

# Getting Started with iMOTION™ Solution Designer

December 2022  
Infineon Technologies AG



## iMOTION™ Solution Designer



.. is an **integrated GUI-based tool** for iMOTION™ motor control solutions entire development process to replace MCEWizard and MCEDesigner

.. **simplifies** the use and design of inverterized drives through **catalog files**

.. includes **configuration, customization, programming, and tuning** for users during the development phase

.. supports **in-app updates** for **SD packs** (FW / GUI definition, board database...) and **configuration files**

.. contains an **oscilloscope tool** to debug/tune motors and is **not an IDE** like Keil, IAR, or a multi-platform development tool with GitHub-hosted firmware libraries like Modus Toolbox

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# Installing iMOTION™ Solution Designer

- › Infineon Developer Center Launcher (to manage Infineon tools)
  - <https://www.infineon.com/cms/en/tools/landing/infineontoolbox.html>
  - Please [register here](#) at myInfineon for exclusive information and tips for projects
- › iMOTION™ Solution Designer installation executable.
  - <https://softwaretools.infineon.com/tools/com.ifx.tb.tool.imotionsolutiondesigner>





## iMOTION™ Solution Designer

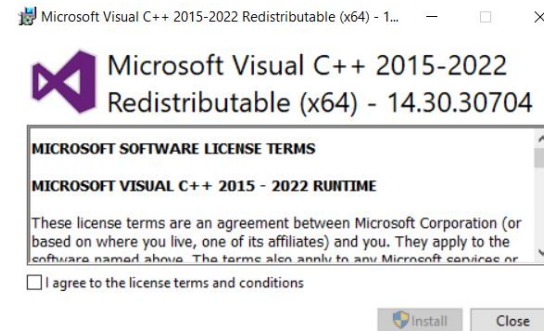
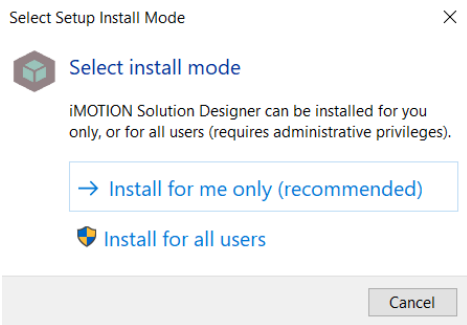
Solution Designer bundles all PC based support functions related to setting up and running iMOTION™ products. This includes the configuration, programming and live tuning using configurable oscilloscopes as well as script editing and debugging.

Install

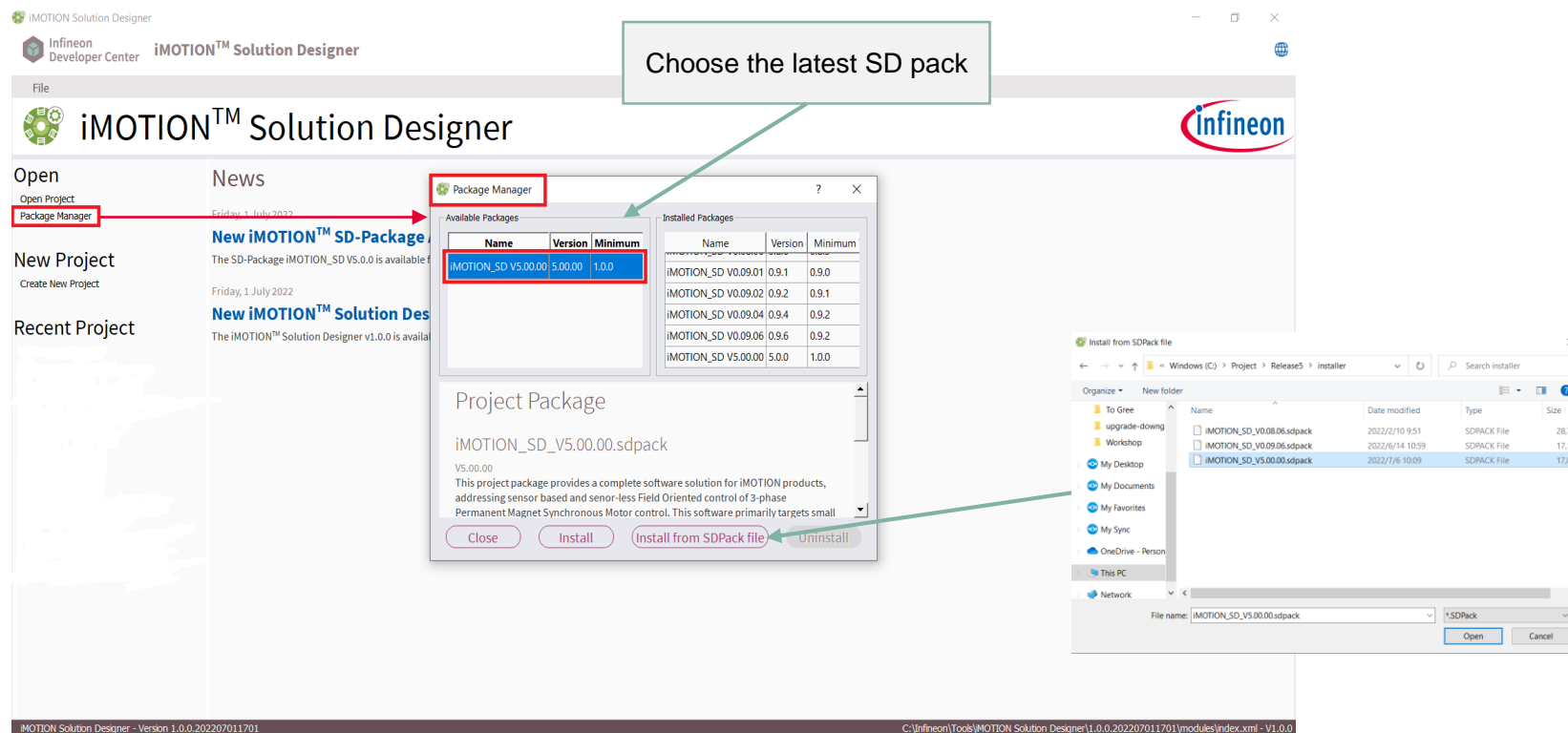
Download ▼

- › Follow installation directions and unzip software package
  - It is recommended users shall enable local administrator rights to ensure smooth installation process.
  - Installation tool will automatically install the driver for J-link and Microsoft Visual C++ during the installation process.



# Installing SD pack

- › Open the **iMOTION™ Solution Designer**, then the **Package Manager**.
- › Check and update the necessary SD pack(s).

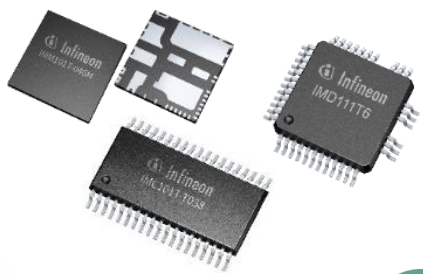
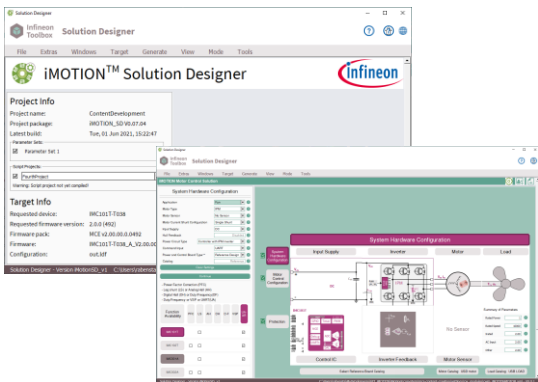


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# iMOTION™ Solution Designer Workflow



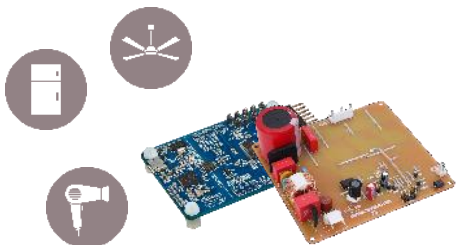
1. Define your setup by Application/Board/...

2. Configure the System

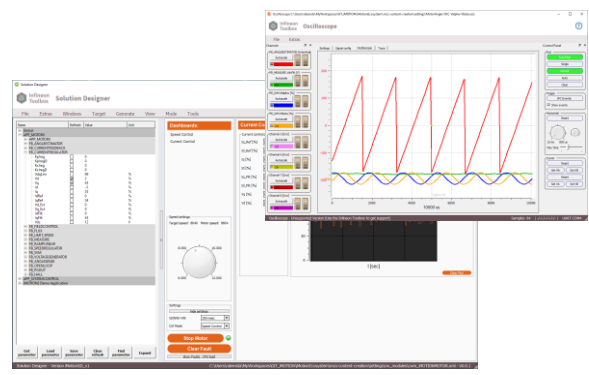
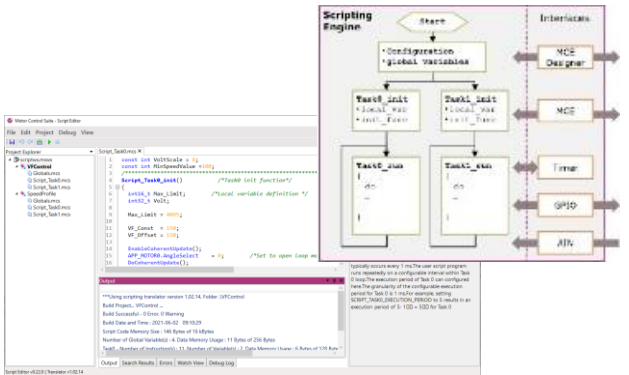
3. Develop a Script (optional)

4. Load the Firmware to the Target

5. Tune the Control Loop



Poles, R, L, ...



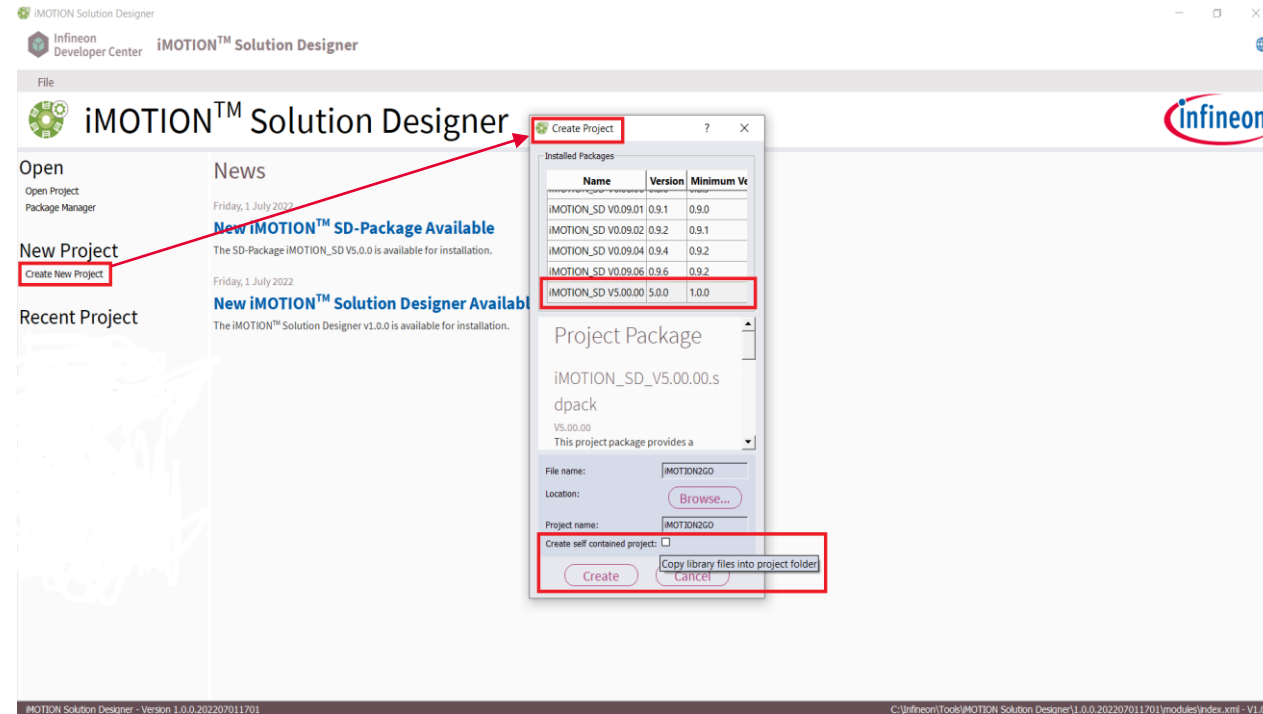


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# Create new Project

- › Create a new project based on the installed SD pack and enter the following information:
  - File name / Location / Project name
- › (Optional) Check **Create self contained project**, allowing easier distribution of the project files to other iSD users.



# Initial project configuration

## 3 ways to start a new project

### 1. Board catalog files

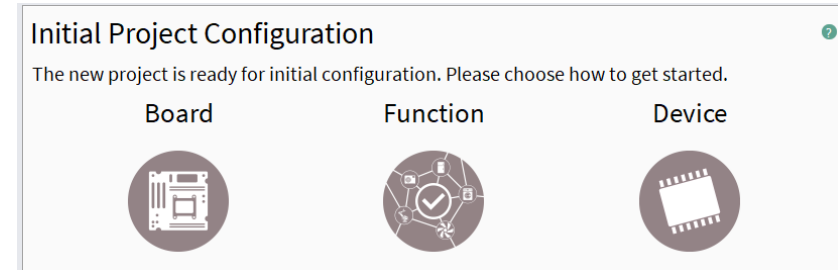
- MADK boards
- Reference design boards
- Customer's boards

### 2. Function selection

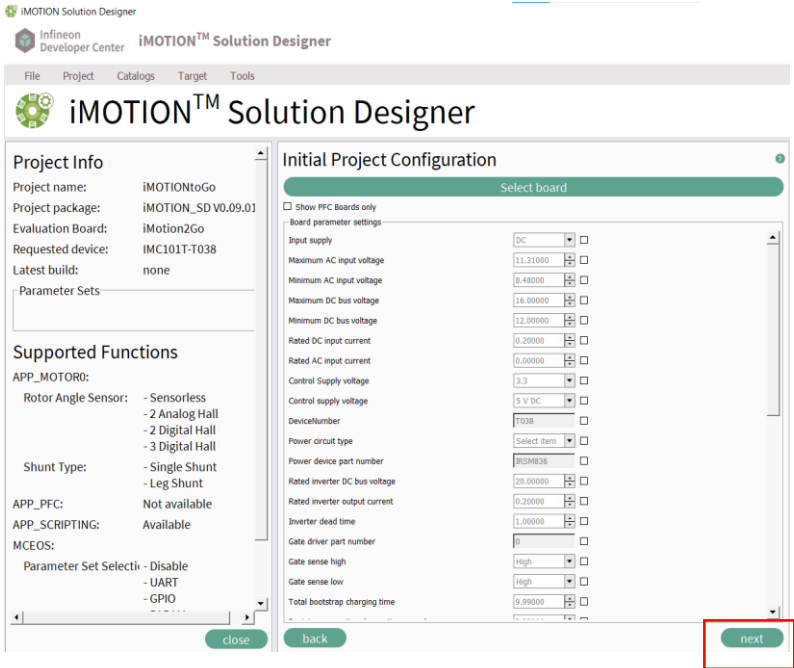
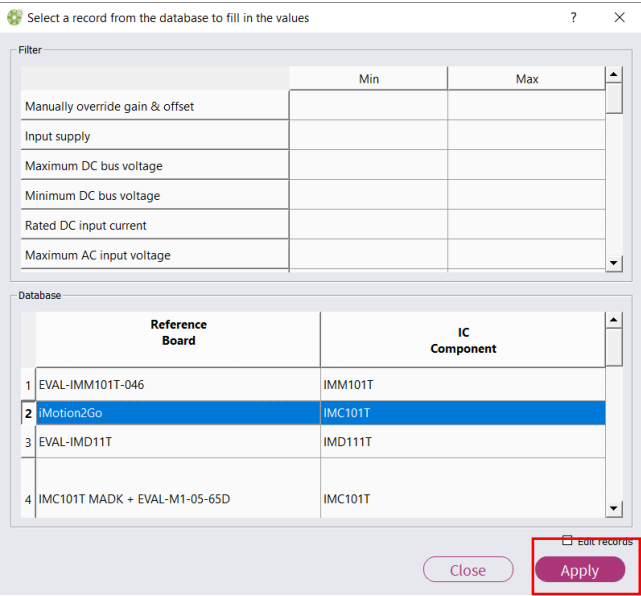
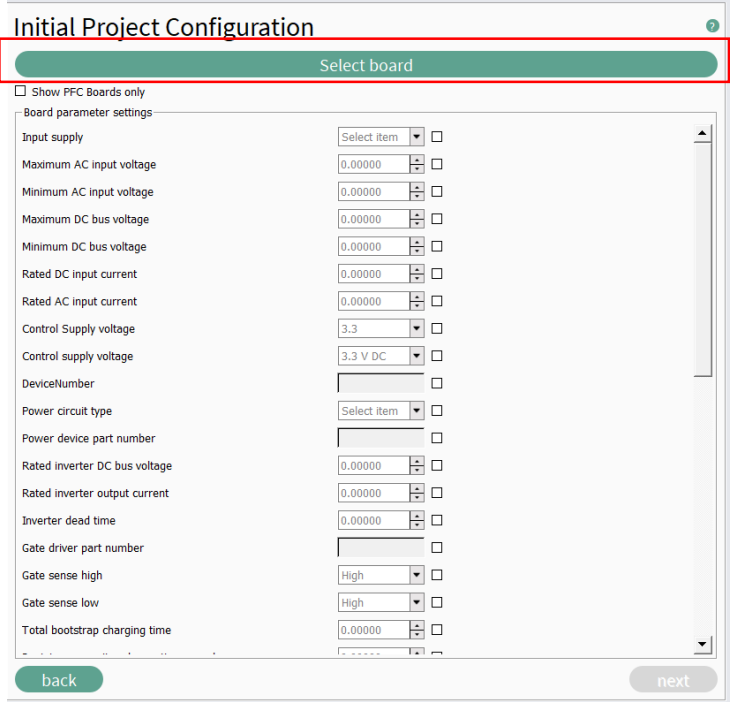
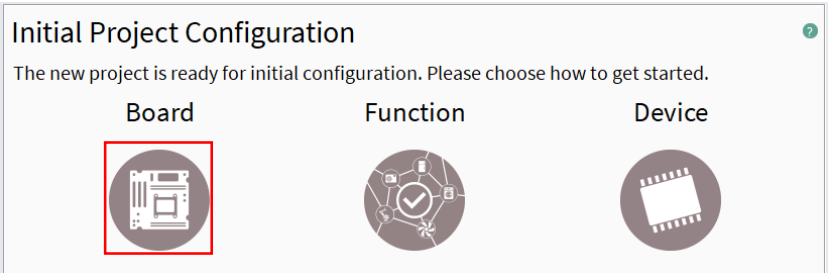
- Communication interface
- Parameter selection method
- GPIO / analog input requirement
- Sensorless / analog Hall / digital Hall
- Current sense type
- PFC frontend
- Scripting

### 3. Device selection

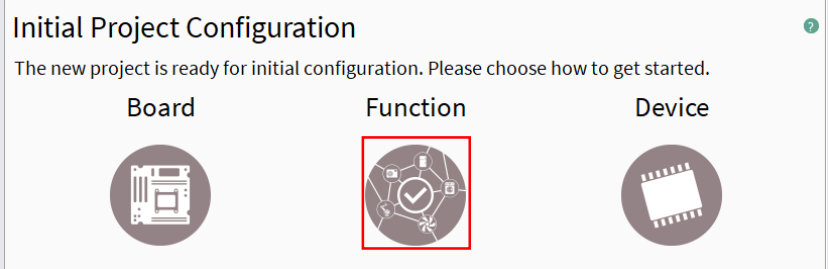
- iMOTION™ Controller
- iMOTION™ Driver
- iMOTION™ IPM



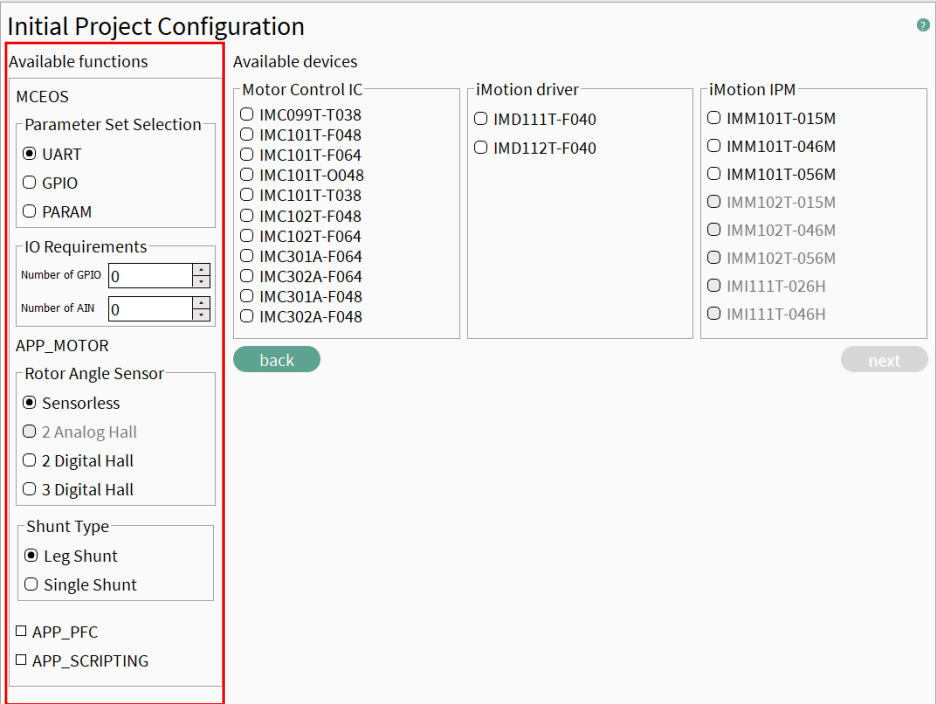
# Initial project configuration – Board Catalog Files



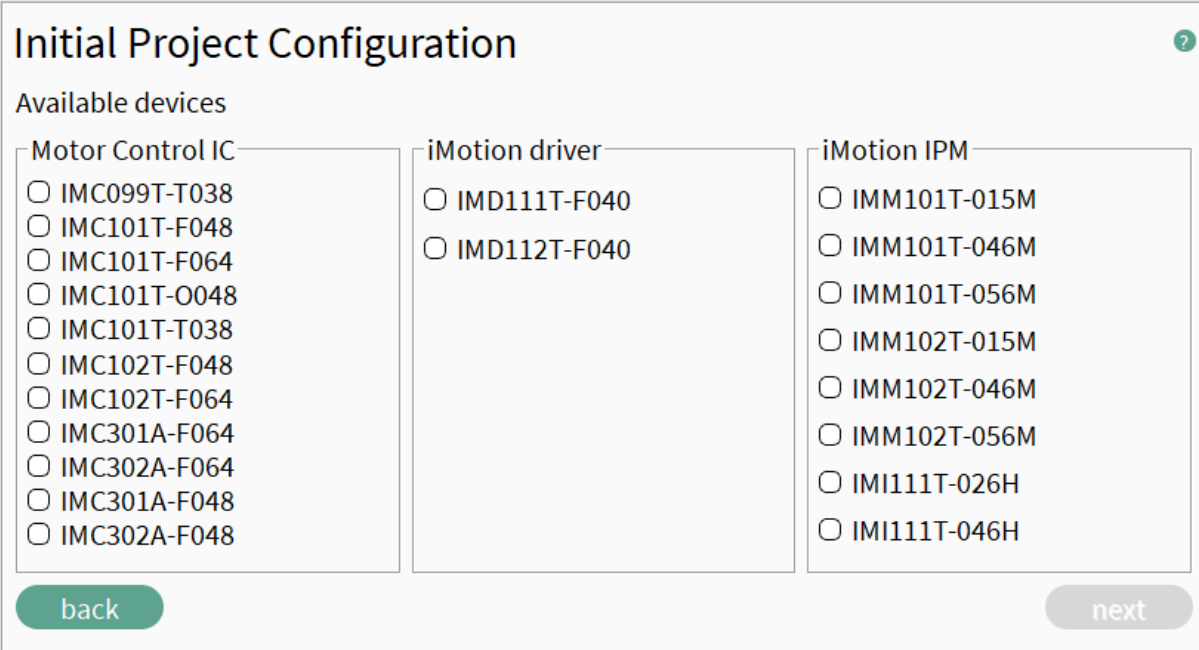
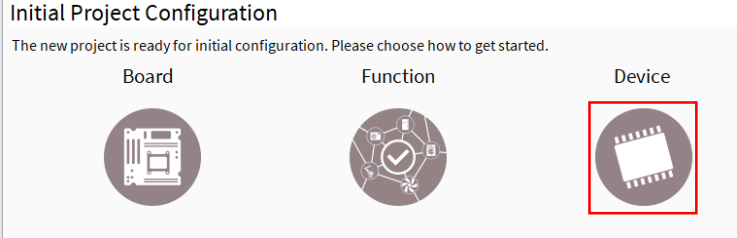
# Initial project configuration - Function selection



Choose required functions



# Initial project configuration - Device selection



Select the target device

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# iMOTION™ Solution Designer: Parameter Configuration Wizard

The screenshot shows the iMOTION Solution Designer interface with several annotations:

- Title Bar:** iMOTION Solution Designer, Infineon Developer Center, iMOTION™ Solution Designer
- Menu Bar:** File, Project, Catalogs, Target, Tools
- Parameter Configuration:** White background box -> can be changed; Green background box -> changed; Gray background box -> read only
- Detailed Help Doc:** is populated by clicking the green question mark
- Shortcut Key:** A toolbar with icons for various functions.
- Mode Switch:** A button in the top right corner.
- Explorer:** A sidebar on the left with sections: Global Configuration (IC Configuration, Scripting), Parameter Set Configuration (myFirstParameterSet), System Hardware Configuration (Input Supply, DC Bus Sensing Feedback, Inverter, Motor Current Sensing, Motor, Load), Motor Control Configuration (Motor Control Configuration, Control Regulators, FOC and Inverter, Application, Angle Feedback), and Protection.
- Input Supply Parameters:** A table with the following data:
 

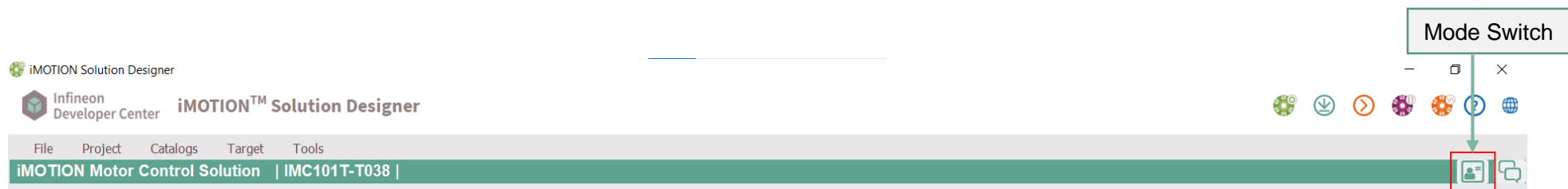
Parameter	Value
Input supply	DC
Maximum DC bus voltage	16.0 V
Minimum DC bus voltage	12.0 V
Control supply voltage	5 V DC
ADC gain	819.00 Count/V
- Input supply:** A diagram showing three input supply configurations: DC, AC, and PFC. The text states: "The input supply is defined to be either DC or AC rectifier or AC with PFC."

A callout box on the left states: "Different parameter sets based on the same set of global configurations" with an arrow pointing to the Explorer sidebar.





# Parameter Configuration Wizard: Normal vs. Expert Mode



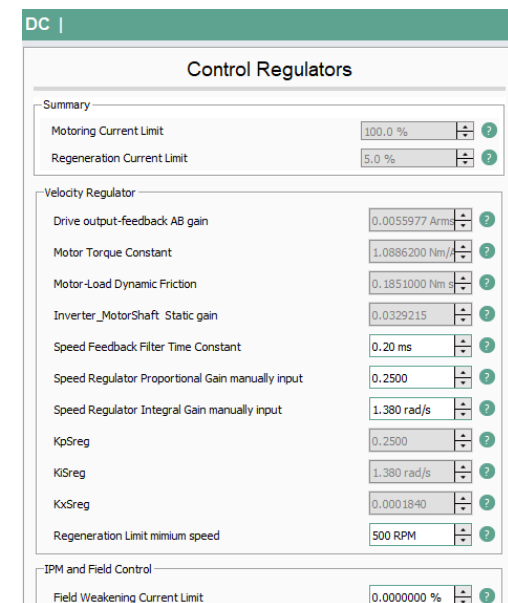
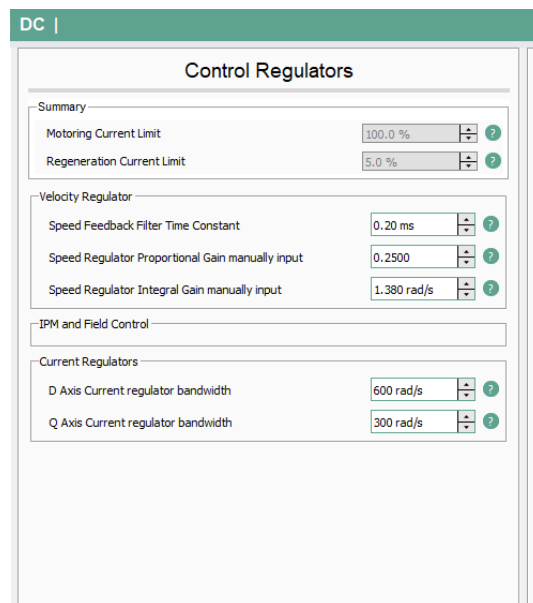
## Normal Mode

Shows the most commonly used and required parameters only



## Expert Mode

Opens up the full parameter tree for more detailed settings





# Parameter Configuration Wizard in Explorer View: Motor Control

## 5 top level parameter groups

### 1. IC Configuration

- General IC configuration
- ADC, UART, Class B, Clock compensation, Control input method

### 2. GPIO & analog input resource configuration for scripting

- Scripting related settings

### 3. System hardware configuration

- System (inverter/board related settings)
- Input supply, DC bus sensing, Inverter and feedback, Motor, Load

### 4. Motor control configuration

- Motor specifics
- Motor control configuration, Control regulators, FOC and inverter, Application (start-up method...), Angle feedback

### 5. Protection

- Motor and system protection
- UART Link Break, CPU Execution Fault, Parameter load fault

Input Supply Parameters	
Summary	
Input Supply	DC
Maximum DC bus voltage	16.5 V
Minimum DC bus voltage	12.0 V

- > Hierarchical configuration tree with logical parameter grouping
- > Integrated parameter help



# Parameter Set Configuration – 3. System Hardware Configuration

The screenshot displays the iMOTION Solution Designer interface for the 'iMOTION Motor Control Solution | IMC101T-T038'. The 'System Hardware Configuration' step is active, with the 'Input Supply' category selected. The 'Input Supply Parameters' table is highlighted with a red box:

Input Supply Parameters	
Summary	
Input supply	DC
Maximum DC bus voltage	19.9 V
Minimum DC bus voltage	12.0 V
ADC	
Control supply voltage	5
ADC gain	819.00

To the right, the 'Maximum DC bus voltage' section explains that these parameters are used for system validation and includes a schematic diagram of a DC supply circuit.

On the left, the 'Explorer' pane shows the configuration tree with 'Input Supply' highlighted. A callout box with arrows pointing to the 'Input Supply' and its sub-items (DC Bus Sensing Feedback, Inverter, Motor Current Sensing, Motor, Load) contains the text: 'Go through all categories of the System Hardware Configuration step by step'.



# Parameter Set Configuration – 4. Motor Control configuration

The screenshot displays the iMOTION Solution Designer interface. The main window is titled "iMOTION Motor Control Solution | IMC101T-T038 |". The left sidebar shows the "Explorer" with "Motor Control Configuration" selected. The central pane shows the "Motor Control Configuration" settings, which are highlighted with a red box. The settings include:

- Control Rates:
  - PWM frequency: 20.0 kHz
  - Current control update rate scaler: 1
  - Total CPU load: 75.2 %
- Control Modes:
  - Motor control modes: Speed Control

The right pane shows a diagram titled "PWM frequency" with the text: "This input specifies the update rate of the inverter gate drive signals. The entry directly determines switching frequency of the inverter and indirectly determines the update rates of the current- and speed control loops (sub-rates)." The diagram illustrates the relationship between PWM Update Rate, Current Control Update Rate, and Speed Control Update Rate, with two "DIV" blocks representing dividers.

Go through **all** categories of the Motor Control Configuration step by step

- Motor Control Configuration
- Control Regulators
- FOC and Inverter
- Application
- Angle Feedback
- Protection
  - Motor Protection
  - System Protection



# Parameter Set Configuration – 5. Protection

iMOTION Solution Designer

Infineon Developer Center iMOTION™ Solution Designer

File Project Catalogs Target Tools

iMOTION Motor Control Solution | IMC101T-T038 |

**Explorer**

Global Configuration

IC Configuration

Scripting

Parameter Set Configuration

myFirstParameterSet

System Hardware Configuration

Motor Control Configuration

Motor Control Configuration

Control Regulators

FOC and Inverter

Application

Angle Feedback

Protection

Motor Protection

System Protection

**Motor Protection**

Over Current Protection

Overcurrent trip signal source selection: Both

Overcurrent fault enable:

GKPIN fault fault enabled:

Overcurrent comparator current trip level (peak): 0.32 A

Overcurrent comparator voltage trip level: 1099.67 mV

Gatekill filter window: 1.00 us

Voltage Protection

Critical overvoltage fault enable:

DC bus critical overvoltage fault level: 19.0 V

Overvoltage fault enable:

DC bus overvoltage fault level: 18.0 V

Undervoltage fault enable:

DC bus undervoltage fault level: 9.0 V

Flux Fault

Flux out-of-control fault enable:

NTC

Over temperature fault enable:

NTC voltage threshold for an overtemp fault: 1.0 V

Rotor Lock Protection

Rotor lock fault enable:

Phase Loss Protection

Phase loss fault enable:

Current Offset Protection

Current offset fault enable:

Hall Fault

Fault Retry

**Overcurrent comparator current trip level (peak)**

OverCurrent Comparator Trip Level

This parameter specifies the OCP current threshold at which OCP fault would be detected. The Solution Designer calculates the corresponding OCP voltage threshold needed to be generated by an ADC composed of an internal sigma-delta modulator and an external capacitor C<sub>Filter</sub> at REFU pin. This OCP voltage threshold is determined from the gain and offset of the external current measurement circuit.

Warning: setting this value too high may lead to power device destruction or motor demagnetization.

$REFU = V_{offset} + G_{ol} \times R_s \times I_{trip}$

$V_s = I_s \times R_e$

Go through all categories of the Protection Configuration step by step



# Parameter Verification

## Parameter Verification

- › Verification results are shown in the following color code:
  - ✔ Success
  - ⚠ Warning
  - ❗ Error (**must** be corrected before proceeding and turns dark orange when selected)
- › Guidelines are shown for why the error or warning occurred
- › Visually directs you to the parameter in question

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## Script Editor and Debugger

### › Script editor

- Runtime syntax checking
- Project management
- Keyword highlighting and auto completion
- Online help system

### › Script translator

- Integrated script code compilation
- Optimized byte code generation to reduce code size and execution time
- Enhanced data memory usage, supports 8, 16 and 32 bit integer variable type
- 256 Byte memory allocated for global variables and 128byte data memory for local variables

### › Script debugger

- Support for break points, variable watch window, and execution control

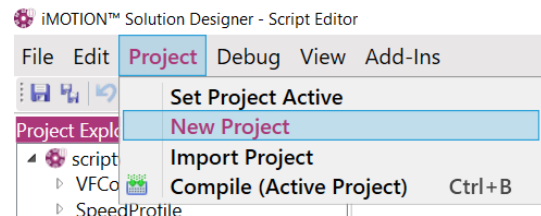
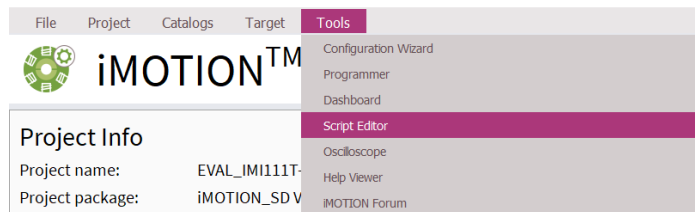
The screenshot shows the iMOTION Script Editor interface. The **Menu Bar** includes File, Edit, Project, Debug, View, and Add-Ins. The **Tool Bar** contains icons for All tasks, Task0, and Task1. The **Project Explorer** on the left shows a tree view with folders like VFControl and Temperature\_protection, and files like Globals.mcs, Script\_Task0.mcs, and Script\_Task1.mcs. The **Editor Area** displays a script for `Script_Task0.mcs` with syntax highlighting and comments. The **Property Window** on the right shows build actions like 'Build' and 'Compile'. The **Output** window at the bottom shows build logs. A **Tool Version** label points to the status bar at the bottom left, which reads 'Script Editor v0.92.0 | Translator v1.50.0'. A callout box at the bottom right lists window management options: 'Change Windows between' followed by 'Output Window (Build Summary)', 'Search Result', 'Error Window (Compiler and Syntax error)', and 'Variable Watch Window (in Debug Mode only)'.



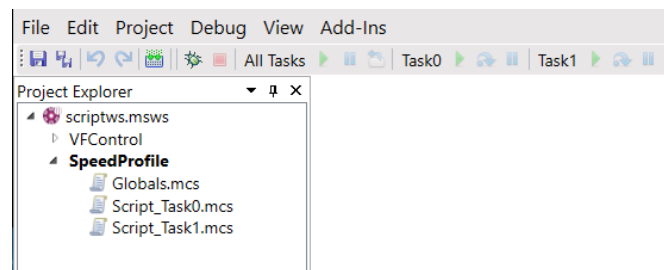


# Script Editor – Step by step

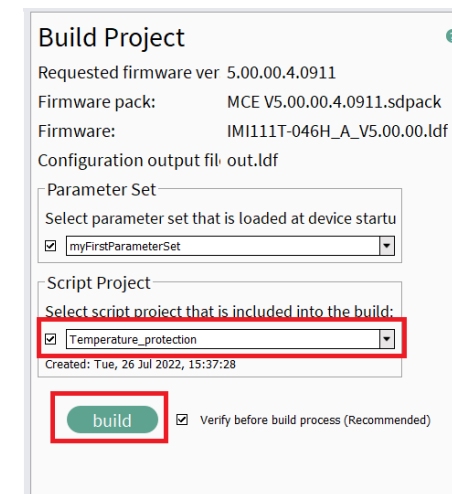
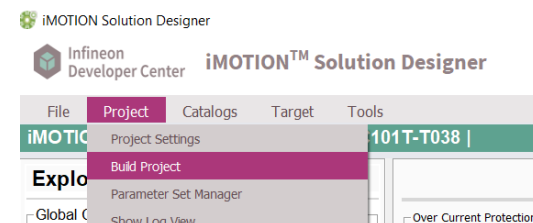
- › After opening the Script Editor, a new Script Project **must** be created.



- › The Script development process consists of defining the Global parameters, Task0, and Task1.



- › Make sure that the script is **selected** in the Project Build settings.

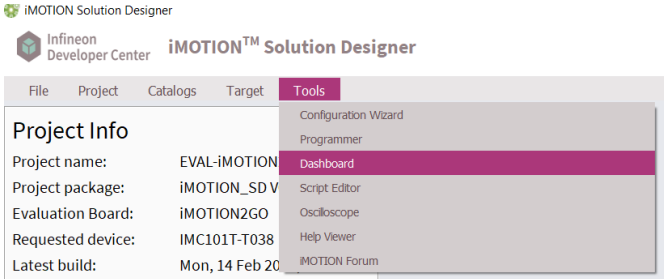


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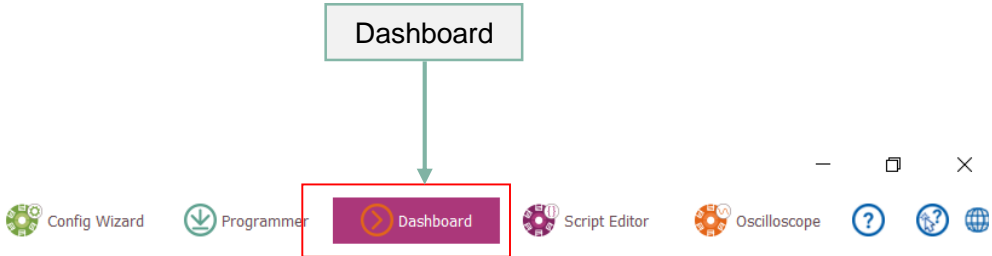
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# Build, Connect and Program

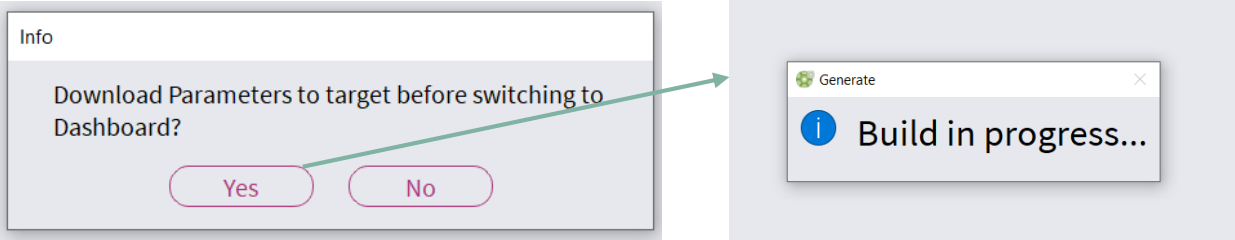
> After opening or creating a project, select **Dashboard** via the methods below.



or

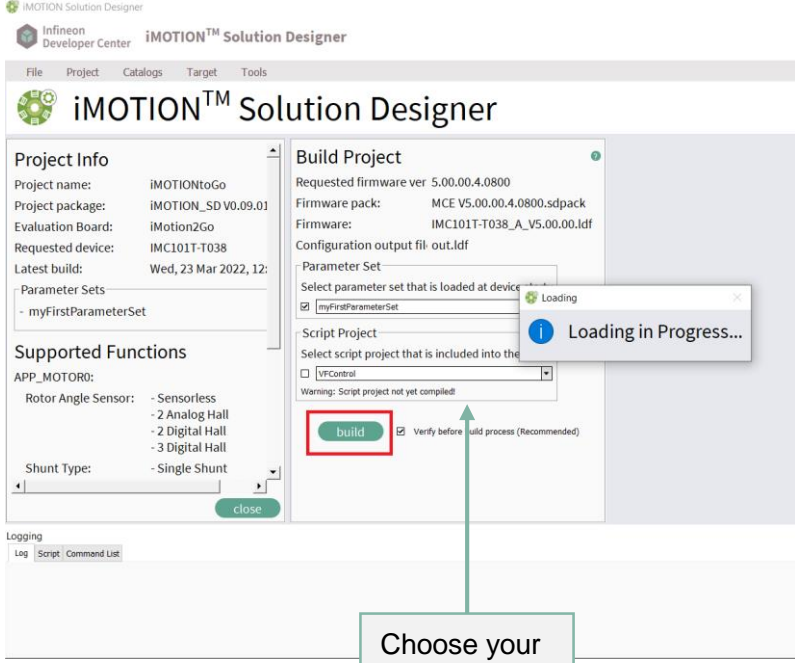
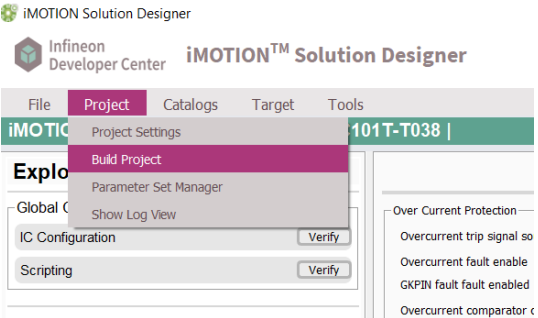


> The **Build, Connect,** and **Program** will be done if required (through popups).

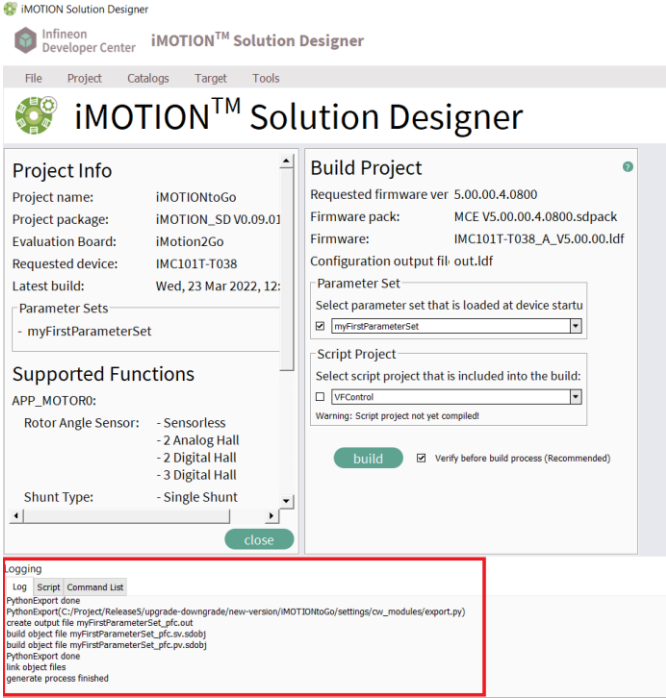


> Steps (Build, Connect, Program) can be done separately and are explained on the next slides.

# Build the program



Choose your script (optional)



# Connect with target

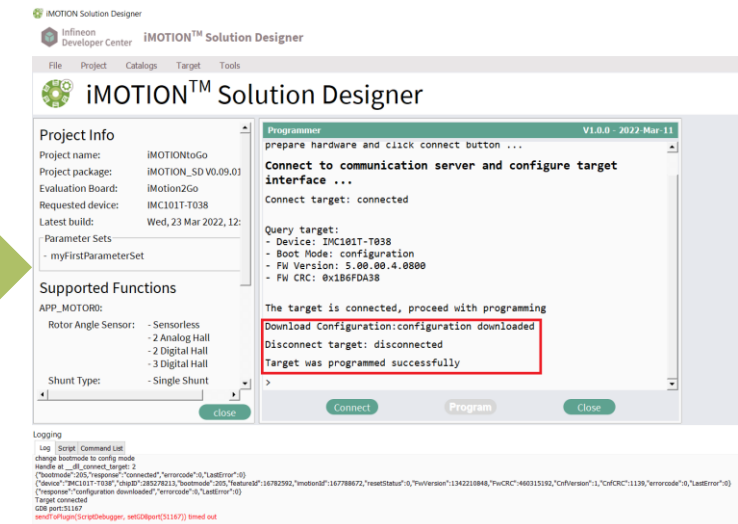
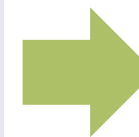
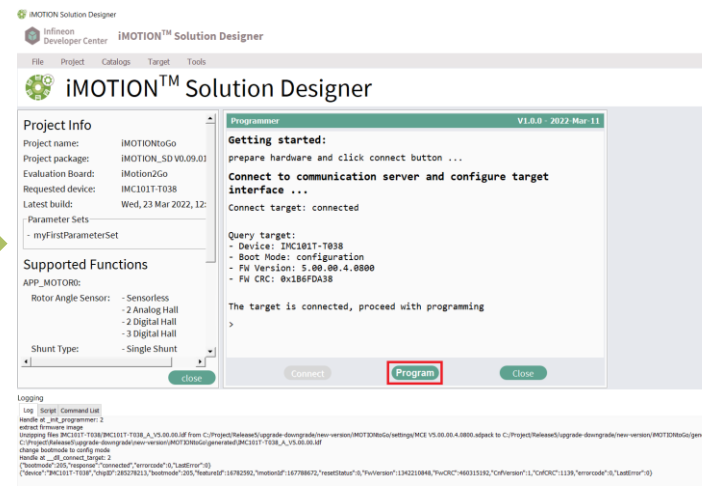
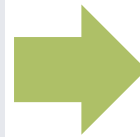
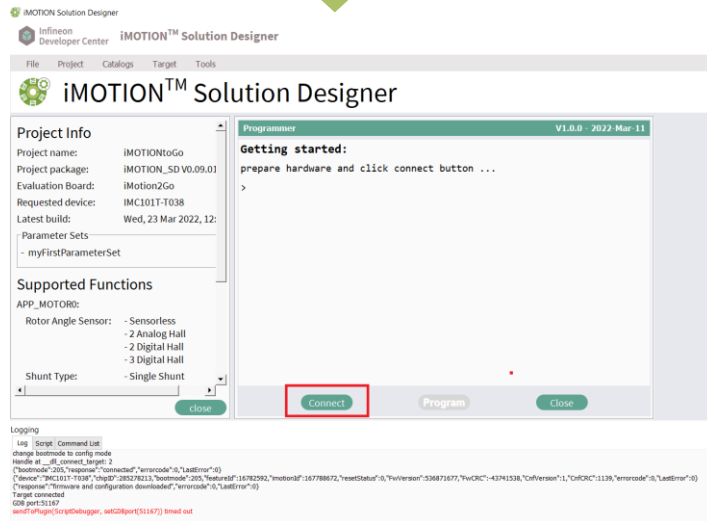
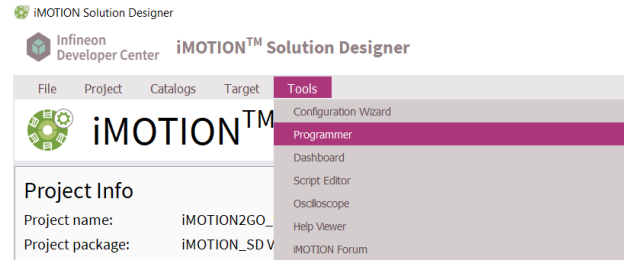
- › Connect with the server and choose the target COM port to connect with it.

The image illustrates the steps to connect with a target device in the iMOTION Solution Designer software. It shows the 'Connect' button in the 'Target' menu, the 'Connect' dialog box where the 'COM port' is set to 'COM5', and the final state where the 'Target Connection' is 'Connected with UART COM5'.



# Connect and program

> Connect and Program with the Solution Designer's **Programmer** tool.



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# Run Motors with Dashboard

## Dashboard

This tool gives users an interactive environment for motor tuning work

- › Parameter tree is updated in real time
- › Pre-configured motor tuning use cases
  - Current sensing
  - Current loop tuning
  - Speed loop tuning
  - And more
- › Motor / PFC operation control and indicators
  - Start / stop motor control
  - Target speed configuration
  - Rotation direction configuration
  - Motor speed estimation
  - CPU load
  - Fault status

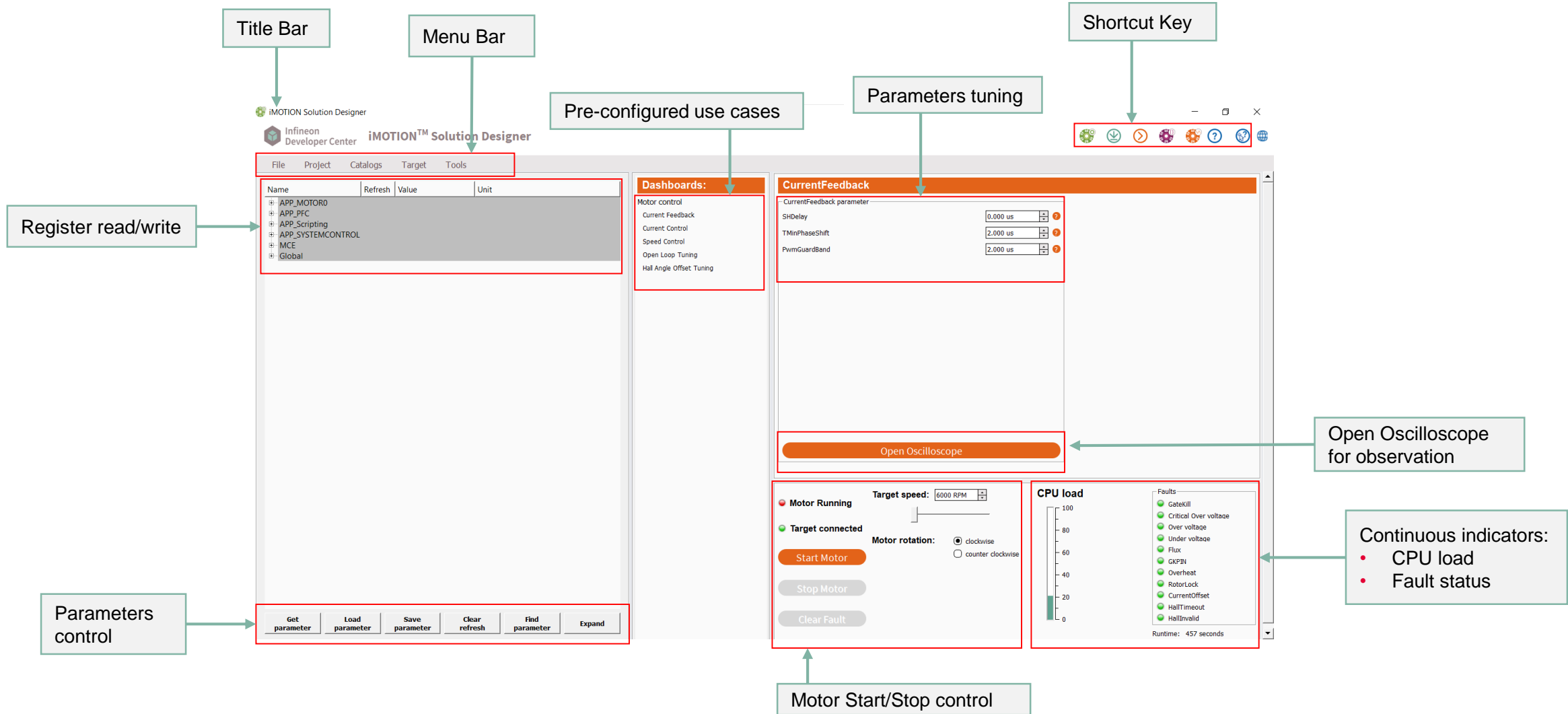
The screenshot displays the iMOTION Solution Designer software interface. On the left, a parameter tree shows various motor control parameters, with 'VSPinInput' selected and set to 1.368 V. The main dashboard area is divided into several sections:

- Dashboards:** A list of control modes including Motor control, Current Feedback, Current Control, Speed Control, Open Loop Tuning, and Hall Angle Offset Tuning.
- Current Feedback:** A section for configuring current feedback parameters, including SHDelay (0.000 us), TMinPhaseShift (2.000 us), and PwmGuardBand (2.000 us). An 'Open Oscilloscope' button is located below these settings.
- Motor Running:** A status panel showing 'Target speed: 16383 RPM' and 'Motor Rotation' options (Clockwise/Counter Clockwise). It includes 'Start Motor', 'Stop Motor', and 'Clear Fault' buttons. The current motor speed is displayed as 7826 RPM.
- CPU Load:** A vertical bar chart showing the current CPU load at 60.6% with a peak of 60.6%.
- Motor Control Faults:** A list of potential faults such as GateKill, Critical Over voltage, Over voltage, Under voltage, Flux, GKPIN, Overheat, RotorLock, Current Offset, HallTimeout, and HallInvalid, all currently shown as green (inactive).

At the bottom of the interface, there are buttons for 'Get parameter', 'Save parameter', 'Clear refresh', 'Find parameter', and 'Expand'. The status bar at the very bottom indicates the software version (1.0.0.202207011701) and the current runtime (228 seconds).



# Dashboard Overview





# Change Speed and Direction of the Motor Rotation

- › The target speed can be configured by either entering another RPM value or by sliding the bar to the left and right.
- › The rotation of the motor can be changed and will be shown with a positive (clockwise) or negative (counter clockwise) speed.

**Dashboards:**

- Motor control
- Current Feedback
- Current Control
- Speed Control
- Open Loop Tuning
- Hall Angle Offset Tuning

**Current Feedback**

Current Feedback Parameter

SHDelay	10.000 us
TMinPhaseShift	2.500 us
PwmGuardBand	2.000 us

Open Oscilloscope

**Motor Running**

Target speed: 661 RPM

Motor Rotation:  Clockwise  Counter Clockwise

Start Motor

Stop Motor

Clear Fault

**-659 RPM**

**CPU Load**

peak: 69.3 %

Runtime: 3 seconds

**Faults**

- GateKill
- Critical Over voltage
- Over voltage
- Under voltage
- Flux
- GKPIN
- Overheat
- RotorLock
- Current Offset
- HallTimeout
- HallInvalid

Counter clockwise rotation



# Debugging and Tuning Motors with Oscilloscope

## Oscilloscope

- › Up to 8 Channels of Real-Time Tracing
- › Sampling has three options
  - Synchronized with motor PWM
  - Synchronized with PFC PWM
- › Advanced trigger methods available (Edge, Slope, Comparison)
- › Autoscaling
- › Cursor function

The screenshot displays the Infineon Oscilloscope software interface. The main window shows two waveforms: a high-frequency sine wave (top) and a lower-frequency sine wave (bottom). The top waveform is zoomed in, showing a yellow box around a portion of the signal. The bottom waveform shows two sine waves with a phase shift. The interface includes a 'Channels' panel on the left with settings for CH1, CH2, CH3, CH4, CH5, CH6, CH7, and CH8. A 'Control Panel' on the right contains 'Run/Stop and trigger settings', 'Horizontal time settings', and 'Cursor settings'. A 'Channel trace settings' box on the left points to the channel configuration area. Three callout boxes on the right point to the 'Run/Stop and trigger settings', 'Horizontal time settings', and 'Cursor settings' sections of the Control Panel.

Channel trace settings

Run/Stop and trigger settings

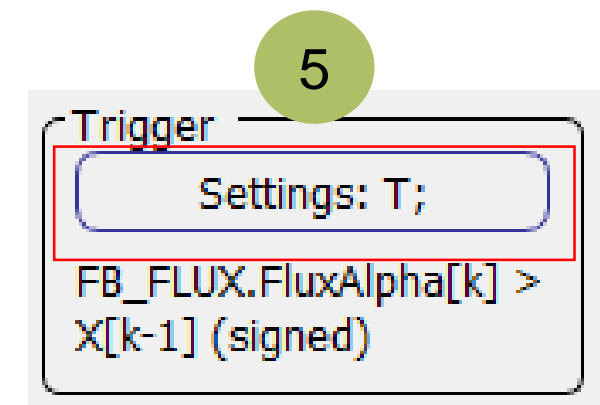
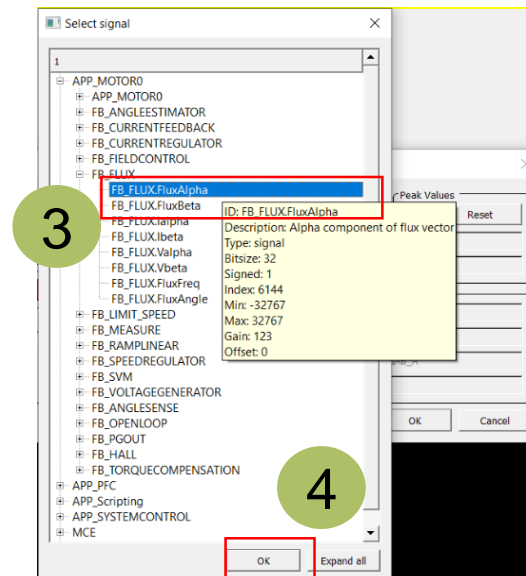
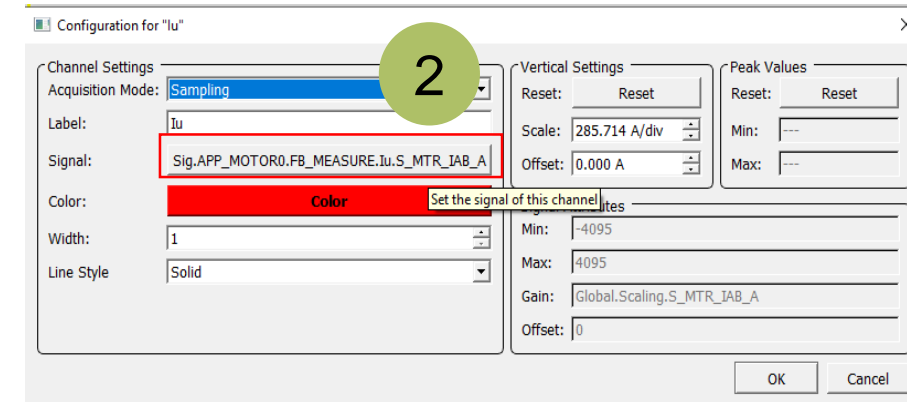
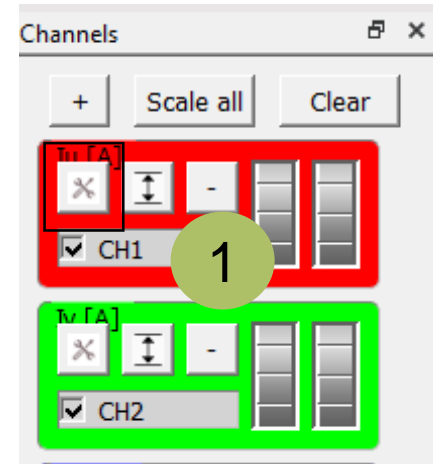
Horizontal time settings

Cursor settings

# iMOTION™ Solution Designer: Channel and control setting with Oscilloscope(1/3)



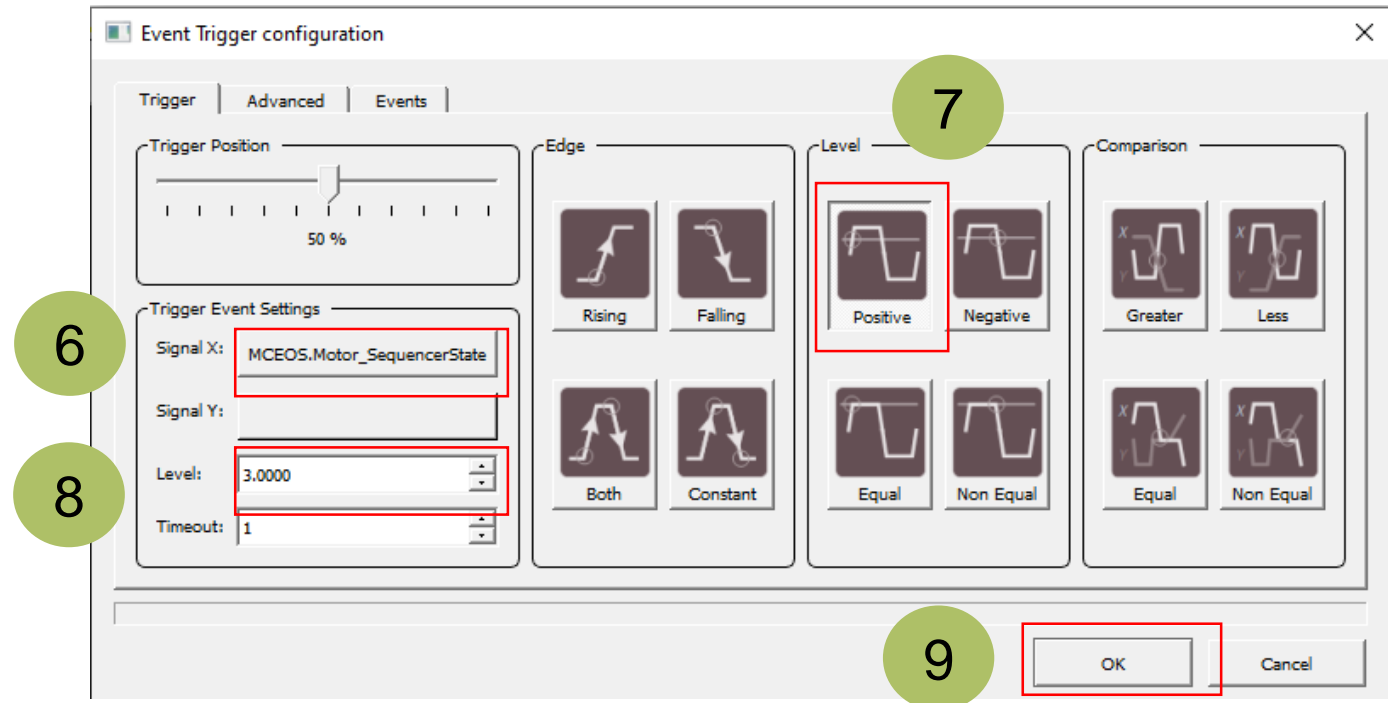
- › Step 1: Configure the settings for each channel.
- › Step 2: Choose the signal of each channel.
- › Step 3: Select the parameter to be measured in the parameter tree.
- › Step 4: Confirm the parameter selection and click OK to exit the po-out window.
- › Step 5: Configure the event trigger for the oscilloscope.



# iMOTION™ Solution Designer: Channel and control setting with Oscilloscope(2/3)



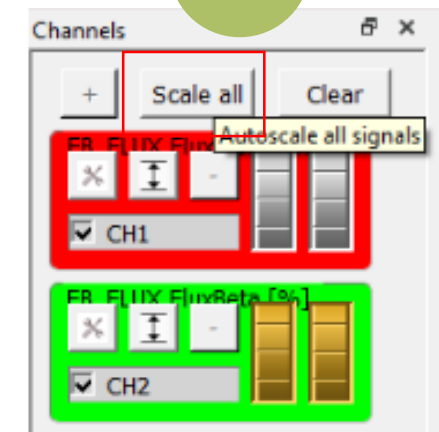
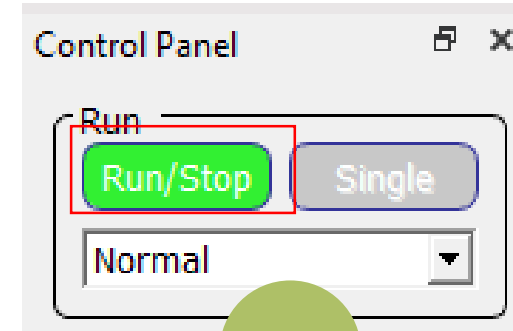
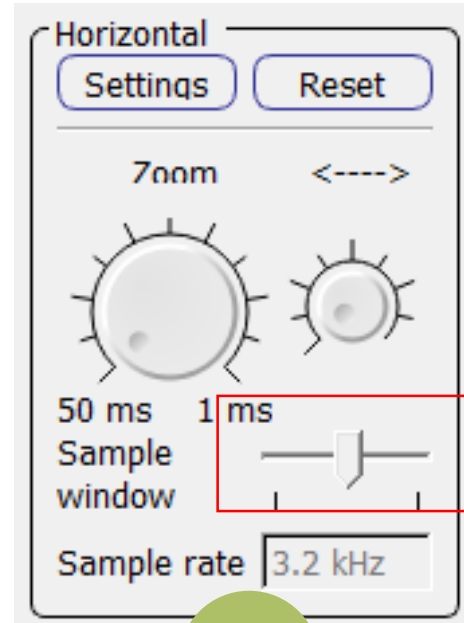
- › Step 6: Choose the trigger signal in the parameter tree (similar to Step 3). Here is an example of level trigger for “SequencerState”.
- › Step 7: Select the “Positive level” trigger type for “SequencerState”.
- › Step 8: Input the level trigger value for “SequencerState” and complete the setting for event trigger.
- › Step 9: Ensure the values for the trigger and signal are correct, then click OK.



# iMOTION™ Solution Designer: Channel and control setting with Oscilloscope(3/3)



- › Step 10: Adjust the sample window in Horizontal direction.
- › Step 11: Activate the Control motor Run/Stop in the control panel.
- › Step 12: Press "Scale all" to auto scale all signals in the Vertical direction.



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# Using catalog files (1/3)

- > Catalog files contain the default parameters for the evaluation/reference design boards. Users can use the default parameters to run the motor after selecting **Boards**, **Motors**, and **Loads**.
- > Click **Boards** to load the default parameters from the boards catalog (iMOTION2Go).

The screenshot shows the iMOTION Solution Designer interface. The 'Catalogs' menu is open, with 'Boards' selected. The 'Input Supply Parameters' dialog is open, showing a table of reference boards and IC components. The 'iMotion2Go' entry is highlighted in the table.

Reference Board	IC Component
1 EVAL-IMM101T-046	IMM101T
2 iMotion2Go	IMC101T
3 EVAL-IMD11T	IMD111T
4 IMC101T MADK + EVAL-M1-05-65D	IMC101T



# Using catalog files (2/3)

> Click **Motors** to load the default parameters from the motors catalog (USB motor).

The screenshot shows the iMOTION Solution Designer interface. In the top-left menu, the 'Motors' option is highlighted with a red box. A large green arrow points to the right, where the 'Motor Parameters' configuration window is shown. In the 'System Hardware Configuration' tree on the left, the 'Motor' item is highlighted with a red box. A red line connects this 'Motor' item to the 'Motor model name' field in the 'Motor Parameters' window, which is also highlighted with a red box. The 'Motor model name' field contains a list of motor models, with '1 USB motor' selected and highlighted with a red box.

Filter	Min	Max
Motor rated amps/phase		
Motor poles		
Motor back EMF constant		
Position sensor		
Motor model name		
Motor nominal voltage		

Database	Motor model name
1	USB motor
2	GK6040
3	SSME072HXP0018(Welling-56-8)
4	WZDK40-38G-W
5	Golde Age
6	NBC9605

# Using catalog files (3/3)

> Click **Loads** to load the default parameters from the loads catalog (iMOTION2Go Load).

The screenshot shows the iMOTION Solution Designer interface. In the Explorer pane, the 'Loads' option is highlighted with a red box. A green arrow points from this box to the 'Load' option in the Parameter Set Configuration pane, which is also highlighted with a red box. A red arrow points from this 'Load' option to the 'iMotion2go Load' entry in the database selection dialog. The dialog shows a table with columns for Filter, Min, and Max, and a list of model names.

Filter	Min	Max
Load type		
Model name		
Rated power		
Minimum speed		
Maximum speed		
Speed ramp rate		

	Model name
1	iMotion2go Load
2	IMM101T-46 Motor
3	GK6040
4	NBC9605

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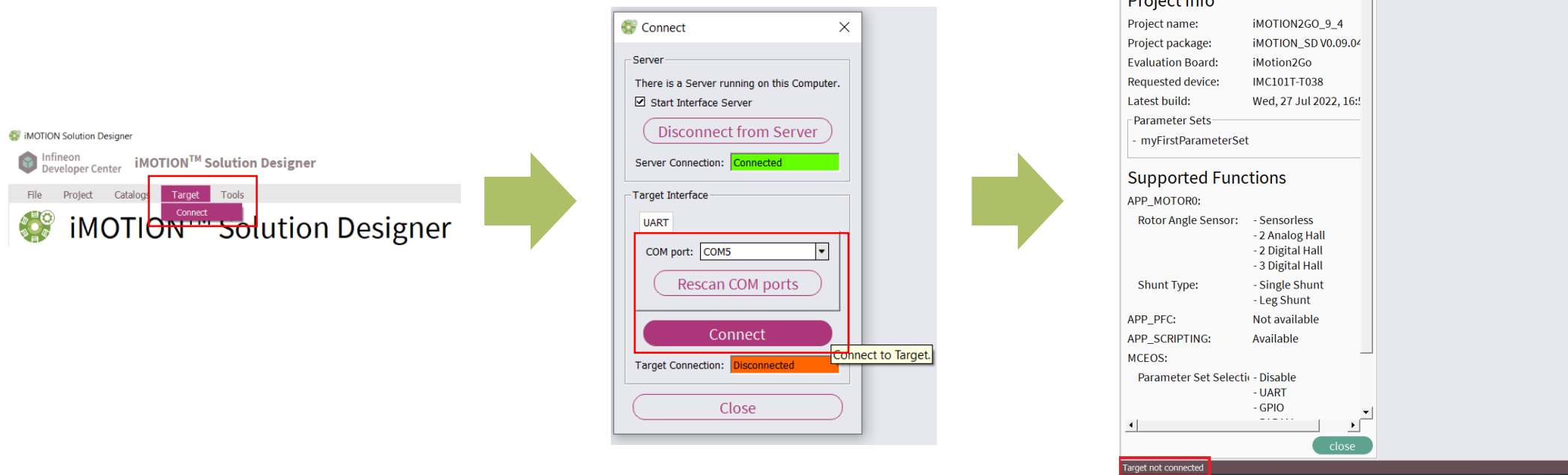
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# Upgrade FW to Release #5.x.x

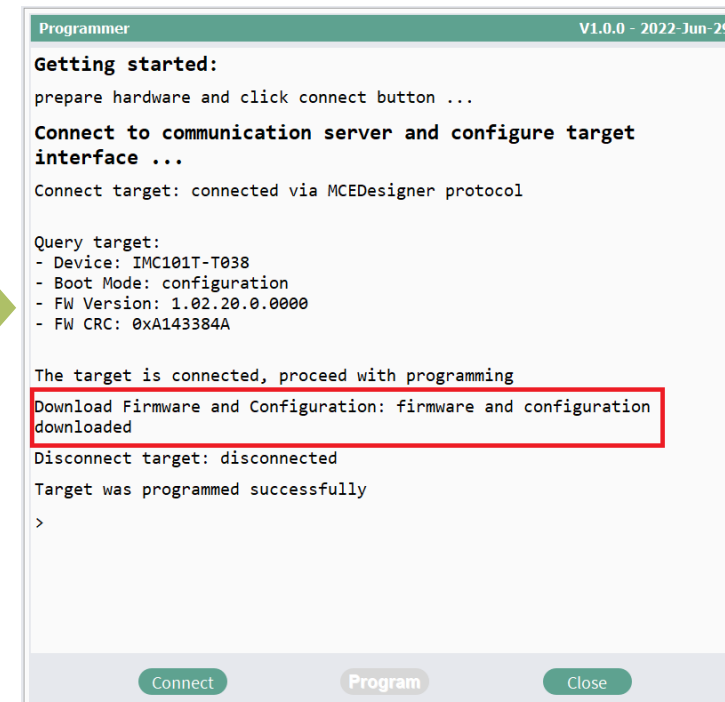
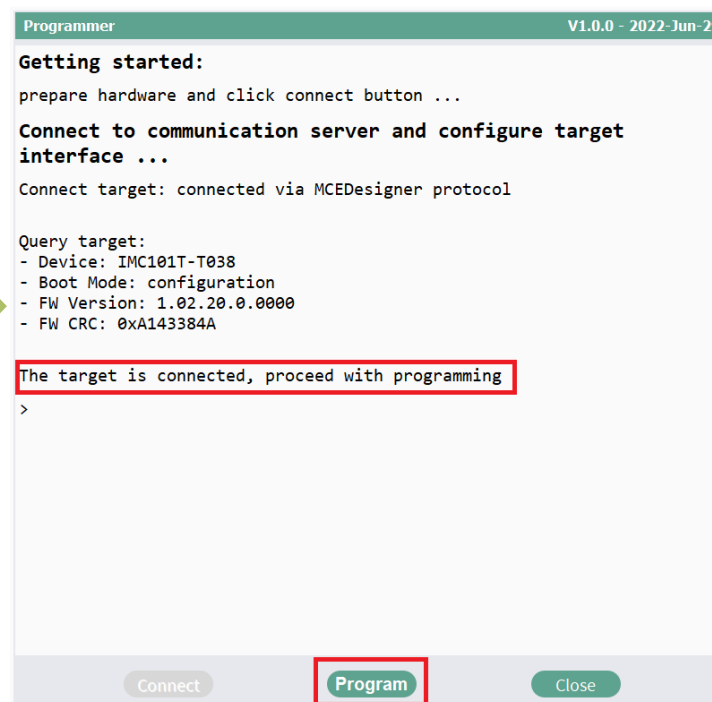
## > Step 1:

- Open the Solution Designer and connect with the device.
  - **NOTE:** Ensure the firmware version is **FW1.03.03** or older.
- Because the Solution Designer cannot connect with the device when the firmware version is FW1.03.03, “Target not connected” will be displayed as below. Users can ignore this information and go straight to the next step.



# Upgrade FW to Release #5.x.x

- › Step 2:
  - Open the **Programmer**.
  - Follow the programming procedure as shown below. Users can then upgrade FW to Release #5.x.x.



# Downgrade to FW1.03.03

## > Step 1:

- Change the **BootMode** from “Application” to “Configure” in the Solution Designer when connected with board. Users will then find “Target disconnected” displayed in the dashboard.

The screenshot shows the iMOTION Solution Designer interface. On the left, a tree view lists various system parameters. The **BootMode** parameter is highlighted with a red box, and its value is set to **configure**. Other parameters like CPUloadPeak, RunTimeCou..., and MotorSeque... are also visible.

The main dashboard area is divided into several sections:

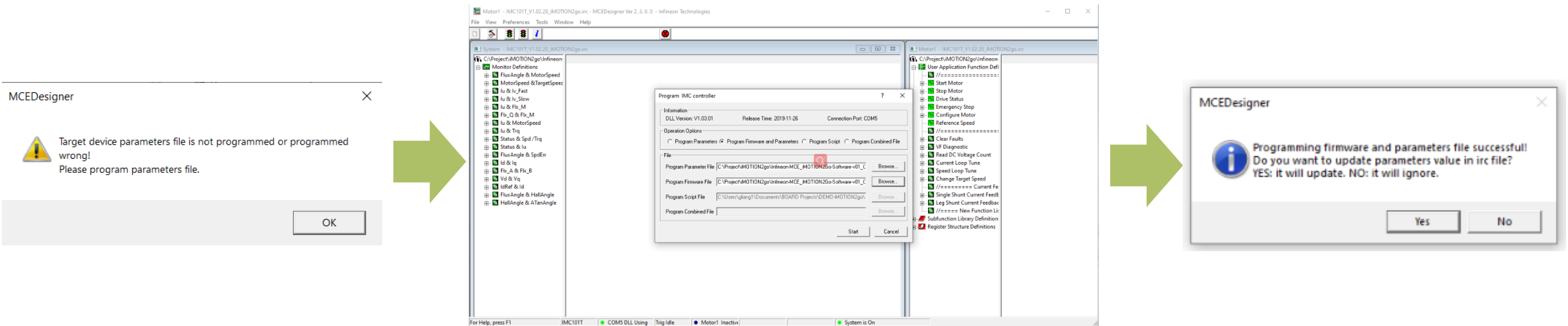
- Dashboards:** A list of control options including Motor control, Current Feedback, Current Control, Speed Control, Open Loop Tuning, and Hall Angle Offset Tuning.
- Current Feedback:** A section with three input fields: SHDelay (0.000 us), TMinPhaseShift (2.000 us), and PwmGuardBand (2.000 us). Below these is an **Open Oscilloscope** button.
- Motor Running:** A status indicator showing a green dot and the text "Motor Running". Below it, a **Target Connected** indicator shows a red dot and the text "Target Connected", which is highlighted with a red box. The target speed is set to 10280 RPM.
- CPU Load:** A vertical bar chart showing the current CPU load, which is approximately 40%.
- Faults:** A list of potential faults including GateKill, Critical Over voltage, Over voltage, Under voltage, Flux, GKPIN, Overheat, RotorLock, Current Offset, HallTimeout, and HallInvalid.

At the bottom of the interface, there are buttons for **Start Motor**, **Stop Motor**, and **Clear Fault**. The current motor speed is displayed as **3113 RPM**. The runtime is shown as 235 seconds.

# Downgrade to FW1.03.03

## > Step 2:

- Ignore the warning information after opening the MCE Designer;
- Use the MCE Designer to download the firmware (FW1.03.03) with the parameter file.
- The firmware will be successfully downgraded to FW1.03.03.





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