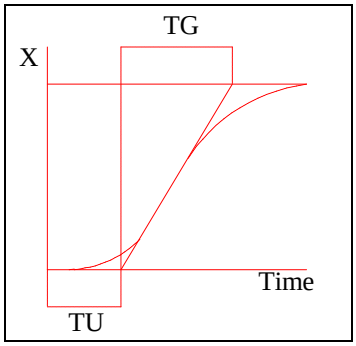
Calculating the PID values for D1C \ pH controllers

$$XP = \frac{X}{Y} \times \frac{TU}{TG} \times \frac{Y\ max}{X\ max} \times 100\%$$



X = Change of pH

Y = Metering rate

TU = Distance of velocity lag in seconds

TU is influenced by the distance between the metering point and the point where the measuring water is extracted, the length of the measure water line and the velocity of flow. These factors cause a certain time to pass until the pH change is registered at the controller.

TG = Compensating time in seconds

The pH value will now increase for some time after the so-called compensating time TG, it will seek a new balanced pH value.

Y max = Metering rate = 100%

X max = pH = 14

In the following example, metering was started with a stroke rate of 25%. After 14 seconds, we can see the first reaction at the controller. After another 50 seconds, the pH value remains almost steady. The newly set pH value is 2 pH values above the initial value.

$$XP = \frac{2\ pH}{25\%} \times \frac{14\ seconds}{50\ seconds} \times \frac{100\%}{14\ pH} \times 100\% = 16\%$$

$$XP = \frac{X}{Y} \times \frac{TU}{TG} \times \frac{Y\ max}{X\ max} \times 100\%$$ **(Proportioning band)**

PI Controller = 3 x TU (14 seconds) = <u>42 seconds</u> Proportional band (16%) x 1.25 = <u>20 %</u>
Set the Integral for 42 seconds and the proportional band for 20%

PD Controller = .25 x TU (14 seconds) = <u>3.5 seconds</u> Proportional band (16%) x .83 = <u>13 %</u>
Set Derivative for 3.5 seconds and proportional band to 13%

PID Controller = TI= 2 x TU (14 seconds) <u>28 seconds</u>
TD= .42 x TU (14 seconds) <u>6 seconds</u>
Proportional band = .83 x 16% = <u>13%</u>