Al-Mustaqbal University College
Department of Medical Device Technologies Engineering
Stage: 2 nd
Clinical chemistry Lab.
Lecture No.: 1

Electronic balance

It's a medical instrument used for measuring of weight, the weight wanted to be measured in laboratories are usually chemicals and sometimes be specimens. The unit used in all balances are the metric units: this meaning that balances uses grams, milligrams, micrograms, kilograms.

All Balances can be grouped with in two categories, they are:

1. **Rom balances:** with accuracy of 0.01g or greater they are either full mechanical or electromechanical systems.
2. **Analytical balances**: with accuracy of 0.001g or less, mechanically or electromechanical systems.

Components:

1. Pan: on which the weight to be measured is placed.

2. Beam: a leaver supported by a knife plane edge in the center point.

3.Movable weights: Placed inside the balance& sometimes inside and outside the balance are attached to the beam to bring the balance to equilibrium.

4. Reading scale: mechanical, optical or digital reading scale. In optical scale a light bulb, mirrors, microfilm& power supply must be found. In digital scale analogue to digital converter, power supply& 7 segments display must be found.

5. Position net: small piece of screwed weight fixed at the bottom of pan, used for setting zero.

Fig (1) Electronic balance

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How Electronic Balances Work

The quickest way to understand the principle of how electronic balances work, is to first understand how they are constructed. There are two basic types of electronic balance designs.

1. Electromagnetic balancing type
2. Electrical resistance wire type (load cell type)

These are based on completely different principles, but what they both have in common is that **neither directly measures mass**. They **measure the force** that acts downward on the pan. This force is converted to an electrical signal and displayed on a digital display.

As a means of measuring force, the electromagnetic balance method utilizes the electromagnetic force generated from a magnet and coil, whereas the electrical resistance wire method utilizes the change in resistance value of a strain gauge attached to a piece of metal that bends in response to a force.

So why do electronic balances display mass values when that is not what they measure? It is because the reference standards for mass are weights, which are placed on a pan to inform the electronic balance that a given force is equivalent to a given number of grams, which is used for conversion. Consequently, electronic balances that do not perform this conversion accurately cannot display accurate mass values.

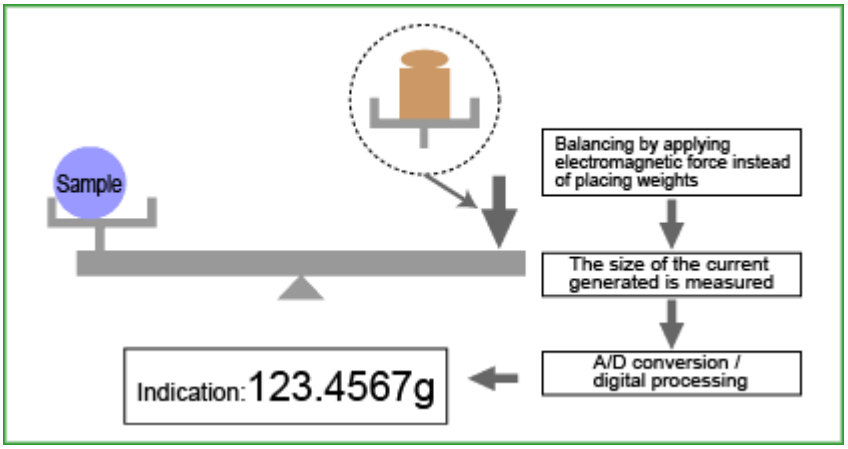
Electromagnetic Type and Load Cell Type

Various principles are used for measuring the weight of objects. The following briefly describes the operating principles and features of the two most popular methods, "electromagnetic type" and "load cell type."

● Electromagnetic Type

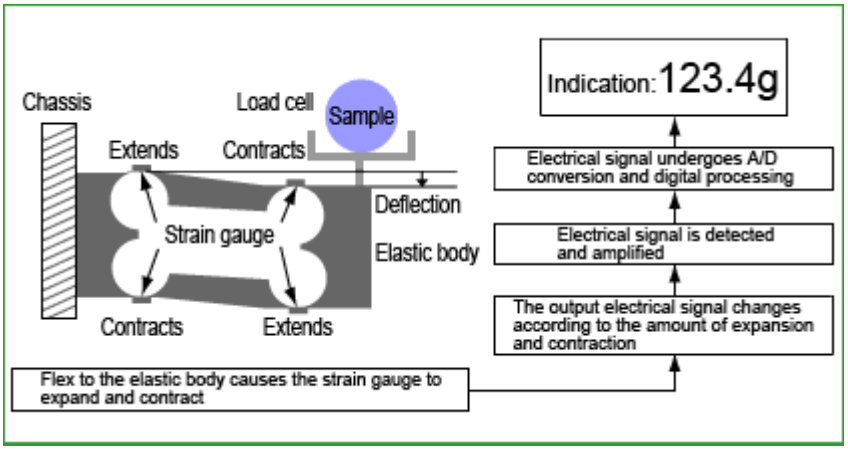
This is also called the "electromagnetic balance method." With mechanical balances, the sample is placed at one end of the beam and the weight is placed at the other end, and the value of the weight when both are perfectly balanced becomes the mass of the sample. With electromagnetic type balances, an electrical force (electromagnetic force) is applied instead of a placed weight to balance the beam. The amount of electricity required for balancing the beam changes according to the weight of the sample that is placed. The amount of current when the beam is perfectly balanced is detected, and the mass is

obtained from that detected value.



● **Load Cell Type (electrical resistance wire method)**

One end of an object (elastic body) made of aluminum and shaped as shown in the figure is fixed in place, and the sample is placed on the other end. The weight of the sample causes the elastic body to flex. The amount of flex causes the strain gauges attached to the elastic body to expand and contract, changing the amount of electricity that is output (strictly speaking, the resistance value). The mass is then obtained from that amount of electricity.



Discussion:

1.

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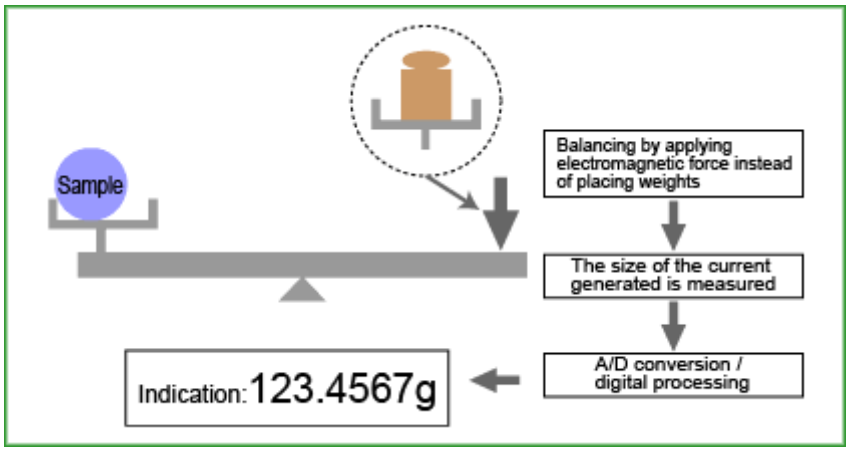
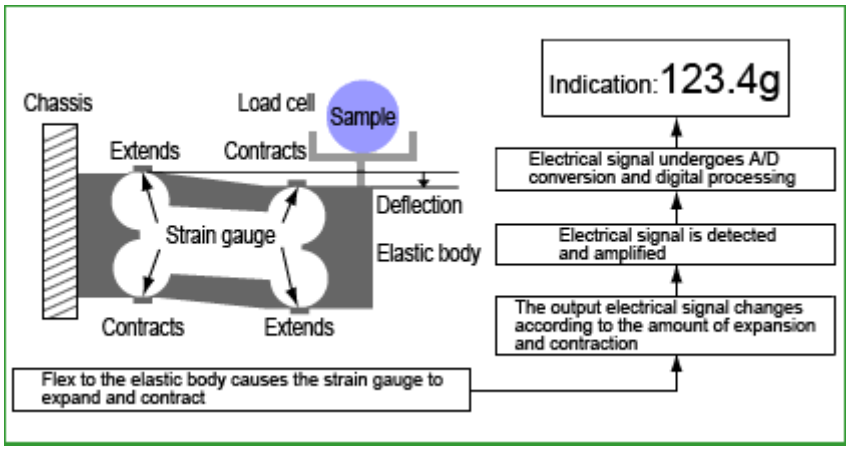
balance the beam. The amount of electricity required for balancing the beam changes according to the weight of the sample that is placed. The amount of current when the beam is perfectly balanced is detected, and the mass is obtained from that detected value, see figure(2).



Fig(2):Show how the electromagnetic Type of electronic balance work.

- **Load Cell Type (electrical resistance wire method)**

One end of an object (elastic body) made of aluminum and shaped as shown in the figure is fixed in place, and the sample is placed on the other end. The weight of the sample causes the elastic body to flex. The amount of flex causes the strain gauges attached to the elastic body to expand and contract, changing the amount of electricity that is output (strictly speaking, the resistance value). The mass is then obtained from that amount of electricity, see figure (3).



Fig(3): show how the Load cell type of electronic balance work.

● Comparison between Electromagnetic Type and Load Cell Type shown in table (1).

Table (1) Comparison between Electromagnetic Type and Load Cell Type:

	Electromagnetic Type	Load Cell Type
Advantages	• High accuracy	• Simple structure • Even large models are easy to make
Disadvantages	• Complex structure • Difficult to downsize	• Accuracy is limited
Applications	• Ultra-precision balances such as analytical balances	• Small, cheap balances that require only moderate accuracy • Large balances

General Faults of Balance

The electrical faults:

1. No light:

a) No power supplied to the light bulb.

b) Damage of light bulb.

c) Damage of fuse.

d) Damage of ON/OFF switch.

e) Light j bulb base is Dirty.

f) Damage of transformer/

f) The transformer input is a primary coil indicated with voltage less than 220V

2. Weak light:

a) The transformer input is a primary coil indicated with voltage more than 220V.

b) Damage of transformer.

3. Light bulb is always on when it is connected to electric supply: Damage of ON/OFF switch.

The optical faults:

1. Light is present but all the shadow of the numbers or a part of it is not found:

a) The microfilm is wrongly placed.

b) The mirrors are wrongly placed.

2. A shadow of a line is display with all or some numbers:

a) Scratching of some mirror.

b) Scratching of microfilm.

The mechanical faults:

1. Losing the sensitivity especially with light weights:

a) Carrying weights more than the capacity of the balance.

b) Wrong dealing with balance and its adjustment.

2. Damage of leavers:

a) Wrong dealing with balance.

b) Very long using of the balance

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Dictation

1. Definition Electronic balance

2. What Is an Electronic Balance Used For and it have a many type ?
3. Why we uses Electronic balance
4. comparison with Rom balances and Analytical balances
5. What advantages and disadvantages of Electronic balance
6. What are precision of Electronic balance