Technical Note 081

PID setpoint over GP1 (FLN), N2, and BACnet Input reference scaling to process PID units

The ACH580 implementation of PID control when using a communication protocol to pass the setpoint signal to the drive is different than the ACH550. For protocols GP1 (Siemens Apogee FLN), Johnson Control Inc. (JCI) Metasys N2, BACnet MS/TP, and BACnet/IP the setpoint is adjusted as a percentage from 0 – 100% on the controller. This Technical Note 081 will detail how to setup the ACH580 drive to receive the setpoint over these protocols. Technical Note 034 "Drive firmware release for GP1" can be referenced for supplemental information on GP1.

The use of the Primary Settings menu to activate PID mode on the ACH580, to adjust the feedback source, and the minimum and maximum ranges is recommended. The focus of Technical Note 081 is on configuring the setpoint source setup using parameters, and this document is not intended to cover in detail a complete setup of the PID control loop.

Four separate sets of instructions are detailed below depending on the communication protocol, and new verse retrofit scenario:

1. GP1 (Siemens Apogee FLN) setup
2. JCI Metasys N2 setup
3. BACnet MS/TP & BACnet/IP for new drive installation setup
4. BACnet MS/TP for ACH550 to ACH580 drive retrofit setup

GP1 (Siemens Apogee FLN) setup

The Siemens controller sends the drive a setpoint signal over serial communication using point 60 (Input Ref1) or 61 (Input Ref2) which is entered as a percentage between 0 – 100 %. Prior to completing the following steps, the ACH580 will receive the values sent to EFB ref1 and EFB ref2 as a frequency command by default (0 % = 0 Hz, 50 % = 30 Hz, 100 % = 60 Hz). Parameters 03.09 *EFB reference 1* and 03.10 *EFB reference 2* show the initial value the drive receives from the Siemens controller points 60 and 61 respectively.

The following steps 1 – 15 will detail how to program the drive correctly so the 0 – 100% signal being sent from the Siemens controller is scaled correctly in the ACH580 drive PID control loop. Table 1 will be referenced in the below steps to provide example parameter settings for different example transducer ranges.

1. Identify the range of the feedback transducer connected to the drive. Table 1 provides example transducer ranges in far-left column.
2. Set parameter 46.02 *Frequency scaling* = 100.00.
3. Set parameter 40.16 *Set 1 setpoint 1 source* = [25] Compensated setpoint.
4. Set parameter 40.26 *Set 1 setpoint min* = to the smallest value of the process signal range. See Table 1 for examples.
5. Set parameter 40.27 *Set 1 setpoint max* = to the highest value of the process signal range. See Table 1 for examples.
6. Set parameter 40.71 *Set 1 compensation input source* = [19] EFB ref1 (if writing to point 60) or [20] EFB ref2 (if writing to point 61) from the Siemens controller.
7. Set parameter 40.72 *Set 1 compensated input 1* = 0.0.
8. Set parameter 40.73 *Set 1 compensated output 1* = smallest value of signal range. See Table 1 for examples.
9. Set parameter 40.74 *Set 1 compensated input 2* = 100.0.

10. Set parameter 40.75 *Set 1 compensated output 2* = largest value of your signal range. See Table 1 for examples.
11. Verify parameter 40.76 *Set 1 compensated non-linearity* = 0 % (default).
12. Verify parameter 40.89 *Set 1 setpoint multiplier* = 1.00 (default).
13. From the Siemens controller set point 60 or 61 = 0.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the smallest process value of your signal range which is also parameter 40.73 setting.
14. From the Siemens controller set point 60 or 61 = 50.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the midpoint of the process value signal range.
15. From the Siemens controller set point 60 or 61 = 100.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the highest process value of the signal range which is also parameter 40.75 setting.

Table 1: Transducer range examples

Transducer range	P40.26	P40.27	P40.73	P40.75
0 – 2.5 inH_2O	0.0	2.5	0.0	2.5
(-)1 – (+)1 inH_2O	-1.0	+1.0	-1.0	+1
0 – 200 psi	0.0	200.0	0.0	200.0
20 – 200 °F	20.0	200.0	20.0	200.0

JCI Metasys N2 setup

The N2 controller sends the drive a setpoint signal over serial communication using Object AO1 (Input Ref1) or AO2 (Input Ref2) which is entered as a percentage between 0 – 100%. Prior to completing the following steps, the ACH580 will receive the values sent to EFB ref1 and EFB ref2 as a frequency command by default (0 % = 0 Hz, 50 % = 30 Hz, 100 % = 60 Hz). Parameters 03.09 *EFB reference 1* and 03.10 *EFB reference 2* show the initial value the drive receives from the N2 controller objects AO1 and AO2 respectively.

The following steps 1 – 15 will detail how to program the drive correctly so the 0 – 100 % signal being sent from the N2 controller is scaled correctly in the ACH580 drive PID control loop. Table 1 will be referenced in the below steps to provide example parameter settings for different example transducer ranges.

1. Identify the range of the feedback transducer connected to the drive. Table 1 provides example transducer ranges in far-left column.
2. Set parameter 46.02 *Frequency scaling* = 100.00.
3. Set parameter 40.16 *Set 1 setpoint 1 source* = [25] Compensated setpoint.
4. Set parameter 40.26 *Set 1 setpoint min* = to the smallest value of the process signal range. See Table 1 for examples.
5. Set parameter 40.27 *Set 1 setpoint max* = to the highest value of the process signal range. See Table 1 for examples.
6. Set parameter 40.71 *Set 1 compensation input source* = [19] EFB ref1 (if writing to object AO1) or [20] EFB ref2 (if writing to object AO2) from the N2 controller.
7. Set parameter 40.72 *Set 1 compensated input 1* = 0.0.
8. Set parameter 40.73 *Set 1 compensated output 1* = smallest value of signal range. See Table 1 for examples.
9. Set parameter 40.74 *Set 1 compensated input 2* = 100.0.
10. Set parameter 40.75 *Set 1 compensated output 2* = largest value of your signal range. See Table 1 for examples.
11. Verify parameter 40.76 *Set 1 compensated non-linearity* = 0 % (default).
12. Verify parameter 40.89 *Set 1 setpoint multiplier* = 1.00 (default).
13. From the JCI N2 controller set object AO1 or AO2 = 0.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the smallest process value of your signal range which is also parameter 40.73 setting.
14. From the JCI N2 controller set object AO1 or AO2 = 50.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the midpoint of the process value signal range.
15. From the JCI N2 controller set object AO1 or AO2 = 100.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the highest process value of the signal range which is also parameter 40.75 setting.

BACnet MS/TP & BACnet/IP for new drive installation setup

This set of instructions is intended for an installation of a new ACH580 drive on a new fan or pump application. The BACnet controller will send the drive a setpoint signal over BACnet communication using object AV42 (LOOP-Setpoint) which is entered as a percentage between 0 – 100 %.

The following steps 1 – 14 will detail how to program the drive correctly so the 0 – 100 % signal being sent from the BACnet controller is scaled correctly in the ACH580 drive PID control loop. Table 1 will be referenced in the below steps to provide example parameter settings for different example transducer ranges.

1. Identify the range of the feedback transducer connected to the drive. Table 1 provides example transducer ranges in far-left column.
2. Set parameter 40.16 *Set 1 setpoint 1 source* = [25] Compensated setpoint.
3. Set parameter 40.26 *Set 1 setpoint min* = to the smallest value of the process signal range. See Table 1 for examples.
4. Set parameter 40.27 *Set 1 setpoint max* = to the highest value of the process signal range. See Table 1 for examples.
5. Set parameter 40.71 *Set 1 compensation input source* = [24] Setpoint data storage
6. Set parameter 40.72 *Set 1 compensated input 1* = 0.0.
7. Set parameter 40.73 *Set 1 compensated output 1* = smallest value of signal range. See Table 1 for examples.
8. Set parameter 40.74 *Set 1 compensated input 2* = 100.0.
9. Set parameter 40.75 *Set 1 compensated output 2* = largest value of your signal range. See Table 1 for examples.
10. Verify parameter 40.76 *Set 1 compensated non-linearity* = 0 % (default).
11. Verify parameter 40.89 *Set 1 setpoint multiplier* = 1.00 (default).
12. From the BACnet controller set AV42 = 0.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the smallest process value of your signal range which is also parameter 40.73 setting.
13. From the BACnet controller set object AV42 = 50.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the midpoint of the process value signal range.
14. From the BACnet controller set object AV42 = 100.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the highest process value of the signal range which is also parameter 40.75 setting.

BACnet MS/TP for ACH550 to ACH580 drive retrofit setup

This set of instructions is intended for use when replacing an ACH550 with an ACH580 and looking to avoid making changes to the building automation controller. The BACnet controller will send the drive a setpoint signal over BACnet communication using object AV16 (Input-Reference 1) or AV17 (Input-Reference 2) which is entered as a percentage between 0 – 100 %.

The following steps 1 – 15 will detail how to program the drive correctly so the 0 – 100 % signal being sent from the BACnet controller is scaled correctly in the ACH580 drive PID control loop. Table 1 will be referenced in the below steps to provide example parameter settings for different example transducer ranges.

1. Identify the range of the feedback transducer connected to the drive. Table 1 provides example transducer ranges in far-left column.
2. Set parameter 46.02 *Frequency scaling* = 100.00.
3. Set parameter 40.16 *Set 1 setpoint 1 source* = [25] Compensated setpoint.
4. Set parameter 40.26 *Set 1 setpoint min* = to the smallest value of the process signal range. See Table 1 for examples.
5. Set parameter 40.27 *Set 1 setpoint max* = to the highest value of the process signal range. See Table 1 for examples.
6. Set parameter 40.71 *Set 1 compensation input source* = [19] EFB ref1 (if writing to object A16) or [20] EFB ref2 (if writing to object A17) from the BACnet controller.
7. Set parameter 40.72 *Set 1 compensated input 1* = 0.0.
8. Set parameter 40.73 *Set 1 compensated output 1* = smallest value of signal range. See Table 1 for examples.
9. Set parameter 40.74 *Set 1 compensated input 2* = 100.0.
10. Set parameter 40.75 *Set 1 compensated output 2* = largest value of your signal range. See Table 1 for examples.
11. Verify parameter 40.76 *Set 1 compensated non-linearity* = 0 % (default).
12. Verify parameter 40.89 *Set 1 setpoint multiplier* = 1.00 (default).
13. From the BACnet controller set AV42 = 0.0 %. Verify parameter 40.03 *Process PID setpoint actual* value

matches the smallest process value of your signal range which is also parameter 40.73 setting.

14. From the BACnet controller set object AV42 = 50.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the midpoint of the process value signal range.
15. From the BACnet controller set object AV42 = 100.0 %. Verify parameter 40.03 *Process PID setpoint actual* value matches the highest process value of the signal range which is also parameter 40.75 setting.

The above procedures provide instructions on how to program the ACH580 drive for receiving the setpoint for a PID control loop over Siemens FLN (GP1), JCI Metasys N2, and BACnet. Reach out to your local ABB representative if you have questions regarding this setup.