

Darryl Evans

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One

a) measurement transducer used to take single shot value of quantity being measured.
Monitoring transducer used for short term continuous readings.

b) Systematic errors are due to poor experimental methodology or the design of the measurement system.

Random errors are from unexpected causes and are determined using standard deviation about the mean.

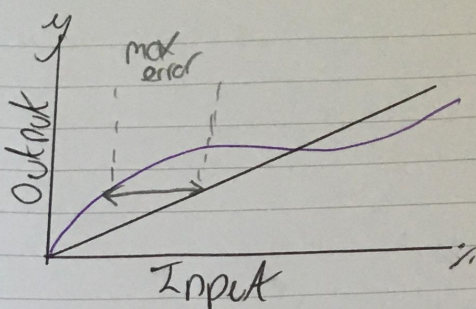
c) Resistance strain gauge is where the change in length of the gauge wire has a proportional change in resistance of the device, $\therefore$ it is used to measure force or strain.

$$d) \frac{C}{R} = 0.75 \times 0.15 \times 500 \times 1$$
$$R = 56.25 \text{ cm/rad}$$

$$ii) C = 8.5 \therefore R = \frac{8.5}{56.25} = 0.15 \text{ rad}$$

iii) Wheatstone bridge changes resistance value into voltage to be read by recorder.

e,



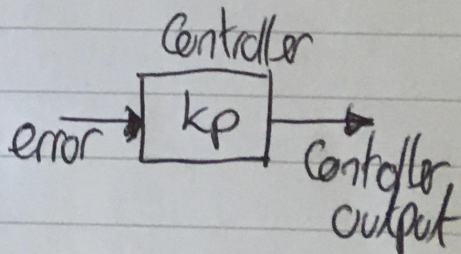
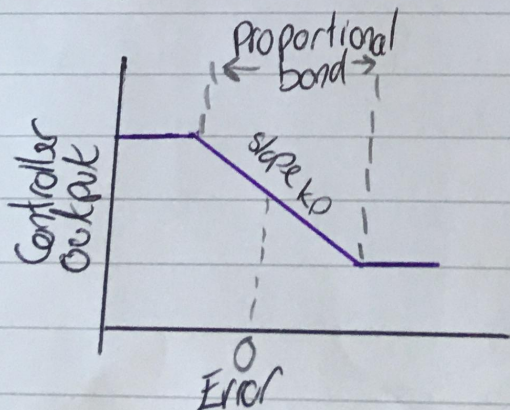
When the output curve is produced max error is determined for either input or output as a percentage.

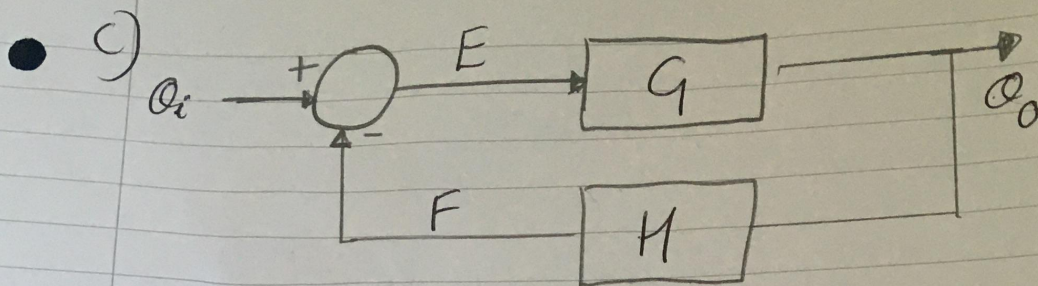
Two

a) Open-loop has no error signal to account for the differences in output value compared to desired value i.e. its input.

Closed loop has a feedback signal and a measurement device and a comparison element. Closed loop system generate an error signal and can deal with system disturbance.

b) Proportional Control produces a control action that is proportional to the error signal. So the bigger the error the greater the output





$$G = \frac{Q_o}{E} \text{ so } E = \frac{Q_o}{G}$$

$$H = \frac{F}{Q_o} \text{ so } F = H Q_o$$

$$E = Q_i - F$$

$$\text{so } \frac{Q_o}{G} = Q_i - H Q_o \quad \frac{Q_o}{G} + H Q_o = Q_i$$

$$Q_o \left(\frac{1 + GH}{G} \right) = Q_i \quad \text{therefore } \frac{Q_o}{Q_i} = \frac{G}{1 + GH}$$

$$d) \frac{Q_o}{Q_i} = \frac{G_1 G_2}{1 + G_1 G_2 H}$$

$$= \frac{5 \times 0.25}{1 + (5 \times 0.25 \times 0.15)}$$

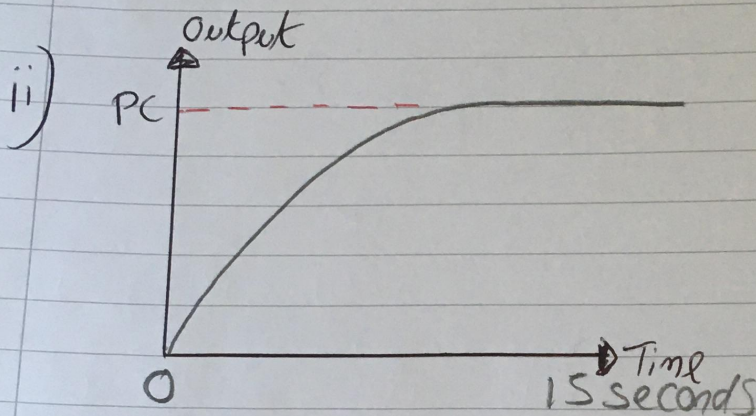
$$= 1.05 \text{ mm/V}$$

e) Used for heat treatment in furnace
Used for speed control in a factory on a conveyor belt.

Three

$$b) \quad P_C = P [1 - e^{-t/R_C}]$$

$$i) \quad \phi_0 = \left(\frac{b_0}{a_0}\right) \phi_i [1 - e^{(-a_0 t/a_1)}]$$



$$c) \quad y(t) = \tilde{y}(t) + \bar{y}(t)$$

$\tilde{y}(t)$ is transient response

$\bar{y}(t)$ is steady state response

Transient response occurs as a result of a change in the system input and generally dies away after a short interval of time

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Steady state response will remain after all transient responses have died down completely.

