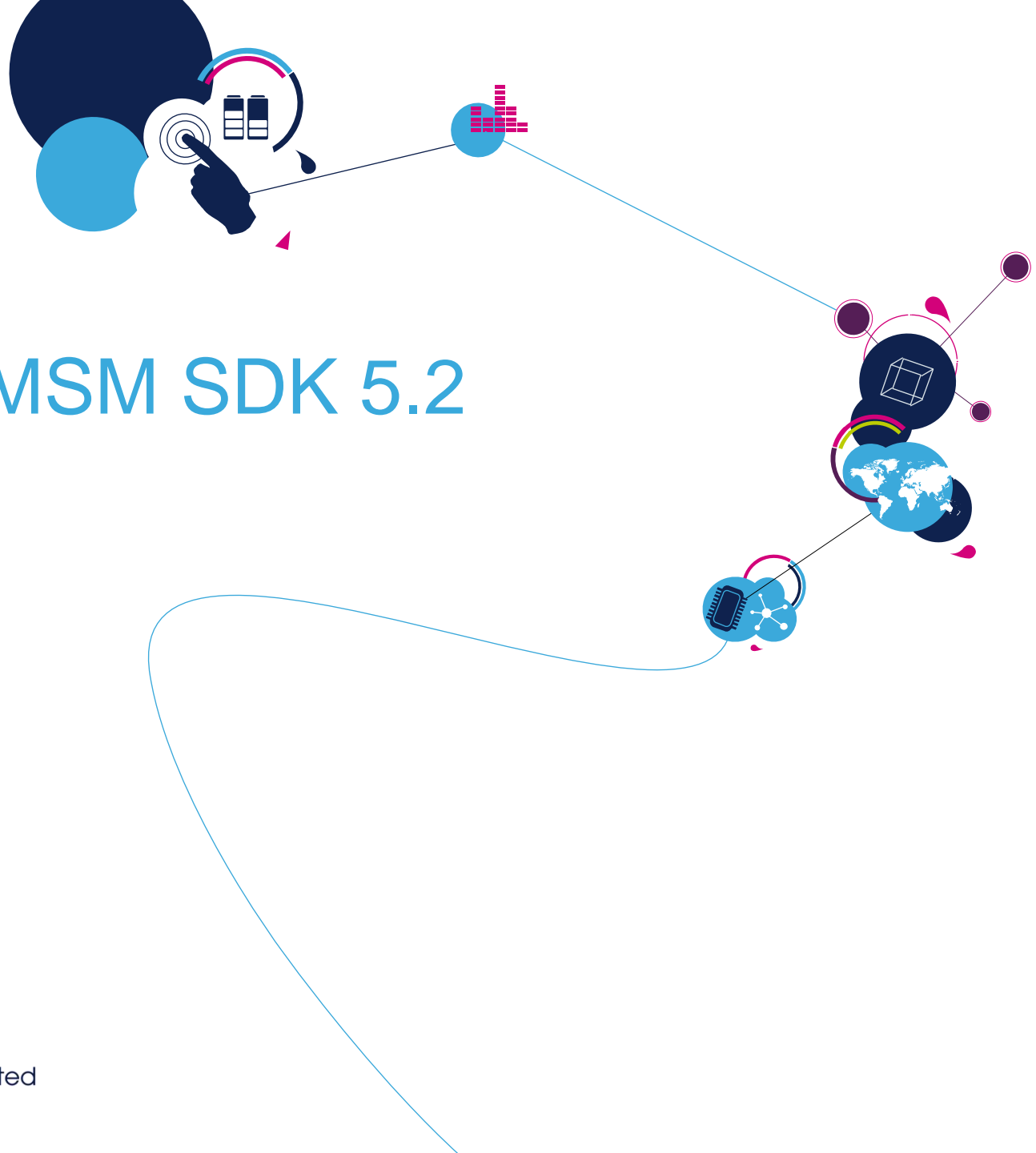


STM32 PMSM SDK 5.2 training

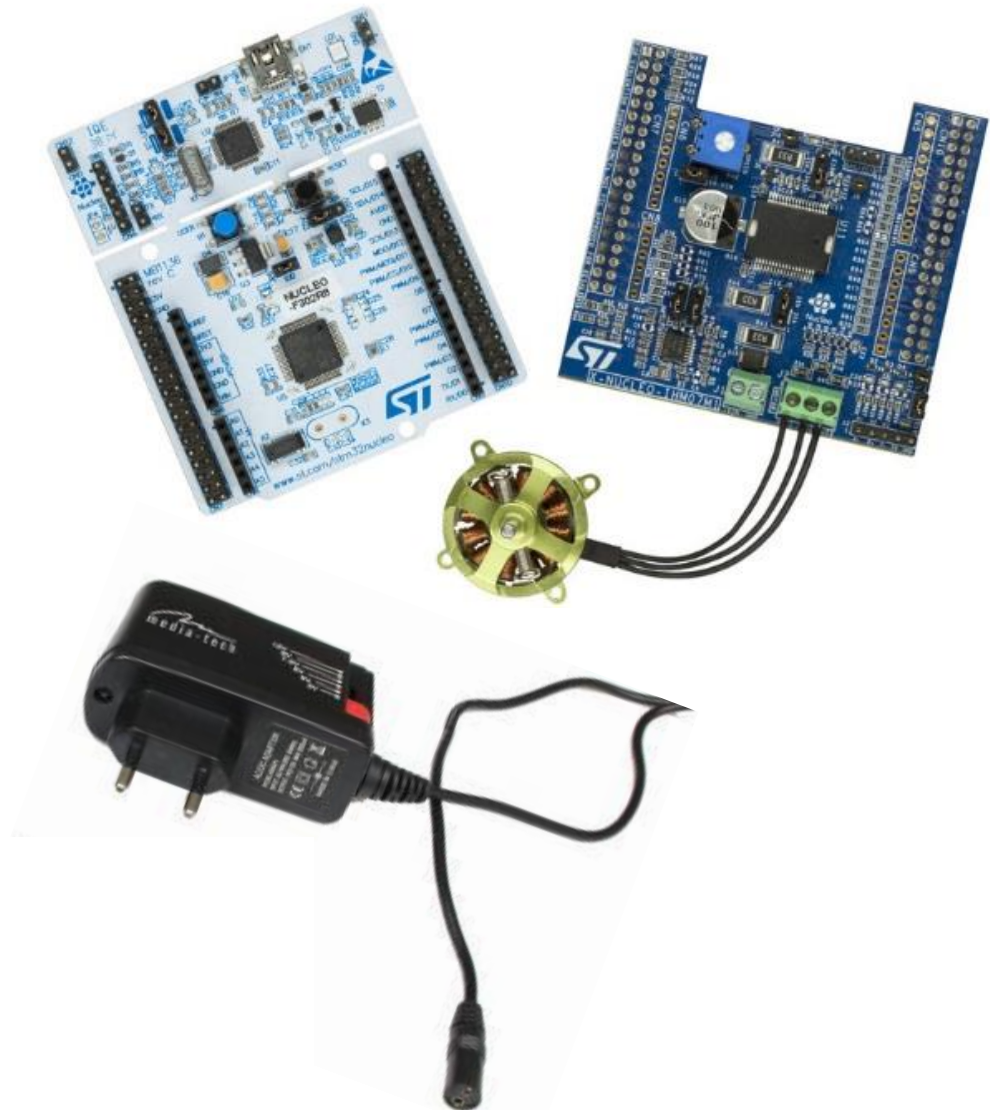
T.O.M.A.S. team



Motor Control Kit – IHM001/002

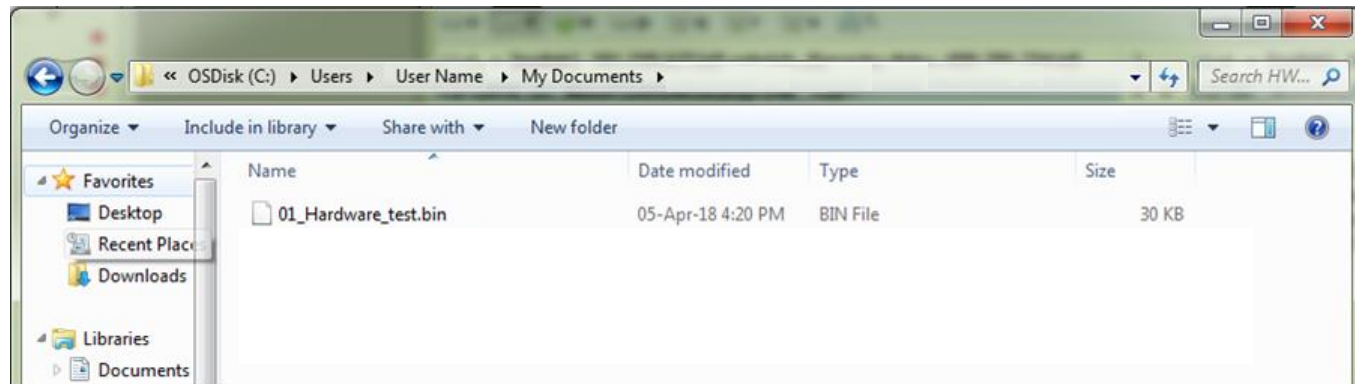
Contents

- NUCLEO-F302R8
 - Control board based on the STM32F302
- X-NUCLEO-IHM07
 - Power board based on the L6230
- 3 Phase Motor
 - BR2804-1700kv
- AC/DC Converter
 - 3VDC - 12VDC @ 2.5A



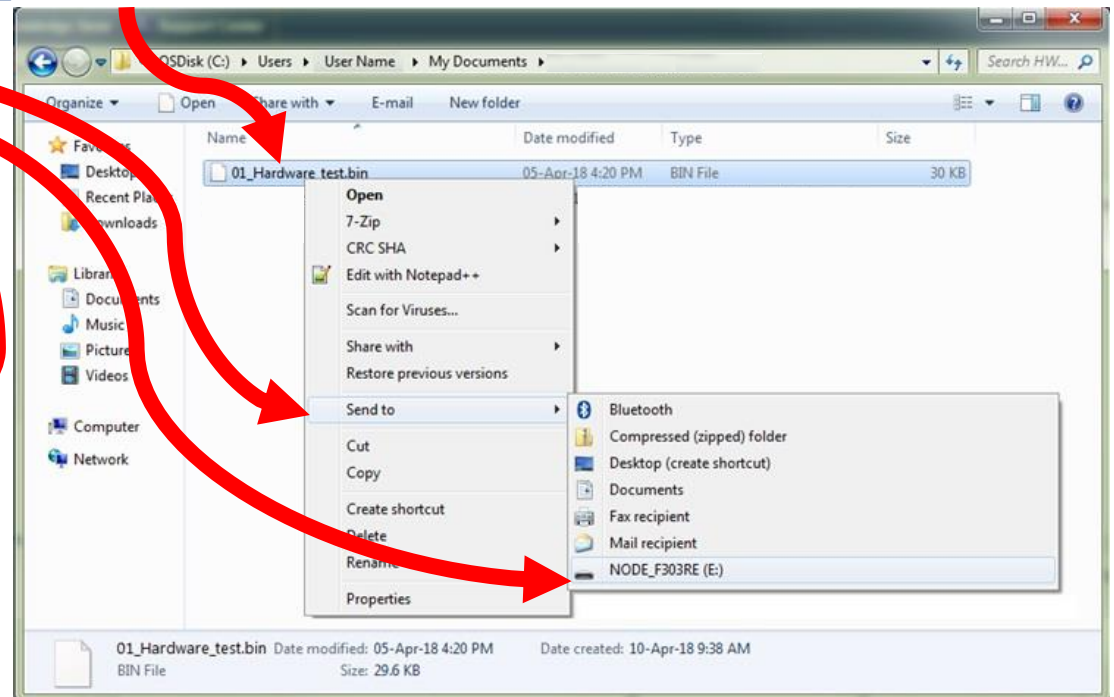
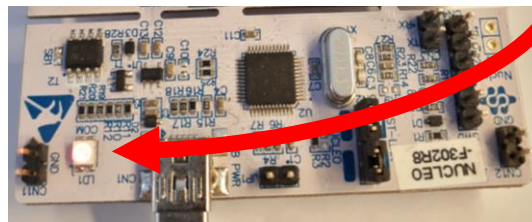
Where to find necessary files

- Files location for 1st Hardware test
 - Binary file
(distributed on USB stick)

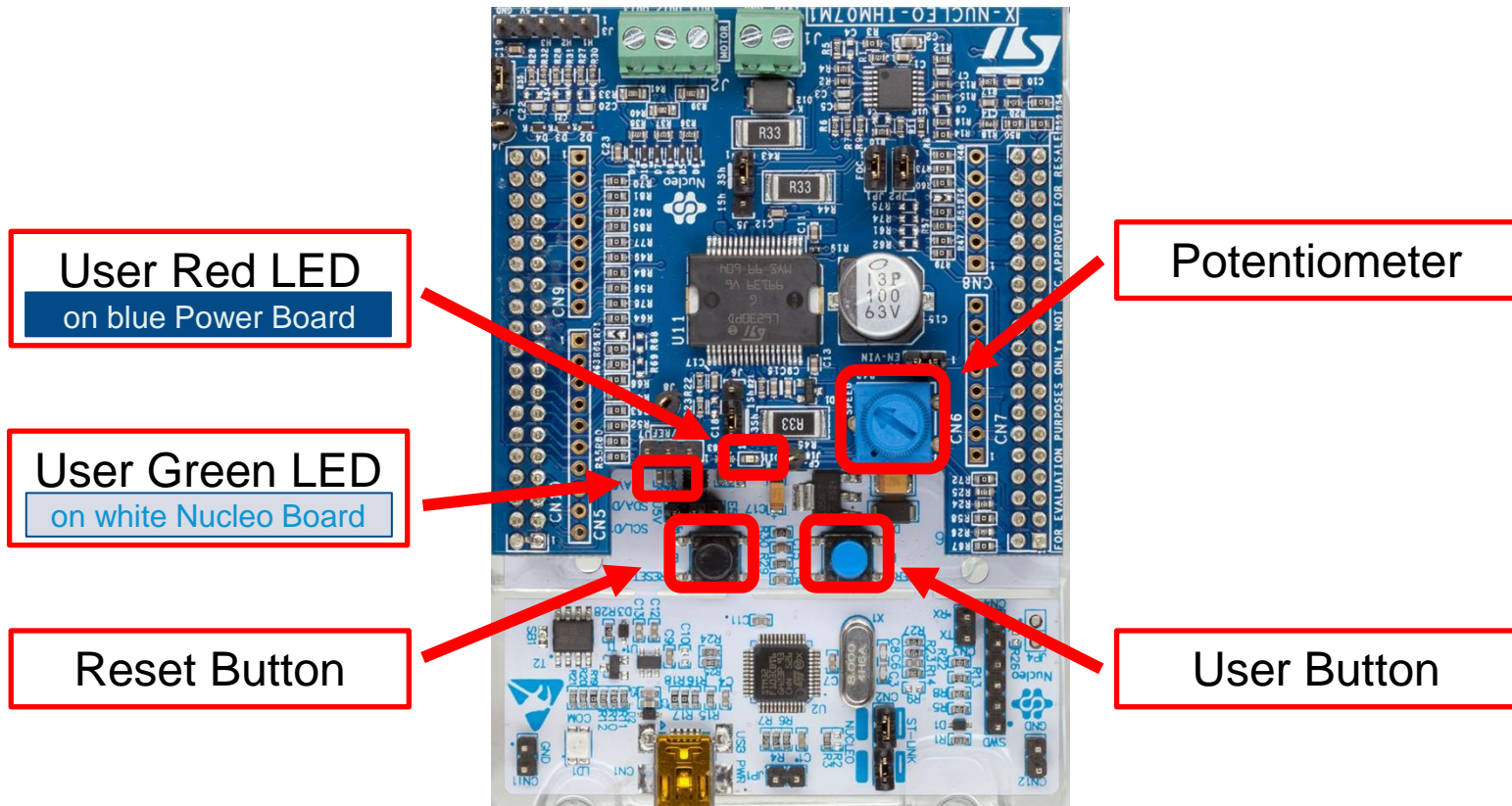


ST Link virtual drive binary upload

- Upload testing Firmware to MCU by “Send to” feature
 - **Right click** on *01_Hardware_test.bin*
 - Select **Send to**
 - Select **NODE_F302R8**
 - ST Link – LED indication



Testing MC firmware – description



Testing MC firmware – description

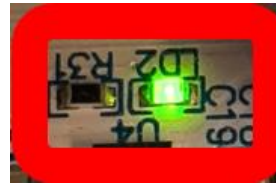
- User button function
 - Start
 - Stop
 - Acknowledge a fault



- Potentiometer
 - Regulation of the speed



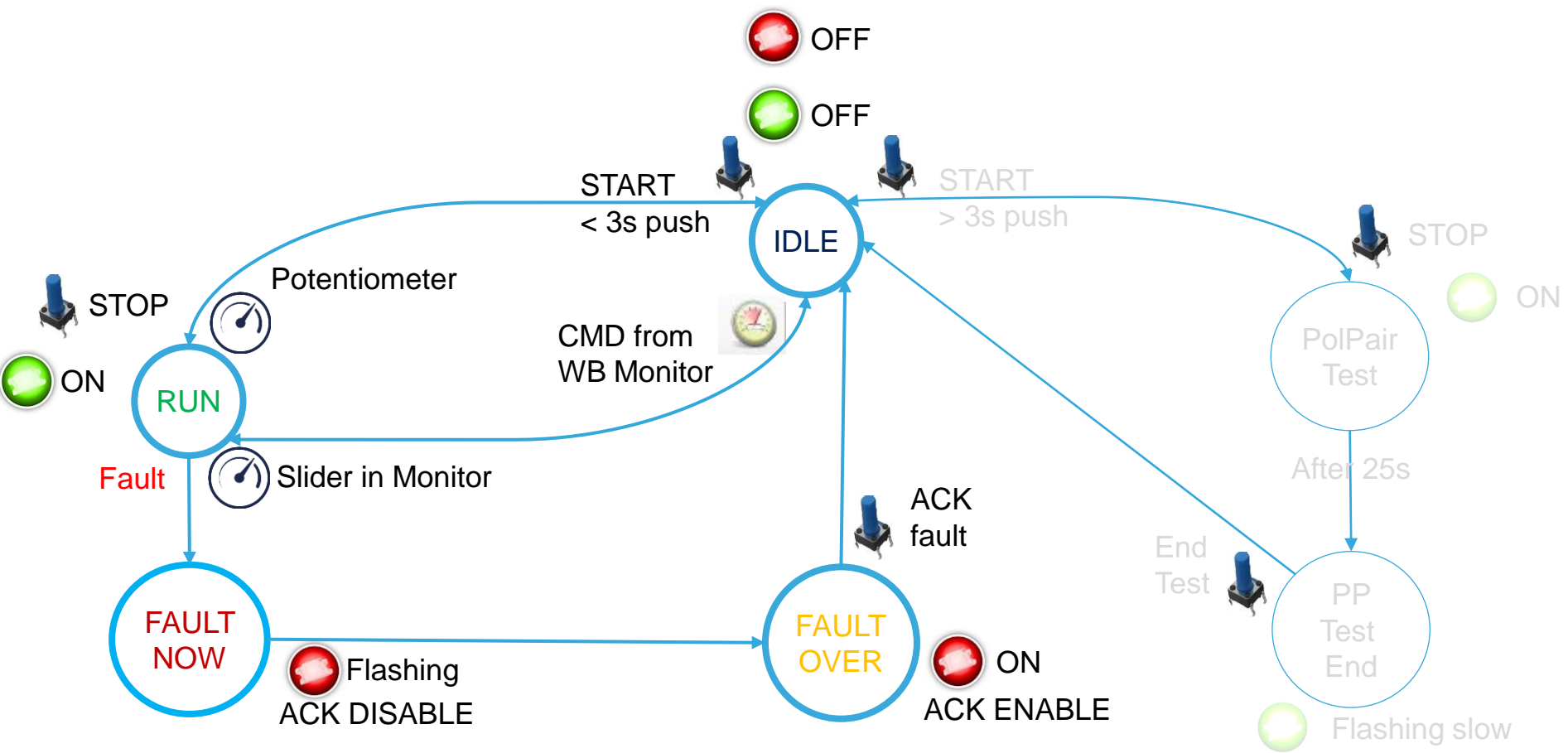
- Green LED diode indication
 - OFF - IDLE
 - ON – RUN



- Red LED diode indication
 - Flashing – FAULT NOW
 - ON - FAULT OVER



Testing MC firmware – description



STM32 PMSM FOC SDK 5.x

Hands-on and Hardware tools



The purpose of this document is to:

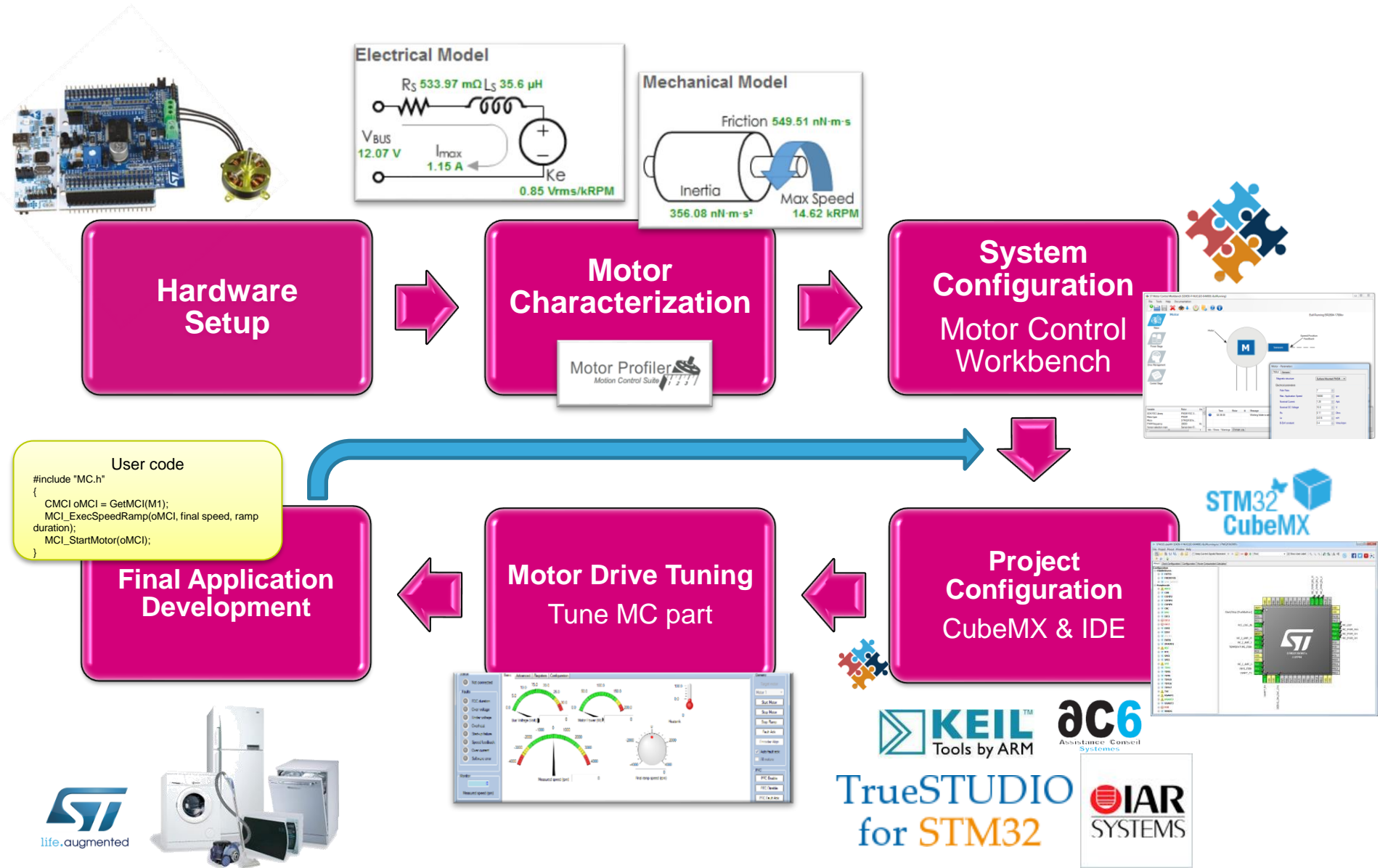
- Help developers get started with the STM32 PMSM FOC SDK using the ST MC Workbench with the final purpose of running a Permanent Magnet Synchronous Motor (PMSM) with ST Evaluation boards.
- Show where to find technical documentation, firmware libraries and other related materials.
- How to obtain additional technical support

- What is needed:
 - Windows laptop (Win 7)
 - ST-LINK dongle (optional)
 - USB to RS-232 dongle and a null modem cable (optional)
 - A permanent magnet motor
 - Multimeter (optional)
 - An oscilloscope with current probe (optional)
 - An insulated DC and or AC power supply



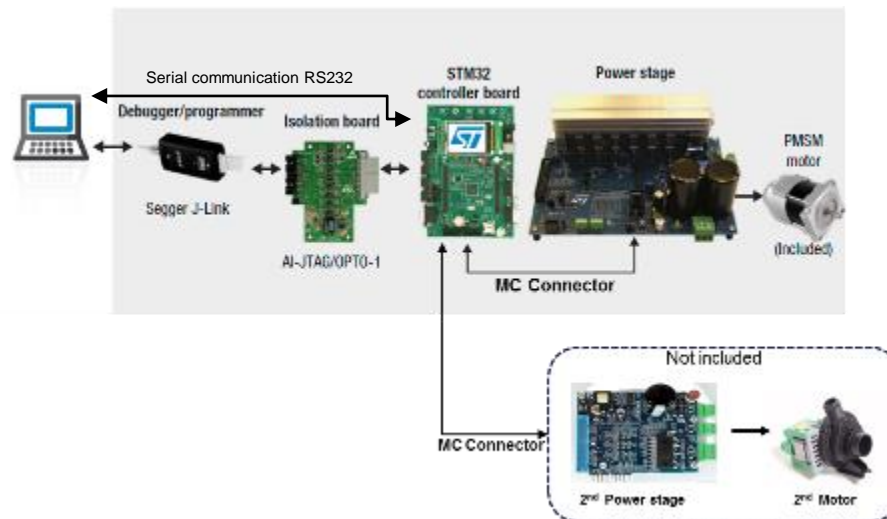
Motor control – SDK workflow

Motor control – SDK – Workflow



Motor control – SDK – Workflow 1/4

- First step → **Set up the hardware.** Depending on the targeted application, it is possible to choose the most suitable hardware configuration from among the different “ready-to-start” ST evaluation boards presented in Steps 1 to 5.
- Set up the selected board according the specification stated in each of the related user manuals.
- Connect the board (if required) to the power supply and your motor.



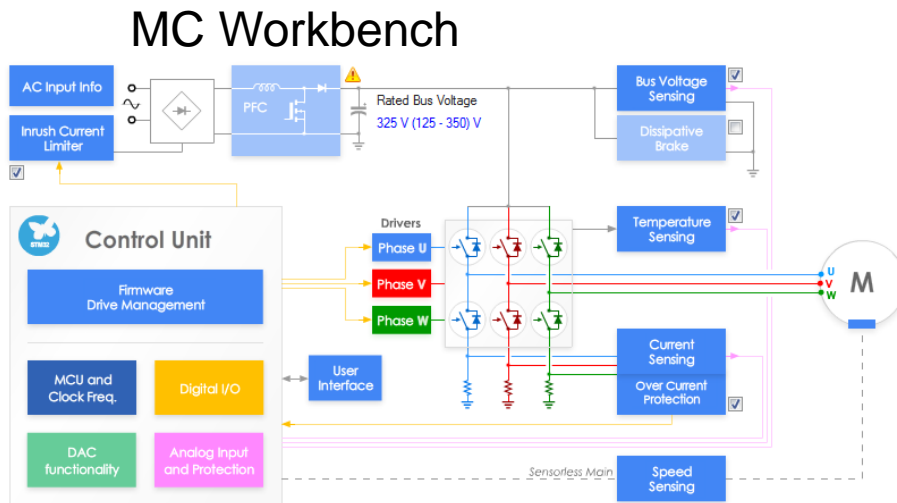
Motor control – SDK – Workflow 2/4

- When the hardware is ready, if the user does not know the motor parameters, he can identify the motor.
- How? Using the **Motor Profiler**!
 - Follow the instruction in [Step 6](#).
- If want to measure the Motor parameter in the lab [Step 8](#)

The screenshot displays the ST Motor Control Workbench software interface. The top menu bar includes 'File', 'Tools', 'Help', and 'Documentation'. Below the menu are four buttons: 'New Project', 'Load Project', 'About', and 'Help'. The 'Motor Profiler' logo is highlighted with a red dashed box. The main workspace shows two motor boards: 'NUCLEO-F302R8' (STM32F302R8T6) and 'X-NUCLEO-IHM07M1 3Sh' (L6230PD). The 'X-NUCLEO-IHM07M1 3Sh' board is selected, showing its specifications: Bus Voltage: 8 - 48 Vdc, Output peak current: 0.28 - 2.8 A. The 'Motor Profiler' settings are displayed on the right, including Pole Pairs (2), Max Speed (4000 RPM), Max Current (2 Apk), VBus (24 V), and Magnetic selection (SM-PMSM). A blue arrow points from the 'Motor Profiler' logo to the settings area. At the bottom, there are controls for 'Disconnect', 'Start Profile', 'Save...', and 'Play'. The 'Electrical Model' shows a circuit diagram with parameters: $R_s = 1.843 \Omega$, $L_s = 84.30 \mu\text{H}$, $V_{BUS} = 12.05 \text{ V}$, $I_{max} = 1.27 \text{ A}$, and $K_e = 0.5 \text{ Vrms/kRPM}$. The 'Mechanical Model' shows a motor diagram with parameters: Friction $304.59 \text{ nN}\cdot\text{m}\cdot\text{s}$, Inertia $209.56 \text{ nN}\cdot\text{m}\cdot\text{s}^2$, and Max Speed 14.87 kRPM . A 'Faults' list is also visible on the right.

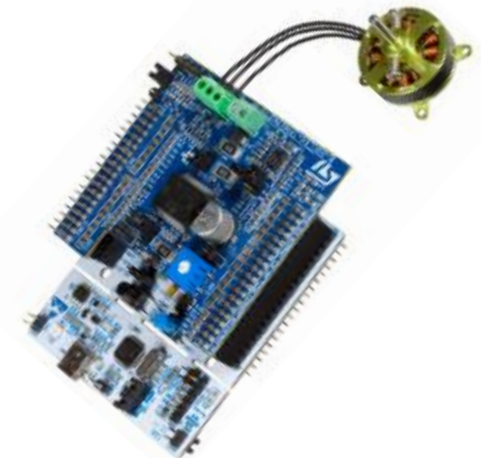
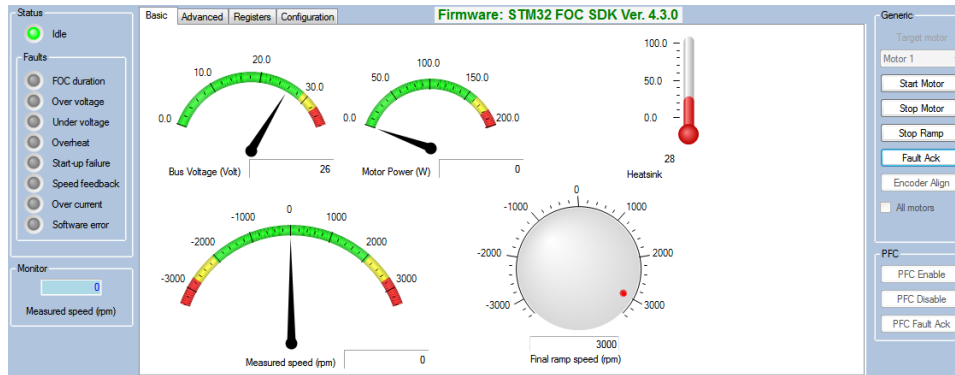
Motor control – SDK – Workflow 3/4

- When using the Motor Profiler, the motor is running but the user can develop his own code!
- **Finalize the MC project** using Workbench according to the instructions in Step 7.
- Use your favorite IDE to develop your code.



Motor control – SDK – Workflow 4/4

- Finally, the user can **send commands** (e.g. start, stop, execRamp, ...) via serial communication.
- Use the Workbench as explained in [Step 13](#).





Hardware setup

Step #1 – Hardware setup

- It is possible to choose one of the following offers:
 - Complete Motor Control Kit.
 - One of the complete inverters currently in stock.
 - Any STM32 evaluation board combined with one of the ST evaluation power stages which include the MC connector.
- The following slides cover the boards in the *ST Evaluation Tools Portfolio* that can be used to arrange a motor control system.
 - Follow the instructions in the related user manual to set up each board.

Motor Control HW boards

Various offer

Control + Power

Eval/Nucleo + Power/Expansion

Control stages



MC Connector



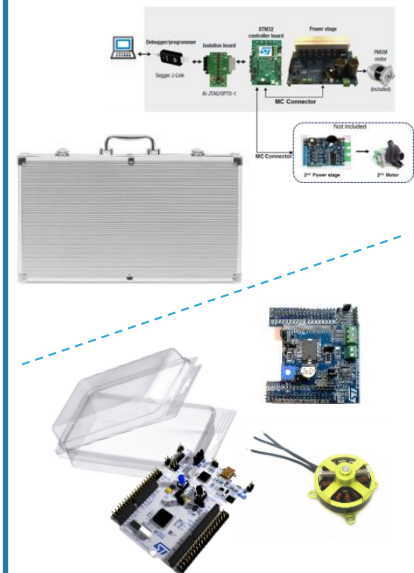
Power stages



Inverter (Complete Drive)



MC Kits





SDK5.x Reference Boards

SDK5.x Control Boards (1)

Family	MCU	Board	SDK4.3	SDK5.x	Description
F0	F030R8	NUCLEO-F030R8	SDK4.3	SDK5.0	F0 Nucleo Board
F0	F072RB	NUCLEO-F072RB	SDK4.3	SDK5.0	F0 Nucleo Board
F0	F072VB	STM32072B-EVAL	SDK4.3	SDK5.0	F0 Evaluation Board
F1	F103RB	NUCLEOF103RB	-	SDK5.1.2	F1 Nucleo Board (MD)
F1		STM3210E_EVAL	SDK4.3	SDK5.1	F1 Evaluation Board
F3	F302R8	NUCLEO-F302R8	SDK4.3	SDK5.0	F3 Nucleo Board
F3	F303RE	NUCLEO-F303RE	SDK4.3	SDK5.0	F3 Nucleo Board
F3	F303VE	STM32303E-EVAL	SDK4.3	SDK5.0	F3 Evaluation Board

SDK5.x Control Boards (2)

Family	MCU	Board	SDK4.3	SDK5.x	Description
F4	F446RE	NUCLEO-F446RE	SDK4.3	SDK5.0	F4 Nucleo Board
F4	F407IG	STM3240G-EVAL	SDK4.3	SDK5.0	F4 Evaluation Board
F4	F417IG	STM3241G-EVAL	SDK4.3	SDK5.0	F4 Evaluation Board
F4	F446ZET	STM32446E-EVAL	SDK4.3	SDK5.0	F4 Evaluation Board
F4	F415ZGT8	STEVAL-IHM039V1	SDK4.3	SDK5.0	F4 Evaluation Board
F4	F401RE	STM32F401RE	-	SDK5.2	F4 Nucleo Board
F7	F746ZG	NUCLEO-F746ZG	-	SDK5.2	F7 Nucleo Board
F7	F769I	STM32F769I-EVAL	-	SDK5.2	F7 Evaluation Board
L4	L452RE	NUCLEO-L452RE	-	SDK5.2	L4 Nucleo Board
L4	L476G	STM32L476G-EVAL	-	SDK5.2	L4 Evaluation Board

SDK5.x Inverters

Family	MCU	Board	SDK4.3	SDK5.x	Description
F0	F031	STEVAL_SPIN3201	SDK4.3	SDK5.1	STSPIN32F0 3-shunt
F0	F031	STEVAL_SPIN3202	-	SDK5.1	STSPIN32F0A 1-shunt
F1	F103RC	STEVAL_IHM034V2	SDK4.3	SDK5.1	Used for PFC
F3	F303RE	X-Nucleo_IHM16 + Nucleo-F303RE	-	SDK5.1	Bundle used for EMEA workshop
F3	F303	STEVAL-ESC001V1	-	SDK5.1.2	F3 ESC board

SDK5.x Power Boards (1)

Board	SDK4.3	SDK5.x	Description
STEVAL-IHM023V3	SDK4.3	SDK5.0	1 kW 3-phase motor control evaluation board featuring L6390 drivers and STGP10H60DF IGBT
STEVAL-IHM025V1	SDK4.3	SDK5.0	Obsolete – but still part of the list in SDK5.0
STEVAL-IHM028V2	SDK4.3	SDK5.0	2 kW 3-phase motor control evaluation board featuring the STGIPS20C60 IGBT intelligent power module
STEVAL-IHM045V1	SDK4.3	SDK5.0	3-phase high voltage inverter power board for FOC based on the STGIPN3H60A (SLLIMM-nano)
X-NUCLEO-IHM07M1	SDK4.3	SDK5.0	Three-phase brushless DC motor driver expansion board based on L6230 for STM32 Nucleo
X-NUCLEO-IHM08M1	SDK4.3	SDK5.0	Low-Voltage BLDC motor driver expansion board based on STL220N6F7 for STM32 Nucleo
X-NUCLEO-IHM11M1	SDK4.3	SDK5.0	Low voltage three-phase brushless DC motor driver expansion board based on STSPIN230 for STM32 Nucleo
STEVAL-IPM10F	SDK4.3	SDK5.0	Motor control power board based on the SLLIMM#8482; 2nd series of IGBT IPMs
STEVAL-IPM15B	SDK4.3	SDK5.0	Motor control power board based on the SLLIMM#8482; 2nd series of IGBT IPMs

SDK5.x Power Boards (2)

Board	SDK4.3	SDK5.x	Description
STEVAL-IPM05F	SDK4.3	SDK5.0	Motor control power board based on the SLLIMM#8482; 2nd series of IGBT IPMs
STEVAL-IPM07F	SDK4.3	SDK5.0	Motor control power board based on the SLLIMM#8482; 2nd series of IGBT IPMs
STEVAL-IPM10B	SDK4.3	SDK5.0	Motor control power board based on the SLLIMM#8482; 2nd series of IGBT IPMs
STEVAL-IPM08B	-	SDK5.1	in one shunt and three shunt topology-
STEVAL-IPM10F	SDK4.3	SDK5.0	Motor control power board based on the SLLIMM#8482; 2nd series of IGBT IPMs
STEVAL-IPM15B	SDK4.3	SDK5.0	Motor control power board based on the SLLIMM#8482; 2nd series of IGBT IPMs
STEVAL-IPMNG3Q	-	SDK5.1	in one shunt and three shunt topology-
STEVAL-IPMNG5Q	-	SDK5.1	in one shunt and three shunt topology-
STEVAL-IPMNG8Q	-	SDK5.1	in one shunt and three shunt topology-
STEVAL-IPMNM1N	-	SDK5.1	in one shunt and three shunt topology-
STEVAL-IPMNM2N	-	SDK5.1	in one shunt and three shunt topology-



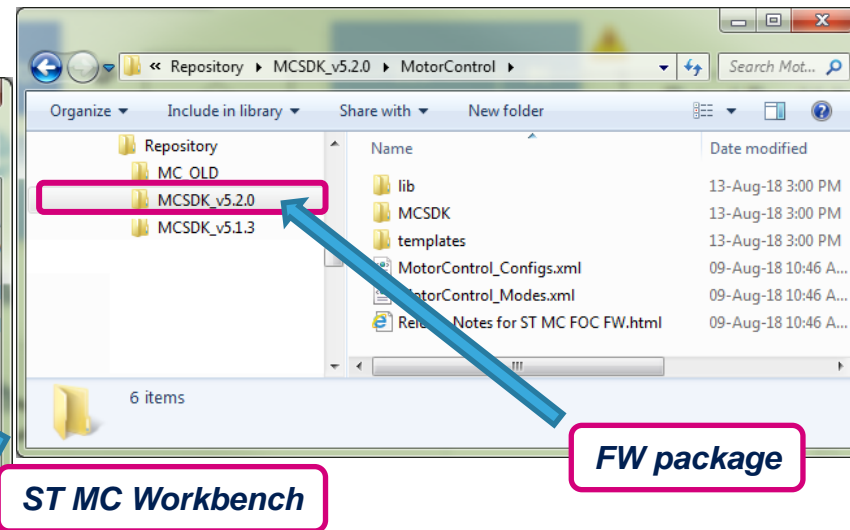
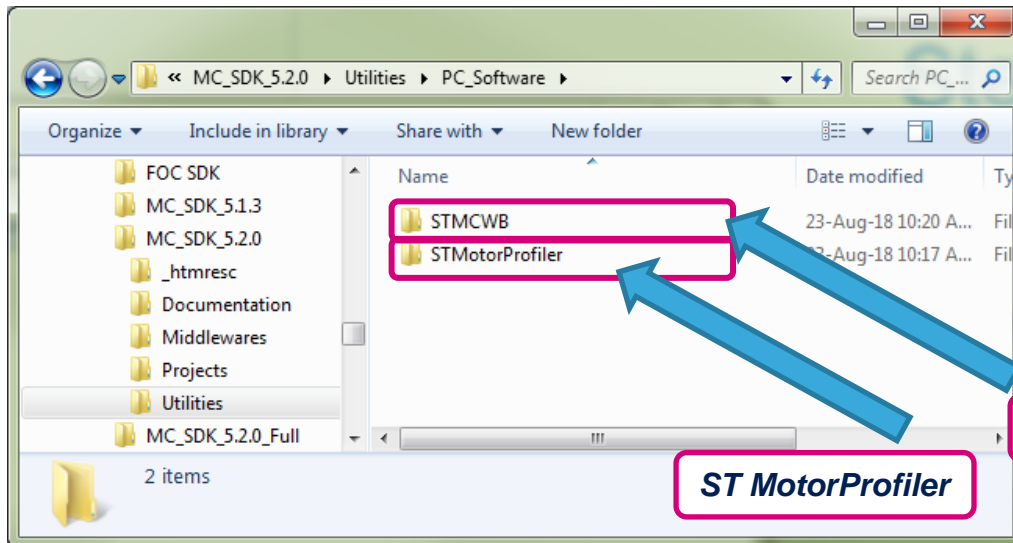
Software setup

Step #2 – Software setup

Download and install the X-CUBE-MCSDK from www.st.com.

It contains the firmware package, the ST MC Workbench (GUI) and Motor profiler.

- ST MC WB and MotorProfiler you can found in installed folder
(c:\Program Files (x86)\STMicroelectronics\MC_SDK_5.x.x\)
- MC library you can found in Repository



Step #3 – IDE setup

- An IDE (Integrated development environment) is required to compile, flash and debug the application.
- Several IDEs are supported:
 - IAR Embedded Workbench for ARM - IAR Systems (<http://www.iar.com/>)
 - Keil Embedded Development Tools for ARM, Cortex-M ... (<http://www.keil.com/>)
 - TrueSTUDIO : free IDE for STM32 on Windows (<https://atollic.com/>)



Step #4 – ST-LINK installation

- If the control board or the complete system doesn't embed the ST-LINK, a stand-alone dongle is required.
- In any case, you must install the ST-LINK driver that can be found in the ST website searching for part number [ST-LINK/V2](#) or [ST-LINK/V2-ISOL](#)

Part Number	Status	Description
ST-LINK/V2	Active	ST-LINK/V2 in-circuit debugger/programmer for STM8 and STM32

- Click on Design Resources, download and install the [STSW-LINK009](#)

Related Tools and Software

Related Tools and Software

Part Number	Description
STSW-LINK004	STM32 ST-LINK utility
STSW-LINK005	ST-LINK/V2 firmware upgrade
STSW-LINK009	ST-Link, ST-Link/V2, ST-Link/V2-1 USB driver signed for XP, Windows7, Windows8



Step #4 – ST-LINK installation

- On the same page, download and install also the STSW-LINK004 – STM32 ST-LINK utility

(This will be required to flash the LCD FW code into the MCU).

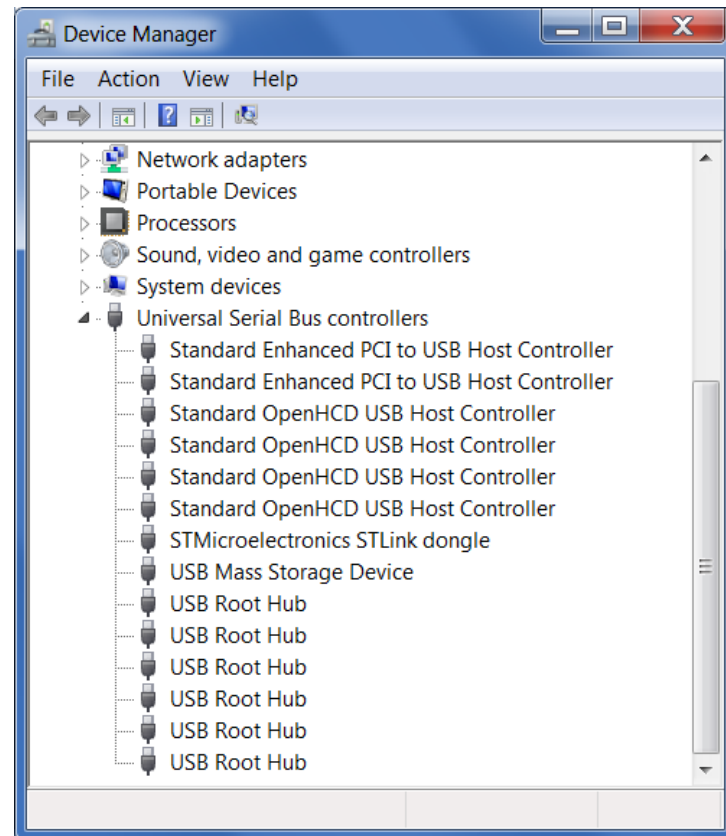
Related Tools and Software

Related Tools and Software	
Part Number	Description
STSW-LINK003	ST-LINK/V2 USB driver for Windows 7, Vista and XP
STSW-LINK004	STM32 ST-LINK utility
STSW-LINK005	ST-LINK/V2 firmware upgrade
STSW-LINK006	ST-LINK/V2 USB driver for Windows 8



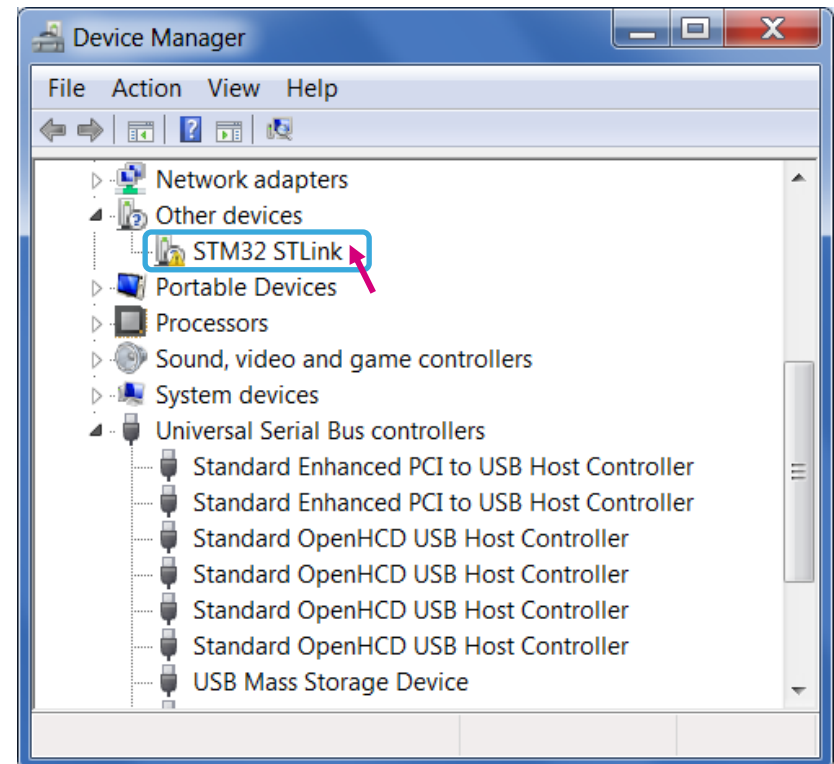
Step #5 – Connect ST-LINK (1/6)

- Using the USB cable, connect the control board with ST-LINK embedded (or the ST-LINK dongle) to the A male connector into your laptop.
- Wait for Windows to recognize the ST-Link device and follow any steps required to install the driver.
- Upon successful driver recognition, the ST-Link device should be fully enumerated in the Windows Device Manager as shown:



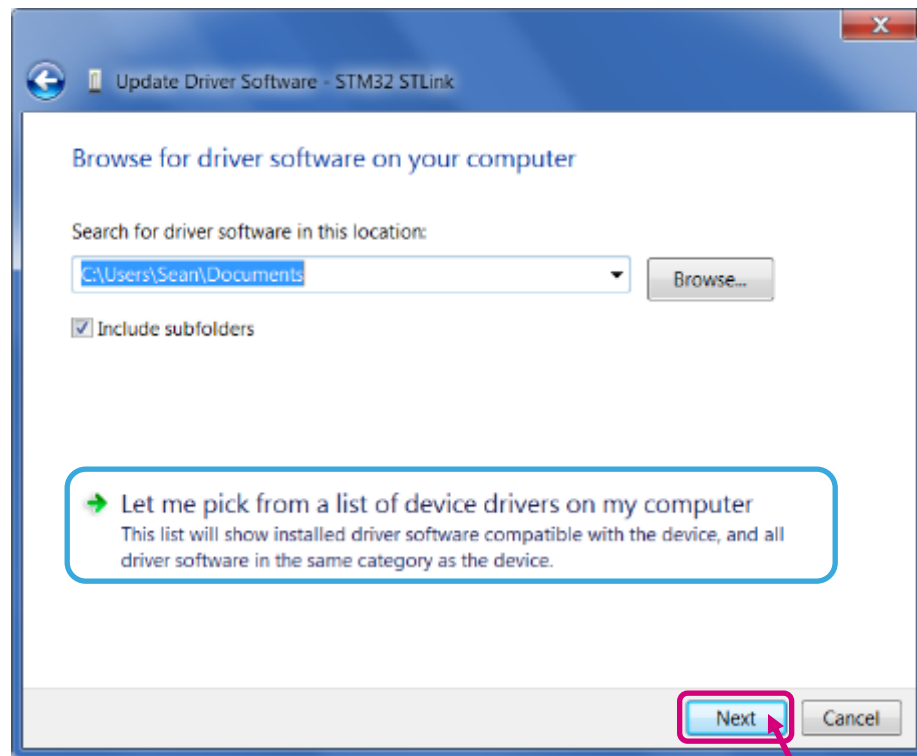
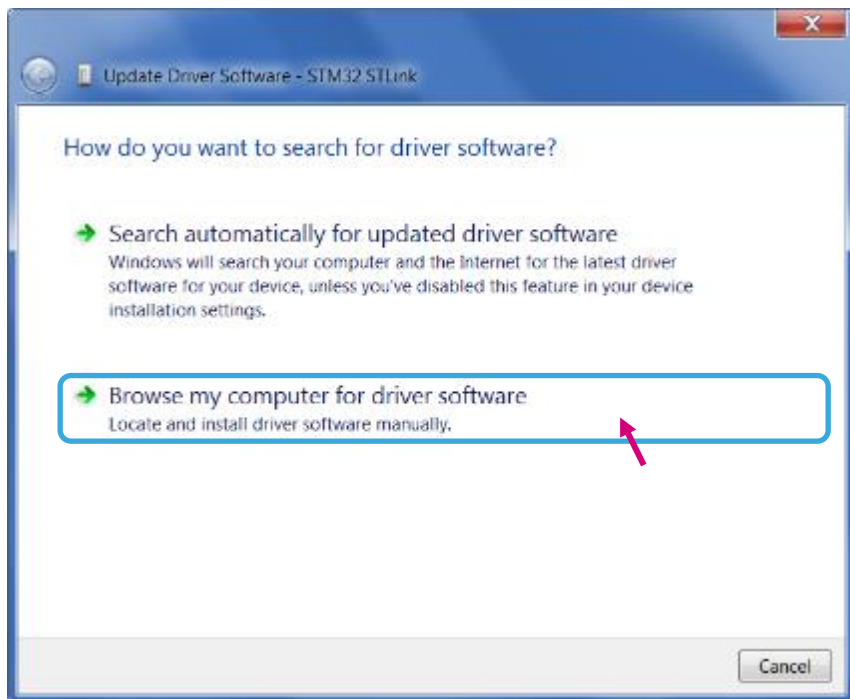
Step #5 – Driver trouble-shooting (2/6)

1. Open Device Manager.
2. Right-click on the “**STM32 STLink**” Driver icon.
3. Select “**Update Driver Software**”.



Step #5 – Driver trouble-shooting (3/6)

4. Select “Browse my computer for driver software”.



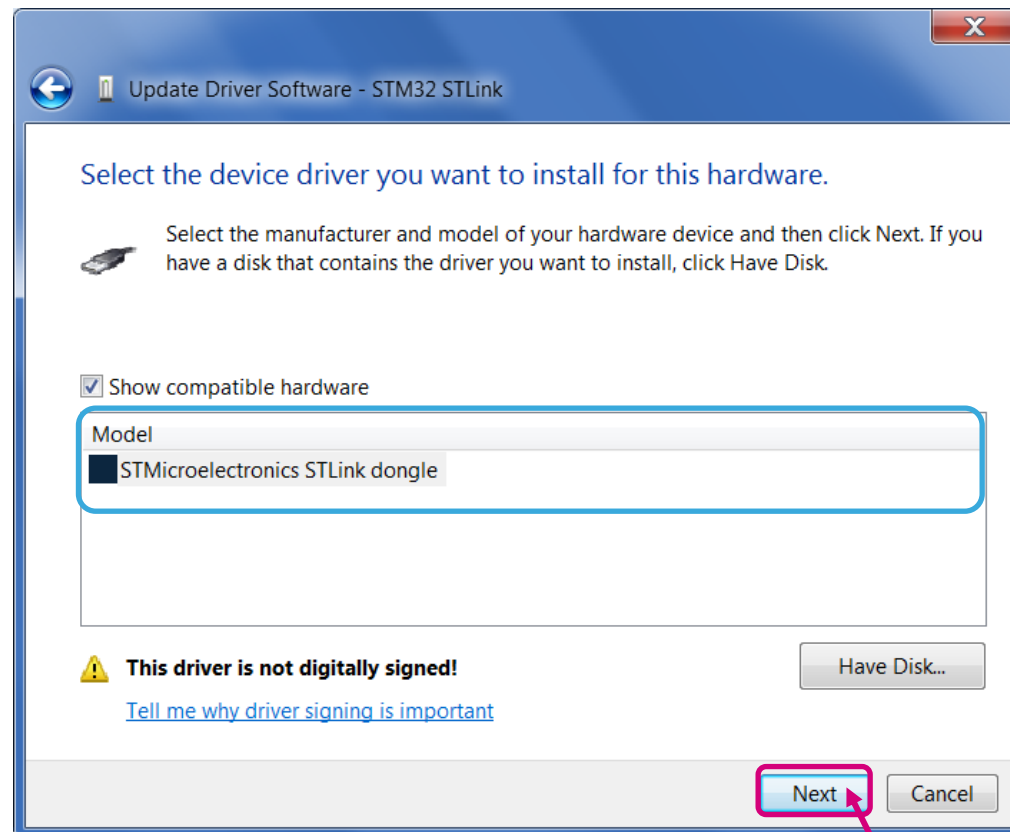
5. Select “Let me pick from a list of device drivers of my computer”.

6. Click “Next”.

Step #5 – Driver trouble-shooting (4/6)

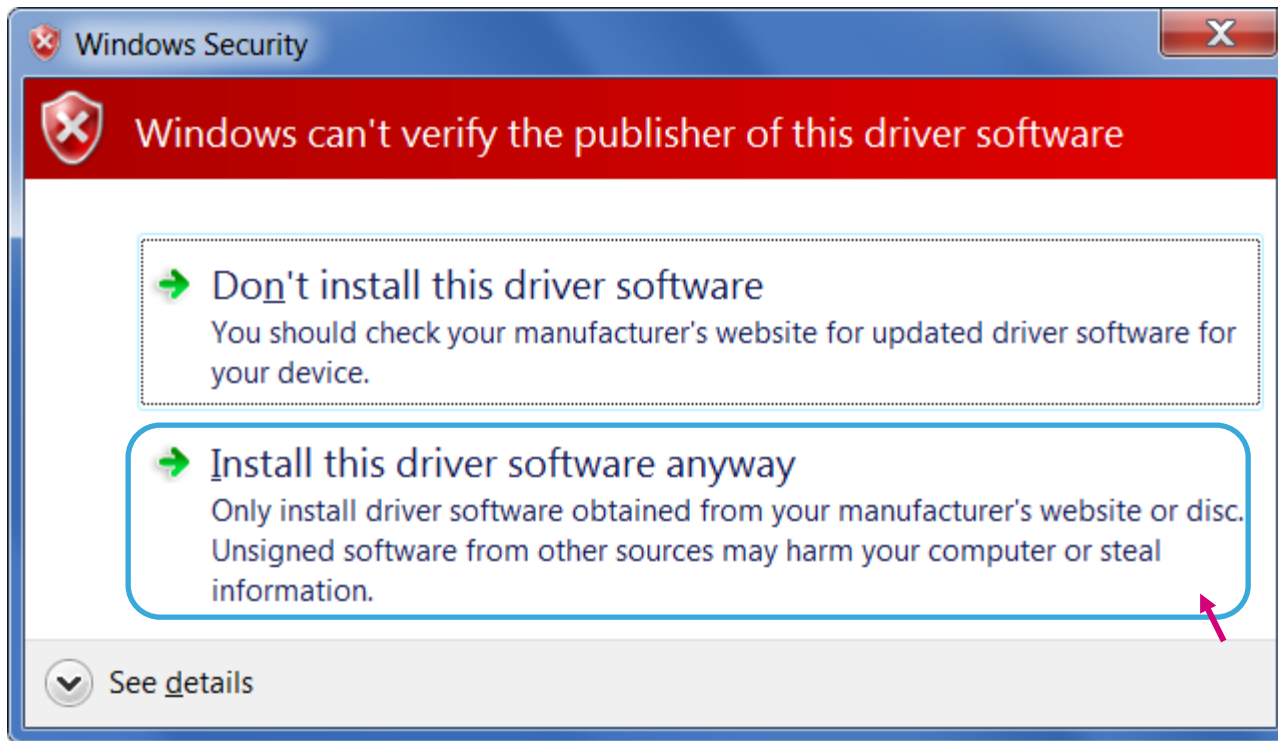
- The “**STMicroelectronics ST-Link dongle**” should be listed.

7. Click “Next”.



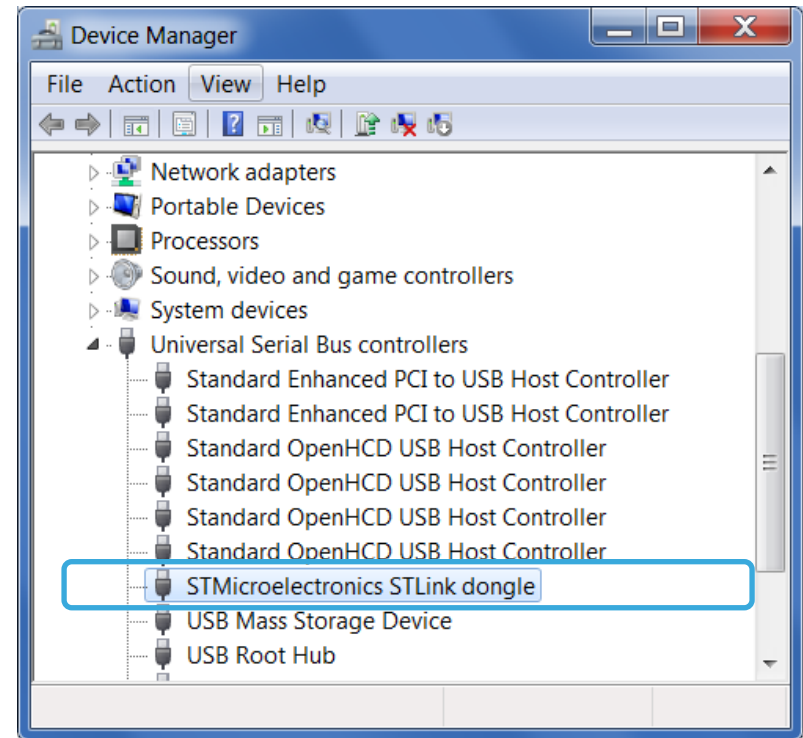
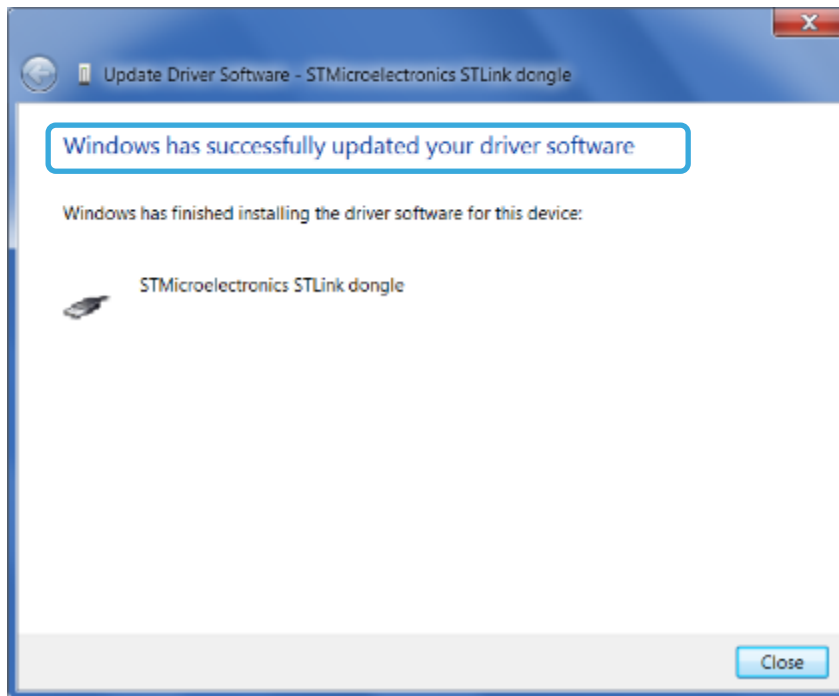
Step #5 – Driver trouble-shooting (5/6)

- A warning message may appear.
8. Select **“Install this driver software anyway”**.



Step #5 – Driver trouble-shooting (6/6)

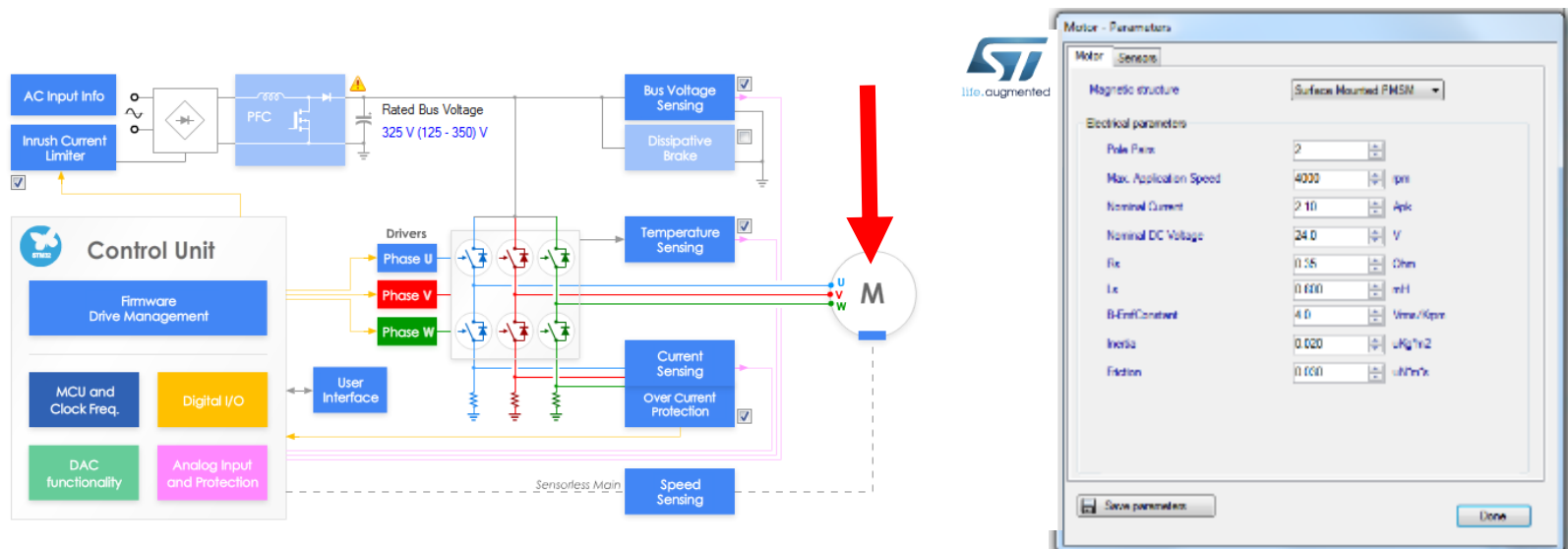
- You should receive a message: **“Windows has successfully updated your driver software”**.



- Re-check Device Manager to ensure **“STMicroelectronics STLink dongle”** is functioning normally.

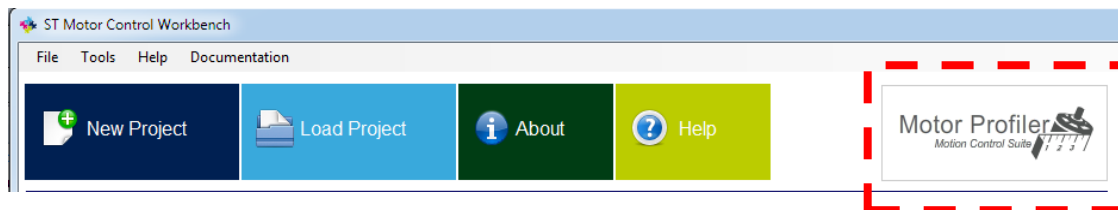
Step #6 – Set up motor parameters

- ST MC Workbench – Motor section contains:
 - Motor parameters
 - Motor sensor parameters
- In this hands-on session, we will configure the system for sensor-less control using a motor with a surface-mounted magnet.
- For a custom project, the user can set all the parameters individually.

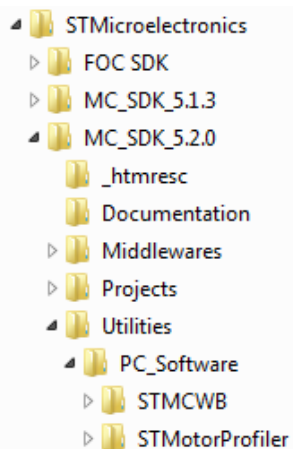


Step #6 – Set up motor parameters

- If motor parameters are unknown (or the instrumentation to measure them is missing), it is possible to use the new **Motor Profiler** feature with the supported ST hardware.
- Two ways to open the Motor Profiler:
 - From the Home page of the ST Motor Control Workbench

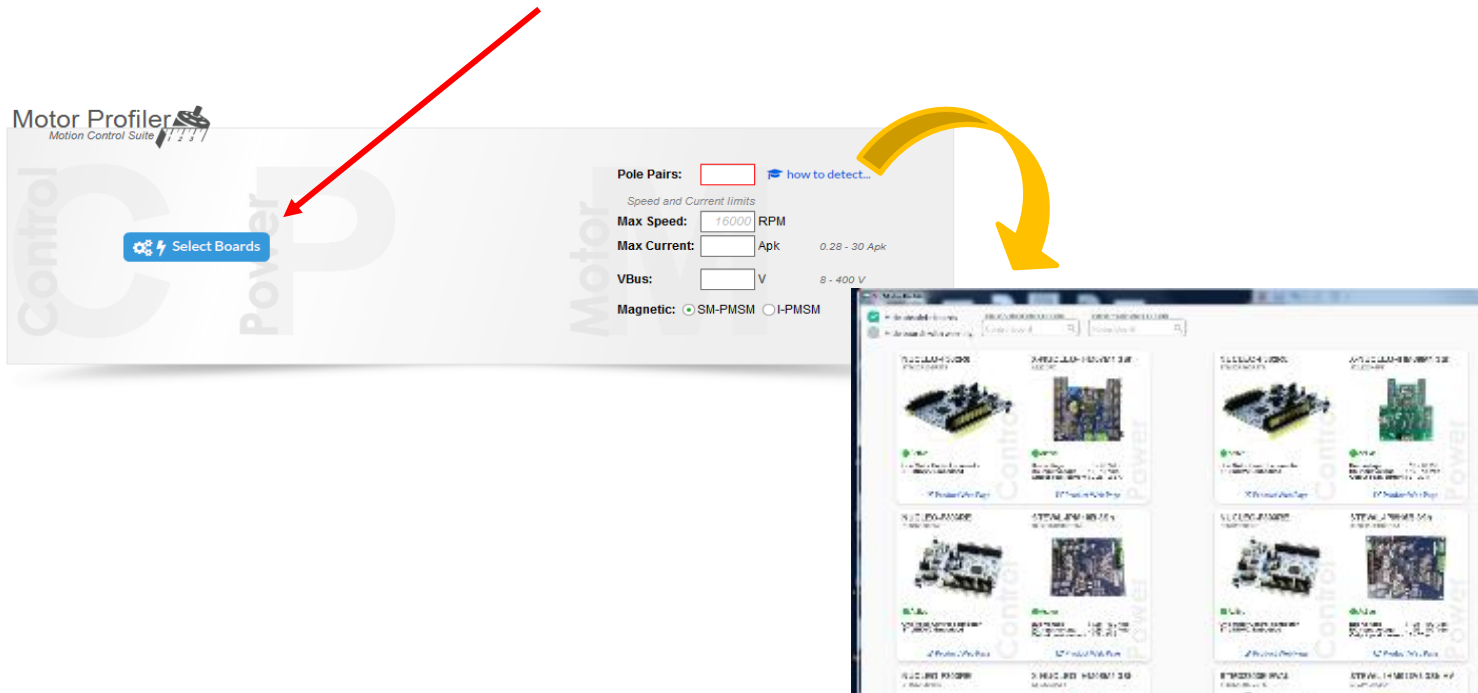


- From the “STMotorProfiler” installation folder



Step #6 – Set up the Motor Profiler

- Click “Select Boards” to display a list of supported boards. The Motor Profiler feature can be used only in the systems listed.





Set up workbench project

Step #7 – Create a new Workbench project based on the ST evaluation board

Choose: New Project

Recent Projects

Filename	Type	MCUs	control board	power board	motor
F446_IHM23V3.stmcx	SINGLE	STM32F446xC-xE	NUCLEO-F446RE	STEVAL-IHM023V3	Custom
test52.stmcx	SINGLE	STM32F446xC-xE	NUCLEO-F446RE	Custom	Shinano LA052-080E3NL1
LAB_3.stmcx	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM16M1	GimBal
F303_IHM16.stmcx	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM16M1	GimBal
F030_IHM07.stmcx	SINGLE	STM32F030x	NUCLEO-F030R8	X-NUCLEO-IHM07M1	BullRunning

Example Projects

Filename	Type	MCUs	control board	power board	motor
NUCLEO_L452RE_IHM07M1_SHINANO_1S_PLL	SINGLE	STM32L452xx	NUCLEO-L452RE	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO_L452RE_IHM07M1_SHINANO_3S_PLL	SINGLE	STM32L452xx	NUCLEO-L452RE	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO_L476RG_IHM07M1_SHINANO_3S_PLL	SINGLE	STM32L476xx	NUCLEO-L476RG	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO-F746ZG_IHM07M1_SHINANO_3S_PLL	SINGLE	STM32F746xx	NUCLEO-F746ZG	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM32F476_IHM07M1_1S_SHINANO_PLL	SINGLE	STM32L476xx	STM32L476G-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO-F303RE-X-NUCLEO-IHM16M1-GimBal	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM16M1	GimBal
NUCLEO-F446RE_IHM07M1_BULLRUNNING_3S_PLL	SINGLE	STM32F446xC-xE	NUCLEO-F446RE	X-NUCLEO-IHM07M1	BullRunning
NUCLEO-F446RE_IHM07M1_SHINANO_1S_CORDIC	SINGLE	STM32F446xC-xE	NUCLEO-F446RE	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO-F446RE_IHM07M1_SHINANO_3S_CORDIC	SINGLE	STM32F446xC-xE	NUCLEO-F446RE	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO_F103RB_LD_IHM07M1_SHINANO_1S_STO_PLL	SINGLE	STM32F103 Low Density	NUCLEO-F103RB	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO_F103RB_MD_IHM07M1_SHINANO_3S_STO_PLL	SINGLE	STM32F103 Medium Density	NUCLEO-F103RB	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM3210E-EVAL_IHM07M1_SHINANO_1S_ENC	SINGLE	STM32F103 High Density	STM3210E-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM3210E-EVAL_IHM07M1_SHINANO_1S_HALL	SINGLE	STM32F103 High Density	STM3210E-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM3210E-EVAL_IHM07M1_SHINANO_3S_ENC_FF	SINGLE	STM32F103 High Density	STM3210E-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM3210E-EVAL_IHM07M1_SHINANO_3S_HALL	SINGLE	STM32F103 High Density	STM3210E-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO-F303RE-X-NUCLEO-IHM07M1-BullRunning	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM07M1	Bull Running BR2804-1700kv
NUCLEO-F303RE-X-NUCLEO-IHM08M1-Shinano	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM08M1	Shinano LA052-080E3NL1
NUCLEO-F302R8-X-NUCLEO-IHM08M1-Shinano	SINGLE	STM32F301x6/8 - STM32F302x6/8	NUCLEO-F302R8	X-NUCLEO-IHM08M1	Shinano LA052-080E3NL1



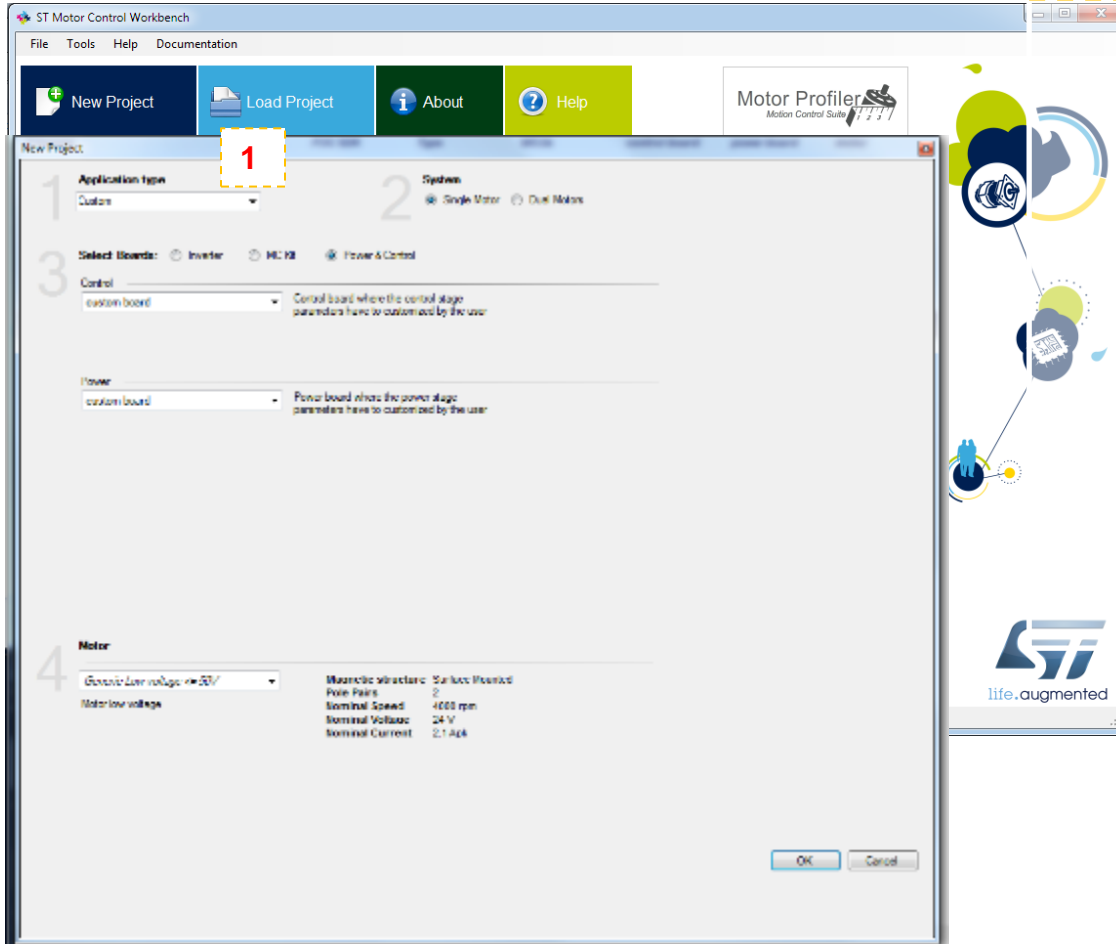
Step #7 – Create a new Workbench project based on the ST evaluation board

Choose:

1. Applications

Application type

- Generic
- Generic
- Pumps
- Compressor
- Air conditioning
- Dish washer
- Fans



Step #7 – Create a new Workbench project based on the ST evaluation board

- Choose the example Workbench project that best fits your needs.
 - Choose the one with the same name of the ST evaluation board you are using, or
 - choose the one with the same microcontroller you are using.

ST Motor Control Workbench

File Tools Help Documentation

New Project Load Project About Help

Motor Profiler
Motion Control Suite

Recent Projects

Filename	Type	MCUs	control board	power board	motor
F446_IHM23V3.stmcx	SINGLE	STM32F446x-xE	NUCLEO-F446RE	STEVAL-IHM023V3	Custom
test52.stmcx	SINGLE	STM32F446x-xE	NUCLEO-F446RE	Custom	Shinano LA052-080E3NL1
LAB_3.stmcx	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM16M1	GimBal
F303_IHM16.stmcx	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM16M1	GimBal
F030_IHM07.stmcx	SINGLE	STM32F030x	NUCLEO-F030R8	X-NUCLEO-IHM07M1	BullRunning

Example Projects

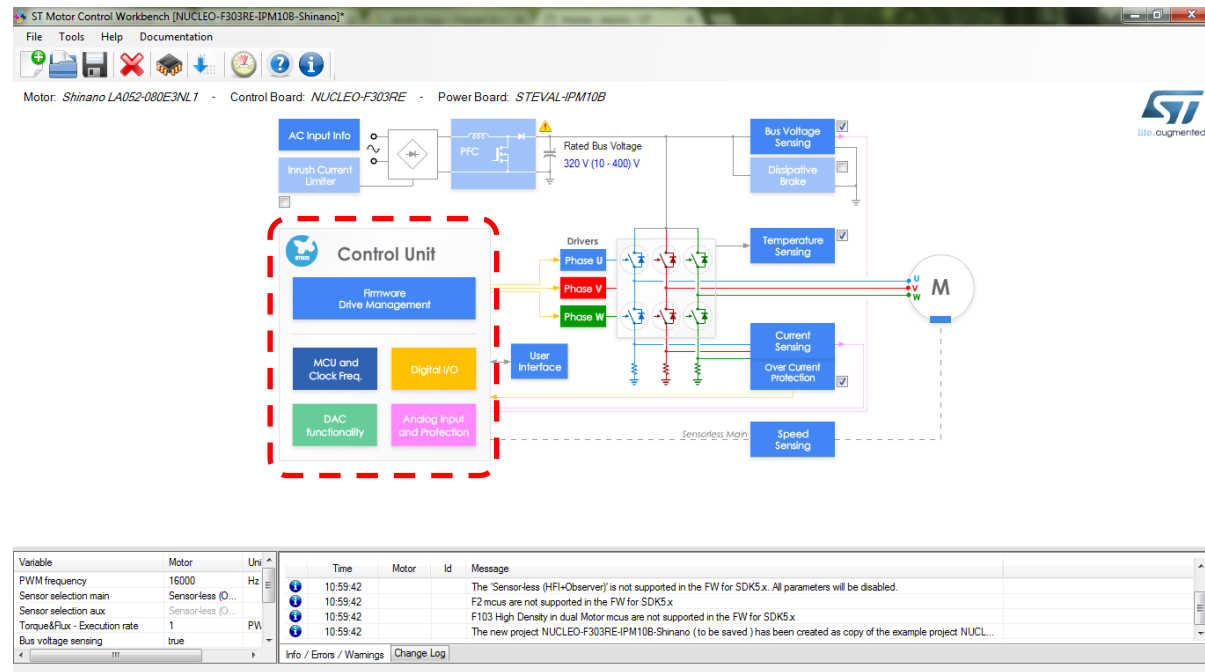
Filename	Type	MCUs	control board	power board	motor
NUCLEO_L452RE_IHM07M1_SHINANO_1S_PLL	SINGLE	STM32L452xx	NUCLEO-L452RE	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO_L452RE_IHM07M1_SHINANO_3S_PLL	SINGLE	STM32L452xx	NUCLEO-L452RE	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO_L476RG_IHM07M1_SHINANO_3S_PLL	SINGLE	STM32L476xx	NUCLEO-L476RG	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO-F746ZG_IHM07M1_SHINANO_3S_PLL	SINGLE	STM32F476xx	NUCLEO-F746ZG	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM32F476_IHM07M1_1S_SHINANO_PLL	SINGLE	STM32L476xx	STM32L476G-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO-F303RE-X-NUCLEO-IHM16M1-GimBal	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM16M1	GimBal
NUCLEO-F446RE_IHM07M1_BULLRUNNING_3S_PLL	SINGLE	STM32F446x-xE	NUCLEO-F446RE	X-NUCLEO-IHM07M1	BullRunning
NUCLEO-F446RE_IHM07M1_SHINANO_1S_CORDIC	SINGLE	STM32F446x-xE	NUCLEO-F446RE	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO-F446RE_IHM07M1_SHINANO_3S_CORDIC	SINGLE	STM32F446x-xE	NUCLEO-F446RE	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO_F103RB_LD_IHM07M1_SHINANO_1S_STO_PLL	SINGLE	STM32F103 Low Density	NUCLEO-F103RB	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO_F103RB_MD_IHM07M1_SHINANO_3S_STO_PLL	SINGLE	STM32F103 Medium Density	NUCLEO-F103RB	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM3210E-EVAL_IHM07M1_SHINANO_1S_ENC	SINGLE	STM32F103 High Density	STM3210E-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM3210E-EVAL_IHM07M1_SHINANO_1S_HALL	SINGLE	STM32F103 High Density	STM3210E-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM3210E-EVAL_IHM07M1_SHINANO_3S_ENC_FF	SINGLE	STM32F103 High Density	STM3210E-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
STM3210E-EVAL_IHM07M1_SHINANO_3S_HALL	SINGLE	STM32F103 High Density	STM3210E-EVAL	X-NUCLEO-IHM07M1	Shinano LA052-080E3NL1
NUCLEO-F303RE-X-NUCLEO-IHM07M1-BullRunning	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM07M1	Bull Running BR2804-1700kv
NUCLEO-F303RE-X-NUCLEO-IHM08M1-Shinano	SINGLE	STM32F303xE	NUCLEO-F303RE	X-NUCLEO-IHM08M1	Shinano LA052-080E3NL1
NUCLEO-F302R8-X-NUCLEO-IHM08M1-Shinano	SINGLE	STM32F301x6/8 - STM32F302x6/8	NUCLEO-F302R8	X-NUCLEO-IHM08M1	Shinano LA052-080E3NL1

It will be today case during

Hands-On
section

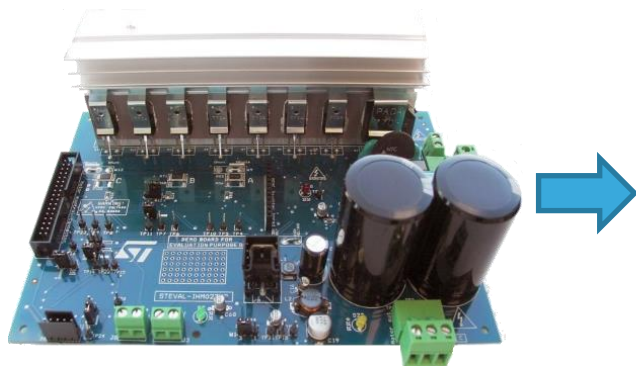
Step #7 – Create a new Workbench project

- Starting from the board selection or example project, the control stage parameters will be populated with the correct values.
- For a custom project, the user can set all the parameters.



Step #7 – Set up power stage

- Starting from the board selection or example project, the power stage parameters will be populated with the correct values.
- For a custom project, the user can set all the parameters.



The screenshot shows the ST Motor Control Workbench software interface. The main window displays a block diagram of the power stage and control unit. The power stage is enclosed in a red dashed box and includes components like AC Input Info, Inrush Current Limiter, PFC, Drivers (Phase U, V, W), Bus Voltage Sensing, Dissipative Brake, Temperature Sensing, Current Sensing, Over Current Protection, and Speed Sensing. The control unit includes Firmware Drive Management, MCU and Clock Freq., Digital I/O, DAC functionality, Analog Input and Protection, and User Interface. The software title bar indicates the project is for a Shinano LA052-080E3NL1 motor on a NUCLEO-F303RE control board and STEVAL-IPM108 power board. The bottom panel shows a variable declaration table and a message log.

Variable	Motor	Unit
PWM frequency	16000	Hz
Sensor selection main	Sensorless (D...)	
Sensor selection aux	Sensorless (D...)	
Torque&Flux - Execution rate	1	PW
Bus voltage sensing	true	

Time	Motor	Id	Message
10:59:42			The 'Sensor-less (HFI+Observer)' is not supported in the FW for SDK5.x. All parameters will be disabled.
10:59:42			F2 mcus are not supported in the FW for SDK5.x
10:59:42			F103 High Density in dual Motor mcus are not supported in the FW for SDK5.x
10:59:42			The new project NUCLEO-F303RE-IPM108-Shinano (to be saved) has been created as copy of the example project NUCL...

Step #7 – Set up drive parameters

- Starting from the board selection according to the chosen application, drive parameters will be populated with the correct values.
- For a custom project, the user can set all the parameters.

Applications

Application type

Generic
Pumps
Compressor
Air conditioning
Dish washer
Fans



The screenshot displays the ST Motor Control Workbench software interface. The main window shows a schematic diagram of a motor control system. The diagram includes an AC input, a PFC (Power Factor Correction) stage, a DC link with a 320V bus, and a three-phase inverter (Phases U, V, W) driving a motor (M). Various protection and sensing blocks are shown, such as Bus Voltage Sensing, Dispersive Brake, Temperature Sensing, Current Sensing, Over Current Protection, and Speed Sensing. A 'Control Unit' block contains Firmware Drive Management, MCU and Clock Freq., Digital I/O, DAC functionality, and Analog Input and Protection. A 'User Interface' block is also present. The bottom of the window shows a table of variables and a log of messages.

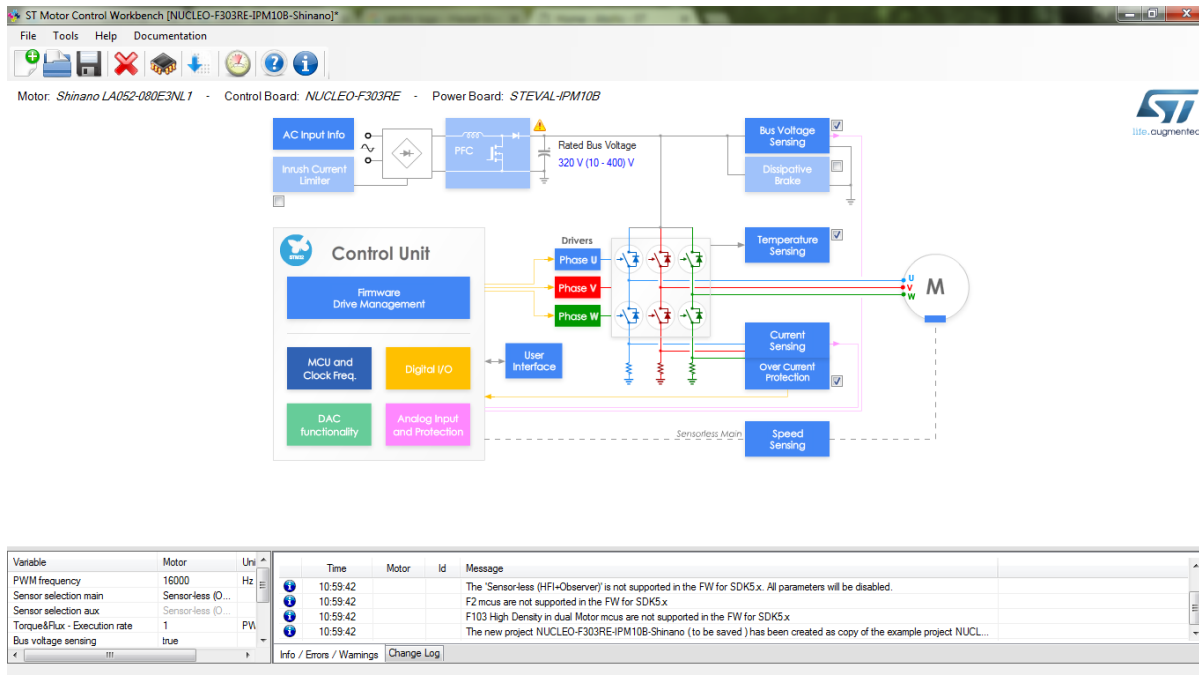
Variable	Motor	Unit
PWM frequency	16000	Hz
Sensor selection main	Sensorless (D...	
Sensor selection aux	Sensorless (D...	
Torque&Flux - Execution rate	1	PW
Bus voltage sensing	true	

Time	Motor	Id	Message
10:59:42			The 'Sensor-less (HFI+Observer)' is not supported in the FW for SDK5.x. All parameters will be disabled.
10:59:42			F2 mcus are not supported in the FW for SDK5.x
10:59:42			F103 High Density in dual Motor mcus are not supported in the FW for SDK5.x
10:59:42			The new project NUCLEO-F303RE-IPM10B-Shinano (to be saved) has been created as copy of the example project NUCL...

Step #7 Finalizing the firmware

1/5

ST MC Workbench

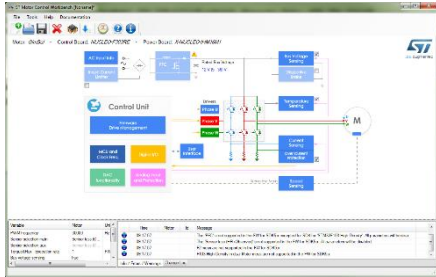


- Open the ST MC Workbench and create a new project.

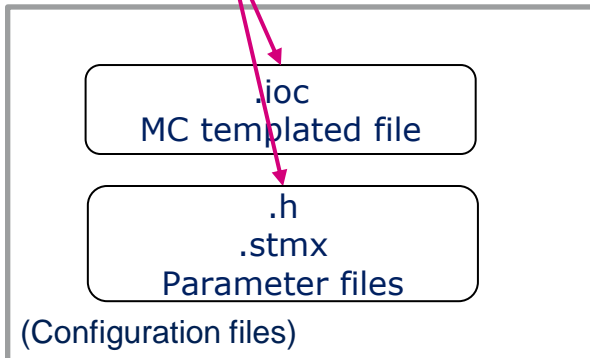
Step #7 - Finalizing the firmware

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ST MC Workbench



SDK

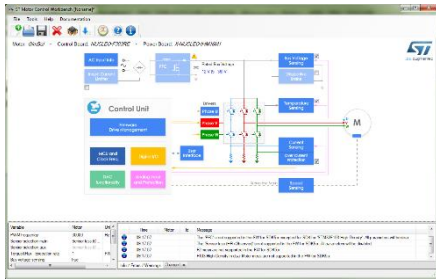


- Generate the configuration (.h) files, (.stmx) Project file and (.ioc) templated file for the firmware library.

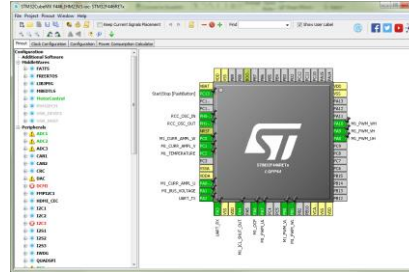
Step #7 - Finalizing the firmware

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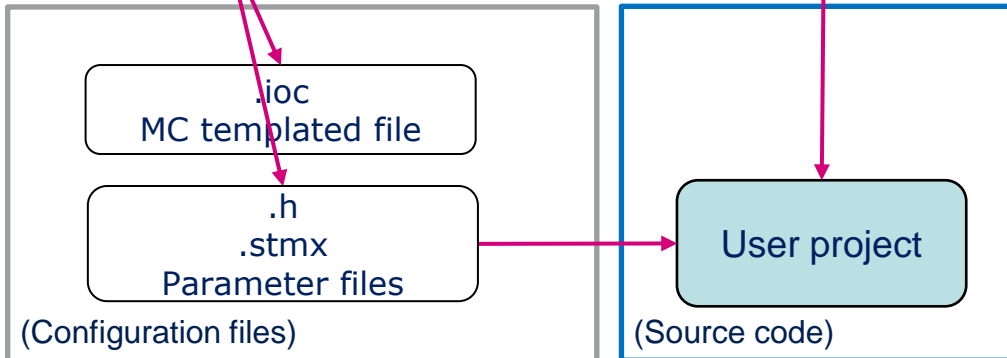
ST MC Workbench



STM32CubeMX



SDK



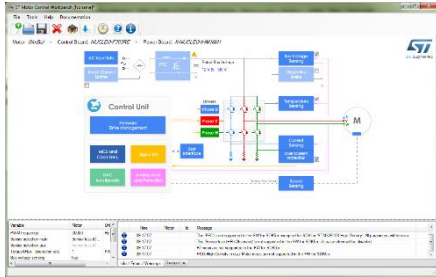
- The STM32CubeMX generated project with Motor Control library in selected IDE

Step #7 - Finalizing the firmware

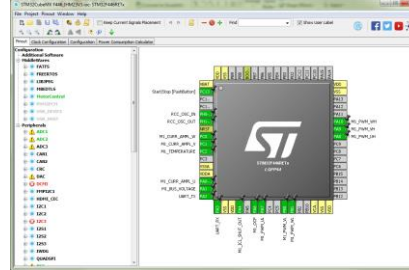
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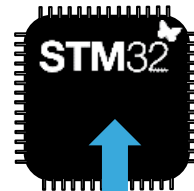
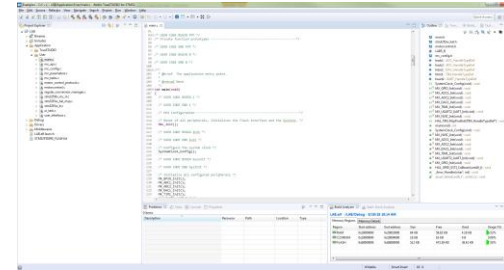
ST MC Workbench



STM32CubeMX

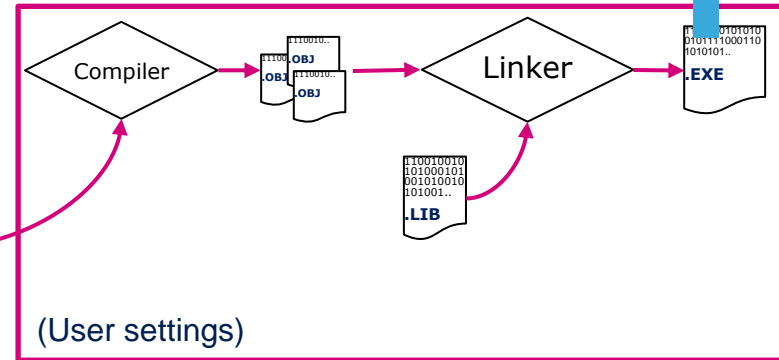
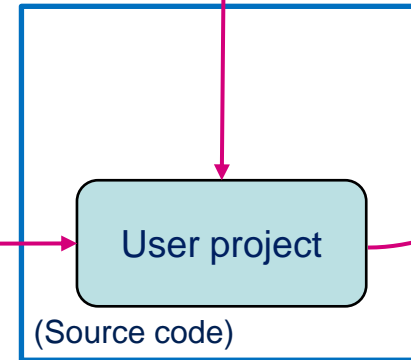
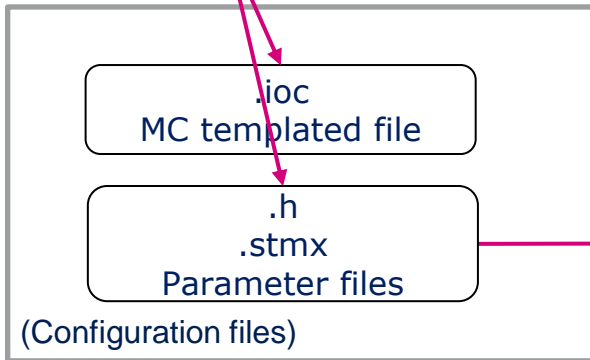


IDE



ST-LINK

SDK



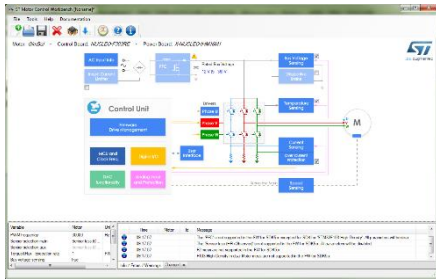
- Compile and flash the executable into the microcontroller using ST-LINK (see Step #10).

Step #7 - Finalizing the firmware

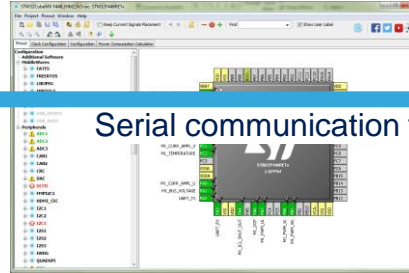
5/5

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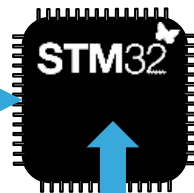
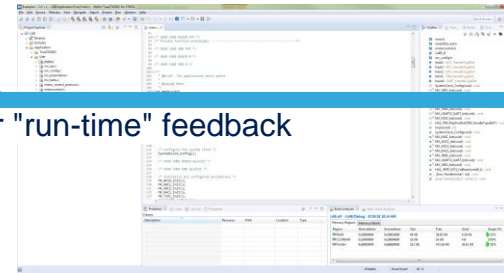
ST MC Workbench



STM32CubeMX



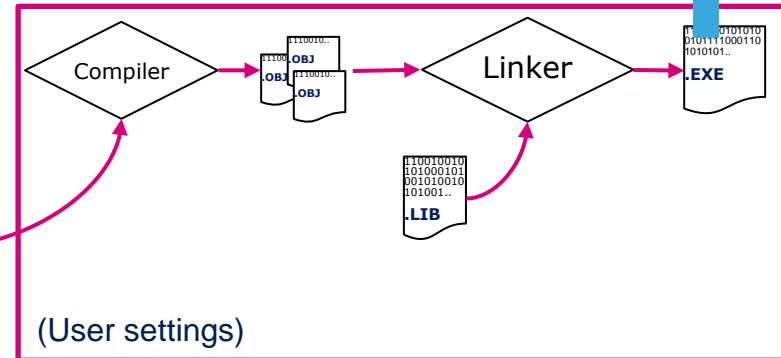
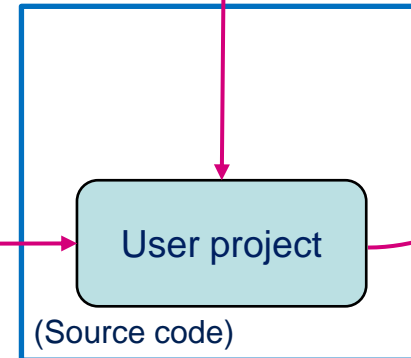
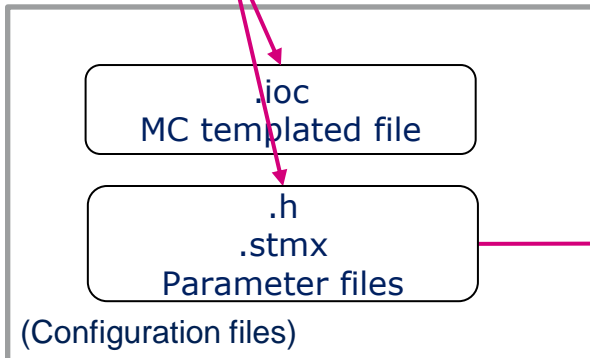
IDE



ST-LINK

Serial communication for "run-time" feedback

SDK



- Establish a real-time communication with the firmware using the monitor feature of ST MC Workbench to start the motor, set the speed and get feedback (see Step #12).

Step #8 – Set up motor parameters manually

- Set **Max Rated Speed** with the maximum motor speed according to the application specs.
- Set **Nominal Current** with maximum peak current provided to each of the motor phases according to the motor specs.
- Set **Nominal DC Voltage** with value of DC bus provided to the inverter or the rectified value of AC input.

Motor - Parameters

Motor Sensors

Magnetic structure: Surface Mounted PMSM

Electrical parameters

Pole Pairs	4	
Max. Application Speed	5000	rpm
Nominal Current	2.95	Apk
Nominal DC Voltage	325.0	V
Rs	2.70	Ohm
Ls	8.440	mH
B-Emf constant	24.7	Vms/krpm
Inertia	5.118	uN*m*s2
Friction	12.130	uN*m*s

Save parameters Done

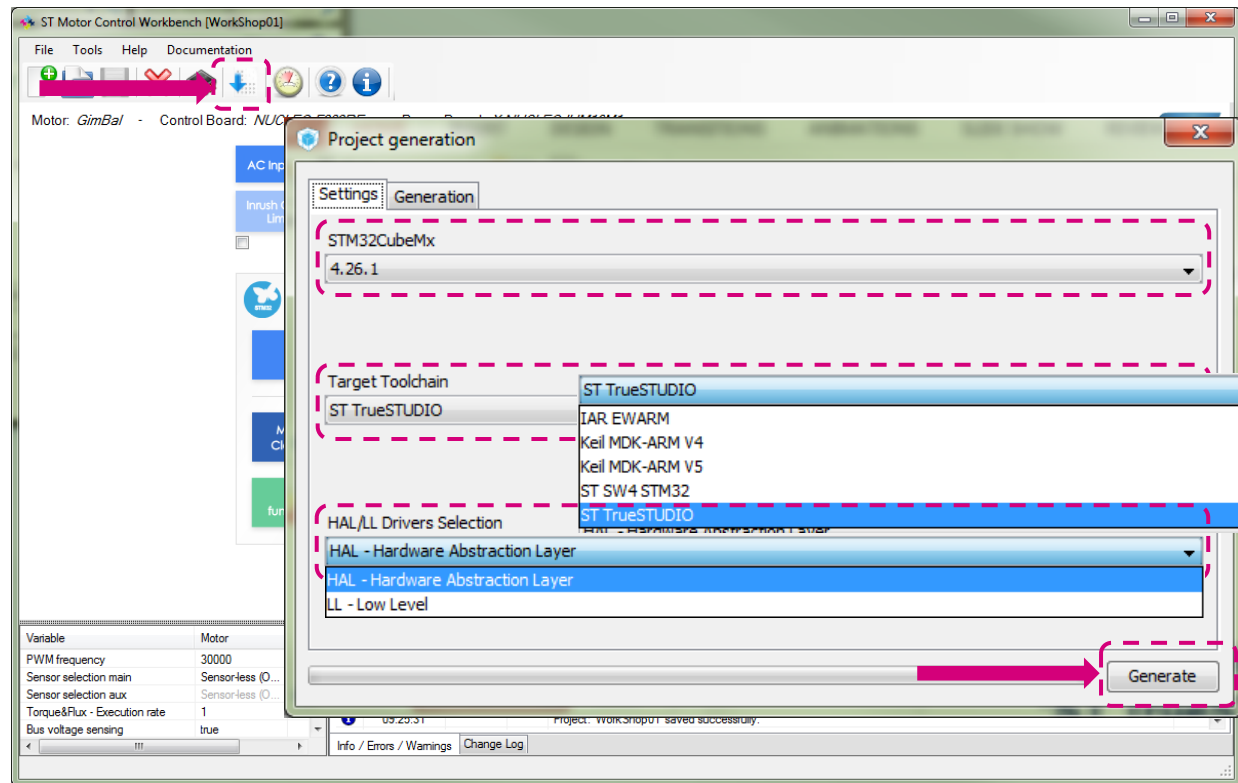


Generate, compile, debug and run

Step #9 – Parameter generation

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- Select the proper version of STM32CubeMX - “**4.26.1**” or newer!
- Select Target toolchain “**ST TrueSTUDIO**”
- Select driver HAL/LL “**HAL**”
- Click on button **Generate**

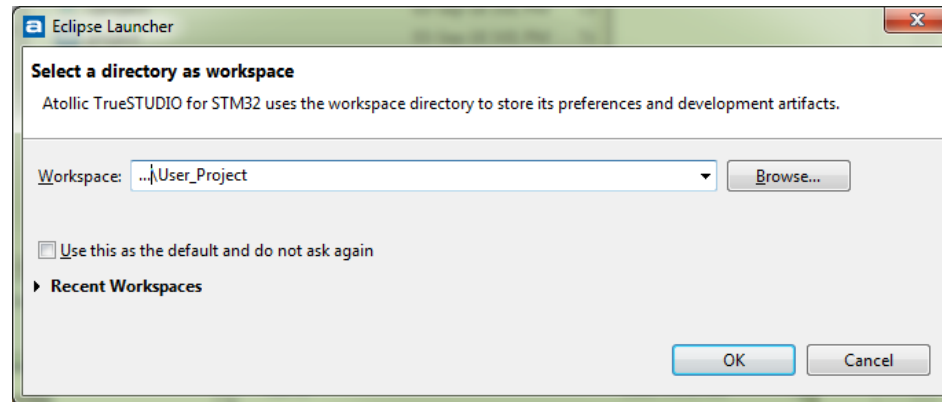


Step #10 – Compile and program the MCU

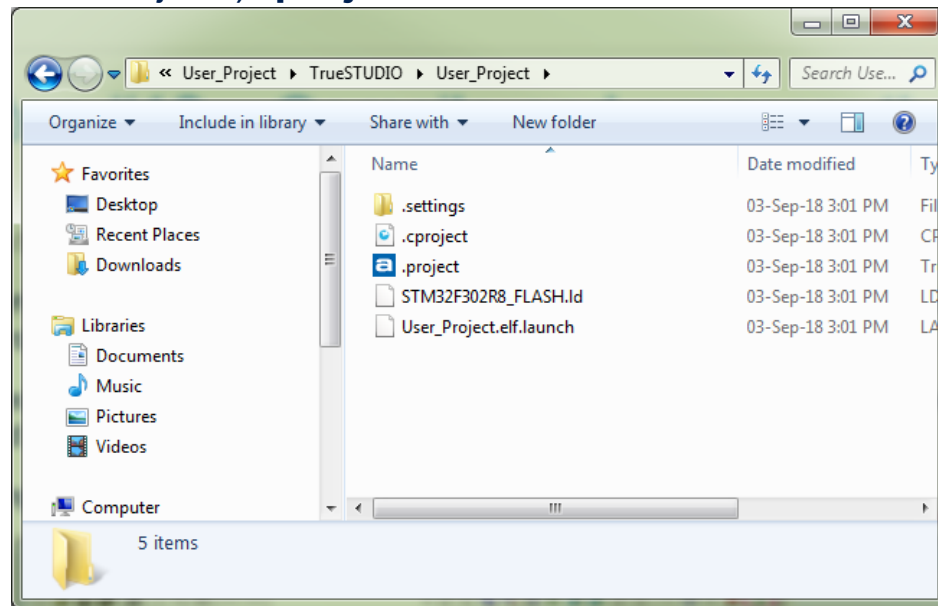
TrueSTUDIO 1/2

- Run the TrueSTUDIO  [Atollic TrueSTUDIO for STM32 9.0.0](#)

- Select your workspace



- Open the TrueSTUDIO workspace (located in `User_Project\TrueSTUDIO\User_Project\`) **.project**



Step #10 – Compile and program the MCU

TrueSTUDIO 2/2

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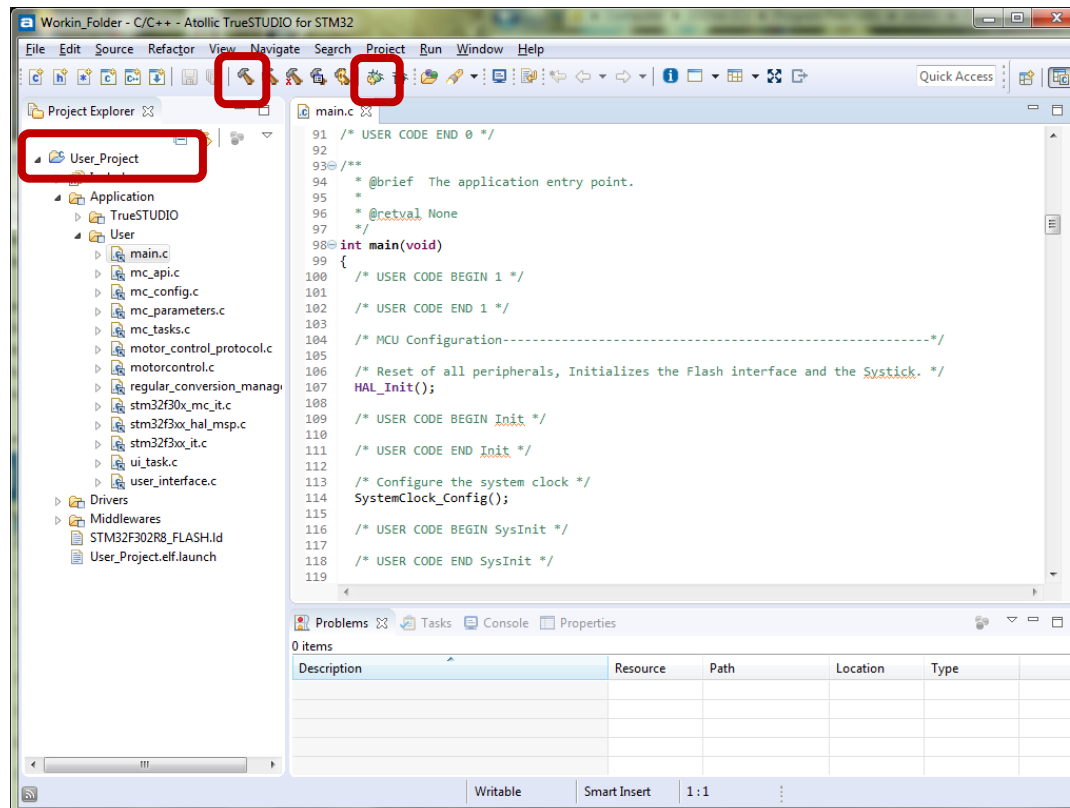
- Select project WorkShop01 and click on the button **“Build”**  or **Ctrl+B**

Build 'Debug' for project 'MC_WorkShop_01'

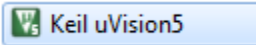
- Click on the button **“Debug”**  or **F11**

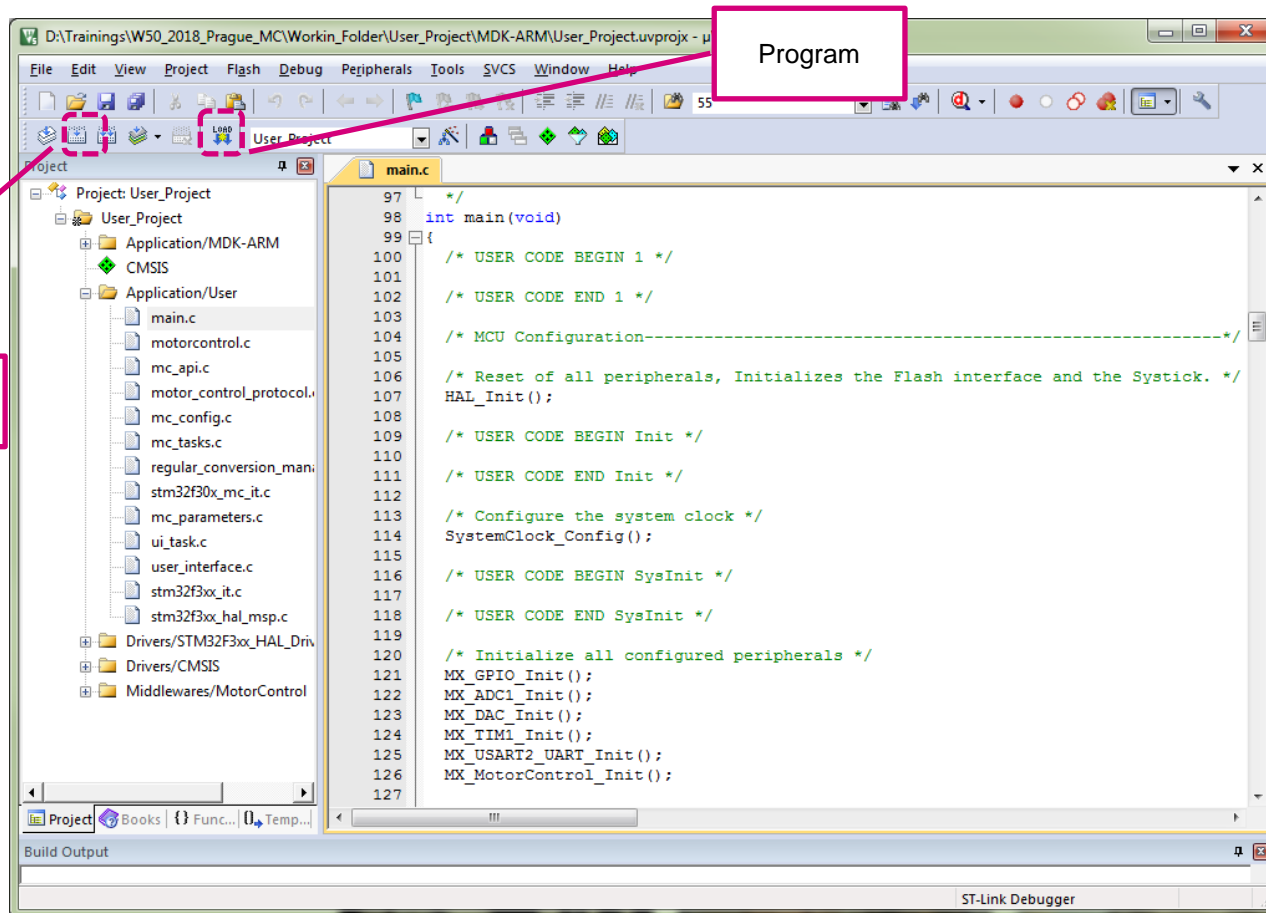
Debug

- After downloaded click on the **“Terminate”**  or **Ctrl+F2**




Step #10 – Compile and program the MCU

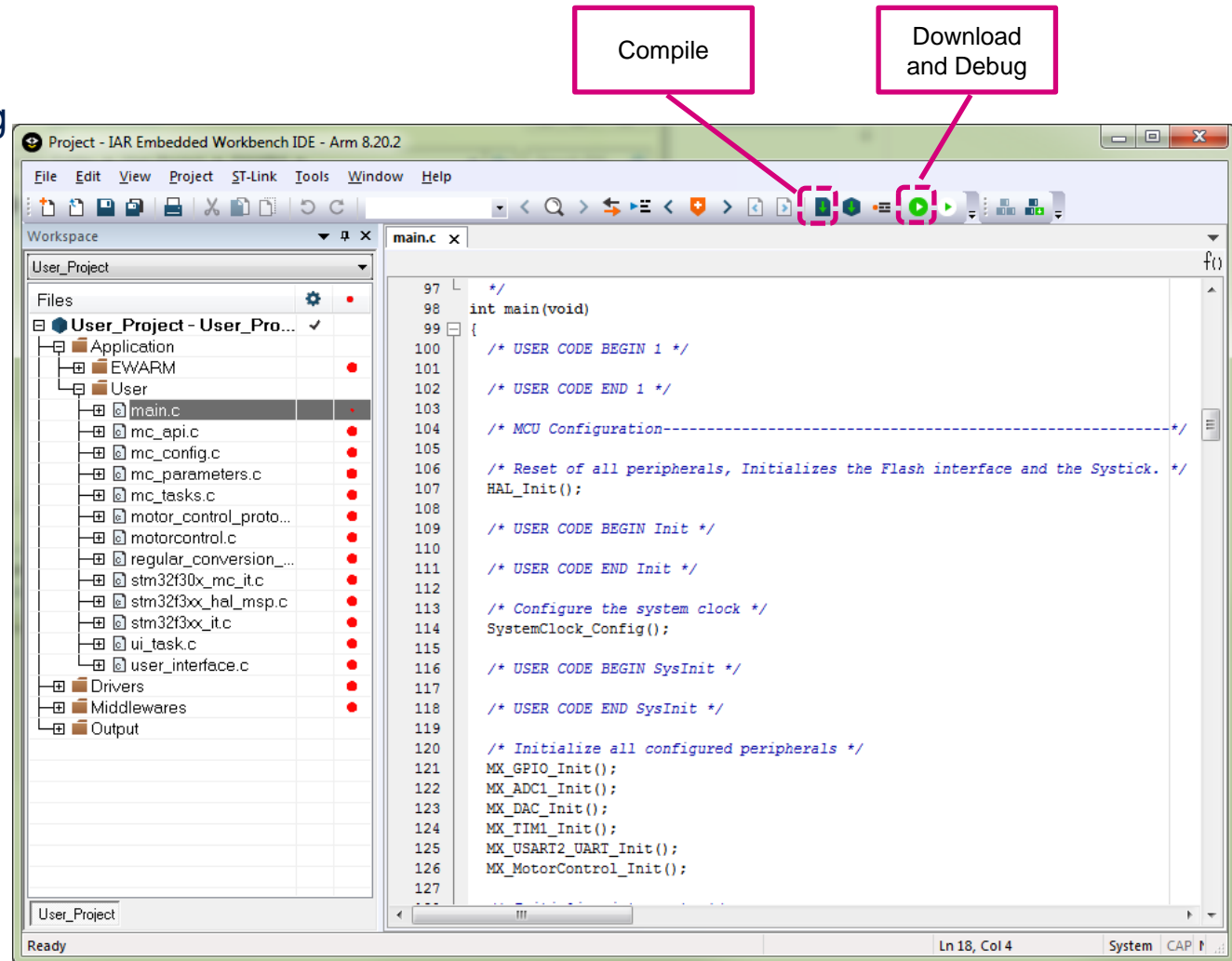
- Optionally, run Keil uVision. 
- Open the Keil workspace (located in User_Project\MDK-ARM) **User_Project.uvprojx**
- Compile and download.



Step #10 – Compile and program the MCU

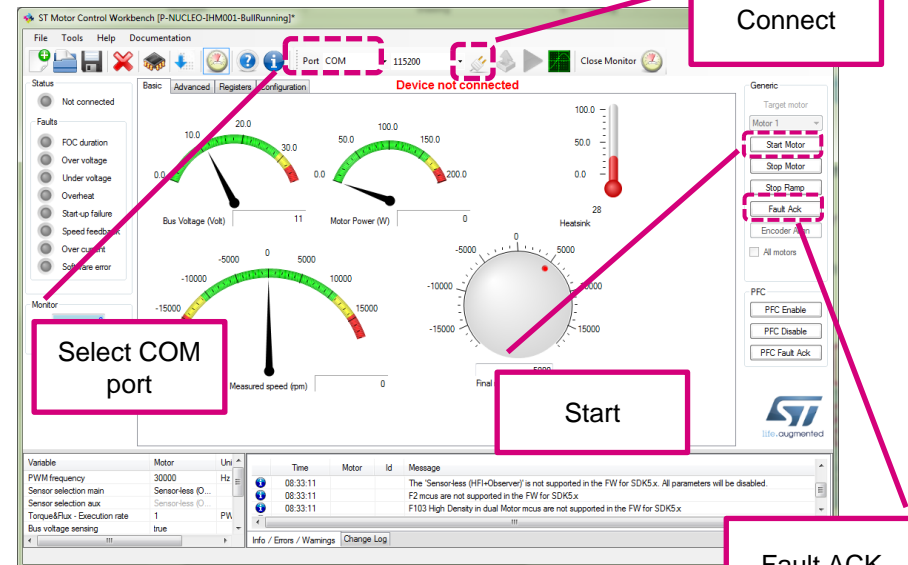
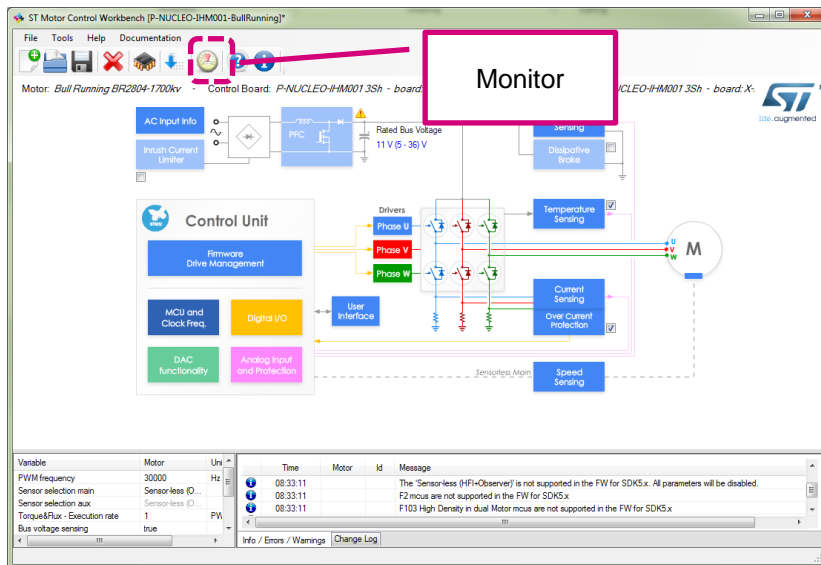


- Run the IAR Embedded Workbench.  IAR Embedded Workbench
- Open the IAR workspace (located in User_Project\EWARM)
- Compile
- Download and Debug



Step #13 – Run the motor

- Optionally you can start the motor using the ST MC Workbench.
- Connect the PC to the control board with the USB to RS-232 dongle (and a null modem cable).
- Open the Workbench project used to configure the firmware and click on *Monitor* button.
- Select the *COM port* and click *Connect* button. This establish the communication with the firmware.
- To clear the fault, click *Fault Ack* and then *Start Motor* button to run the motor.



Thanks

