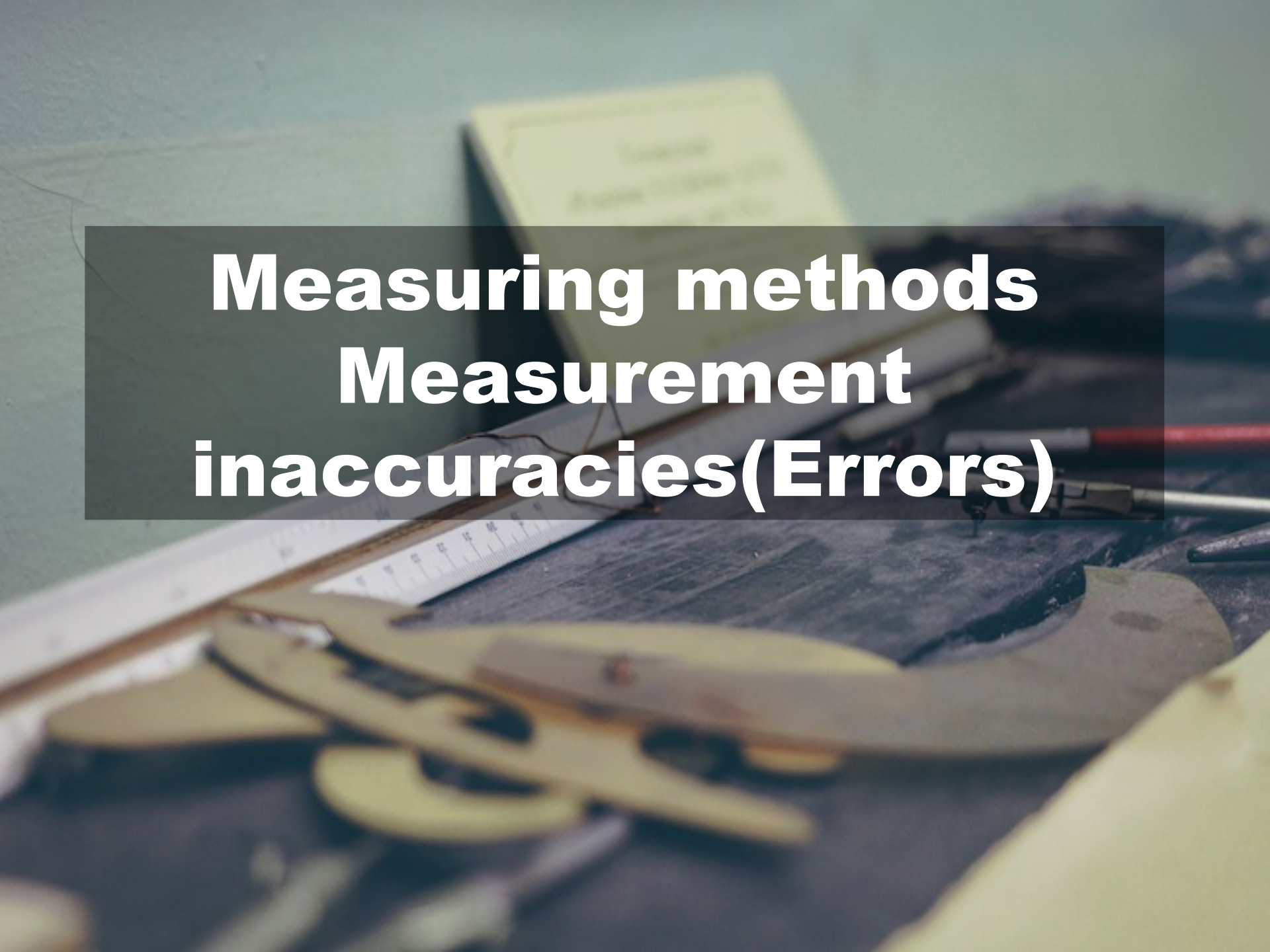
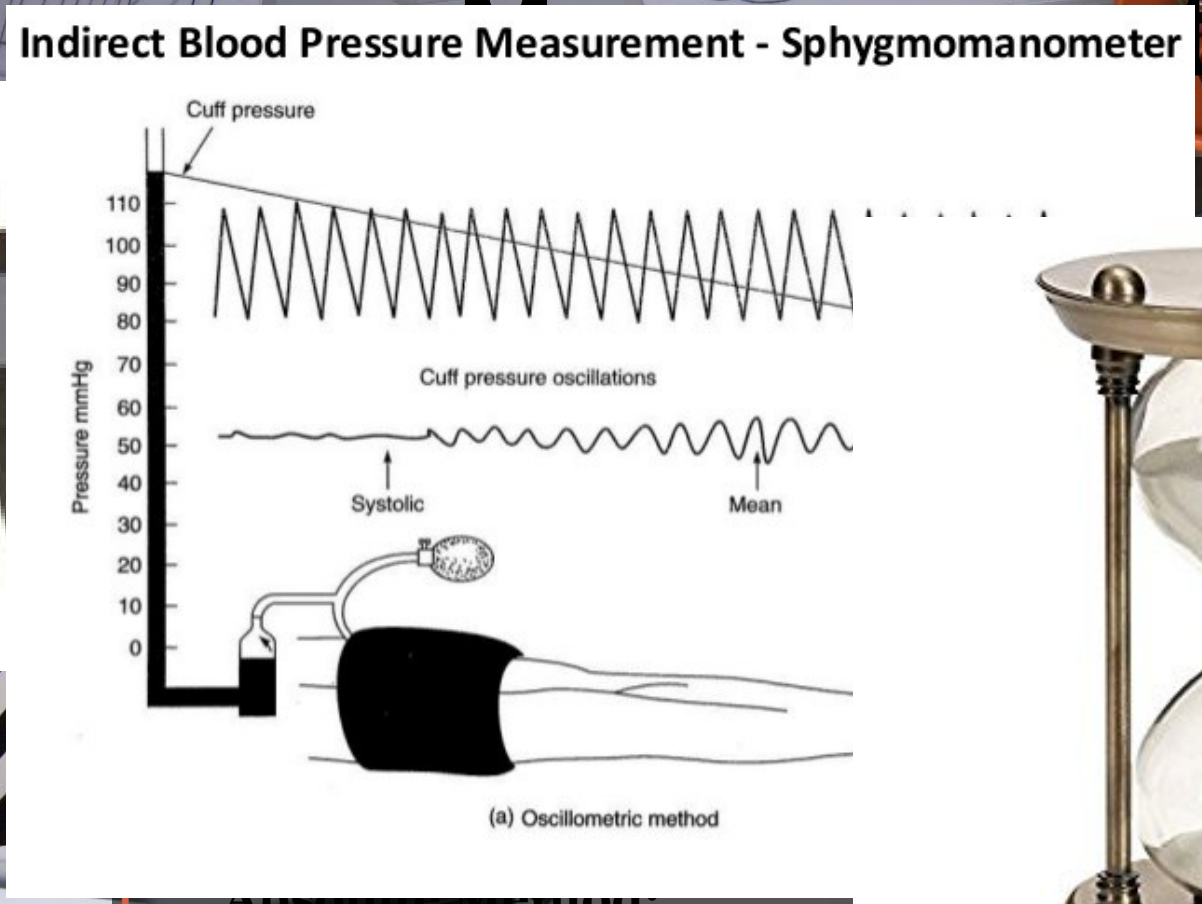

Measuring methods
Measurement
inaccuracies(Errors)

Methods of



1. Absolute Method:

Also called fundamental me
measurement of the base
particular quantity.

4. **Comparison Method:**

The value of quantity to be measured is compar a same or related quantity to it.

- E.g. dial indicators & other comparators.(cloc

5. **Substitution Method:**

The quantity is measured by direct comparison by replacing the measurable quantity with an e same effect on the indicating device.

5. **Coincidence Method:**

There is a very small difference between the value of the quantity to be measure & the reference.

It is also called differential method of measurement.

5. **Transposition Method:**

In this method the value of the quantity measured is first balanced by an initial known value P of the same quantity.

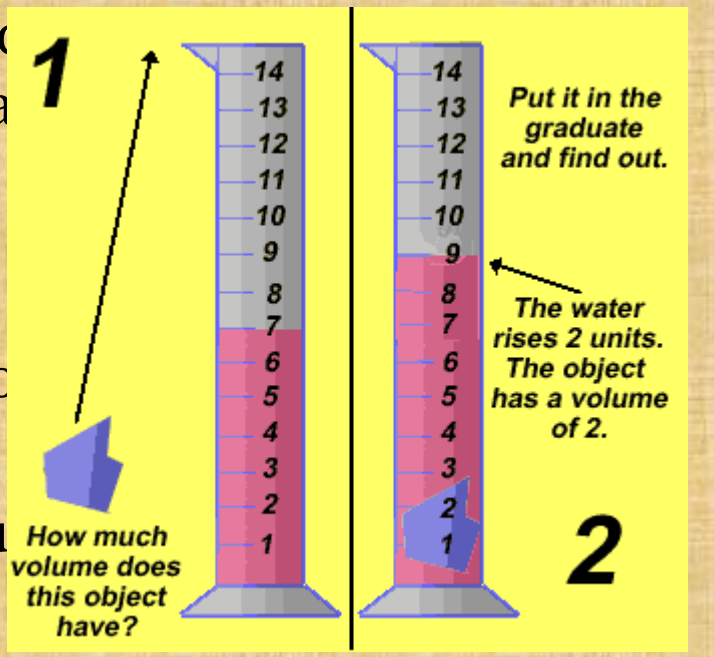
Then the value of the quantity measured is put in place of that known value & is balanced again by another known value Q.

Finally the value of the quantity is to be measured by $\sqrt{\square}$

8. Deflection Method:

The value of the quantity to be measure
the deflection of a pointer on a calibra

e.g. dial indicator.



9. Complementary Method:

The value of the quantity measured is co
value of the same quantity.

E.g. determining volume of solid by liqu

9. Method of Null Measurement:

It is a method of Differential measurement.

In this method the difference between measured & known value is brought to zero.

E.g. measurement by potentiometer.

Errors in Measurements

Error in Measurement=Measured value-True Value

Error may be Absolute or Relative.

1. Absolute Error:

It is divided into two types:

True absolute Error:

It is defined as the algebraic difference between the result of measurement & the conventional true value of the quantity Measured.

Apparent Absolute Error:

It is defined as the algebraic difference between the arithmetic mean & one of the results of measurement when a series of measurements are made.

2. Relative Error:

It is the quantity of the absolute error to the true/ actual value (may be true or arithmetic mean of a series of measurements)

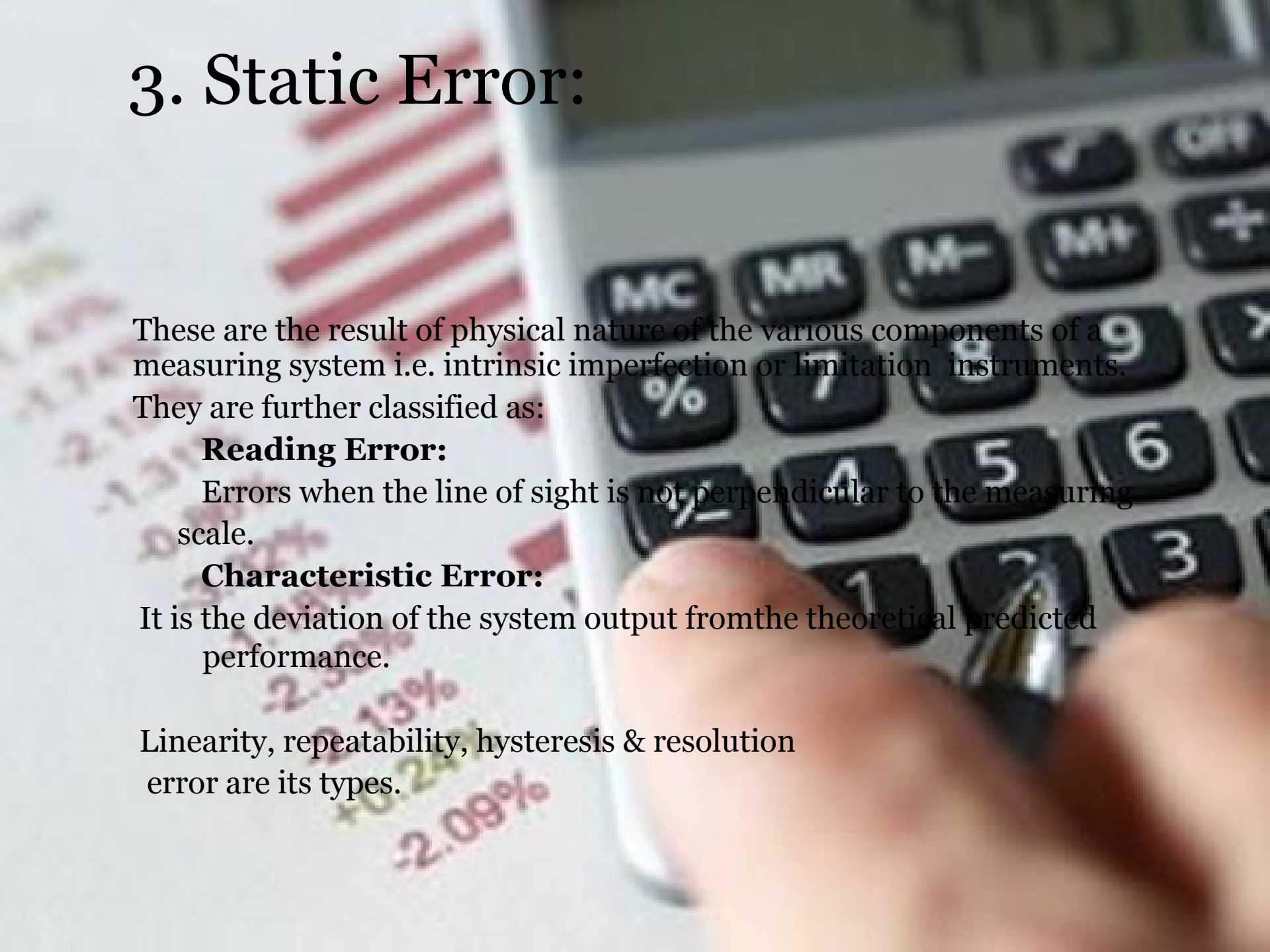
Relative Error = |□□□□□□□ □□□□□□ −□□□□□□□□□□□□□□□ □□□□□□|

|□□□□□□□ □□□□□□|

Relative Error = dx/x

Percentile Error (Ep) = Relative Error * (100)

3. Static Error:



These are the result of physical nature of the various components of a measuring system i.e. intrinsic imperfection or limitation instruments.

They are further classified as:

Reading Error:

Errors when the line of sight is not perpendicular to the measuring scale.

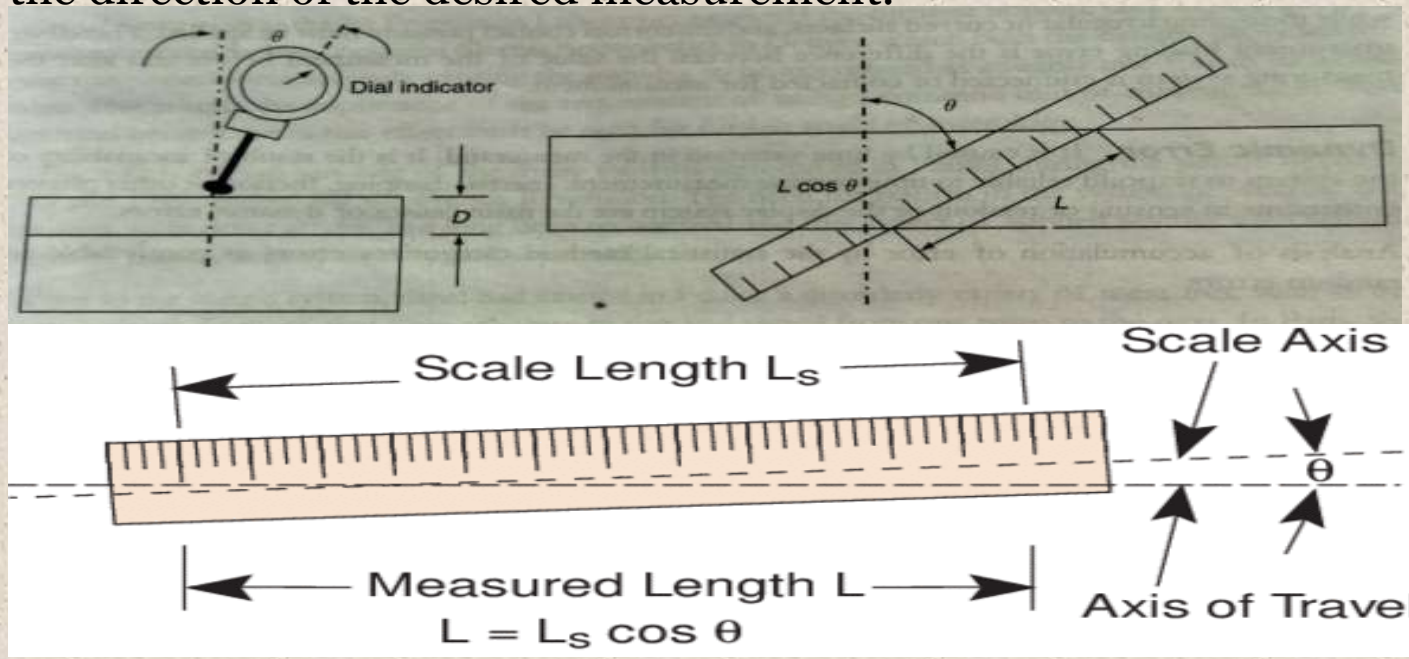
Characteristic Error:

It is the deviation of the system output fromthe theoretical predicted performance.

Linearity, repeatability, hysteresis & resolution error are its types.

4. Alignment error:

This occurs when the checking of an instrument is not correctly aligned with the direction of the desired measurement.



To avoid alignment error Abbe's Principle has to be followed which states that:

"the axis or line of measurement should coincide with the axis of the measuring instrument or the line of the measuring scale"

5. Environmental Error:

The error arising from the effect of the surroundings like pressure, temperature, humidity, magnetic & electric fields etc.

It can be controlled by controlling the atmospheric factors.

6. Loading error:

If the datum surface is not flat or if foreign matters like dirt, chips etc. get entrapped between the datum & work piece then there will be Loading error.

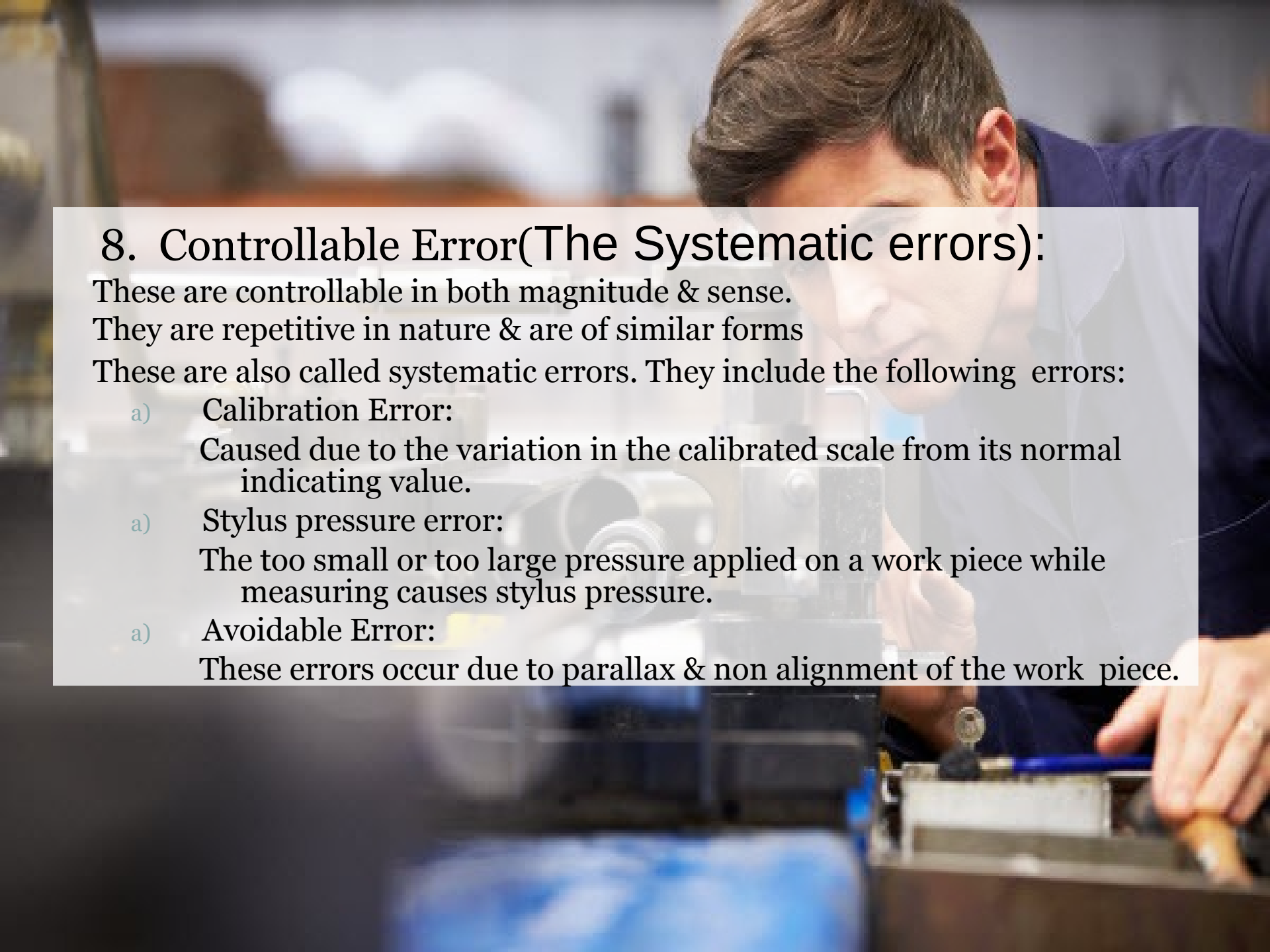
Also poor contact between instrument & work piece can cause this.

To avoid such errors an instrument with wide area of contact should not be used.

7. Dynamic error:

It is caused by time variation in the Measurand. It is the result of incapability of the system to respond reliably to time varying measurement.

Inertia, damping & friction are causes of dynamic error.



8. Controllable Error(The Systematic errors):

These are controllable in both magnitude & sense.

They are repetitive in nature & are of similar forms

These are also called systematic errors. They include the following errors:

a) Calibration Error:

Caused due to the variation in the calibrated scale from its normal indicating value.

a) Stylus pressure error:

The too small or too large pressure applied on a work piece while measuring causes stylus pressure.

a) Avoidable Error:

These errors occur due to parallax & non alignment of the work piece.

9. Random Error:

These errors are accidental, non consistent in nature.

As they occur randomly they cannot be eliminated since no definite cause can be located.

Small variation in the setting standards & the work piece can

cause such errors.