

# ANYLOAD<sup>®</sup>

## LCT100

Load Cell Tester

User's Guide (v1711)

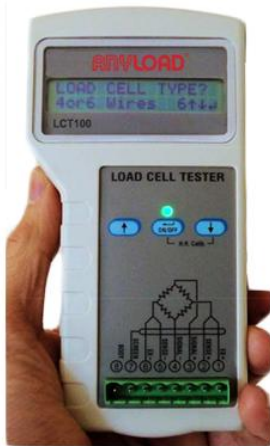


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## A. Basic Steps in Load Cell Testing using the LCT100:



1. Connect the load cell cable to the right pins in the connector
2. Make sure that the shield and body are not connected
3. Turn on the unit by pressing on/off key for a few seconds
4. The display shows the welcome screen for a few seconds and then will ask for load cell type ( 4 or 6 wires )
5. For the most accurate results for the insulation high resistance ( leakage ), this is the time to run the calibration. Hold both the right key and on/off key, the display will show "Calibrating..." After 2 seconds the unit is calibrated
6. Now connect the shield and body ( if available ) to the connector
7. Choose type of Load Cell ( 4 or 6 wires ) and press Enter
8. Choose L/C rated output with the up and down keys and press Enter
9. Press Enter for full testing or, down arrow for continuous display

### **If continuous mode is chosen:**

The LED will blink in various colors and the Load Cell signal will be displayed continuously in percentage of the full L/C capacity.

For example: applying 10Kg on a 100Kg load cell will show of 10%

Note: To save the battery the unit will shut off after 6 minutes

**If full testing cycle is chosen:**

The LCD shows “ Test in progress” and the LED blinks for a few seconds. Once the test is finished you may scroll the results by pressing the up arrow key. The results will be displayed in the following order:

**Input** – Resistance between Ex+ and Ex- ( Max 5000  $\Omega$  )

**Output** - Resistance between Signal+ and Signal- ( Max 5000  $\Omega$  )

**Sense+** - Resistance between Ex+ and Sense+ ( applicable for 6 wires load cell ) ( Max 5000  $\Omega$  )

**Sense-** - Resistance between Ex- and Sense- (applicable for 6 wires load cell) (Max 5000  $\Omega$  )

**Signal Output** – Load cell signal in percentage of full L/C capacity. Note: in case of a broken cable or a very high input/output resistance the display will show “ Cannot measure”

**Shield to Brdg** – Resistance between the cable shielding (screen) and the bridge

**Body to Brdg** – Resistance between the load cell body and the bridge

**Shield to Body** – Resistance between the load cell body and the cable’s shielding

**B. Tips for trouble shooting Load Cell and scales**

Load cells might be damaged due to many reasons: Overloading, lightning strikes, moisture or chemical ingress, vibrations, corrosion, pulling the cable etc. As a result, the scale may provide unstable readings, zero drifting, error reading, non-linearity etc.

The LCT100 is the only measuring tool required to perform the tests either on site or in the lab. Before you start, make sure to have the Load cell specs and the cable color code (usually you get it with the load cell, or it can be downloaded from the manufacturer’s web site).

**C. How to test a weighing platform with a few load cells:**

1. First stage: Leave all load cells connected to the summing box. Disconnect the cable from the weighing indicator, connect it to the LCT100 and perform a test.
2. Expected results for a good scale are as per the following example: If you have 4 load cells of 1000 $\Omega$ , 100kg each and 40kg are applied on the scale than you would expect to see around 250 $\Omega$  for the input and output (total of the Input resistance divide by 4 and the same for the

output resistance). In case of six wires cable, you should expect to get very low resistance between the sense lines and the inputs those are shorted inside the L/C. Signal output must be around 10% (full scale capacity is 400kg) and the Shield to bridge resistance must remain very high.e. >1000MΩ

3. If some of the expected results are not in the required range, or you get erratic / unstable readings when testing in Continuous (Gain) mode: Check the cable integrity between the summing box and the tester. If it looks fine, disconnect each Load Cell cable and check each Load Cell separately. Note: there is no need to remove the load cell from the scale.
4. If all results seem to be in range, you may check for scale linearity, by choosing Continuous mode (Gain) on the LCT100 and applying various weights on the scale.

**D. Understanding the LCT100 results:**

Testing result with LCT	Possible reasons	What to do?
Input / Output resistance not in range	Cable or connector problem	Check cable integrity and the connectors
	Problems inside the load cell	Replace or send for repair
Sense is Too high (6 wires cell)	Not connected inside L/C, or it can be 4 wires Load Cell	Replace or send for repair
Signal Output from the scale is not in the expected range	Corrosion, force shunts, accumulated dust below the L/C or a faulty L/C	Clean the dust and check force shunts and alignment. Replace L/C if necessary
Signal Output not in the expected range (Unloaded Load Cell it should be around 0%)	Load cell zero balance damaged because of shock or overload	If the output signal is still low, the load cell can be used. A new calibration will be required.
Shield to bridge is too low	Water or chemical ingress to the cable or into the L/C	Replace the cable or repair the L/C

## **E. Load Cell Troubleshooting using LCT100**

The load cell sensor used to sense weight and force under a wide range of adverse conditions and various environment like; vibrations, high moisture etc. Load cell might be damaged because of overloading, chemical or moisture ingress, lightning strikes, mishandling (dropping or side hitting), vibrations, cable and connector problems or internal components malfunction. As a result, the system might provide unstable/unreliable readings, zero drifting or even stop from functioning.

The portable load cell tester model LCT100 allows to perform a complete and professional test in a minutes and saving the need for the following equipment:

- High quality digital volt meter with high measuring accuracy to measure the zero balance, bridge integrity and signal output
- A Mega-Ohmmeter (Megger) capable of reading up to 5000 Mega-Ohm to measure the insulation resistance
- A stable power supply
- A calculator to do all required calculations to check scale / load cell linearity

Carefully do a visual inspection to check the system integrity for the followings:

- Damage, corrosion on the load cell body
- Cable integrity and connections inside the junction/summing box
- Water or chemical ingress inside the summing box
  
- Force shunts due to dirt or mechanical misalignment

Note: The load cells are produced according to specifications which generally described in the product data sheet. In most cases you get detailed information on the calibration certificate that comes with each load cell. It will mention the exact values for the input/output resistance, insulation resistance, zero balance rated output and the wiring code.

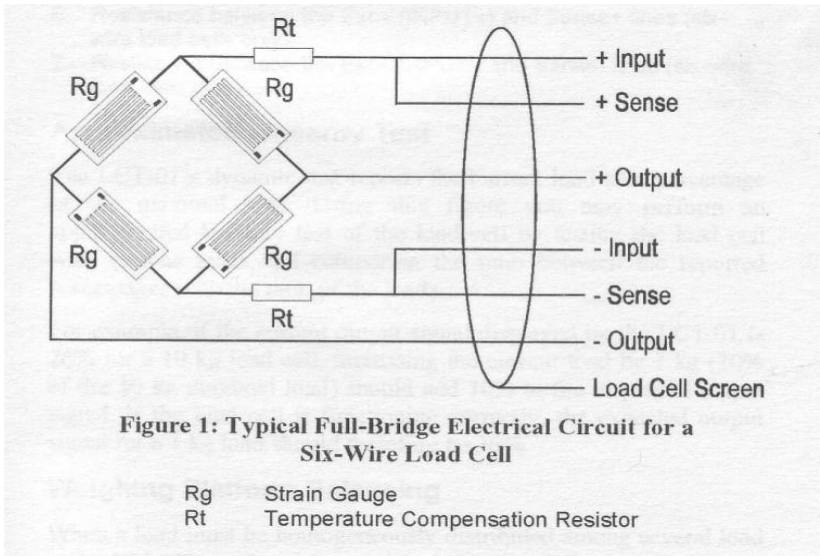


Figure 1 A typical scheme of 6 wires load cell

### E.1 Testing the Zero Balance

The zero Balance is defined as the load cell output when it's not loaded. The LCT100 will show the output in percentage from the full scale. For example: Testing a load cell with a load capacity of 100kg when it's not loaded, we expect to get a result around 0% while if we apply 40kg on the cell, we expect to see around 40%. Changes in Zero balance occur if the load cell has been permanently deformed by overloading or excessive shock or metal fatigue. Also, moisture ingress will change the strain gages resistance and will affect the zero balance.



Figure 2 Zero output when load cell is loaded

Note: In most calibration certificates, the manufacture will show the zero balance that was measured while testing the cell. It doesn't have to be exactly 0% and it can vary around zero. By going back to the example above, if the zero balance is 0.32% so, after applying 2kg we expect to see 2.32%.

## E.2 Bridge Integrity

The bridge integrity is verified by measuring the input (excitation voltage) and Output (Signal) resistance. Results must be the same as in the original calibration certificate or the data sheet specifications. Changes in the bridge resistance are most often caused by a broken or burned wire, electrical component failure or short circuit. This might happened due to vibrations, excessive temperature or from lightning or welding.



Figure 3 Typical bridge input/output results

Note: In most load cells the manufacture will add internal compensation resistors to compensate temperature changes (figure 1). Therefore the input and output resistance of the bridge are not identical.

## E.3 Insulation Resistance

The insulation resistance is measured between the load cell circuit and the cable shield and the load cell body. The LCT100 will measure the resistance between the bridge and the cable shield, between the bridge and the load cell body and between the load cell body and cable shield. The insulation resistance of the 3 measurements should be higher than 3000 MΩ when typically it will be 5000 MΩ or more. A lower value indicates electrical leakage caused by moisture

ingress within the load cell body or, the cable. It results in unstable reading and stability changes with temperature.



Figure 4 showing the insulation resistance results. The right one is an example of bad result and led turns red

Note: To get accurate insulation reading, it is important to perform a quick calibration on the LCT100 before conducting the test otherwise, the insulation resistance results will be wrong. First make sure to connect only the 4 / 6 wires to the tester and leave the cable screen and body not connected (those are the 2 left pins on the connector). Turn on the device and simultaneously press the 2 right buttons (marked for calib) . The display will show that the unit is being calibrated and in few second it is ready for the test. Now connect the screen and shield and perform the test. There is no need to run the calibration procedure in case of not measuring the insulation resistance.

#### E.4 Shock Resistance and repeatability

This test can be done by choosing the “gain” test from the menu. In gain mode, the LCT100 performs as an indicator - continuously showing the load cell output in percentage from the full scale. Lightly rap on the cell to shock it and watch the readings during the test. Those should not become erratic and return to original zero when stop rapping. Erratic readings may indicate a failed electrical connection or damaged glue layer between strain gage elements.





Figure 5 Typical reading when load cell is not loaded

### E.5 Testing Linearity

This test is conducted by choosing the “gain” test from the menu. By applying a known weight on the scale / load cell you should see a percentage change which must be equivalent to the applied weight in percentage from the full capacity of the load cell. For example; 10kg weight on a 50kg scale will show 20% change, while 50kg will show 100% change. Results that show a non linear load cell, may indicate force shunts that might be caused by dirt, mechanical misalignment or accompanying components. It is recommended to do this test with few weights to check the full range of the load cell / scale.



Figure 6 performing a linearity test with 3 weights

Note: The linearity test can be done on a single load cell or on a complete scale by connecting the LCT100 to the junction box that summing all the load cells. The test can be done even when you don't know exactly the load cell gain (mv/V) - by watching the percentage change on known weight. For example if 10kg shows 8.5% change adding another 10kg must show 17% etc.

## E.6 Distinguishing Between Four- and Six-Wire Load Cells

Both four- and six-wire cells have +/- Input (excitation) and +/- signal lines, while six-wire cells have + and - sense lines, connected in parallel to the input lines.

The sense lines used to actually measure the excitation voltage at the load cell and feed this back to the indicator that modifies its amplifier or its output voltage to compensate for resistance fluctuations (caused by temperature changes ) on the cable.

A 4 wire cell is calibrated and temperature compensated with a certain length of cable and must perform within a specific temperature range. Never cut or extend the length of a 4 wire cable. Unlike four-wire load cells, six-wire cables do not contain a temperature compensating system and the sense wires are critical for best performances especially with long cables. The resistance between sense+ and Input+ and Sense- and Input- must remain in the range of few ohms. High resistance means a cable problem or broken wires inside the cell.

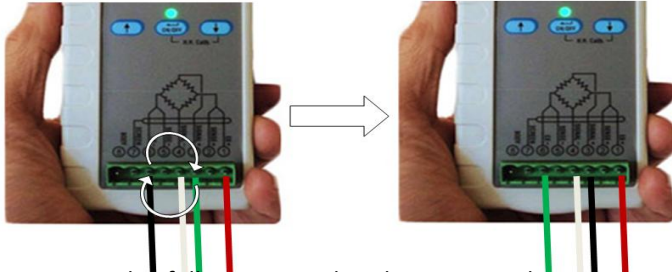


Figure 7 Typical reading when sense lines are OK

Note: Make sure to choose 6 wires load cell to perform this test. If 4 wires were chosen, the LCT100 will skip the sense test,

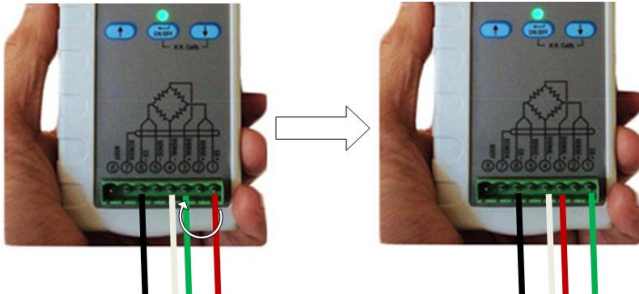
**E.7 Measuring Resistance Across Each Strain Gage of a Load cell:**

Following the basic steps in testing a load cell, switch the Ex- and Sig+ wires. Hook the Ex- wire to the Sig + pin in the LCT100 and hook the Sig + wire to the Ex- pin in the LCT100.



Run the tester using the full testing cycle. The input and output resistance results will be the resistances of a pair of strain gages.

Now, hook back the Ex- wire and Sig + wires to its original wiring configurations then switch the Sig + and Ex + wires. Hook the Ex+ wire to the Sig + pin in the LCT100 and hook the Sig + wire to the Ex+ pin in the LCT100



Run the tester using the full testing cycle. The input and output resistance results will be the resistances of the other pair of strain gages.

Note:

- Good Load Cell** – All resistances across each strain gage should be identical
- Strain Gage Problem** – If resistances across each strain gage are not identical or one or two of the strain gages’ resistance are different from the rest
- Overloaded / Shock loaded** – If the resistance values of each pair are not equal. For example: One pair has 250Ω each strain gage and the other pair has 251Ω each strain gage, the load cell was overloaded.

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