



# UDC 3200 Application Note

## *Feed Forward Summer*

Feed forward 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 it's name implies, the disturbance is measured and transmitted, i.e. **Feed forward**, 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 Feed forward summer is:

Final Output = [PID Output] + [(Input A x Ratio A + Bias A) ÷ (100/Input A Hi – Input A Lo)]  
Where “A” can be Input 1, or 2.  
The Feed forward Output is always in percent.

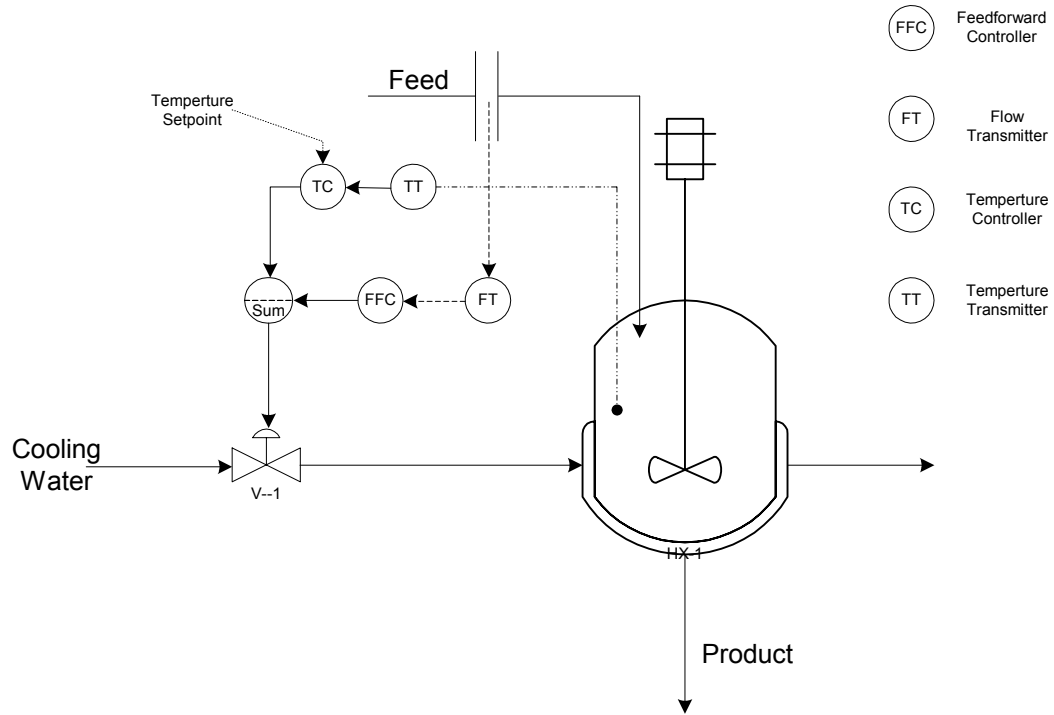
### Feedforward Requirements

- 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.

Feed forward control can result in closer control by eliminating the influence long before closed loop PID can, because the PID loop cannot react until after the error is measured. Since the effect of Feedforward is an “Open Loop system”, i.e. no feedback, it is never perfect and it's 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

Feed forward 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 | 100/Input Range |
|--------------------|-------|-------|------|-----------------|
| -50.00             | 250   | -1.00 | 125  | 0.4             |
| -40.00             | 225   | -1.00 | 125  | 0.4             |
| -30.00             | 200   | -1.00 | 125  | 0.4             |
| -20.00             | 175   | -1.00 | 125  | 0.4             |
| -10.00             | 150   | -1.00 | 125  | 0.4             |
| 0.00               | 125   | -1.00 | 125  | 0.4             |
| 10.00              | 100   | -1.00 | 125  | 0.4             |
| 20.00              | 75    | -1.00 | 125  | 0.4             |
| 30.00              | 50    | -1.00 | 125  | 0.4             |
| 40.00              | 25    | -1.00 | 125  | 0.4             |
| 50.00              | 0     | -1.00 | 125  | 0.4             |