Micrium® uC/Probe™ XMC™ getting started

XMC™ microcontrollers
July 2016

Agenda

1. Objective of this tutorial
2. What we need to follow this tutorial?
3. Introduction to Micrium® uC/Probe™ XMC™
4. Using the dashboard
5. Using the oscilloscope
6. Other features
7. References
8. Support material

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Objective of this tutorial

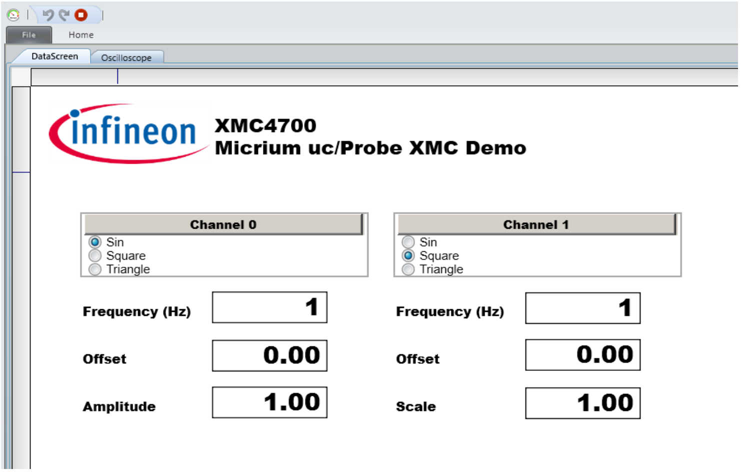
1. Download provided example application to your board

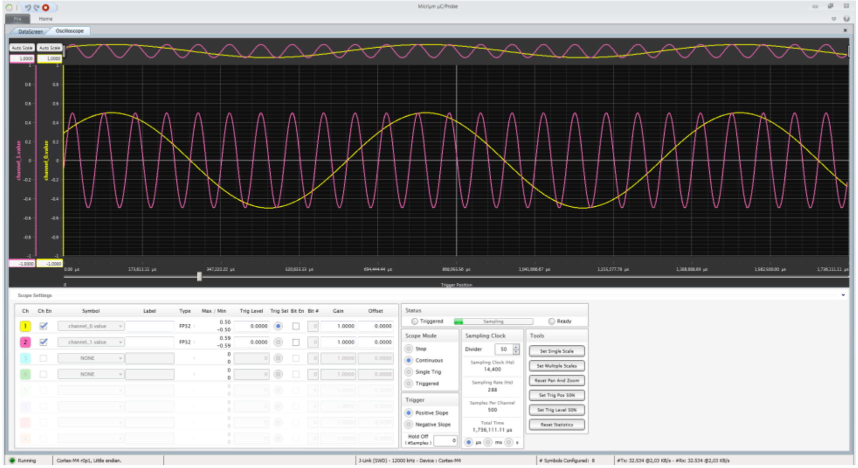
› Using DAVE™ 4 integrated debugger

› Using XMC™ Flasher tool

2. Control and monitor your application using the Micrium® uC/Probe™ XMC™ dash board

3. Monitor variables using the Micrium® uC/Probe™ XMC™ oscilloscope control





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What we need to follow this tutorial?

Software

- To download to the target the provided example application, use either:
  - **DAVE™ version 4**

    Development Platform for XMC™ microcontrollers

    Go to www.infineon.com/DAVE and download DAVE™ version 4
  - **XMC™ Flasher**

    Free of charge programming tool

    Go to XMC™ Software Download and download XMC™ Flasher
- **Micrium uC/Probe™ XMC™ version 4**

  Go to www.infineon.com/ucProbeXMC and download the latest version of Micrium® uC/Probe™ XMC™
- Example application project for DAVE™ version 4 accompanying this document

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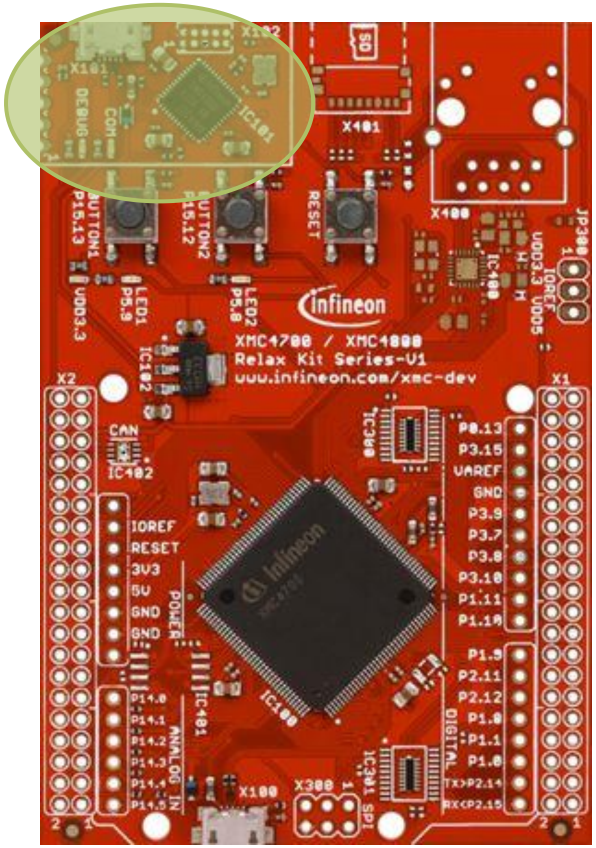
What we need to follow this tutorial?

Hardware

- Any Infineon XMC™ board
- In this document XMC4700 Relax Kit is used featuring:
  - XMC4700-F144 microcontroller based on ARM® Cortex®-M4 at 144 MHz, 2 MB Flash and 352 KB RAM
  - On-board debugger (Segger J-Link)
  - Power over USB
  - ESD and reverse current protection
  - 2 x user button and 2 x user LED
  - Arduino hardware compatible 3.3 V pinout
- On board debugger is used
- Connect the board to your PC using a micro USB cable



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Introduction to Micrium® uC/Probe™ XMC™

What is Micrium® uC/Probe™ XMC™?

- uC/Probe™ XMC™ is a Windows® based application that let’s you control and monitor a running embedded system
- Allows easy visual access to the internals of your application using the oscilloscope control, gauges, spreadsheets, LEDs and other widgets
- Create rich visually appealing user interfaces for your applications
- Can be used with any toolchain that can generate an ELF fileCan connect to the embedded system using SWD/JTAG, UART, Ethernet or USB
  - SWD communication does not need any target firmware to set or retrieve the values of variables
  - Other communication interfaces need adding a C library to your application to respond to the requests from µC/Probe™ running on the Windows® PC. Library can be obtained at µC/Probe Embedded Target Code

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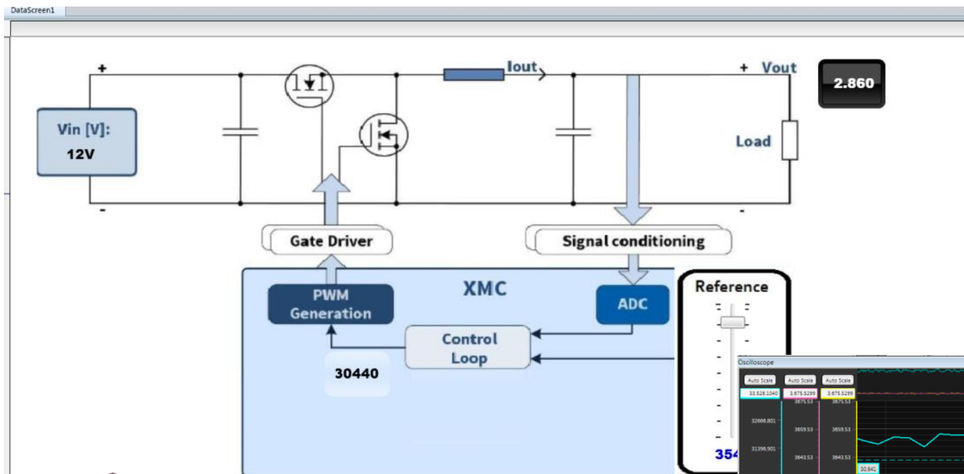
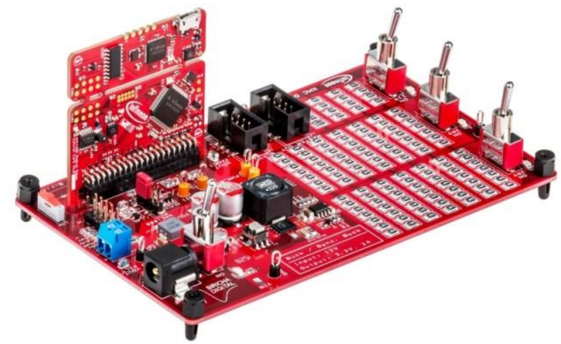
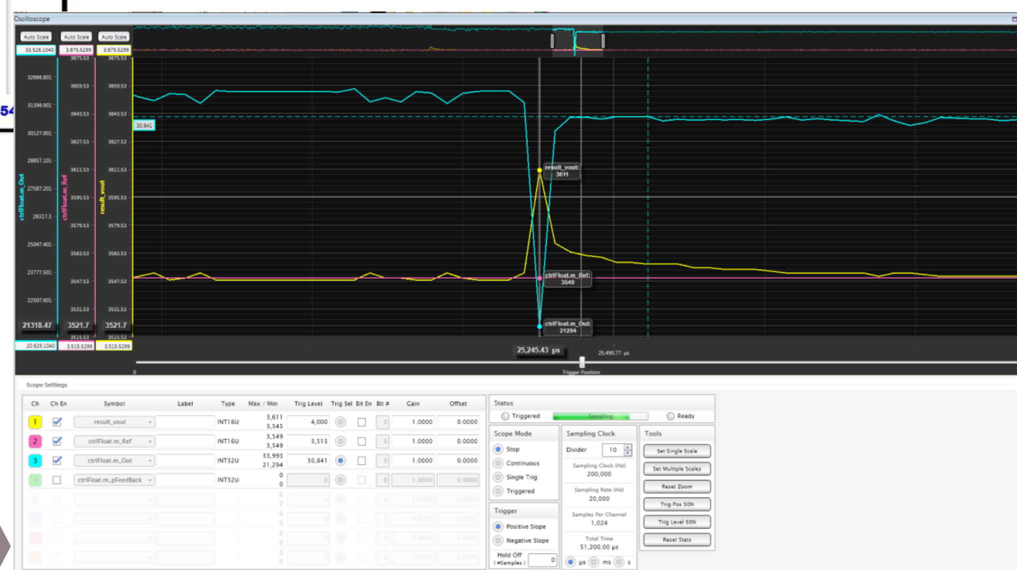
Introduction to Micrium® uC/Probe™ XMC™

uC/Probe™ XMC™ example for XMC™ Digital Power Explorer Kit



Dash board





Oscilloscope

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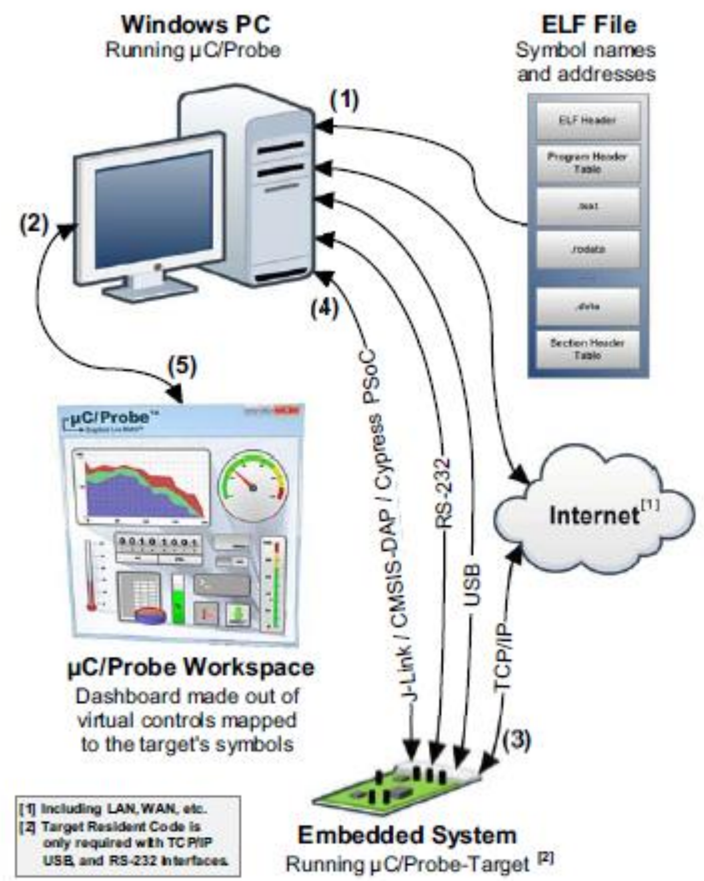
Introduction to Micrium® uC/Probe™ XMC™

How it works?

- uC/Probe™ XMC™ obtains the address of the variables from the ELF file
- Design your dash board by dragging and dropping widgets
- Associate a variable to each of the widgets
- Configure the communication interface
- Start uC/Probe™ XMC™
- uC/Probe™ make requests to read the value of all variables used in the dashboard



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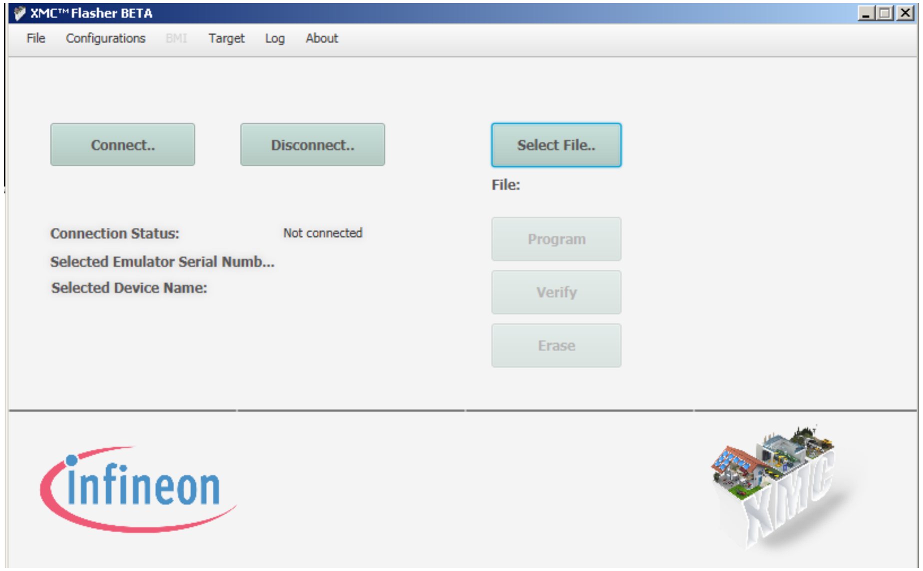
Download the application to your target using XMC™ Flasher

1. Connect your board to the PC using a micro USB cable
2. Start XMC™ Flasher
3. Select the hex file
   - Click on *File* in the menu bar
   - Browse to the location of your file



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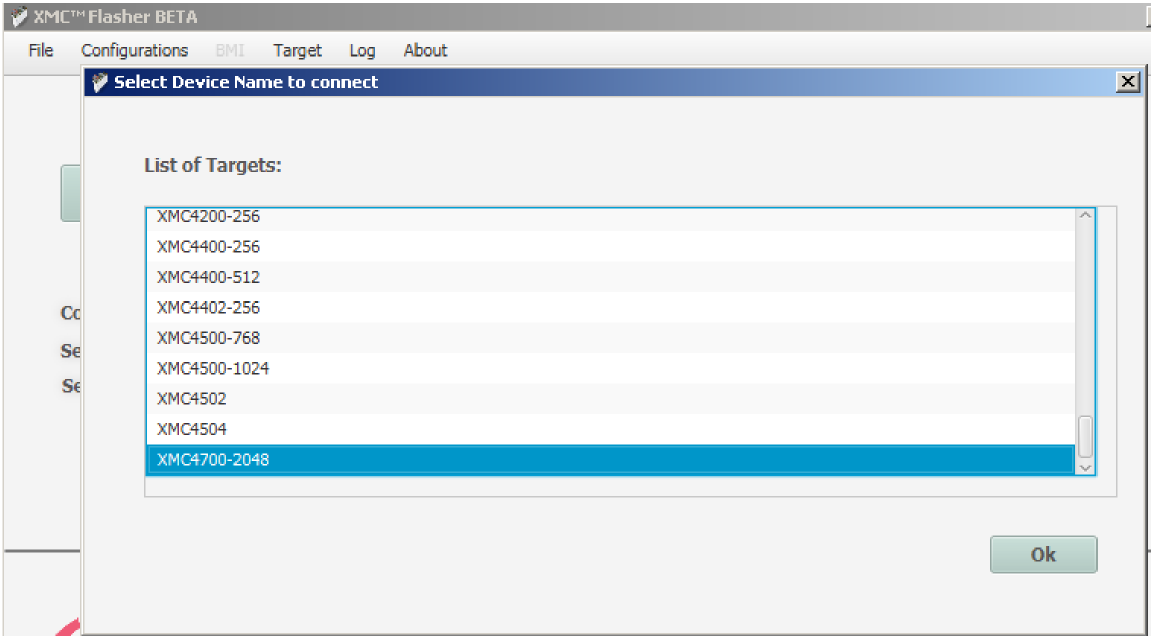
Download the application to your target using XMC™ Flasher

4. Connect to your device
   - Click on *Connect…*
   - Select your device



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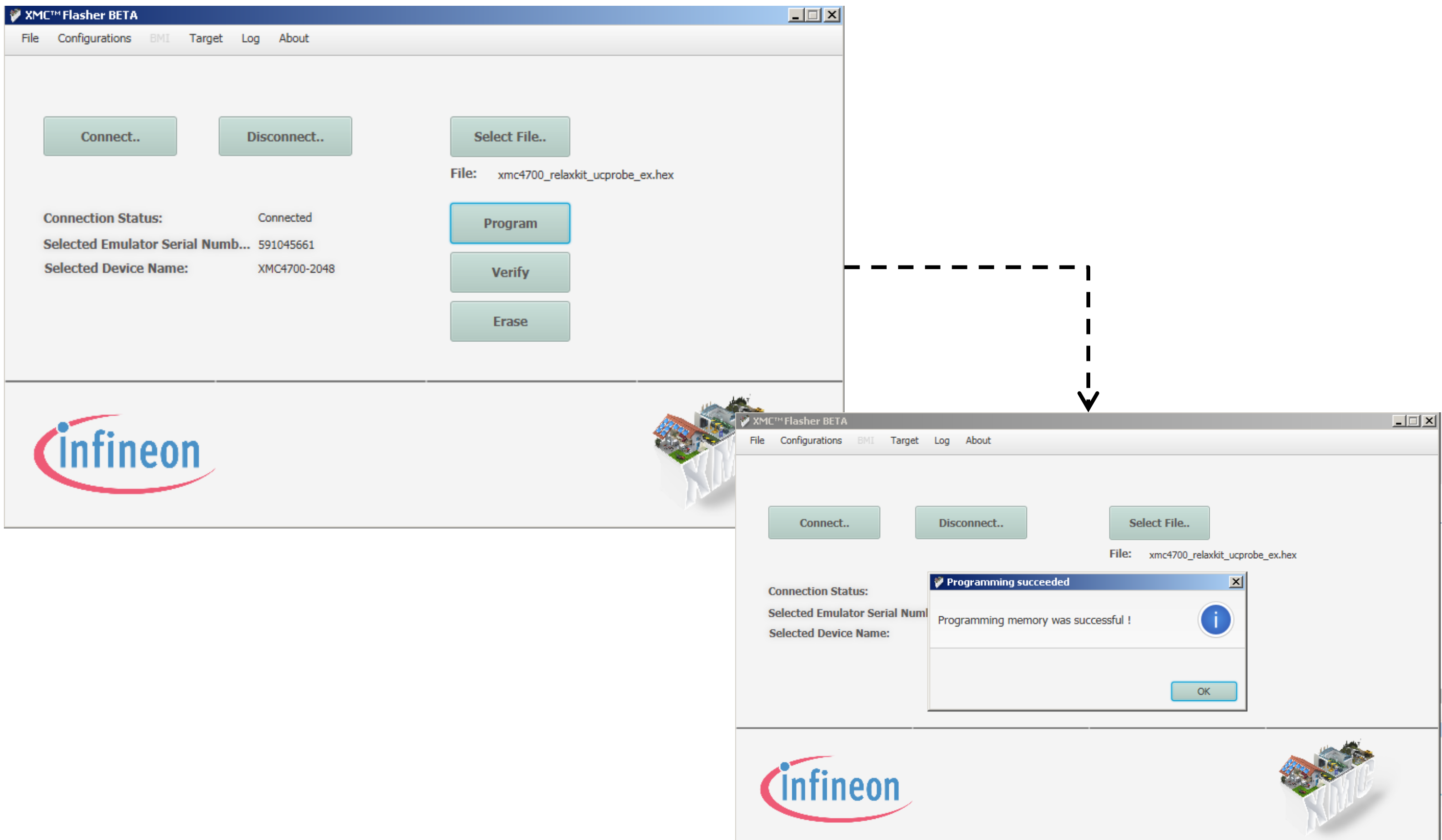
Download the application to your target using XMC™ Flasher

5. Click on *Program…*



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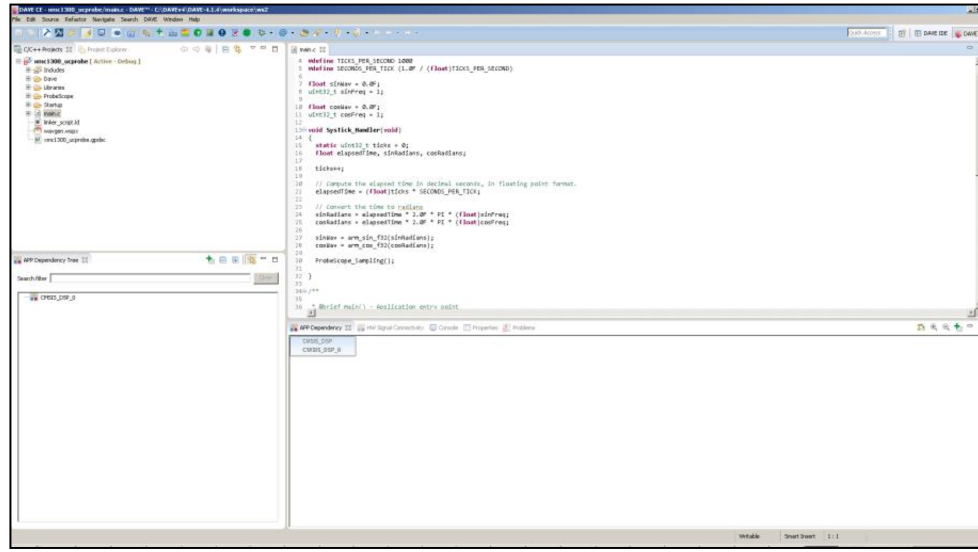
Download the application to your target using DAVE™ version 4



1. Start DAVE™ version 4

2. Import the example project

› Click on *File > Import...*

› Select *Infineon > DAVE Project*

› Click on *Next*

› Select *Archive File*

› Click on *Browse*

› Browse to the location of the example project and select the zip file

› Click on *Finish*

3. Compile the project

› Click on *Rebuild Active Project* button in the tool bar

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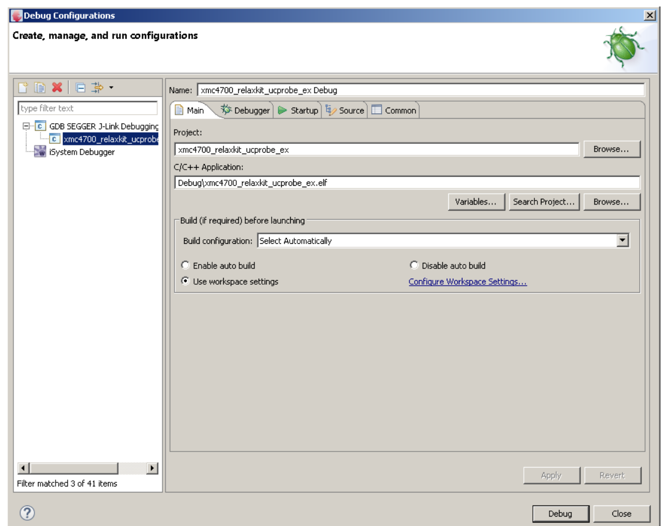
Download the application to your target using DAVE™ version 4

4. Start debugger

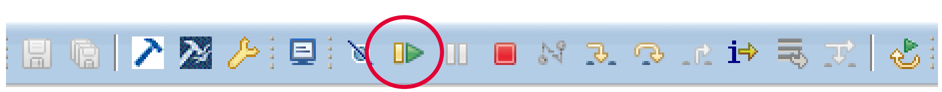
› Click on *Debug* button in the toolbar

› Double click on *GDB SEGGER J-Link Debugging*

› Click on *Debug*



› The debugger will program your board. In the debugger view click on *Resume* button in the toolbar to start your application



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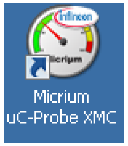
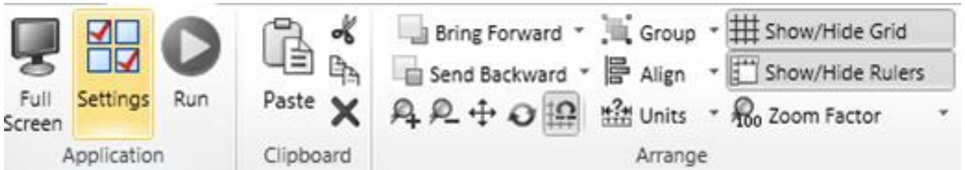
Using Micrium® uC/Probe™ XMC™ Dashboard

- This section shows you how to monitor and control your application using the dash board
- By having a dashboard for your C code, you will gain a firm understanding of what the embedded system is doing at any given time
- Use **xmc4700_relaxkit_ucprobe_ex1.zip** example project

1. Start Micrium® uC/Probe™ XMC™
   - Click on 

     in your desktop

2. Setup communication to board
   - Click on *Settings* button in the toolbar



   - Select *Debug Interfaces > J-Link*
   - Click *Ok*

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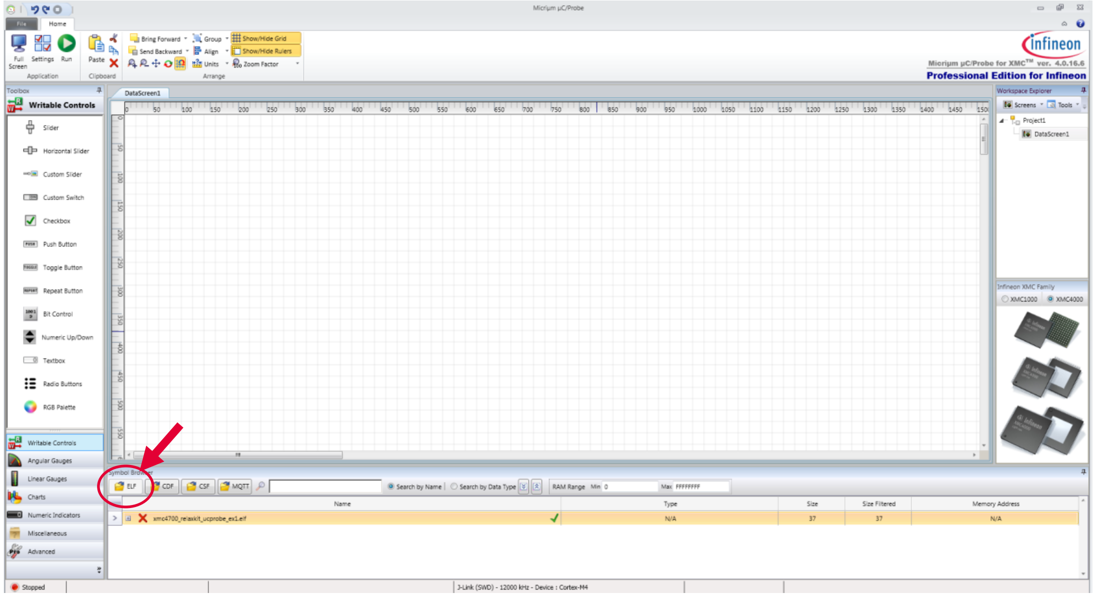
Using Micrium® uC/Probe™ XMC™ Dashboard

3. Load an ELF file

- Click on *ELF* button in Symbol Browser window
- Browse to the location of the ELF file in the Debug folder of the example project
- Select the file. Click *Open*
- Now you are ready to start designing your graphical UI



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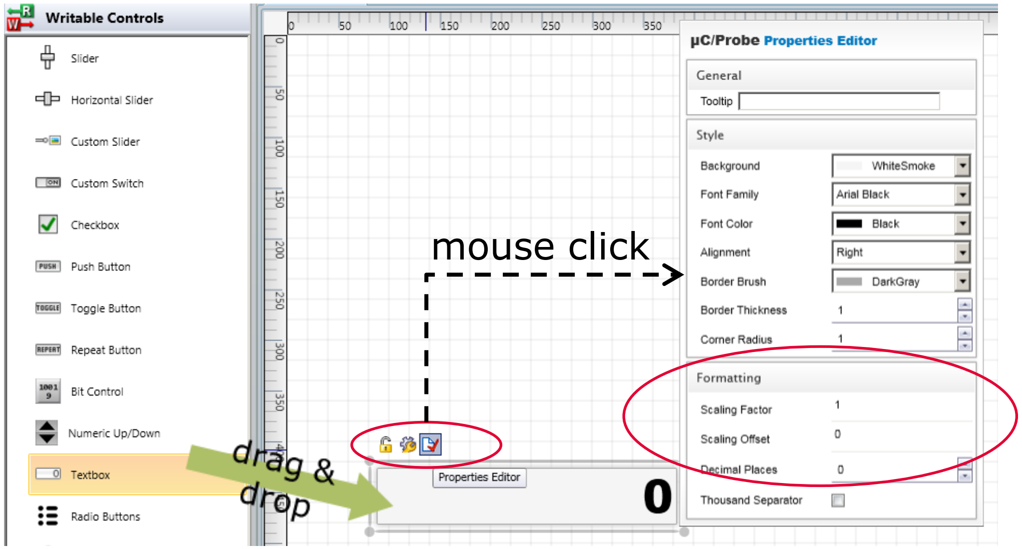
Using Micrium® uC/Probe™ XMC™ Dashboard

4. Drag and drop controls to build your user interface

- In this example we will monitor and control a global variable of our application
- Add a **Textbox** from the Writable Controls. We will use this control to change the value of the variable
- In the Properties Editor you could apply scaling to the read value of the form y = scale*x + offset. You can also adjust the Decimal Places. These settings are available for almost all controls



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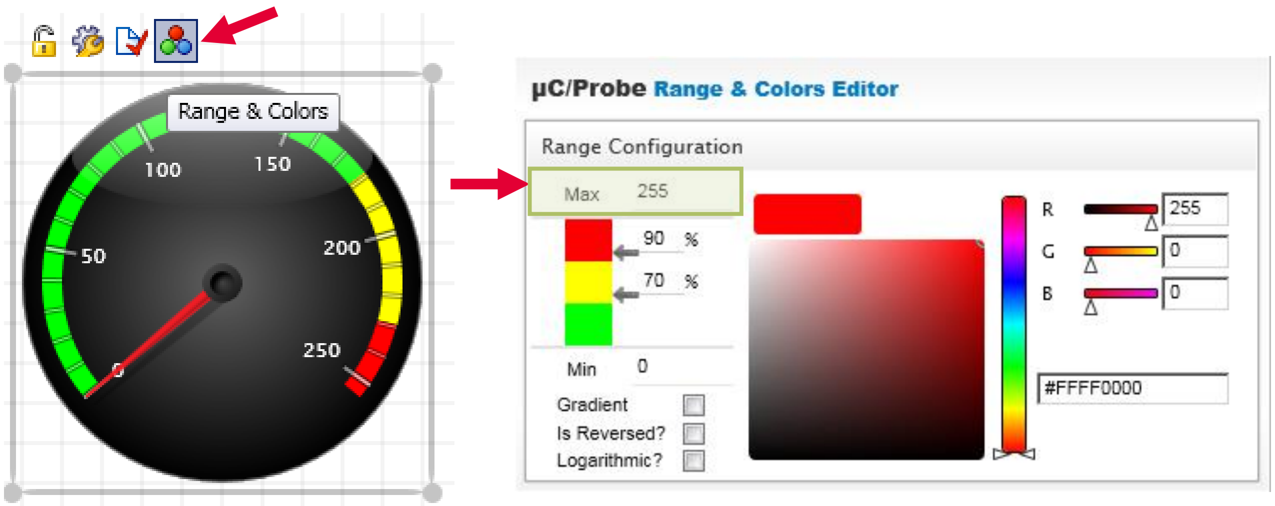
Using Micrium® uC/Probe™ XMC™ Dashboard

› Add a **Radial 1** from the Angular Gauges. We will use this control to monitor the value of the variable.

  In the Range and Colors of the control select maximum value 255



› Add a **Cylinder 1** from the Linear Gauges. We will use this control to monitor the value of the variable.

  – In the Range and Colors of the control select maximum value 255

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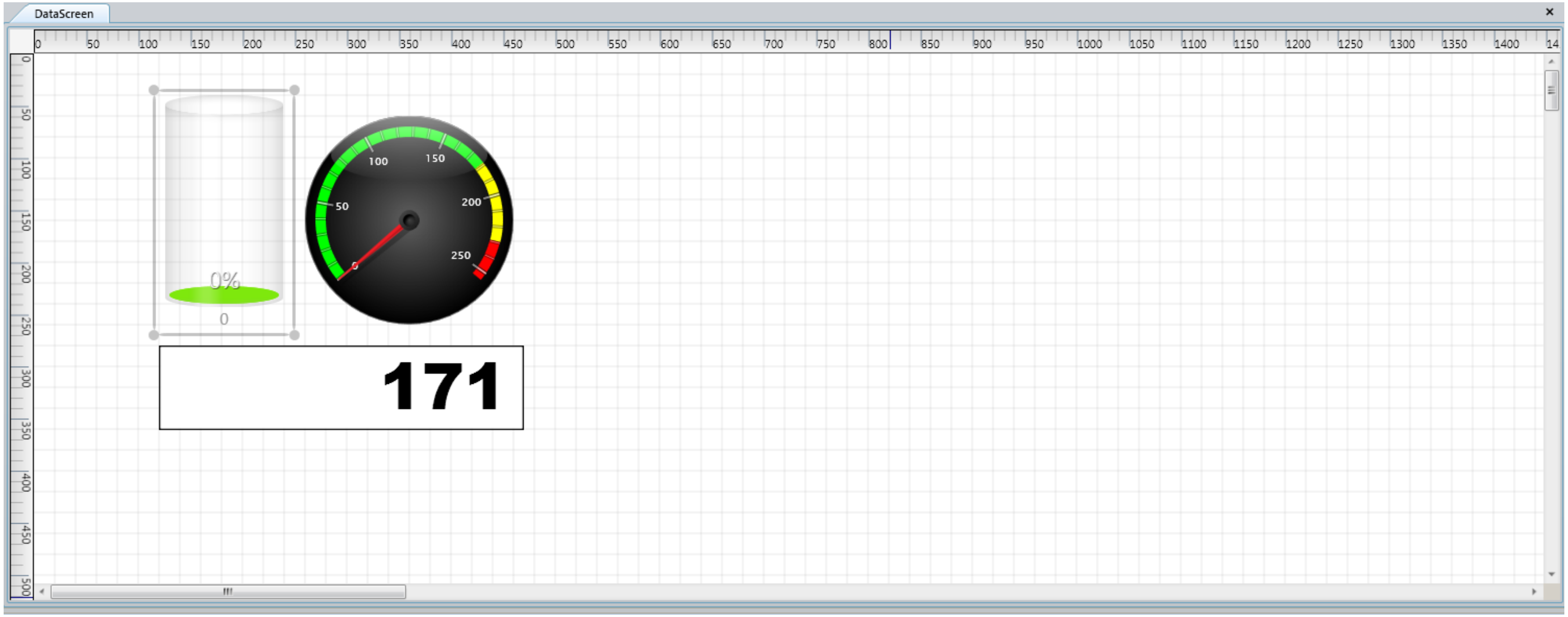
Using Micrium® uC/Probe™ XMC™ Dashboard

› Your dash board should look like as shown below

› You can always save your workspace by *Ctrl-S* or *File > Save* for later use or for sharing



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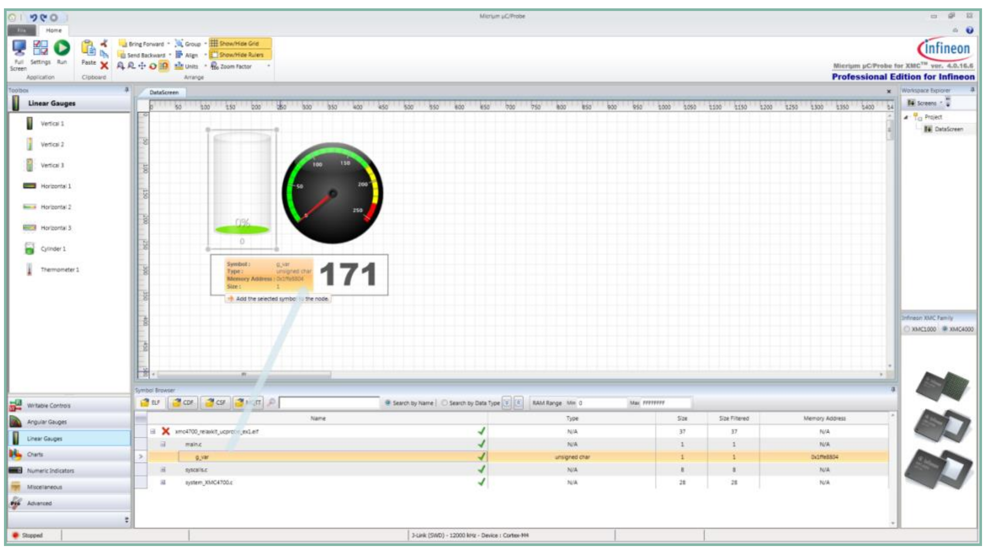
Using Micrium® uC/Probe™ XMC™ Dashboard

5. Associate variables to controls

- Search for the **g_var** symbol in the Symbol Browser:
  - Either use the search function if you know the name of the variable
  - Or unfold the ELF file and navigate through the modules
- Drag the **g_var** variable and drop it over the Textbox control
  - Do the same for all the other controls



Alternatively you can associate a variable to a control by double clicking on the variable if previously the control was selected by clicking on it.

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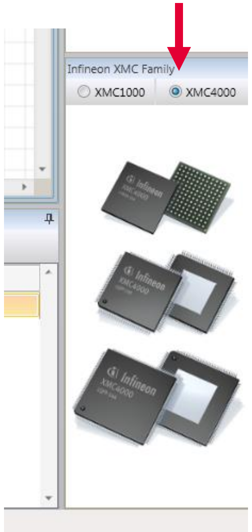
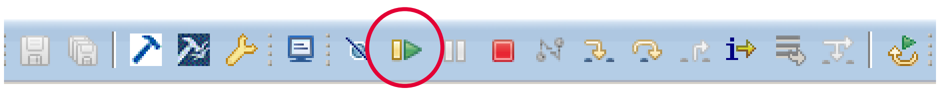
Using Micrium® uC/Probe™ XMC™ Dashboard

6. Since we are connecting to a XMC4700 board, select *XMC4000* in the Infineon XMC™ Family window



7. Before the next step ensure your board is running,

   i.e. not halted by debugger



6. Click on *Run* button in toolbar

› The controls visualization will get updated periodically according to the value of the variable **g_var**

› In this case the application increments the variable **g_var** in a loop

› You can also modify the value of the variable in run time

No programming is required!
No need to instrument your embedded code nor need to write any single line of code in the PC to get insight of your application.

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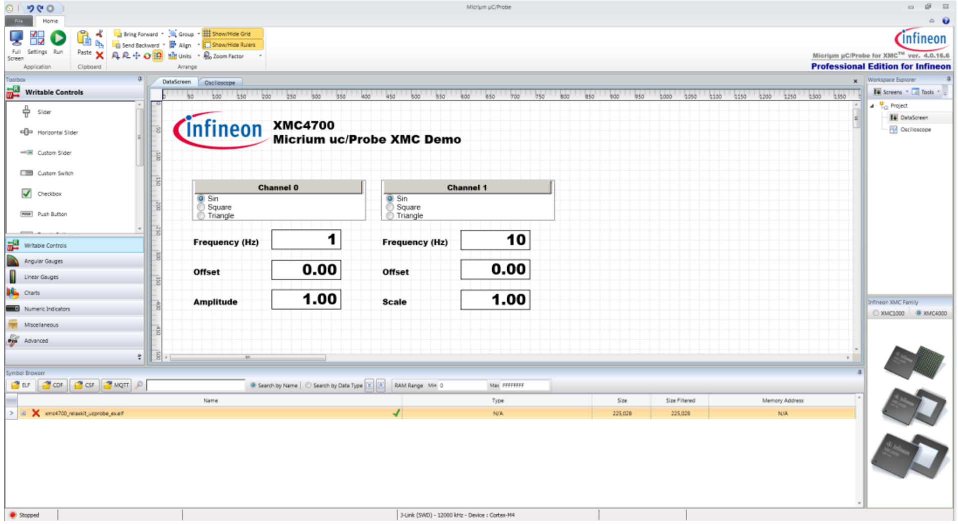
Using Micrium® uC/Probe™ XMC™ Oscilloscope control

In this section will explore the capabilities of the oscilloscope control of Micrium® uC/Probe™ XMC™

- Use **xmc4700_relaxkit_ucprobe_ex2.zip** example project

1. In this section you will open an existing Workspace (.wspx)

- Simply double click on the provided .wspx file in the example project.
- Micrium® uC/Probe™ XMC™ will start, showing the panel control for a software “signal generator”



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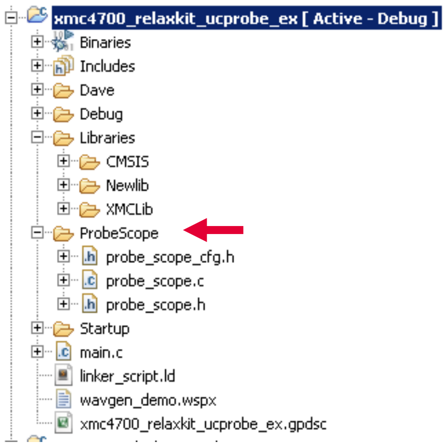
Using Micrium® uC/Probe™ XMC™ Oscilloscope control

2. Add uC/Probe™ Embedded Target code



- To use the oscilloscope control, it requires adding to your application the Scope library which is part of the Target Code included in the µC/Probe™ XMC™ download package or can be downloaded from µC/Probe Embedded Target Code
  - Add folder and adjust the compiler settings, i.e. Include Paths
  - Include probe_scope.h into your application code
- The library provide two functions:
  - **ProbeScope_Init()**
    Initializes the internals of the Oscilloscope module. It sets the time base indicated as a parameter to the function, i.e. the frequency of calling the sampling function
  - **ProbeScope_Sampling()**
    Take a sample of each active oscilloscope channel. This function should be called in periodic function, i.e. control loop or timer ISR like in the example
- The library can be configured adapting the defines in probe_scope_cfg.h
  - Number of channels
  - Number of sample per channel
    - It determines the length of the waveform, i.e. T = sampling period X number of samples per channel

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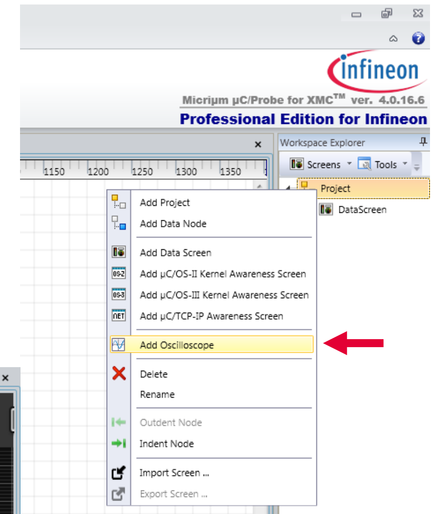
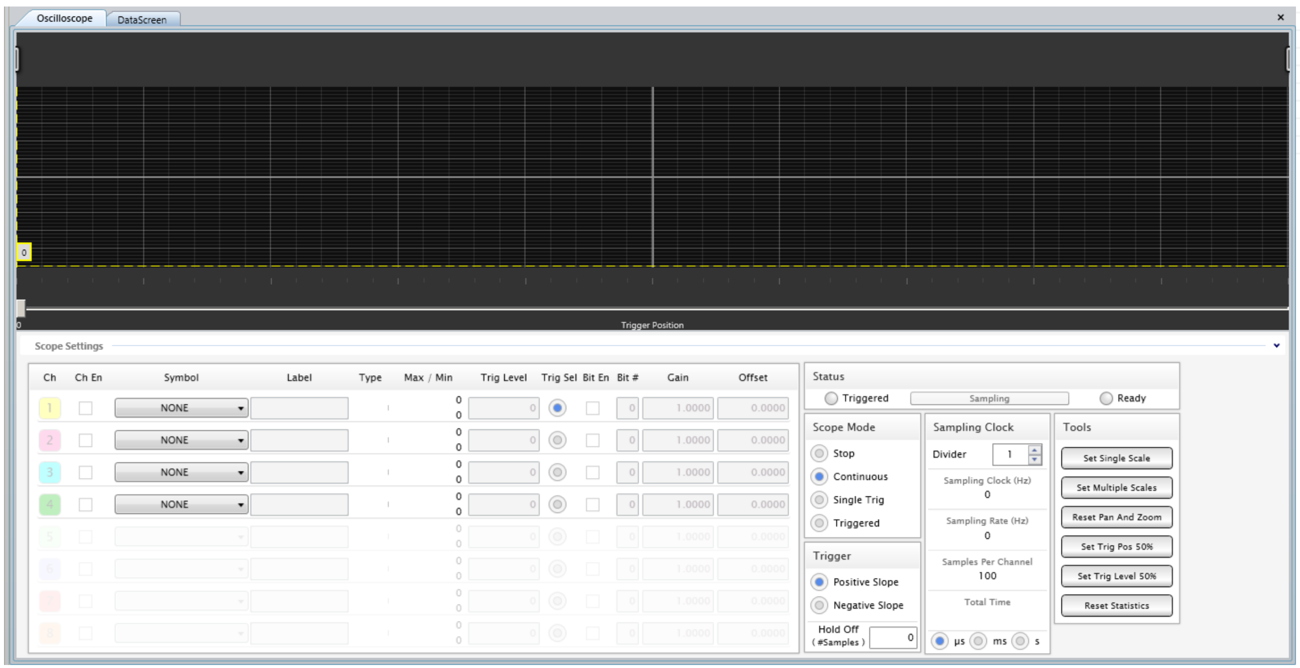
Using Micrium® uC/Probe™ XMC™ Oscilloscope control

3. Create an oscilloscope

› Click on *Project > Add Oscilloscope*

› A new tab is created in the workspace containing the oscilloscope control





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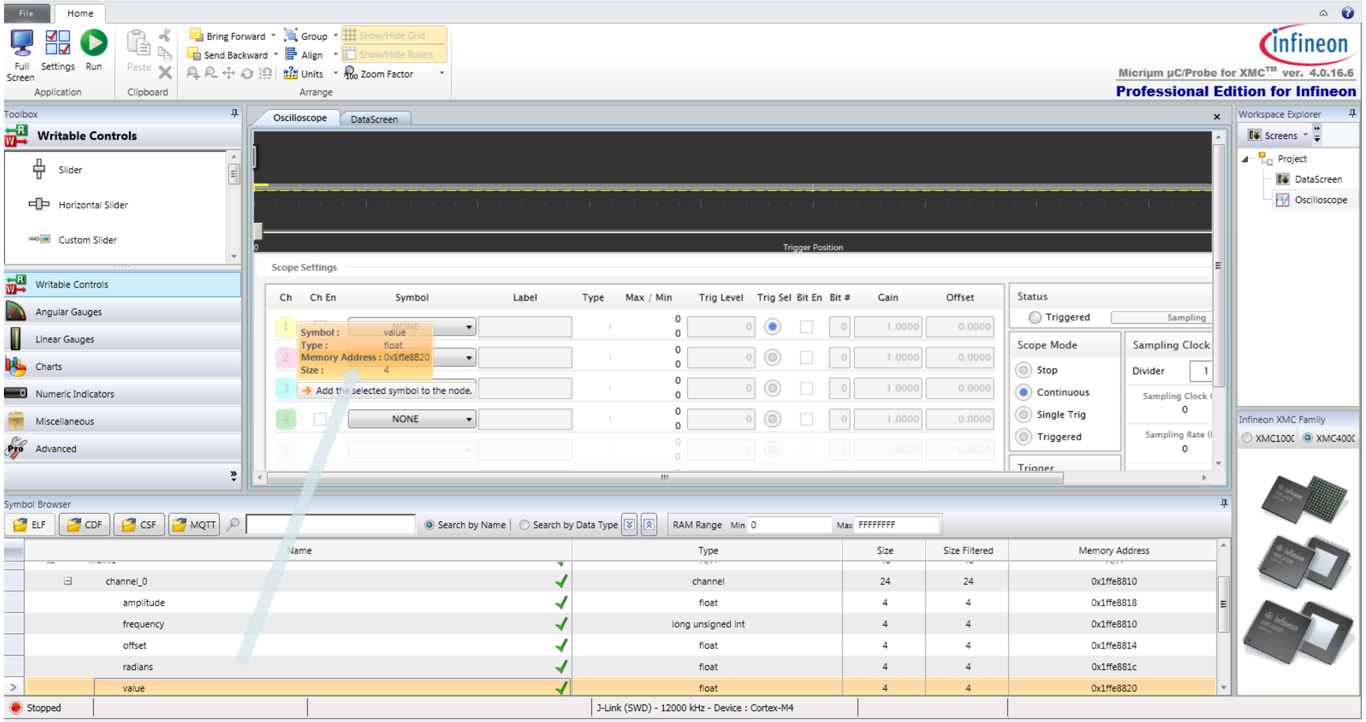
Using Micrium® uC/Probe™ XMC™ Oscilloscope control

4. Associate variables to the oscilloscope channels

› Using the symbol browser drag and drop the variables channel_0.value and channel_1.value to the oscilloscope channels



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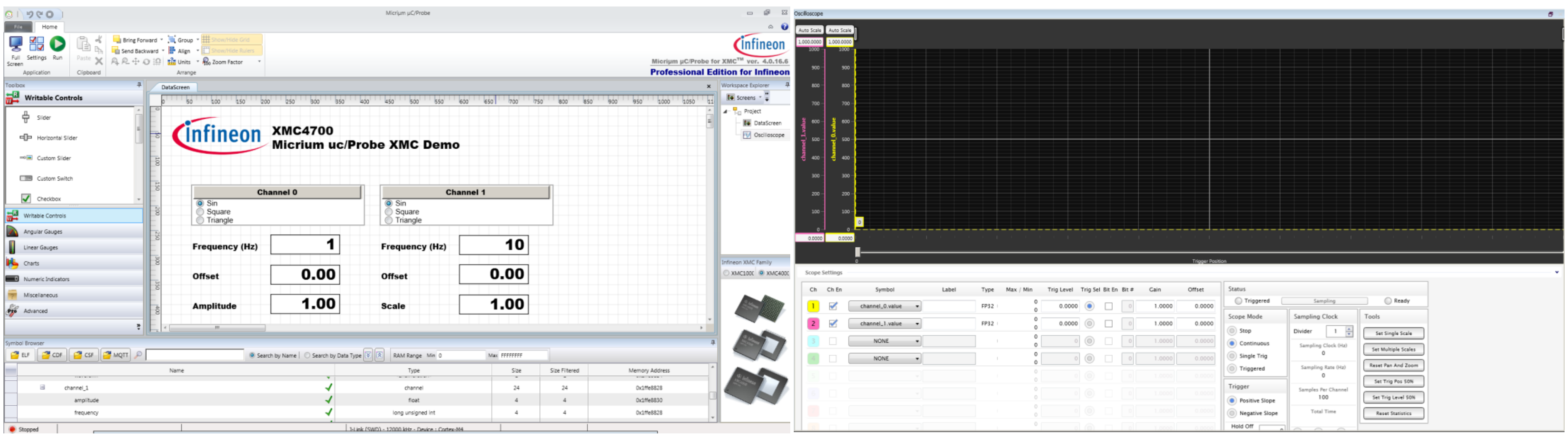
Using Micrium® uC/Probe™ XMC™ Oscilloscope control

5. Change the layout of the workspace

› To easily access the controls of the dashboard and simultaneously observe the oscilloscope, right click on the tab **Oscilloscope** and select *Floating*. The oscilloscope window will be detached from the main window of Micrium® uC/Probe™ XMC™



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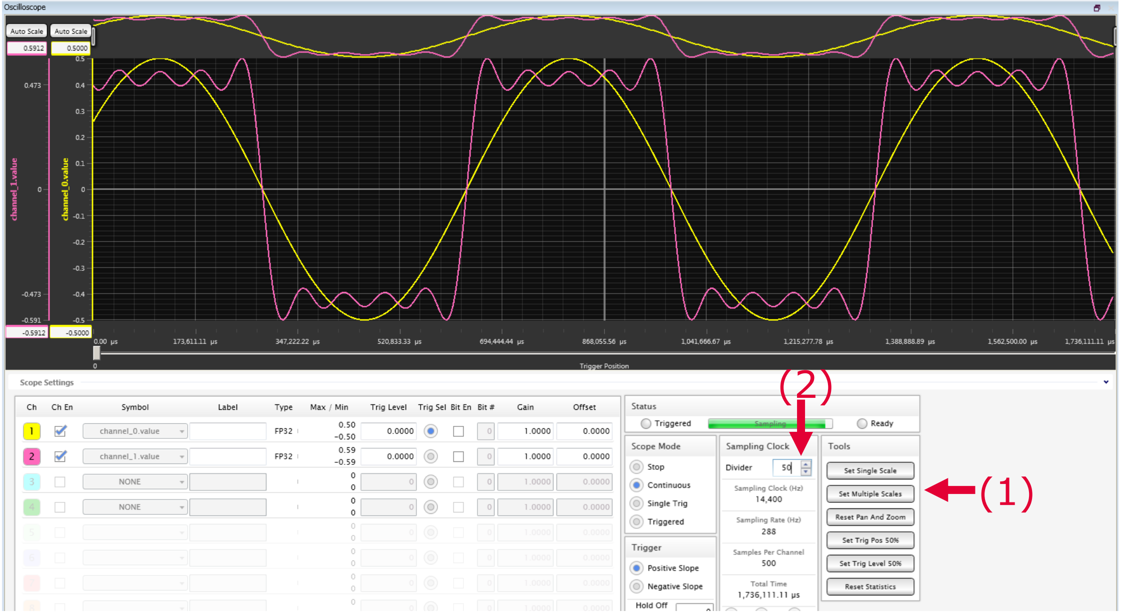
Using Micrium® uC/Probe™ XMC™ Oscilloscope control

6. Ensure target is running.
7. Click on *Run* button in toolbar.
8. Adjust the oscilloscope channel scale.

› Click on **Set Multiple Scales** (1) in Tools to adjust the vertical scale.

› Set the **Sampling Clock Divider** (2) to adjust the time base scale.



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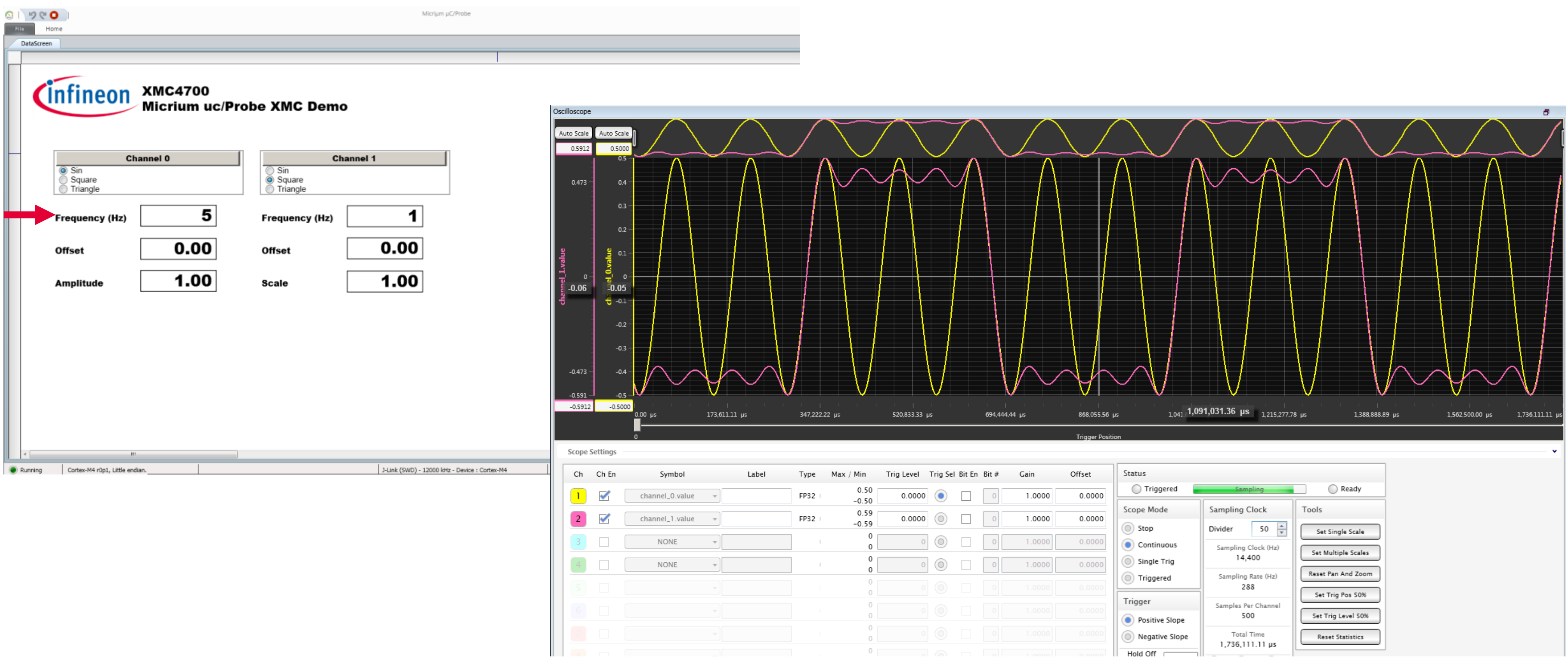
Using Micrium® uC/Probe™ XMC™ Oscilloscope control

9. Use the dash board to control your application and observe the effect on the oscilloscope

› For example, change frequency of the waveform generator channel 0 Hz to 5 Hz. You should observe something similar to the picture below



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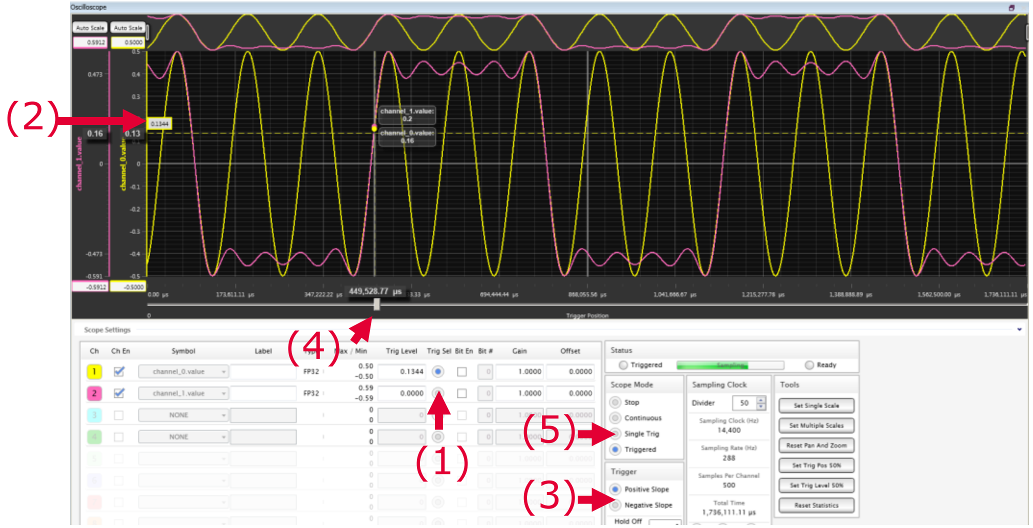
10. Oscilloscope trigger options

- One of the main features of the Oscilloscope control is the capability of triggering with the following options:
  - Trigger channel selection (1)
  - Trigger level (2)
  - Rising or falling edge (3)
  - Pre trigger (4)
  - Single trigger or continuous trigger (5)



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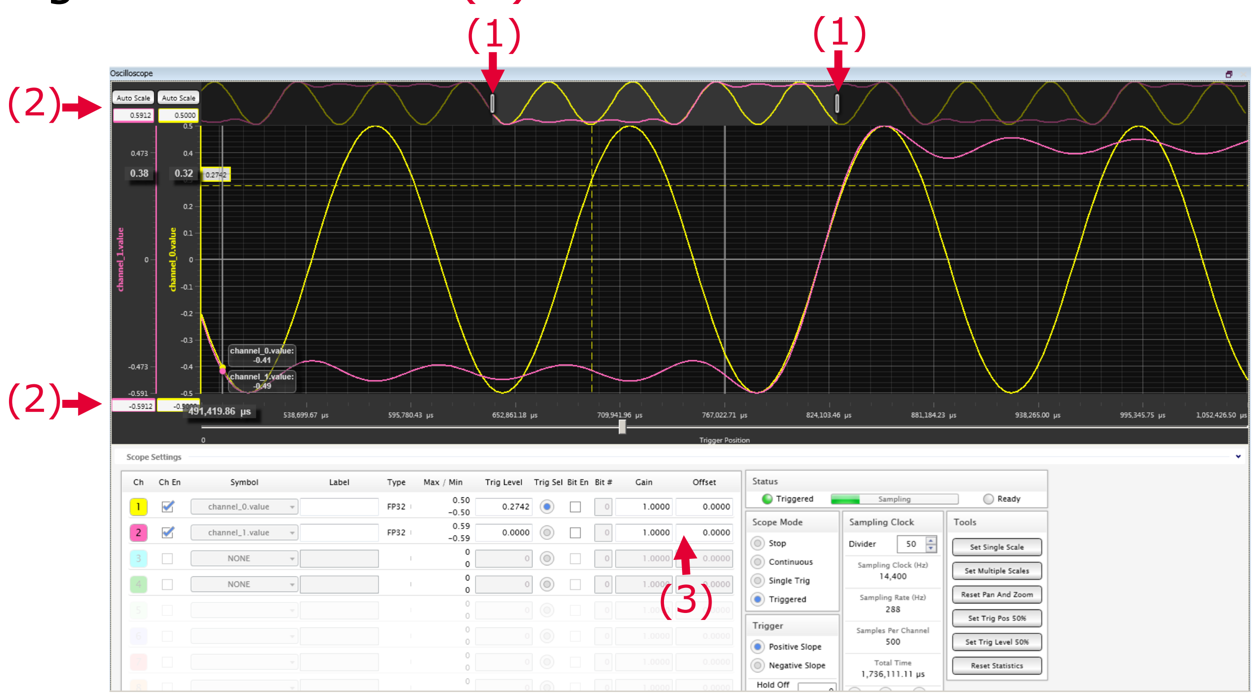
Using Micrium® uC/Probe™ XMC™ Oscilloscope control

11. Oscilloscope other features

- Time axis zoom
  - Use the scroll bars in the top area of the Oscilloscope window (1)
- Individual Y vertical channel scale (2)
- Offset and gain of channels (3)



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Micrium® uC/Probe™ XMC™
Other features

- **Data logging control**

  Log the values of any variable(s) in your symbols browser to a CSV file

- **Microsoft ® Excel® Bridge**

  Map an embedded target's symbol to a cell in Microsoft® Excel®

- **uC/OS Kernel Awareness**

  The µC/OS Kernel Awareness in µC/Probe™ is a series of pre-built screens that allows you to see the run time behavior of all the µC/OS-II kernel objects used in your embedded application

- **Terminal Window**

  Interact with your embedded target in a shell-like fashion

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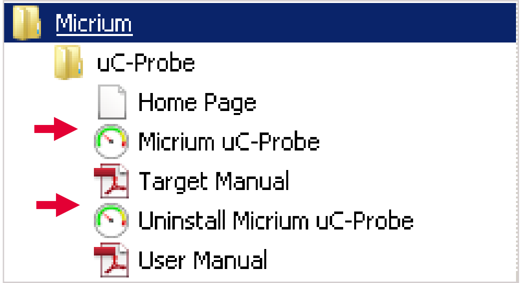
References

- **Micrium® uC/Probe™ XMC™ documentation**
  - **Accessible in the Start menu of Windows®**
  - **Or in the File tab**



- **Micrium® uC/Probe™ XMC™ features**

  https://www.micrium.com/tools/ucprobe/features/

- **uC/Probe™ Oscilloscope Feature: BLDC Design Case Study**

  https://www.micrium.com/new-%C2%B5cprobe-features-simplify-bldc-design/

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Collaterals and Brochures	› Product Briefs › Selection Guides › Application Brochures › Presentations › Press Releases, Ads	› www.infineon.com/XMC
Technical Material	› Application Notes › Technical Articles › Simulation Models › Datasheets, MCDS Files › PCB Design Data	› www.infineon.com/XMC › Kits and Boards › DAVE™ › Software and Tool Ecosystem
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