Digital Scale Kit

Installation and Operating Instructions

Important information about your Scale Kit

Introduction

Thank you for purchasing a Digital Scale Kit from B and B Scales! This document contains important information and guidelines about installing, wiring and using your new scale. Please take the time to read through this document before you attempt to install any of the scale components that came with your scale kit. ***Failure to follow the guidelines in this document may result in permanent damage to the components in your scale kit.***

Please note: This document does not contain information about programming or calibrating your indicator. Please see the separate indicator manual that came with the kit.

A Brief Word about Load Cells (READ THIS SECTION!!)

Digital scales have revolutionized the weighing industry. By simply measuring minute changes in electrical current, it is possible to determine the weight of an item with extreme accuracy. When you weigh an item on a digital scale, the indicator sends a very small electric current to the load cells and measures the amount of current that is returned from the load cells. Changes in this current enable the indicator to calculate the amount of force, or weight, that the load cells are being subjected to. As you can imagine, the load cells that came with your kit are delicate and can be damaged if subjected to abuse. Please read through the sections below to familiarize yourself with the limitations of your load cells.

What's Inside a Load Cell?

Take a moment to learn about how a load cell works!

The load cells that came with your kit are what are called "strain gauge load cells." They contain four very small devices called strain gauges. Each strain gauge looks like this (actual size):  The strain

gauges are suspended in a silicone-like gel that stretches when the load cell has weight on it. As the strain gauge stretches, the electrical resistance increases.

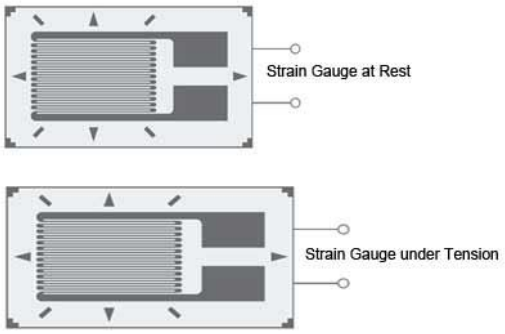

Figure 1: Strain Gauges at Rest and Under Load

Overloading Your Scale

Subjecting a load cell to more force than it was designed to handle can permanently damage the load cell. The internal strain gauges are designed to stretch only so much before they cannot return to their original position. If you put so much force on your load cell that it permanently stretches (or twists), the load cell is ruined. Generally speaking, most load cells can withstand about 150% of their rated capacity before permanent damage to one or more strain gauges occurs. To be on the safe side, we strongly recommend that you follow the "Divide by two" rule and limit the amount of force on any given load cell to no more than 50% of its rated value.

For example, if your load cell is rated for 2,500lbs, do not subject it to forces greater than 1,250lbs. If it is rated for 5,000lbs, limit the force to 2,500lbs, etc. This is why our 5,000lb Build Your Own Scale Kit, which contains FOUR 2,500lb load cells, is rated at 5,000lbs instead of 10,000lbs.

Important: *When calculating the safe load for a load cell, remember to include potential "shock" loads. Shock loads include such things as installing a load cell in a vehicle-mounted feeder, where the scale*

could potentially bounce up and down when the vehicle is in motion, or under a squeeze chute, where an animal could suddenly jump around and exert excess force on the load cell.

Electrical Current (including welding)

Load cells send and receive extremely low electrical current. If your load cells are mounted to a structure that conducts electricity such as steel, completely disconnect and remove the load cells prior to welding anything to the structure. Failure to do so may permanently damage your load cells. Recall the "actual size" image of the strain gauge in the previous section? You can imagine, it doesn't take very much current to melt it. Damaged load cells that have been subjected to excess electrical current are not covered by the warranty. (There are tools that can identify this kind of damage.)

Moisture

Your load cells are sealed with a silicone-based gel and are largely water resistant. In most cases, it is perfectly fine if your load cells get wet. In fact, we encourage you to wash them down if they are excessively muddy or dirty. However, do not leave your load cells submerged in standing water for any period of time. Water, especially water that contains animal waste, is extremely corrosive and will eat away at the load cell seals over time.

For just about any location in the United States, including the Deep South, the amount of naturally occurring humidity will not damage your load cells. If you are in an environment such as The Caribbean, or in an indoor industrial setting with artificially high humidity, you may want to consider a stainless steel, hermetically sealed load cell.

Heat and Cold

Your load cells are temperature compensated and can withstand exposure to extreme heat and cold and still weigh accurately in most conditions. Even exposure to an environment as cold as -30F or as hot as +120F will not permanently damage your load cells. However, extreme heat and cold do have an

effect on electrical resistance, so you may find that your load cells are not as accurate at these sorts of temperature extremes. So, next time it's minus 35 and you feel like going outside to weigh your animals, resist the temptation. The scale probably won't be accurate anyway.

Load Cell Cables

Your digital indicator relies on electrical resistance to measure the amount of force on a load cell. If you cut the cables that are permanently connected to your load cells, or if the cable becomes damaged, you will change the amount of resistance (it will decrease) that is applied to the signal. Since the load cell cables are physically soldered to the inside of each load cell, ***cutting the load cell cables will permanently destroy the entire load cell***. If you find that the load cell cables are too long, use a zip tie or similar device to manage the excess cable.

We strongly recommend that you run either PVC or steel wire conduit to protect the load cell cables. Damaged load cell cables are not covered under the product warranty.

Mounting Your Load Cells

To function properly, load cells must be able to "deflect" (bend). This deflection stretches or compresses the strain gauges, which changes the amount of resistance in the current that is returned to the indicator. Because of this, it is important that you install the load cells so that they can function as designed.

Refer to Figure 2 for the following general guidelines:

1. Install the load cells with the arrow pointing up, toward the load. (In the Figure below, the load cell foot screws in to the bottom side of the load cell.)

2. Install the included spacer in between the load cell and your platform. This will create a small gap above the “Foot Side” of the load cell, allowing it to deflect.
3. Install the load cells as far apart as possible under your platform.

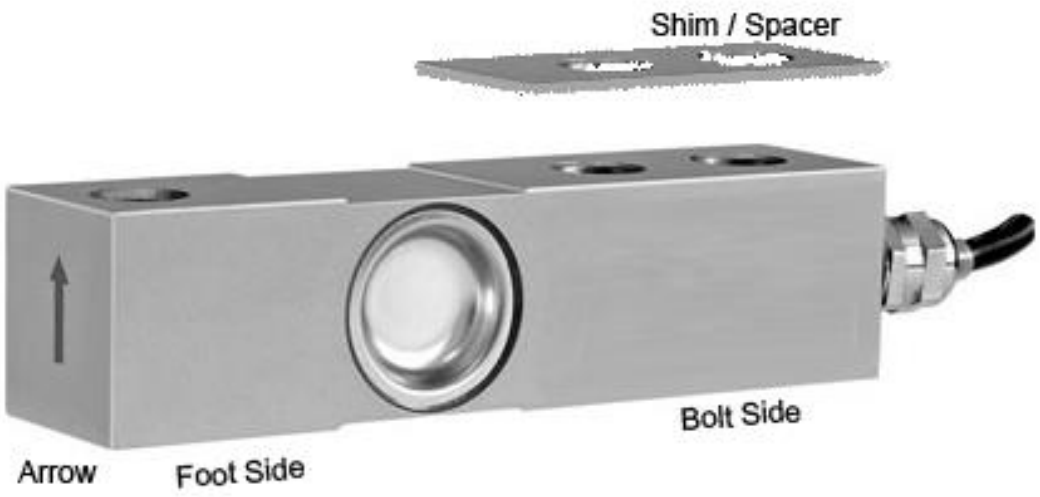

Figure 2: Mounting Your Load Cells

Hooking Everything Up

Once your load cells are mounted, simply run the load cell cables to the junction box and wire them up (see next section), then connect the Home Run Cable to the indicator (also in the next section) and you should be ready to calibrate your scale. Our award-winning team of technical illustrators put together the following diagram to illustrate how everything goes together.

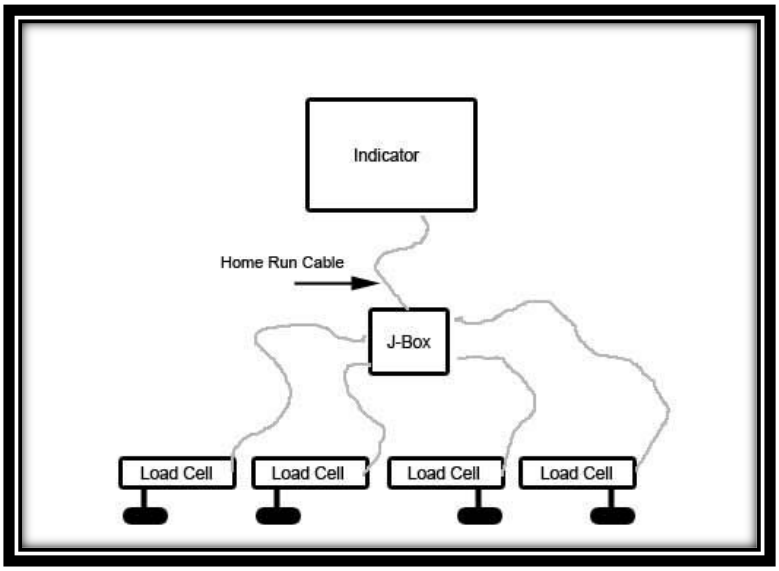

Figure 3 Hooking Everything Up. (Signed copies of this amazing illustration are available for $500.00 each. Contact us for details.)

Wiring the Junction Box

The junction box that came with your kit contains a "summing card" that adds up the signals that it receives from all of the load cells that are connected to it. The junction box is connected to the indicator via the Home Run Cable. To function properly, the load cells must be properly connected to the junction box, as follows:

Table 1: Wiring the Load Cells

Wire Color	Junction Box Connection
RED	EXC + (or E+)
BLACK	EXC – (or E-)
GREEN	SIG + (or S+)
WHITE	SIG – (or S-)
YELLOW (this wire is sometimes Black, depending on the load cell manufacturer. If you have two black wires, this is **thicker** of the two.)	SHLD (Ground)

Note: Some junction boxes will have spaces for sensor wires, labeled SEN+ and SEN-. These are not used for standard four-wire load cells.

TIP: Your scale will function with as few as only one load cell connected to it. This can be useful if you are troubleshooting a suspected load cell problem. See the Troubleshooting section for more info about this.

Table 2: Wiring the Home Run Cable (the cable that goes to the Indicator)

RED	EXC + (or E+)
BLACK	EXC – (or E-)
GREEN	SIG + (or S+)
WHITE	SIG – (or S-)

Note: There is usually no Ground Wire on the Home Run Cable. If yours happens to have one, it will be Yellow. Wire it to the SHLD space.

The Signal Wires

The green and white wires that come from each load cell transmit the signal from the load cell to the indicator. If you installed your load cells with the arrow facing down (shame on you), your load cells will send a negative signal. Simply reverse the green and white wires to correct this problem. You will receive an error when you calibrate the indicator if the signal is negative.

Calibrating your Scale

Since B and B Scales, Inc. supplies numerous different indicators, the specific calibration instructions for your indicator are located in the Indicator User's Guide, which should have come with your kit. If for some reason it is missing, you can download it at www.bbscales.com in the "Support" section.

A Quick Word about Test Weights

You will need a "known" weight to calibrate your scale. Professional scale companies typically use NIST-traceable, certified test weights when they calibrate a scale. You probably don't have these and that's okay. To calibrate your scale you can use any "known" weight. Examples of common items that you can use to calibrate your scale include:

- New Bags of Feed
- New Bags of Concrete
- Tractor Weights
- Salt or Mineral Blocks
- Exercise Weights (not really recommended but they'll do in a pinch)

Examples of common items that you SHOULD NOT use to calibrate your scale include:

- Anything that is alive. Don't use an animal, your son, or your brother-in-law, Larry, to calibrate your scale. It is not physically possible to remain still enough. Just the beating of your heart or your breathing is enough motion to cause a motion error in the indicator.
- Buckets of water. Yes, water weighs about 8lbs a gallon and you can, in theory, fill a 5-gallon bucket to the top and make a 40lb test weight. This is almost always problematic – water spills and buckets are not exact. Not recommended.
- In general, you must use a known "dead" weight.

  True story: I was once helping a gentleman calibrate his scale on the phone. I asked him what he was using for his test weights and he told me he had three of his ranch hands who were going to stand on the scale.

  I told him, "You have to use a dead weight."

  "Well, hell," the guy says, "everyone who works for me IS dead weight."

Troubleshooting

The table below lists some common error conditions with suggestions for probable causes and solutions. Please also see the Troubleshooting section of your Indicator manual for additional tips. The table below deals primarily with load cell, junction box and cabling issues.

Symptom	Probable Cause	Solution
Scale weighs negative	The indicator is receiving a negative signal from the junction box.	Verify that the arrows on the load cells are pointing up and that the load cells and home run cable are properly wired.
Weights are different at one end of the platform vs. the other	**This cannot be an indicator problem.** This is almost always a physical problem with the load cell installation. It is also possible that you have a bad load cell.	1. Make sure that the load cells are free from obstruction and are able to deflect. 2. Make sure that the load cell cables are not damaged. 3. Verify that all load cells are properly connected in the junction box.
Displayed weight is not steady; indicator jumps	Nine time out of ten, this is a bad home run cable. Sometimes the plug on the indicator itself may be loose. Also check your junction box wires. This can be a load cell problem, but it is very unusual.	1. Wiggle the home run cable where it connects to the indicator. If the display moves around in response to your wiggling, replace the home run cable. 2. Check for loose wire in the junction box.
Scale does not weigh at all (stays at zero)	1. There is no communication between the junction box and the indicator. 2. The load cells cannot deflect 3. Check that the indicator is functioning. (see your indicator manual) 4. Bad junction box (extremely rare)	1. Verify junction box wiring. 2. Check that the home run cable is not damaged. Try wiggling it, as above. 3. Make sure the load cells are properly installed and can deflect. (If they are flush-mounted, they won't work.) 4. Inspect junction box for damage or signs of excess moisture (rust).

Testing a Load Cell

If you determine that you may be having a problem with a load cell, here are some tips for testing them.

If you have a Multi-meter

A $10.00 digital multi-meter can sometimes save you a whole lot of work. You can simply test your load cells by touching the leads on your multi-meter to the load cell wires and comparing the signals. To do this:

1. Open the junction box.
2. Set your multi-meter on the "Resistance" setting.
3. Touch the Red lead to the red wire and Black lead to the black wire. Verify that the reading for all four load cells is the same (or very close).
4. Touch the Red lead to the green wire and the Black lead to the white wire. You should have about 350 Ohms of resistance on an unloaded load cell. Of course, if you have a squeeze chute or cake feeder sitting on your load cells, the readings will be different. Verify that all four load cells have similar readings (or very close).

   In general, if one of your load cells emits wildly different readings than the other three, replace the load cell.

If you don't have a multi-meter

You can test the load cells by disconnecting them from the junction box one at a time and seeing how the indicator reacts. Remember that you only need one load cell connected to a junction box for the scale to function (it won't be accurate, but it will function). Try the procedure below:

1. Open the junction box.
2. Completely disconnect all but one of the load cells.

3. With one load cell still connected, recalibrate the scale. If it calibrates properly, connect a second load cell to the junction box and recalibrate it again. Repeat this for all of the load cells. This procedure is cumbersome but it is usually effective at identifying a bad load cell.

Contact Us

We always want to hear from you and we are happy to help if you are having problems, even on a Sunday morning.

Call us: 575-332-4111. This is the office number. If we are closed, this number is almost always forwarded to someone's cell phone. We are located in Mountain Time. Please don't call before 6:00AM or after 9:00PM. If you get our voicemail, leave a message. We'll call you back.

E-mail us: We monitor our e-mail continuously. Reach us at "sales@bbscales.com"

Web: There is a lot of information on our website at www.bbscales.com. Go to the Support section for up-to-date downloads and information.

Enjoy Your Scale!