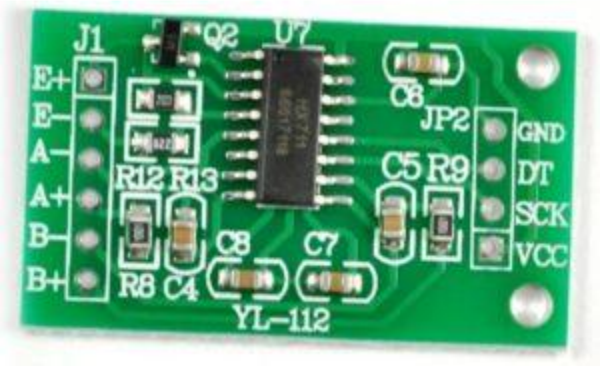
HX711 Load Cell Amplifier Interface with Arduino

In this arduino tutorial of HX711 Load Cell amplifier interface. We are interfacing 40Kg load cell to the arduino using HX711 Load cell amplifier module. HX711 is a precision 24-bit analog to-digital converter (ADC) designed for weigh scales and industrial control applications to interface directly with a bridge sensor. The input multiplexer selects either Channel A or B differential input to the low-noise programmable gain amplifier (PGA). Channel A can be programmed with a gain of 128 or 64, corresponding to a full-scale differential input voltage of ±20mV or ±40mV respectively, when a 5V supply is connected to AVDD analog power supply pin. Channel B has a fixed gain of 32. Onchip power supply regulator eliminates the need for an external supply regulator to provide analog power for the ADC and the sensor. Clock input is flexible. It can be from an external clock source, a crystal, or the on-chip oscillator that does not require any external component. On-chip poweron-reset circuitry simplifies digital interface initialization. There is no programming needed for the internal registers. All controls to the HX711 are through the pins.

Load Cell Connection diagram and its Pinout

HX711 Module



HX711 Module

[Datasheet: HX711](#)

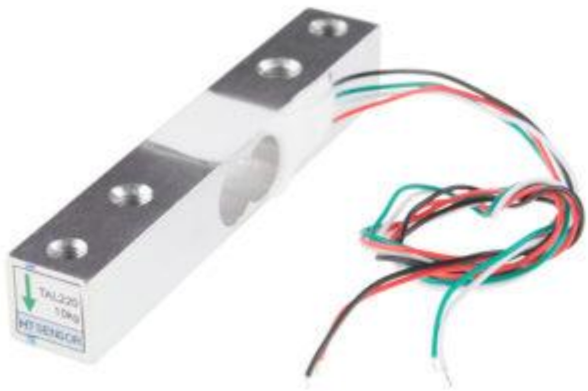
Most Load cell have four wires red, black, green and white. On HX711 board you will find E+, E-, A+, A- and B+, B- connections. Connect load cell

Red wire to E+

Black wire to E-

Green wire to A-

White wire to A+

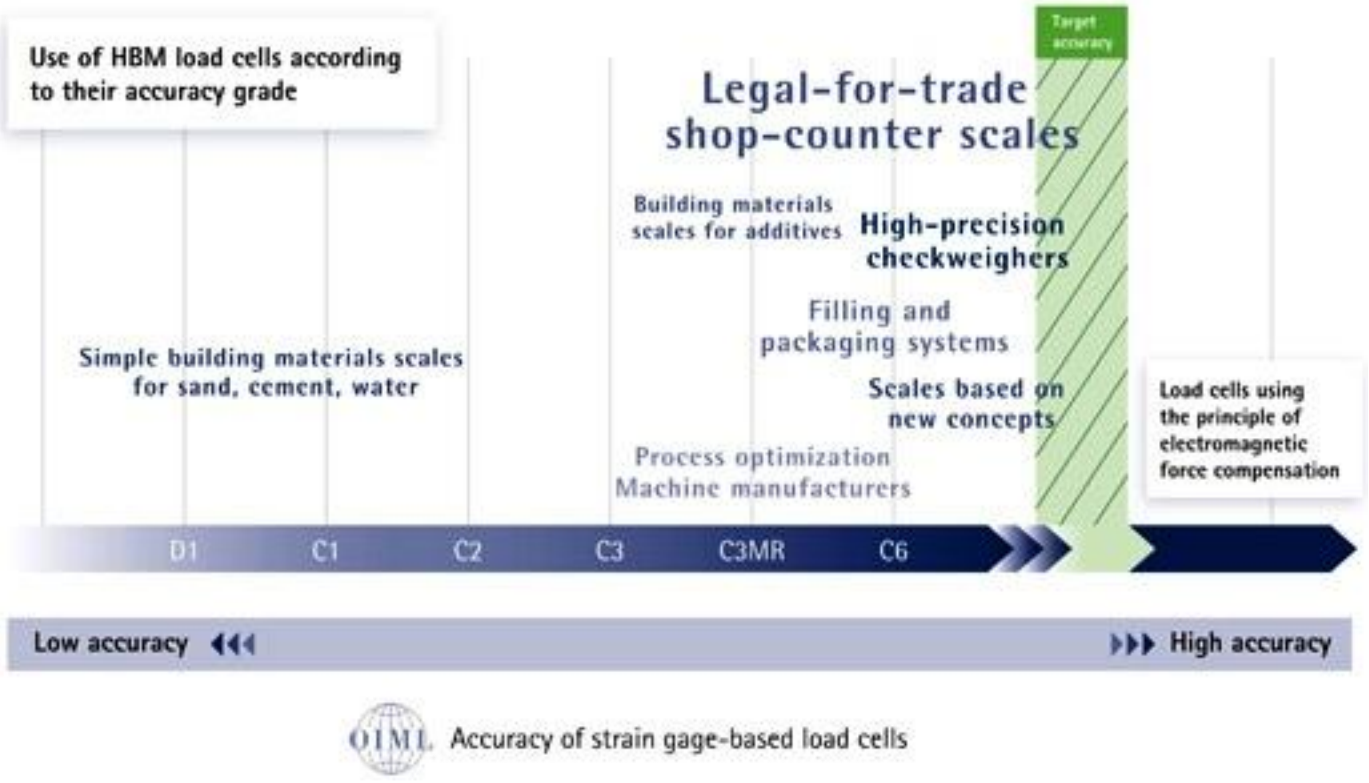


Load Cell

Load cell comes in various **weights** depending on your application select the load cell weight specification, In this tutorial **I have used 40Kg, Precision Grade C2 load cell**. Load cell also have **precision type.**

Precision classes explained: Which load cell for which application?

Load cells are ranked, according to their overall performance capabilities, into differing accuracy classes or grades. A specific accuracy grade specifies an error envelope for certain parameters, such as linearity, hysteresis, temperature effects, creep, etc. In practice, certain system accuracy parameters depend considerably on the application of use, physical load introduction to the transducer and disturbing factors such as Zener barriers and surge protection devices.



Use of HBM load cells according to their accuracy grade
Target accuracy
Legal-for-trade shop-counter scales
Building materials scales for additives
High-precision checkweighers
Filling and packaging systems
Simple building materials scales for sand, cement, water
Scales based on new concepts
Load cells using the principle of electromagnetic force compensation
Process optimization Machine manufacturers
D1
C1
C2
C3
C3MR
C6
Low accuracy
High accuracy
OIML
Accuracy of strain gage-based load cells

Load Cell Classification

Load cells with **different accuracy classes** are required depending on the application. The chart provides an overview of **typical applications**, ranging from the lowest to the highest accuracy class.

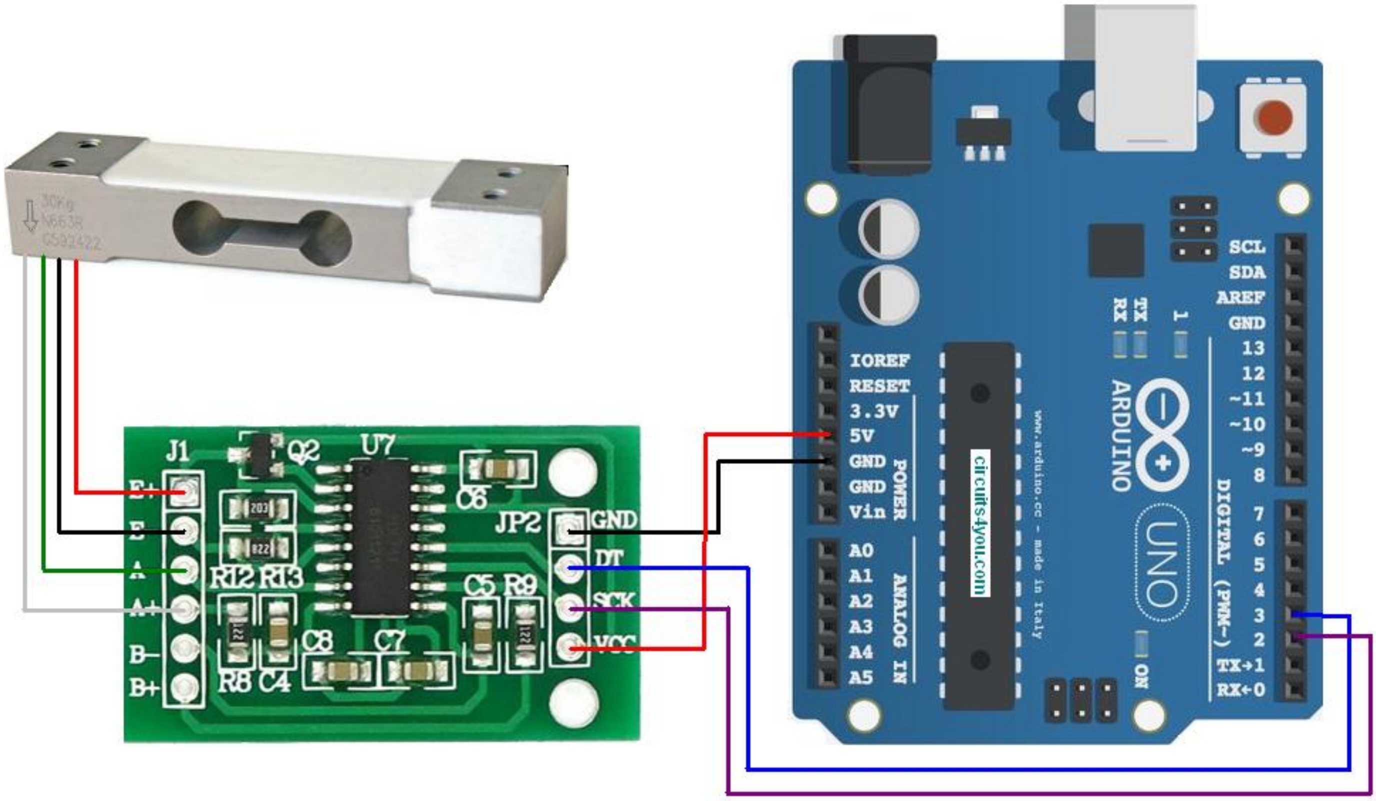
Load cells with relatively low accuracy classified **D1** to **C2** are sufficient for**simple building materials scales** used to weigh **sand, cement or water**.

Adding the right proportion of **additives to building materials** is essential. For this purpose, special **building materials scales** using accuracy class **C3** load cells are available for **mixing additives** such as ash or sand .

Accuracy class **C3** load cells are widely used in **machine construction** as well. Here, scales contribute to **quality assurance**, for example, when **ball bearings**are checked.

However, increased accuracy is needed with **shop-counter scales** or **scales used in filling machines**. Grams or micrograms are required here. Load cells used in these applications comply with accuracy classes **C3** to **C6**.

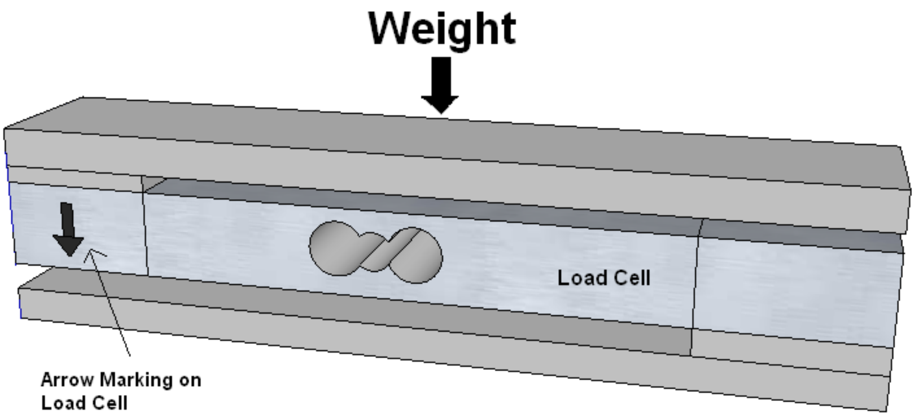
Load Cell connections to HX711 and Arduino



Load Cell Interface with Arduino
HX711 Module operates at 5V and communication is done using serial SDA and SCK pins.

Where to apply weight on load cell?

You can see a arrow is shown on Load cell. this arrow shows the direction of force on the load cell. You can make arrangement shown in figure using metal strips. Attach metal strip on the Load cell using bolts.



Load Cell Mounting

Programming Arduino UNO to Measure Weight in Kgs

Calibration Sketch

For this program to run you need HX711 Library Download from here hx711-master

```
/*
 * circuits4you.com
 * 2016 November 25
 * Load Cell HX711 Module Interface with Arduino to measure weight in Kgs
 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"  //You must have this library in your arduino library folder

#define DOUT  3
#define CLK  2

HX711 scale(DOUT, CLK);

//Change this calibration factor as per your load cell once it is found you many need to vary it in thousands
float calibration_factor = -96650; //-106600 worked for my 40Kg max scale setup

//=============================================================================================
//                         SETUP
//=============================================================================================
void setup() {
  Serial.begin(9600);
  Serial.println("HX711 Calibration");
  Serial.println("Remove all weight from scale");
  Serial.println("After readings begin, place known weight on scale");
  Serial.println("Press a,s,d,f to increase calibration factor by 10,100,1000,10000 respectively");
  Serial.println("Press z,x,c,v to decrease calibration factor by 10,100,1000,10000 respectively");
  Serial.println("Press t for tare");
  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);
}

//=============================================================================================
//                         LOOP
//=============================================================================================
void loop() {

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

  Serial.print("Reading: ");
  Serial.print(scale.get_units(), 3);
  Serial.print(" kg"); //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;
    else if(temp == 's')
      calibration_factor += 100;
    else if(temp == 'x')
      calibration_factor -= 100;
    else if(temp == 'd')
      calibration_factor += 1000;
    else if(temp == 'c')
      calibration_factor -= 1000;
    else if(temp == 'f')
      calibration_factor += 10000;
    else if(temp == 'v')
    calibration_factor -= 10000;
  else if(temp == 't')
    scale.tare();  //Reset the scale to zero
  }
}
//=============================================================================================
```

Once you upload the code adjust your scale factor with known weight until you see the correct readings. Press a,s,d,f to increase calibration factor by 10,100,1000,10000 respectively. Press z,x,c,v to decrease calibration factor by 10,100,1000,10000 respectively.

Note: Before you start running calibration code keep your Load Cell horizontal so that it will not have any weight (Weight of your fixture arrangement). Fixture arrangement causes problem to base line scale.

```
scale.set_scale();
```

Once you find the calibration factor update it in below code.

Final Code for Weight Measurement

```
/*
 * circuits4you.com
 * 2016 November 25
 * Load Cell HX711 Module Interface with Arduino to measure weight in Kgs
 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"  //You must have this library in your arduino library folder

#define DOUT  3
#define CLK  2

HX711 scale(DOUT, CLK);

//Change this calibration factor as per your load cell once it is found you many need to vary it in thousands
float calibration_factor = -96650; //-106600 worked for my 40Kg max scale setup

```

```
//=====================================================================================
//                        SETUP
//=====================================================================================
void setup() {
  Serial.begin(9600);
  Serial.println("Press T to tare");
  scale.set_scale(-96650);  //Calibration Factor obtained from first sketch
  scale.tare();             //Reset the scale to 0
}

//=====================================================================================
//                        LOOP
//=====================================================================================
void loop() {
  Serial.print("Weight: ");
  Serial.print(scale.get_units(), 3);  //Up to 3 decimal points
  Serial.println(" kg"); //Change this to kg and re-adjust the calibration factor if you follow lbs

  if(Serial.available())
  {
    char temp = Serial.read();
    if(temp == 't' || temp == 'T')
      scale.tare();  //Reset the scale to zero
  }
}
//=====================================================================================
```

This code gave me accuracy of less than +/- 3 grams on Precision grade C2 40Kg Load Cell