
STM32 Tutorial 001

GPIO Operations using Hardware Abstraction Libraries (HAL)

On NUCLEO F103RB

Getting started in embedded software engineering on the STM32 platform. Using STM32CubeMX, Keil uVision 5 (MDK ARM) and Hardware Abstraction Libraries (HAL). Basic understanding of the C language, especially pointers, are presumed.

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Contents

1	Configuring the MCU with STM32CubeMX	1
1.1	STM32CubeMX	1
2	Bibliography	3

1 Configuring the MCU with STM32CubeMX

You can use the STM32CubeMX tool to create the necessary config. files to enable the GPIO Pins. In this tutorial I'm going to explain how you can modify the generated GPIO configs and add additional GPIOs.

This tutorial uses the following equipment: - NUCLEO-F103RB Board - Keil uVision 5 with the necessary packages for Nucleo boards installed - STLink USB Driver - STM32CubeMX

1.1 STM32CubeMX

Generating the config. files from STM32CubeMX.

1. Open STM32CubeMX and open a new project.
2. Select the Nucleo-F103RB from the Boards tab
3. Enable FreeRTOS
4. Set the RCC (HSE & LSE) to Crystal/Ceramic Resonator
5. Enable the USART2 port in Asynchronous mode
6. Set any GPIO to Output or Input (I am using PB13, PB14 and PC4)
7. Go to Project > Generate code
8. Enter a project name and select MDK-ARM V5
9. Generate the code and open the project in Keil uVision

```
1 {
2
3     GPIO_InitTypeDef GPIO_InitStruct;
4
5     /* GPIO Ports Clock Enable */
6     __GPIOC_CLK_ENABLE();
7     __GPIOD_CLK_ENABLE();
8     __GPIOA_CLK_ENABLE();
9     __GPIOB_CLK_ENABLE();
10
11    /*Configure GPIO pin : B1_Pin */
12    GPIO_InitStruct.Pin = B1_Pin;
13    GPIO_InitStruct.Mode = GPIO_MODE_EVT_RISING;
14    GPIO_InitStruct.Pull = GPIO_NOPULL;
15    HAL_GPIO_Init(B1_GPIO_Port, &GPIO_InitStruct);
16
17    /*Configure GPIO pin : LD2_Pin */
18    GPIO_InitStruct.Pin = LD2_Pin;
19    GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;
20    GPIO_InitStruct.Speed = GPIO_SPEED_LOW;
21    HAL_GPIO_Init(LD2_GPIO_Port, &GPIO_InitStruct);
22
23    /*Configure GPIO pin : PC4 */
24    GPIO_InitStruct.Pin = GPIO_PIN_4;
25    GPIO_InitStruct.Mode = GPIO_MODE_INPUT;           // digital Input
26    GPIO_InitStruct.Pull = GPIO_NOPULL;
27    HAL_GPIO_Init(GPIOC, &GPIO_InitStruct);
28
29    /*Configure GPIO pin : PB13 */
30    GPIO_InitStruct.Pin = GPIO_PIN_13;
```

```
31  GPIO_InitStruct.Mode = GPIO_MODE_ANALOG;           // analog Input
32  HAL_GPIO_Init(GPIOB, &GPIO_InitStruct);
33
34  /*Configure GPIO pin : PB14 */
35  GPIO_InitStruct.Pin = GPIO_PIN_14;
36  GPIO_InitStruct.Mode = GPIO_MODE_OUTPUT_PP;        // digital Output
37  GPIO_InitStruct.Speed = GPIO_SPEED_LOW;
38  HAL_GPIO_Init(GPIOB, &GPIO_InitStruct);
39
40 }
```

2 Bibliography