HOW TO SET UP PID
in VFD-B+

CONTENTS:

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1 APPLICATION

1.1 Application data

- Drive controls fan.
- Pressure feedback via sensor –1000Pa~5000Pa = 4~20mA.
- Pressure set point 1500Pa.
- Drive power and fan inertia not known.
- Operating frequency range not known.

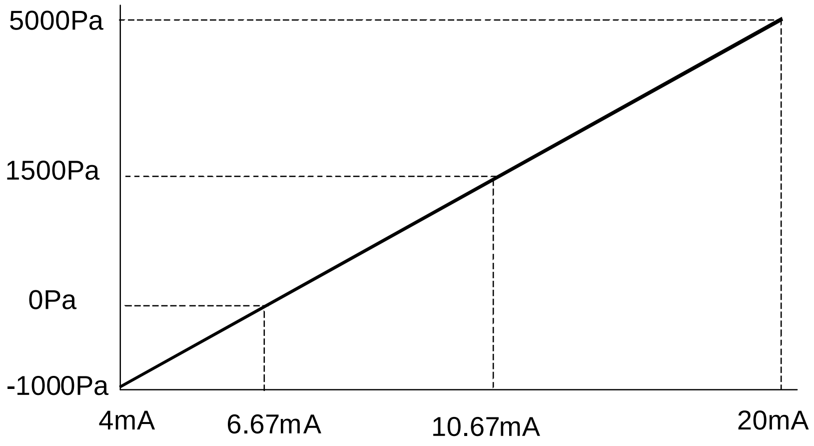
1.2 General

The examples are given for sensor feedback on ACI input and set point via AVI input.

2 FEEDBACK

Because the feedback sensor is 4~20mA, the ACI input is used for feedback. Set Pr10-00=02 Negative Feedback on ACI. (Negative feedback because pressure increases with output frequency).

2.1 Sensor characteristic



-1000Pa = 4mA
5000Pa = 20mA

Therefore 0Pa = $\dfrac{1000\,Pa}{5000\,Pa + 1000\,Pa} \bullet (20mA - 4mA) + 4mA = 6.67\,mA$

And 1500Pa = $\dfrac{1000\,Pa + 1500\,Pa}{5000\,Pa + 1000\,Pa} \bullet (20mA - 4mA) + 4mA = 10.67\,mA$

And 2000Pa = $\dfrac{1000\,Pa + 2000\,Pa}{5000\,Pa + 1000\,Pa} \bullet (20mA - 4mA) + 4mA = 12.00\,mA$

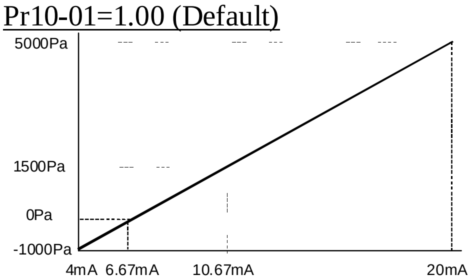
2.2 Scaling feedback input

The input, that is used for PID feedback, cannot be scaled via Bias and Gain, they have no influence!

2.2.1 Pr10-01 Gain over the PID Detection Value

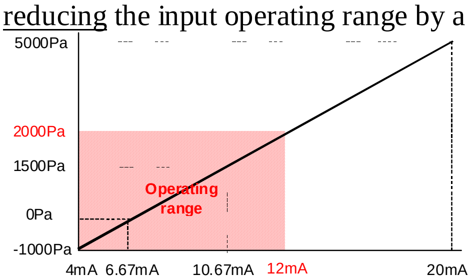
With Pr10-01 the Gain for the feedback input can be set. Range 0.00~10.00, default 1.00.

<u>Pr10-01=1.00 (Default)</u>



<u>Pr10-01=2.00</u>

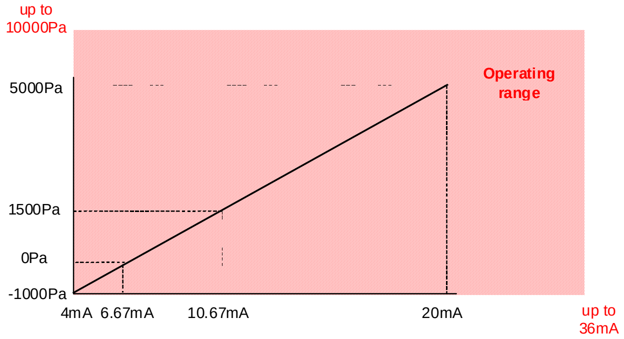
Internally the feedback input value will be multiplied by 2 before it is input to the PID-controller, so actually <u>reducing</u> the input operating range by a factor 2.



<u>Pr10-01=0.50</u>

Internally the feedback input value will be multiplied by 0.5 (divided by 2) before it is input to the PID-controller, so actually expanding the input operating range by a factor 2.

In this case the useful operating range will be limited by the sensor itself.



2.2.1.1 Example for setting Pr10-01

Range of sensor : -1000Pa ~ 5000Pa.
Max Pa value to be used: 2000Pa

Used range of sensor (capteur): -1000Pa ~ 2000Pa.

This is $\frac{2000\,Pa-(-1000\,Pa)}{5000\,Pa-(-1000\,Pa)}=50\%$

So if the system is to be used up to 2000Pa with this sensor (capteur), Pr10-01= $1/_{50\%}=2$

2.2.1.2 General formula for setting Pr10-01

Sensor maximum value:	MaxVal
Sensor minimum value:	MinVal
Maximum feedback value to be used:	MaxFBVal (Note: MaxFBVal $\leq$ MaxVal)

Pr10-01 = $\frac{MaxVal-MinVal}{MaxFBVal-MinVal}$

3 SET POINT (FREQUENCY COMMAND)

The input that is used for input command can be scaled via Bias and Gain.
Because the fan only operates in one direction, it's most convenient to use AVI by setting Pr02-00=01.

3.1 Pr01-00 Max Frequency

Set Pr01-00 to the value of the Max Frequency of the fan. In this case Pr01-00=50Hz is assumed.

3.2 Min Frequency

The Min frequency has no influence in PID.

3.3 Bias & Gain

Set Pr04-00 AVI Bias, Pr04-01 AVI Bias Polarity, Pr04-02 AVI Gain as required.
Because the fan rotates in one direction only, set Pr04-03=00 (Default).

3.4 Set point

To set the normal operating point, the input frequency range can be considered as 0~100%.

3.4.1 Set point 1500Pa

When the fan produces a pressure of 1500Pa, the sensor feedback value is 10.67mA (ca. 42% of the range of –1000~5000Pa and if Pr10-01=2 it's ca. 84% of the range –1000Pa~2000Pa).
So the set point for 1500Pa with an output frequency operating range should be 42%*50Hz=21Hz if Pr10-01=1 and 84%*50Hz=42Hz if Pr10-01=2.

3.5 Output frequency limit

The drive output frequency limit can be set by Pr10-07 but is always limited by Pr01-07.
To use Pr10-07 it must be ≤Pr01-07.

4 PID OPERATION

4.1 Acceleration/Deceleration

When the drive operates in PID control, it's best to set the Acc Time and Dec Time to the lowest possible values (avoid OC error) in the application to have the least influence on PID control.

4.2 PID tuning

Some general hints on PID tuning:

- Set P=5 to have a good starting point for tuning the PID control. Pr10-02=5.0.
- Adjust I to have fast response to changes without overshoot. Pr10-03 value depends on application.
- In case of fan D is not needed because the process is relatively slow.
- Set other parameters acc. to application. Best is to leave the default settings and change only when required.

4.3 General PID info

- Increasing P makes the process faster and the static error smaller but makes it more sensitive to changes or disturbances.
- When P is too high the process becomes unstable.
- Small I makes the process faster but also less stable.
- Fast process requires lower I and lower P.
- Slow process (like fan) requires higher P. Too low I gives overshoot.
- Keep Acc Time and Dec Time as low as possible. Increasing them is comparable to higher inertia.