How to use STM32 motor control SDSK v6.0 profiler

Introduction

The STM32 motor control software development kit (MC SDK) is part of the STMicroelectronics motor-control ecosystem. It is referenced as X-CUBE-MCSDK or X-CUBE-MCSDK-FUL according to the software license agreement applied. It includes:

- ST MC FOC firmware library for permanent magnet synchronous motor (PMSM) field-oriented control (FOC)
- ST MC 6-step firmware library
- ST motor profiler
- ST motor pilot
- ST MC workbench software tool, a graphical user interface (GUI) for the configuration of MC SDK firmware library parameters

This user manual explains how to use the ST motor profiler software tool included within the MC SDK firmware version 6.0.

1 General information

The ST motor profiler software tool is part of the MC SDK that is used for the development of motor control applications running on STM32 32-bit microcontrollers, based on the Arm® Cortex®-M processor.

The ST motor profiler provides the user with an easy and friendly way to find profiled information for a user custom motor and save it as user motor.

It runs on a PC system using Windows® and requires a USB Type-A connector.

Refer to the STM32 MC SDK release note to get all information about the ST motor profiler usage possibilities.

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2 Related documents

Documents available from Arm® infocenter website

- Cortex®-M0 Technical Reference Manual
- Cortex®-M3 Technical Reference Manual
- Cortex®-M4 Technical Reference Manual

Documents available from *www.st.com* or your STMicroelectronics sales office

- STM32F0xx datasheets
- STM32F3xx datasheets
- STM32F4xx datasheets
- STM32G4xx datasheets
- STM32G0xx datasheets
- STM32F7xx datasheets
- STM32H7xx datasheets
- STM32L4xx datasheets

Motor control reference documents

Table 1 presents the documentation that helps to get a deeper understanding of the STMicroelectronics motor control solution.

Table 1. Reference documentation

Reference	Document
[AN5143]	Application note *How to migrate motor control application software from SDK v4.3 to SDK v5.x*
[AN5166]	Application note *Guidelines for control and customization of power boards with STM32 MC SDK v5.0*
[AN5464]	Application note *Position control of a three-phase permanent magnet motor using X-CUBE-MCSDK or X-CUBE-MCSDK-FUL*
[DB3548]	Data brief *STM32 MC SDK software expansion for STM32Cube*
[UM2374](1)	User manual *Getting started with STM32 motor control SDK v5.x*
[UM2380](1)	User manual *Getting started with STM32 motor control SDK v5.x*
[UM2392]	User manual *STM32 motor control SDK v5.0.0 firmware*
[UM2916]	User manual *MCSDK - 6-step firmware examples: insights of the firmware and how to customize it*
[UM3016]	User manual *STM32 MC SDK motor profiler*
[UM3026](1)	User manual *Getting started with STM32 motor control SDK v6.0*
[UM3027](1)	User manual *Workbench tools for STM32 motor control SDK 6.0*
[wiki]	Refer to the motor control pages at the wiki.st.com/stm32mcu STMicroelectronics wiki site

1. *UM3026 and UM3027 are respectively the evolutions of UM2374 and UM2380 for MC SDK 6.0.*

3 The ST motor profiler

The ST motor profiler software tool can be used to identify the main permanent magnet synchronous motor (PMSM) characteristics, which are further transferred to the ST MC workbench.

3.1 Launch the ST motor profiler

Launch the *ST Motor Profiler* software tool by clicking either its icon (Figure 1) or either running directly from the installation folder.

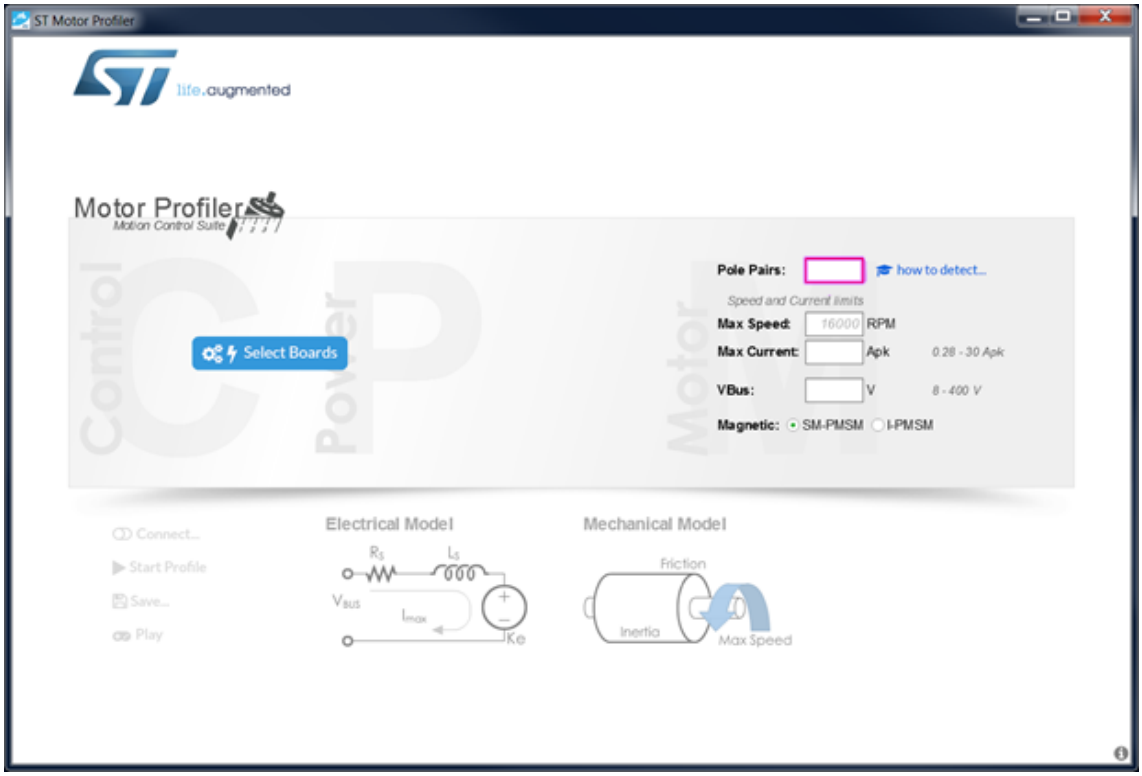
Figure 1. ST Motor Profiler – Icon

The user can also launch the *ST Motor Profiler* software tool from the dedicated link button from the ST motor control workbench GUI (Figure 2).

Figure 2. ST Motor Profiler – GUI (Home page toolbar)

Then, the ST motor profiler starts up a GUI window as shown in Figure 3.

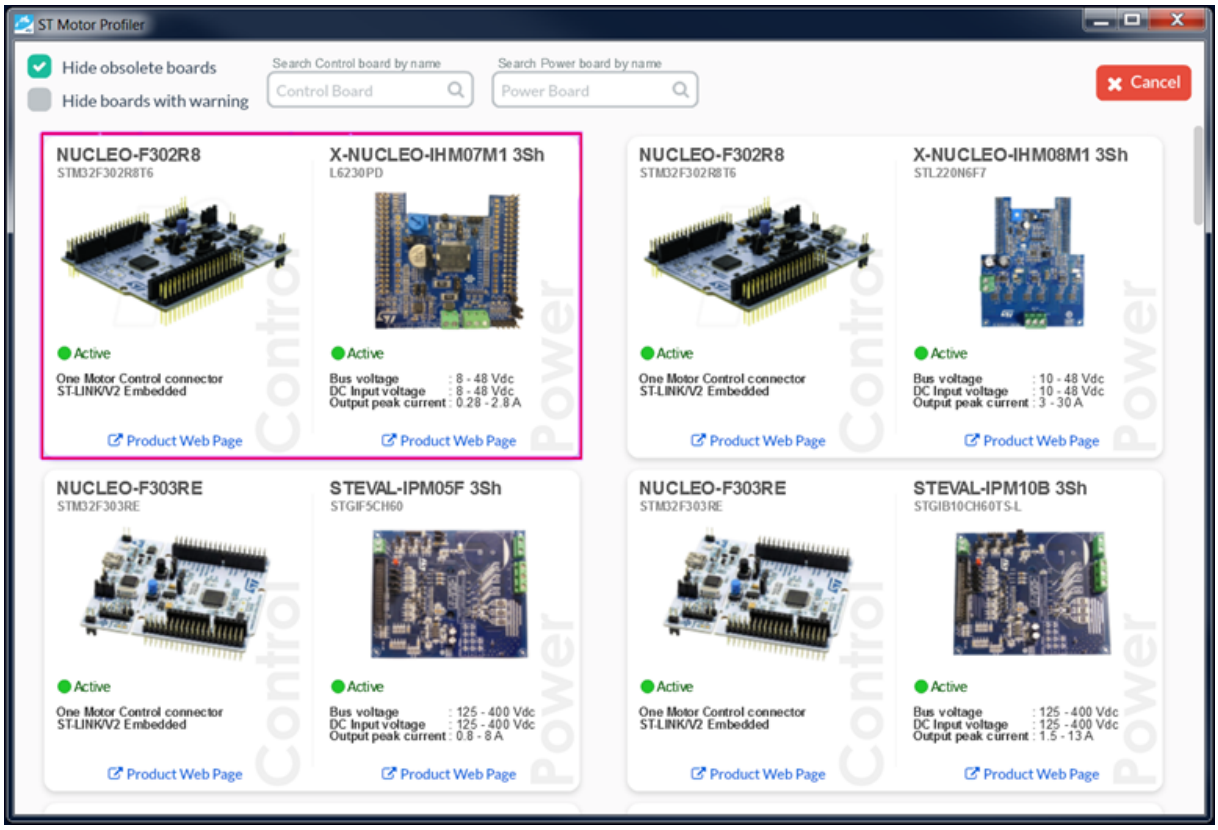
Figure 3. ST Motor Profiler – Start-up GUI



3.2 Configure your hardware setup

Click on the *Select Boards* button to display the list of supported boards (Figure 3), then choose your ST application board setup. Note that the ST motor profiler software tool can be used only with the ST hardware setup listed there. Figure 4 presents an example from this list.

Figure 4. ST Motor Profiler – Hardware setup list examples



Just click on the ST hardware setup to select it, thus configure the ST motor profiler software tool. As an example, Figure 4 shows the P-NUCLEO-IHM001 selection.

Then, complete the parameter fields with your motor information:

- The number of pole pairs inside your motor (mandatory field)
- The Max Speed of your motor (optional field):
  - By default, the ST motor profiler software tool looks for the maximum allowed speed matching the motor and the hardware setup used.
- The Max Current admissible by your motor (optional field)
  - By default, it is the maximum peak current deliverable by your hardware setup.
- The nominal DC bus voltage used by your hardware setup (optional field):
  - By default, it is the power supply stage as either the bus voltage for low voltage applications (DC voltage) or the $\sqrt{2}V_{ACrms}$ for high voltage applications (AC voltage).
- The magnetic build-in type (mandatory field):
  - By default, it is the SM-PMSM with is selected.
- The Ld/Lq ratio (mandatory field) only in the case of I-PMSM build-in (Figure 6).

Figure 5 provides example values for the BR2804-1700KV-1 motor provided with the P-NUCLEO-IHM001 hardware setup.

Figure 5. ST Motor Profiler – SM-PMSM parameters example

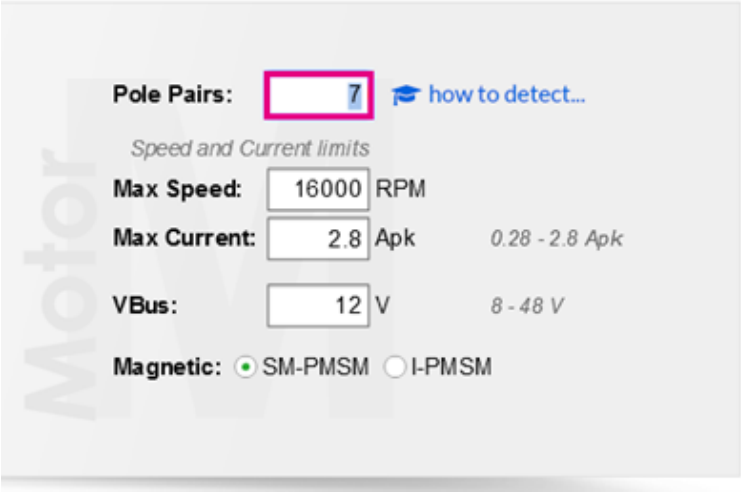
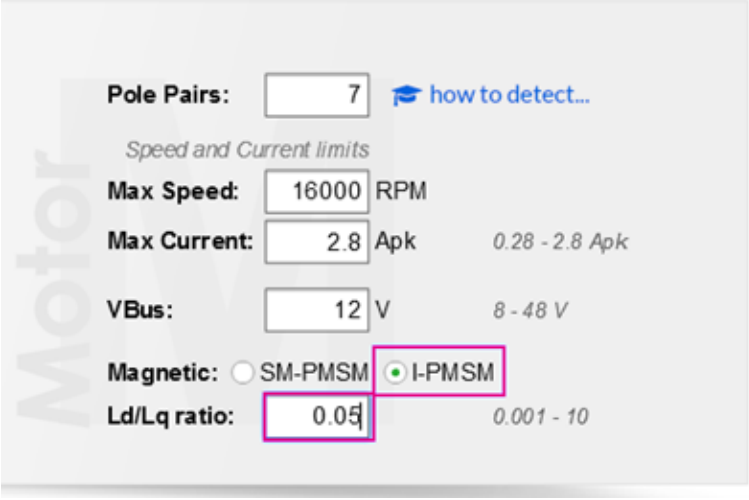


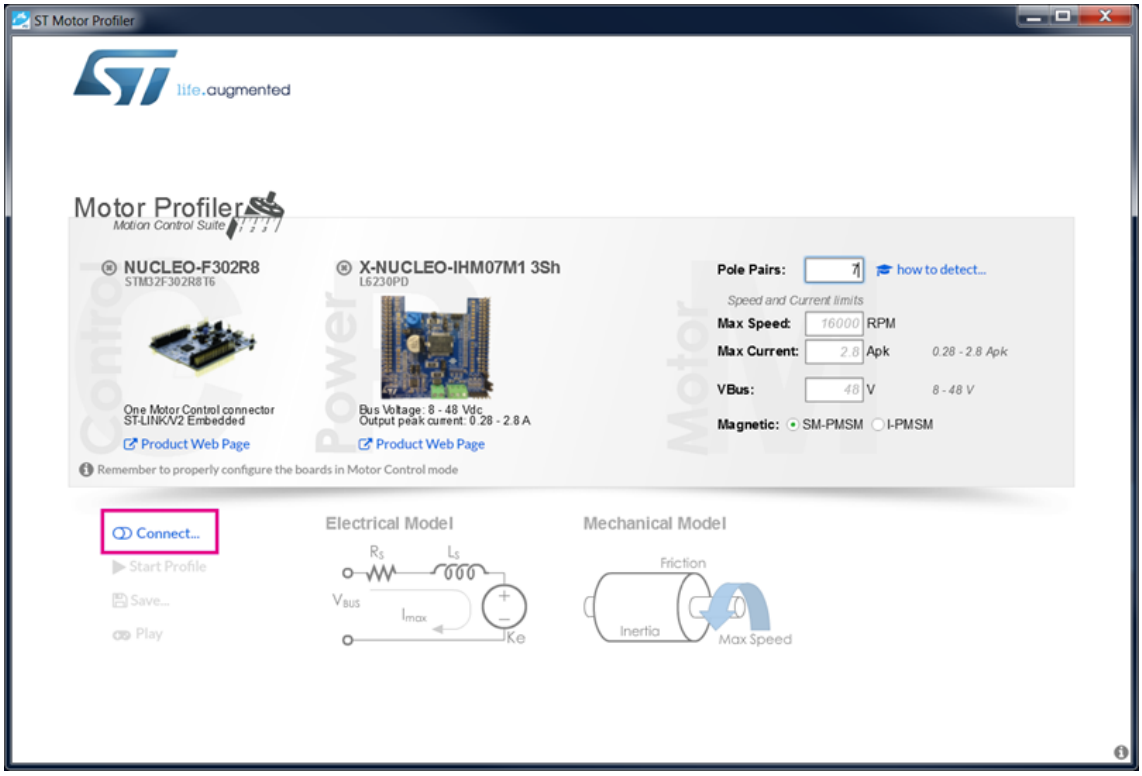
Figure 6. ST Motor Profiler – I-PMSM parameters example



3.3 Connect to your hardware setup

When the ST motor profiler is configured, click on the *Connect* button (Fuchsia area in Figure 7).

Figure 7. ST Motor Profiler – Configured GUI



Then, depending on your hardware setup history, a status window appears as shown in Figure 7. ST Motor Profiler – Configured GUI. In case of a problem, a troubleshot message window will pop up (Table 2) to support your recovery action

Figure 8. ST Motor Profiler – Download status window

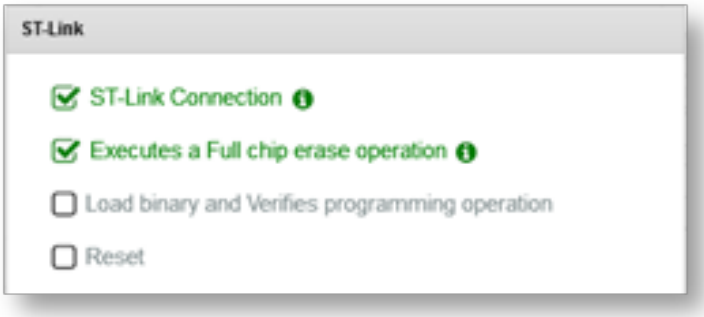
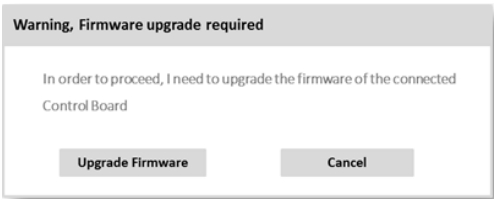
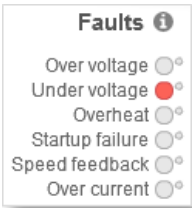
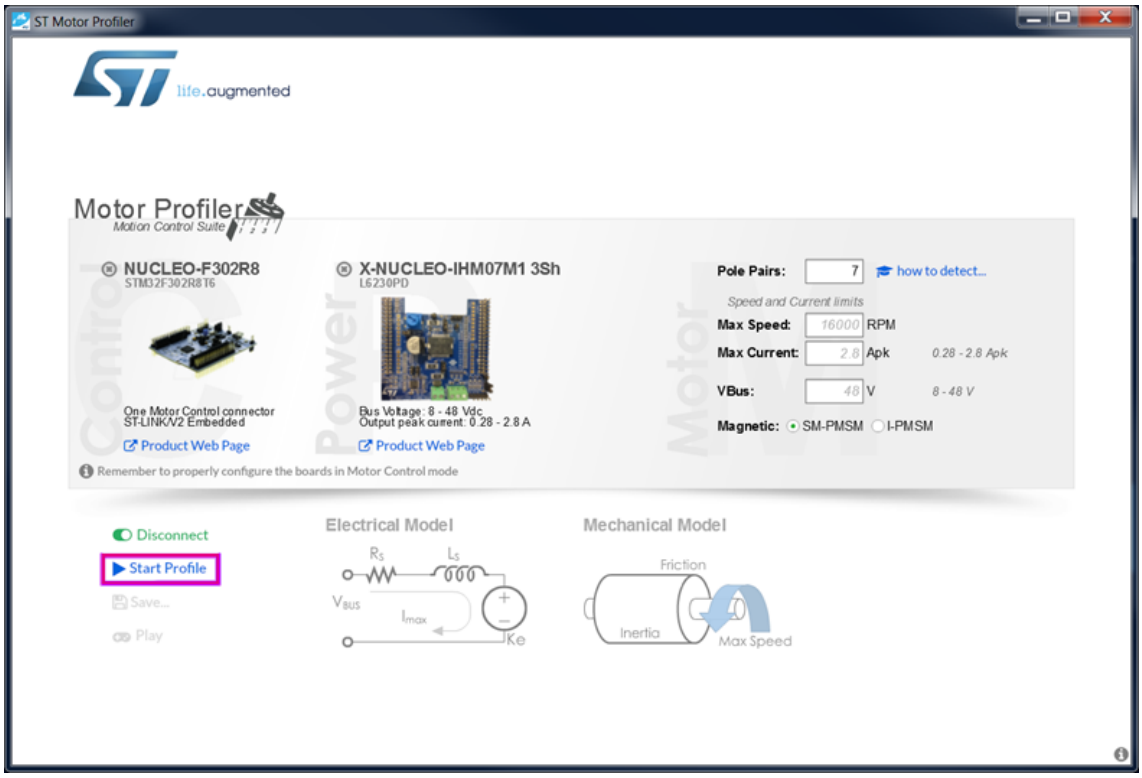


Table 2. ST Motor Profiler – Possible window messages

Message type	Information content	Action to perform
Error		Depending on the status window: • If the programming procedure cannot be executed, check the JTAG/SWD programming cable. • If the programming procedure is executed but the ST motor profiler software tool still cannot communicate with the board, check the serial communication connections.
Warning		When the board is new or has been erased, the correct firmware is automatically loaded into the microcontroller. Press the *Upgrade Firmware* button to confirm proper firmware upload.
Warning		Acknowledge and return to the selection of the boards used in your hardware setup.
Faults		In case of over- or under-voltage detection, correct the bus voltage setting and its proper connection to the power board.

When successfully connected to your hardware setup, the *Start Profile* button must appear as surrounded in fuchsia in Figure 9.

Figure 9. ST Motor Profiler – Connected GUI

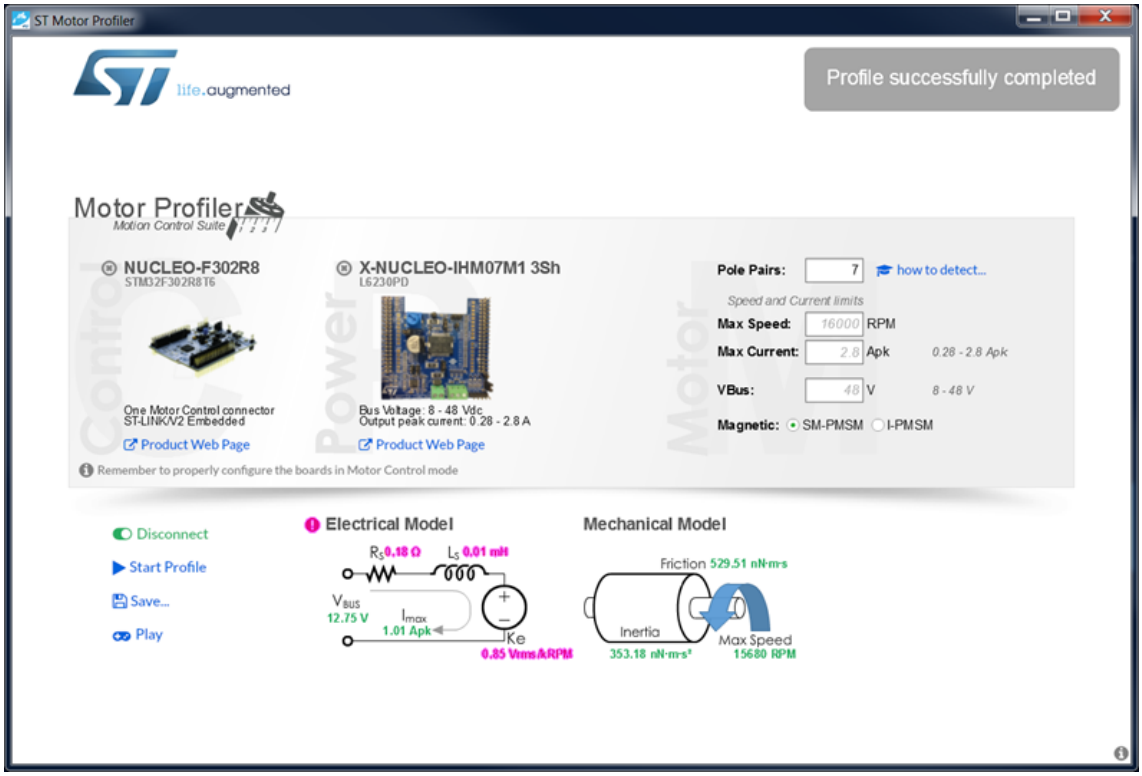


3.4 Profile your motor

Click on the *Start Profile* button as surrounded in Figure 9 to profile the motor.

First, the electrical parameters are identified, then the mechanical ones. In the case of over-current fault detection, the profiling is restarted with a reduced current. When profiling is completed, all the motor measurements are shown in green or orange colors (Figure 10) depending on the relative accuracy. When red color is used, please check your hardware setup and restart the motor profiling sequence.

Figure 10. ST Motor Profiler – Profiled motor GUI



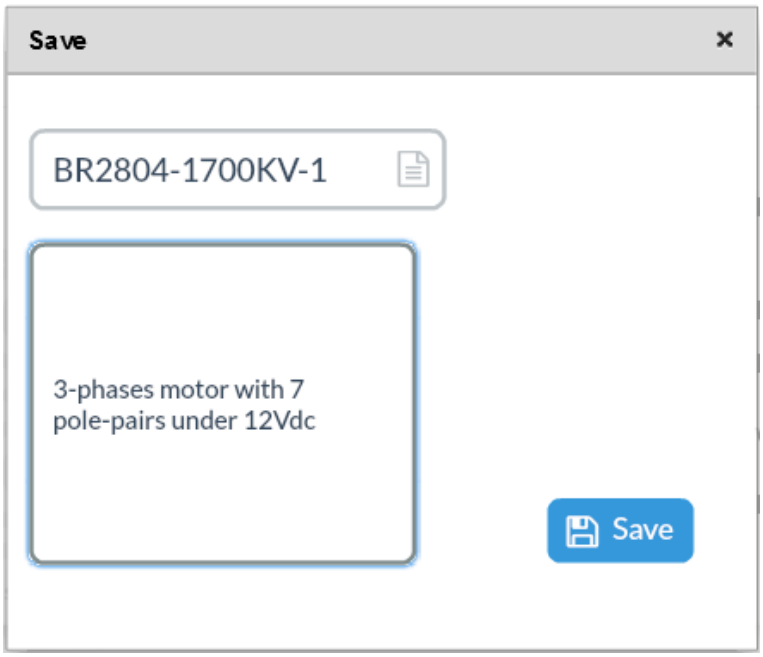
3.5 Save your profiled motor

Click on the *Save…* button (Figure 10) to store the motor measurements for later usage with the ST motor control workbench software tool.

Figure 11 shows the saving window in that case, then the user may provide the motor information:

- Naming of your profiled motor
- Provide details about your profiled motor
- Click on *Save*

Figure 11. ST Motor Profiler – Save window



3.6 Play with your motor

Click on the *Play* button (Figure 10. ST Motor Profiler – Profiled motor GUI) to spin your just profiled motor.

Figure 12 shows the spin control window. Preset the maximum acceleration and click on the *Start* button to activate your motor control. Then, select your *Speed [RPM]* with the cursor.

Figure 12. ST Motor Profiler – Spin control window (Start)

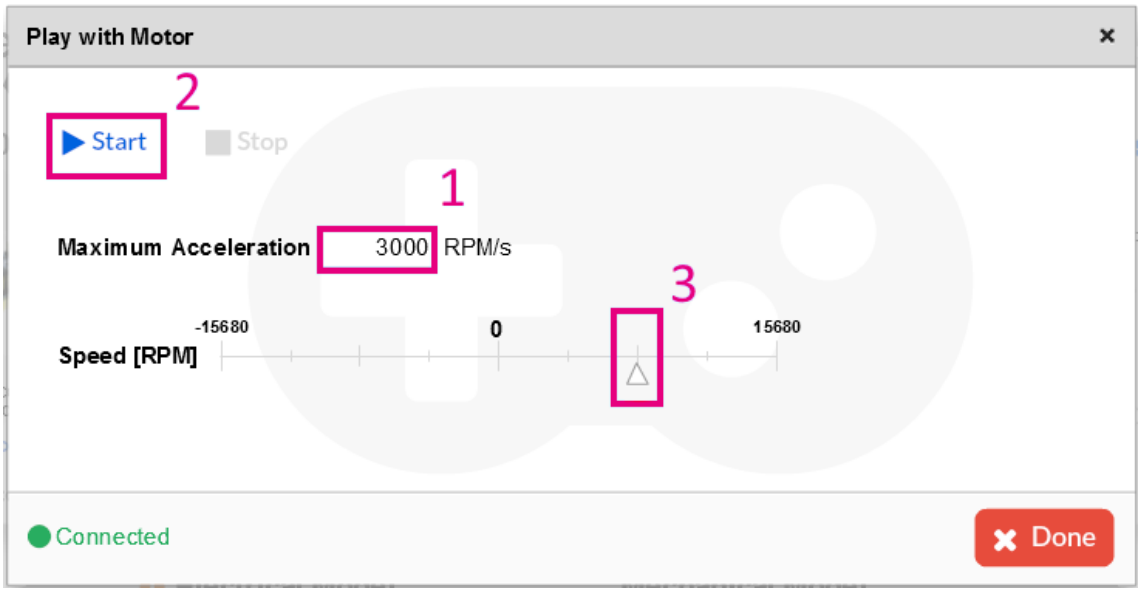
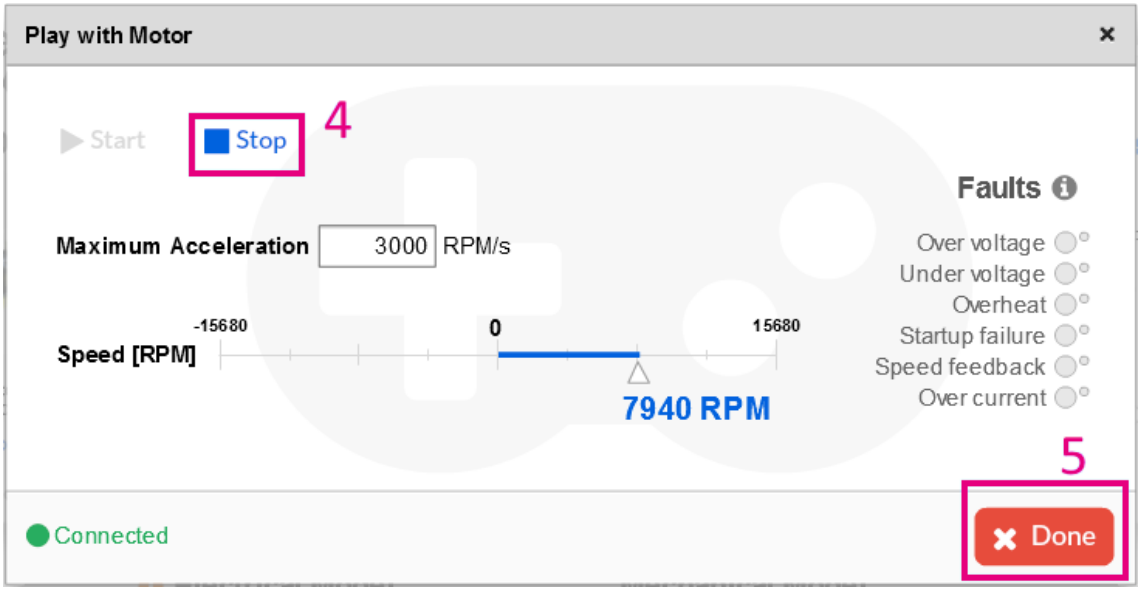


Figure 13 presents how to stop properly playing with your motor.

Figure 13. ST Motor Profiler – Spin control window (Stop)

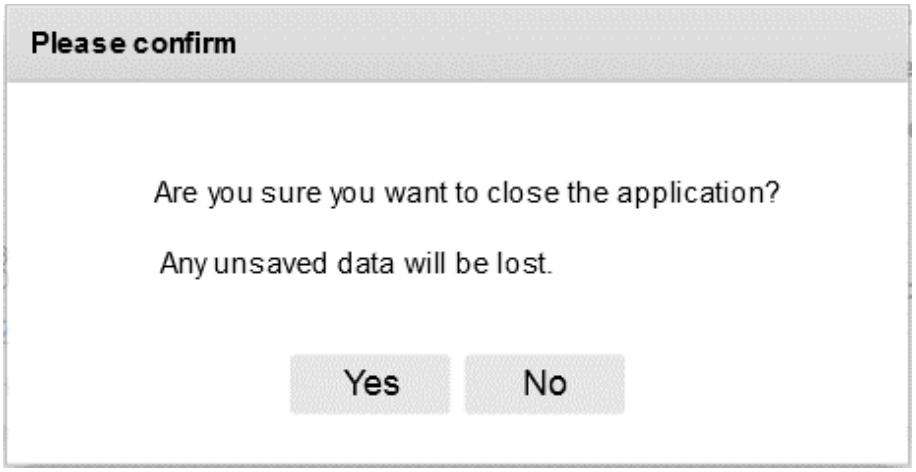


3.7 End the ST motor profiler

Click on the *Disconnect* button (Figure 10) to stop properly the ST motor profiler software tool, then close the window using the upper-right cross icon.

If you forgot to save your motor parameters, then select the *No* button (Figure 14), click on the *Connect* button (Figure 7) and save your motor parameters (Refer to Section 3.5). However, clicking on the *Yes* button loses your unsaved motor parameters and closes the ST motor profiler software tool.

Figure 14. ST Motor Profiler – Tool closure confirmation window



Revision history

Table 3. **Document revision history**

Date	Revision	Changes
27-Apr-2022	1	Initial release.

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