

GUI emWin Start Guide

V1.00.007

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Support Chips:
N9H20 Series

Support Platforms:
Non-OS

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1. Introduction

1.1. Introduction

emWin is a graphic library with graphical user interface (GUI). It is designed to provide an efficient, processor- and display controller-independent graphical user interface (GUI) for any application that operates with a graphical display.

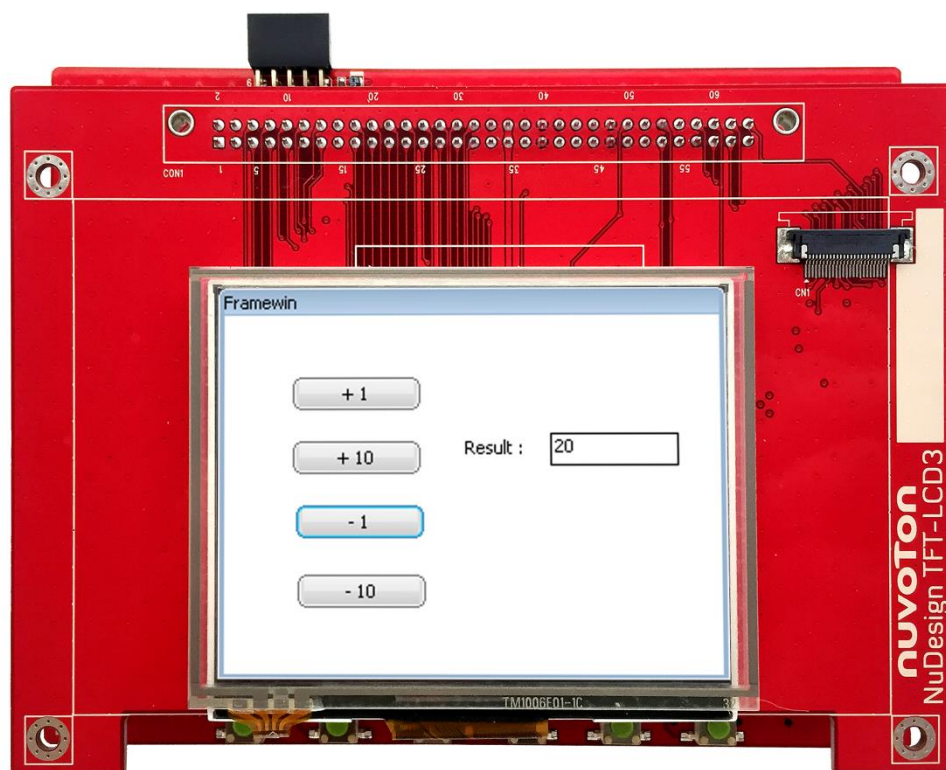


Figure 1.1-1 emWin runs on N9H20.

N9H20 BSP includes emWin related materials, e. g., sample codes, library, documents and tools. We can develop emWin applications on Keil MDK includes IDE, compiler and debugger (embedded development tools for Arm) to build, modify and debug. We'll introduce the basic operations on section 2.4.

1.2. emWin Folder structure

N9H20 BSP contains emWin related materials and the folder structure is shown below:

Directory Name	Content
SampleCode \ emWin	Two emWin samples: 1. GUIDemo 2. SimpleDemo
ThirdParty \ emWin \ Config	emWin configuration files, memory pool & display driver
ThirdParty \ emWin \ Doc	Three emWin official documents: 1. AN03002_Custom_Widget_Type.pdf 2. UM03001_emWin.pdf 3. Release.html Three Nuvoton documents: 1. Changelog.pdf 2. UM_Font_Architect_EN_Rev1.02.pdf 3. UM_Font_Architect_TC_Rev1.02.pdf
ThirdParty \ emWin \ Include	emWin include files
ThirdParty \ emWin \ Lib	Two emWin libraries: 1. NUemWin_ARM9_Keil.lib 2. libNUemWin_ARM9_GNU.a
ThirdParty \ emWin \ Tool	Four emWin official tools 1. BmpCvtNuvoton.exe 2. emWinPlayer.exe 3. GUIBuilder.exe 4. JPEG2Movie.exe One Nuvoton tool: 1. FontArchitect.exe

1.3. Resource link

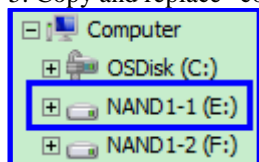
We can utilize official websites for further assistance, here is the resource link table:

Topic	Resource link
Nuvoton Website	Nuvoton official website entrance link: https://www.nuvoton.com/
Nuvoton Forum	Nuvoton HMI/GUI official forum link: http://forum.nuvoton.com/viewforum.php?f=31 http://nuvoton-mcu.com/forum.php?mod=forumdisplay&fid=86
SEGGER Forum	SEGGER emWin official forum link: https://forum.segger.com/index.php/Board/12-emWin-related/
Nuvoton BSP	The latest N9H20 BSP GitHub link: https://github.com/OpenNuvoton/N9H20_emWin_NonOS BSP contained pre-built emWin SimpleDemo & GUIDemo https://www.nuvoton.com/products/application-specific-socs/hmi-emwin-mpus/-n9h-series/?group=Software&rt=Board%20Support%20Package%20(BSP)&tab=2
Data Sheet & PCB Related	Parts information list and pin configuration link: https://www.nuvoton.com/products/application-specific-socs/hmi-emwin-mpus/-n9h-series/?group=Document&tab=2
Online Training	Video for creating control interface: https://www.nuvoton.com/products/application-specific-socs/hmi-emwin-mpus/-n9h-series/?tab=4
Software	Open Source IDE: NuEclipse_V1.01.01x_Platform (Note: for GNU toolchain ONLY) https://www.nuvoton.com/tool-and-software/software-development-tool/driver/ Note: some hints can be found at NuForum http://forum.nuvoton.com/viewforum.php?f=12 For example: [N9H series Non-OS NuEclipse] How to import GCC project to NuEclipse? http://forum.nuvoton.com/viewtopic.php?f=12&t=8398

1.4. How to update application binary

We can update application binary through USB cable to device and here are the steps:

1. Power off device.
2. Plug in USB cable to PC/NB.
3. Power on device.
4. Rename **application binary** to “conprog.bin”.
5. Copy and replace “conprog.bin” to “NAND1-1”.



6. Remove USB device safely.
7. Plug out USB cable from PC/NB.
8. Reset device.

Here are the pre-built **application binaries** for SimpleDemo and GUIDemo:

SimpleDemo application binary:

The path is in “BSP\SampleCode\emWin\SimpleDemo\Bin\”

Sample Target	Pre-built Application Binary
N9H20K5_NAND	For 320 x 240 LCD SimpleDemo_N9H20K5_NAND.bin
N9H20K5_NAND_480x272	For 480 x 272 LCD SimpleDemo_N9H20K5_NAND_480x272.bin

GUIDemo application binary:

The path is in “BSP\SampleCode\emWin\GUIDemo\Bin\”

Sample Target	Pre-built Application Binary
N9H20K5_NAND	For 320 x 240 LCD GUIDemo_N9H20K5_NAND.bin
N9H20K5_NAND_480x272	For 480 x 272 LCD GUIDemo_N9H20K5_NAND_480x272.bin

Please note that we need to rename **application binary** to “conprog.bin” before copy to “NAND1-1”.

2. Start emWin

2.1. Step 1: Open project

Double click “SimpleDemo.uvproj” (the path is in “SampleCode\emWin\SimpleDemo\KEIL”) to open project.

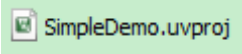


Figure 2.1-1 “SimpleDemo” project file.

“SimpleDemo” is a sample code to utilize emWin library to demonstrate interactive feature. It contains a frame window, four buttons, a text and a text editor. We can touch the GUI button and check the result that shown on the text editor.

The path of “SimpleDemo” is in “SampleCode\emWin”.

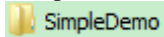


Figure 2.1-2 “SimpleDemo” sample folder is in “SampleCode\emWin”.

The structure of “SimpleDemo”:

- Blue part is related with BSP.
- Red part is related with emWin.

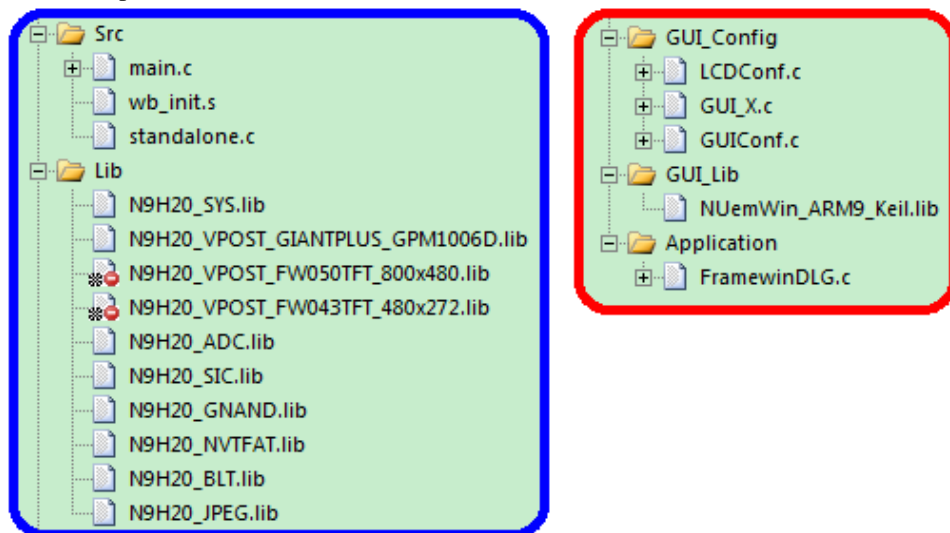


Figure 2.1-3 “SimpleDemo” project structure.

2.2. Step 2: BSP Initialization

In “main.c”, it contains the N9H20 start up flow, e.g., clock setting, timer, uart debug port, display output panel, vendor filesystem and resistor-type touch screen.

The path of “main.c” is in “SampleCode\emWin\SimpleDemo”:

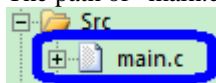


Figure 2.2-1 “main.c” contains N9H20 start up flow.

```
int main(void)
{
    ...
    /* N9H20 start up here */
    ...

    /* emWin start up here */
    MainTask();

    return 0;
}
```

2.3. Step 3: emWin Initialization

In “main.c”, called “MainTask()” to start up emWin GUI system.

“MainTask()” is in “SampleCode\emWin\SimpleDemo\main.c”:

```
void MainTask(void)
{
    GUI_Init();
    CreateFrameWin();
    while (1)
    {
        GUI_Delay(500);
    }
}
```

2.4. Step 4: Build

Please note that we suggest to utilize Keil MDK version 5 or above with professional or plus license.

To download and run the application, first, we need to utilize Keil to rebuild the application project.

Press “[F7]” to rebuild the application project or click “Rebuild”.

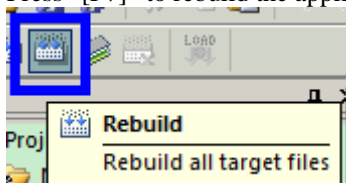


Figure 2.4-1 Rebuild application project.

2.5. Before download and run

IMPORTANT!!! We need to configure ICE setting to download and run.

Press “[Alt + F7]” for project options.



Figure 2.5-1 Options for target.

Choose “Debug” page and select properly ICE, e. g., J-LINK, then press “Settings”.

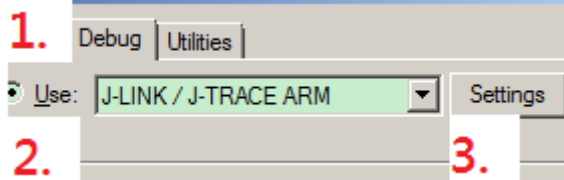


Figure 2.5-2 Select ICE to debug.

Set “Speed” (Auto or lower speed), disable “Debug Cache”, then select “Reset Strategy as Hardware, halt after reset (normal)”, finally, click “OK”.

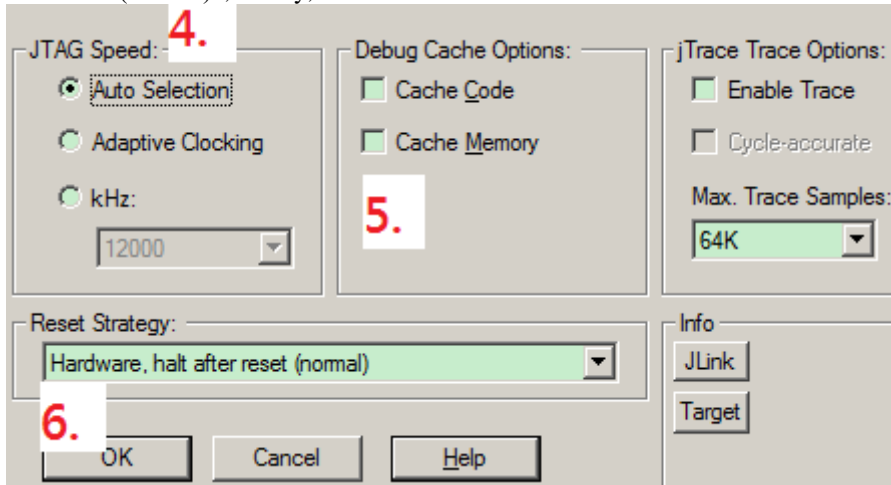


Figure 2.5-3 ICE environment setting.

2.6. Step 5: Download and run

Press “CTRL + [F5]” to download the application and run debug session. After downloaded, it will halt at main() and we should see the similar screenshow below.

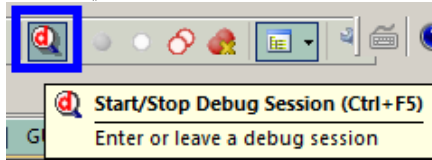


Figure 2.6-1 Download and run application.

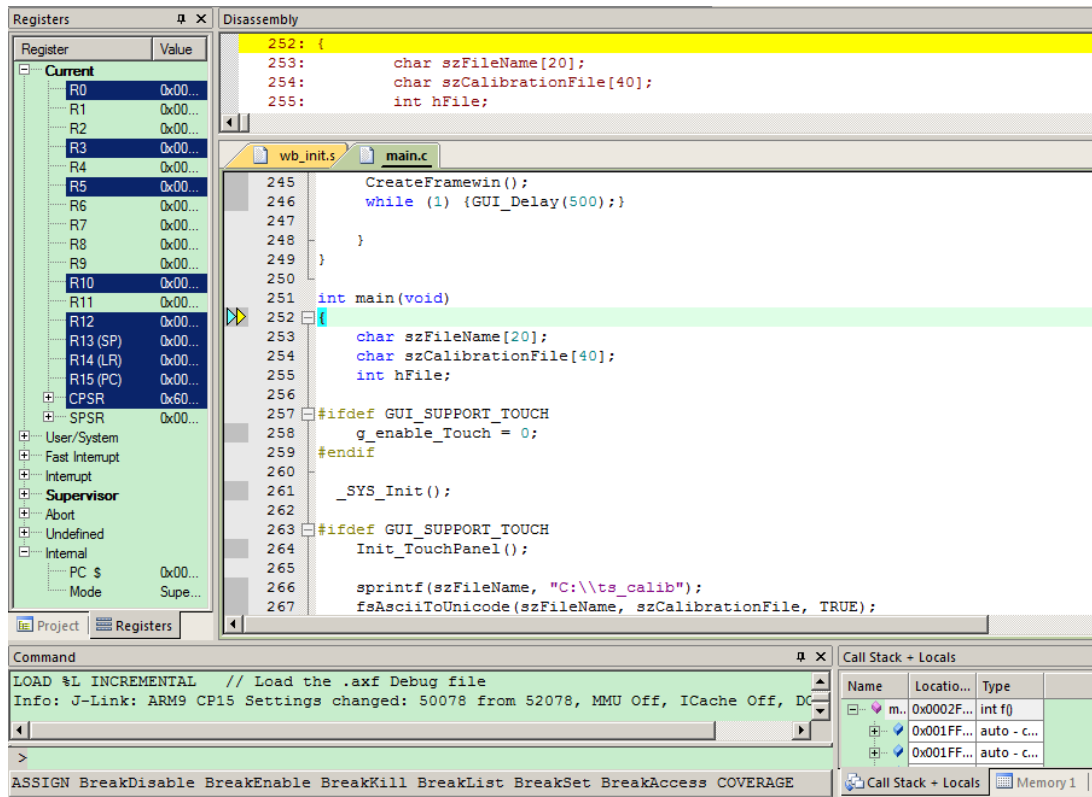


Figure 2.6-2 Debug session.

2.7. Touch screen

To control touch panel, we utilize N9H20 ADC library and open source library “tslib”. The touch calibration results store to a single file called “ts_calib”.

The path of “tslib” is in “SampleCode\emWin\SimpleDemo”:

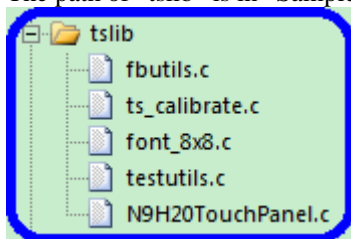


Figure 2.7-1 tslib structure.

3. Start emWin GUIBuilder

3.1. Step 1: Create widget

To create widget, we can utilize emWin “GUIBuilder” to arrange GUI layout and generate source file.

The path of “GUIBuilder” is in “ThirdParty\emWin\Tool”:

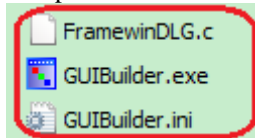


Figure 3.1-1 emWin GUIBuilder.

After finish GUI layout, then execute “File” → “Save...”, we can get the source file called “FramewinDLG.c”.

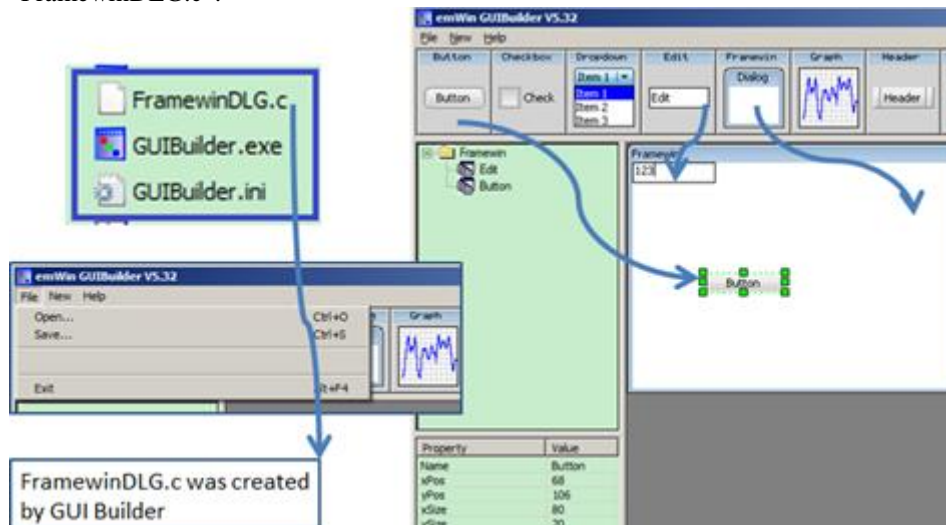


Figure 3.1-2 emWin GUIBuilder can arrange GUI layout and generate source file.

3.2. Step 2: Handle widget event

In “FramewinDLG.c”, we can handle widget event, e. g., button clicked, released or others and update text editor’s content when button released.

The path of “FramewinDLG.c” is in “SampleCode\emWin\SimpleDemo\Application”:

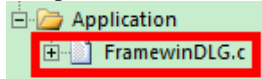


Figure 3.2-1 emWin GUI application source file.

```
...
switch(Id)
{
case ID_BUTTON_0: // Notifications sent by '+ 1'
switch(NCode)
{
case WM_NOTIFICATION_CLICKED:
// USER START (Optionally insert code for reacting on notification message)
// USER END
break;
case WM_NOTIFICATION_RELEASED:
// USER START (Optionally insert code for reacting on notification message)
value += 1;
sprintf(sBuf,"%d  ", value);
hItem = WM_GetDialogItem(pMsg->hWin, ID_EDIT_0);
EDIT_SetText(hItem, sBuf);
// USER END
break;
// USER START (Optionally insert additional code for further notification
handling)
// USER END
}
break;
...

```


4. How to change display panel

4.1. Step 1: emWin display

“LCDConf.c” defines emWin display configurations.

The path of “LCDConf.c” is in “ThirdParty\emWin\Config”:

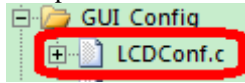


Figure 4.1-1 emWin display configurations.

- Display panel resolution:
In “N9H20TouchPanel.h”, we can modify the “XSIZE_PHYS” and “YSIZE_PHYS” for display panel width and height respectively. Please note that “XSIZE_PHYS” and “YSIZE_PHYS” are defined in “SampleCode\emWin\SimpleDemo\tslib\N9H20TouchPanel.h”.

```
...
#define XSIZE_PHYS 320
#define YSIZE_PHYS 240
...
```

- Display buffer address:
In “LCDConf.c”, we can assign display buffer address to emWin. Here, we utilize a “Sync-type LCD 320x240”, the display buffer size in RGB565 is 320-width x 240-height x 2-byte-per-pixel = 153600Bytes = 150KB.

```
void LCD_X_Config(void)
{
    ...
    /* assign display buffer address to emWin */
    LCD_SetVRAMAddrEx(0, (void *)u8FrameBufPtr);
    ...
}
```

4.2. Step 2: BSP display

N9H20 can utilize VPOST library to output display data to “Sync-type LCD”. N9H20 BSP contains the default display library for 320 x 240 at 16-bit depth RGB565.

The path of the default display library is in “Library\IPLib\N9H20_GIANTPLUS_GPM1006D.lib”.

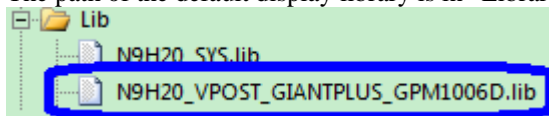


Figure 4.2-1 BSP default display library.

```
void LCD_X_Config(void)
{
    ...
    /* assign display buffer address to emWin */
    LCD_SetVRAMAddrEx(0, (void *)u8FrameBufPtr);
    ...
}
```

5. Revision History

Version	Date	Description
V1.00.007	May. 21, 2020	<ul style="list-style-type: none"> • Update chapter 1.2 & 1.3
V1.00.006	Dec. 28, 2018	<ul style="list-style-type: none"> • Update pre-built path to "Bin"
V1.00.005	Dec. 25, 2018	<ul style="list-style-type: none"> • Update footer version • Update Nuvoton HMI/GUI forum link
V1.00.004	Dec. 25, 2018	<ul style="list-style-type: none"> • Add official SEGGER emWin forum link • Add Nuvoton resource link • Add how to update application
V1.00.003	Sep. 13, 2018	<ul style="list-style-type: none"> • Update source path and description
V1.00.002	Aug. 17, 2018	<ul style="list-style-type: none"> • Update introduction for Keil MDK
V1.00.001	Mar. 30, 2018	<ul style="list-style-type: none"> • Created

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