



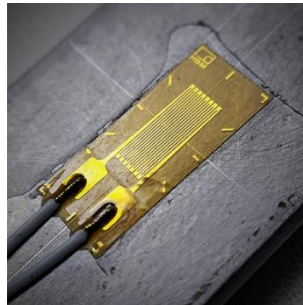
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### **Strain /weight, Colour sensors**

Strain Gauges are important geotechnical tools that measure strain in underground cavities, tunnels, buildings, concrete, masonry dams, bridges, and embedment in soil/concrete. etc. The main purpose of a strain gauge is to indirectly determine stress and its variation with time, quantitatively. Change in stress is determined by multiplying the measured strain by the modulus of elasticity.

#### **What Is a Strain Gauge?**



**Strain Gauge** or Strain Gage was invented in 1938 by Edward E. Simmons and Arthur C. Ruge. It is one of the significant sensors used in the geotechnical field to measure the amount of strain on any structure (Dams, Buildings, Nuclear Plants, Tunnels, etc.). The resistance of a strain gauge varies with applied force and, it converts parameters such as force, pressure, tension, weight, etc. into a change in resistance that can be measured later on.

Whenever an external force is applied to an object, it tends to change its shape and size thereby, altering its resistance. The stress is the internal resisting capacity of an object while a strain is the amount of deformation experienced by it.

Any basic strain gauge consists of an insulating flexible backing that supports a metallic foil pattern. The gauge is attached to the object under stress using an adhesive. The deformation in the object causes the foil to get distorted which ultimately changes the electrical resistivity of the foil. This change in resistivity is measured by a Wheatstone bridge which is related to strain by a quantity called, Gauge Factor.

#### **What is Weight Sensor?**

**Definition:** A load cell or weight sensor is one kind of sensor otherwise a **transducer**. The **working principle of the weight sensor** depends on the conversion of a load into an electronic signal. The signal can be a change in voltage; current otherwise frequency based on the load as well as used circuit.

Theoretically, this sensor detects changes within a physical stimulus like force, pressure or weight and produces an output that is comparative to the physical stimulus. So, for a specific stable load otherwise weight size, this sensor provides an output value and that is comparative to the weight's magnitude. The best example of this sensor module is SEN0160.

#### **Module – SEN0160**

The SEN0160 weight sensor module is based on HX711 ADC; it is an accurate 24-bit ADC which is designed for industrial control as well as weighs scale applications to connect straight with a bridge sensor. Evaluated with other **integrated circuits**, this HX711 includes basic functions and also some features like a quick response, high integration, immunity, etc. This chip reduces the cost of electronic scale as well as improves the reliability and performance.

#### **Different Types**

There are many options available for measuring a stable weight otherwise any size of loads with the help of a single load cell. Load cells or weight sensors are classified into different types. The **applications of weight sensors** mainly involve in measuring weight in several applications. The most frequently used weight sensors are a strain gauge, capacitance, hydraulic and pneumatic.

In the above-mentioned types of sensors, the first two are electrical transducer devices. It is a sensor used to detect a physical stimulus and generate voltage as an output.

The remaining two sensors do not openly generate output like electrical signals however they can have their o/p based on the application condition. The strain gauge is the most frequently used sensor in various industries like domestic, [automation](#), medicine, automotive, etc.

### How to Select Load Cell/Weight Sensor?

The selection of a [load cell](#) for a specific application can be done by considering the following points.

- Range of measurement
- Based on application
- Capacity requirements
- based on size & specification requirements
- Overload should be best

### HX711 Specifications

The specifications of HX711 include the following.

- 24 bit ADC for weight scales
- Two different input channels which are selectable
- Digital control is easy as well as interface is serial
- Selectable o/p data rate is 10SPS otherwise 80SPS
- Instantaneous supply rejection is 50Hz & 60Hz
- The voltage supply is 2.6V to 5.5V
- The current supply is less than 1.6mA
- Working temperature is -40°C to 85°C
- 16- Pin SOP-16 package

Thus, the performance of the weighing system can be influenced by several factors like vibration, temperature, environment, maintenance, and structural movement.

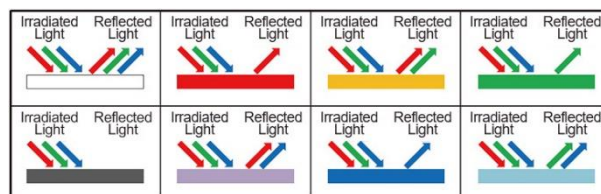
### What is a color sensor?

Among sensors that detect light, those that detect the three primary colors of red, green, and blue are called color sensors.

Color sensors detect RGB values by receiving ambient light using a photodiode.

### Color Sensor - Operating Principle

When an object is irradiated with light containing RGB components, the color of the reflected light will change depending on the color of the object. For example, if the object is red, the reflected light component will be red. For a yellow object, the reflected light will be red and green, and if the object is white all three components will be reflected.

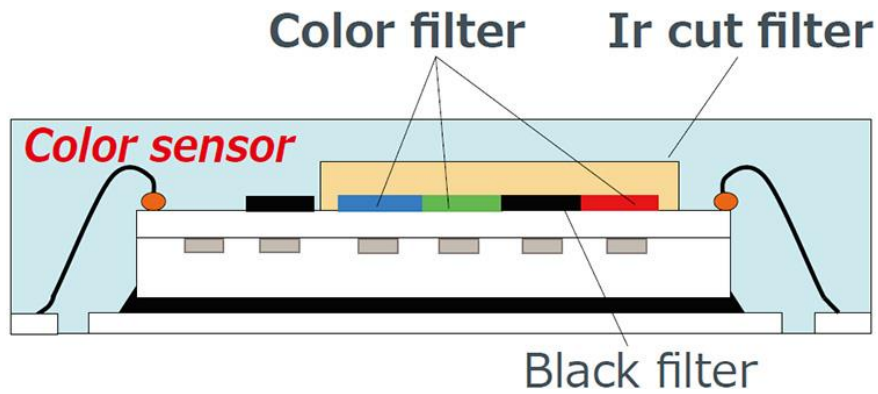


In this way, the color of the object is determined from the ratio of color components (RGB) in the reflected light.

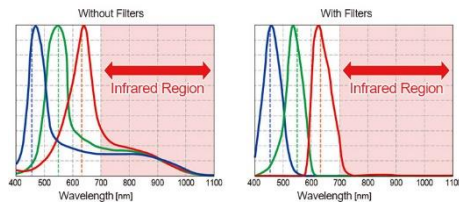
Similarly, the human eye determines color by receiving these reflected light components. It is impossible to see in the dark. This is because there is no irradiating (illuminating) light, which means there is no reflected light so everything looks pitch black. Like human eyes, color sensors determine the color by first detecting light (using photodiodes) then calculating the ratio of R, G, and B received.

### Color Sensor IC Structure

The figure below shows the structure of a color sensor IC with built-in color and IR (Infrared) cut filters.



Below we compare the spectral characteristics of a color sensor with and without these filters.



**[RGB Spectral Characteristics]**

ROHM's color sensor IC delivers high RGB spectral characteristics by applying RGB color filters to the internal sensor along with infrared removal characteristics (using the internal IR cut filter) to achieve high accuracy color discrimination.