

Arduino Bathroom Scale With 50 Kg Load Cells and HX711 Amplifier

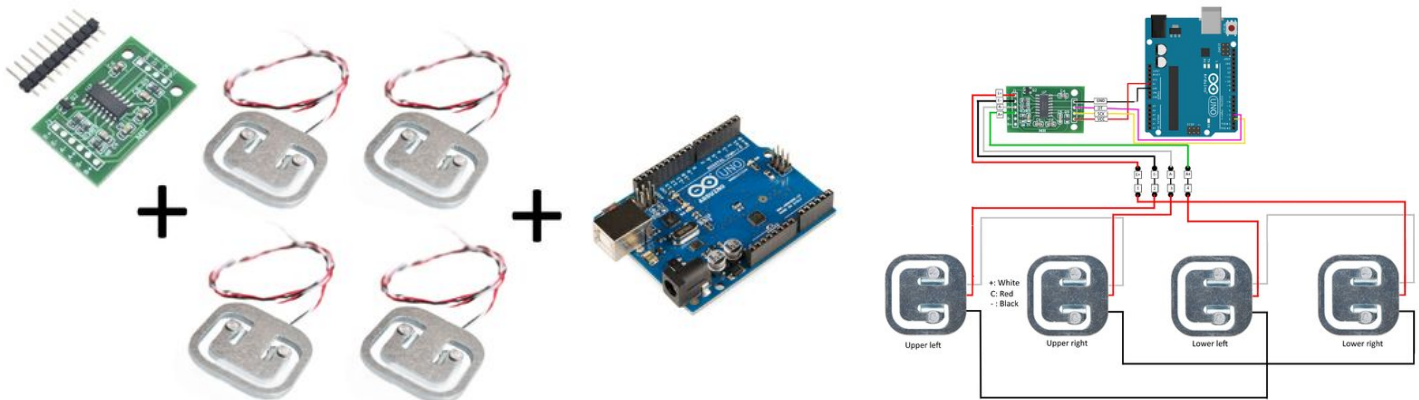


by DegrawSt

This Instructable describes how to make a weighing scale using readily available off the shelf parts.

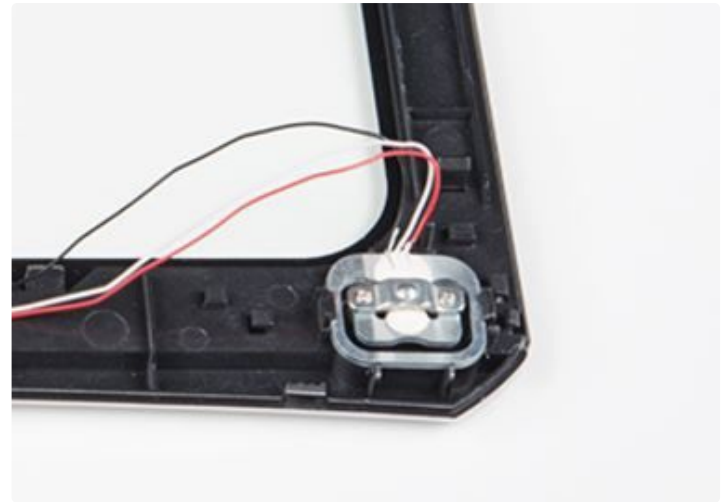
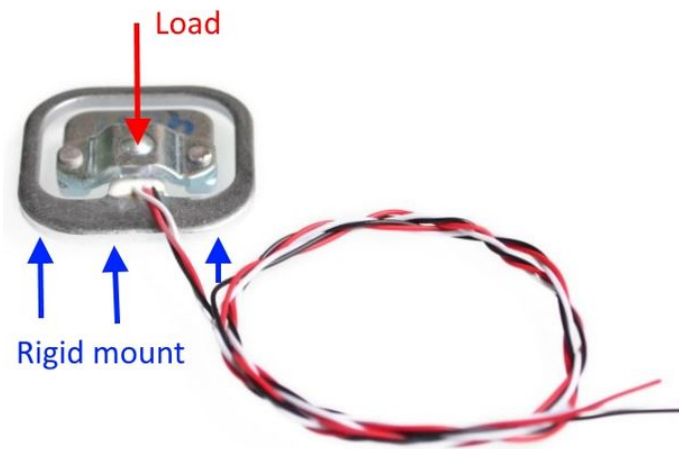
Materials needed:

1. Arduino - (this design uses a standard Arduino Uno, other Arduino versions or clones should work also)
2. HX711 on breakout board - This microchip is specially made for amplifying the signals from load cells and reporting them to another microcontroller. The load cells plug into this board, and this board tells the Arduino what the load cells measure.
3. 50kg load cells (x4) - Load cells are specially shaped metal parts that have strain gauges glue to them. The strain gauges are resistors that change their resistance when they are bent. When the metal part bends, the resistance of the load cell changes (the HX711 measures this small change in resistance accurately). You can buy the load cells and HX711 as a kit here: <https://www.amazon.com/Degraw-amplifier-weight-Arduino-Bathroom/dp/B075Y5R7T7/> If you do purchase the kit please leave a review! It is really helpful for future buyers.
4. Sturdy flat mounting surface - a stiff piece of hardwood or metal is ideal
5. Wires in various colors for connecting all the parts
6. Power supply for Arduino



Step 1: Mount the Load Cells

Mount the 4 load cells to the bottom of the scale in the four corners. Epoxy works well to hold them in place. See the mounting diagram, it shows which surface should be mounted to the base and which surface should touch the floor.



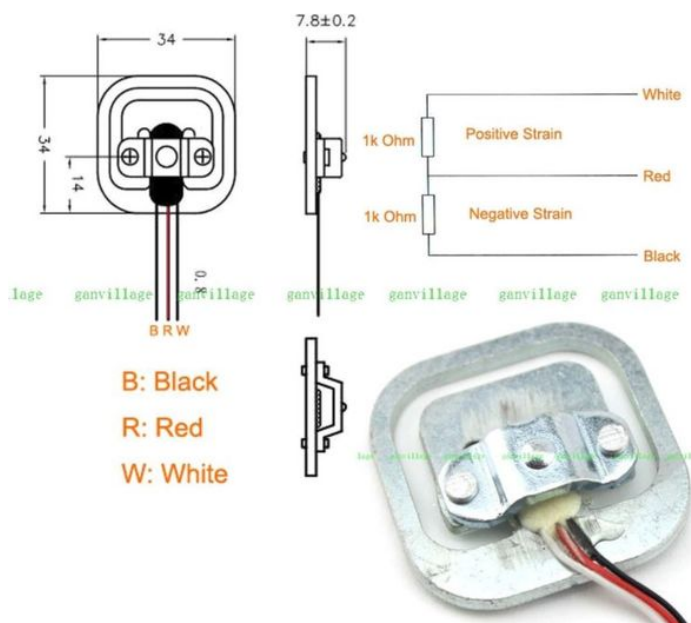
Step 2: Verify the Load Cell Wiring

The wiring diagram is made assuming the load cell is constructed like this picture.

To make sure you get it right, be sure to figure out which two terminals on the load cells have the highest resistance between them (E.g. Black and White, to match the schematic), wire them in a big color matching loop, like B-B W-W B-B W-W and

then excite (E+/E-) two opposite center taps (R) and sense (A+/A-) on the other pair of center taps.

This page on Sackexchange has even better information: <https://arduino.stackexchange.com/questions/11946/how-to-get-weight-data-from-glass-electronic-bathroom-scale-sensors/18698#18698>



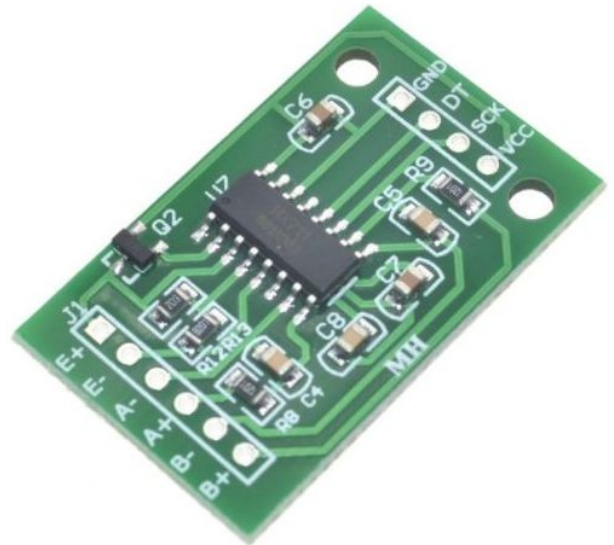
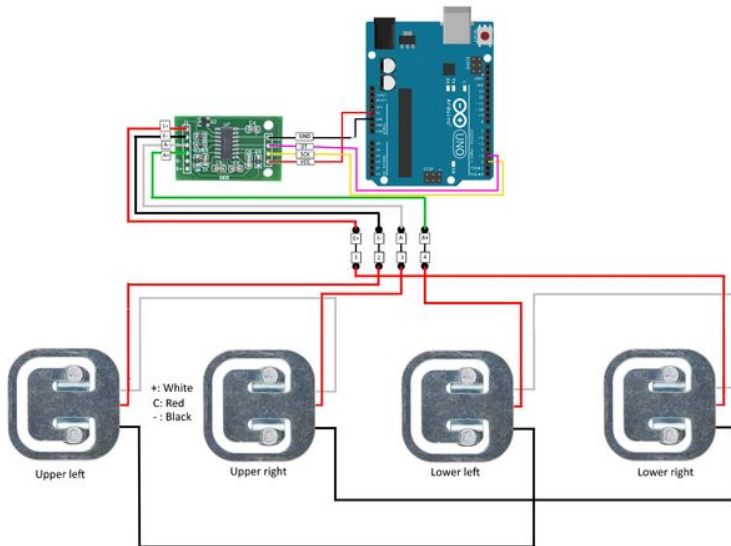
Step 3: Wire the Load Cells and HX711

See the wiring diagram for how to connect the load cells, HX711, and Arduino.

combinator board - <https://www.sparkfun.com/products/13878>

Some of the load cell wires are connected together to form what is called a Wheatstone bridge arrangement. This can get a little confusing. A good option for connecting all the load cells in a clean, easy to understand way is the SparkFun load cell

This arrangement allows the loads on all of the different load cell sensors to be combined and measured at once.



Step 4: Add HX711 Library to Your Arduino IDE

The HX711 library is available here: <https://github.com/bogde/HX711>

See this link on the Arduino website for instructions on how to add the library to your Arduino IDE: <https://www.arduino.cc/en/Guide/Libraries>

Step 5: Calibrate and Weigh!

Sparkfun has great Arduino programs to run the scale. The most up to date versions are available on GitHub and reprinted below: <https://github.com/sparkfun/HX711-Load-Cell-Amplifier>

The first software step is to determine calibration factors for the scale. To do this, run this code:

```
/*
Example using the SparkFun HX711 breakout board with a scale
By: Nathan Seidle
SparkFun Electronics
Date: November 19th, 2014
License: This code is public domain but you buy me a beer if you use this and we meet someday (Beerware license).

This is the calibration sketch. Use it to determine the calibration_factor that the main example uses. It also
outputs the zero_factor useful for projects that have a permanent mass on the scale in between power cycles.

Setup your scale and start the sketch WITHOUT a weight on the scale
Once readings are displayed place the weight on the scale
Press +/- or a/z to adjust the calibration_factor until the output readings match the known weight
Use this calibration_factor on the example sketch

This example assumes pounds (lbs). If you prefer kilograms, change the Serial.print(" lbs"); line to kg. The
calibration factor will be significantly different but it will be linearly related to lbs (1 lbs = 0.453592 kg).

Your calibration factor may be very positive or very negative. It all depends on the setup of your scale system
and the direction the sensors deflect from zero state
This example code uses bogde's excellent library:"https://github.com/bogde/HX711"
bogde's library is released under a GNU GENERAL PUBLIC LICENSE
Arduino pin 2 -> HX711 CLK
3 -> DOUT
5V -> VCC
GND -> GND

Most any pin on the Arduino Uno will be compatible with DOUT/CLK.

The HX711 board can be powered from 2.7V to 5V so the Arduino 5V power should be fine.

*/

#include "HX711.h"

#define DOUT 3
#define CLK 2

HX711 scale;

float calibration_factor = -7050; //-7050 worked for my 440lb max scale setup

void setup() {
  Serial.begin(9600);
  Serial.println("HX711 calibration sketch");
  Serial.println("Remove all weight from scale");
  // ...
```

```

Serial.println("After readings begin, place known weight on scale");
Serial.println("Press + or a to increase calibration factor");
Serial.println("Press - or z to decrease calibration factor");

scale.begin(DOUT, CLK);
scale.set_scale();
scale.tare(); //Reset the scale to 0

long zero_factor = scale.read_average(); //Get a baseline reading
Serial.print("Zero factor: "); //This can be used to remove the need to tare the scale. Useful in permanent scale projects.
Serial.println(zero_factor);
}

void loop() {

scale.set_scale(calibration_factor); //Adjust to this calibration factor

Serial.print("Reading: ");
Serial.print(scale.get_units(), 1);
Serial.print(" lbs"); //Change this to kg and re-adjust the calibration factor if you follow SI units like a sane person
Serial.print(" calibration_factor: ");
Serial.print(calibration_factor);
Serial.println();

if(Serial.available())
{
char temp = Serial.read();
if(temp == '+' || temp == 'a')
calibration_factor += 10;
else if(temp == '-' || temp == 'z')
calibration_factor -= 10;
}
}

```

After calibrating the scale, you can run this sample program, then hack it up for your own purposes:

```

/*
Example using the SparkFun HX711 breakout board with a scale
By: Nathan Seidle
SparkFun Electronics
Date: November 19th, 2014
License: This code is public domain but you buy me a beer if you use this and we meet someday (Beerware license).

This example demonstrates basic scale output. See the calibration sketch to get the calibration_factor for your
specific load cell setup.

This example code uses bogde's excellent library: "https://github.com/bogde/HX711"
bogde's library is released under a GNU GENERAL PUBLIC LICENSE

The HX711 does one thing well: read load cells. The breakout board is compatible with any wheat-stone bridge
based load cell which should allow a user to measure everything from a few grams to tens of tons.
Arduino pin 2 -> HX711 CLK
3 -> DAT
5V -> VCC
GND -> GND

The HX711 board can be powered from 2.7V to 5V so the Arduino 5V power should be fine.
*/

#include "HX711.h"

#define calibration_factor -7050.0 //This value is obtained using the SparkFun_HX711_Calibration sketch

#define DOUT 3
#define CLK 2

HX711 scale;

void setup() {
  Serial.begin(9600);
  Serial.println("HX711 scale demo");

  scale.begin(DOUT, CLK);
  scale.set_scale(calibration_factor); //This value is obtained by using the SparkFun_HX711_Calibration sketch
  scale.tare(); //Assuming there is no weight on the scale at start up, reset the scale to 0

  Serial.println("Readings:");
}

void loop() {
  Serial.print("Reading: ");
  Serial.print(scale.get_units(), 1); //scale.get_units() returns a float
  Serial.print(" lbs"); //You can change this to kg but you'll need to refactor the calibration_factor
  Serial.println();
}

```



Hello,

Thanks for posting these instructions, as they seem very thorough.

I'm having some trouble, and its very likely an extremely simple fix, as I haven't touched a circuit board in years. I did great in that one class I took a decade ago... which is worth nothing at the moment.

I keep getting an error: "no matching functon for call to 'HX711::HX711(int, int)' "

This happens when i try to load the calibration code into the arduino. What gives?

Any help would be greatly appreciated!



Hello,

I am working on a beehive scale using these sensors and setup. I had the same problem and the reason was that the HX711 library updated during March in a way that is not compatible with old projects anymore. Remove all versions of HX711 library that you installed, delete them from the local folder and install the previous version of the library. The scripts of this article was written based on the previous version. Check here , <https://github.com/bogde/HX711/releases> For me everything works. The calibration script is what i needed



PASSED THAT ERROR. now on to, HX711 does not name a type



Do you mind explaining how you got rid of the error?

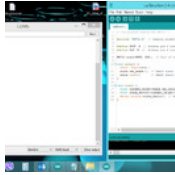


Hello,

I'm currently running into the same problem while trying to run the calibration code. How did you get passed it?



Nice instruction and coding However, the scale does not really have a stable reading. It fluctuates. is it wiring problem or faulty HX711? any advice?



I applied these instructables to measure the weight of Japanese wild bee box . And it works well. I appreciate your efforts and kindness.



do you put holes on the below the center of the load cells? for the center to go down when you put heavy object?



Yes, I put holes on the below the center of the cells. Because the cavity is necessary for the load cell center to go down when weight on it.



how did you do connect the black cables?

And how did you calibrate the sensor?

Because I have a problem with my scale.

Please Helpme



I calibrate the sensor ,using the number=21500 worked for my 200Kg max scale setup. After readings begin, I placed known weight on scale. If there is a difference between known weight and scale reading, I changed the calibration factor bit by bit to minimize the difference. In my case I do not use (+) nor (-), because I cloud not change the calibration factor by (+) nor (-).



Wow, this is the coolest use I have seen so far! Why are you measuring the weight of the box?



Because, the weight is one of the most reliable signals we could get without disturbing bees daily life. The signals tell us the time when we could gather honey,and also tell us bees health. Japanese wild bee is rather sensitive so I want to watch them from remote places.



Just for Information I was wondering how this circuit works, the answer is that this loadcell has two resistors which one of the is constant and the other varies with load.

this link my help you

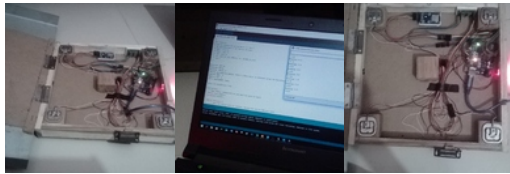
<https://electronics.stackexchange.com/questions/75005/digital-bathroom-scale-circuit-how-it-works>



Looks awesome. I am ordering stuff to make it .



Ok, I made it. It worked for a few days but now it shows only zero value if *any weight is placed or not*. What do you think the problem is?



do you get solution ? i just get 0 to much



Can you solved the problem?
Because I have the same problem.

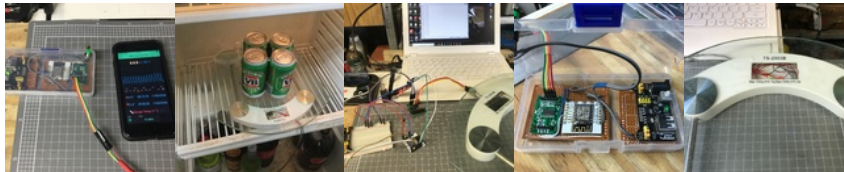
Please if you can Help me



Hi, thnx for the instructable, very thorough. I combined the HX711 with an old bathroom scale, running the code on an ESP8266 WiFi module. I integrated the output to send data to the Blynk app on my phone to tell me how many beers left in my fridge! (Calibrated the scale based on the known weight of a single can of beer.) Not the most practical use but good way to learn about sensors, ESP8266 standalone module, Blynk etc.

cul

billd



i am having an issue i was hoping you might know how to resolve. my load cell is only accurate for small loads, i calibrated it using a 8lb weight, but i really need the scale to measure force up to 400lb yet when i stand on the scale it only reads out 100lb (i weigh 200lb), and if i calibrate it to show the correct weight when i stand on it, then when i put the 8lb weight on it it shows something in the 20s,



I've seen a similar issue (using a XFW-HX711 board and the same type of load cells as illustrated in this instructable). I found that the correction factor is almost exponential - i.e $5\text{kg} = 100$, $20\text{kg} = 25$, $100\text{kg} = 5$ which seems odd as the sensor spec says it should be fairly linear. I wonder if this is a fault in the chip, or in my wiring?



What are the capacity of your load cells? They have different specifications, perhaps you have small capacity cells? How many cells are you using? What are their capacity?



Hi, how did you calibrate the sensor?
You would pass me your code, he searched but I can not make me show any weight



I used to the code supplied in the instructable. If you not seeing any weight you need to check the wiring connections.

Once you are seeing weight (random numbers when you press on the sensors), then you can calibrate it. To calibrate place a known weight (I weighed a can of beer on another accurate scale); then use the known weight as a reference to adjust the calibration factor in the code, so that your scale shows the same weight as your known reference.



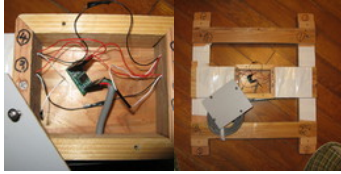
Wow this an an awesome project for learning about the setup, nice job!



Hi, I have a problem, the black cables are all connected equally, or they are connected in pairs of two, for example: cell one with two and cell three with four.



I connected the black cables in pairs of two, for example :cell one with four and cell two with three. In this case I also connected the white cables in pairs of two, for example :cell one with two and cell three with four. For the reference, red cables goes to HX711 , three, one, four, two, respectively.



Can you pass me your two codes?
and photos of how do you connect everything?
Please



The picture is from an old bathroom scale, you can use a broken one for the project . If you don't have this I glue the load cells with epoxy to a thick wood board.



Wiring the load cells can be very hard, there are a lot of connections and it is confusing. If the reading only shows zero it is usually a wiring problem. One thing that helps fix a wiring problem is to use Load Cell Combinator board from Sparkfun - <https://www.sparkfun.com/products/13878> . It makes the connections more organized and it is very cheap.

Also check the load cells individually using a multimeter to make sure there are no broken wires inside the load cell.



I have connected up the three wire load sensor to the amplifier and arduino as mentioned above. The output gives me zero reading even if I place a weight on top of these load sensors. Measured the highest resistance for the three wires and the White- Red pair had the highest resistance similar to the one you have above. It would be great if you could help me.



Wiring the sensors can be very challenging to keep track of. One thing that has helped a lot of people in the past is to use this load cell combinator board (\$2) from SparkFun: <https://www.sparkfun.com/products/13878>

This page also has some good information on troubleshooting:

<https://electronics.stackexchange.com/questions/19...>



I do have a Sparkfun HX711 board connected up to 4 load cells. Somehow I am not getting a reading. Did check the voltages and seems to work fine.



Yes, the board I linked to is actually a separate board to help wire the load cells together before connecting to the HX711. Did you run the calibration script? It could be the calibration factor is off so readings are not showing up. I wish I could help more but it is hard to troubleshoot without the set up in front of me.



1.alguien sabe como hacer una bascula solo con un sensor de estos ?



Hey dude!

I have a question for you that I hope you can answer.

Me and my friend bought an HX711 but it looks a but different.

we've followed your tutorial and couldn't get any input from the load cells.

Do you have any idea in what way we should connect it? (look at the image)

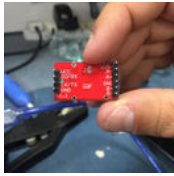
We've treated the GND and OUT as E+ and E-.

and CK/TX as SCK.

We don't really have alot of knowledge in this field so we're probably have no idea what we're doing.

Can you please help us? :)

Thank you!!



Can you tell me how to connect 4-wire loads together????
I need this information to achieve the above with 4-wire loads.....



I have another instructable about using load cells with 4 wires. It is located here, hopefully it is helpful with your setup:

<https://www.instructables.com/id/Arduino-Scale-With-5kg-Load-Cell-and-HX711-Amplifi/>



For a ground point I have attempted to wire things up as close as I can figure to the diagrams and have used the calibration sketch, as is.

When I load the sketch the values float. With nothing on the scale, they will rise or fall, as much as 50 Lbs.

Does anyone have any thoughts on what may cause this behavior?

Thanks



Nice instructable, I'm definitely going to build one, but what is the weight range? I would like to measure grams.



This is probably the wrong set up if you need to measure grams. Fortunately, measuring on the gram scale is even easier! You can buy a single aluminum beam load cell already wired up. Check out this instructable for more info: <https://www.instructables.com/id/Arduino-Scale-With-5kg-Load-Cell-and-HX711-Amplifi/>



The coloring/configuration of the half-bridge cell wires is very important. They are different in several of your pictures. The wires on the cells pictured in step 2 (W-R-B) don't match the cells in the schematic (B-W-R). The wiring on the cells in the different panels of the step 1 pic differ from each other.

If you don't drive and sense on the center taps of the half-bridges, the circuit would have half the sensitivity of <https://arduino.stackexchange.com/a/18698/6628> configuration since your wheatstone bridge would exist between the cell's center terminals, and then be attenuated from each node of the wheatstone bridge into the HX711 by the variable resistance of the strain gauge.

To make sure you get it right, be sure to figure out which two terminals on the load cells have the highest resistance between them (E.g. Black and White, to match your schematic), wire them in a big color matching loop, like B-B W-W B-B W-W and then excite (E+/E-) two opposite center taps (R) and sense (A+/A-) on the other pair of center taps.



Great feedback, thank you! I will add a step with your information and verification step.



Great, I recently recycled 4 of these from a broken bathroom scale and was not sure how to use them. Thanks for sharing!



Thanks for sharing :)