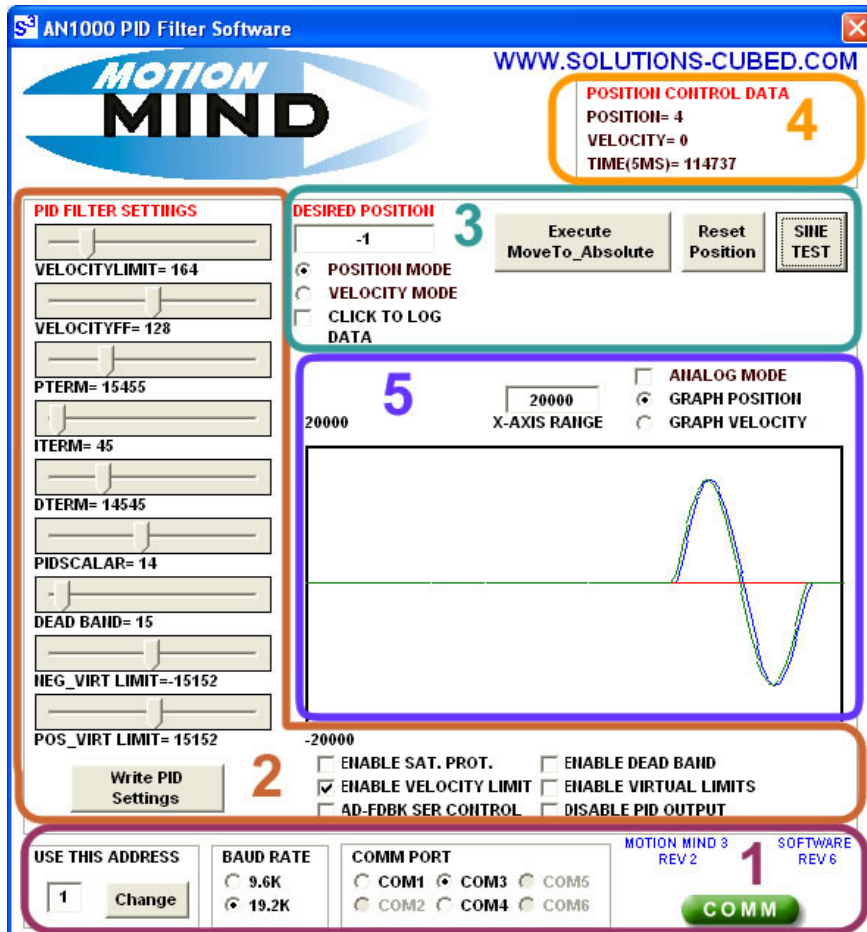


Overview:

AN1000 is a piece of software that simplifies the tuning of the PID filter in the Motion Mind 3. It may be used to log data as *.csv (comma-delimited) files that can be opened and graphed with spreadsheet programs. The software window has been broken down into 5 areas, each of which is described below.

NOTE: When installing the software do not overwrite drivers on your computer. If a copy error occurs while installing the software choose the option to “ignore” the error.

**Section 1- COMM Settings:**

To use the PID Filter Software the Motion Mind should be configured for binary communication. The baud rate may be set for either 9.6KBPS or 19.2KBPS. The serial COMM ports available on your computer will be automatically detected as the program is executed. Select the COMM port you want to use for communication. If you're using a Motion Mind that has been programmed with an address value other than 1 you'll need to enter the appropriate address value and press the “Change” button. If communication is successful the COMM status indicator will be green (as shown). If communication fails it will be red.

Section 2- PID Settings:

Moving the slider bar associated with each register can change the contents of the registers associated with the PID filter. FUNCTION bits associated with PID filter operation may be enabled or disabled via the check boxes below the slider bars. Pressing the “Write PID Settings”

button will send the new values to the Motion Mind, and store them in EEPROM (using the WRITE_STORE command).

For more information on the PID related registers see the complete Motion Mind datasheet.

Section 3- MOVETO_ABSOLUTE, MOVEAT_VELOCITY Commands, Reset Position, data logging, and SINE TEST:

The PID Filter can be applied to either position or velocity control. You should select what mode of operation you want by checking either the POSITION MODE or VELOCITY MODE radio button. Depending on your selection you will either be sending a MOVETO_ABSOLUTE or MOVEAT_VELOCITY command. The text of the command button will change based on which mode you are in.

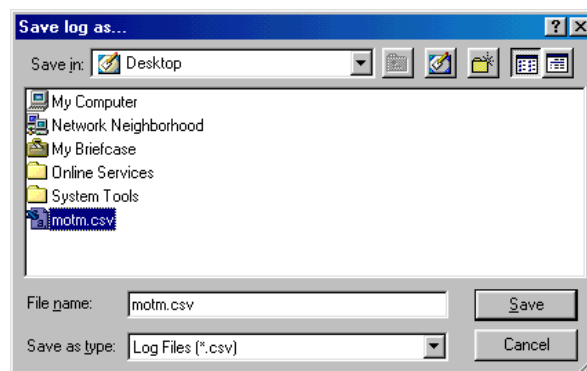
The MOVETO_ABSOLUTE command will move the motor to the position loaded into the text box to the right of the command button. This value should be +1,000,000 to -1,000,000 (24 bits). The Motion Mind accepts 32 bit position values, but this software is only designed to accept 24 bit values. Position moves may be velocity limited by modifying the VELOCITYLIMIT register and selecting the ENABLE VELOCITY LIMIT checkbox. The “Reset Position to Zero” button can be useful when tuning the PID filter. This button resets the position value in the Motion Mind to zero, allowing moves to be repeated without typing new position values into the text box. Note that the quadrature encoder on the Motion Mind is decoded at either a 1:1 or 4:1 ratio (see datasheet for settings). In 4:1 mode 250 encoder counts is displayed at 1000 counts. The following equation relates a single motor output shaft rotation to encoder counts.

$$\text{shaft_revolution} = \text{gear_ratio} \times \text{encoder_CPR} \times \text{ratio_1_or_4}$$

The MOVEAT_VELOCITY command moves the motor at the commanded velocity. The value should be +1023 to -1023. The velocity is related to motor output shaft speed with the following equation.

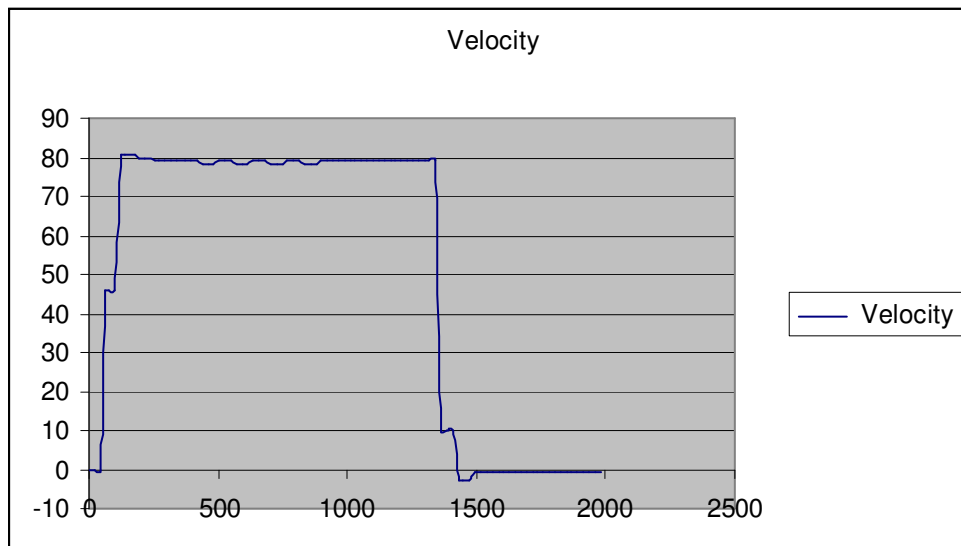
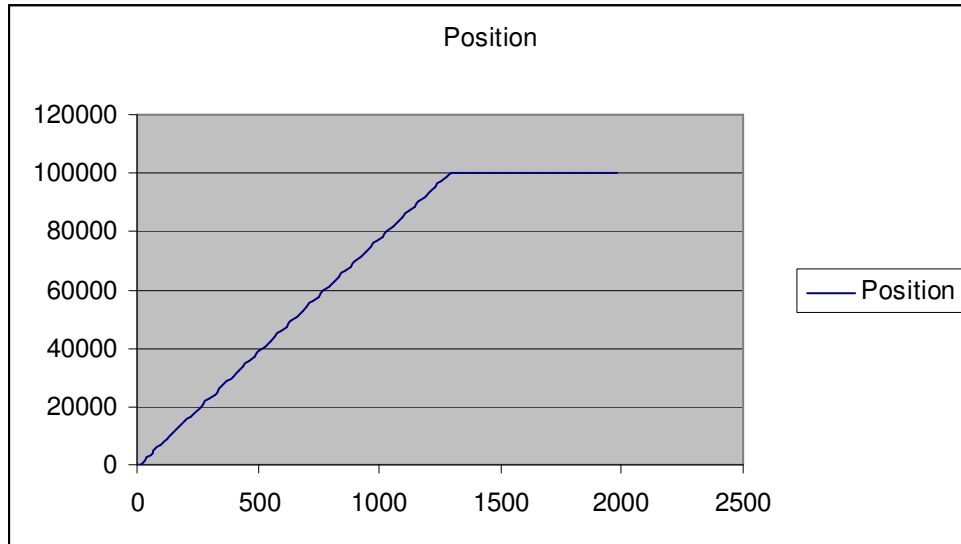
$$\text{MotorShaftRotations / Second} = \frac{\text{VELOCITY} \times 50}{\text{EncoderCPR} \times \text{GearRatio}}$$

To log data check the CLICK TO LOG DATA checkbox. A text box will appear to the right of the box you just checked. Enter the number of seconds you want to collect data for. Then enter the position (or velocity depending on mode) that you want to move to. When you click the “Execute MoveTo_Absolute” button a dialogue box will open and prompt you to select a file name and location (see below).



When you enter a file name and location, and click the "Save" button the data logging will start, and the commanded movement will begin. When the data log timer elapses a blue text message will briefly appear below the CLICK TO LOG DATA checkbox indicating the log is complete. The position, velocity, and internal timer value (increments of 5ms) will be stored in the *.csv file.

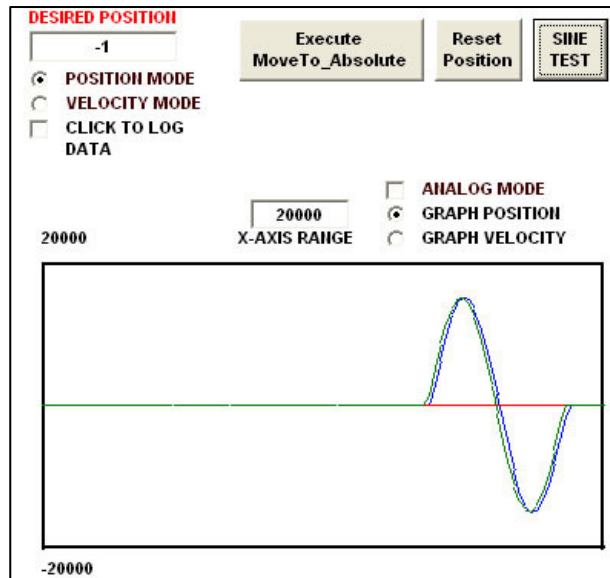
The *.csv data log may then be opened with a spreadsheet program. Motor position, velocity, and the internal timer (5ms increments) will be arranged in columns in the *.csv file. Plotting the data as an XY Scatter chart with the timer as the X axis data will provide a time adjusted plot of position or velocity VS time. The Position and Velocity data of a move from 0 to +100,000 with a velocity limit of 78 counts/PID update are displayed below. The time data was modified to display the start value of the timer minus the logged timer value.



You can also implement a sine wave position control test by entering the magnitude of the sine wave in the desired position box and pressing the "SINE TEST" button. The period of the sine wave is not adjustable in this software. But this test does allow you to see how the PID settings you've chosen will react to a changing desired position value.

If the start position of the sine wave move is not "0" it will be set to 0 and the "Desired Position" text box will display the sine wave positions as the move is made completing back at 0.

The green line is the desired position while the blue line indicates the actual position as returned by the Motion Mind.



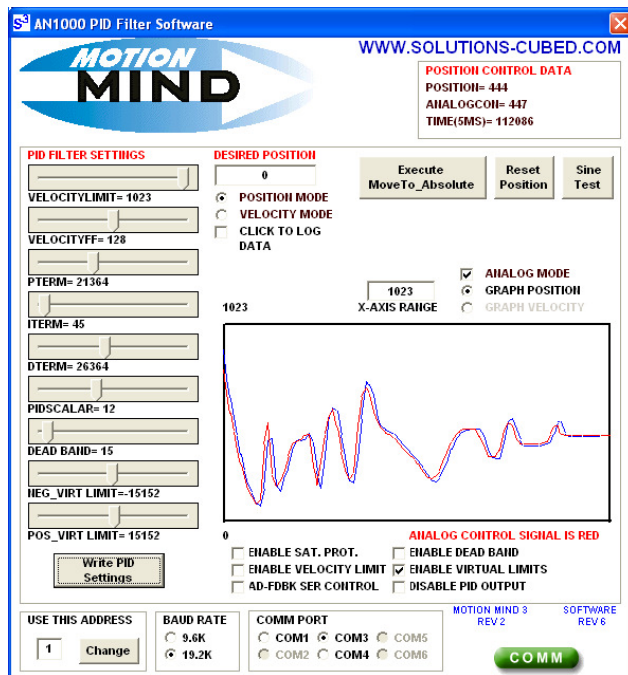
Sine wave test data cannot be logged as absolute movement data can be.

Section 4- Position Control Data:

As long as communication to the Motion Mind is successful the current position, velocity, and internal timer, are displayed in this area of the software window.

Section 5- Data Graph:

The PID filter software provides a display of the position or velocity data in real-time. The user may elect to display either position or velocity data with the radio buttons labeled GRAPH POSITION or GRAPH VELOCITY. The X axis display range may be adjusted by entering text into the text box labeled X AXIS RANGE. For example, if you wanted to see velocity data and had your VELOCITYLIMIT value set for 50, you might use an X AXIS RANGE of 100. If you wanted to view position over time of a movement to +100,000 you might select an X AXIS RANGE value of 120,000.



If you are operating the Motion Mind in mode 5 where analog signals are used for position control and position feedback you should select the ANALOG MODE check box. When checked the graph will display the analog feedback value as a blue line, and the analog control value as a red line. The X axis will be scaled to +/- 1023 automatically when this check box is selected.

The screen capture shows a Motion Mind performing control in analog mode. In this mode the red line indicates the analog control signal, while the blue line indicates the analog feedback signal.