be placed on the ends of the beams to hold them down.



Alternatively, weights can be placed on the ends of the beams to hold them down.

IMPORTANT! There is a 5000 lb upward float force of the lower frame in the wet/vibrated cement. To ensure the lower frame is held down while the concrete cures, 6000 lb of evenly distributed weight is required.

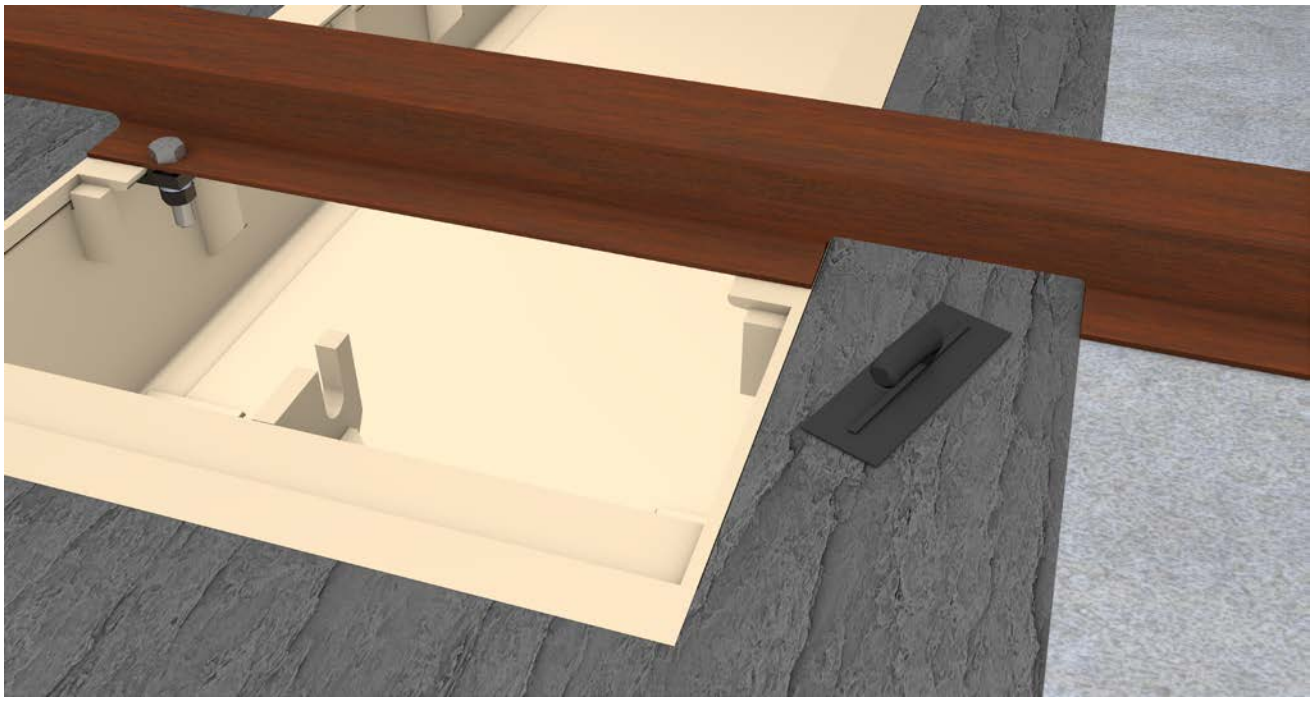
8. Connect the drainpipe to the bottom pan.

9. When the concrete is placed, it must be vibrated to ensure that no voids are left under or around the frames.

Connect the drainpipe to the bottom pan.

Vibrate the concrete to ensure that there are no voids under and around the frame.

10. After the concrete is poured, it should be finished smooth, without bumps or dips in the transition on and off the weighbridge. The wheels (tires) must have a smooth level approach on and off the scale.



Trowel the concrete to provide a smooth, level approach on and off the weighbridge.

11. When the concrete is set, remove the beams. If the expansion anchors were used, trim them flush with the roadway surface.

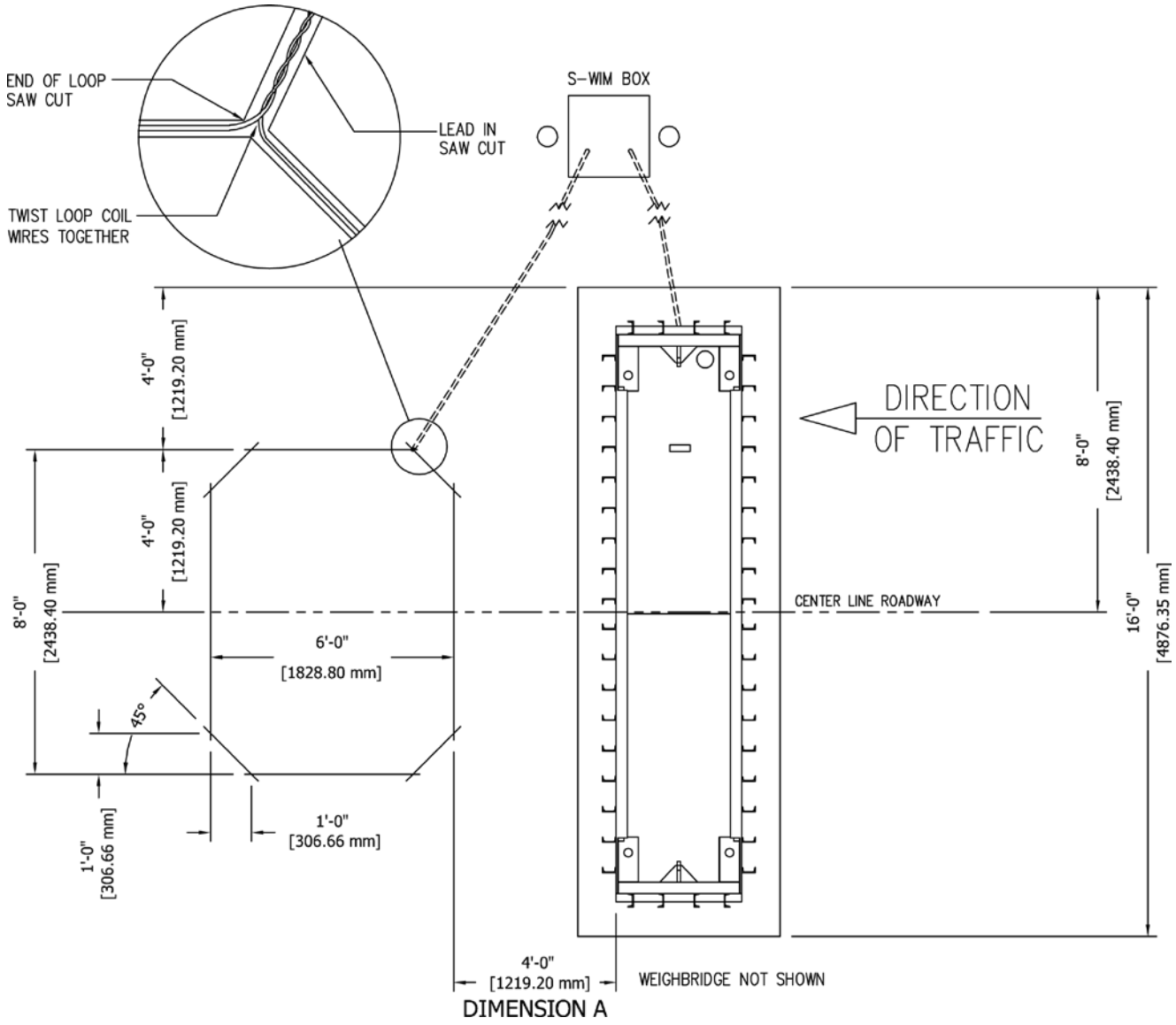
LOOP COIL INSTALLATION

Refer to the *certified* Loop Coil Installation Instructions drawing for details.

1. Layout the loop profile on the pavement before saw cutting the slots.

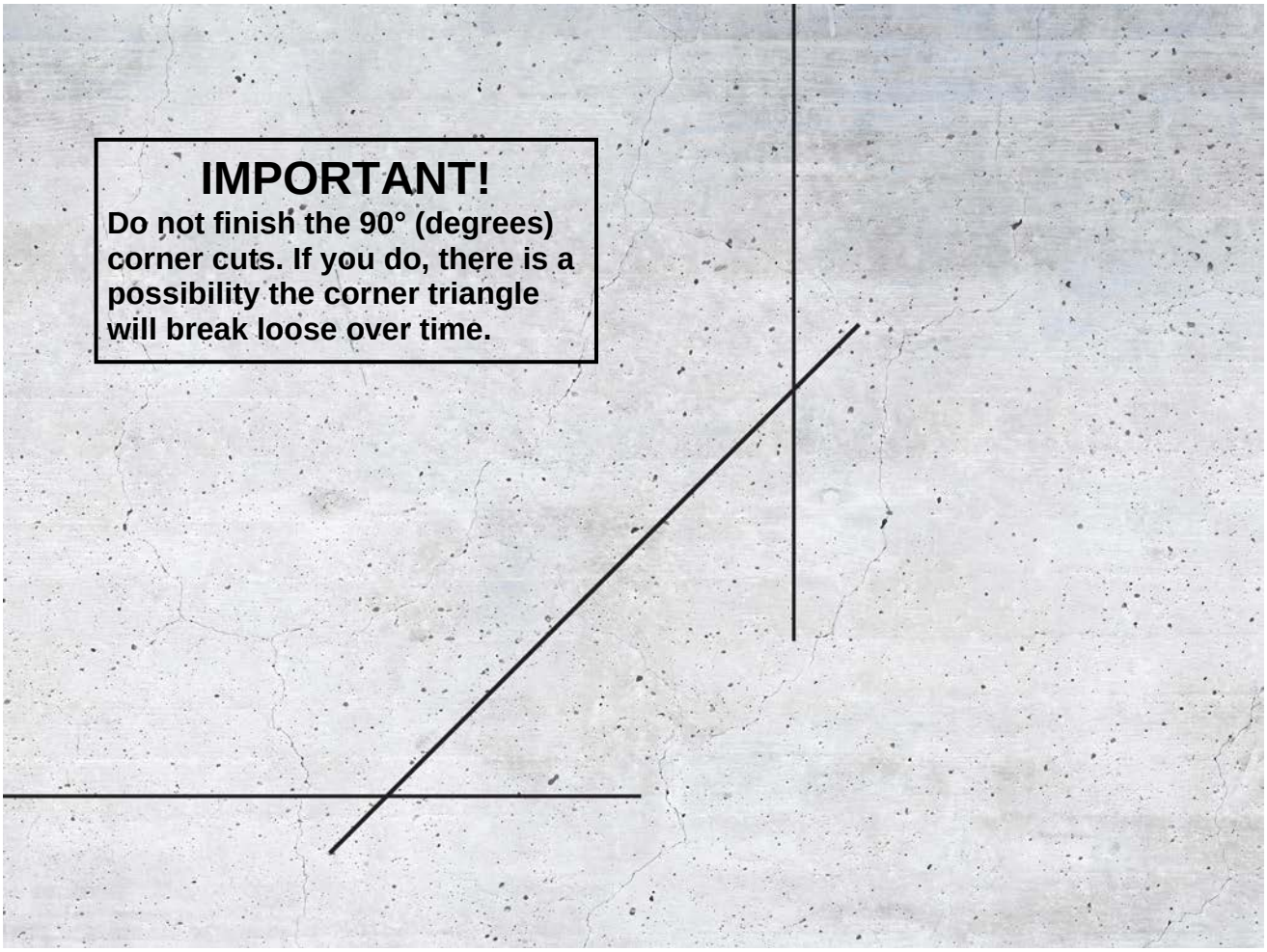
2. Be sure there is the proper distance from the loop to the scale. Refer to DIMENSION A.

3. Center the loop layout on the centerline of the scale as shown.



Loop Coil Installation Diagram

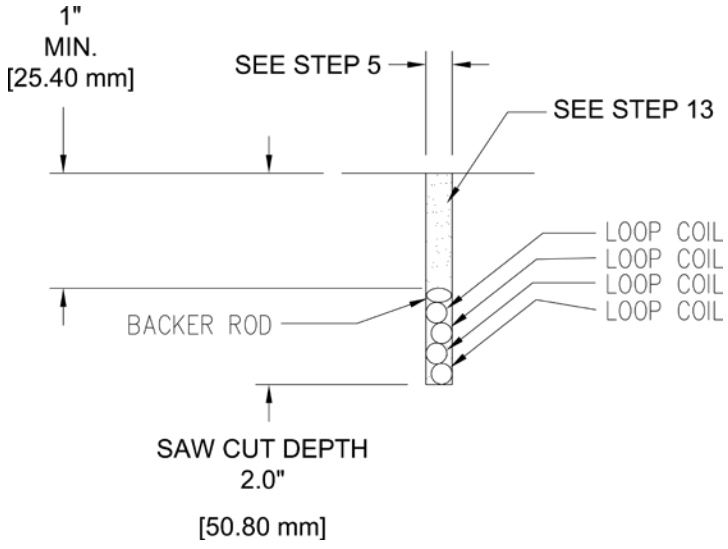
4. Note the 45° (degrees) saw cuts at each corner. This is to reduce the bend in the coil to make the loop coil turn or change in a direction less sharp. Do not finish the 90° (degrees) corner cuts. If you do, there is a possibility the corner triangle will break loose over time.



Make 45° degree saw cuts at each corner to reduce the bend in the loop coil.

5. Set the saw cut depth to insure a minimum 1" distance from the top of the loop coil wire to the pavement surface. Cardinal Scale recommends a 2" saw cut depth for most applications. The saw cut width should be larger than the loop wire diameter to avoid damage to the loop wire insulation when installing the wires in the slots.

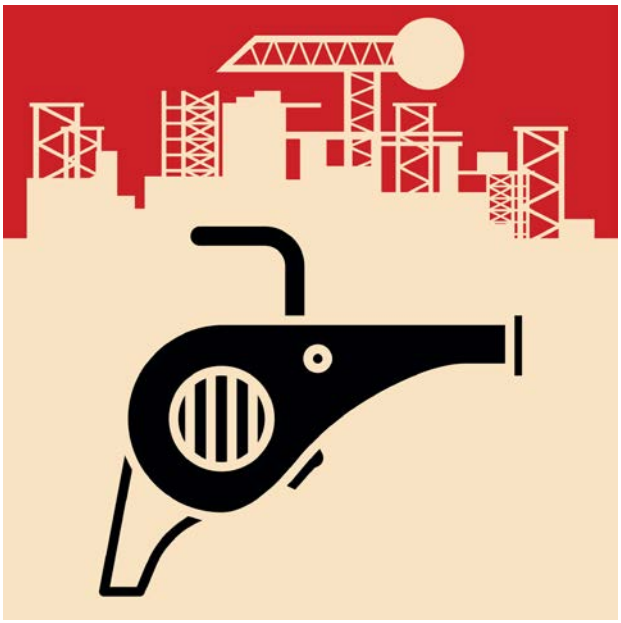
NOTE: Cardinal Scale recommends a 1/4” concrete blade. This will make the wire installation easier and allow the sealant to flow into the cut better and encase the wires without any trapped air bubbles.



Loop Coil Saw Cut Dimensions Diagram

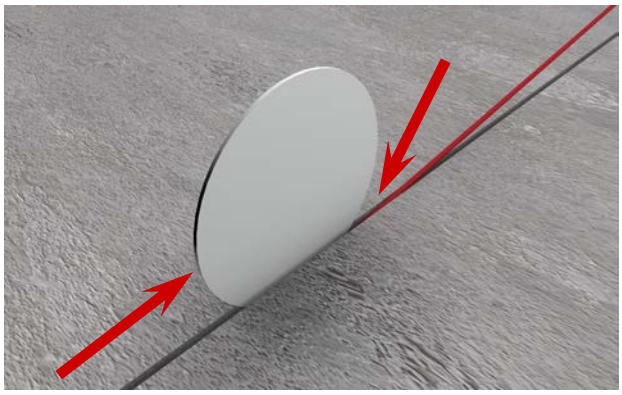
6. Cut the saw slots. After the slots have been cut, inspect the slots for sharp edges that may cause damage or abrasion to the loop coil. Remove all sharp edges if present.
7. Use compressed air or a high-speed blower to clear out any debris that may be in slots.

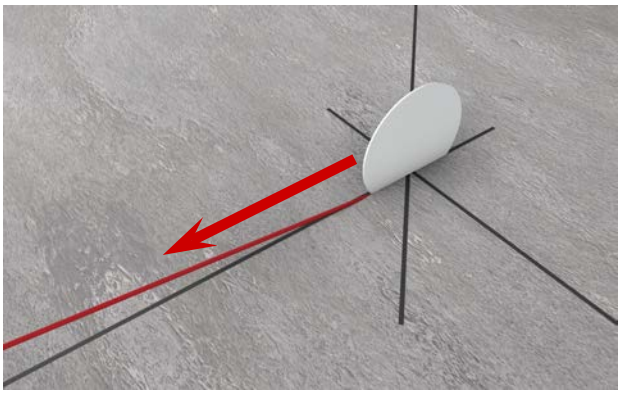
To ensure a minimum 1" distance from the top of the loop coil wire to the pavement surface, set the saw cut depth to 2".



Before installing loop coil wires, blow out any debris that may be in the slots.

8. Install the supplied loop coil wire (P/N 6980-2051) using a roller or non-sharp wood stick to place it at the bottom of the saw cut slots.



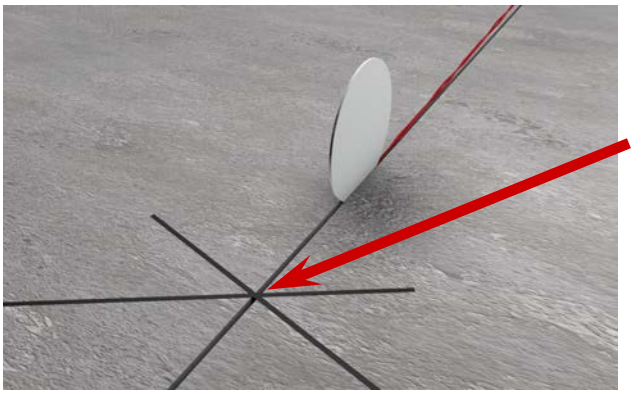


Use a roller or non-sharp wood stick to place the loop coil wire at the bottom of the slots.

IMPORTANT! To avoid damaging the loop coil wire, do not use sharp objects when installing the loop coil wire in the saw cut slots.

9. Place the loop coil wire in the cut-out slots around the entire perimeter of the entire loop. Go around the entire perimeter four times, making four full turns to stop where the loop coil started (at the lead-in slot). Note that each turn of the loop wire must lay flat on top of the previously placed turn of wire.

10. Twist the loop coil wires together. Begin the twist at the end of the saw cut of the loop and twist back to the loop detector. Twist them together with a minimum of six twists per foot.



Use the roller or non-sharp wood stick used earlier to place twisted loop coil wires in the bottom of the slot.

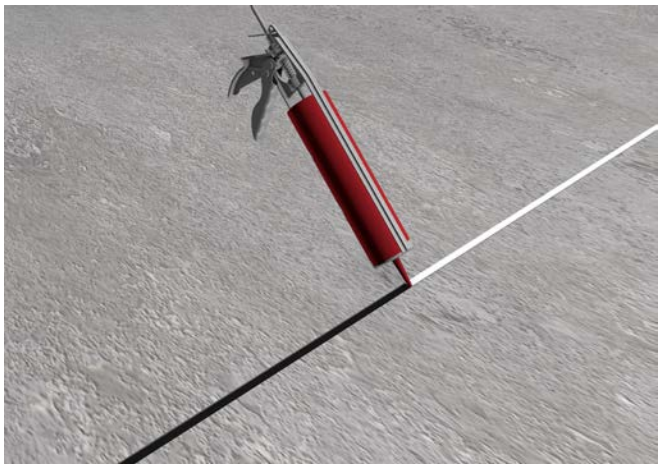
Twist the loop coil wires together a minimum of *six twists* per foot.

Begin at the end of the lead-in slot and twist the loop coil wires together back towards the loop.

11. Cardinal Scale Mfg. Co. recommends using a liquid-tight flex conduit to help protect the loop coil wire and to make the connection to the S-WIM trim board box (8300-0131-0A). Consult local codes regarding the depth of buried wires and/or conduit.

12. To hold the loop coil wires in place and prevent them from floating up to the pavement surface after the sealant has been applied, place a 1" length backer rod in the slots on top of the wire, every 1 to 2 feet around the perimeter of the loop.

13. Fill the slots with sealant. Refer to construction code and/or governing authority requirements regarding what type of sealant to use. For all other loop installations Cardinal Scale recommends using Vulkem® 45 SSL, Cardinal part number (6560-1139), 3 required, or Durant® Stat-A-Flex, Cardinal part number (6560-1128), 2 required. The approximate volume for filling the saw cut of the loop with sealant is 154 cubic inches. The volume for the loop lead in the saw cut area will vary per site application. Allow for the proper amount of sealant cure time according to the sealant manufacturers' specifications.



Fill the slots with sealant. Vulkem® 45 SSL or Durant® Stat-A-Flex is recommended.

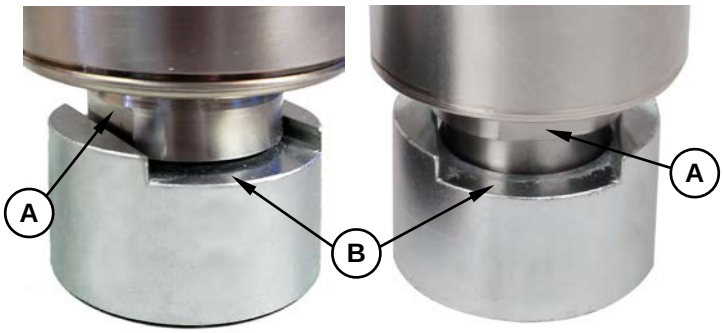
14. Refer to drawing 3502-0669-02 for a complete interconnection diagram.

INSTALLING THE LOAD CELLS

1. Verify that the recess in the lower locating plate is clean and free of dirt and debris.

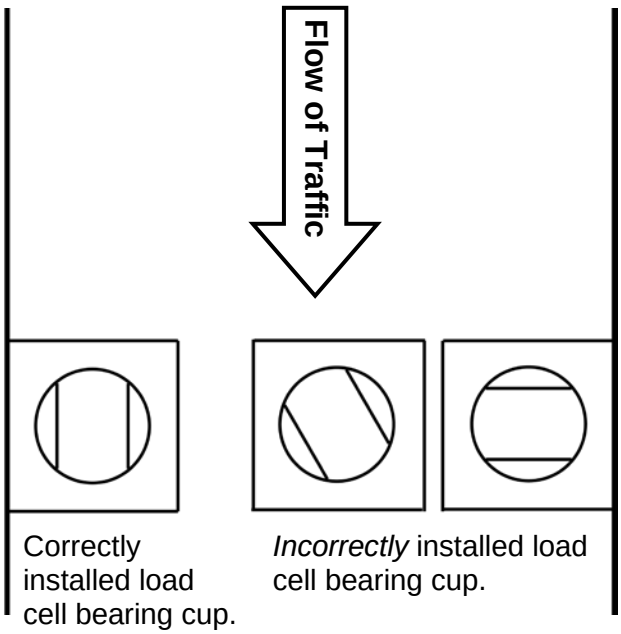
2. Place the load cells in the lower locating plate, following these guidelines:

- Turn the load cells so that the load cell cable is facing the ends of the pit frame.
- Ensure the flat surface (A) of the load cell is aligned with the notch (B) in the load cell bearing cup.
- Make sure you place the load cell bearing cup with the notch in the lower locating plate.
- Additionally, the load cell must be correctly oriented in the scale. The notch in the load cell bearing cup must be placed in the lower locating plate in the direction of longitudinal scale movement (with the flow of traffic).



Flat surface (**A**) of load cell correctly installed in notch (**B**) of load cell bearing cup.

Flat surface (**A**) of load cell *incorrectly* installed in notch (**B**) of load cell bearing cup.



Correctly installed load cell bearing cup.

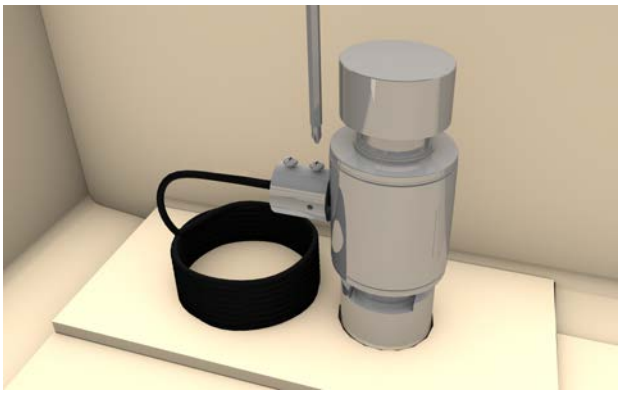
Incorrectly installed load cell bearing cup.

WARNING! Failure to install the load cell correctly in the load cell bearing cup, and the notched load cell bearing cup properly oriented in the lower locating plate will result in damage to the load cell and void the warranty!

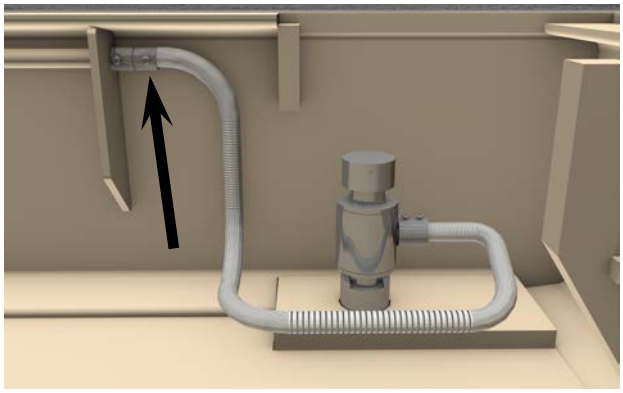
NOTE: The load cell bearing cups are provided with O-ring seals to ensure the cleanliness of the bearing surfaces, and that the bearing buttons are properly centered on the bearing surface. Should the cups become separated from the cells, first lubricate the O-ring, and then using a small wire to break the air seal on the O-ring, press the load cell bearing button back into the load cell bearing cup, and then remove the wire.

3. Install the fittings and flex conduit over the load cell cables, and then run the load cell cables through the conduit installed in the frame.

4. Connect the flex conduit covering the load cell cables to the conduit in the frame.



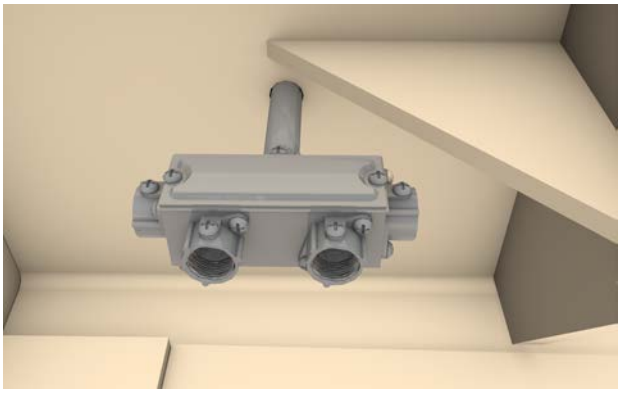
Install the fittings and flex conduit over the load cell cables.



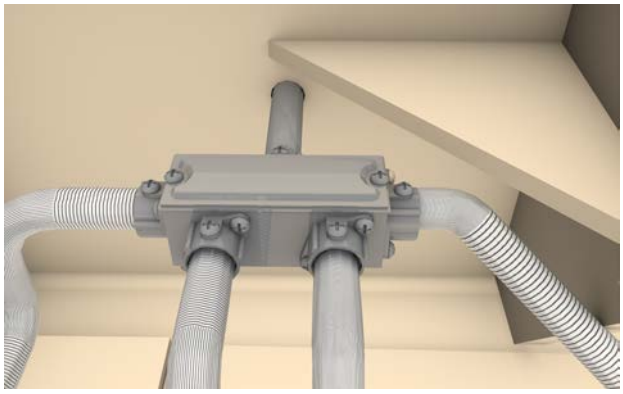
Connect the flex conduit from the load cells to the frame conduit.

5. Install the access port hub to the *customer-supplied conduit* at the end of the weighbridge mounting frame.

6. Connect the flex conduit from both frame conduits and the two load cells near the access port hub to the access port hub.



Install the access port hub to the *customer supplied* conduit in the frame.



Connect the flex conduits from the frame and the load cells to the access port hub.

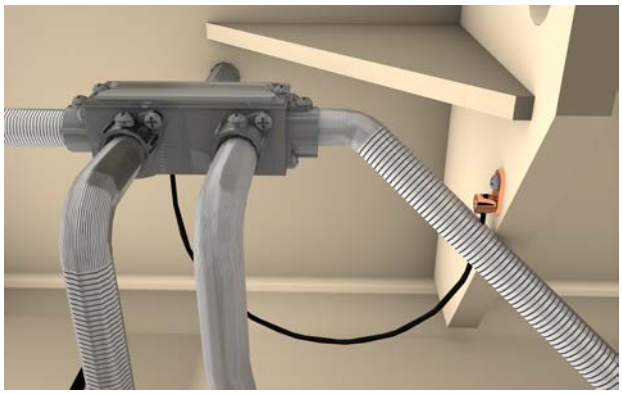
View of the access port hub with the flex conduits from the frame and the load cells connected.

GROUNDING INSTALLATION INSTRUCTIONS

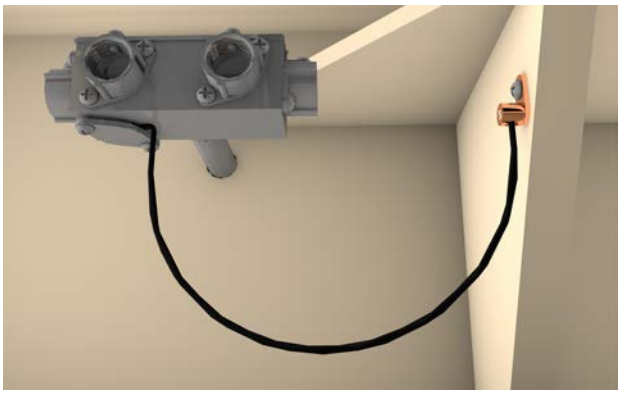
Grounding the Mounting Frame

1. Remove the paint around the small threaded hole on the center check bracket to provide a good ground connection under the grounding lug.
2. Attach the grounding lug to the center check bracket with the included 1/4”-20 x 5/8 hex head bolt.
3. Included with the scale is 4 feet of 10GA green ground wire. Using approximately half (2 feet) of the wire, connect a ground wire from the access port hub cover screw to the grounding lug on the center check bracket.

To provide a good ground connection, remove the paint around the small threaded hole before installing the lug.



Attach the 2 feet of the included 10GA green ground wire to the grounding lug and the access port hub.

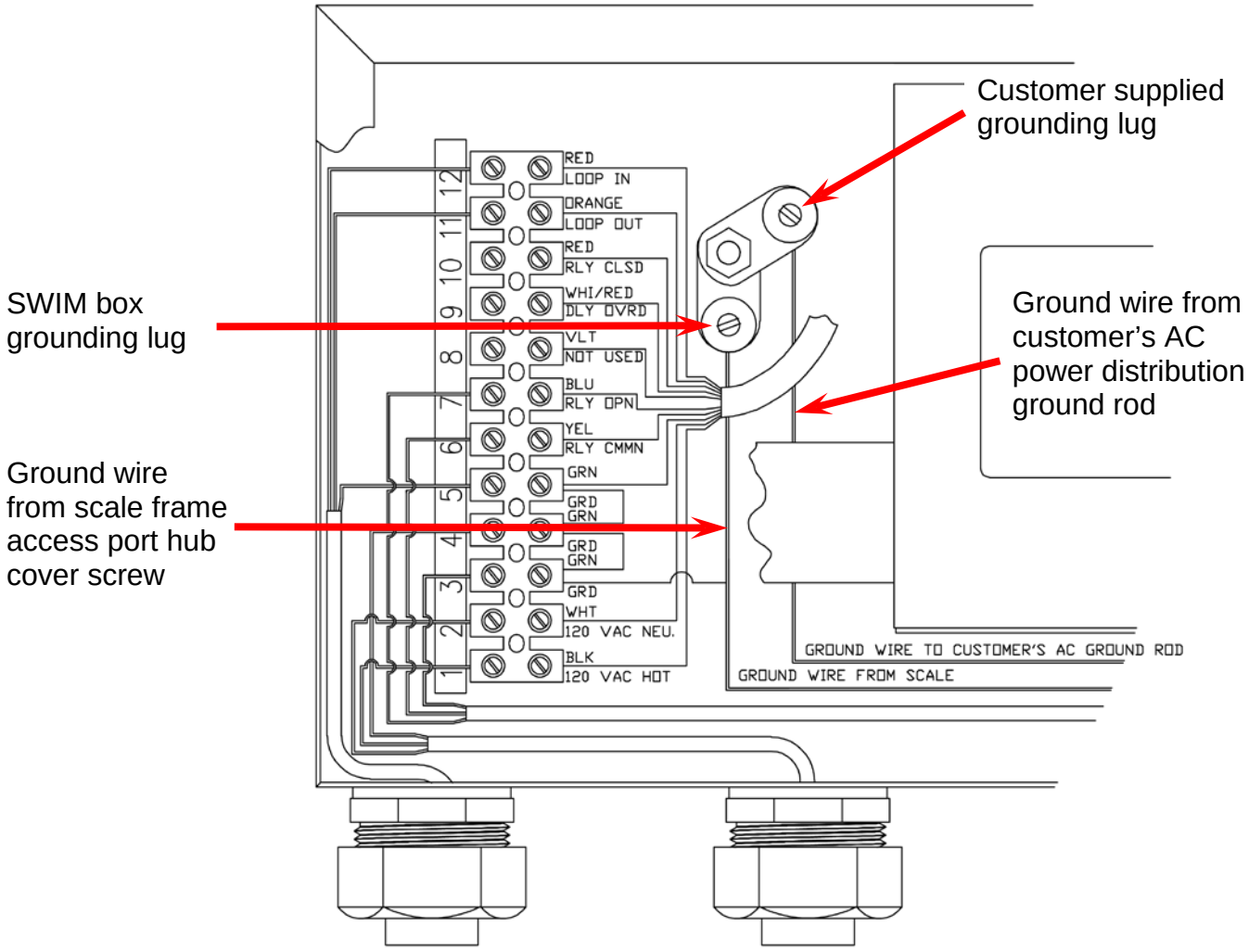


Ground wire connection is shown without flex conduit for visual clarity.

Grounding the Scale Frame and SWIM Box

1. Attach a ground wire (#10 AWG minimum insulated wire, customer supplied) to an access port hub cover screw.
2. Pull the ground wire to the SWIM box along with the load cell cables.
3. Attach the ground wire from the scale frame access port hub cover screw to the grounding lug in the SWIM box.
4. Connect a ground wire (#10 AWG minimum size wire, customer supplied) to a customer-supplied grounding lug in the SWIM box to the customer's AC power distribution ground rod.
5. After installation of all the grounding cables, verify continuity between all conductive scale components and the ground rod.

SWIM Box Scale Ground and AC Power Ground Connections

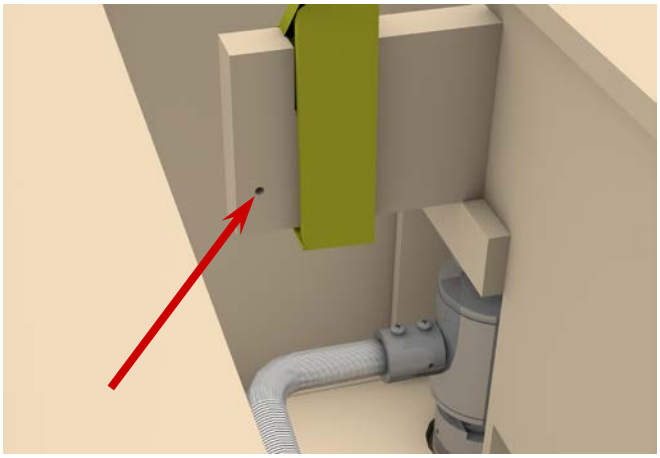


Connect the ground wire from the scale frame access port hub cover screw to the grounding lug in the SWIM box.

Connect a customer-supplied ground wire to a customer-supplied ground lug in the SWIM box to the customer's AC power distribution ground rod.

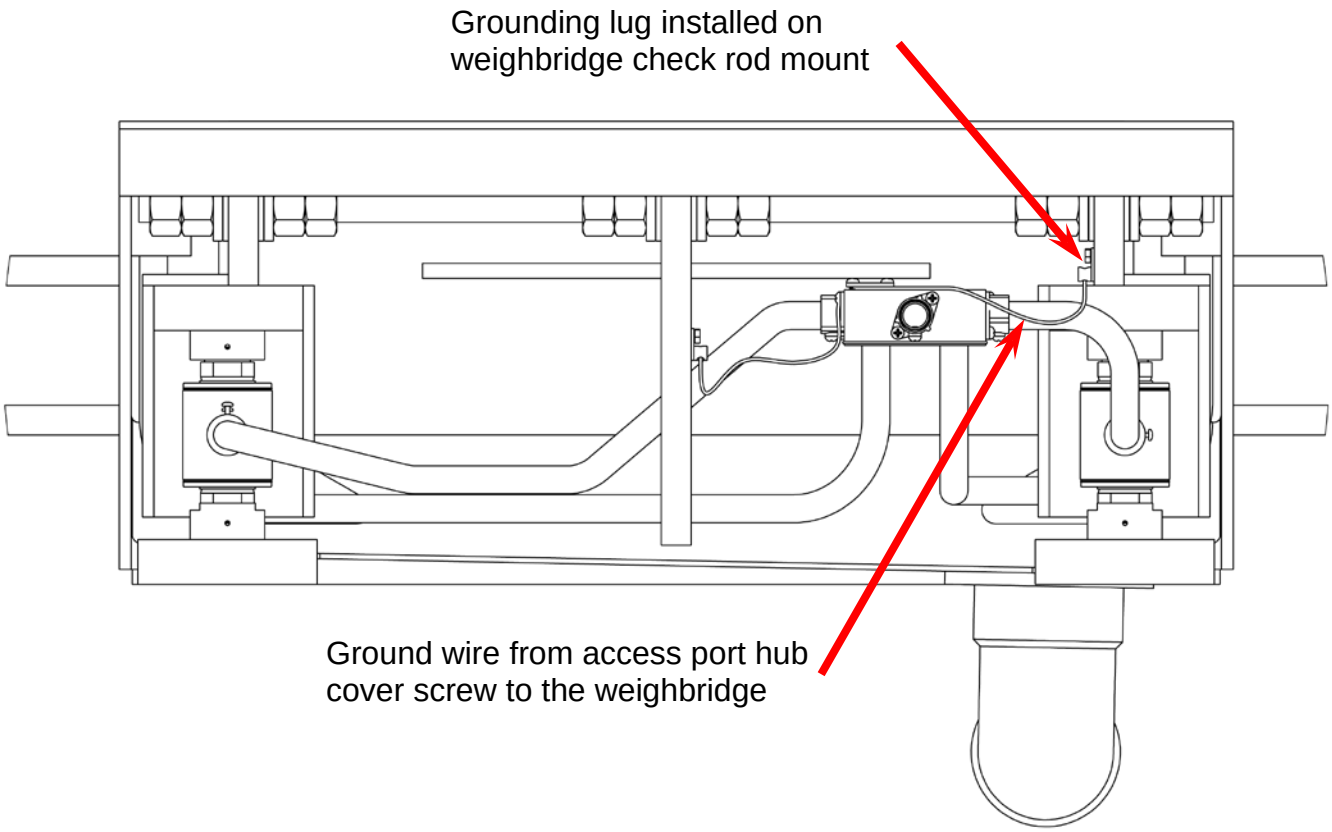
Grounding the Weighbridge to the Scale Frame

1. Remove the paint around the small threaded hole on the weighbridge check rod mount to provide a good ground connection under the grounding lug.
2. Attach the grounding lug to the weighbridge check rod mount with the included 1/4”-20 x 5/8 hex head bolt.
3. After the weighbridge has been installed, connect the remaining half (approximately 2 feet) of the included 10GA green ground wire to the grounding lug on the weighbridge check rod mount.
4. Connect the other end of the ground wire to another access port hub cover screw.



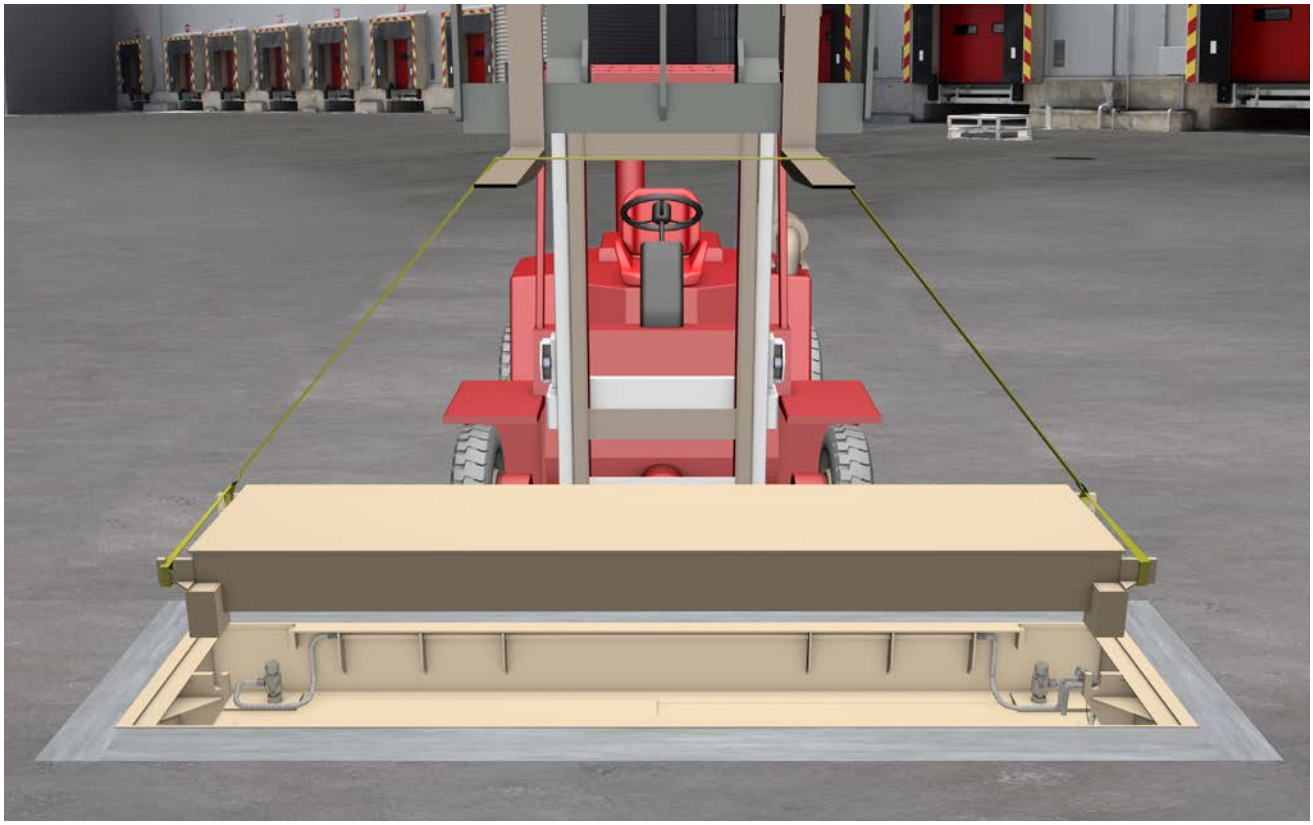
To provide a good ground connection, remove the paint around the small threaded hole before installing the lug.

Weighbridge Grounding Lug Location and Ground Wire Connection

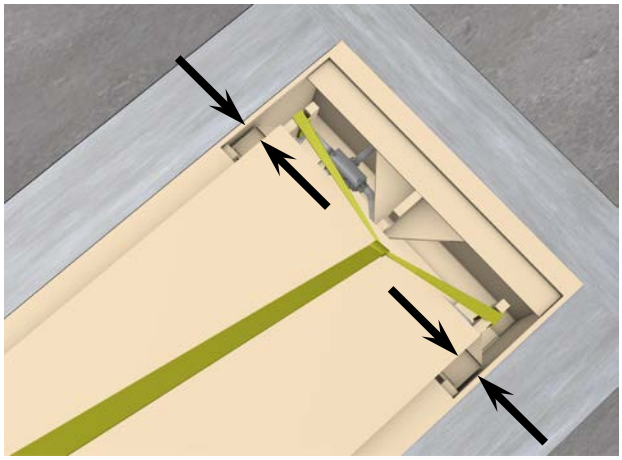


WEIGHBRIDGE INSTALLATION

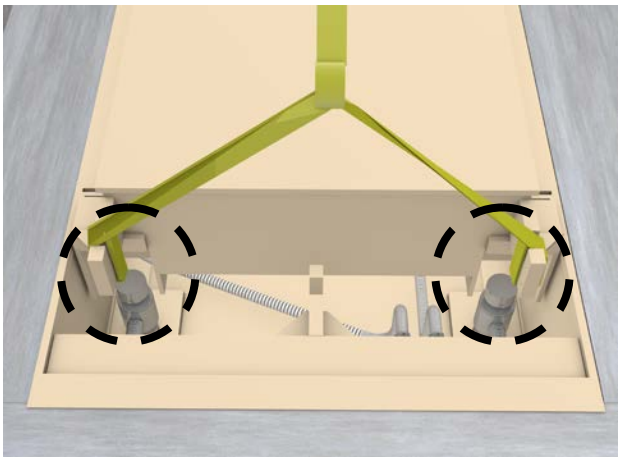
1. Lower the weighbridge into the mounting frame, ensuring that it is centered in the mounting frame opening and that the recesses in the weighbridge are aligned with the load cells.



Lower the weighbridge into the mounting frame.

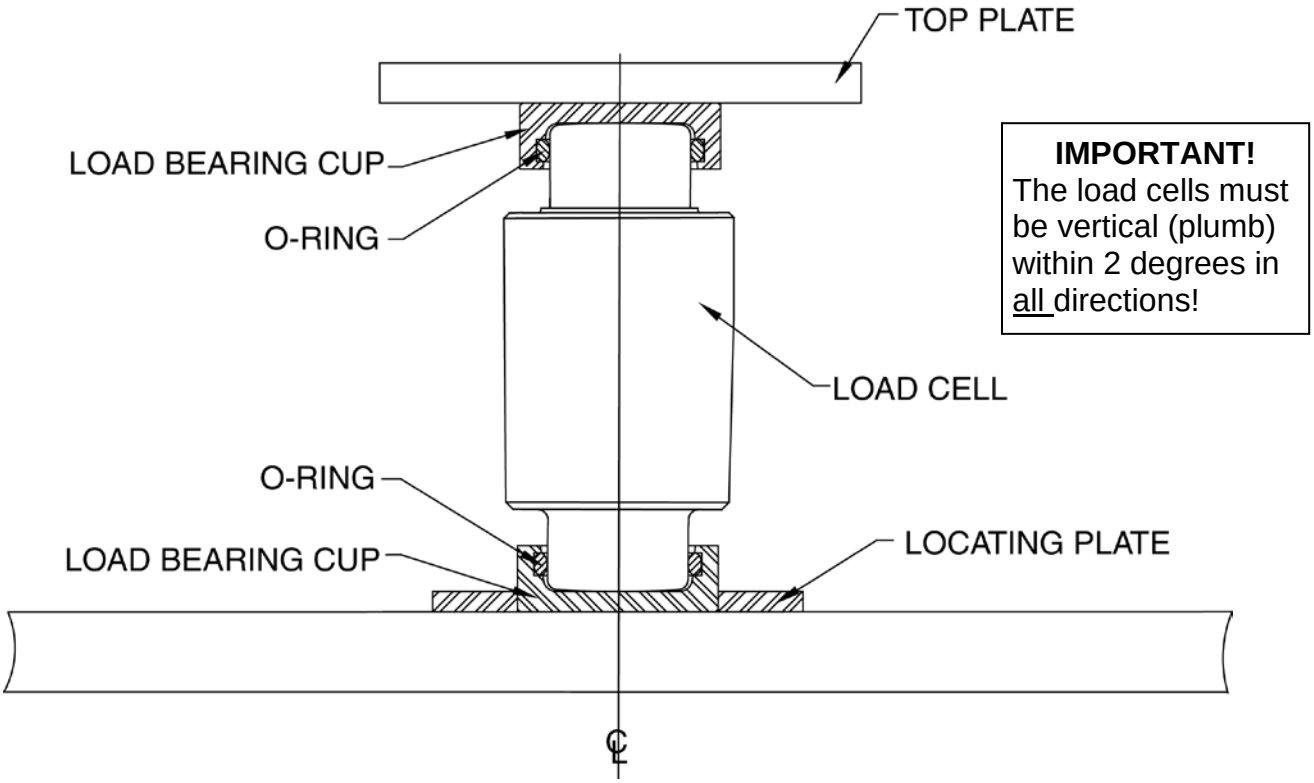


Ensure the weighbridge is centered in the mounting frame opening.



Verify the recesses at the end of the weighbridge are aligned with the load cells.

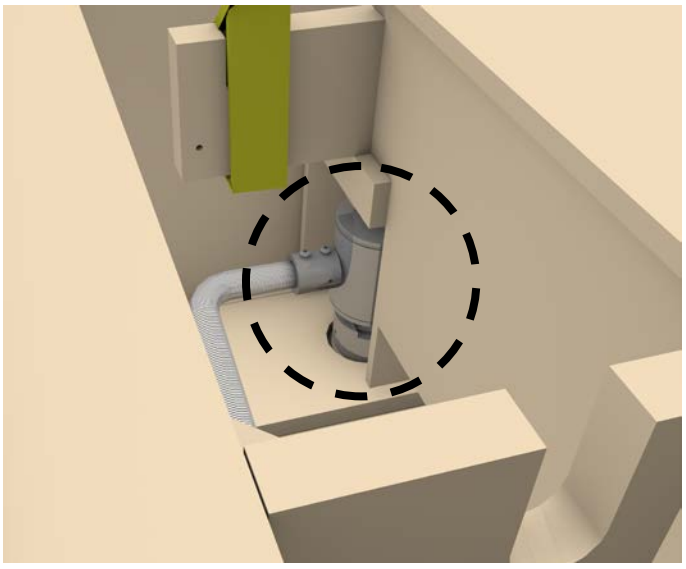
2. Verify that the load cell bearing cup is seated on the top plate and that the load cell is plumb (within 2 degrees in all directions).



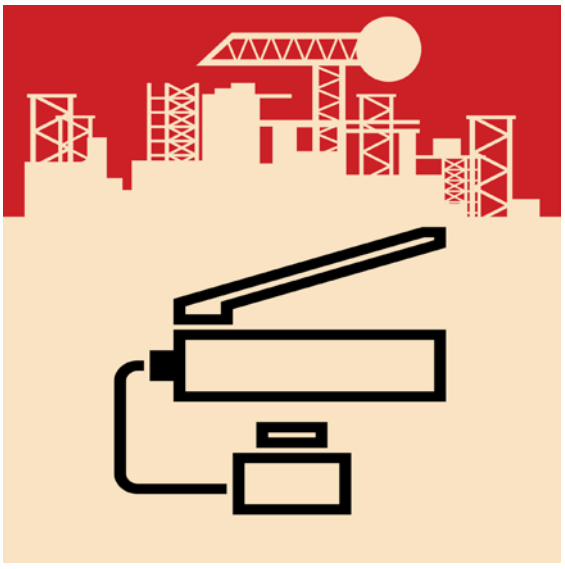
IMPORTANT!
The load cells must be vertical (plumb) within 2 degrees in all directions!

Load Cell and Bearing Cup Detail

WARNING! Failure to install the load cell correctly in the load cell bearing cup, and the notched load cell bearing cup properly oriented in the lower locating plate will result in damage to the load cell and void the warranty!



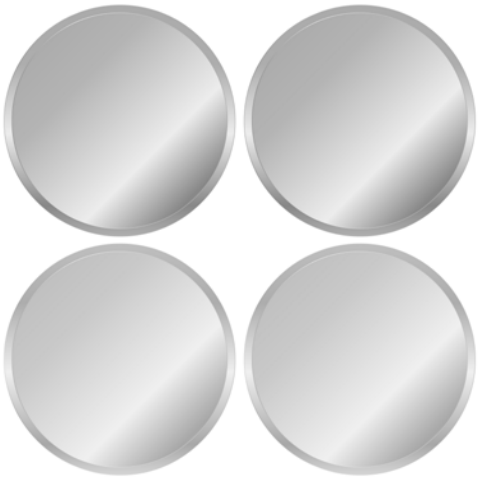
Ensure the load cell is plumb (within 2 degrees in all directions) after lowering the weighbridge.

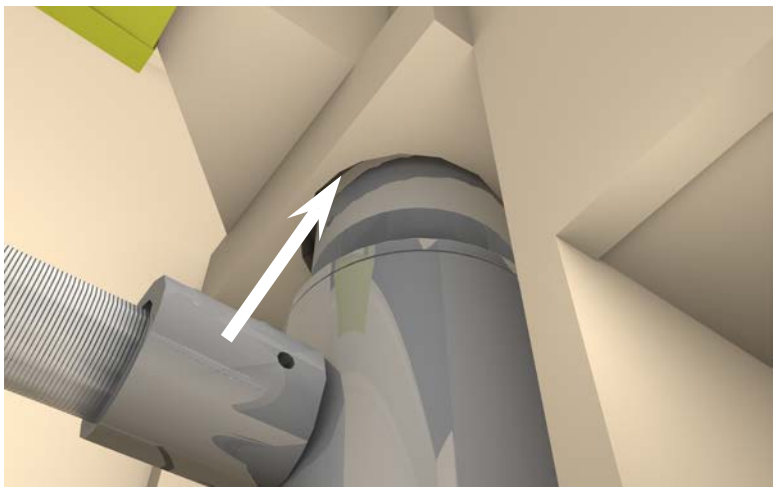


If a load cell is not plumb, raise the weighbridge with a hydraulic jack to reposition the load cell.

3. When all load cells are in place, verify that the scale weighbridge is properly located laterally and longitudinally. Verify that all load cells are vertical (plumb, within 2 degrees in all directions). If any are not plumb, use a hydraulic jack to raise the scale at that cell, and reposition the cell. Care should be exercised to ensure that when the process is complete, all load cells are still vertical (plumb).

4. After repositioning the load cells and verifying they are in place and vertical (plumb, within 2 degrees in all directions), ensure that the weighbridge is seated on each load cell and not rocking. If necessary, install one or more of the included shims* between the load bearing cup and the weighbridge.





If the weighbridge is rocking on the load cells, install one or more of the included shims* between the load bearing cup and the weighbridge.

5. Next, verify that each load cell is taking its share of the dead load of the scale. This can best be done by measuring the output voltage of each load cell using a 3 1/2-digit DVM. If necessary, install one or more shims between the upper loading bearing cup and weighbridge.

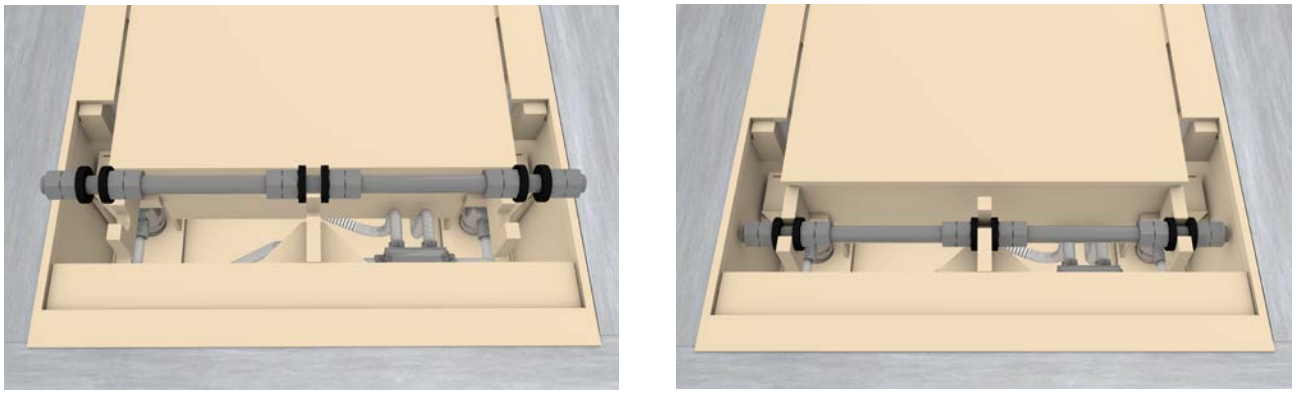
NOTE: Refer to the TROUBLESHOOTING section of this manual for additional instructions on checking load cell output and installing shims.

* Two 16 GA (CPN: 0170-0147-08) and two 11 GA (CPN: 0170-0148-08) shims are included in the packing kit box.

CHECK ROD INSTALLATION

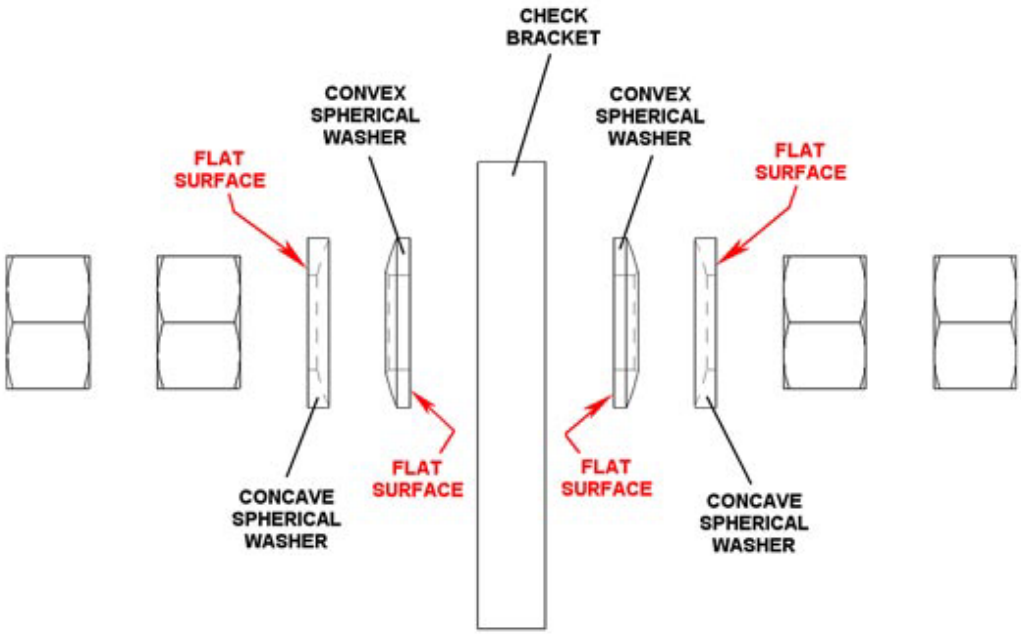
Now install the check rods and make sure they are parallel with the deck. If there are minor differences in the edge gap from one side of the scale to the other, adjust the position of the spherical washers and nuts on both sides of the center checking bracket to even the edge gap.

1. Begin by loosely assembling all the components in their respective places, including positioning the check rod in the brackets. It is recommended to use commercial-grade waterproof grease between the spherical washers to help reduce friction.



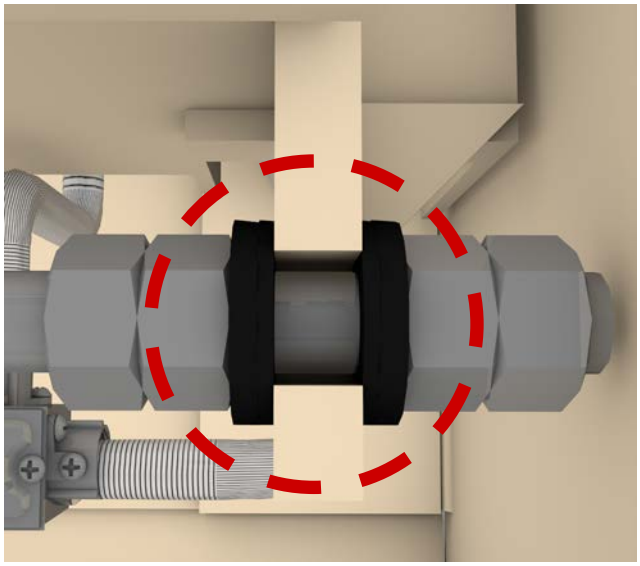
Loosely assemble the components on the check rod and then install the check rod in the check brackets.

2. The checking system uses pairs of spherical washers on each side of the check brackets; the order of assembly and orientation of these washers is important. See the figure below for the proper placement and orientation of the spherical washers; the assembly order of the washers is the same for all check brackets. Note the orientation of each washer with respect to its flat side.

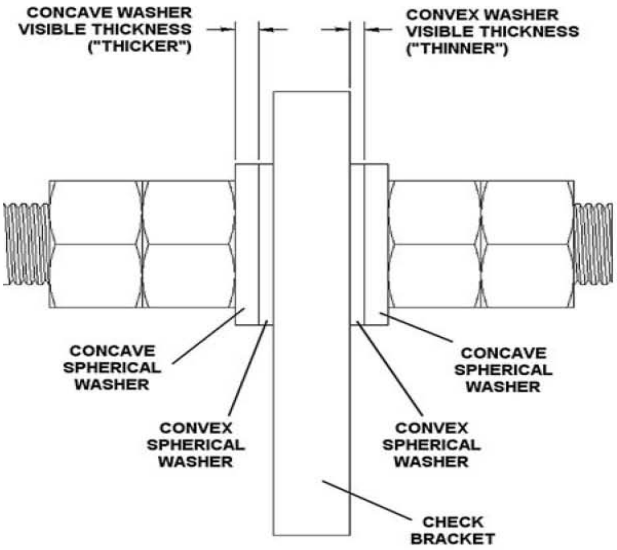


Proper Placement of Spherical Washers

3. For a visual confirmation of the washer locations after assembly, refer to the illustration and detailed figure below. You'll notice that there is a distinct difference in the visible amounts of each washer type (concave and convex), giving rise to the appearance of different thicknesses of each washer after assembly. The "thinner" washers should be against the check bracket.



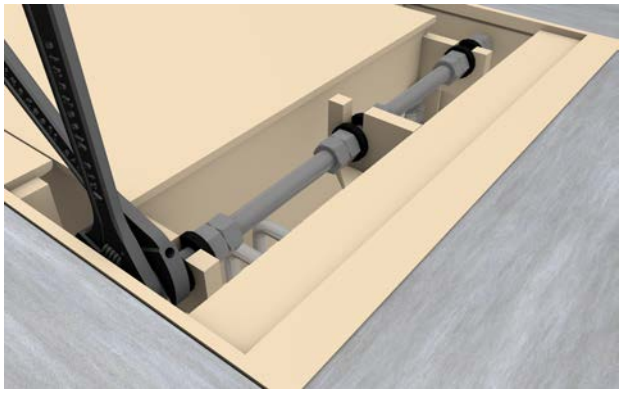
Visual Confirmation of Washer Location

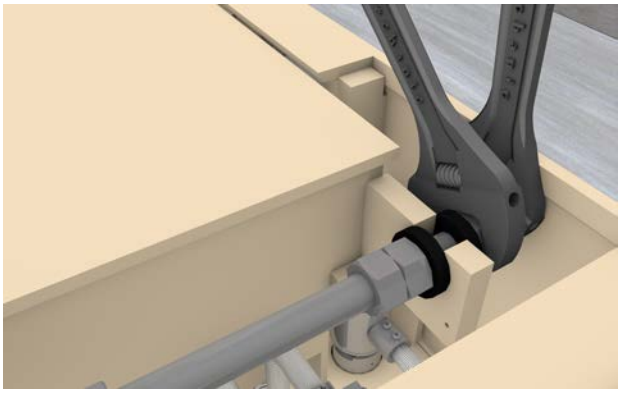


Washer Location Detail

4. The check rod should be positioned such that the end of the rod that is attached to the bracket, will be centered vertically in the slot. Ideally, this should place the check rod parallel to the ground. With the check rod in position, begin by tightening the nuts on each side of the spherical washers on the vertical-slot check bracket. These nuts should be tightened securely, and the jam nuts on each side should be tightened at this point. This is done to keep this end of the check rod from working its way down in the vertical slot.

5. Start at a bracket on one side of the weighbridge and repeat for the other side.



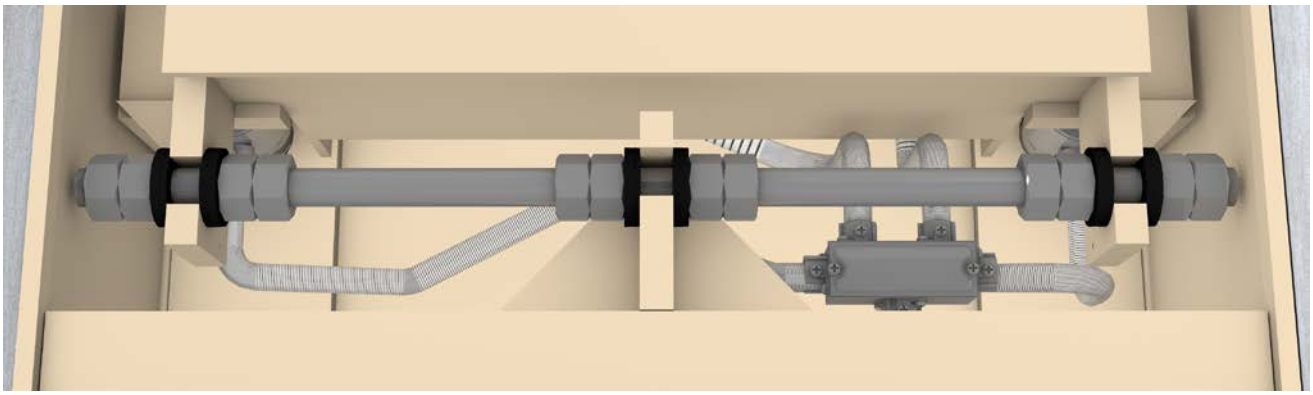


Securely tighten the nuts on the ends of the Check Rod, on both sides of the bracket

6. After this step is complete, the check rod should be mounted securely to both weighbridge brackets, parallel to the ground, and should be passing through the slot in the mounting frame check bracket (centered vertically – “floating” through the check bracket slot without touching it).

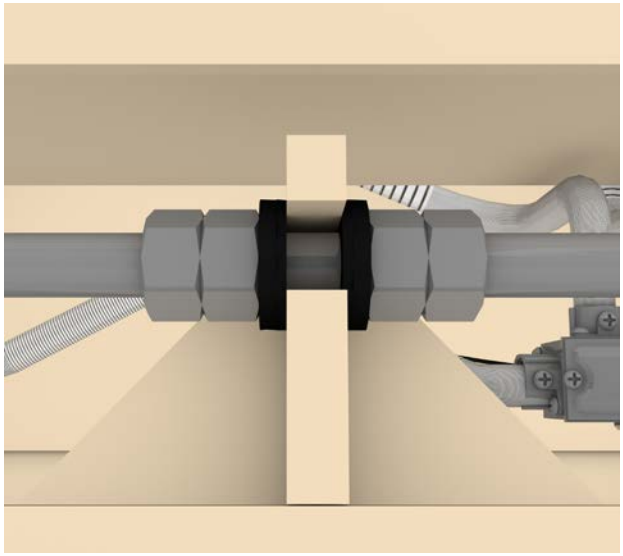
7. Repeat steps 4, 5, and 6 for the other end of the weighbridge.

8. Moving to the center of the check rod that passes through the slot in the mounting frame check bracket (centered vertically – “floating” through the check bracket slot without touching it), tighten the first set of nuts on each side of the check bracket against the spherical washers hand-tight.



Check Rod Centered, Floating Through Mounting Frame Check Bracket Slot

9. Hold the position of the first set of nuts with a wrench and tighten the jam nuts against them on each side with a second wrench. After the jam nuts are tight, check to ensure that the spherical washers can still spin; they shouldn’t be able to freely rotate, but you should be able to spin them with your fingers and feel a light drag on them. By setting the pressure on the washers in this manner, it will allow the weighbridge to move vertically without interference from the check rods. Under normal operation, the check bracket will slide between the two sets of spherical washers on both sides of it; if the bracket gets bound and will not freely slide between the washers, the spherical washers will allow the check rod to rotate and not interfere with the function of the weighing structure.

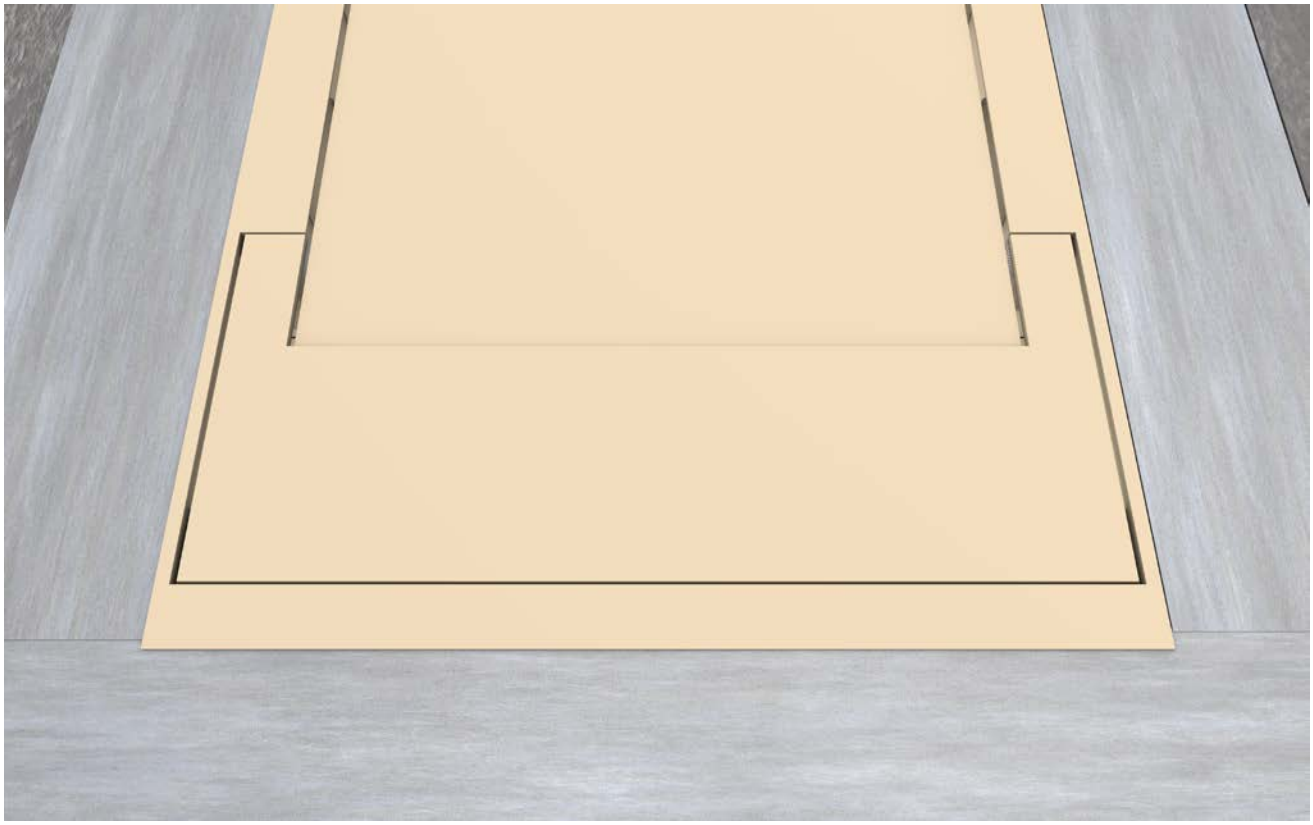


Close-up of the check rod through the Mounting Frame Bracket

10. The check rod adjustment should be periodically checked.

ACCESS PLATE INSTALLATION

The access plates in the scale are at each end of the weighbridge. Place one side of the access plate in the opening and then lower the other side to close the opening. Repeat for the other end of the scale.



Complete the installation by placing the access plates at each end of the weighbridge

CALIBRATION

If, after test loading the scale, it is determined that adjustments are required, follow the procedure below. This section describes the procedure necessary to calibrate a Cardinal Scale SWIM Slow-Speed In-Motion Vehicle Scale.

1. Before any adjustments are made, turn on the power to the digital weight indicator and power to the SWIM box.

2. Drive a test truck across the scale *at least three times* in each direction before calibrating the scale.

3. Before any sealing can be done, the weight indicator must be calibrated to the scale. A division size of 10 lbs should be selected and the auto-zero function turned off. Refer to the 825 Weight Indicator Installation and Technical Manual, 8545-M838-O1.

Your scale was factory adjusted to ± .05 percent accuracy at the factory. Minor changes in calibration due to shock and vibration encountered during shipping may necessitate it to be re-calibrated.

The following procedures require a known test weight. Make certain the test weight is accurate.

Place a test weight or weights on the scale deck and record the weight displayed. If the displayed weight does not fall within this ± .05 percent value of the test weight, the scale may need to be re-calibrated.

It should be noted that in addition to the ± .05% tolerance, ± 1/2 graduation is added when connected to a digital display.

Please check the following before proceeding:

1. Make certain the proper installation procedures were followed.

2. Is there debris near or under the scale deck restricting the proper scale operation?

Calibration procedures should be performed by a qualified scale technician or someone familiar with scale calibration procedures.

3. Place a test weight or weights in the center of the scale deck.

4. Record the displayed weight.

5. If the difference in the displayed weight exceeds ±.05 percent of the test weight, trimming adjustments must be performed. Refer to the TRIM ADJUSTMENT section for further instruction.

6. If the weight reading is within the allowable tolerance (±.05 percent of the test weight), the weight indicator should be re-calibrated following the indicator manual.

TRIM ADJUSTMENT

The purpose of adjusting trim is so the same weight reading will be displayed regardless of where the load is placed on the scale deck. All scales are corner-trimmed before leaving the factory. In the event of re-calibration or load cell replacement, follow the instructions below to re-trim the corners. It is assumed the other three load cells are already corner sealed to agree with each other. If not, please refer to the next page for further instruction.

One Load Cell Replaced

1. Open the SWIM box to gain access to the Trim Board.

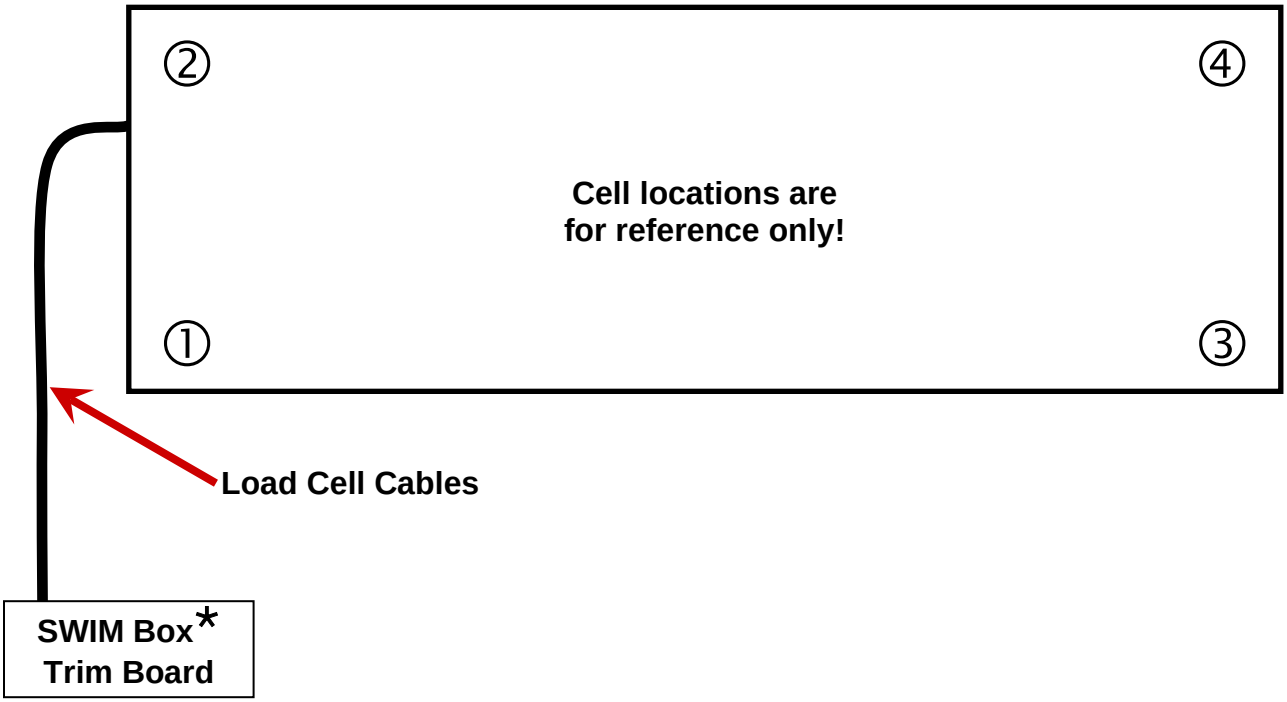
2. Refer to the figure below for load cell location reference. *Note that the locations of the load cells in the figure are for illustration purposes only, your scale may have the load cells numbers in a different location*.

3. Turn the trim potentiometer for the load cell requiring re-calibration clockwise 25 turns, to the end of the potentiometer adjustment.

4. Place a test weight on each corner of the scale, *one at a time*, and record the displayed weight for each corner.

5. Place the test weight on the corner with the highest reading and adjust the appropriate trim potentiometer until the weight reading matches the lowest reading obtained in Step 4.

6. Repeat Step 5 until all corners of the scale have the same weight reading.



* The SWIM box should be mounted as required by the customer and local regulations. Load cell cables must be protected from damage.

Two or More Load Cells Replaced or Overall Corner Resealing Required

If two or more load cells must be replaced or the scale needs an overall resealing of each corner, these procedures should be followed.

1. Open the SWIM box to gain access to the Trim Board.

2. Refer to the figure on the previous page for load cell location reference. *Note that the locations of the load cells in the figure are for illustration purposes only, your scale may have the load cells numbers in a different location*.

3. Turn all the potentiometers clockwise for 25 turns. Now turn all the potentiometers counterclockwise one (1) turn.

4. Place a 1000# test weight on each corner of the scale, *one at a time*, and record each displayed weight.

5. Place the test weight on the corner with the highest displayed weight and adjust the appropriate trim potentiometer *counterclockwise* until the corner reading matches the lowest weight reading.

6. Repeat Step 5 until all the corners of the scale are equal.

7. Re-calibrate the weight indicator following the procedures in the indicator manual.

EXAMPLE

	CORNER NUMBER			
1000# TEST WEIGHT	1	2	3	4
DISPLAYED WEIGHT READING	1020	1016	1017	1021

1. Place a test weight on each corner, one at a time, and record each displayed weight.

2. Place the test weight on corner number 1 and adjust the number 1 trim potentiometer to reduce the displayed weight to the lowest corner reading (Number 2 in the example).

3. Repeat step 2 with corners number 3 and 4 until all corner weight readings match.

4. Calibrate the weight indicator following the instructions provided in the indicator manual.

SWIM APPLICATION REQUIREMENTS

This section explains the changes made to the standard 825 Weight Indicator system operation to provide the SWIM features. Use this section in conjunction with the 825 Weight Indicator Installation and Technical Manual (8545-M838-O1) and any additional operation manuals and software addendums for a complete understanding of the SWIM operation.

Hardware Requirements

(1) Cardinal 825 Weight Indicator with a single SIB input.

(1) Cardinal SWIM weighbridge – 4 AC-50K load cells, 4-cell junction box, and cabling

(1) Loop coil detector and controller

(1) SWIM special application software loaded on an 825 weight indicator

Vehicle Classification Requirements*

(1) Control Box containing (1) CVW, BL Sensor Amplifier, Loop Controller

Fiber Optic Converters, Fiber Optic Cables

Recommended Initial 825 Calibration Setup

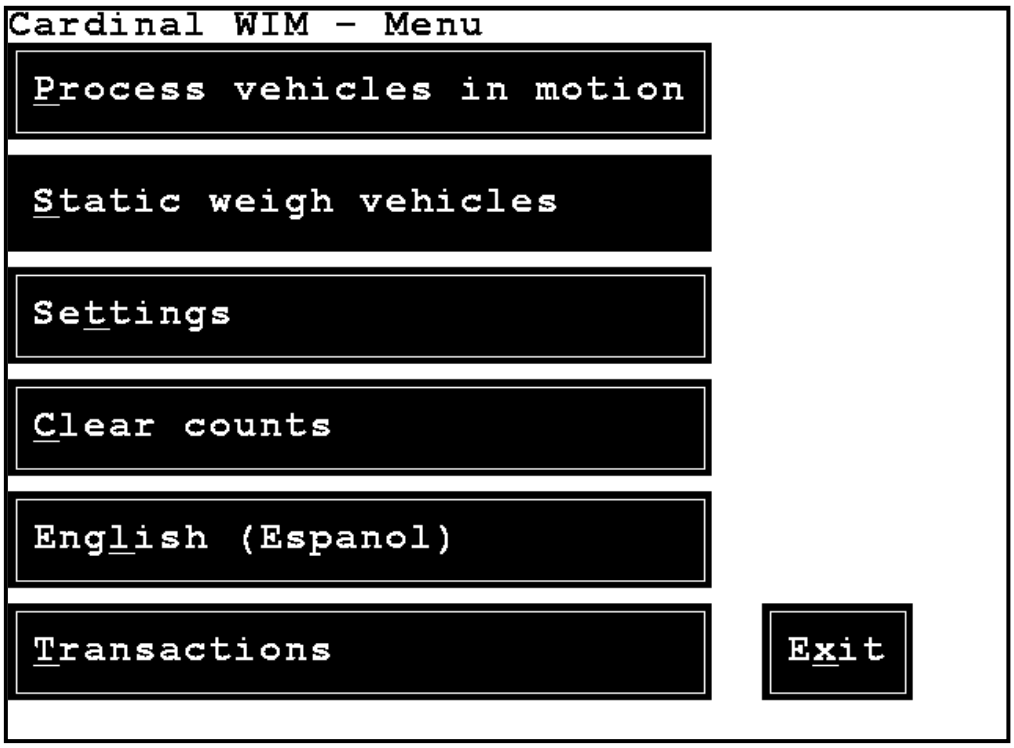
Prompt	Value
Capacity:	100000
Base Units:	lb
Interval:	20
Interval Dec:	0
Conv Units:	kg
Zero Track:	3
Motion Range:	3
Filtering:	Off
Sample Rate:	100
Num Cal Pts:	1
OIML:	No
Zero Limit:	No
USA:	Yes
2nd Order Lin:	No

* **NOTE: Requires optional equipment that is not part of the standard SWIM package.**

CARDINAL WIM MENU

Cardinal WIM – Menu

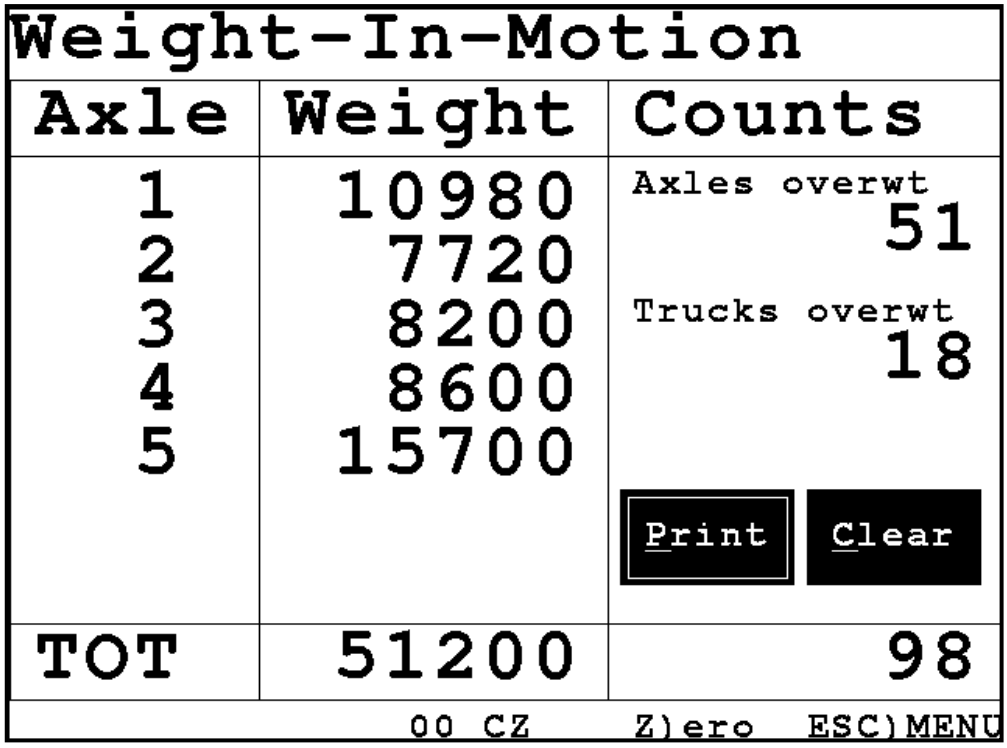
When the application is started, the menu screen will be shown.



Process Vehicles in Motion

Select the **Process vehicles in motion** option for in-motion weighing.

Vehicle weighing and counting will only occur while this display is shown.



Press **Print** to print a ticket of the latest vehicle shown on the display.

Press **Clear** to clear the display. This can be helpful if a vehicle backs up over the scale which may leave extraneous axles on the display.

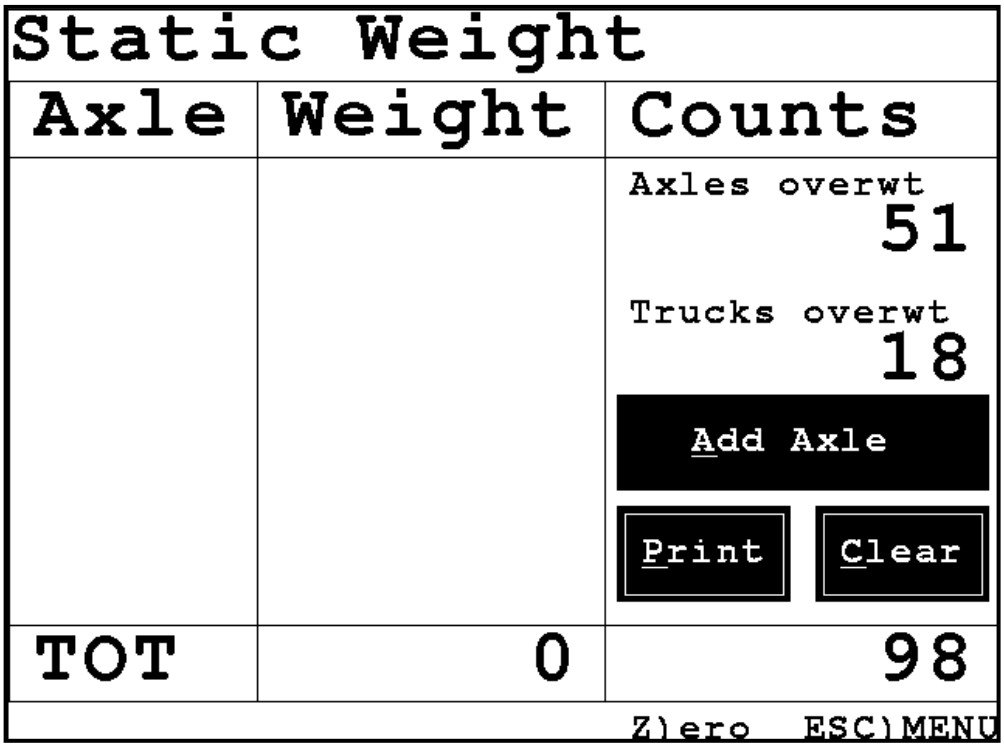
Press **Z)ero** to zero the scale reading.

Press **ESC** to quit in-motion weighing and return to the menu.

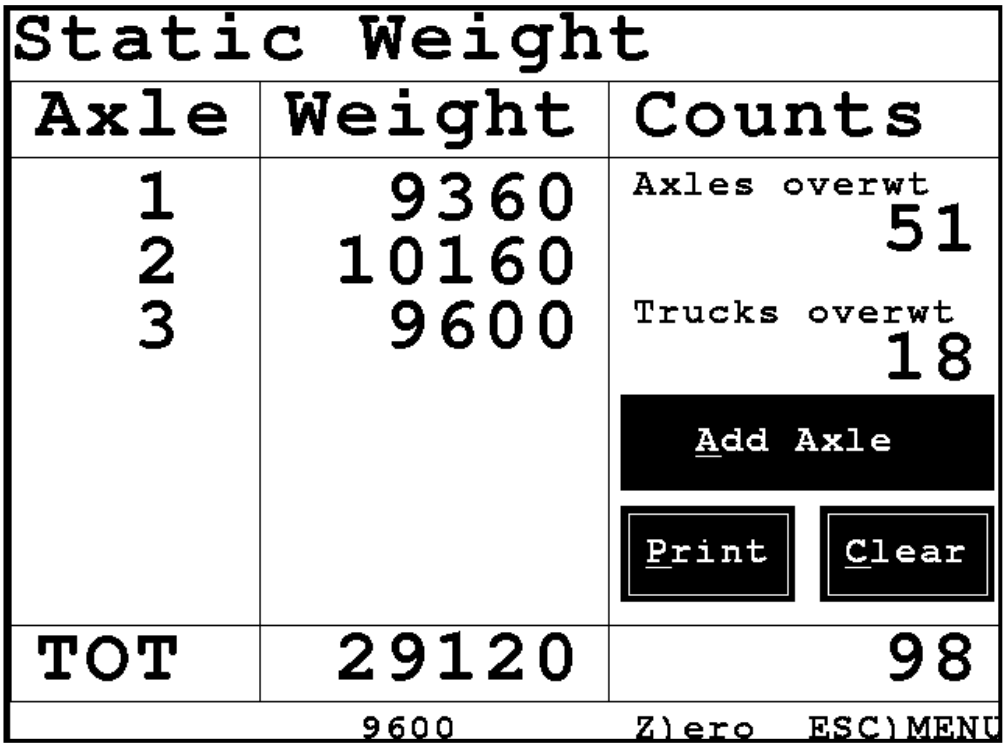
NOTE: The live scale weight is displayed at the bottom center of the screen.

Static Weigh Vehicles

Select **Static weigh vehicles** for static weighing of vehicles.



In this mode of operation, the vehicle is manually directed to pull each axle onto the scale and the operator will press the **Add Axle** button to weigh each axle.



NOTE: The live scale weight is displayed at the bottom center of the screen.

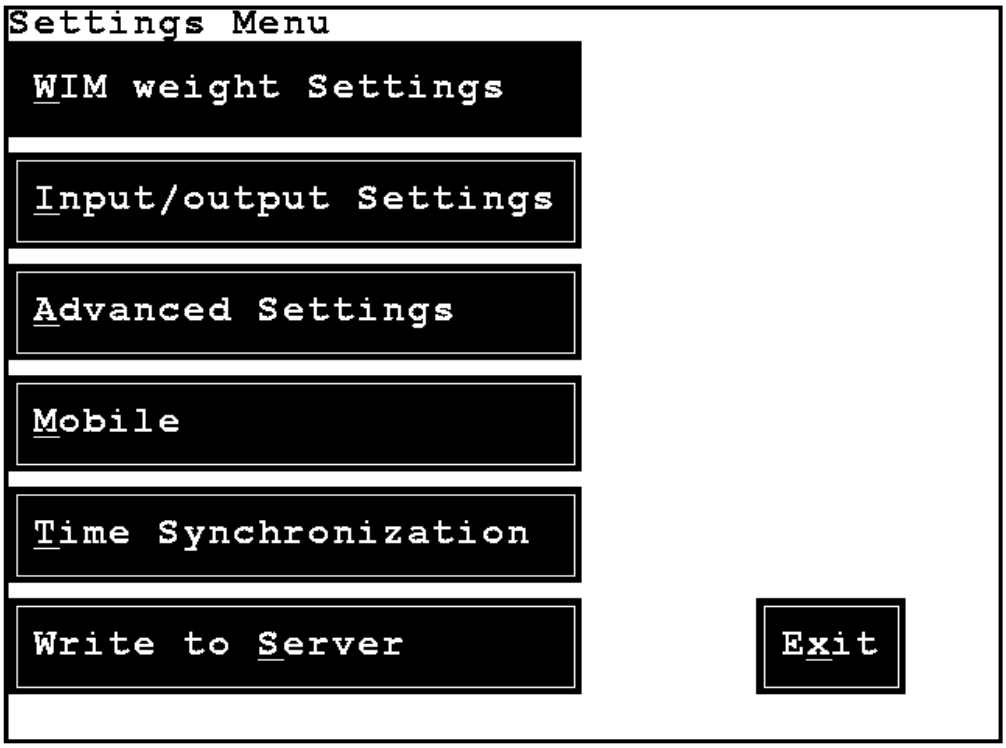
Static Weigh Vehicles, Cont.

If a mistake is made the operator may press the **Clear** button to clear all vehicles recorded so far and start over. When all axles have been weighed the operator will press the **Print** button to complete the vehicle weighing operation and print the ticket. The operator may press print again for additional tickets. The information from the vehicle will remain on screen (but grayed out) until the next vehicle is started by pressing **Add Axle**.

The **Z)ero** button on the keypad may be pressed to zero the scale. Press **SHIFT-ESC** to return to the menu.

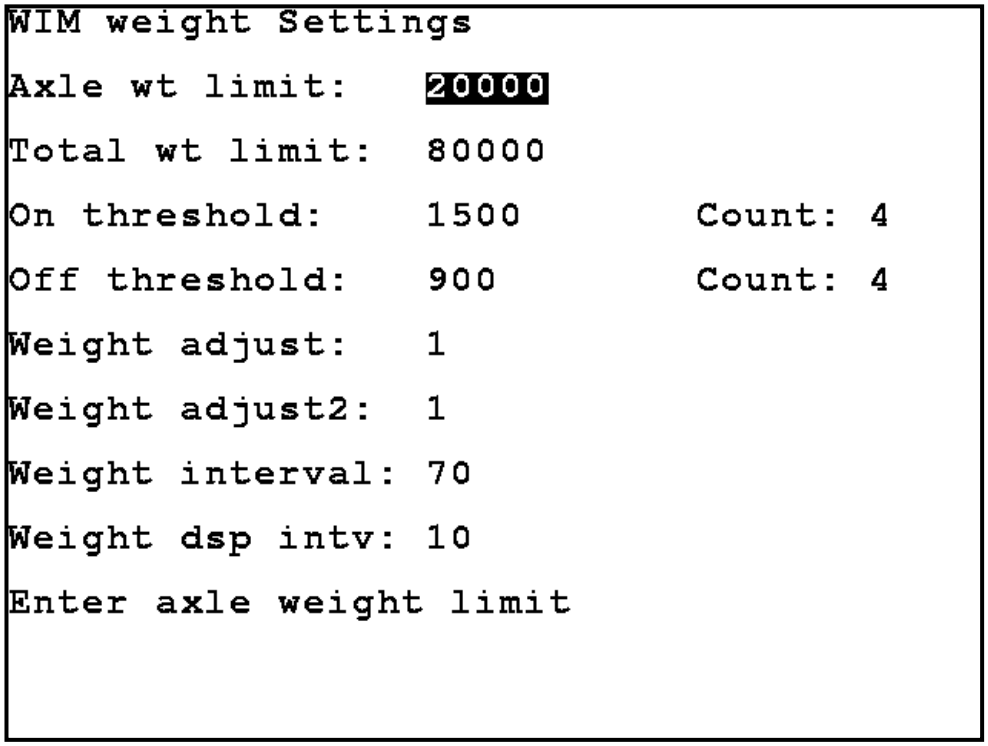
Settings Menu

Select **Settings** to show the settings menu.



WIM Weight Settings

Select **WIM weight settings** to show the WIM weight settings.



`Axle wt limit:`
This prompt is used to set the limit for the alarm condition for individual axles.

`Total wt limit:`
This prompt is used to set the limit for the alarm condition for vehicle weight.

`On threshold:`
This is the weight value for determining when an axle first contacts the weighbridge.

`Count:`
This is the number of times an axle has first contacted the weighbridge.

`Off threshold:`
This is the weight value for determining when an axle is passing off of the weighbridge.

NOTE: The `Off threshold` should be less than the `On threshold` to prevent bouncing from making a single axle appear to be multiple axles. The on and off threshold count values are used to specify the number of consecutive samples that must be on or off threshold before the axle weighing state is changed. This provides a de-bounce to avoid problems if the weight samples are noisy.

`Count:`
This is the count of the number of times an axle has passed off the weighbridge.

WIM Weight Settings, Cont.

`Weight adjust:`

This prompt allows an adjustment factor to be entered. Set to “1.0” for no adjustment.

`Weight adjust2:`

This prompt allows an adjustment factor to be entered for axles recorded with only a few weight samples. Set to “1.0” for no adjustment.

`Weight interval:`

This is the interval for repeat weight requests in milliseconds.

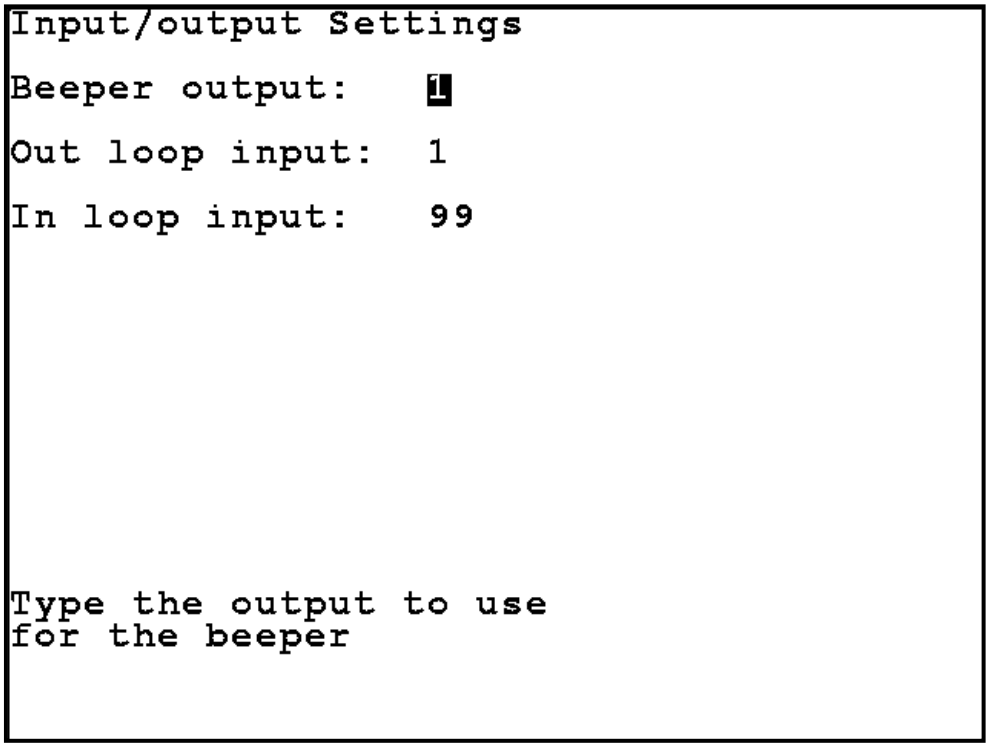
`Weight dsp intv:`

This prompt sets the frequency of weight updates for the live weight display at the bottom of the screen. This is set as a count for the number of weight intervals.

Use the **UP/DOWN** navigation keys to select items to make changes. When finished press **ENTER** to save changes or press **ESCAPE** to cancel changes.

Input/Output Settings

Select **Input/output Settings** to show the input and output settings.



`Beeper output:`
This prompt is used to set the output (relay number) for the alarm beeper.

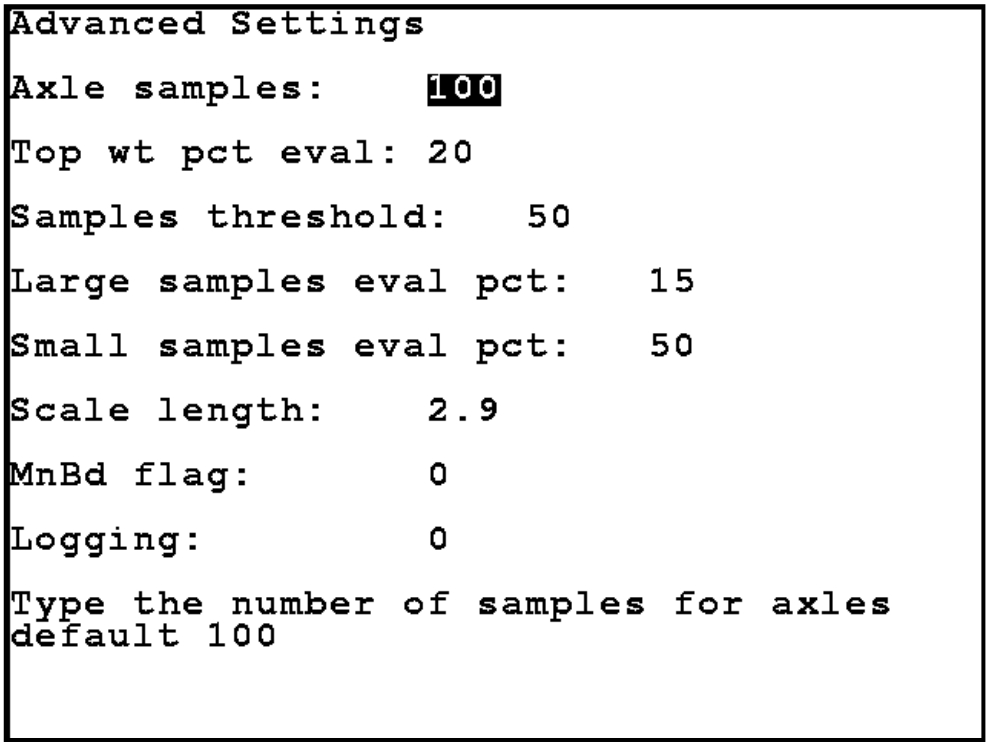
`Out loop input:`
This prompt is used to set the input number for the loop detector input, or if the two-direction capability is enabled the first loop to be hit for the out direction. For WIM operation this determines when a vehicle has finished weighing.

`In loop input:`
This prompt is used for systems that allow for two-direction weighing to specify the first loop input for the “in” direction. For systems that are “one” direction, this should be set to “99”

Use the **UP/DOWN** navigation keys to select items to make changes. When finished press **ENTER** to save changes or press **ESCAPE** to cancel changes.

Advanced Settings

Select **Advanced Settings** to show the advanced settings.



`Axle samples:`
This prompt is set to the total number of samples that may be used for a single axle calculation.

`Top wt pct eval:`
This prompt is set to a percentage of samples to be used near the peak weight value seen for the axle for greater consideration of the weight. For example, if the peak weight sample is 10000 lb and the top wt percent is 20, 10000 x .20 = 2000 lb, so the weight samples from 8000 and above are given consideration.

`Samples threshold:`
This is the number of samples threshold for each axle for consideration.

`Large samples eval pct:`
This is a percentage of the top weight value samples to consider if the number of samples is at or above the samples threshold.

`Small samples eval pct:`
This is a percentage of the top weight value samples to consider if the number of samples is below the samples threshold.

`Scale length:`
This is the length of the scale to allow for an approximate speed calculation to be performed.

Advanced Settings, Cont.

`Mnbd flag:`
This is a setting to allow for some specialized diagnostics. This should be “0” for normal operation.

`Logging:`
This prompt should be set to “0” for normal operation.

For diagnostic logging of summary for each axle: peak value, number of samples recorded, number of top samples selected, and calculated weight set this to “1”. This log is written to /mnt/nand/apps/swim/diag.csv.

For additional diagnostic logging of all samples of each axle set this to “2”. This log is written to /mnt/nand/apps/swim/diag2.csv.

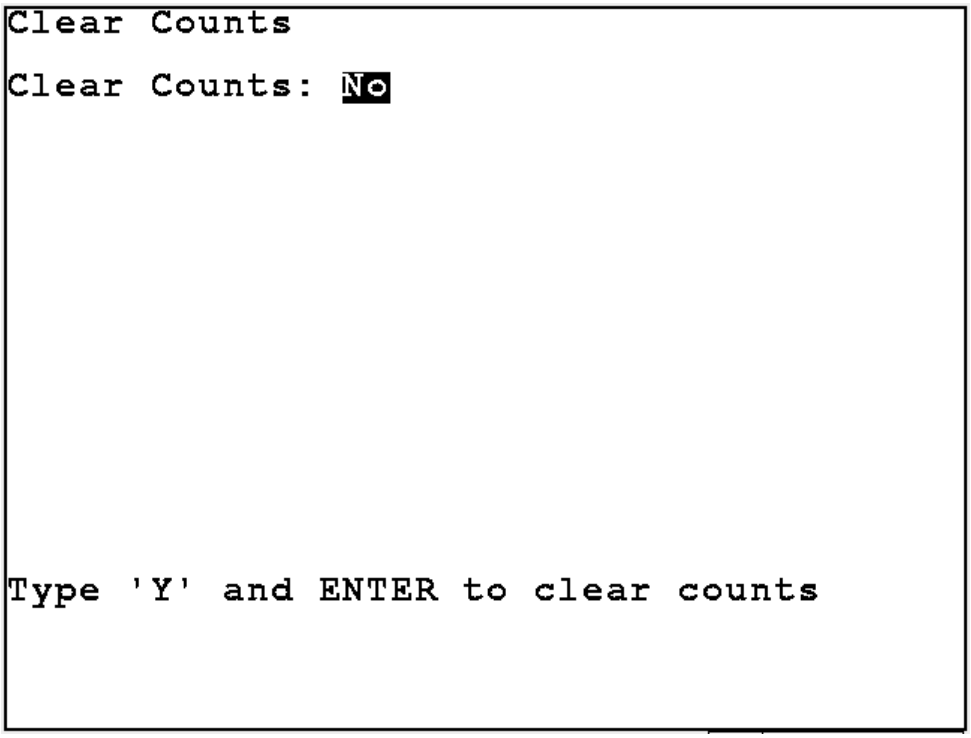
NOTE: If logging is left on for a long period of time the memory may fill up.

Use the **UP/DOWN** navigation keys to select items to make changes. When finished press **ENTER** to save changes or press **ESCAPE** to cancel changes.

Press **`Exit`** to return to the main menu.

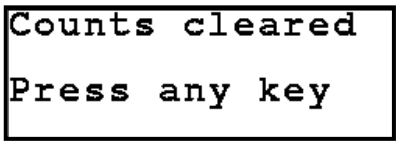
Clear Counts

Select **Clear Counts** to clear the displayed counts.



Press **Y** and **ENTER** to clear the counts or **N** and **ENTER** to cancel.

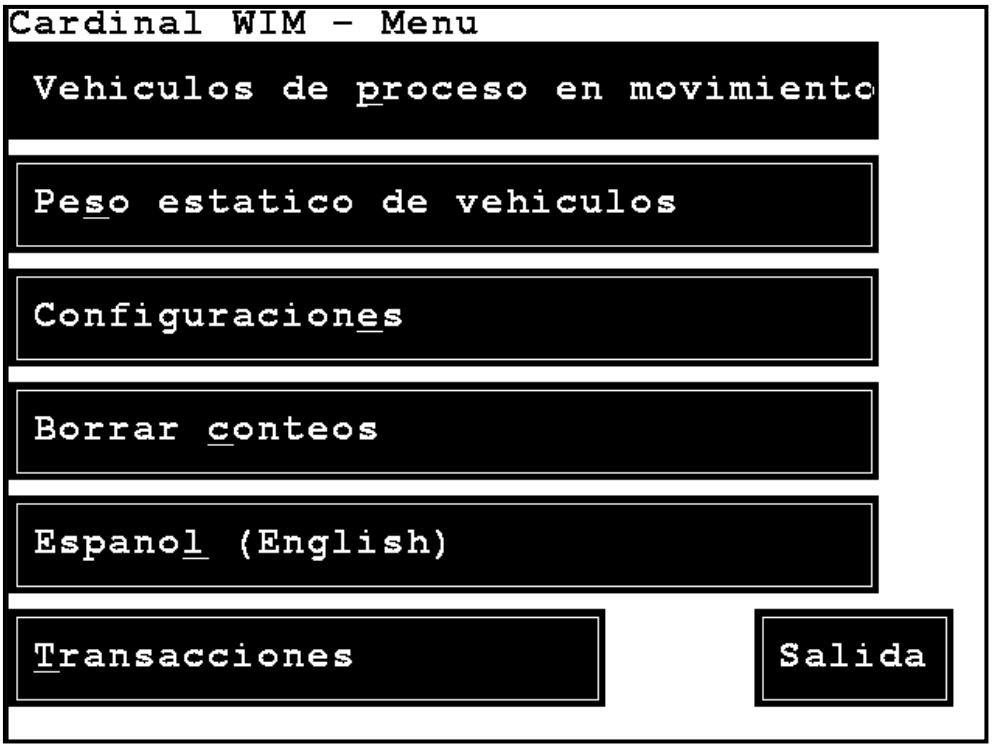
When the counts have been cleared, a prompt will appear.



Press any key to return to the menu.

Change Language

Select Language to change the current display language for the application.

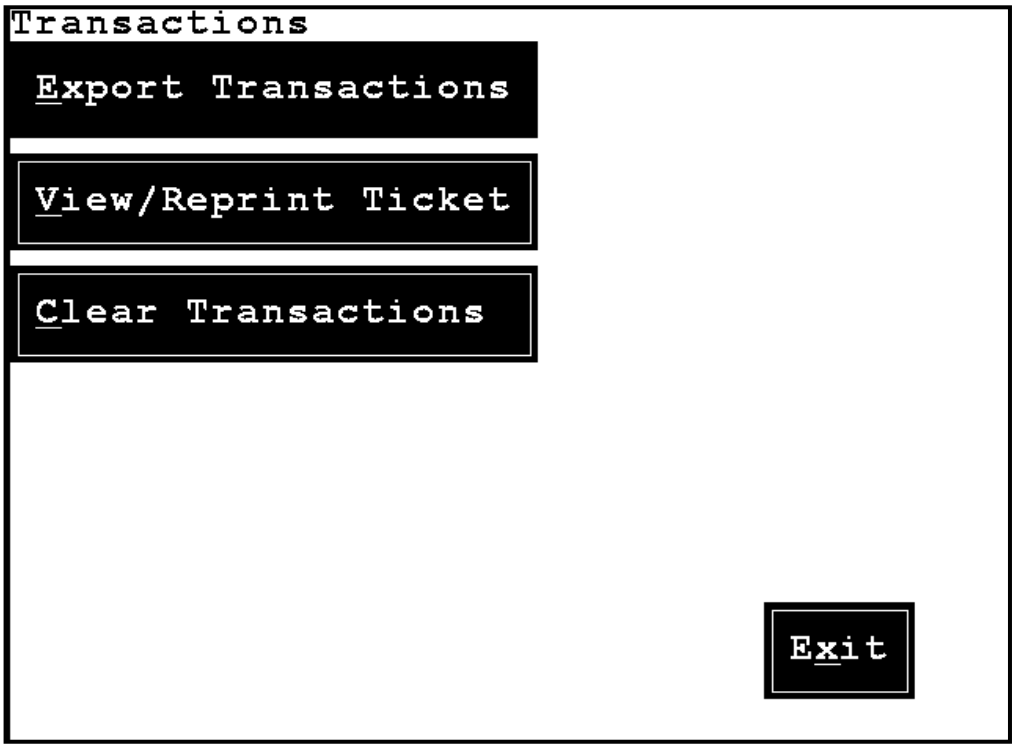


The application displays are changed to use translated strings based on free online translation services at the time the application was written. These translations may not be ideal due to online translators not understanding the correct context of the words or phrases.

NOTE: Abbreviations are sometimes necessary to fit display space. Please contact your dealer or Cardinal if you wish to assist to improve the translations for the application.

Transactions

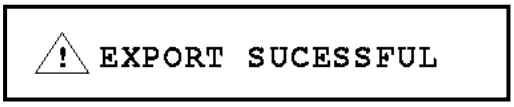
Select Export Transactions to export all currently recorded transactions.



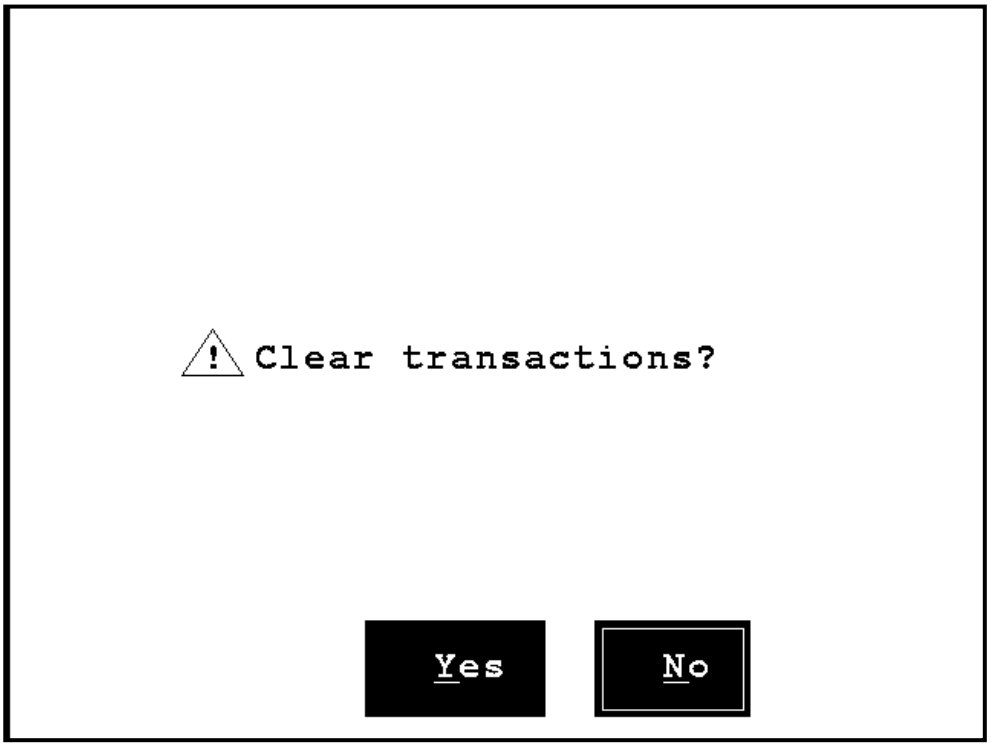
Select **Yes** to export to a USB flash drive.

Transactions, Cont.

When the export to the USB flash drive has been successful, a prompt will appear.



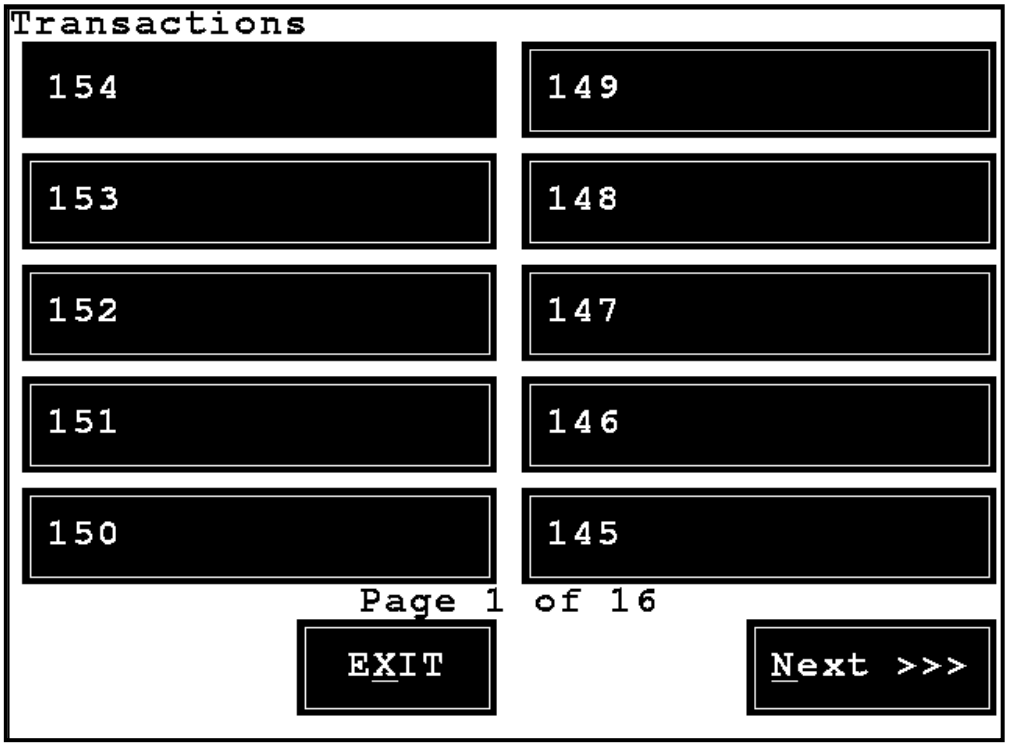
After the export has been completed and the successful message has been displayed, a prompt will appear to `Clear Transactions?`



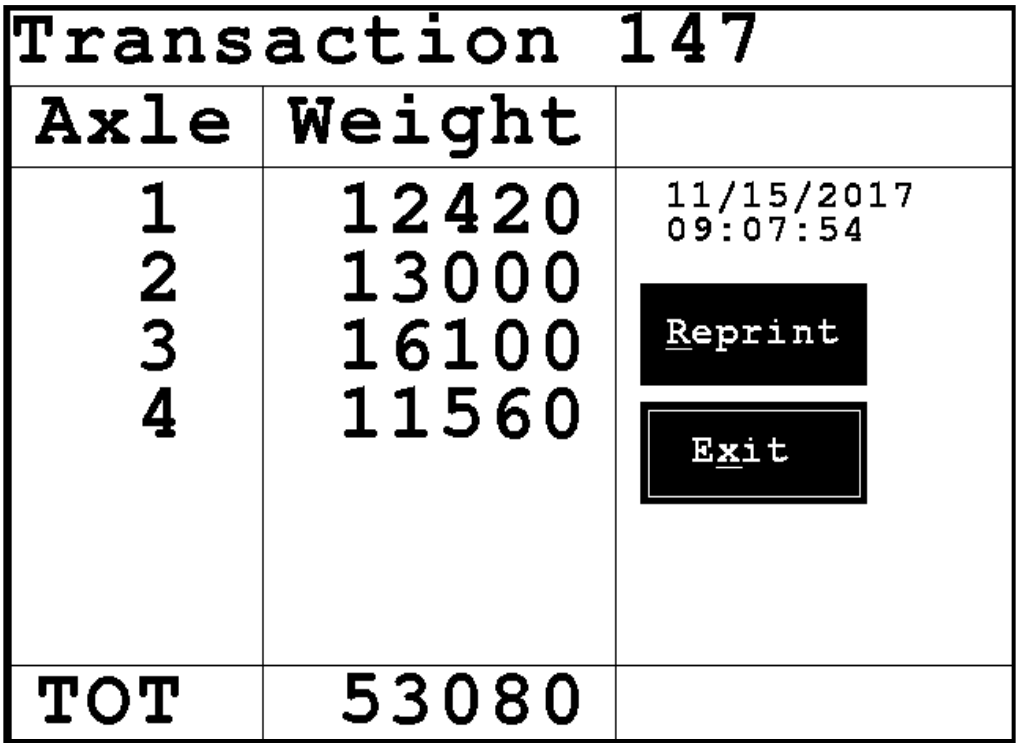
Select **Yes** to clear the transactions from the database.

View or Reprint Ticket

Select View/Reprint Ticket to view the database transactions starting from the most recent transaction.



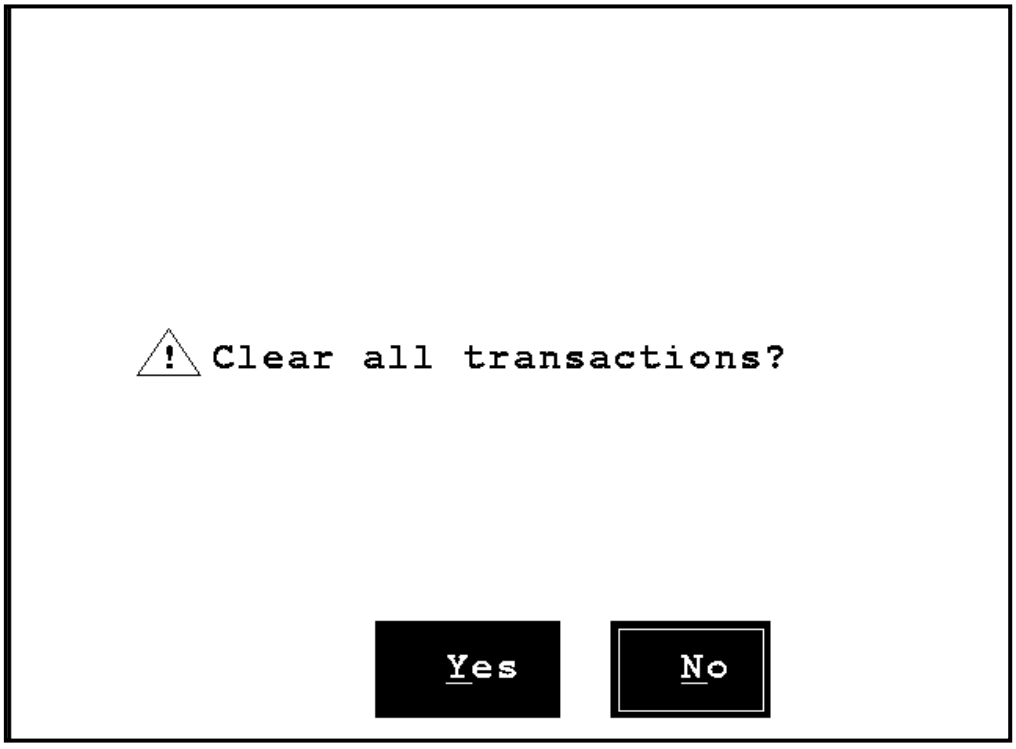
Select a transaction number to view/reprint.



Select Reprint to reprint the transaction. Select Exit to return to the Transactions menu.

Clear Transactions

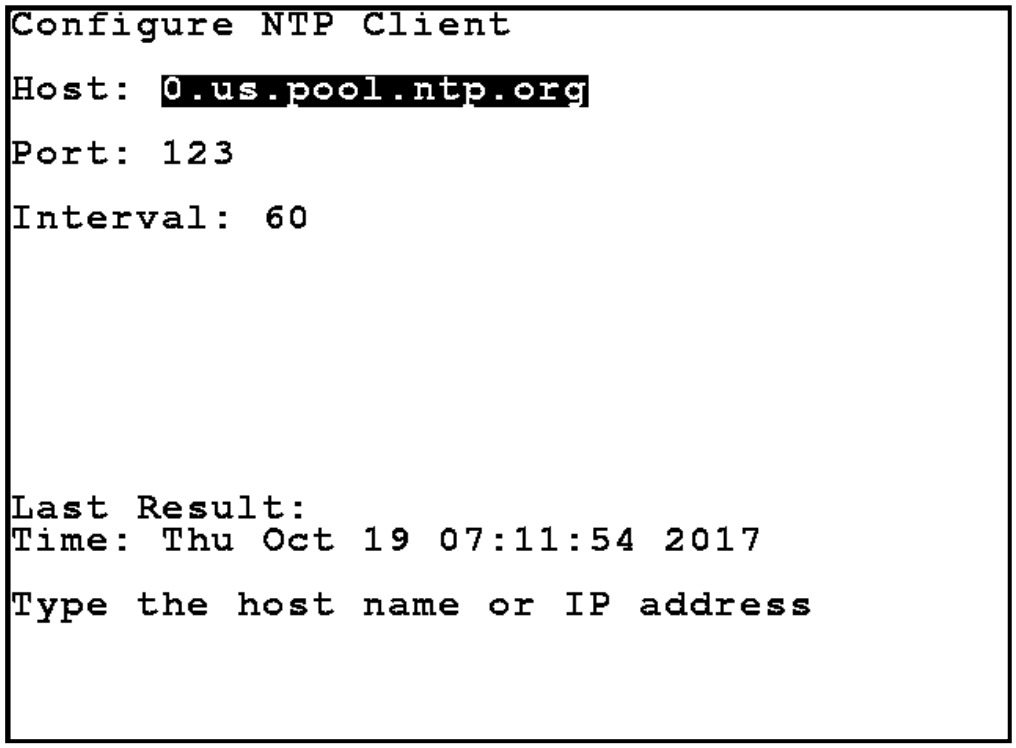
Select `Clear Transactions` to clear transactions from the database.



Select **Yes** to clear all transactions from the database, or **No** to keep the transactions and return to the `Transactions` menu.

Time Synchronization

Select Time Synchronization to configure automatic clock synchronization from a server.



`Host:`
Set the `Host:` to a public NTP server name or IP address of a server on the local network.

`Port:`
Set the `Port:` if necessary. Most NTP servers use port “123”.

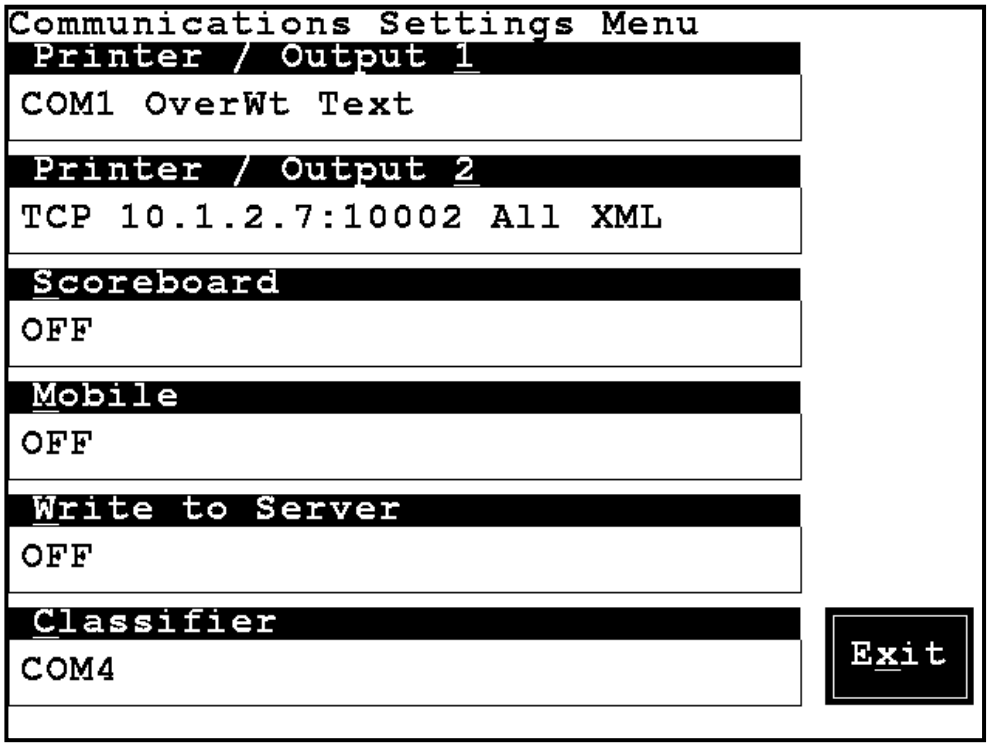
`Interval:`
Set the `Interval:` in minutes for the time update.

`Last Result:`
The display will show the "`Last Result:`" time update or an error message if the time update was not successful.

NOTE: This display does not update automatically so it will be necessary to exit the screen and return to it to see any updates.

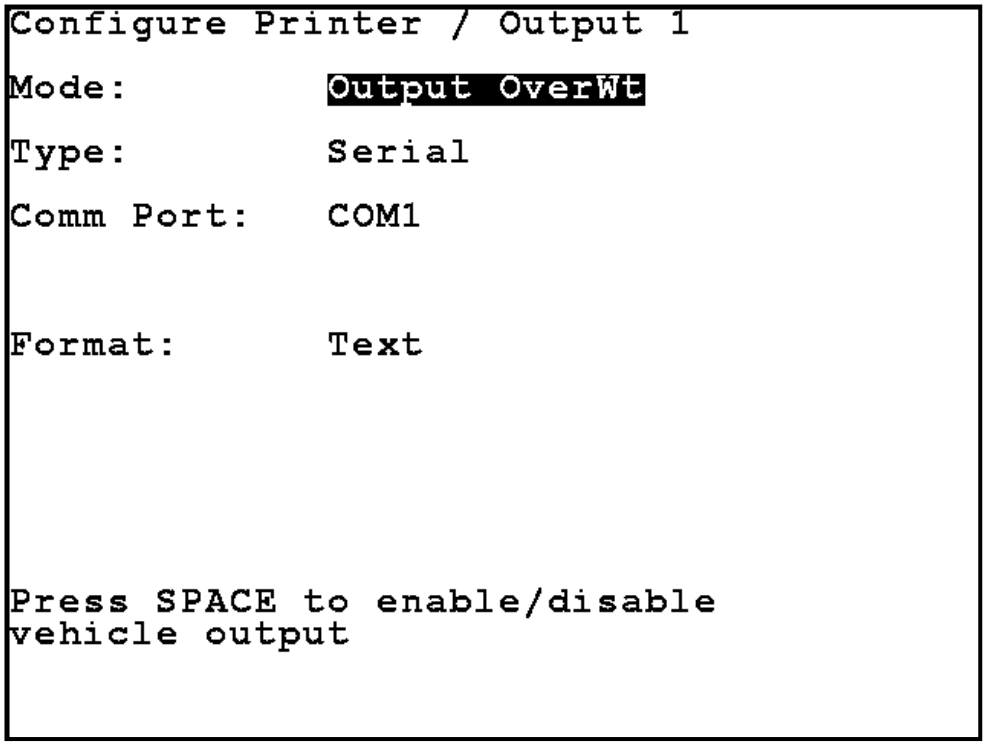
Communications

The communications menu is used to set up the communications with various devices.



`Printer / Output 1` and `Printer / Output 2`

The "`Printer / Output 1`" and "`Printer / Output 2`" selections allow setting up output devices for completed vehicle data.



Communications, Cont.

`Printer / Output 1` and `Printer / Output 2`, Cont.

`Mode:`

Allowable selections for "`Mode:`" are:

- OFF = no output
- Output OverWt = Output only when the vehicle is overweight
- Output All = Output for all vehicles

`Type:`

Allowable selections for "`Type:`" are:

- Serial = for the serial port
- TCP Client = for a TCP/IP client connection
- TCP Server = for TCP/IP server operation

NOTE: For "Serial" the "Comm Port" must be specified.
For "TCP Client" the "TCP/IP Port" and "IP Address" must be specified.
For "TCP Server" the "TCP/IP Port" must be specified.

`Format:`

Allowable selections for "`Format`" are "Text" or "XML". (See the output examples below).

Text Output Example:

```
02/25/2021 09:18:24
Axle 1:   9840
Axle 2:  10100
Axle 3:  11580
Total:   31520
Class:  5  Num Axles:  3   Speed: 11.6
```

XML Output Example:

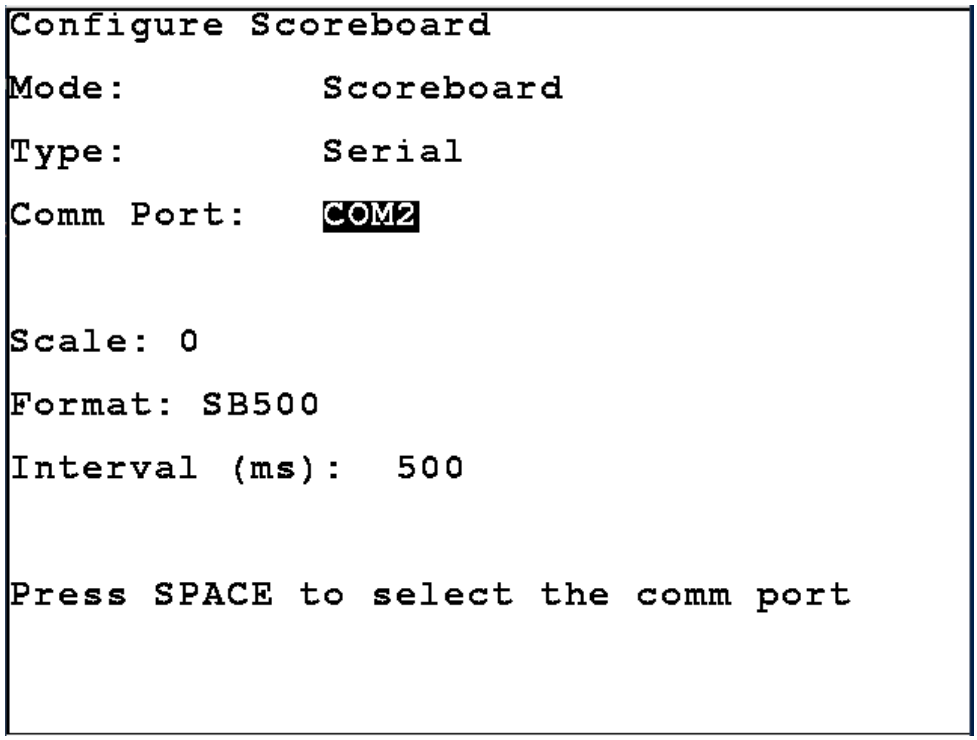
```
<?xml version="1.0" encoding="UTF-8" ?>
<scale time="2021-02-25T09:18:24" id="1">
  <grossweight>31520</grossweight>
  <axles>
     <axle id="1">
        <weight>9840</weight>
        <spacing>8.0</spacing>
     </axle>
     <axle id="2">
       <weight>10100</weight>
       <spacing>9.0</spacing>
     </axle>
     <axle id="3">
       <weight>11580</weight>
     </axle>
   </axles>
   <status>Ok</status>
   <class>5</class>
   <numaxles>3</numaxles>
   <speed>11.6</speed>
</scale>
```

NOTE: `Spacing`, `class`, `numaxles`, and `speed` are provided when "classifier" is enabled.

Communications, Cont.

Scoreboard

A scoreboard type (remote display) may be included. This will show live weight on the scale when the scale is in an idle mode. After a vehicle completes weighing across the scale the scoreboard will show the gross weight of the vehicle for several seconds.



Mode:

Allowable selections for "Mode:" are "OFF" or "Scoreboard".

Type:

Allowable selections for "Type:" are:

- Serial = for the serial port
- TCP Client = for a TCP/IP client connection

NOTE: For "Serial" the "Comm Port" must be specified.
For "TCP Client" the "TCP/IP Port" and "IP Address" of the scoreboard must be specified.

Scale:

The "Scale:" prompt should be set to "0".

Format:

The "Format" prompt is used to specify the type of output format. Allowable selections are

Computer	SB200	Generic	IQ355	SB500

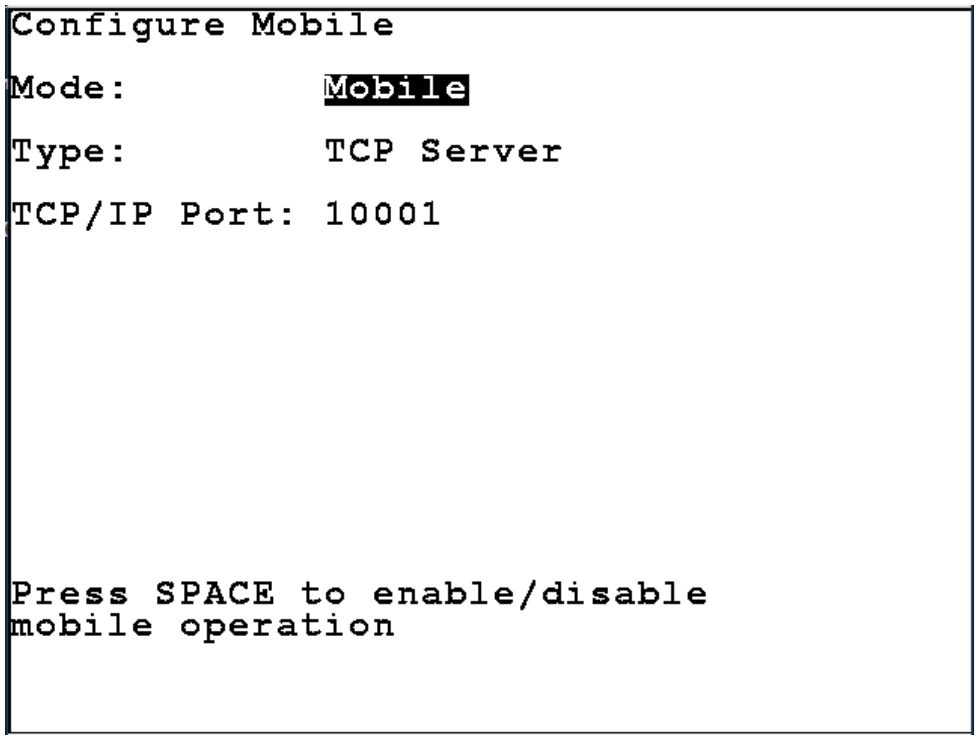
Interval:

The "Interval" prompt is used to specify the scoreboard update interval in milliseconds.

Communications, Cont.

`Mobile`

The “Mobile” option allows the mobile app output to be enabled and configured.



`Mode:`

Allowable selections for “`Mode:`” are “OFF” or “Mobile”.

`Type:`

Allowable selections for “`Type:`” are:

- Serial = for the serial port
- TCP Client = for a TCP/IP client connection
- TCP Server = for TCP/IP server operation

NOTE: For “Serial” the “Comm Port” must be specified.
For “TCP Client” the “TCP/IP Port” and “IP Address” must be specified.
For “TCP Server” the “TCP/IP Port” must be specified.

NOTE: All SWIM messages start with a DLE (hex 10) and end with a carriage return (hex 0D).

Every 1800ms the SWIM app will output [DLE]C[CR] This is just a heartbeat message to inform the client that they are still connected.

Communications, Cont.

`Mobile`, Cont.

When an axle is registered on the scale 2 weight messages will be sent. The gross and the current axle. The weight messages are formatted as follows.

[DLE]XWWWWW[CR]

Where:

"X" = The axle number with 0 being the gross weight. **NOTE:** Due to only having 1 character for the axle number the protocol will only support up to 9 axles.

"WWWWW" = The weight value.

When the vehicle is finished (loop goes off) the following message will be sent.

[DLE]N0[CR]

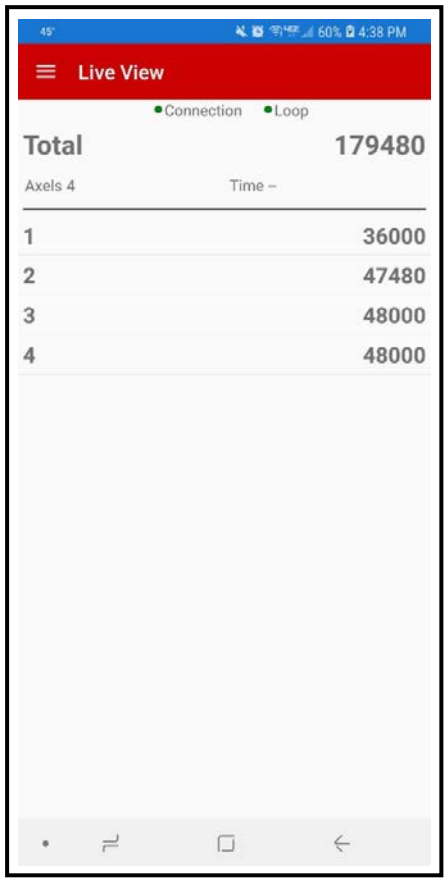
Example of a 4-axle vehicle.

```
[DLE]N0[CR][DLE]036000[CR][DLE]136000[CR][DLE]N0[CR][DLE]036000[CR][DLE]136000[CR
][DLE]083480[CR][DLE]247480[CR][DLE]C[CR][DLE]N0[CR][DLE]036000[CR][DLE]136000[CR
][DLE]083480[CR][DLE]247480[CR][DLE]0131480[CR][DLE]348000[CR][DLE]N0[CR][DLE]036
000[CR][DLE]136000[CR][DLE]083480[CR][DLE]247480[CR][DLE]0131480[CR][DLE]348000[C
R][DLE]0179480[CR][DLE]448000[CR]
```

IMPORTANT! There are currently no commands to send to the 825.

NOTE: For drivers to see the weights as they go across the SWIM, there is an Android app that implements the above protocol. It is available on Google Play.

https://play.google.com/store/apps/details?id=com.cardet.roadway



Communications, Cont.

`Write to Server`

Select Write to Server to configure and write vehicle records to a server.

```
Write to Server

Type: Windows

Path: 10.1.2.15/Users

User: don_w

Password: ******

Options:


Last Result:

Press SPACE to select
```

`Type:`

Allowable selections for `Type:` are “Windows” or “NFS” (Linux).

`Path:`

Set the `Path:` to the server.

`Path:`

Select and input the user name and password to access the share.

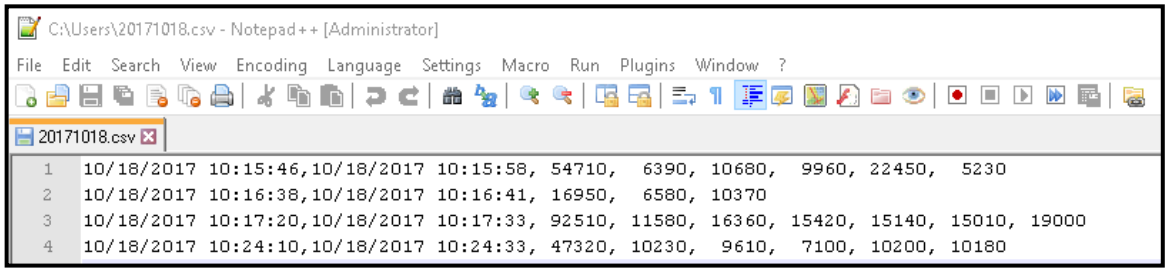
`Password:`

When entering the `Password:` note that by default, the 825 keyboard sends alphabetical characters in UPPER CASE. Press the **SHIFT** key then the letter for every character to be set to lower case.

`Options:`

For NFS, the `Options:` field may require “-o nolock”.

After the loop turns off for each vehicle, a file will be created or appended. The name of the file is date-based “YYYYMMDD.CSV”. Each record of the file will be the vehicle information “<Loop on time>,<loop off time>,<total weight>,<axle 1 wt>,<axle 2 wt>, etc.”



Communications, Cont.

`Write to Server`, Cont.

`Last Result:`

The display will show an error message if there was an error attempting to write the data to the server.

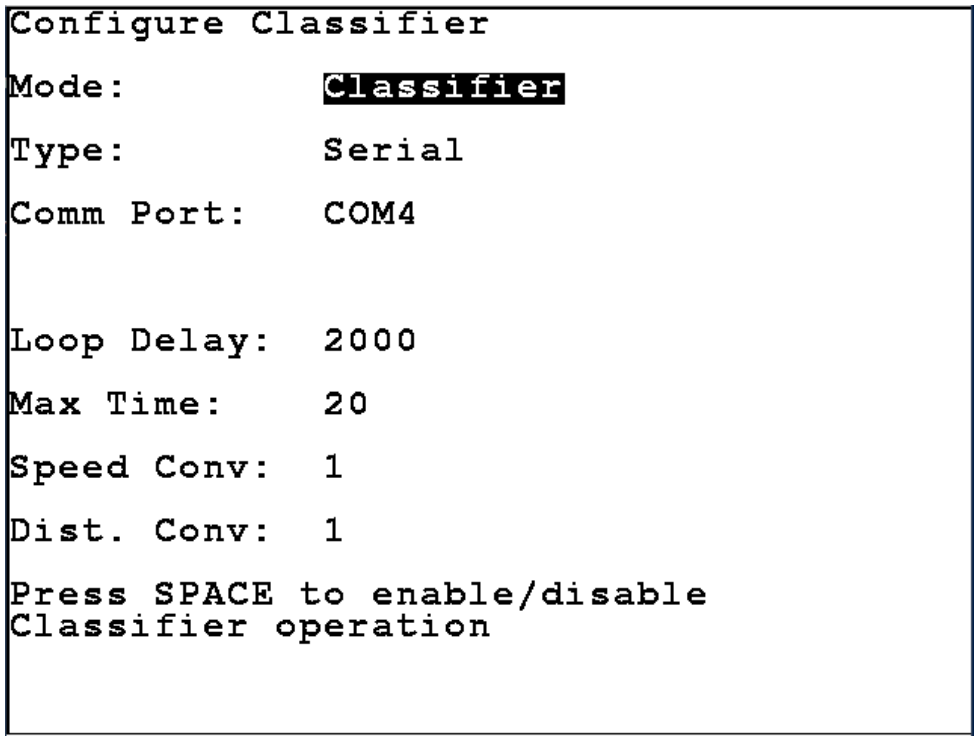
IMPORTANT! For Windows, this only works with basic PC workgroup shares. This will not work for Windows server shares or PCs connected to a Windows server domain. Anti-virus or antimalware may prevent this from working.

NFS may be a useful alternative for Windows PCs by using a third-party NFS server such as that provided by the Cygwin project.

Select **`Exit`** to exit the application and return to the Application menu.

Communications, Cont.

`Configure Classifier`*



`Mode:`

Allowable selections for "`Mode:`" are "OFF" or "Classifier".

`Type:`

Allowable selections for "`Type:`" are:

- Serial = for the serial port
- TCP Client = for a TCP/IP client connection

NOTE: For "Serial" the "Comm Port" must be specified.
For "TCP Client" the "TCP/IP Port" and "IP Address" must be specified.

When Classifier is enabled the SWIM loop inputs will not be used. Instead, the Classifier module (CVW) will send "LOOP ON" and "LOOP OFF" messages to the 825 indicator. For Classifier Operation, the loop is located before the SWIM scale.

NOTE: Refer to the CVW documentation for the setup and configuration of the CVW.

`Loop Delay:`

The "Loop Delay" is set to a number of milliseconds after the "LOOP OFF" message to allow for the last axles of the vehicle to travel across the scale.

`Max Time:`

The "Max Time" prompt is a maximum number of seconds for synchronization of the CVW classifier data with the SWIM vehicle data.

* **NOTE: Requires optional equipment that is not part of the standard SWIM package.**

Communications, Cont.

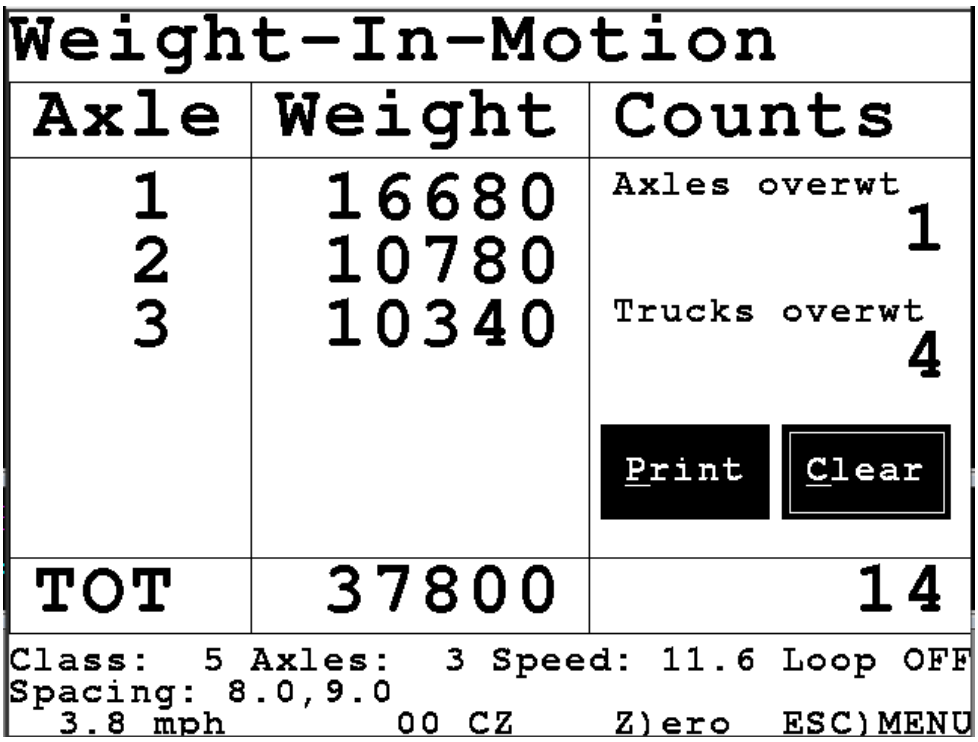
`Configure Classifier`, Cont.

`Speed Conv:`

The “Speed Conv” prompt allows for a conversion to be performed on the speed value returned from the CVW classifier. The default of “1” is no conversion.

`Dist. Conv:`

The “Dist. Conv” prompt allows for a conversion to be performed on the distance values returned from the CVW classifier. The default of “1” is no conversion.



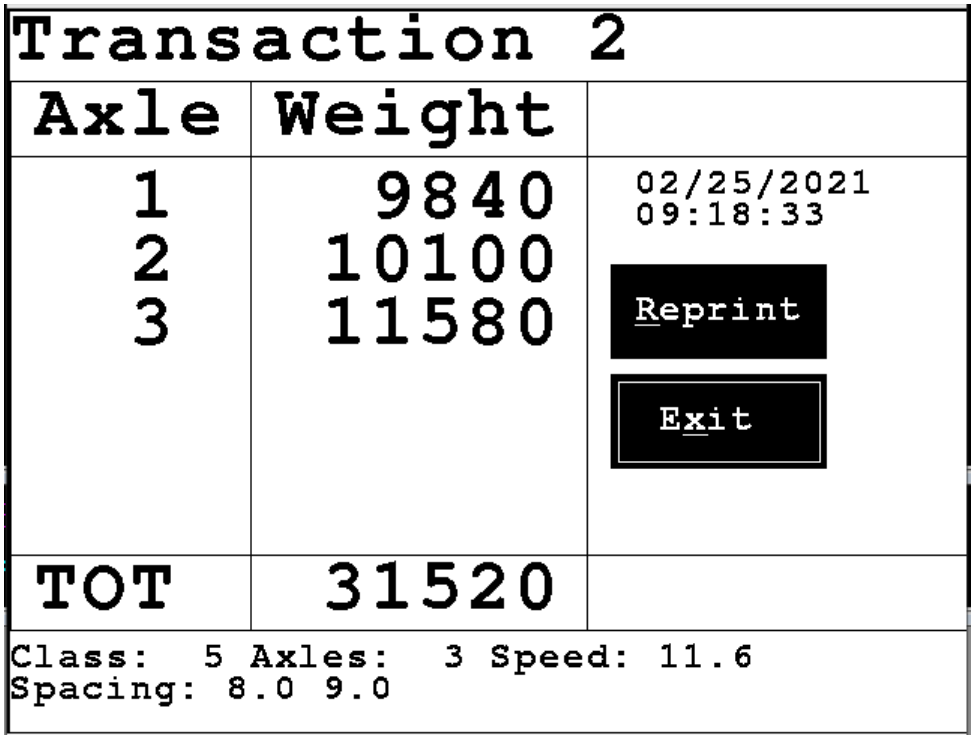
When classifier mode is enabled the WIM screen will show additional data at the bottom of the screen. Below the SWIM TOT, the display will show the vehicle classification “Class”, the number of axles, and the speed. The “Loop ON” and “Loop OFF” messages from the classifier are shown to the right of this.

The second line (below “Class”) shows the vehicle spacing. The first number is the distance from the steering axle to the next axle.

Communications, Cont.

`Configure Classifier`, Cont.

The classification data will be added to the outputs. This data will also show on the "View/Reprint" transactions.



TROUBLESHOOTING

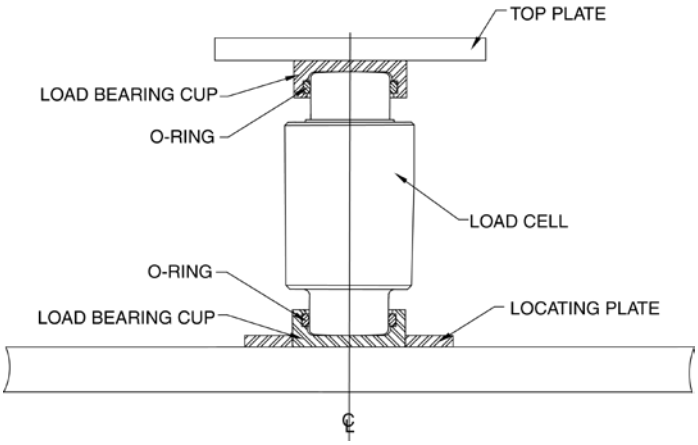
1. Open the SWIM box and check for moisture, loose connections, or damaged wiring. Check all cables for damage.

2. Use a hydraulic jack to lift the weighbridge off each load cell.

CAUTION! Be sure any restraint system is loosened before lifting the weighbridge off the scale.

3. Disconnect the signal leads of the load cell and check its output voltage using a meter with a *10-microvolt minimum* resolution. Any load cell with a no load output of more than 2 or 3 millivolts should be considered suspect. Record the no load outputs from each cell in Table A, Column 1.

4. While the weighbridge is off the load cell, physically check the load bearing cup and load bearing plate (top plate) for any damage.



Load Cell and Load Bearing Cup Detail

5. With the weighbridge ***only*** on the load cells and the signal wires still disconnected, record each load cell output voltage in Table A, Column 2. If there is a difference of more than one millivolt between two lateral cells, install one or more shims between the load bearing cup and weighbridge until the output of the two cells is within one millivolt. Keep in mind that the four load cells should be approximately the same. After the shimming is complete, record all outputs for possible future use, in Table A, Column 3.

6. Check to ensure that the check rods are level, square and tight. If there is any kind of gap filler on the ends of the scale, ensure that it is not causing any force on the scale.

7. Perform the Calibration procedure on the scale.

8. If the problem should occur again, check the load cell outputs against the values recorded in Step 5. Any appreciable change could indicate a possible defective load cell. If the load cells check OK, install a different indicator to eliminate the possibility of an indicator problem.

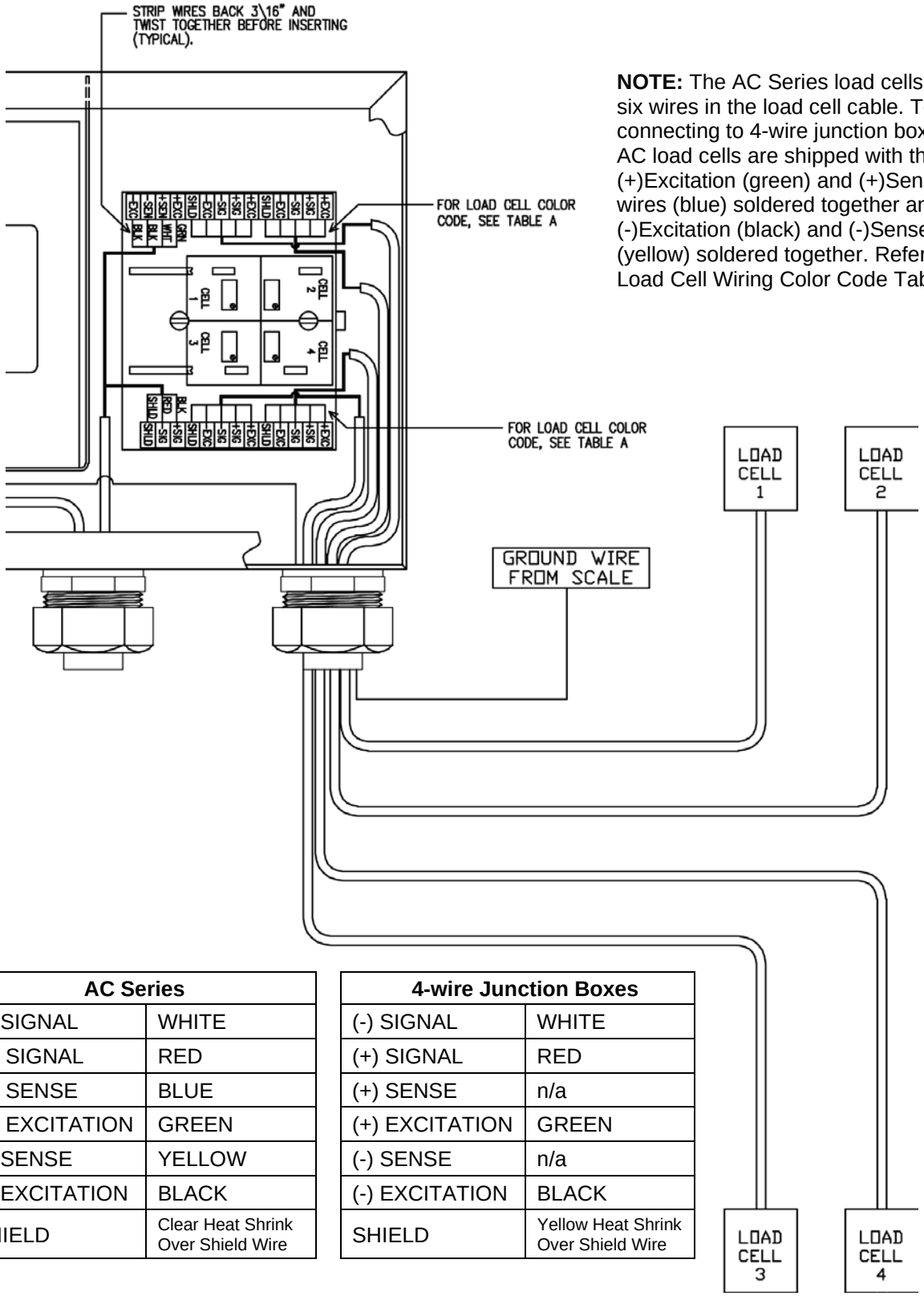
Table A – Load Cell Output Voltage Chart

	No Load	Dead Load	
Cell Number	**Col. 1 mV Output**	**Col. 2 mV Output**	**Col. 3 mV Output**
1			
2			
3			
4			

INTERCONNECTION DIAGRAM

SWIM INTERCONNECTION DIAGRAM – 3502-0669-02

Load Cell Connections



NOTE: The AC Series load cells have six wires in the load cell cable. To allow connecting to 4-wire junction boxes, the AC load cells are shipped with the (+)Excitation (green) and (+)Sense wires (blue) soldered together and the (-)Excitation (black) and (-)Sense wires (yellow) soldered together. Refer to the Load Cell Wiring Color Code Table.

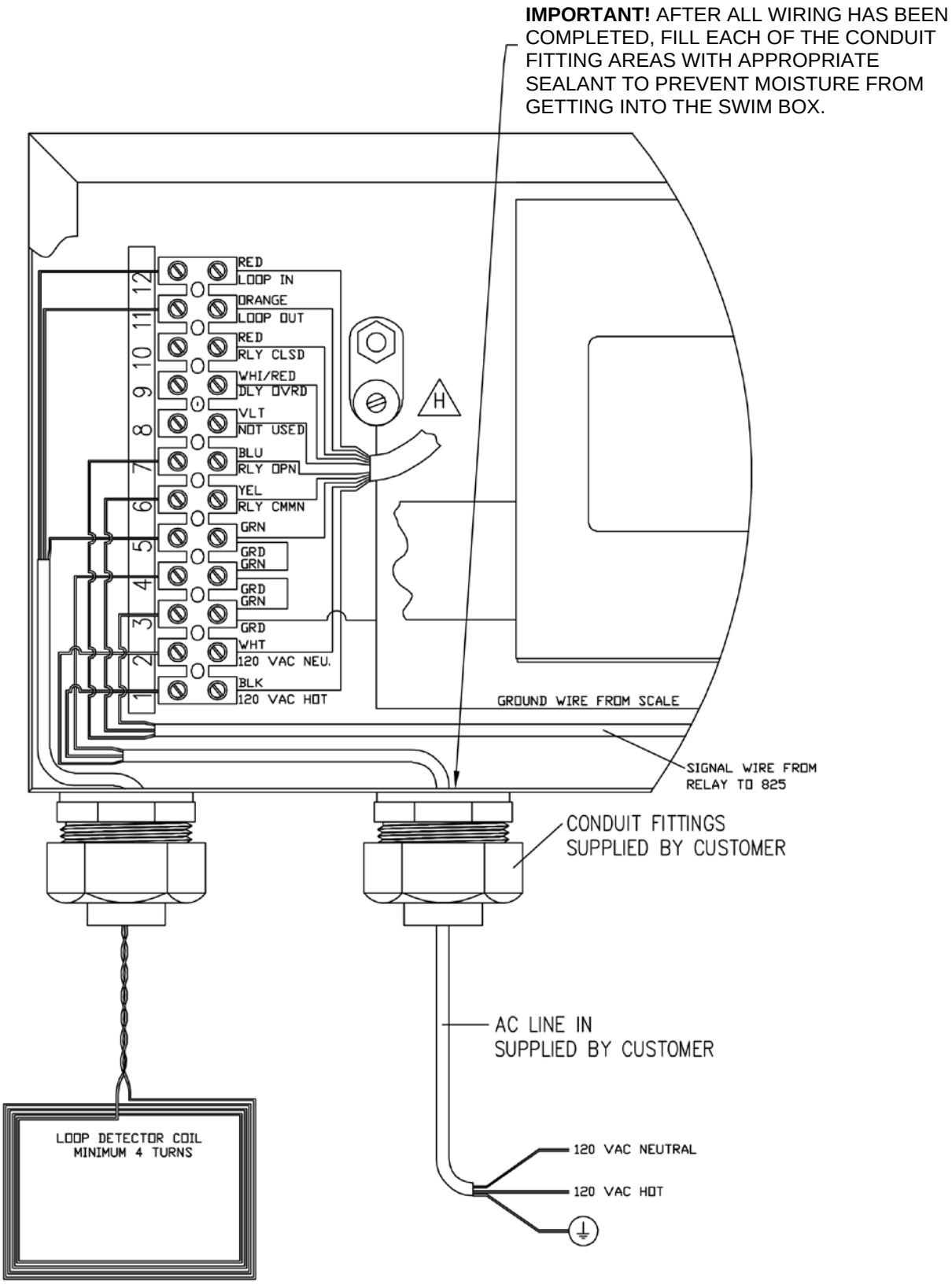
AC Series	
(-) SIGNAL	WHITE
(+) SIGNAL	RED
(+) SENSE	BLUE
(+) EXCITATION	GREEN
(-) SENSE	YELLOW
(-) EXCITATION	BLACK
SHIELD	Clear Heat Shrink Over Shield Wire

4-wire Junction Boxes	
(-) SIGNAL	WHITE
(+) SIGNAL	RED
(+) SENSE	n/a
(+) EXCITATION	GREEN
(-) SENSE	n/a
(-) EXCITATION	BLACK
SHIELD	Yellow Heat Shrink Over Shield Wire

INTERCONNECTION DIAGRAM

SWIM INTERCONNECTION DIAGRAM – 3502-0669-02

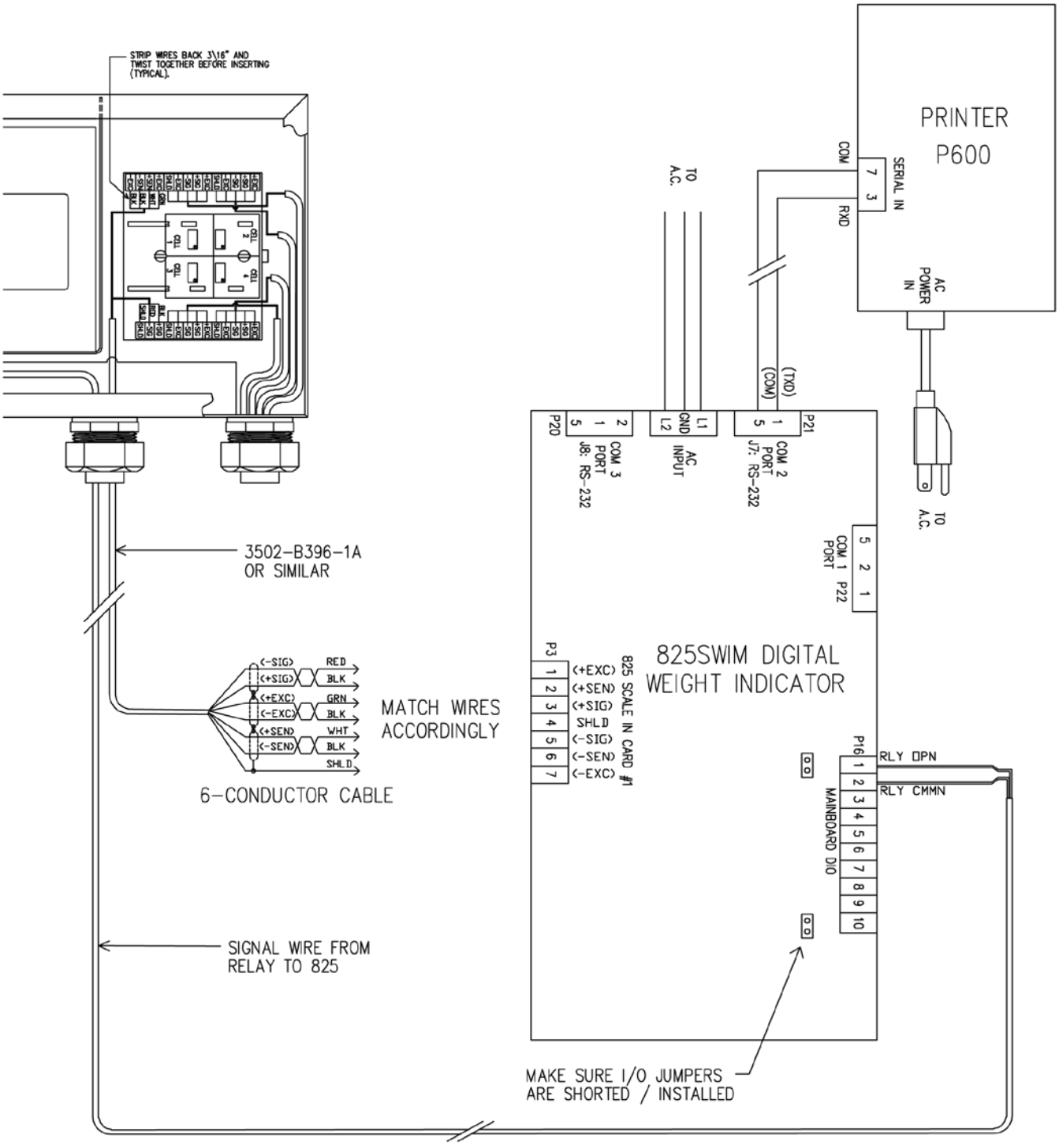
Loop Detector Coil and AC Power Connections



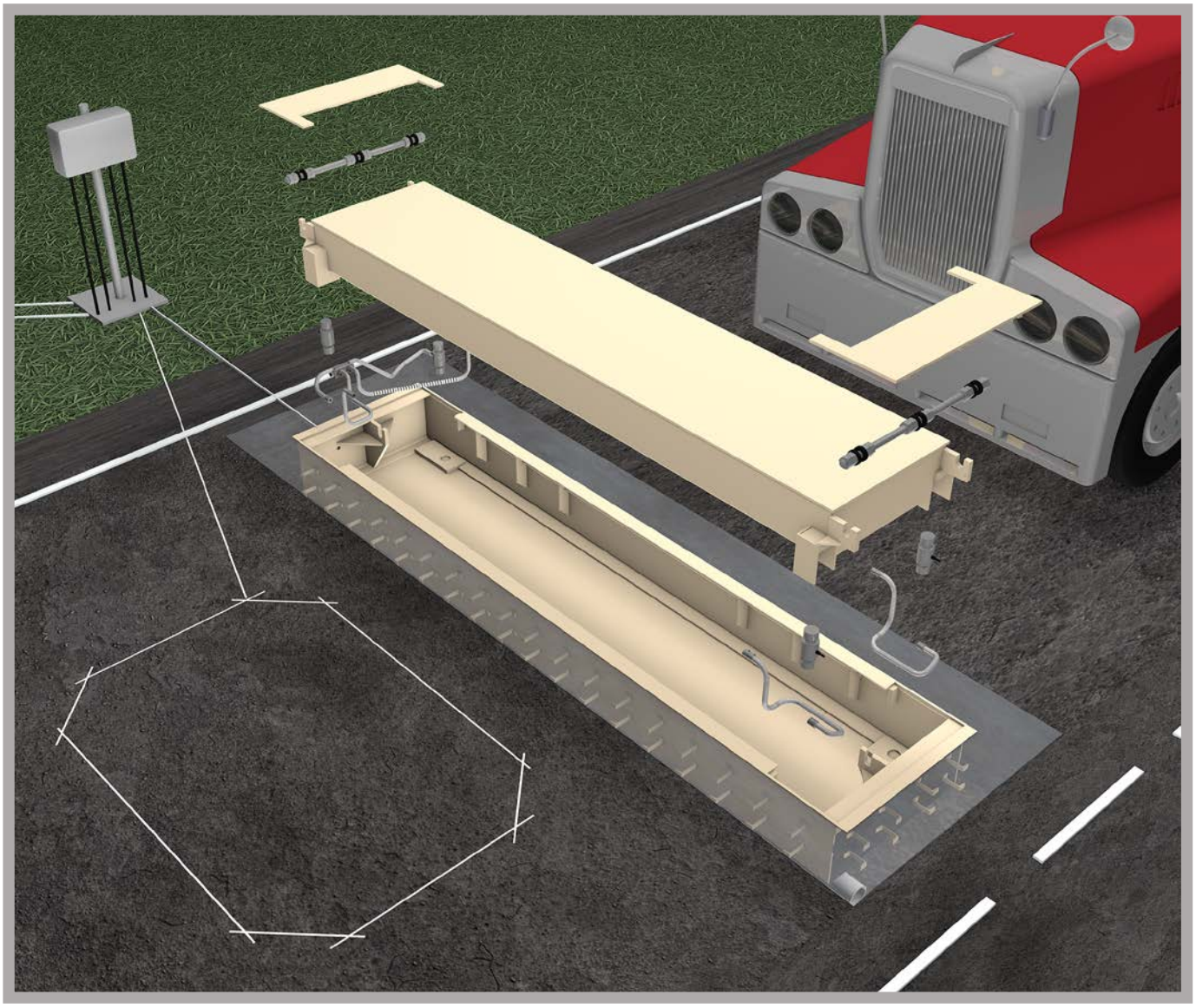
INTERCONNECTION DIAGRAM

SWIM INTERCONNECTION DIAGRAM – 3502-0669-02

825SWIM Digital Weight Indicator and P600 Printer Connections



PARTS IDENTIFICATION



PARTS IDENTIFICATION, CONT.

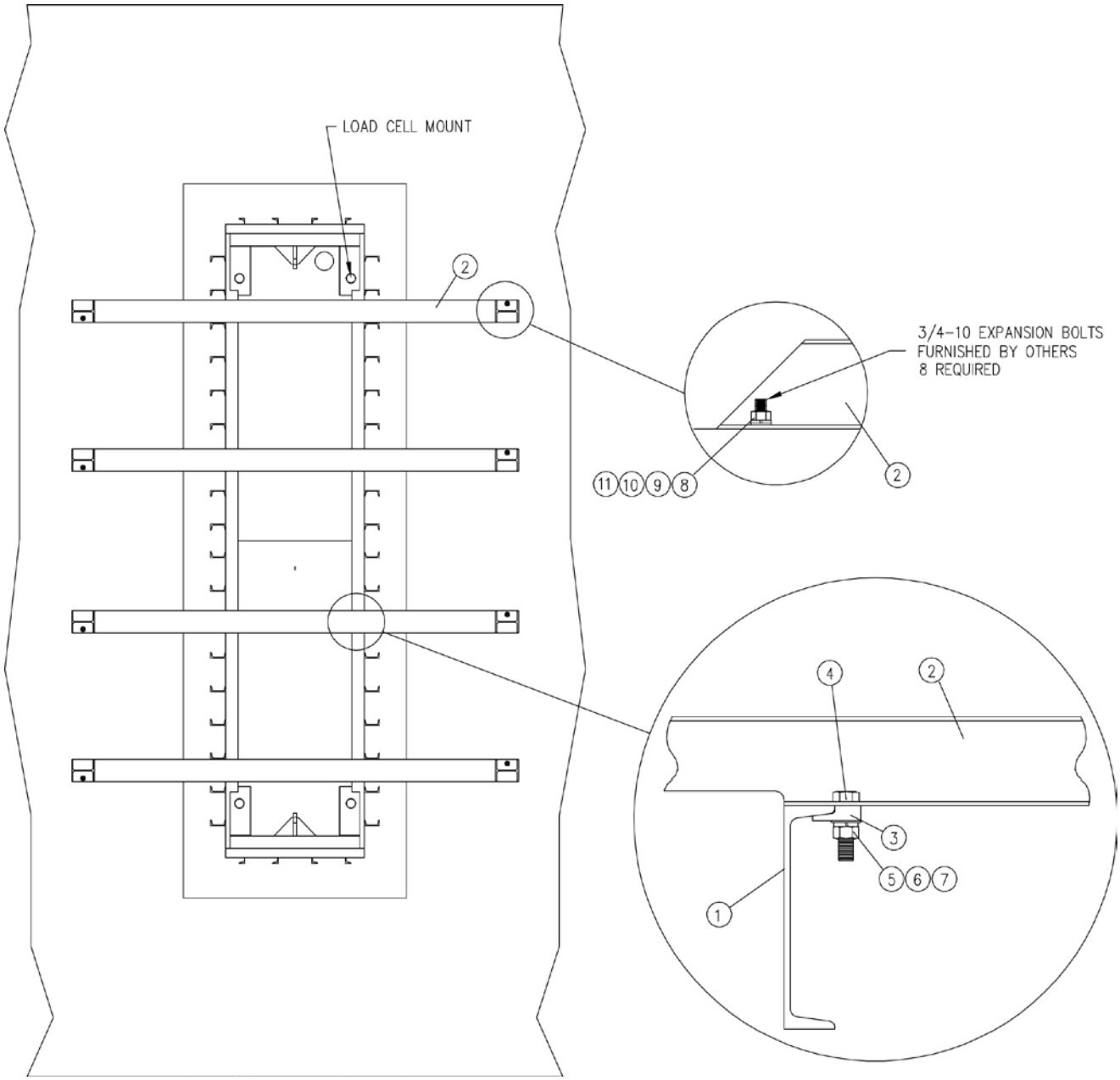
Mounting Frame Installation Kit – 0170-0140-0A

ITEM #	QTY	PART NUMBER	DESCRIPTION
1	REF	0170-0106-0A	MOUNTING FRAME (SEE PIT PLAN 0170-0141-0A)
2	4	0170-0137-08	BEAM
3	8	0170-0138-08	BEAM CLIP
4	8	6007-0372	HEX HEAD BOLT, 1-8UNC-2A X 4”
5	8	6024-0060	LOCK WASHER, 1”
6	8	6024-0027	FLAT WASHER, 1”
7	8	6013-0165	HEX NUT, 1-8UNC-2B
8	8	∗	LOCK WASHER 3/4”
9	8	∗	FLAT WASHER 3/4”
10	8	∗	HEX NUT 3/4-10UNC-2B
11	8	∗	EXPANSION BOLT 3/4-10UNC X 6” LONG

∗ FURNISHED BY OTHERS

PARTS IDENTIFICATION, CONT.

Mounting Frame Installation Kit – 0170-0140-0A



PARTS IDENTIFICATION, CONT.

Weighbridge Installation Assembly – 0170-0105-0A

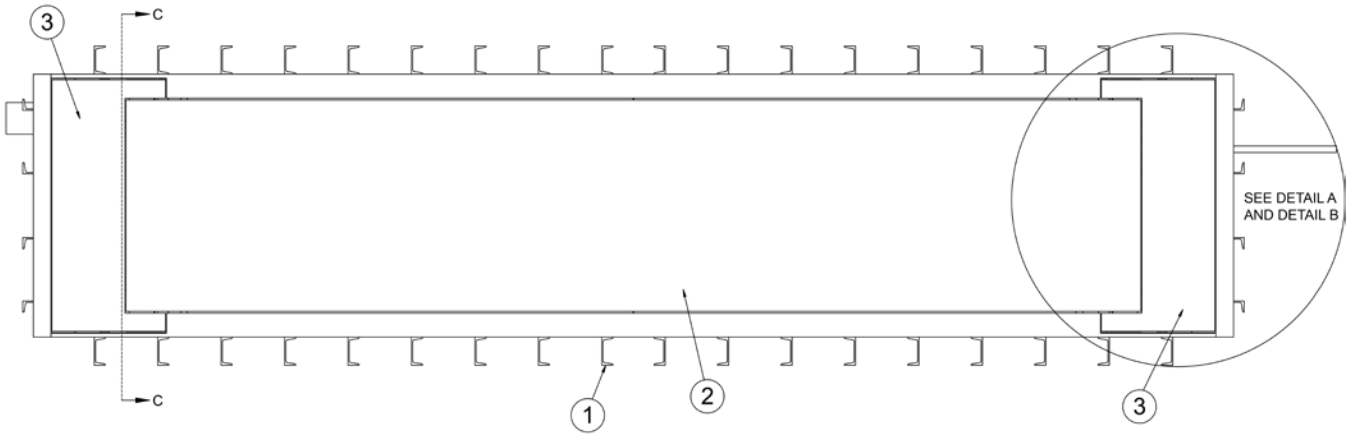
ITEM #	QTY	PART NUMBER	DESCRIPTION
1	1	0170-0105-1A	MOUNTING FRAME INSTALLATION ASSEMBLY
2	1	0170-0117-0A	WEIGHBRIDGE ASSEMBLY
3	2	0170-0120-0A	ACCESS PLATE ASSEMBLY
4	2	0169-0191-08	CHECK ROD 1 1/4" x 36"
5	12	0142-B184-18	CONVEX WASHER (HALF OF A SET)
6	12	0142-B184-08	CONCAVE WASHER (HALF OF A SET)
7	24	6013-0176	NUT 1-1/4-7 HEX Z-PLATED
8	2	0170-0147-08	SHIM, 16 GA. FOR SWIM
9	2	0170-0148-08	SHIM, 11 GA. FOR SWIM
10	2	6007-0021	1/4"-20 UNC 2A X 5/8"
11	2	6610-5006	GROUND LUG
12	4 FT	6980-0035	GROUND WIRE, 10GA, GREEN
13	1	0170-0143-08	CARDINAL DATA PLATE
14	4	6680-2102	RIVET POP, BH AL 1/8 DIA x 376-500 GR

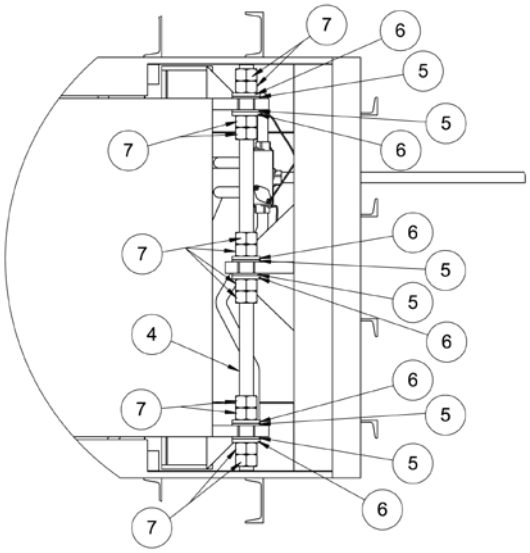
NOTES:

1. Shim under the load cells using part numbers (0170-0147-08 – 1/16” thick) and (0170-0148-08 – 1/8” thick) (NOT SHOWN) if necessary to obtain a proper dead load.

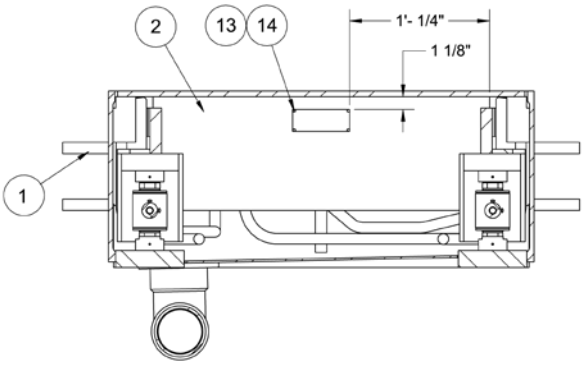
PARTS IDENTIFICATION, CONT.

Weighbridge Installation Assembly – 0170-0105-0A



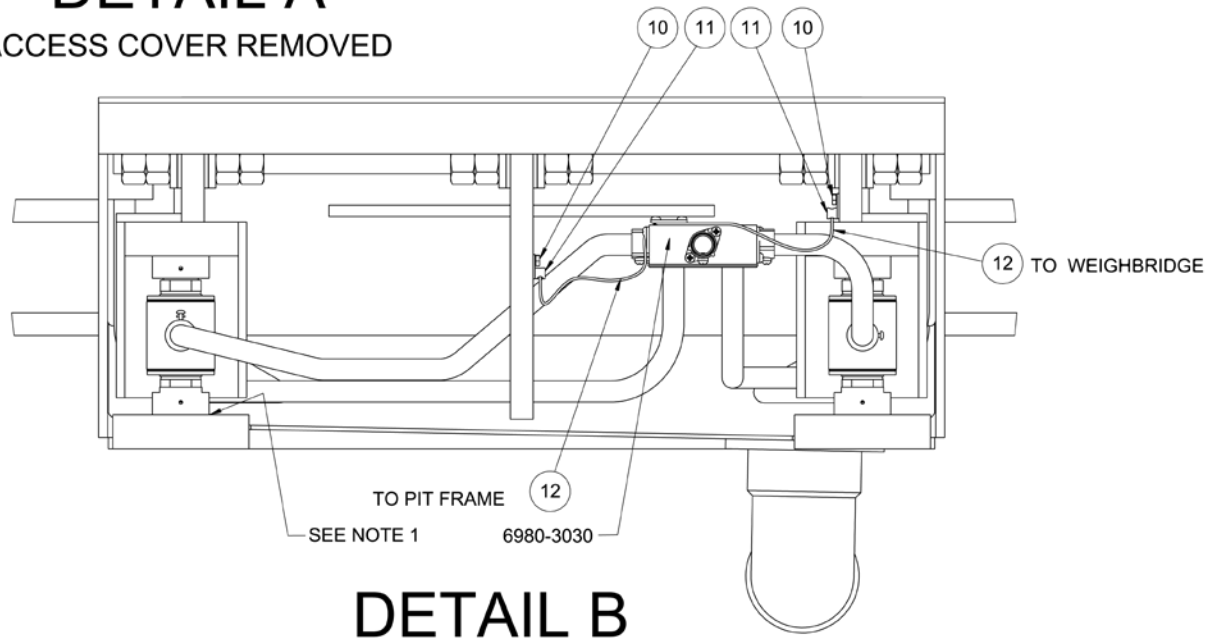


DETAIL A



SECTION C-C

ACCESS COVER REMOVED



DETAIL B

PARTS IDENTIFICATION, CONT.

SWIM BOX WITH HARDWARE – 8300-0131-0A

ITEM #	QTY	PART NUMBER	DESCRIPTION
2	1	6600-1231	LOOP DETECTOR
3	1	3502-C205-1A	PCB TRIM BOARD
4	1	6610-5080	TERMINAL BLOCK
7	2	6680-2105	SPACER #4-40 X .750 NYLON
8	2	6021-0661	SCW PHMS S.S. 6-32 X 1/4”
10	1	6610-5006	GROUND LUG L-70
11	1	6013-0297	HEX NUT #10-32 S.S.
12	1	6024-0037	LOCK WASHER #10 REG S.S.
13	1	6600-1234	CABLE WIRE HARNESS FOR LOOP DETECTOR
14	2	6980-0127	GROUND WIRE
15	4	3502-B215-08	HOLE PLUG
16	4	3502-B216-08	GASKET
17	4	3502-B215-0A	HOLE PLUG WLD.
18	4	6013-0184	WING NUT
21	1		TERMINAL BLOCK NUMBER LABEL

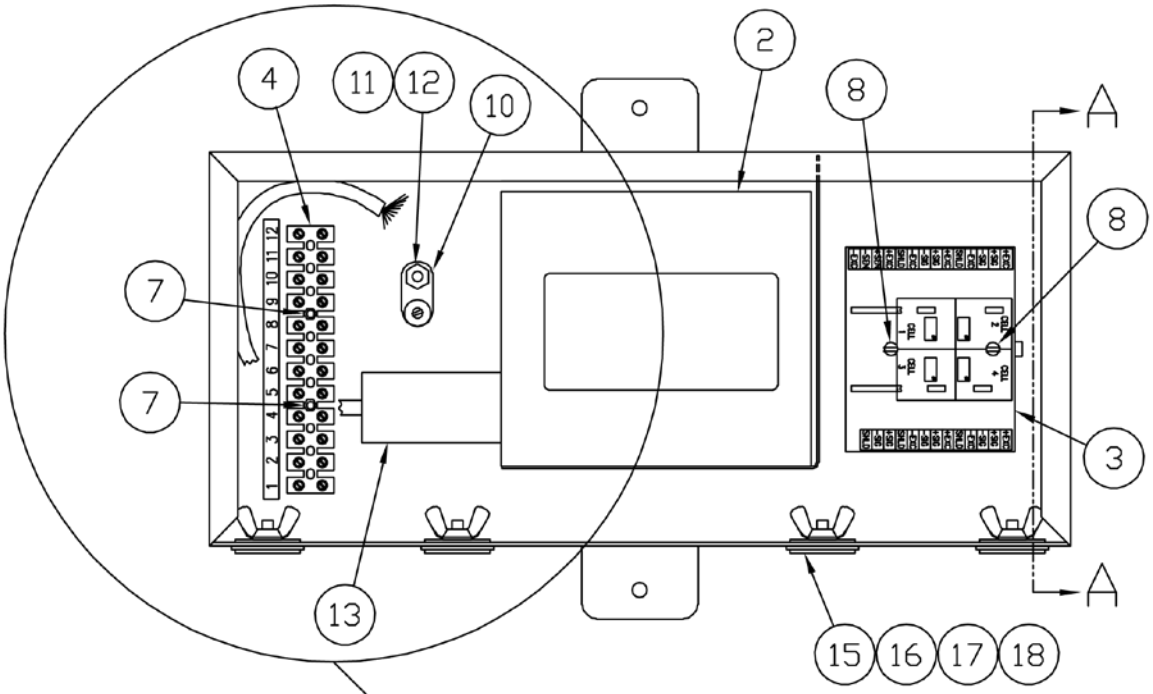
LOOP DETECTOR COIL

QTY	PART NUMBER	DESCRIPTION
250 FT	6980-2051	14 AWG LOOP WIRE
2	6560-1128	LOOP SEALANT (DURANT® STAT-A-FLEX) ✳
3	6560-1139	LOOP SEALANT (VULKEM® 45 SSL) ✳

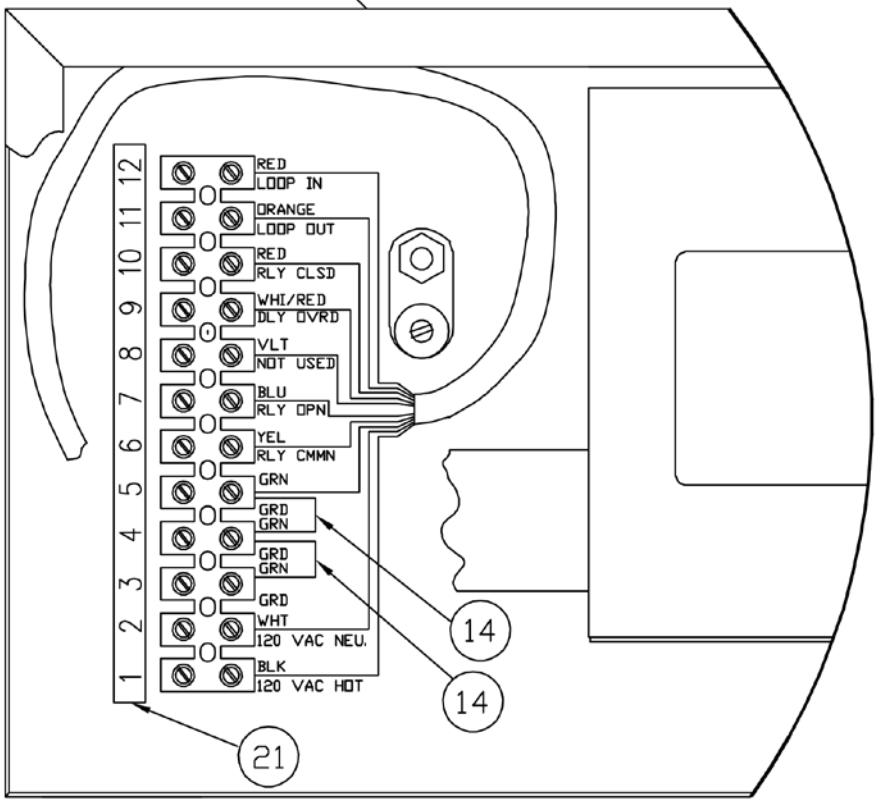
✳ Refer to construction code and/or governing authority requirements regarding what type of sealant to use.

PARTS IDENTIFICATION, CONT.

SWIM BOX WITH HARDWARE – 8300-0131-0A



VIEW SHOWN WITHOUT COVER, HINGE, OR DRAW LATCH.



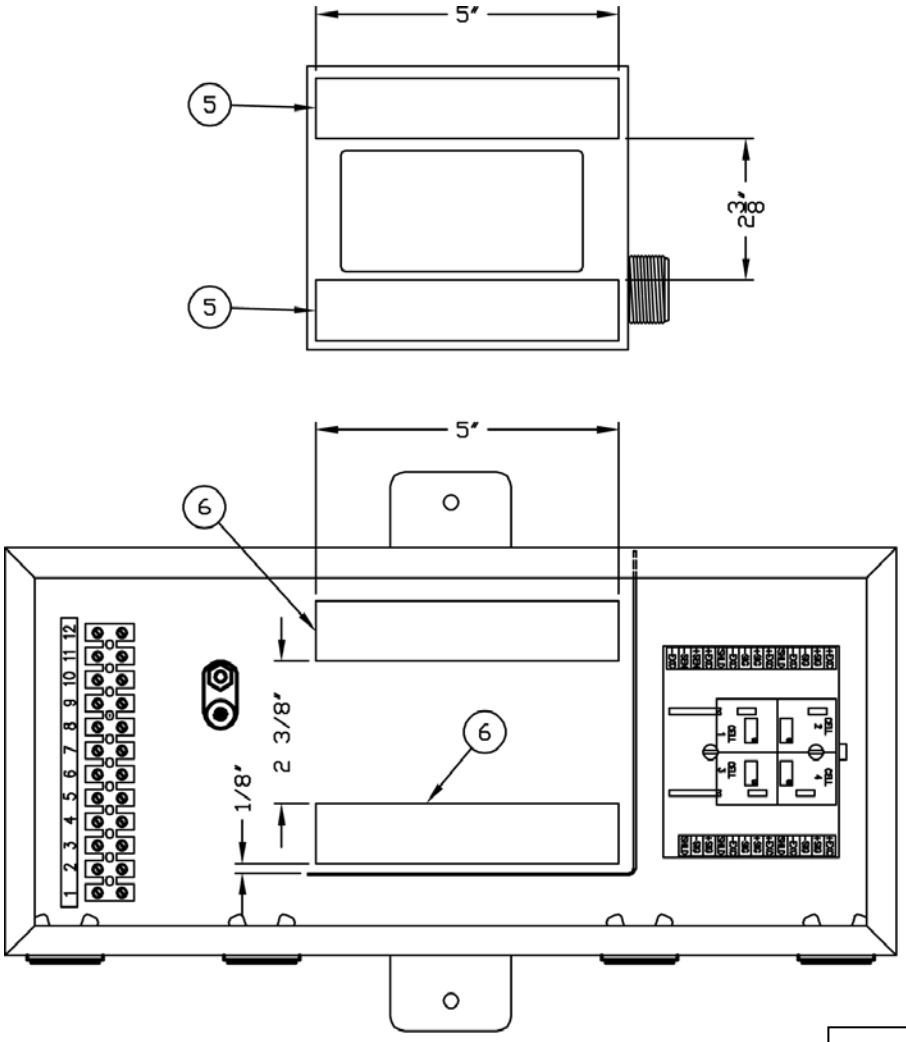
PARTS IDENTIFICATION, CONT.

SWIM BOX WITH HARDWARE – 8300-0131-0A

ITEM #	QTY	PART NUMBER	DESCRIPTION
1	1	8300-0130-0A	SWIM-BOX WELDMENT
5	10 IN.	6680-2097	NYLON LOOP SOFT
6	10 IN.	6680-2098	MUSHROOM HOOK ROUGH
19	1	3502-B428-08	GASKET
20	1	6560-0064	DESSICCANT BAG
22	1	3502-0670-GS	FILL WITH SEALANT NOTE (NOT SHOWN)

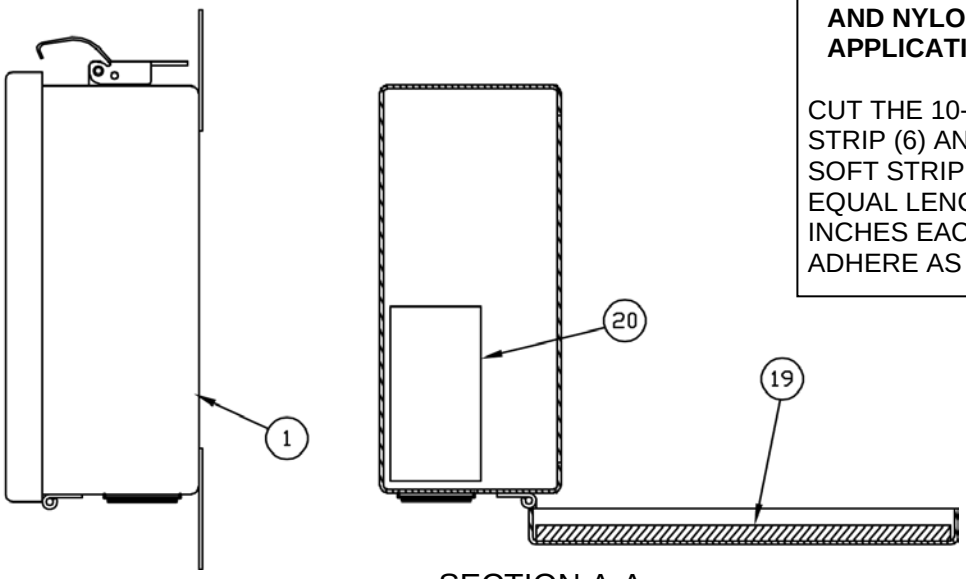
PARTS IDENTIFICATION, CONT.

SWIM BOX WITH HARDWARE – 8300-0131-0A



MUSHROOM HOOK (ROUGH) AND NYLON LOOP (SOFT) APPLICATION DETAIL

CUT THE 10-INCH ROUGH STRIP (6) AND THE 10-INCH SOFT STRIP (5) INTO TWO EQUAL LENGTH PIECES OF 5 INCHES EACH. APPLY AND ADHERE AS SHOWN.

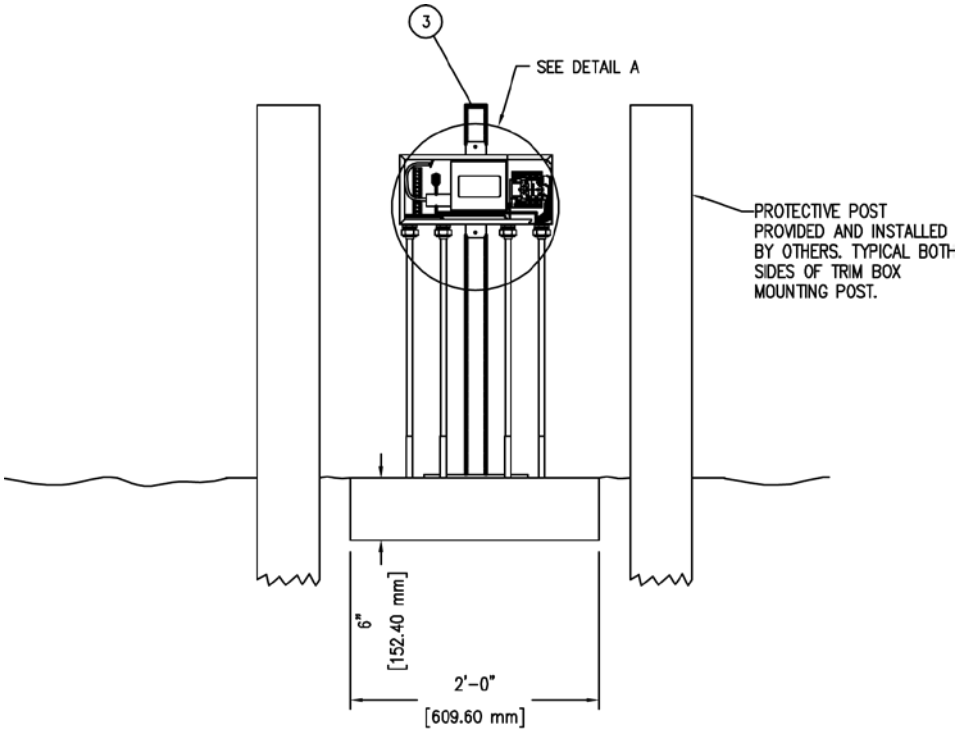


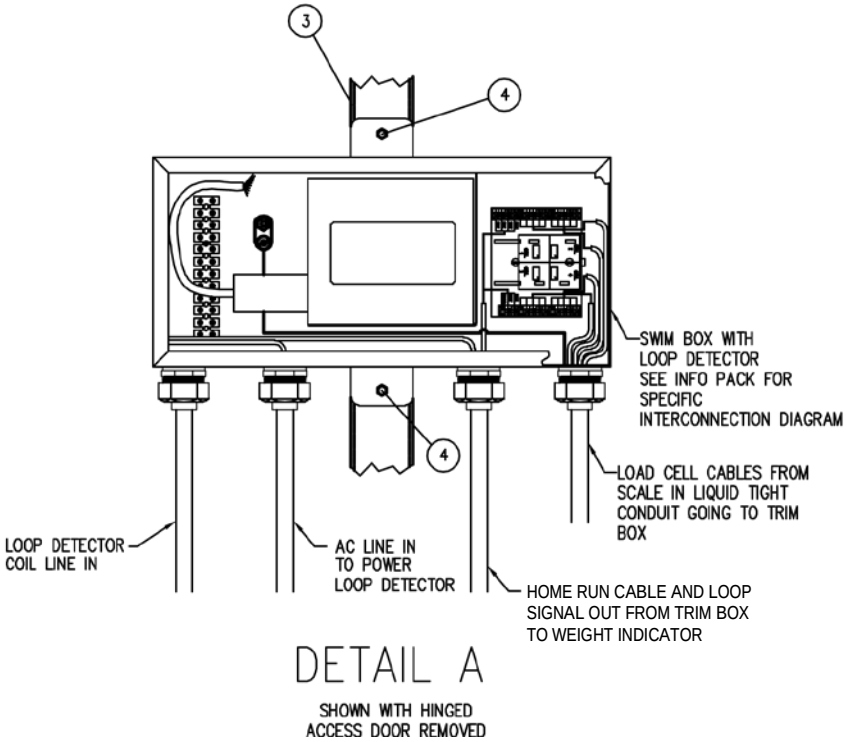
SECTION A-A

PARTS IDENTIFICATION, CONT.

SWIM Box Mounting Post

ITEM #	QTY	PART NUMBER	DESCRIPTION
3	1	0170-0136-0A	JUNCTION BOX POST
4	2	6021-1416	SELF TAPPING SCREW, 1/4” DIA X 1/2” LONG





STATEMENT OF LIMITED WARRANTY

WARRANTY TERMS

Cardinal Scale Manufacturing Company warrants the equipment we manufacture against defects in material and workmanship. The length and terms and conditions of these warranties vary with the type of product and are summarized below:

PRODUCT TYPE	TERM	MATERIAL AND WORKMAN-SHIP	LIGHTNING DAMAGE See note 9	WATER DAMAGE See note 7	CORROSION See note 4	ON-SITE LABOR	LIMITATIONS AND REQUIREMENTS
WEIGHT INDICATORS	90 DAY REPLACEMENT --- 1 YEAR PARTS	YES	YES	YES	YES	NO	1, 2, 3, 5, 6 A, B, C, D
LOAD CELLS (Excluding Hydraulic)	1 YEAR	YES	YES	YES	YES	NO	1, 2, 3, 5, 6 A, B, C, D
HYDRAULIC LOAD CELLS (When purchased with Guardian Vehicle Scale)	LIFETIME	YES	YES	YES	YES	90 DAYS	1, 5, 6, 8 A, B, C, D
HYDRAULIC LOAD CELLS (When purchased separately)	10 YEARS	YES	YES	YES	YES	NO	1, 5, 6, 8, 9 A, B, C, D
VEHICLE SCALE (Deck and Below Excl. PSC Series)	5 YEARS	YES	YES	YES	YES	90 DAYS	1, 2, 3, 5, 6 A, B, C, D, E
LSC SCALE (Deck and Below)	3 YEARS	YES	YES	YES	YES	90 DAYS	1, 2, 3, 5, 6, 11 A, B, C, D
GUARDIAN FLOOR SCALES	10 YEARS	YES	YES	YES	YES	NO	1, 2, 3, 5, 6, 9, 10 A, B, C, D
ALL OTHER CARDINAL PRODUCTS	1 YEAR	YES	YES	YES	YES	NO	1, 2, 5, 6 A, B, C, D, E
REPLACEMENT PARTS	90 DAYS	YES	YES	YES	YES	NO	1, 2, 4, 5, 6 A, B, C, D
SWIM AND 760 SERIES VEHICLE SCALES	1 YEAR	YES	YES	YES	YES	90 DAYS	1, 2, 5, 6 A, B, C, D
SOFTWARE	90 DAYS	YES	N/A	N/A	N/A	NO	1, 6 B, C, D
CONVEYOR BELT SCALES (including Belt-Way)	1 YEAR	YES	YES	YES	YES	NO	1, 2, 3, 5, 6 A, B, C, D, E, F

CARDINAL®

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Webb City, MO 64870

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315-WARRANTY-CAR-M

APPLICABLE LIMITATIONS AND REQUIREMENTS

1. This warranty applies only to the original purchaser. The warranty does not apply to equipment that has been tampered with, defaced, damaged, or had repairs or modifications not authorized by Cardinal or has had the serial number altered, defaced or removed.
2. This warranty is not applicable to equipment that has not been grounded in accordance with Cardinal's recommendations.
3. This equipment must be installed and continuously maintained by an authorized Cardinal / Belt-Way dealer.
4. Applies only to components constructed from stainless steel.
5. This warranty does not apply to equipment damaged in transit. Claims for such damage must be made with the responsible freight carrier in accordance with freight carrier regulations.
6. Warranty term begins with date of shipment from Cardinal.
7. Only if device is rated NEMA 4 or better or IP equivalent.
8. Lifetime warranty applies to damages resulting from water, lightning, and voltage transients and applies only to the hydraulic load cell structure itself (does not include pressure transducers, rubber seals, o-rings, and associated wiring).
9. 10-Year prorated warranty on hydraulic load cells.
10. 1-Year warranty for scale structure.
11. PSC models' warranty coverage applies only to agricultural installations on farms up to 3,000 acres (LSC models not limited in this manner).
12. Load cell kits MUST be installed in accordance with Cardinal Scale instructions. Failure to follow these instructions will void the warranty.

EXCLUSIONS

A.) This warranty does not include replacement of consumable or expendable parts. The warranty does not apply to any item that has been damaged due to unusual wear, abuse, improper line voltage, overloading, theft, fire, water, prolonged storage or exposure while in purchaser's possession or acts of God unless otherwise stated herein.

B.) This warranty does not apply to peripheral equipment not manufactured by Cardinal. This equipment will normally be covered by the equipment manufacturer's warranty.

C.) This warranty sets forth the extent of our liability for breach of any warranty or deficiency in connection with the sale or use of our product. Cardinal will not be liable for consequential damages of any nature, including but not limited to loss of profit, delays or expenses, whether based on tort or contract. Cardinal reserves the right to incorporate improvements in material and design without notice and is not obligated to incorporate said improvements in equipment previously manufactured.

D.) This warranty is in lieu of all other warranties expressed or implied including any warranty that extends beyond the description of the product including any warranty of merchantability or fitness for a particular purpose. This warranty covers only those Cardinal products installed in the forty-eight contiguous United States and Canada.

E.) This warranty does not cover paint coatings due to the variety of environmental conditions.

F.) Do not cut load cell cables on load cells returned for credit or warranty replacement. Cutting the cable will void the warranty.

G.) Software is warranted only for performance of the functions listed in the software manual and/or the Cardinal proposal.

H.) The software warranty does not cover hardware. Warranties on hardware are provided from the hardware vendor only.

I.) The software warranty does not cover interfacing issues to non-Cardinal supplied hardware.

J.) The software warranty does not include automatic software upgrades unless purchased separately.

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