

**Arm® 926-EJS
32-bit Microcontroller**

**N9H20
Freezer HMI
User Manual**

The information described in this document is the exclusive intellectual property of Nuvoton Technology Corporation and shall not be reproduced without permission from Nuvoton.

Nuvoton is providing this document only for reference purposes of NuMicro microcontroller based system design. Nuvoton assumes no responsibility for errors or omissions.

All data and specifications are subject to change without notice.

For additional information or questions, please contact: Nuvoton Technology Corporation.

www.nuvoton.com

Table of Contents

| | |
|--|-----------|
| 1 OVERVIEW | 3 |
| 2 FEATURES | 4 |
| 2.1 Freezer HMI Features..... | 4 |
| 3 INSTALLATION AND ENVIRONMENT | 5 |
| 3.1 Installing N9H20 | 5 |
| 3.2 Installing Freezer HMI..... | 5 |
| 3.3 System Requirements | 5 |
| 4 FOLDER STRUCTURE..... | 6 |
| 4.1 Code Folder Structure | 6 |
| 4.2 Image and Dta Resource Folder Structure..... | 8 |
| 5 DESIGN GUIDE | 9 |
| 5.1 Main Menu Control..... | 9 |
| 5.2 Freezer Menu Control..... | 10 |
| 5.3 Setting Menu Control | 11 |
| 6 FAQ..... | 13 |
| 6.1 How to replace image or dta?..... | 13 |
| 7 REVISION HISTORY | 14 |

1 OVERVIEW

Freezer HMI for N9H20 is a GUI reference implementation.

This document utilizes Nuvoton N9H20 series general-purpose microprocessor N9H20K5 (32MB DDR) to implement freezer HMI with emWin GUI library. Freezer HMI image format supports JPEG and DTA.

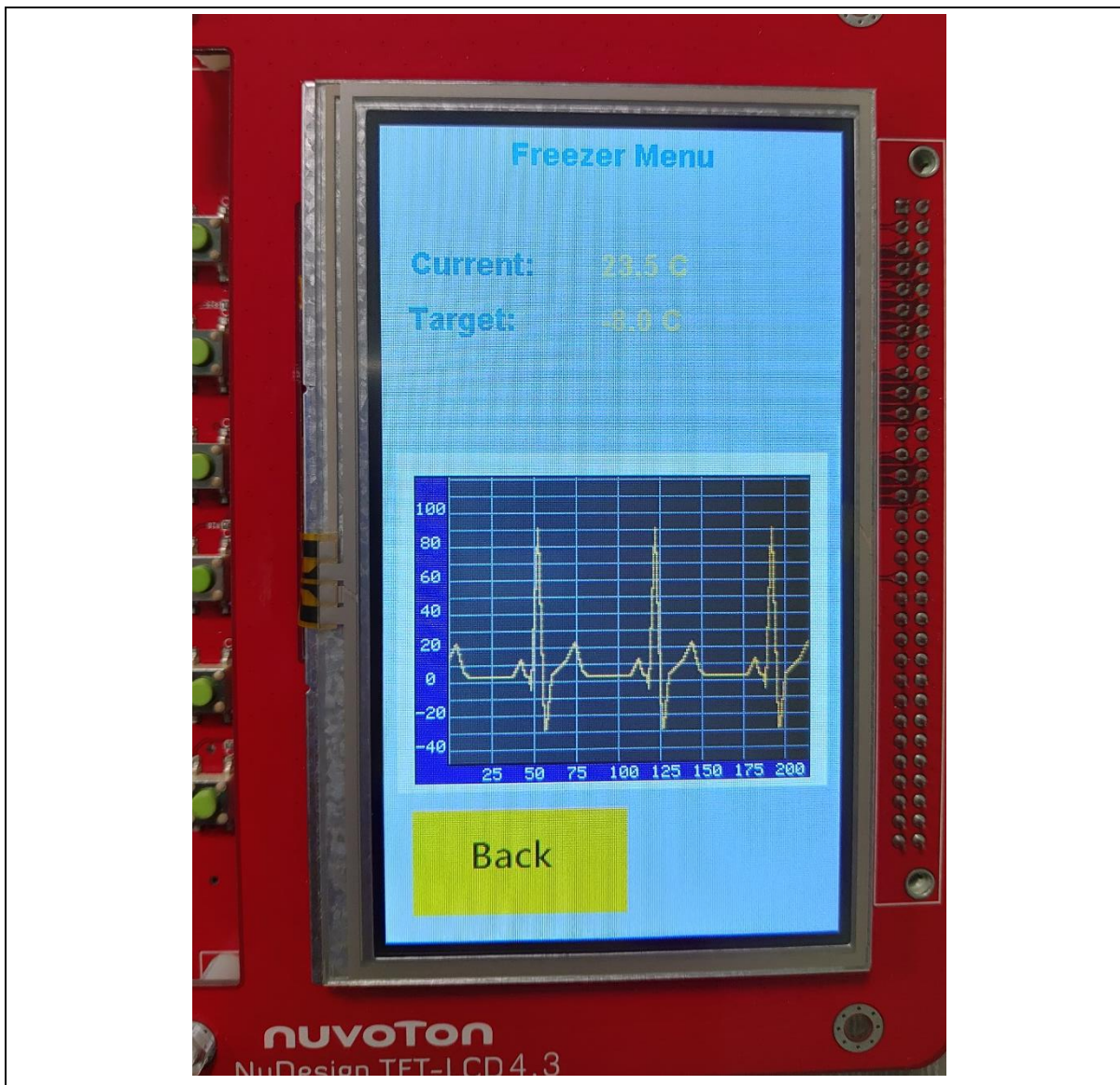


Figure 1-1 Freezer HMI

2 FEATURES

2.1 Freezer HMI Features

- Supports SEGGER licensed emWin GUI library
- Supports resistive touch at 480x272 area with built-in touch ADC
- Supports high quality and contrast LCD panel with resolution up to 480 x 272
- Supports many popular image formats, e. g., PNG, GIF, JPG and BMP
- Supports user defined image as icon source

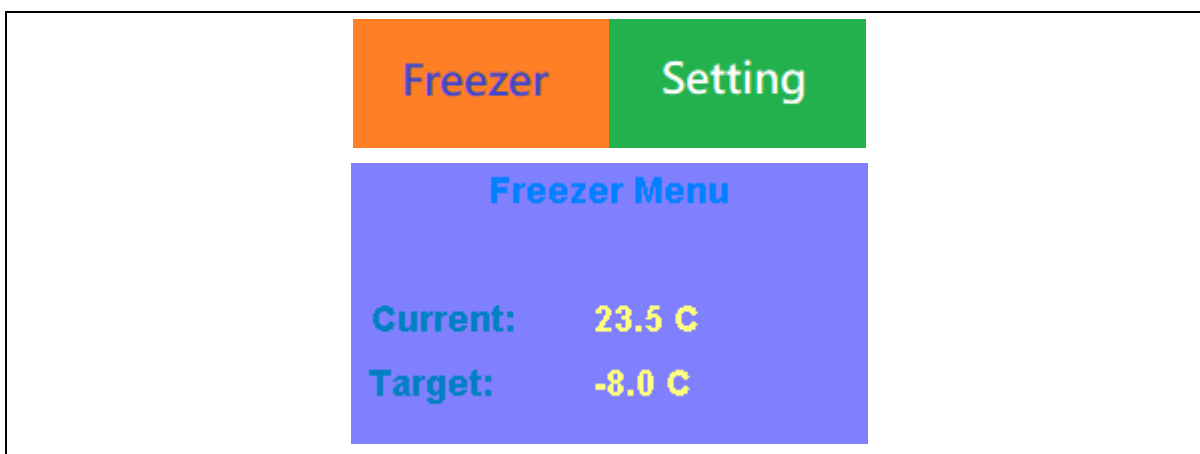


Figure 2-1 Typical Information for Freezer

3 INSTALLATION AND ENVIRONMENT

3.1 Installing N9H20

First, download the latest N9H20 BSP from https://github.com/OpenNuvoton/N9H20_emWin_NonOS, and unzip “N9H20_emWin_NonOS-master.zip” to a working folder, e.g., unzip it to the path “C:\N9H20”, where “N9H20” is the working folder.

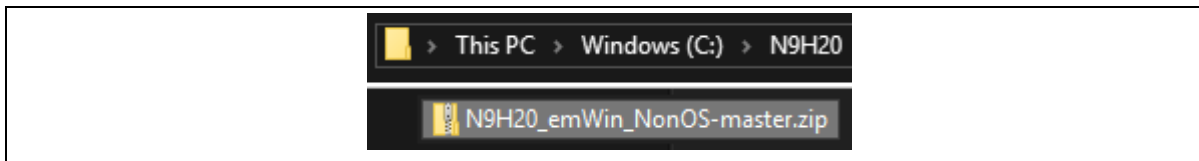


Figure 3-1 N9H20 BSP File Name and Working Folder

The detailed information of N9H20 BSP and emWin library can be found at “W9H20_emWin_NonOS-master\N9H20_Readme.pdf” and “emWinStartGuide-N9H20-Series.pdf” respectively.

3.2 Installing Freezer HMI

First, download the latest “N9H_emWin_Template-master.zip” from https://github.com/OpenNuvoton/N9H_emWin_Template and unzip and copy “Freezer_N9H20_NonOS” to the BSP sample path “W9H20_emWin_NonOS-master\BSP\SampleCode\emWin”.

Then, open freezer project “W9H20_emWin_NonOS-master\BSP\SampleCode\emWin\Freezer_N9H20_NonOS\KEIL\SimpleDemo.uvproj” and start compiling. The executable binary is in “W9H20_emWin_NonOS-master\BSP\SampleCode\emWin\Freezer_N9H20_NonOS\Bin”, called “conprog.bin”. Next, connect the USB cable between PC/NB and N9H20 and power on. Then copy “conprog.bin” to “NAND1-1” USB disk. Finally, remove the USB disk safely and reboot N9H20.

3.3 System Requirements

- KEIL IDE V5.xx and above with professional license
- Nuvoton N9H20K5 480 x 272 demo board (NuDesign HMI-N9H20 + NuDesign TFT-LCD4.3)

4 FOLDER STRUCTURE

4.1 Code Folder Structure

The content of “Freezer_N9H20_NonOS” is described as follows.

| Folder | Description |
|--|--|
| Freezer_N9H20_NonOS | Base folder <ul style="list-style-type: none"> main.c is freezer code and platform related initializations Changelog.pdf is version history Freezer_Reference_Implementation.pdf is user manual |
| Application | emWin resource folder <ul style="list-style-type: none"> GUIConf2.c is for emWin memory pool LCDConf2.c is for emWin multiple buffers NVT_Config.c is for Nuvoton platform Main1DLG.c is for main menu NVT_Main1.c is for main menu extension Freezer1DLG.c is for freezer menu NVT_Freezer1.c is for freezer menu extension Setting1DLG.c is for setting menu NVT_Setting1.c is for setting menu extension GUIDEMO_Graph.c is for freezer chart |
| Bin | Pre-built binaries folder <ul style="list-style-type: none"> conprog.bin is for freezer execution file NAND1-1 is for device's NAND1-1 NAND1-2 is for device's NAND1-2 |
| Bin / NAND1-1 | Resource folder <ul style="list-style-type: none"> conprog.bin is for freezer execution file ts_calib is for touch library tslib calibration file |
| Bin / NAND1-2 | Resource images and dtas |
| Bin / 9To555 | Any image convert to dta file format |
| Bin / LogGen | Any image convert to logo file format |
| Bin / TurboWriter V2.30.001_N9H20K5 | Development burning tool |
| KEIL | Arm Keil MDK project folder |

| | |
|-------|--|
| tslib | <div>Touch folder<ul style="list-style-type: none">● Resistive touch panel● Touch area is 480x272</div> |
|-------|--|

Table 4-1 Freezer HMI Folder Structure

4.2 Image and Dta Resource Folder Structure

The “NAND1-2” folder contains image and dta files.

| Disk | Description |
|---------|---|
| NAND1-2 | Resource folder <ul style="list-style-type: none"> ● logo.dta is for nuvoton logo file ● main_background.jpg is for main menu background file ● main_freezer.dta is for freezer menu button image source ● main_setting.dta is for setting menu button image source ● freezer_background.jpg is for freezer menu background file ● freezer_back.dta is for back button image source ● setting_background.jpg is for setting menu background file ● setting_back.dta is for back button image source |

Table 4-2 Freezerr HMI Image and Dta Folder Structure

5 DESIGN GUIDE

Freezer reference implementation guide assumes that you already have a mature knowledge of the following:

- IDE operation for editing and compiling
- The C programming language, how to use linker and C compiler
- The N9H20 Non-OS BSP programming knowledge
- The basic emWin programming knowledge

5.1 Main Menu Control

Main menu is generated from GUIBuilder, called "*Main1DLG.c*". You can open this file by GUIBuilder and re-arrange widget position, size and property. It contains 1 background IMAGE, 1 title TEXT, 2 BUTTONs and 1 logo.

By "*NVT_Main1.c*", you can assign user define image or dta file to replace the original.

```
// USER START (Optionally insert additional code for further widget
initialization)

hItem = WM_GetDialogItem(pMsg->hwin, ID_IMAGE_0);
NVT_Main1SetBackground(hItem);

hItem = WM_GetDialogItem(pMsg->hwin, ID_IMAGE_1);
NVT_Main1SetLogo(hItem);

hItem = WM_GetDialogItem(pMsg->hwin, ID_BUTTON_0);
NVT_Main1SetButton(hItem, 1);

hItem = WM_GetDialogItem(pMsg->hwin, ID_BUTTON_1);
NVT_Main1SetButton(hItem, 2);

// USER END
```

Freezer menu button to execute freezer menu:

```
// case WM_NOTIFICATION_RELEASED:

    // USER START (Optionally insert code for reacting on
notification message)

    g_Freezer1Flag = 1;
```

```
// USER END

break;
```

setting menu button to execute setting menu:

```
// case WM_NOTIFICATION_RELEASED:

    // USER START (Optionally insert code for reacting on
notification message)

    g_Setting1Flag = 1;

// USER END
```

User defined image file name in "NVT_Main1.c":

```
#define NVT_MAIN_BACKGROUND "D:\\main_background.jpg"
#define NVT_MAIN_LOGO "D:\\logo.dta"
#define NVT_MAIN_BUTTON1 "D:\\main_freezer.dta"
#define NVT_MAIN_BUTTON2 "D:\\main_setting.dta"
```

5.2 Freezer Menu Control

Freezer menu is generated from GUIBuilder, called "*Freezer1DLG.c*". You can open this file by GUIBuilder and re-arrange widget position, size and property. It contains 1 background IMAGE, 1 title TEXT, 1 BUTTON and 1 GRAPH widget for drawing chart.

Note: GRAPH widget is running on child window.

By "*NVT_Freezer1.c*", you can assign user define image or dta file to replace the original.

```
// USER START (Optionally insert additional code for further widget
initialization)

hItem = WM_GetDialogItem(pMsg->hwin, ID_IMAGE_0);
NVT_Freezer1SetBackground(hItem);

hItem = WM_GetDialogItem(pMsg->hwin, ID_BUTTON_0);
NVT_Freezer1SetButton(hItem, 1);

WM_CreatewindowAsChild(8, 190, 256, 200, pMsg->hwin, WM_CF_SHOW |
WM_CF_STAYONTOP, _cbTempMenu, 0);
```

```
// USER END
```

Back button to execute main menu:

```
// case WM_NOTIFICATION_RELEASED:
    // USER START (Optionally insert code for reacting on
notification message)
    g_Main1Flag = 2;

    // USER END
    break;
```

User defined image file name in “NVT_Freezer1.c”:

```
#define NVT_FREEZER_BACKGROUND "D:\\freezer_background.jpg"
#define NVT_FREEZER_BUTTON1 "D:\\freezer_back.dta"
```

5.3 Setting Menu Control

Setting menu is generated from GUIBuilder, called “Setting1DLG.c”. You can open this file by GUIBuilder and re-arrange widget position, size and property. It contains 1 background IMAGE, 1 title TEXT, 1 BUTTON, 1 RADIO group, 1 CHECKBOX group and 1 SPINBOX.

By “NVT_Setting1.c”, you can assign user define image or dta file to replace the original.

```
// USER START (Optionally insert additional code for further widget
initialization)
hItem = WM_GetDialogItem(pMsg->hwin, ID_IMAGE_0);
NVT_Setting1SetBackground(hItem);

hItem = WM_GetDialogItem(pMsg->hwin, ID_BUTTON_0);
NVT_Setting1SetButton(hItem, 1);

// USER END
```

Back button to execute main menu:

```
// case WM_NOTIFICATION_RELEASED:
```

```
// USER START (Optionally insert code for reacting on
notification message)

    g_Main1Flag = 1;

// USER END

break;
```

User defined image file name in “*NVT_Setting1.c*”:

```
#define NVT_SETTING_BACKGROUND "D:\\setting_background.jpg"
#define NVT_SETTING_BUTTON1 "D:\\setting_back.dta"
```

6 FAQ

6.1 How to replace image or dta?

Use the same image filename, width and height, then copy to related folder, please see the chapter 4.2.

7 REVISION HISTORY

| Date | Revision | Description |
|------------|----------|-----------------------|
| 2020.11.30 | 1.00 | 1. Initially release. |

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.

*Please note that all data and specifications are subject to change without notice.
All the trademarks of products and companies mentioned in this datasheet belong to their respective owners.*