



UDC 3500 Application Note

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Feedforward Summer

Feedforward control is a strategy of implementing a control action based on some known disturbance to minimize the effect of that disturbance on the process variable. The Feedforward effect bypasses the closed loop PID algorithm.

As its name implies, the disturbance is measured and transmitted, i. e. **Feedforward**, ahead of the PID algorithm to add in an Output effect that is summed with the closed loop PID algorithm. The summation of the closed loop PID output and the Feedforward equation is then transmitted to the final control output.

The equation for Feedforward Summer is:

Final Output = [PID Output] +

$$100 \times \frac{[Input A * Ratio A + Bias A] - Input A Low}{Input A Hi - Input A Low}$$

Where “A” can be either Input 1, 2, or 3.
The Feedforward Output is always in percent.

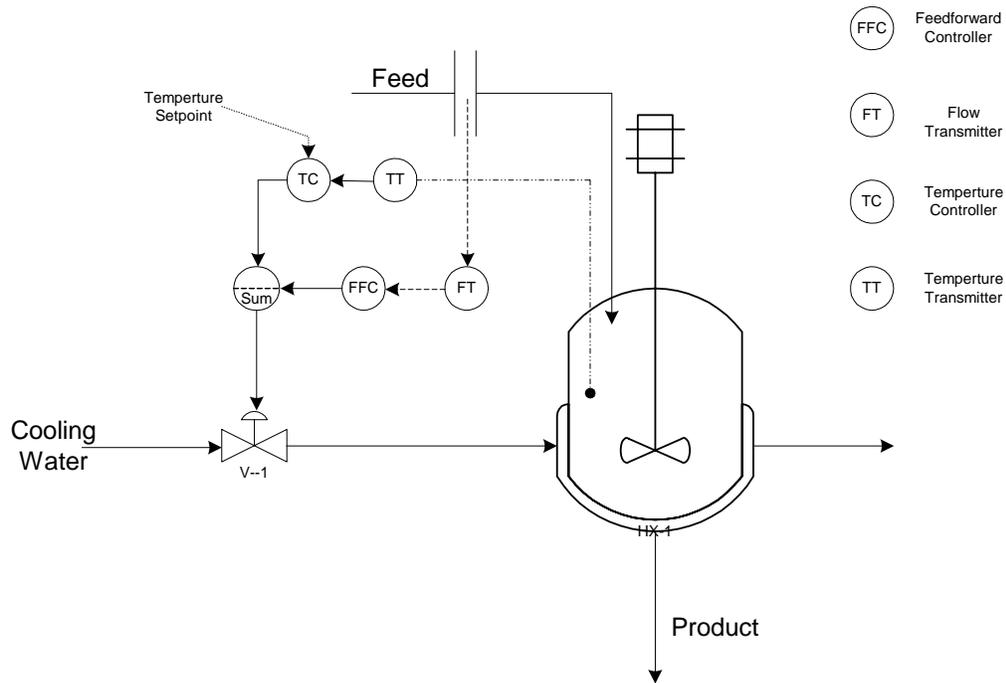
Feedforward Requirements

- The disturbance must be measurable
- You must know in how much that you wish to move the Output based upon the disturbance, i.e. Knowledge of the process.
- You must know in what direction to move the Output based upon the disturbance.

Feedforward control can result in closer control by eliminating the influence long before closed loop PID can, because the PID loop can not react until after the error is measured. Since the effect of Feedforward is a “Open Loop system”, i.e. no feedback, it is never perfect and its effect should be used with caution.



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Feedforward control on the feed to a continuously stirred tank reactor operating under reactor temperature control



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Example

PV Input 0 - 250 GPM

Steady State Condition = 125 GPM

Feedforward effect = If Flow goes to 250 GPM then add -50% to the PID output

Since we want the Output to decrease as the Input increase, use a Negative Ratio.

Since we want a 50% effect, and the Input is at 50% of the range, use a ratio of -1

Feedforward Output	Input	Ratio	Bias	
-50.00	250	-1.00	125	
-40.00	225	-1.00	125	
-30.00	200	-1.00	125	
-20.00	175	-1.00	125	
-10.00	150	-1.00	125	
0.00	125	-1.00	125	
10.00	100	-1.00	125	
20.00	75	-1.00	125	
30.00	50	-1.00	125	
40.00	25	-1.00	125	
50.00	0	-1.00	125	