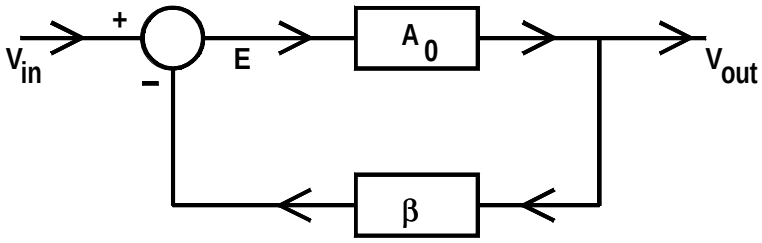
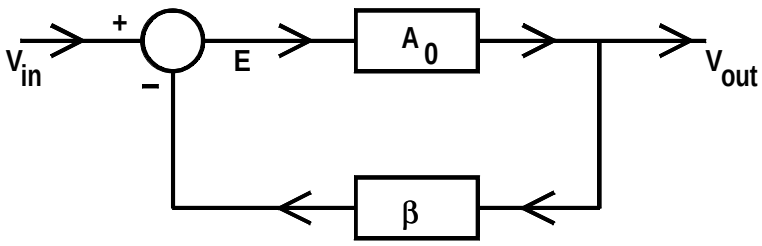


If a fraction, β, of the output of an amplifier is fed back and subtracted from the input to the amplifier and if the open loop gain of the amplifier is large, the closed loop gain of the amplifier is given by:—

$$A_V = \frac{1}{\beta} = \frac{1}{\text{Feedback Fraction}}$$



$$V_{out} = E \times A_o$$

Feedback a fraction of this output voltage,

$$\beta \times V_{out}$$

to the –input of the comparator

$$V_{out} = E \times A_o = A_o \times (V_{in} - \beta V_{out})$$

which simplifies to give

$$A_V = \frac{V_{out}}{V_{in}} = \frac{A_o}{1 + A_o\beta} = \frac{1}{\frac{1}{A_o} + \beta}$$

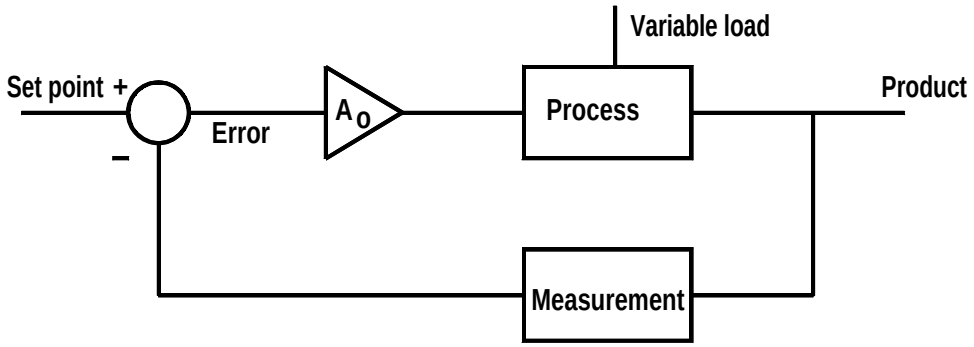
Or if A_o is large

$$A_V \approx \frac{1}{\beta} = \frac{1}{\text{Feedback fraction}}$$

Negative feedback systems are used in many areas of modern industry as well as in electronic circuits.

Control systems. A typical example of a control system is a ctextbfServo systems comprise the second main group of negative feedback applications.

Servo systems comprise the second main group of negative feedback applications.



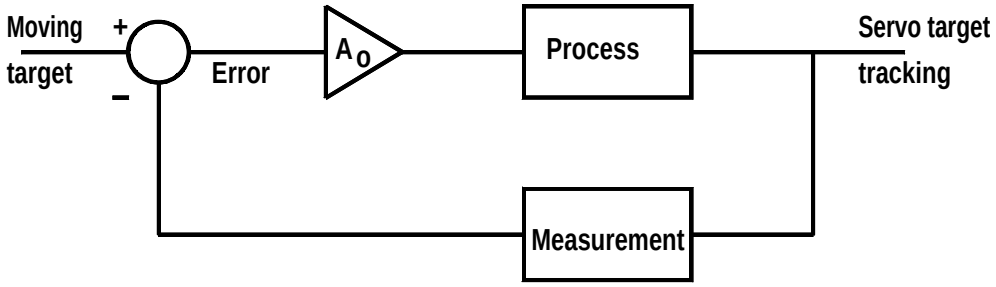
Generalised control loop

Typical example is a chemical process where a uniform product is to be delivered even though the load or process throughput may vary.

The characteristic feature of a control loop is that the set point is fixed but that the load or throughput may vary. The loop maintains the product operating point (temperature, pressure, etc.) constant.

The table shows, on each horizontal row, some typical applications of negative feed back control systems and some of the associated variables within the control loop.

Use	S P	Meas.	Method	Load
DC supply	V	V	Trans	I
Heater	Temp	Therr	Heater	Flow
Traffic	Sp limit	Meter	Acc	Slope
Economy	Growth	Inflation	Intt rates	World

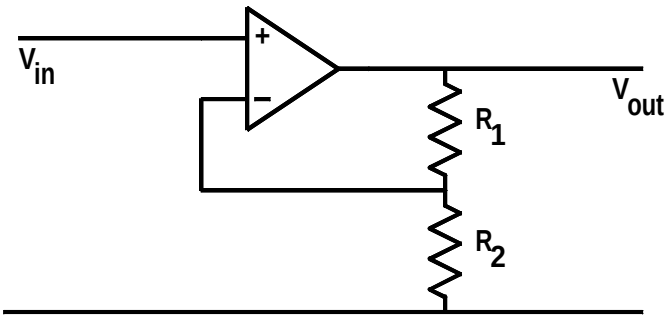


Servo systems comprise the second main group of negative feedback applications.

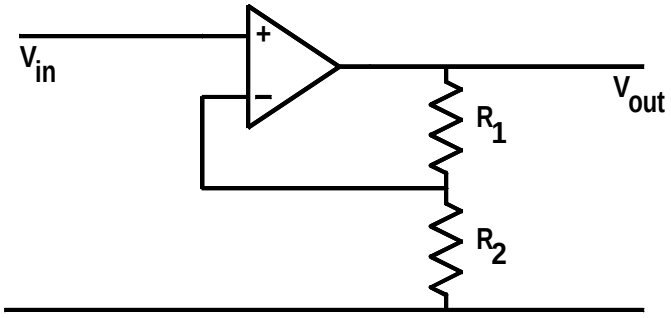
In this group the target or set point varies and the servo loop acts to force the process to follow the varying target. The load in general is constant or nearly so.

Examples of servo system
Automatic guided vehicle which follows a white, painted track around a factory floor as it delivers parts to the various machines.

National economy in which the apparent growth rate is manipulated by controlling the interest rates at the expense of inflation.



Analyse the noninverting amplifier shown in Figure 41.4 in terms of a negative feed back system.



$$\text{The feedback fraction} \quad = \beta = \frac{R_2}{R_1 + R_2}$$

Therefore the gain of the amplifier is

$$\begin{aligned} A_V &= \frac{1}{\beta} \\ &= \frac{1}{\frac{R_2}{R_1+R_2}} \\ &= \frac{R_1 + R_2}{R_2} \\ &= 1 + \frac{R_1}{R_2} \end{aligned}$$

which is the same result which we obtained in Unit 40 using a different method.