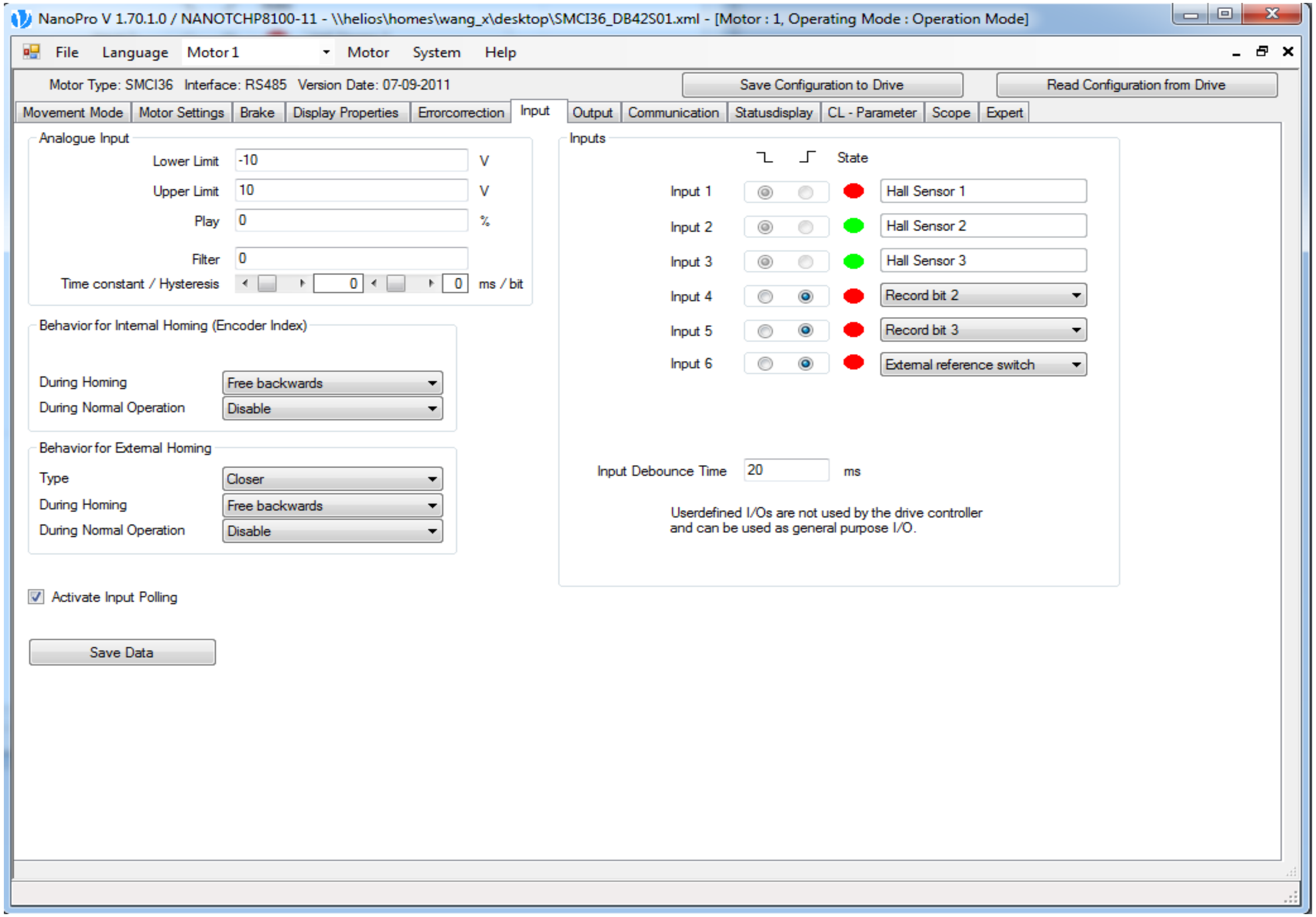
Special features and settings for BLDC motors

Special features for BLDC motors



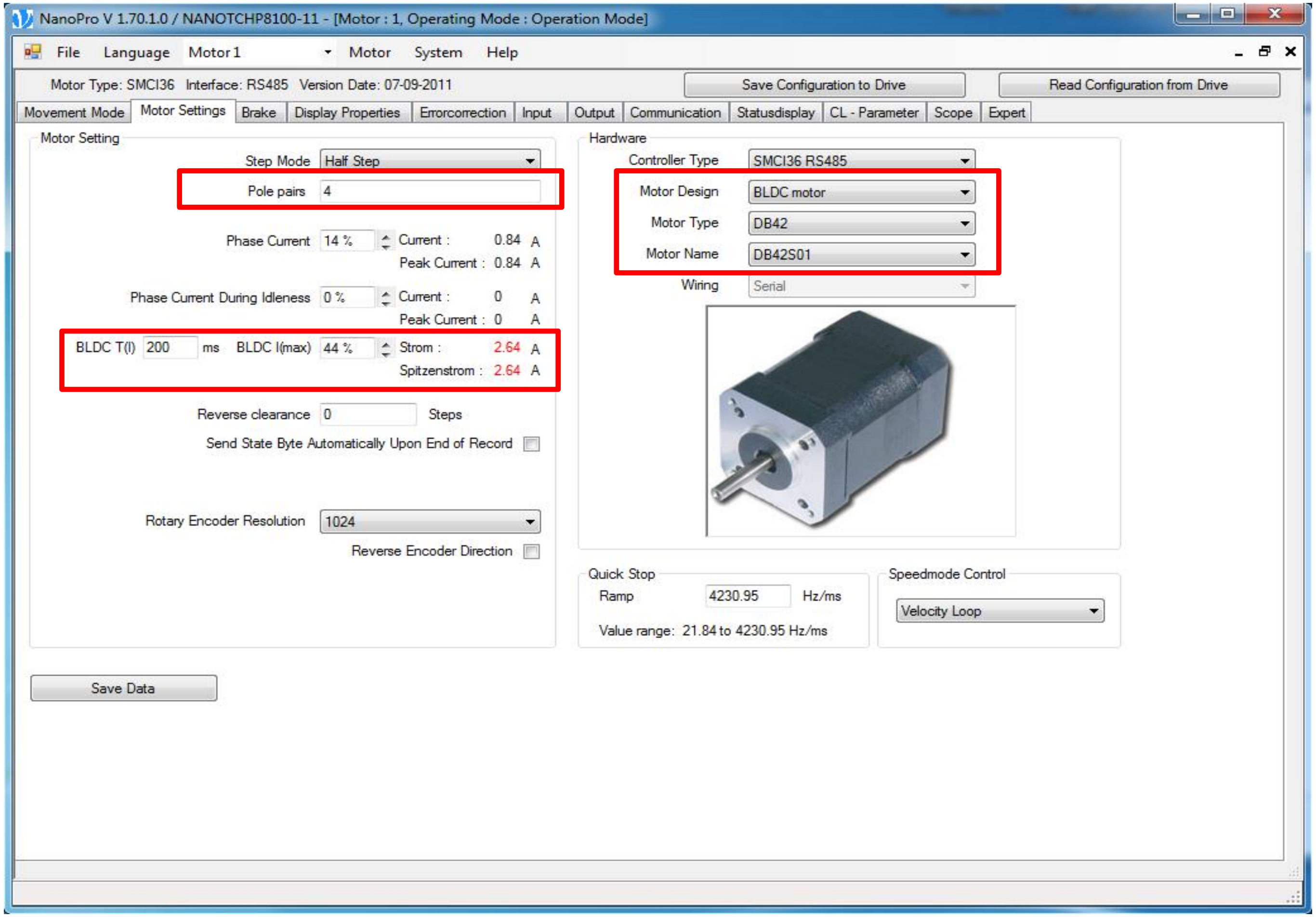
Special features for BLDC motors on the "Input" tab

- The hall signal could be observed through the state of input 1 to input 3. Input polling must be activated.
- Input 1 to input 3 should be configured as low-active because of the invert circuit at the hall input of controller SMCI36
- Input 1 to input 3 can no longer be used as a normal input.

Exercise:

Please configure input 1 to input 3 as low-active.

Special features for BLDC motors



Special features for BLDC motors on the “Motor Settings” tab

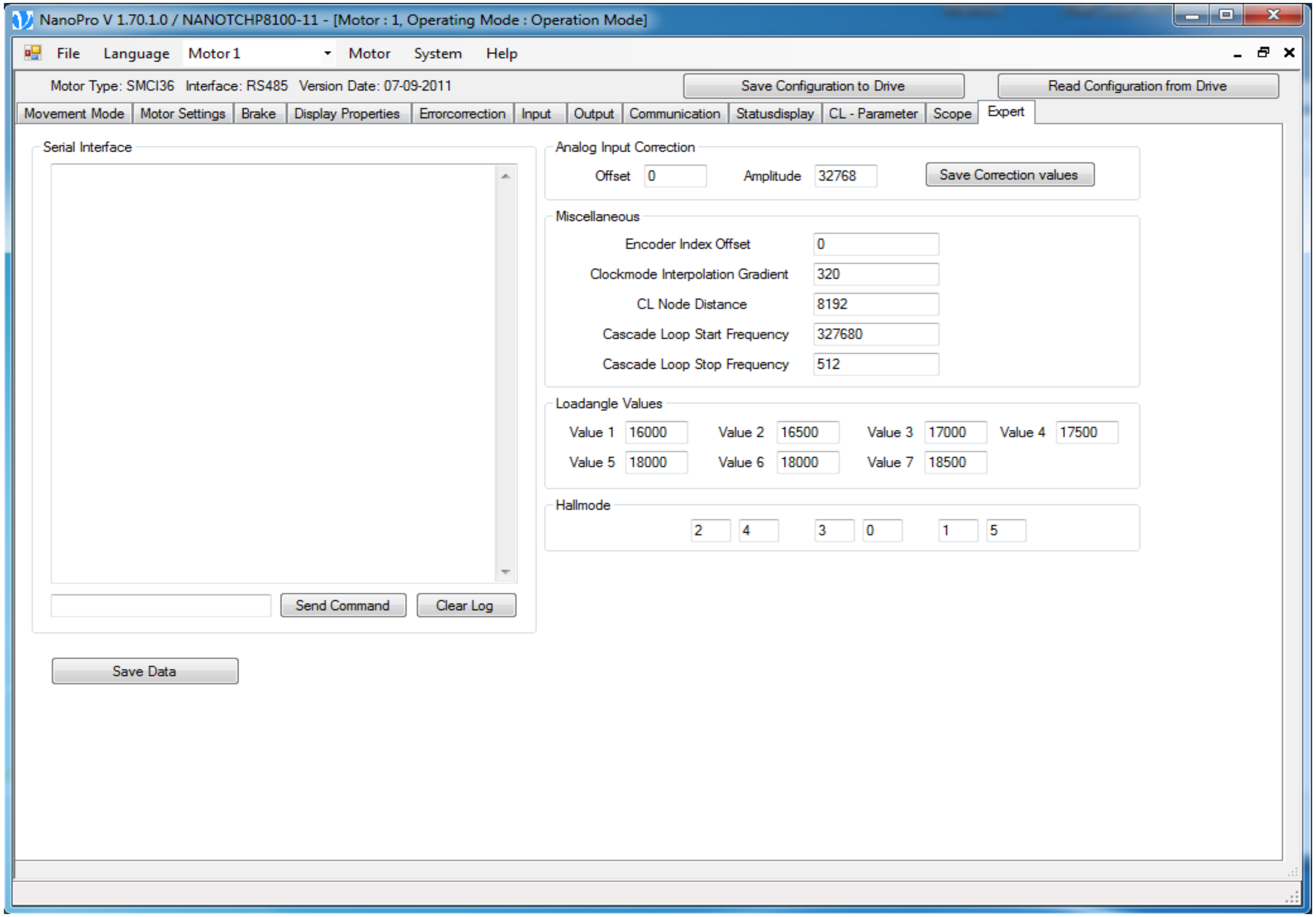
- Motor design
- Motor type
- Motor name
- Pole pairs
- BLDC T(t)
- BLDC I (max)

Exercise:

Please set up your controller for the BLDC motor according to the datasheet.

CAUTION! The wrong settings could damage your motor and the controller!

Special features for BLDC motors



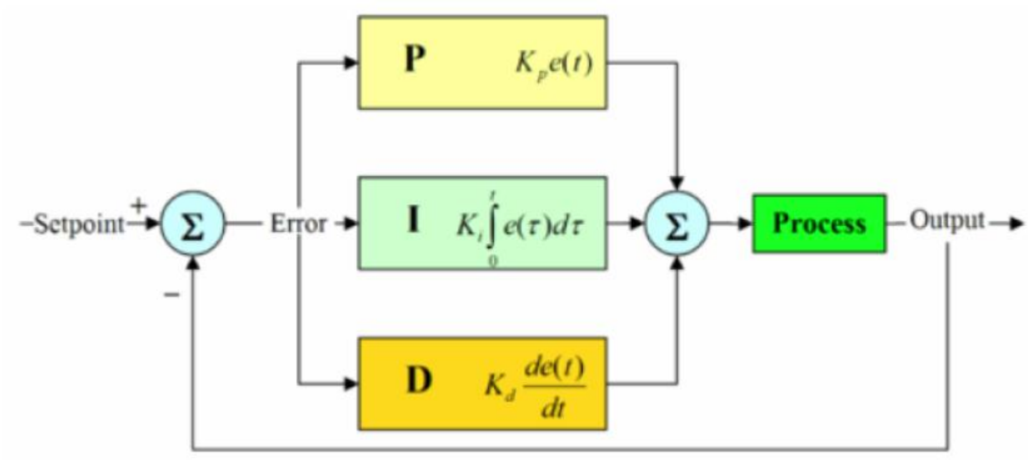
Special features for BLDC motors on the “Expert” tab

- CL Node Distance = distance between the individual load angles. The value 8192 represents a speed of 1000 rpm.
- Loadangle Values = lead values for the magnetic field. Value range: -32768 to 32767, which represents -180° to 180° electrical degrees.

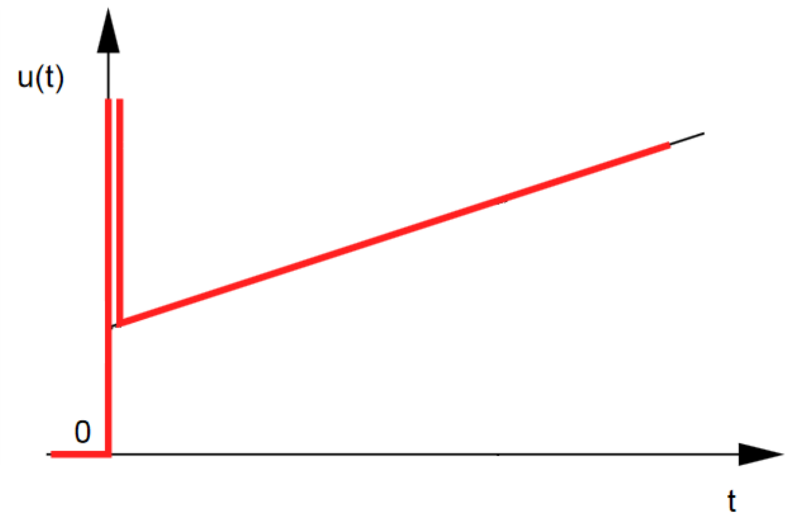
- Hallmode = configuration of the hall sensors of the BLDC motors. This describes the relationship of the hall signals to the pre-defined electrical sector in the controller.

PID controller parameters

Parallel Structure



Step Response

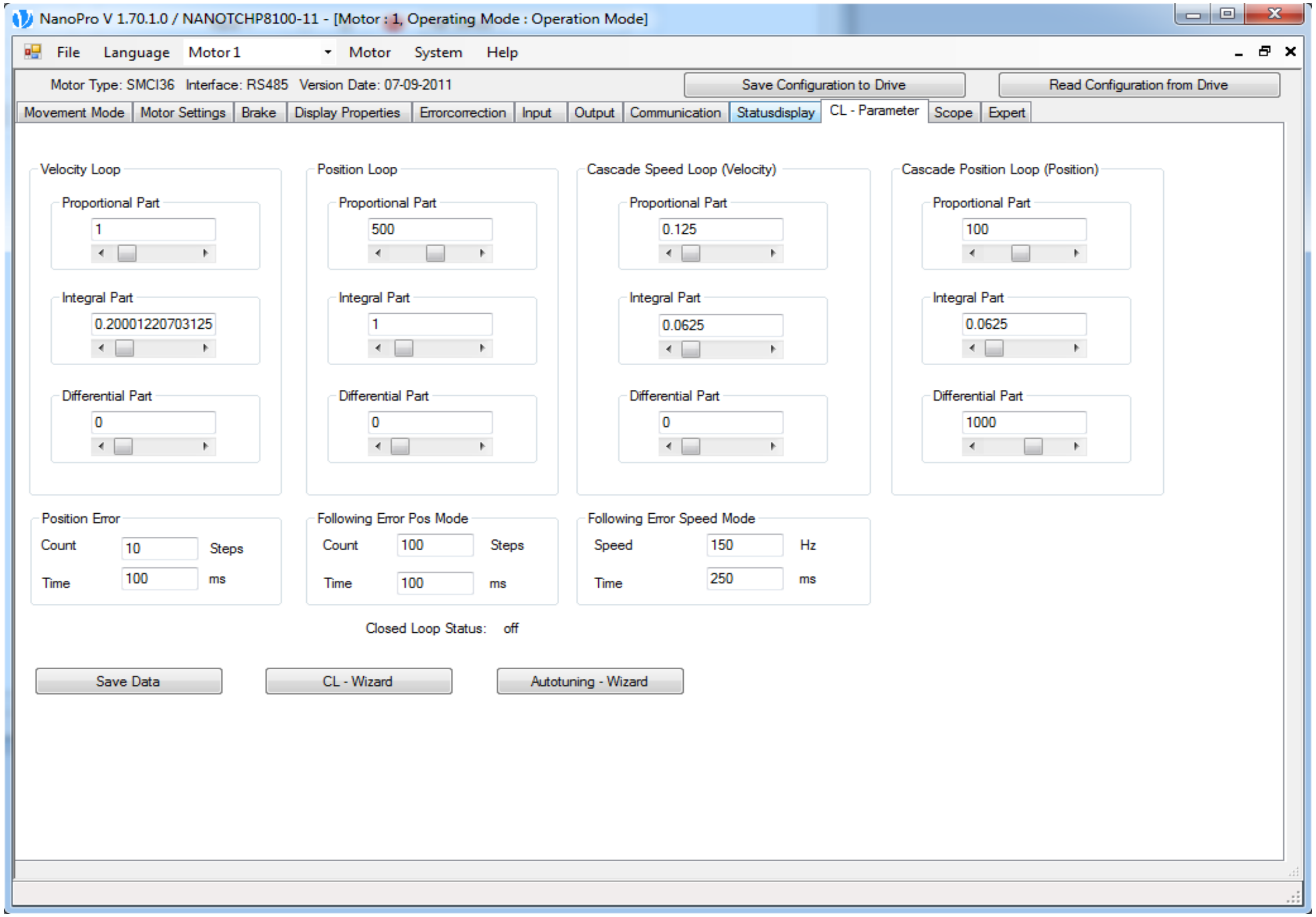


$$u_n = KP * e_n + KI * e_n + KD * (e_{n-1} - e_n)$$

KP	Proportional component
KI	Integral component
KD	Differential component

u_n	Control variable
e_n	Deviation of actual value from set point value
e_{n-1}	Deviation of previous actual value from previous set point value

PID controller parameters



- The Velocity control loop is used for speed mode, analogue mode, joystick mode.
- The Position control loop is used for relative/absolute position mode, flag position mode, clock direction mode, analogue position mode and reference run.
- The Cascade Speed and Cascade Position loops are rarely used.

Exercise:

Please set the PID parameters in Velocity Loop and Position Loop according to the motor used.

Adjusting PID parameters

Problem	Solution
Motor oscillations increase or persist for too long afterwards.	• Reduce I-component • Increase D-component • Increase P-component
Motor "cracks" during the run.	• Reduce D-component • Possibly reduce P-component
Motor takes too long to reach the end position.	• Increase I-component • Increase P-component
Motor compensates for static loads too slowly.	• Increase I-component

Adjusting PID parameters

Problem	Solution
Motor signals a position error.	• Increase permissible following error • Operate controller more firmly, increase P-component, increase I-component. • Decrease maximum speed. • Increase phase current. CAUTION! Note maximum motor current. A new rotor position initialization may be necessary.
Motor is not accelerating as fast as the set ramp, possibly combined with a position error during the acceleration phase.	• Increase phase current. CAUTION! Note maximum motor current. • Set a slower ramp. • Use a stronger motor with an appropriately set phase current.

Determining the hall mod

Pre-Defined Electrical Sector	0	1	2	3	4	5
Phase U connected to	H	L	L	L	H	H
Phase V connected to	L	L	H	H	H	L
Phase W connected to	H	H	H	L	L	L

Hall-Signal for Electrical Sectors 0 to 6

Hall 1	0					
Hall 2	1					
Hall 3	1					
Hall-Value	3					

H: High voltage (e.g.+24V) 1: Logic High
L: Low voltage (GND) 0: Logic Low

Step 1: Connect the hall sensor to SMCI36, connect SMCI36 to the power supply and open NanoPro.

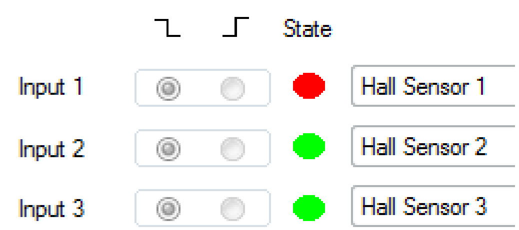
Step 2: Energize the motor with an external power supply for electrical sector 0, phases U and W are connected to high voltage (e.g.+24V), phase V is connected to low voltage (GND).

CAUTION! The max. current of the external power supply must be below the rated current of the motor!

Step 3: Read out the hall signal in NanoPro through the input status for electrical sector 0, and calculate the hall value from the hall signal in decimals.

E.g.: The hall value for electrical sector 0 is: (011)2 = 3

1 (Logic High)
0 (Logic Low)



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Determining the hall mode

Pre-Defined Electrical Sector	0	1	2	3	4	5
Phase U connected to	H	L	L	L	H	H
Phase V connected to	L	L	H	H	H	L
Phase W connected to	H	H	H	L	L	L
Hall-Signal for Electrical Sectors 0 to 6						
Hall 1	0	0	1	1	1	0
Hall 2	1	1	1	0	0	0
Hall 3	1	0	0	0	1	1
Hall-Value	3	2	6	4	5	1

H: High voltage (e.g.+24V) 1: Logic High
L: Low voltage (GND) 0: Logic Low

Step 4: Repeat step 1 and step 2 for electrical sector 1 to electrical sector 5 to get all hall values.

Step 5: Find out the relationship between the electrical sectors and the hall values.

Step 6: Write down the hall values in a table, downwards from 6 to 1.

Step 7: Write down each electrical sector number in the row of each hall value, and the generated sequence is the hall mode of this BLDC motor in NanoPro.

Hall Value	6	5	4	3	2	1
Pre-Defined Electrical Sector	2	4	3	0	1	5
Hall Mode in NanoPro	2	4	3	0	1	5

Thanks for your attention!

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