

Getting Started with iMOTION™ 2.0

Step-by-step instructions for setting up and running
a motor control system with iMOTION™ 2.0

V1.1
13/12/21



Available in video on www.infineon.com/imotion



Overview

What is the iMOTION™ 2.0 platform?

- Digital motor controllers that integrate all control and analog interface functions using the configurable Motion Control Engine (MCE)

What are the iMOTION™ 2.0 tools? Two downloadable tools:



MCE Wizard v2.3.0

GUI for inputting system and motor parameters (and script function if enabled)

- Exports a .txt file (and .ldf file + .map file if scripting is enabled)



MCE Designer v2.3.0

GUI for programming controller, starting/stopping motor, real time changing of parameters (read/write registers), and viewing real time traces of motor performance

- Import files from MCEWizard

What iMOTION™ 2.0 products are available?



iMOTION™ controller

Motor controller w/wo PFC control, script engine, and additional MCU options



iMOTION™ driver

Motor controller integrated with gate driver in a compact package



iMOTION™ IPM

Motor controller integrated with gate driver and switches in a compact package

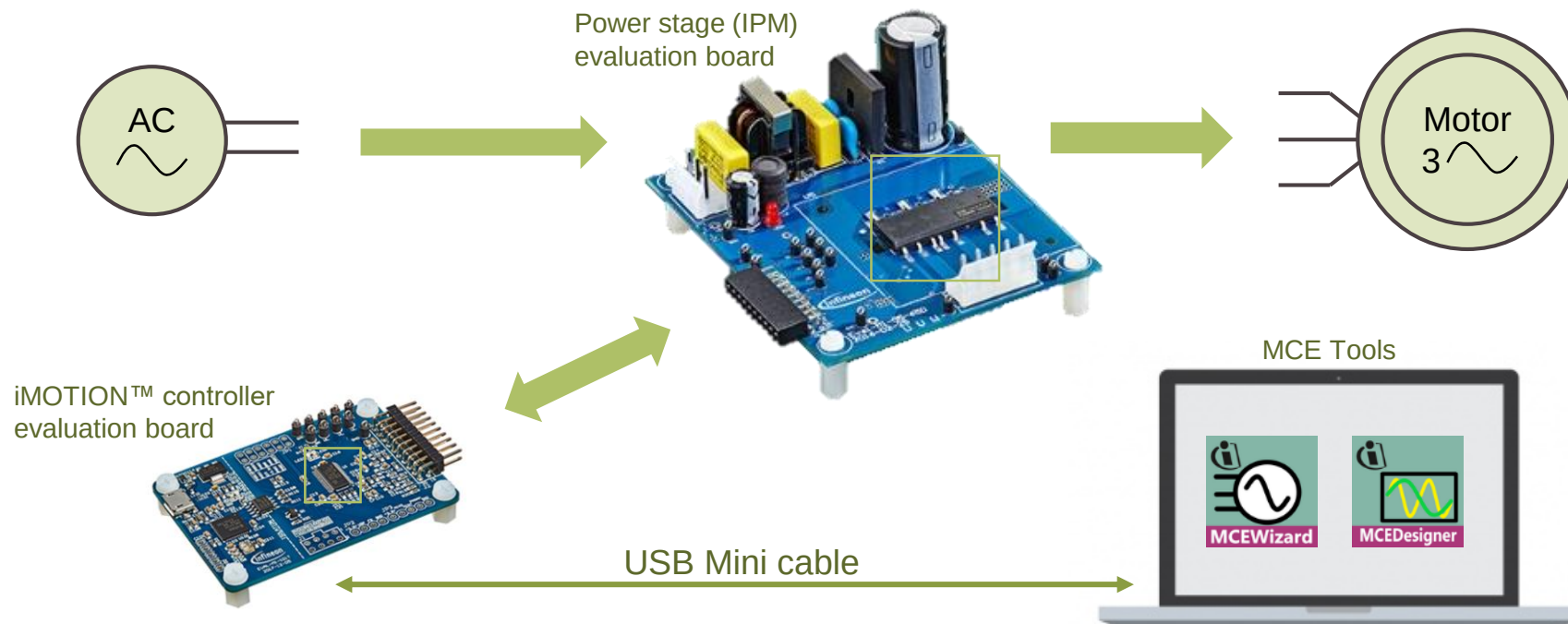


MADK

Design kits w/ controller & power stage for quick and easy product evaluation

iMOTION™ 2.0 provides a full motor control solution

System solution example using MADK



Getting started overview

1

Purchase an iMOTION™ device or MADK

- If iMOTION™ controller only, driver or IPM is purchased, PCB must be designed.

2

Download latest version of iMOTION™ Tools and selected product's software package

- If using MADK, additionally download the board's MCEWizard configuration file (.mc2) + register board for exclusive content

3



Use MCEWizard to input motor and system parameters

4



Use MCEDesigner to program controller, start/stop motor, debug, and monitor motor parameters with real-time graphs.

Product list and MADK registration

[Link to iMOTION products](#)

[Link to MADK products](#)

To register MADK, scan QR code on case or register from product page.

- Gain access to Gerber files, PCB layout, AppNotes, design rules, PCB libraries, etc.



 Get exclusive information
Register product

Be first to know! Be first to innovate!

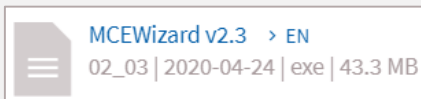
* You may have to create a myInfineon-Account first.



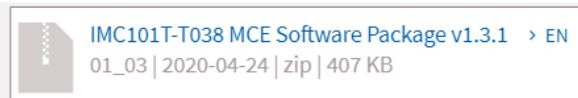
Downloading required files

Files located on iMOTION™ webpage under [Tools & Software](#)

Download latest version of MCE development tools



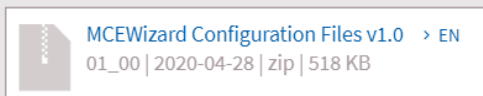
Download selected controller's software package



Includes:

- MCEDesigner configuration file (.irc)
- Firmware file (.ldf)
- Default parameter and register map file (.txt & .map)
- Release notes and readme file (read the readme!)

- If using MADK, download its MCEWizard Configuration file (.mc2) to speed up input parameter process
 - File comes in zip file with all MADK configurations.



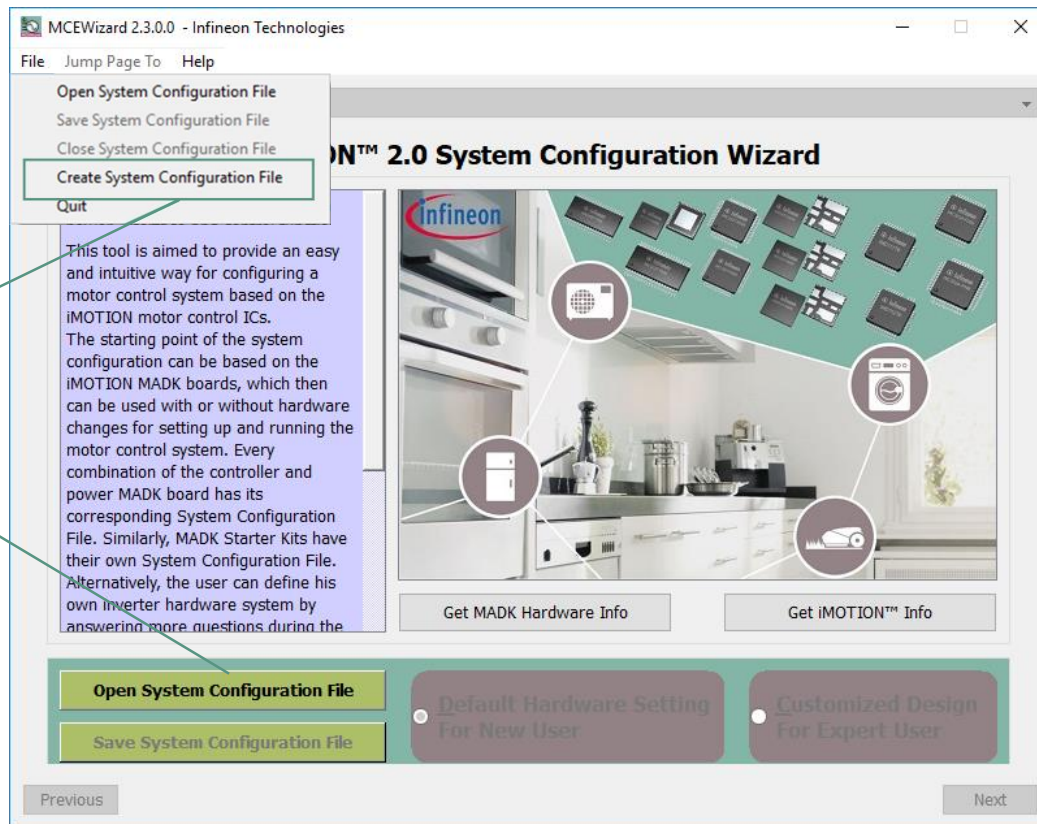
Follow installation directions and unzip software package

MCEWizard v2.3.0: Welcome

To start, create a new system configuration file or open a pre-made file (.mc2) if using MADK

Create a new configuration file for selected controller

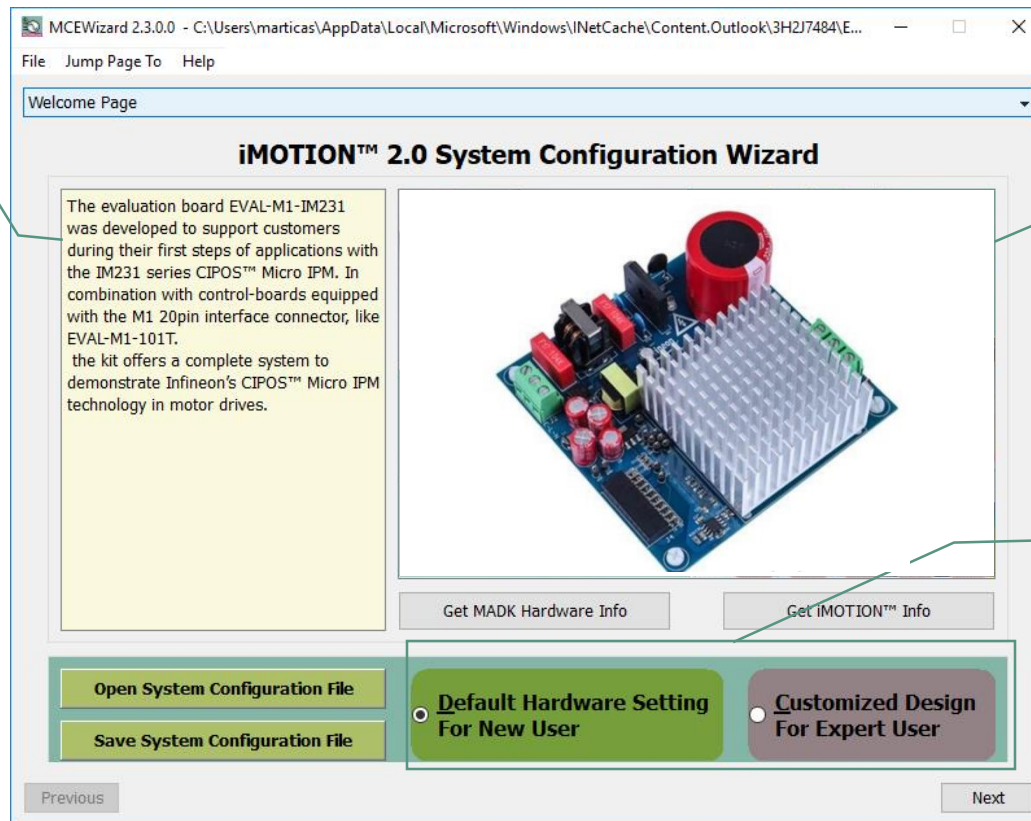
Open configuration file for MADK controller and power board set



MCEWizard v2.3.0: Welcome

Use default hardware settings for MADK, or enable customized design if own PCB design or modifications were made. Once selected, click **Next**

MADK Description and specs. Can be edited to detail modifications if customized design is selected.

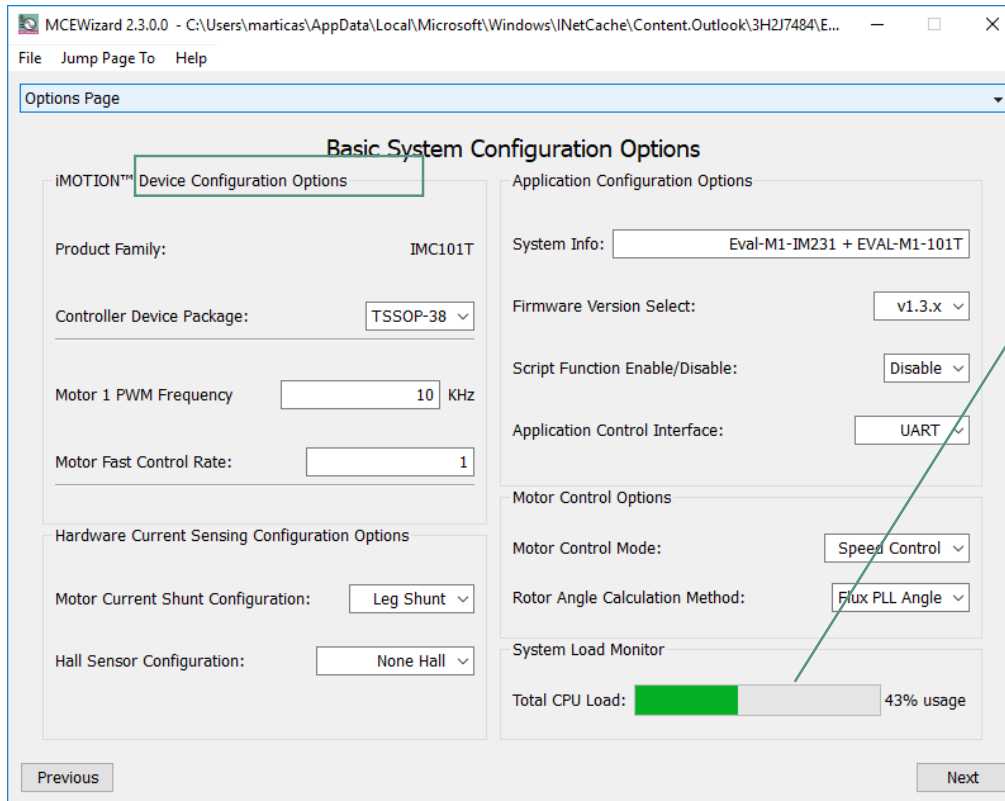


Evaluation board image

Default = Short list of parameter questions (14)
Customized= Full list of parameter questions (up to 120)

MCEWizard v2.3.0: Options

For default design, all options will be greyed out. Click **Next**
For customized design, user selects control and MCE feedback options.



Basic System Configuration Options

IMOTION™ Device Configuration Options

Product Family: IMC101T

Controller Device Package: TSSOP-38

Motor 1 PWM Frequency: 10 KHz

Motor Fast Control Rate: 1

Application Configuration Options

System Info: Eval-M1-IM231 + EVAL-M1-101T

Firmware Version Select: v1.3.x

Script Function Enable/Disable: Disable

Application Control Interface: UART

Hardware Current Sensing Configuration Options

Motor Current Shunt Configuration: Leg Shunt

Hall Sensor Configuration: None Hall

Motor Control Options

Motor Control Mode: Speed Control

Rotor Angle Calculation Method: Flux PLL Angle

System Load Monitor

Total CPU Load: 43% usage

Previous Next

For customized design, total CPU load will change according to PWM frequency and other configuration options.

MCEWizard v2.3.0: Questions

For default design, 14 questions must be answered for motor parameters. Each question includes a description to help determine answer.

MCEWizard 2.3.0.0 - C:/Users/Murray/Documents/iMotion/MCEWorking/iMOTION1.5_Test/iMOTION1.5 Beta Tests Tas...
File Jump Page To Help

Question 4 : Motor 1 Motor Parameters - Motor Stator Resistance

Motor 1 Motor Parameters

Question 4 - Motor Stator Resistance

Expand Picture

This is the per phase winding resistance of the motor.

When measuring the winding resistance between two phase terminals divide the result by two to get the the per phase resistance value for both Y or delta connected motors.

If the motor winding resistance is low, you will need to adjust for cable and contact resistance.

Answer: Ohms/phase

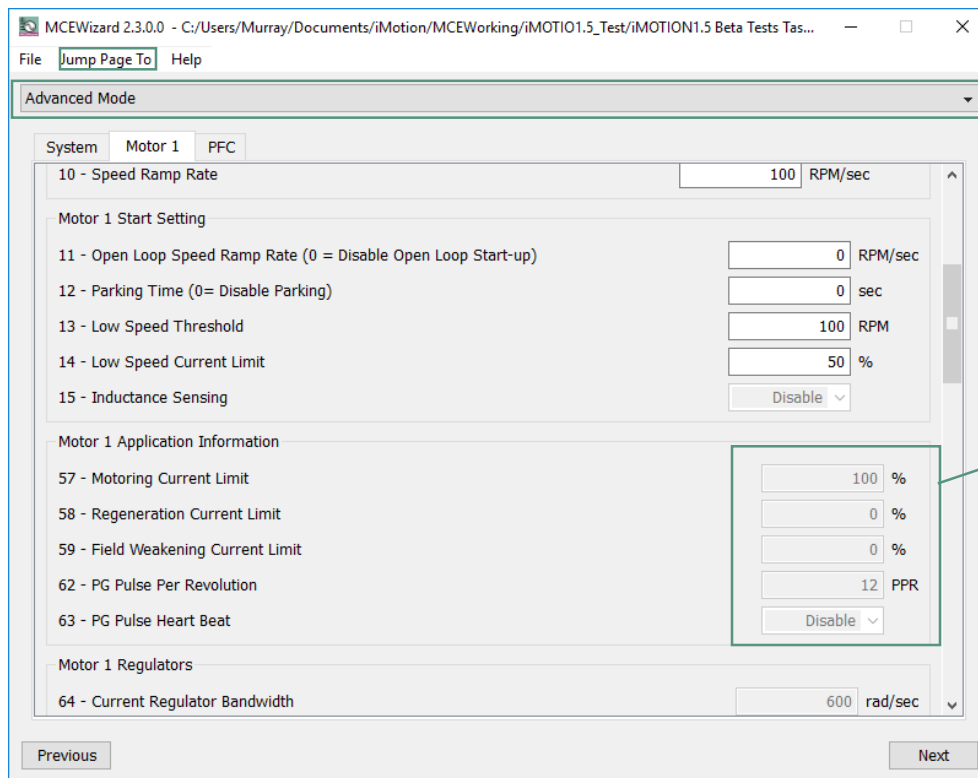
Previous Next

Select drop down to see list of all questions.

Next button steps the user through each open question

MCEWizard v2.3.0: Advanced mode

For experienced users, parameter questions can be quickly edited in one list in advanced mode.



The screenshot shows the MCEWizard v2.3.0 interface in Advanced Mode. The window title is "MCEWizard 2.3.0.0 - C:/Users/Murray/Documents/iMotion/MCEWorking/iMOTION1.5_Test/iMOTION1.5 Beta Tests Tas...". The menu bar includes "File", "Jump Page To", and "Help". A dropdown menu at the top shows "Advanced Mode" selected. Below this, there are tabs for "System", "Motor 1", and "PFC". The "Motor 1" tab is active, displaying a list of parameters for Motor 1. The parameters are grouped into sections: "Motor 1 Start Setting" (10-15), "Motor 1 Application Information" (57-63), and "Motor 1 Regulators" (64). Parameters 10-15 are active, while parameters 57-63 are greyed out. Parameter 64 is active. The "Jump Page To" button is highlighted in the top menu bar. The "Previous" and "Next" buttons are at the bottom.

Parameter ID	Parameter Name	Value	Unit	Status
10	Speed Ramp Rate	100	RPM/sec	Active
11	Open Loop Speed Ramp Rate (0 = Disable Open Loop Start-up)	0	RPM/sec	Active
12	Parking Time (0 = Disable Parking)	0	sec	Active
13	Low Speed Threshold	100	RPM	Active
14	Low Speed Current Limit	50	%	Active
15	Inductance Sensing	Disable		Active
57	Motoring Current Limit	100	%	Greyed out
58	Regeneration Current Limit	0	%	Greyed out
59	Field Weakening Current Limit	0	%	Greyed out
62	PG Pulse Per Revolution	12	PPR	Greyed out
63	PG Pulse Heart Beat	Disable		Greyed out
64	Current Regulator Bandwidth	600	rad/sec	Active

Advanced mode selected in drop down or "Jump Page To"

Greyed out parameters can only be changed if customized design is selected.

MCEWizard v2.3.0: Script edit (enabling page)

Script function is enabled and disabled on the Option Page.
If scripting is disabled, the script page is greyed out. This is default for the MADK boards.

Enable script function if desired

Options Page

System Basical Configuration Options

IMOTION™ Device Configuration Options

Product Family: JMC101T

Controller Device Package: TSSOP-38

Motor 1 PWM Frequency: 10 KHz

Motor Fast Control Rate: 1

Hardware Current Sensing Configuration Options

Motor Shunt Configuration: Leg Shunt

Hall Sense Configuration: None Hall

Application Configuration Options

System Info: Eval-M1-CT620N3 + EVAL-M1-101T

Firmware Version Select: v1.02.xx

Script Function Enable/Disable: **Enable**

Application Control Interface: UART

Motor Control Options

Motor Control Mode: Speed Control

Motor Angle: Flux PLL Angle

System Load Monitor

Total CPU Load: 43% usage

Previous Next

Page greyed out for “default design”. Change to customized design in “Welcome” page

MCEWizard 2.3.0.0 - C:/Users/marticas/Desktop/EVAL-M1-CT620N3.mc2

File Jump Page To Help

Script

Script Function Enable/Disable: **Enable**

Application Control Interface: UART

Motor Control Options

Motor Control Mode: Speed Control

Motor Angle: Flux PLL Angle

System Load Monitor

Total CPU Load: 43% usage

Previous Next

MCEWizard v2.3.0: Scrip edit (Script Configuration)

Depending on selected device, certain analog and digital pins can be selected for use in your script function. Analog pins are input only, while digital pins can be defined as input or output.

MCEWizard 2.3.0.0 - C:/Users/marticas/Desktop/EVAL-M1-CT620N3.mc2

File Jump Page To Help

Script Edit Page

Script Configuration Script Coding

System Configuration information

IMC101T Controller for Motor.
 Controller Package Type: TSSOP-38
 Motor Current Sample Circuit: Leg Shunt
 Motor Control Mode: UART
 Multi-Motor Support: MotorID-Disabled
 NTC Temperature Protection: Enable

ADC pin configuration

AIN0/VSP	☐	AIN4/DHALL	☐		☐
AIN1/IW/AHALL	☐		☐		☐
AIN2/REFW/AHALL	☐		☐	AIN10/NTC	☐
AIN3/DHALL	☐	AIN7/REFV/AHALL	☐	AIN11/PARAM/DHALL	☐

GPIO pin configuration

GPIO0/LED	Output		NotUsed
GPIO1/PG_OUT	Output		NotUsed
GPIO2/PAR0	NotUsed		NotUsed
GPIO3/PAR1	NotUsed		NotUsed

Previous Next

Define GPIO pins as Input or Output

Analog inputs must be enabled through parameter questions, see software manual

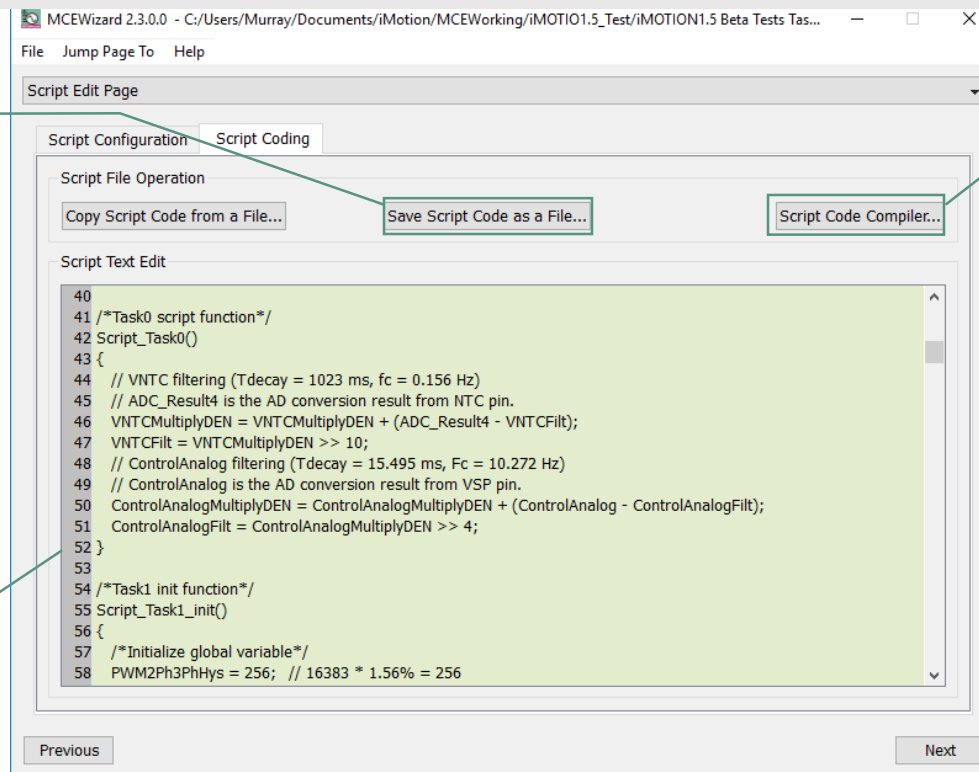
Some analog inputs are multiplexed with other functions and may not be available. See relevant device datasheet

MCEWizard v2.3.0: Script edit (Script Coding)

Two custom script functions (tasks) can be defined using 'C' like language. Tasks can be created to read analog (ADC) pins, read/write digital (GPIO) pins and MCE parameter registers. See Software manual or script application note.

Script will be saved within configuration file (.mc2) but can also be exported to script file (.mcs) for compatibility w/ previous MCEWizard versions

Example script, field will initially be blank

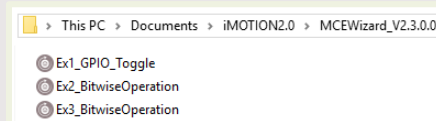


Script can be compiled here or as final step in "Verify Parameters"

MCEWizard v2.3.0: Additional Script Information

Example script files (.mcs) are installed w/ MCEWizard and opened from “script edit page”

- Typically stored within iMOTION2.0 folder in “Documents”



Script engine supports two tasks, named Task0 and Task1

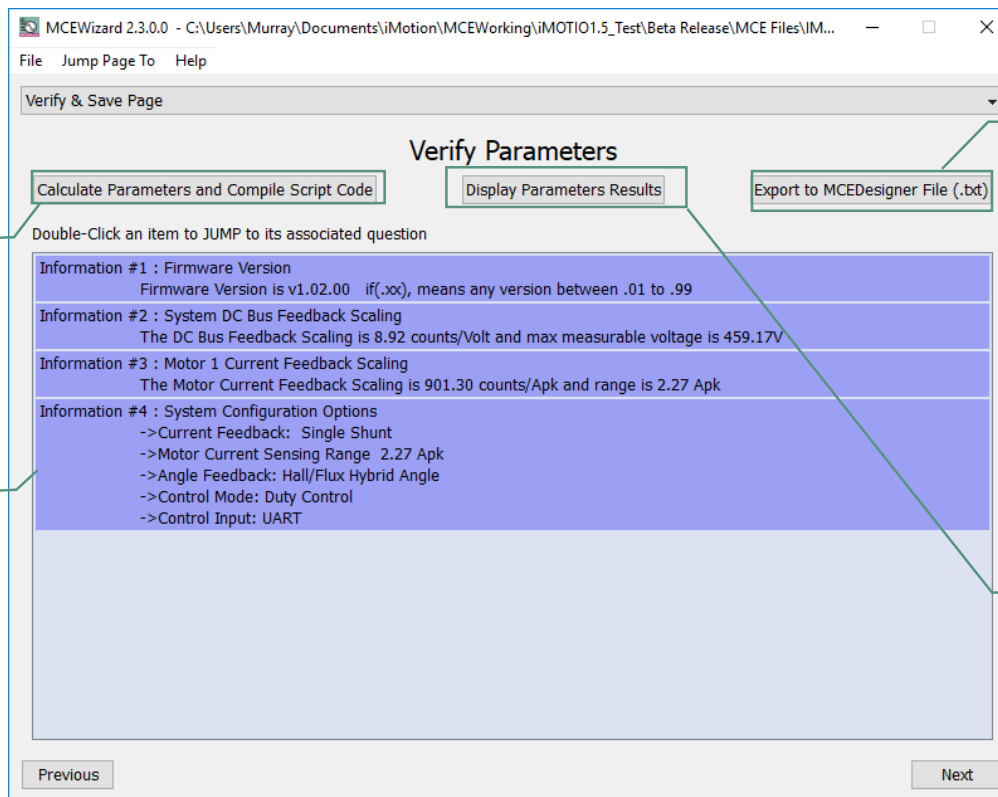
- Script runs in a repeated loop with a configurable execution period for each task.
 - Task0 executes each line of code every 1ms with default execution period of 50ms, which can be configured to multiples of 1ms.
 - Task1 executes 10 lines of code every 10ms with default execution period of 100ms, which can be configured to multiples of 10ms
- Task0 has higher priority than Task1, but both have lesser priority than motor and PFC control loop functions.
- Ensure both tasks are fully executed within set execution period time.

Script engine capabilities and interfaces

- Max number of total global variables = 30, with max number of variables for each task = 24
 - These can be plotted/ traced in MCEDesigner like other MCE parameters
- Max script code size = 16kB (approximately 1500 lines)
- Script engine supports 32-bit signed integer variables
- ADC pins are sampled every 1ms, GPIO pins are sampled/updated every 1ms

MCEWizard v2.3.0: Verify & Save

Once all parameters have been entered (and script function defined), values must be verified and file created for MCEDesigner.



Calculate button also compiles script code

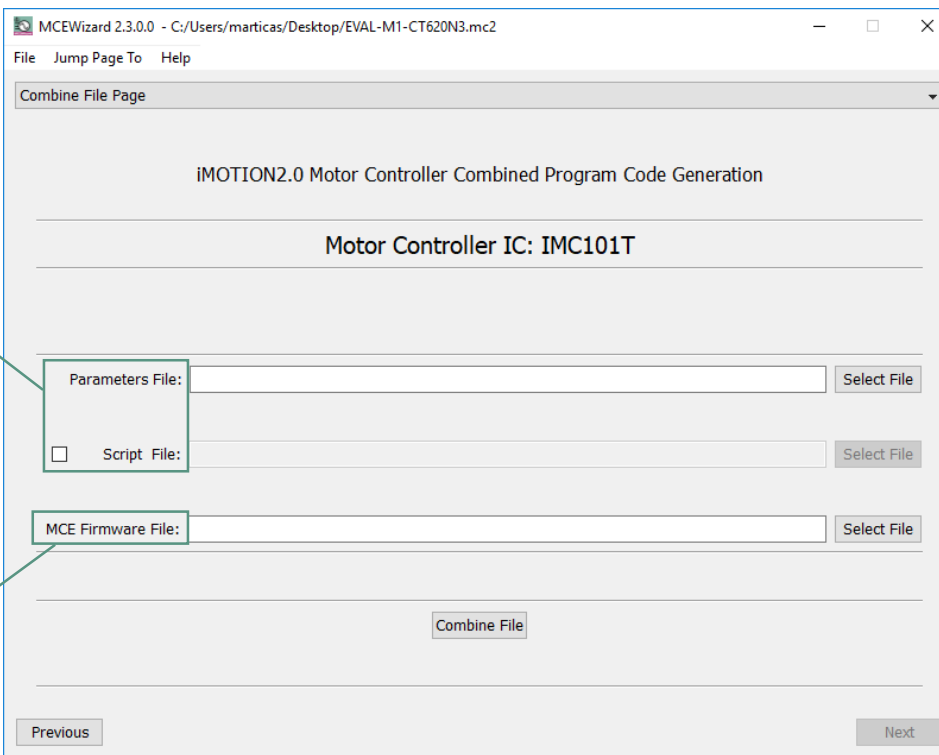
Field will be empty until parameters are calculated. Any errors in calculation will display here. Double-clicking error will open problem question

Click to export text file for MCEDesigner. If script was defined, this will also export a register map (.map) and script (.ldf) file.

Results window shows calculated parameters and any changes from previous calculation

MCEWizard v2.3.0: Combine file

Optionally, the generated files can be combined with controller firmware file to create a single project file (.ldf) allowing a 'single file programming' in MCEDesigner.



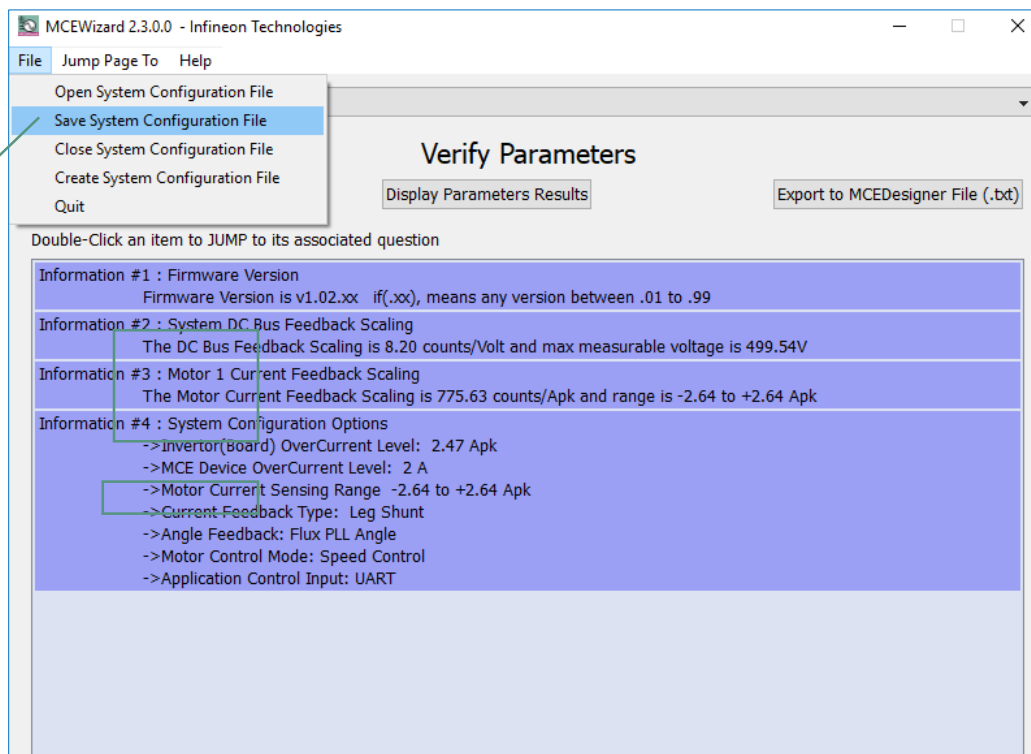
Generated text (.txt) and script file (.ldf) from "Verify and save" page

Firmware file (.ldf) downloaded in controller software package.

MCEWizard v2.3.0: Saving files

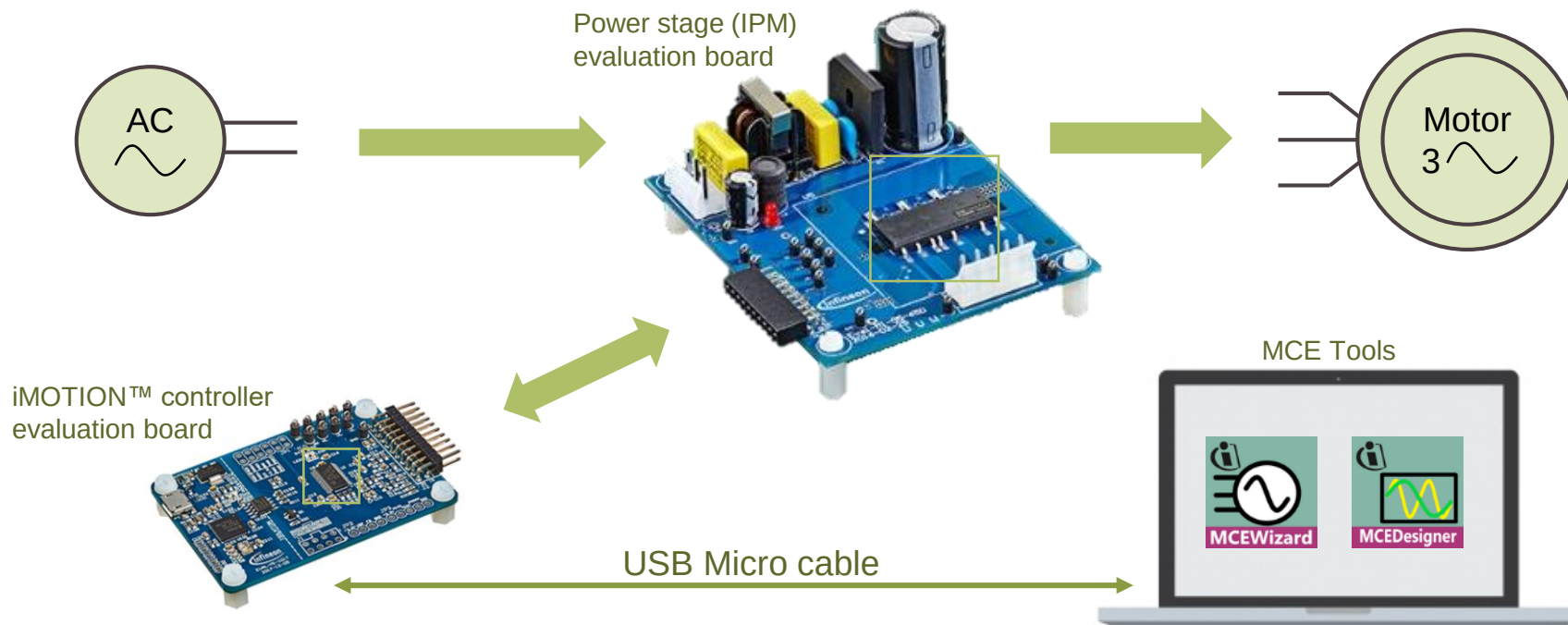
Before moving to MCEDesigner, it is highly recommended to save the system configuration file so it can be opened at a later time to change parameters and generate new text file when debugging.

Save here!
Recommended to name
file w/ description of
controller/parameters



Before MCEDesigner

Before using MCEDesigner, your motor control system must be set up with selected controller plugged into computer using a USB Micro cable. Example below is w/ MADK evaluation boards.

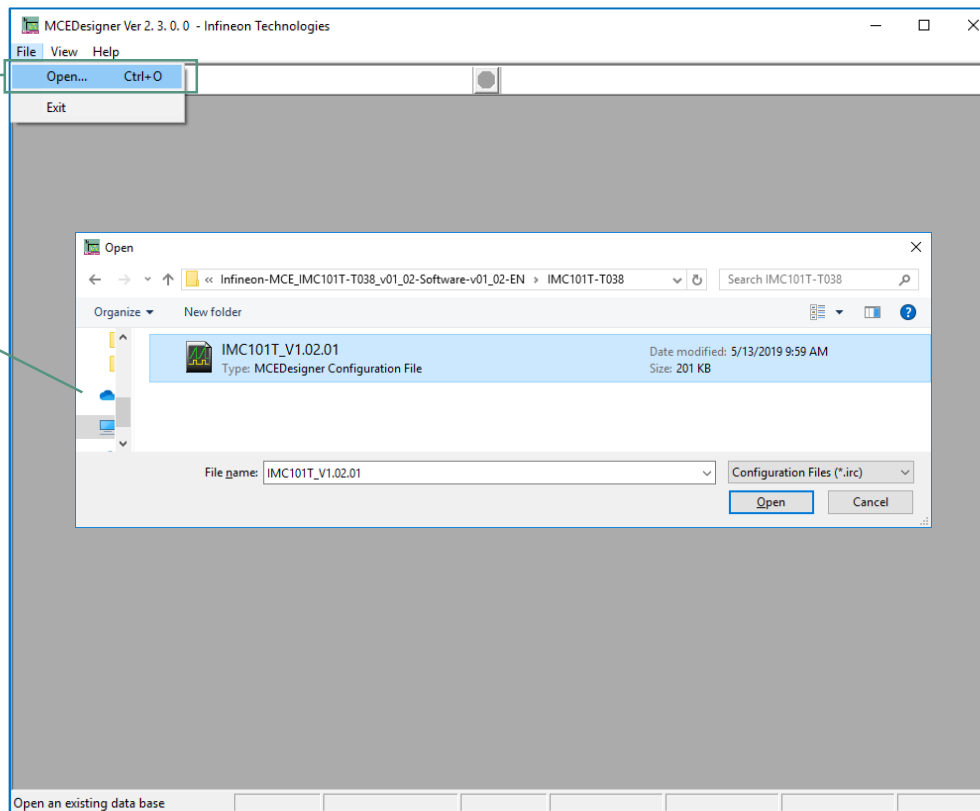


MCEDesigner v2.3.0: Opening tool and configuration file

Open MCEDesigner and then open the MCEDesigner configuration file (.irc) from the controller software package you previously downloaded

Select file,
then open

Window will pop up.
Navigate to where you
have stored and
extracted the controller
software package

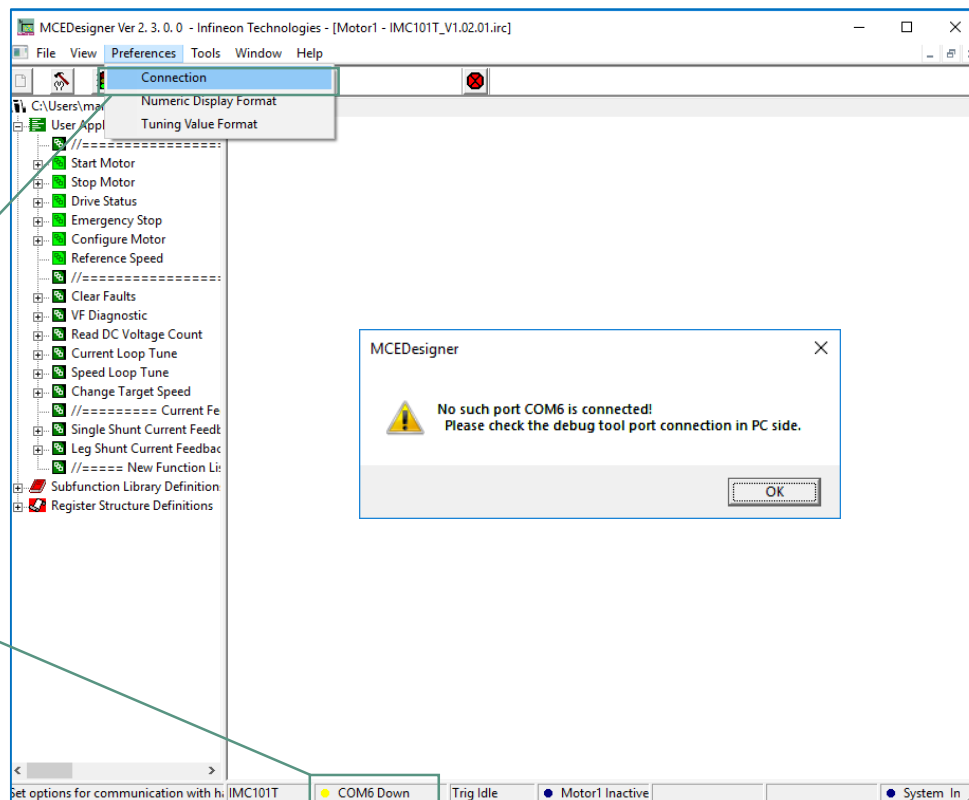


MCEDesigner v2.3.0: COM ports

If power is not yet supplied to controller, a COM port error will appear. Provide 3.3/5V to controller. If using evaluation board, provide AC input to board, which is converted to 3.3V

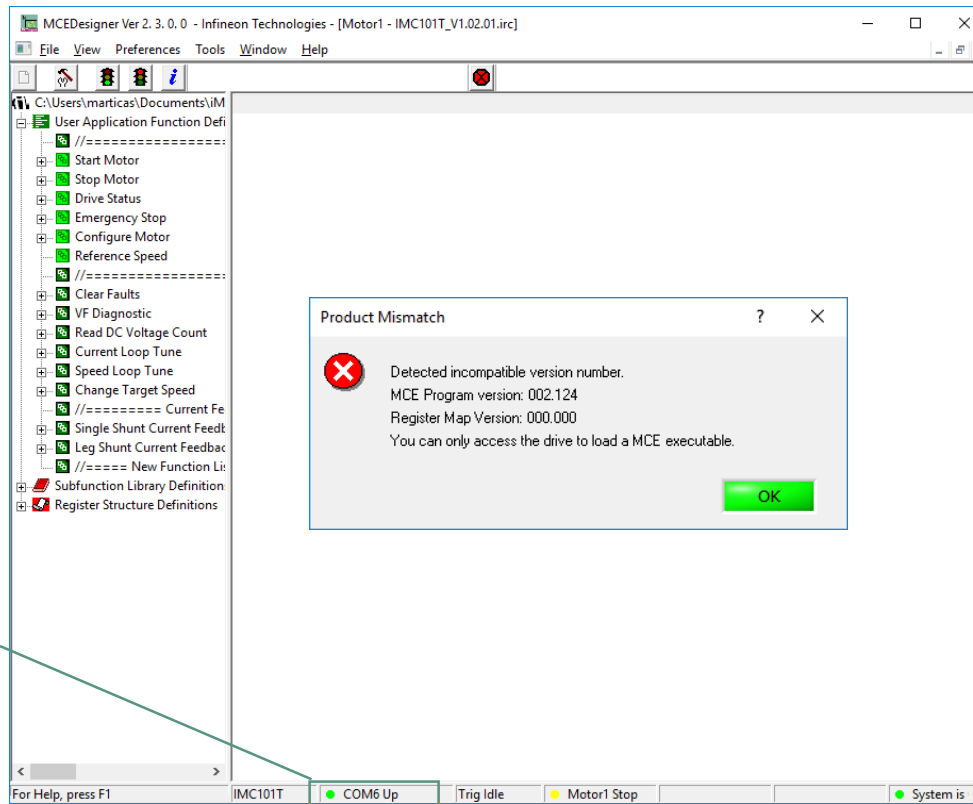
If computer can still not connect to controller, change COM port

Check status of COM port



MCEDesigner v2.3.0: Product mismatch

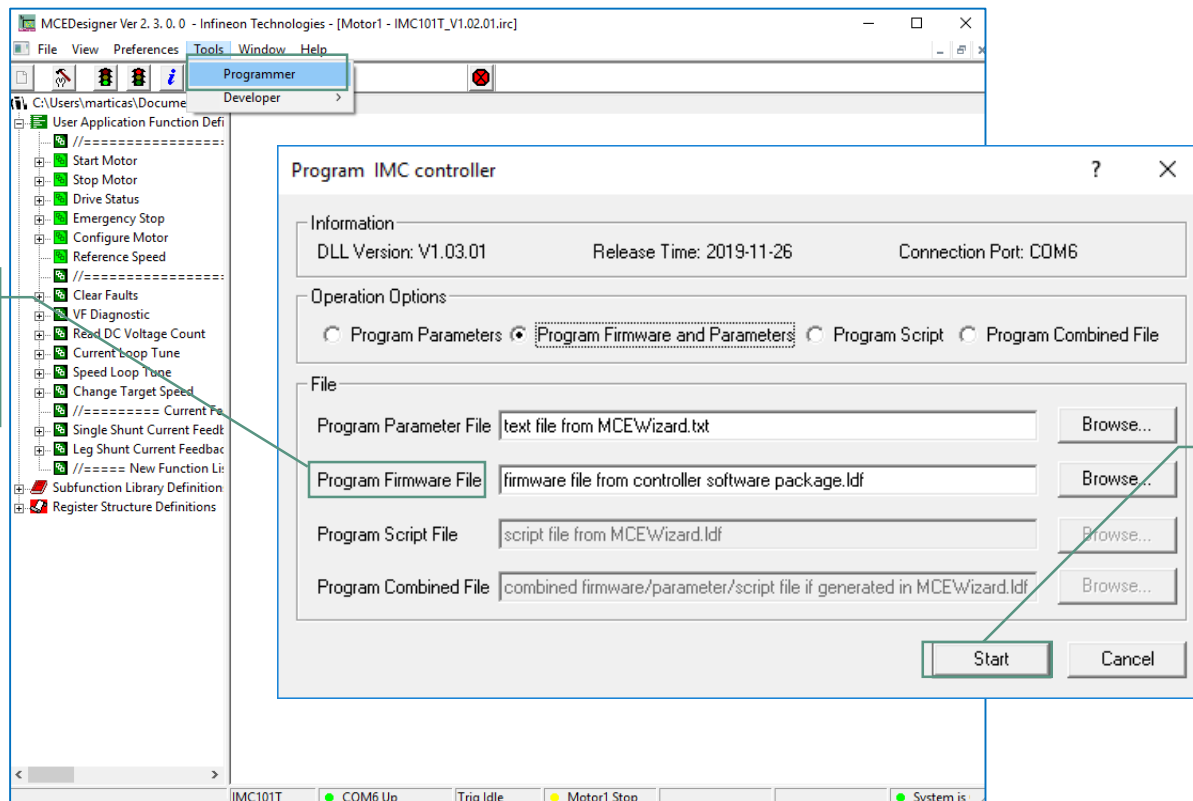
Once connected, COM port will turn green. A product mismatch error may appear. Ignore for now as you will be programming controller and this will solve error.



Check status
of COM port

MCEDesigner v2.3.0: Programming

Select Tools > Programmer. A pop-up window will appear. First program firmware and parameter file, then script file if created. If files were combined in MCE Wizard, select combined file instead.



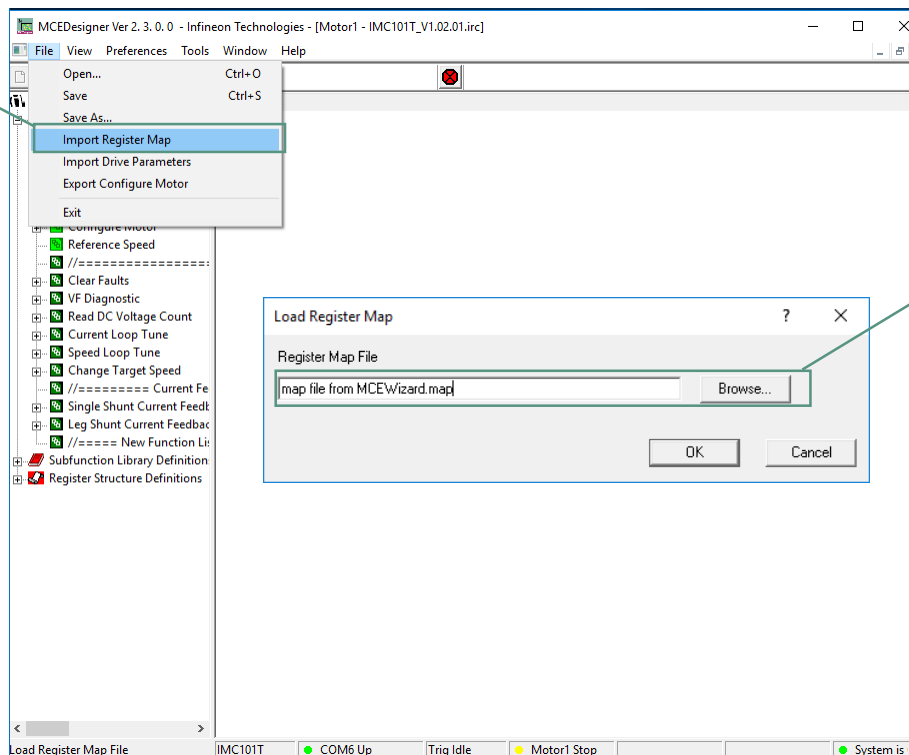
Firmware only needs to be programmed once (first time).

Program by clicking start. Controller cannot be programmed if motor is running.

MCEDesigner v2.3.0: Register map

If script file was created, register map file (.map) must be imported to reflect registers used in script. This enables user to view global script variables in MCEDesigner and virtual scopes.

File > import
register map



Select file exported from
MCEWizard

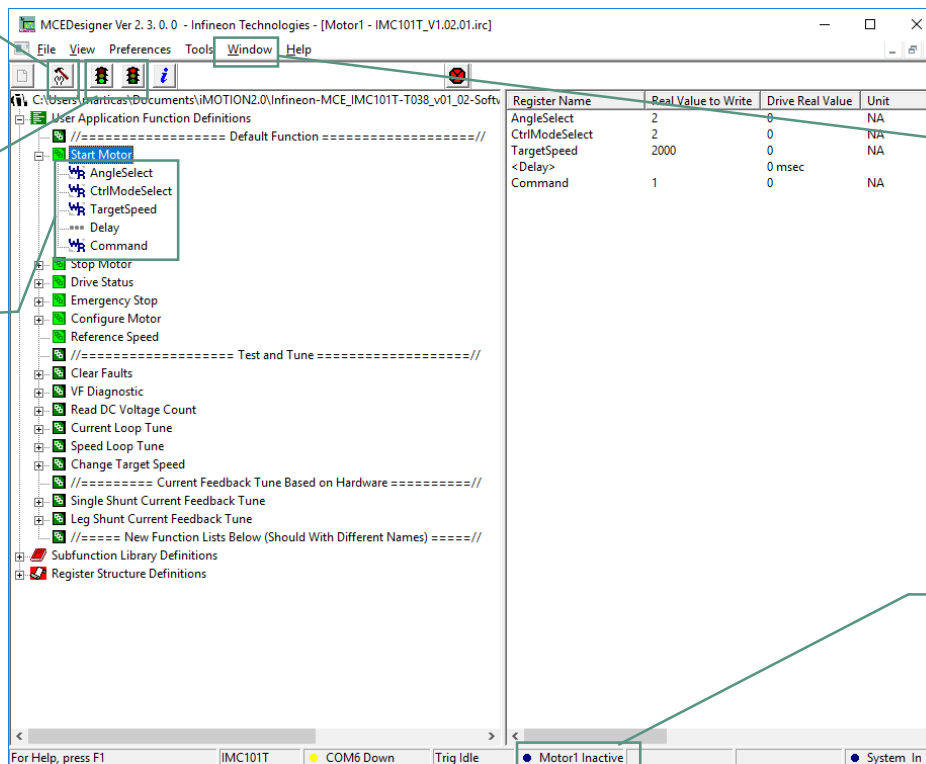
MCEDesigner v2.3.0: Running motor

Now that controller is programmed and MCEDesigner updated, motor can be run by clicking the green light (start motor). All events specified in “Start Motor” dropdown will be run. Please note for this tutorial only speed control is covered, but same steps can be applied to other control methods.

Click to clear any faults

Start and stop motor

Start motor events
The values for these were set in MCEWizard. Descriptions can be viewed by double clicking.



MCEDesigner Ver 2.3.0.0 - Infineon Technologies - [Motor1 - IMC101T_V1.02.01.irc]

File View Preferences Tools Window Help

User Application Function Definitions

Start Motor

- AngleSelect
- CtrlModeSelect
- TargetSpeed
- Delay
- Command

Stop Motor

- Drive Status
- Emergency Stop
- Configure Motor
- Reference Speed

Test and Tune

- Clear Faults
- VF Diagnostic
- Read DC Voltage Count
- Current Loop Tune
- Speed Loop Tune
- Change Target Speed
- Current Feedback Tune Based on Hardware
- Single Shunt Current Feedback Tune
- Leg Shunt Current Feedback Tune

New Function Lists Below (Should With Different Names)

Subfunction Library Definitions

Register Structure Definitions

Register Name	Real Value to Write	Drive Real Value	Unit
AngleSelect	2	0	NA
CtrlModeSelect	2	0	NA
TargetSpeed	2000	0	NA
<Delay>		0 msec	NA
Command	1	0	NA

For Help, press F1

IMC101T

COM6 Down

Trig Idle

Motor1 Inactive

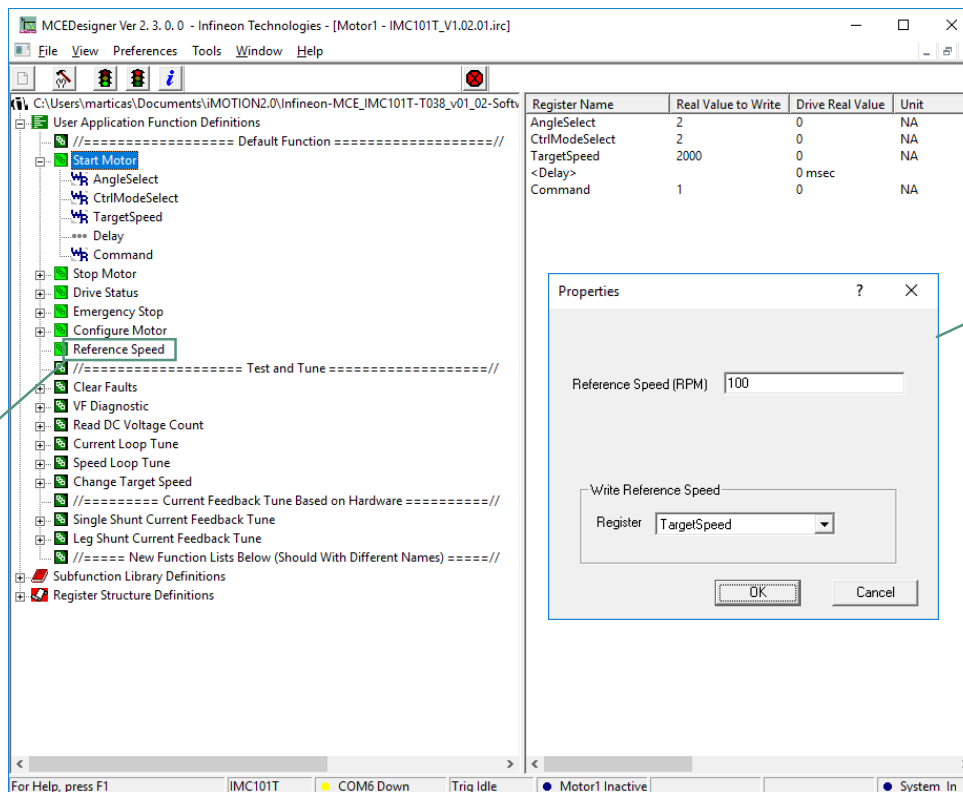
System In

Make sure motor window is open

Check motor status. Any faults will appear here.

MCEDesigner v2.3.0: Changing speed

To change speed while motor is running, right click “Reference Speed” and open properties. After setting value, double click “Reference Speed” to execute.



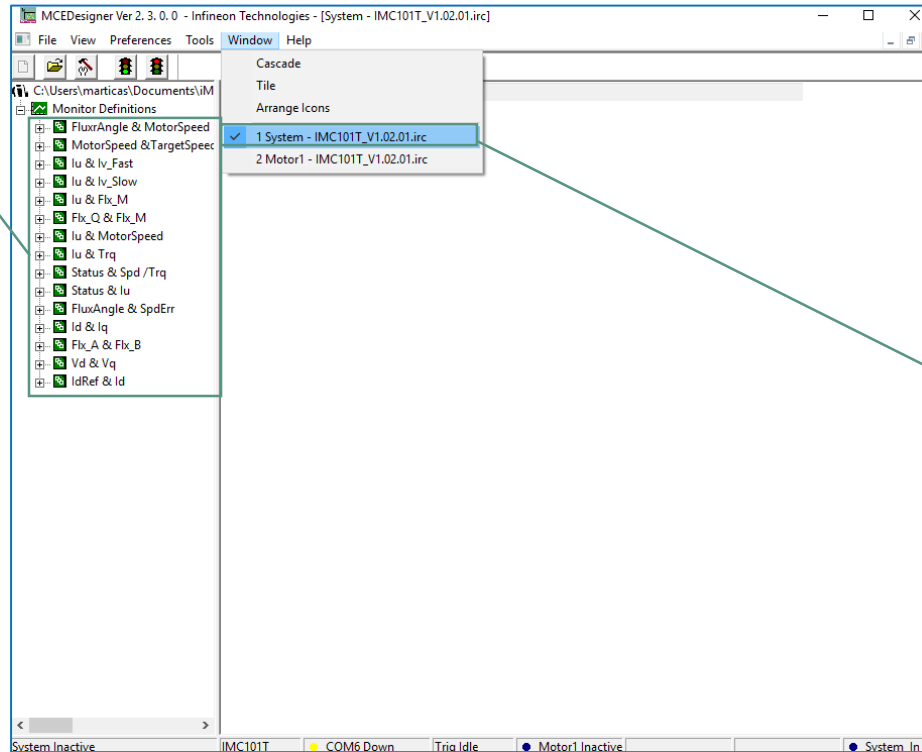
Right click

Set speed in RPMs

MCEDesigner v2.3.0: Monitor performance

Real-time graphs can be viewed in MCEDesigner to monitor traces like voltage, current, flux, speed, global script variables, etc. Default traces are given, but additional trace functions can be defined.

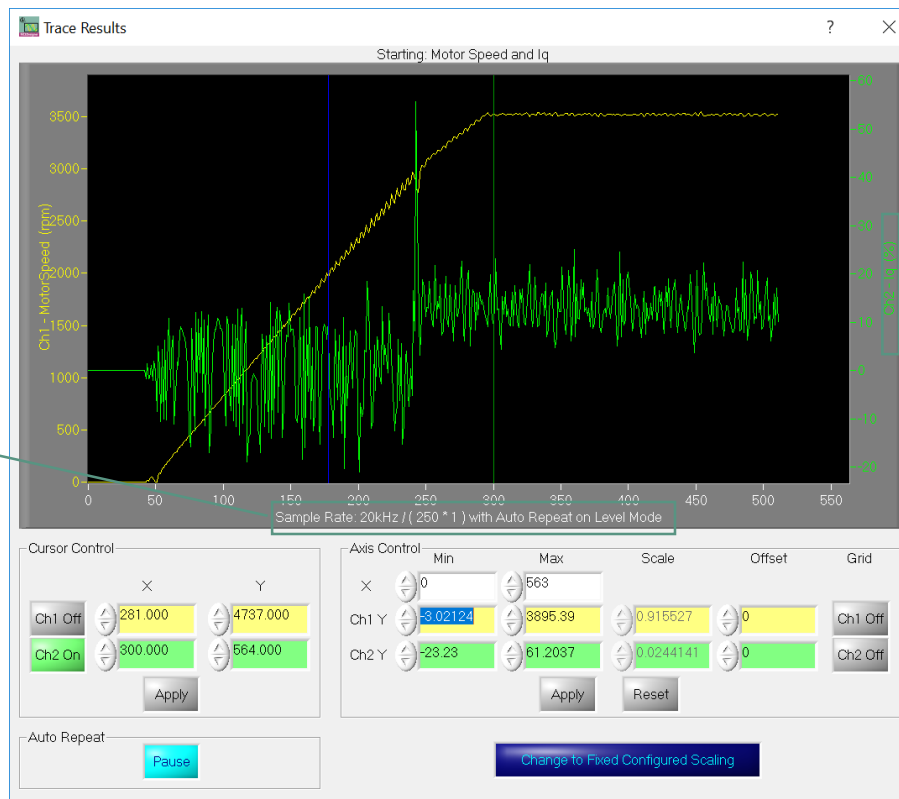
Default graph options. Double-click to open. These can be edited by right clicking, then defining trace



Open "System" window

MCEDesigner v2.3.0: Monitor performance

Graphs can have two traces plotted at one time. Scaling can be adjusted.



Sample timing and trigger information

Channel trace and unit



Part of your life. Part of tomorrow.