

# SimplexMotionTool software manual

**This document is a short manual covering the functionality of the SimplexMotionTool software.**

**The SimplexMotionTool is a PC software to configure and test SimplexMotion motor units.**

**SimplexMotion motor units are integrated electric motor drive units with control electronics for either standalone operation or with external control through one of its digital communication interfaces.**

Examples of the software features:

- Connect to a SimplexMotion device using USB or RS485/Modbus communication.
- Read and write the register map of the device. These registers control all functionality in the motor device.
- Easy access to the internal recorder of the motor device. This recorder is used to save measurement data in real time, which is useful to verify and improve performance.
- Simple mode for running the motor in speed or position feedback mode while watching real time (can also be saved to excel compatible file).
- A mode for optimizing position ramping control for fast and precise positioning.

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## 1 Overview

This software runs on PC computers in Windows XP / Windows 7 environments. It allows connection to SimplexMotion motor devices using USB or serial RS485/Modbus communication. The software has only one window and the different operating modes are represented by tabs in this window. The remainder of this document describes each of these tabs as they represent different functions.

## 2 Start tab

This tab is used to setup connection to a SimplexMotion device. It also allows the user to check information about the SimplexMotion unit model, serial number and versions of hardware and firmware. There is also a button to access this documentation.



There are two buttons for connection; One for USB connection and one for serial port (RS485/Modbus communication). For the later you have to choose correct serial port and baud rate (default 57600). Connection is established to the device with the lowest address found. If there are several units connected to the computer at the same time it is possible to switch between them using the arrow buttons. As long as the connection is maintained there is a green text indicating this in the lower status bar.

### 3 Register tab

This tab allows access to the registers in the device register map.

All functions are controlled and monitored using registers. The registers are stored in 3 different memories:

- The currently used settings (volatile memory, lost when powered off)
- Stored settings in memory (nonvolatile memory, loaded at power on)
- Factory default settings (Can be used for a reset to factory default settings)

Register	Description	Type	Value (dec/string)	Value (hex)
1	VerParameters	uns16	258	0102
2	VerFirmware	uns16	258	0102
3	VerHardware	uns16	259	0103
10	ModelName	str	SimplexMotion 100A	
20	SerialNumber	str	SM100A-1207000428	
30	UserString1	str		
40	UserString2	str		
50	Address	uns16	1	0001
51	Identification	uns16	255	00ff
52	ModbusControl	uns16	4	0004
100	Supply	uns16	2403	0963
101	TempElectronics	uns16	2839	0b17
102	TempMotor	uns16	4663	1237
120	SpreadSpectrum	uns16	0	0000
121	SpeedFilter	uns16	4	0004
140	InputPolarity	uns16	15	000f
141	InputThreshold	uns16	6536	1988
142	Input	uns16	0	0000

Connected USB address 1 (SimplexMotionRegisters\_p01.02.dat)

The registers shown in the table are updated in real time to show the currently used values in the SimplexMotion device. They can be changed by editing the values, either the decimal/string value or the hexadecimal value. This changes the currently used register value.

If the changed values should be used after next power off/on cycle the current values has to be saved to the nonvolatile memory by pressing the 'Write to memory' button.

## 4 Recorder tab

To facilitate performance validation and optimization it is necessary to be able to measure parameters in the motor device. To accomplish this there is a recorder feature within the SimplexMotion device. This tab is used to operate this recorder.

The recorder has 4 channels and always record 500 consecutive values for each channel. These values are 16-bit values, which means that 32 bit registers only record the lower 16 bits.

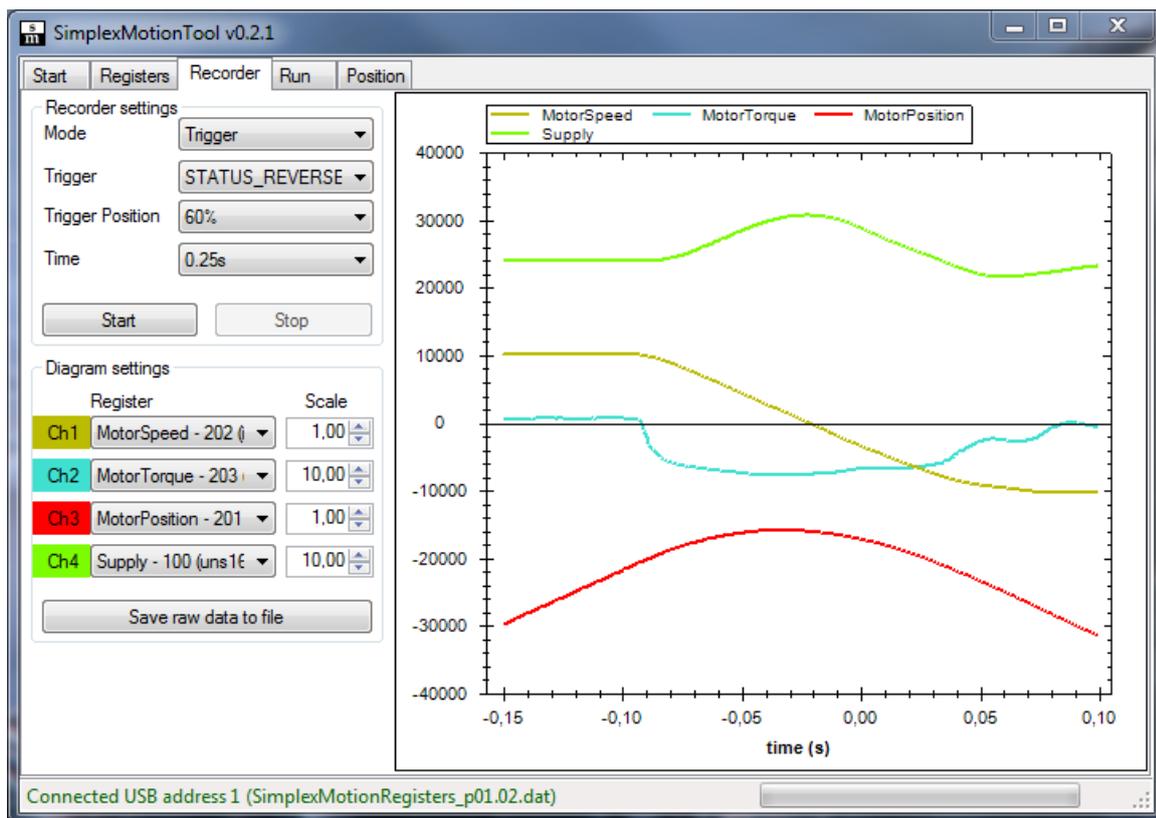
The recorder can be used in several modes:

Mode:	Description:
Single	A single recorder sweep is performed directly
Trigger	A single recorder sweep is performed at a certain trigger condition. The trigger condition can be chosen from the bits in the status register in the device. Consult the device datasheet for further information.
Continuous	Continuous recorder sweeps are done and presented
Only download	This is a special mode that only downloads the data in the recorder memory without operating the recorder. It is mainly used for debugging purposes when this memory is used for other data.

When using triggered operation it is possible to decide how much data should be shown prior to the time of triggering, by use of the 'Trigger position' setting.

The speed of the recorder can be changed to match the sequence of interest by use of the 'Time' setting.

The registers that should be recorded are selected by the drop down lists for each channel. Since some registers hold small values compared to others, and the diagram uses one common Y-scale, it is also possible to scale the different channels.



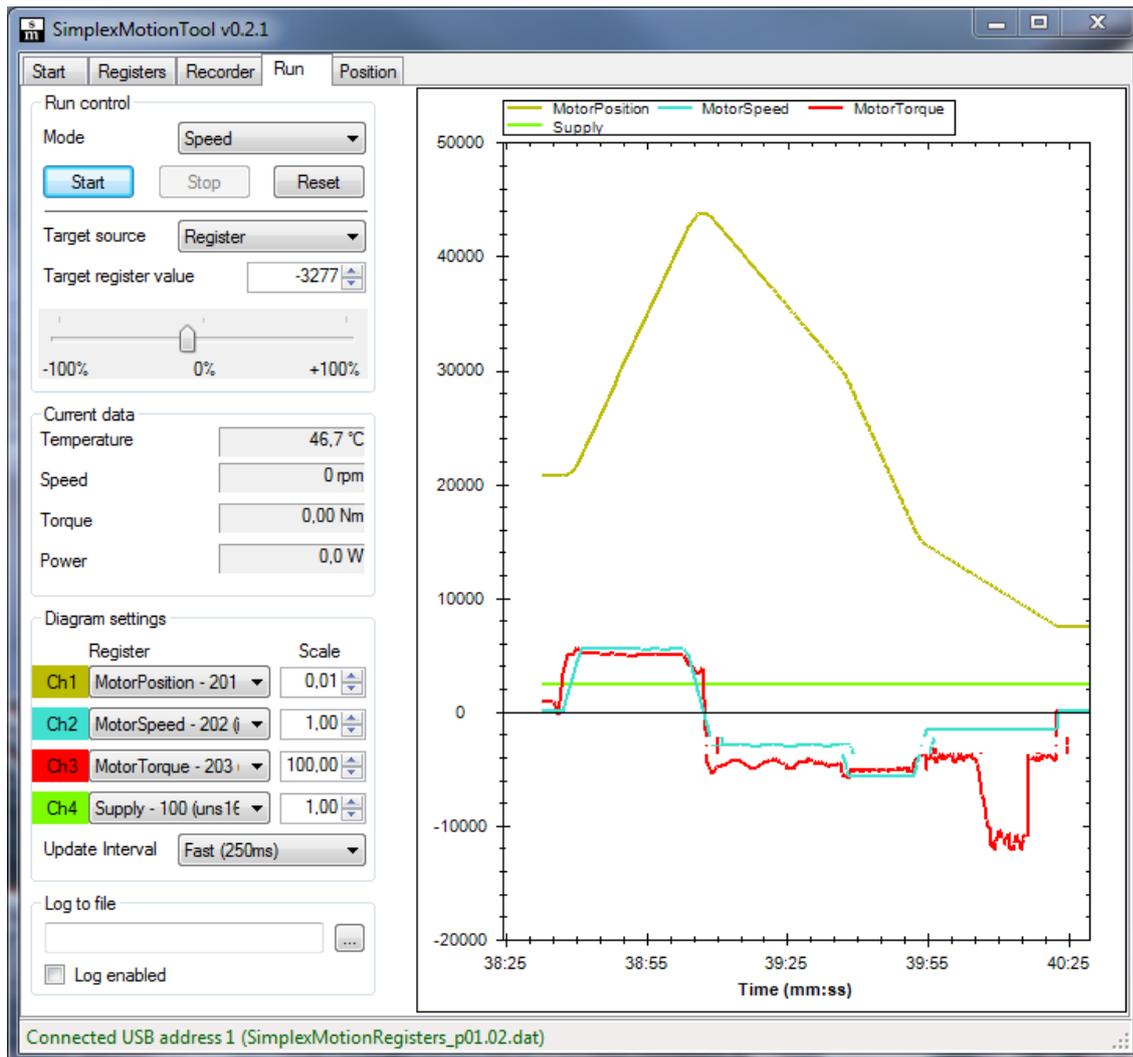
The above screenshot shows a recording of some registers when the motor changes direction from positive to negative direction of rotation. In this case it takes about 0.15s to change the speed from +2300rpm to -2300rpm.

The diagram can be zoomed using the left mouse button. Using the right button allows copying or saving the diagram image. It is also possible to save the data values to an excel compatible file (\*.csv).

## 5 Run tab

This tab makes it simple to quickly test the motor. It allows running the motor in speed, position or torque mode. Ramping is used for the speed and position modes to limit the motor acceleration. Select mode and target source and press start. By setting the target source to 'Register' the target value can be set directly in the 'Target register value' or by the slider control.

Some of the more generally interesting data are shown as real time values, while it is also possible to select 4 different channels of registers to monitor more closely in graph form. This graph is in a rolling mode and is continuously filled with new data to the right. The speed of data measuring can be set to Slow/Normal/Fast. It is also possible to enable a continuous logging to a file (\*.CSV format).



The graph in the screenshot above shows operation of the motor at a few different speeds, first in the positive direction and then in the negative direction. Note that the channel scaling has been used to allow all channels to be visible with the same Y-scale.

An extra breaking load was applied to the motor at the end as seen by the high negative value on the motor torque. It can be seen that this did not influence the motor speed.

## 6 Position tab

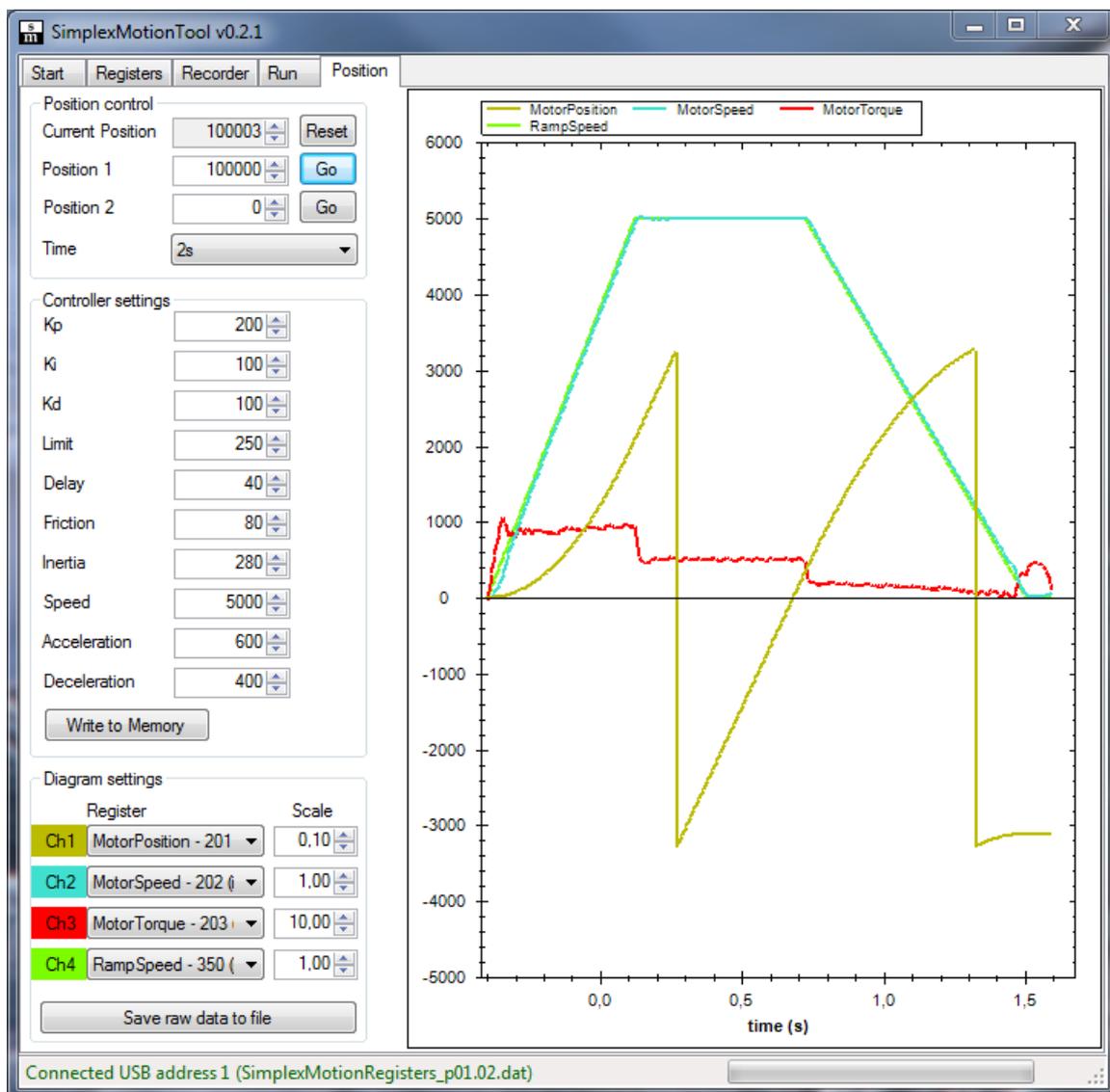
Typical use for the SimplexMotion devices is in position control with rapid transfers from one position to another. To accomplish this with high performance and a minimum of mechanical vibrations it is important to use ramping where the acceleration and maximum speed are controlled.

To further improve performance when dealing with high inertia loads is to use feed forward control in addition to the PID feedback regulator. If the inertia of the load is known as well as the required acceleration it is possible to directly apply the correct motor torque.

To allow tuning and optimization of the regulator, ramping parameters and feed forward settings this tab can be used. It uses the ramping position mode to run the motor between different positions while taking recordings that can be used to judge the performance.

The 'reset' button resets the current motor position to 0. The 'Go' buttons runs the motor to the position entered in the adjacent fields. The recorder time has to be set as well as the channel registers and their scaling.

The typical parameters that are subject for tuning are accessible here. They are loaded from the devices current values when the tab is activated, and can then be changed directly. Once the values have been improved they can be written to the nonvolatile memory by the 'Write to memory' button.



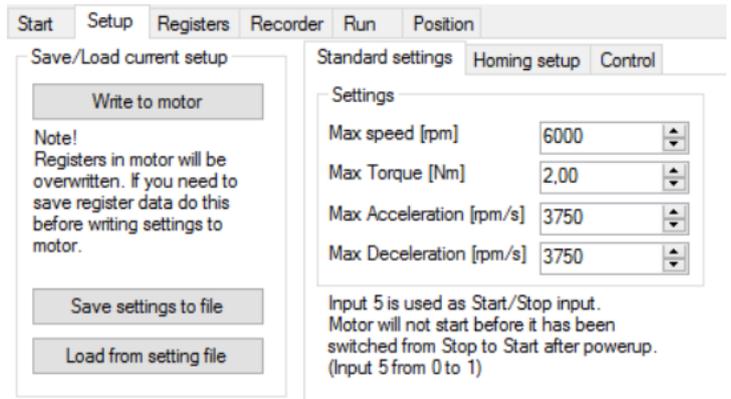
This screenshot shows a ramping move that has a higher acceleration than deceleration, and a maximum speed at 5000. Since the recorder can only handle 16bit values we observe wrap around on the Motor Position channel.

## 7 Setup

The setup tab is used to make simple standalone application for the motors by using either digital inputs or analog. It comprises of 3 tabs, Standard settings, Homing setup and Control. By pressing the write to motor tab all the settings from all 3 tabs are loaded in to the motor.

### Standard settings

In standard settings you can choose the maximum values used for speed, torque and acceleration.



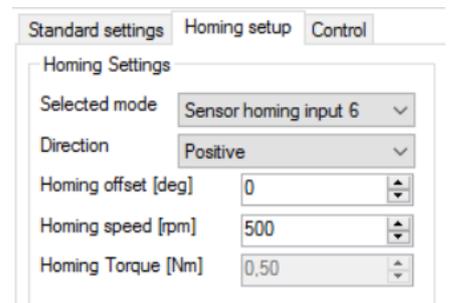
### Homing setup

In the Homing setup tab you can choose what kind of homing you want to use. The homing sequence works at following;

Moving at set homing speed until input/torque reach its target.

Then move slowly in opposite direction until input/torque goes below its target (input 6 = 0, Torque is below homing torque)

If no homing is chosen, then the zero position will be position at start (input 5 from 0 to 1)



### Control

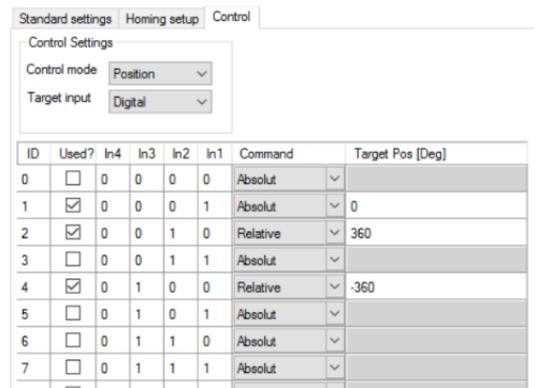
In the control tab the control settings are chosen. You can control the motor with position, speed or torque mode. This can in turn be controlled by ether 4 digital inputs (16 values) or an analog input (potentiometer).

The digital mode can be controlled in two ways;

Absolute commands = motor goes directly to target

Relative commands = motor adds target to previous target

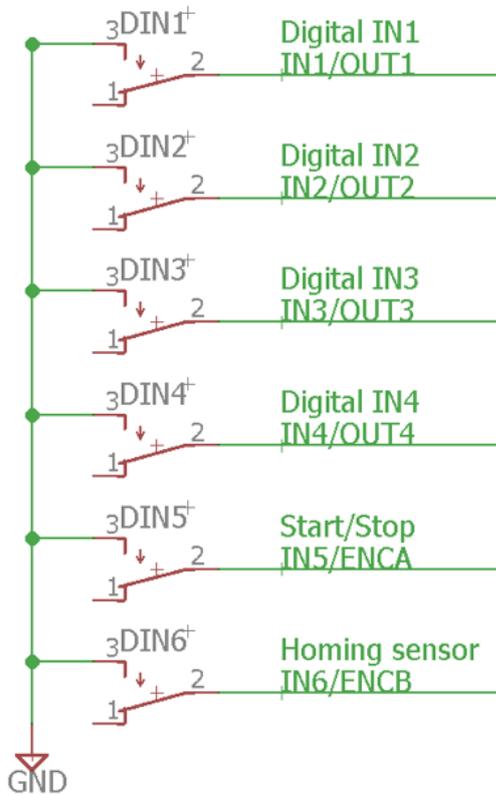
When using analog mode, input 2 is used to change direction.



## 8 Setup Schematics

How the inputs should be connected if using the setup tab control.

### Control mode digital



### Control mode analog

