

# Lab 6: Interfacing Keypad with LCD

**Instructor:**

Dr. Carl Latino

[carl.latino@okstate.edu](mailto:carl.latino@okstate.edu)

**Graduate Teaching Assistant:**

Francisco E. Fernandes Jr.

[feferna@okstate.edu](mailto:feferna@okstate.edu)

**School of Electrical and Computer Engineering**

**Oklahoma State University**

Fall 2019



- **Write an Assembly program to scan a 4x4 matrix keypad and display the pressed key in the STM32 Discovery Kit's LCD.**
  - The program should follow the algorithm described in Chapter 14.9 (3<sup>rd</sup> Ed.) or Chapter 14.7 (1<sup>st</sup> Ed.) of the textbook.

- You **MUST** demo a **working** LAB 5 on **October 28, 2019 (2 weeks)** by the end of your lab section!
- **Grading for Lab 6:**
  - **Pre-lab quiz:** 2 points! Read Chapter 14.9 (3<sup>rd</sup> Ed.) or Chapter 14.7 (1<sup>st</sup> Ed.)!
    - Due on October 21 at 1:20pm.
  - **Functionality and Correctness:** **8 points.**
    - Partial credits: **4 points** (if it doesn't work)
- **Grading penalization:**
  - Students who **do not follow the lab safety procedures** (e.g. coming to lab with shorts and flip flops) will **lose 1 points** in their lab's grade!

# Keypad Scan Algorithm

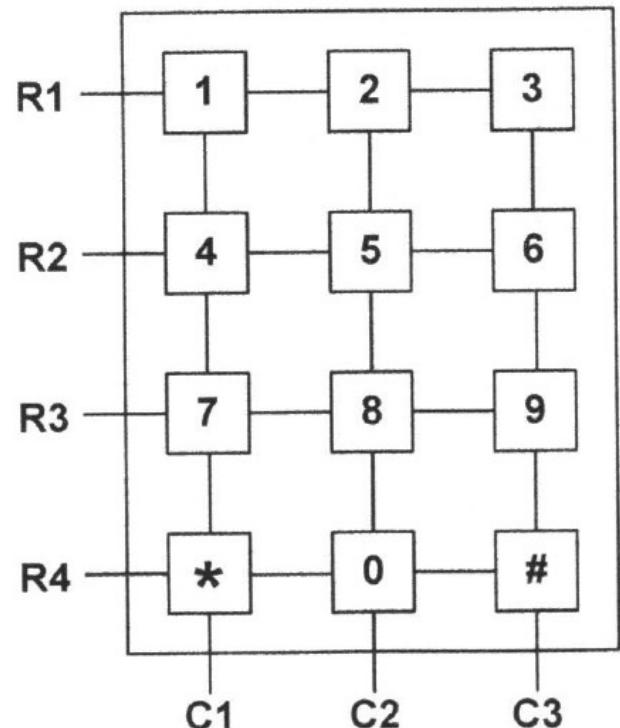


Figure 14-17. 3x4 keypad

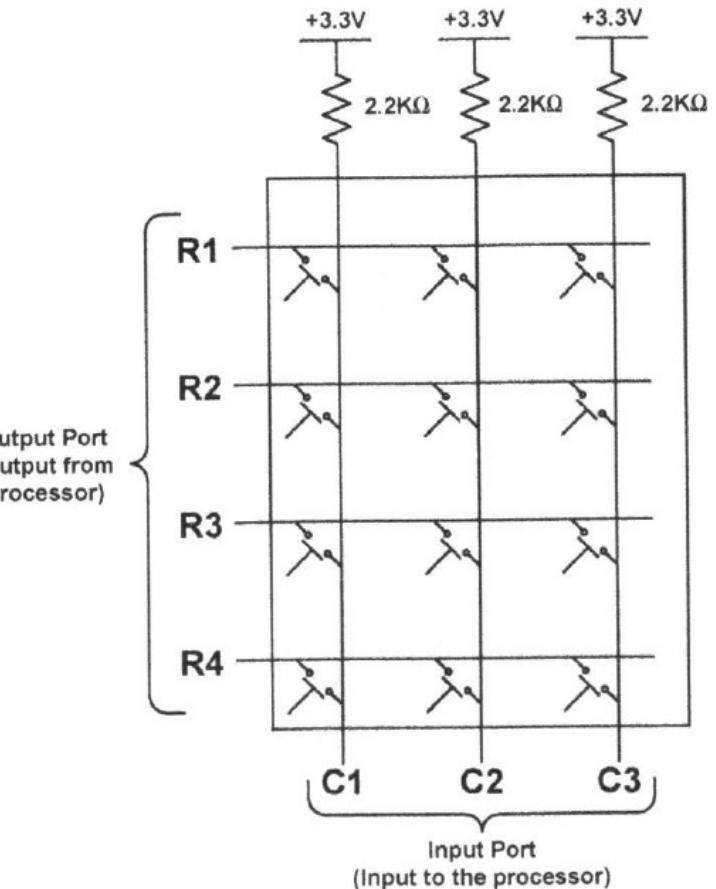


Figure 14-18. Input and output setting

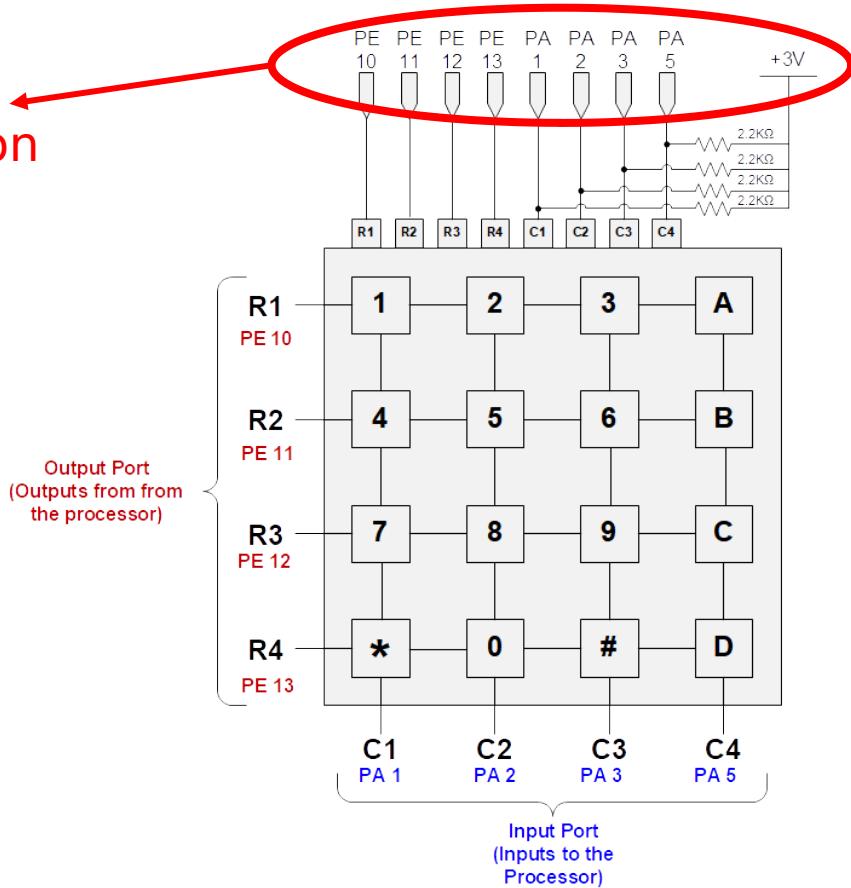
# Connecting the keypad with the STM32 Discovery Kit



- Use two breadboards and **FOUR 2.2k resistors** to connect the keypad with the development kit.



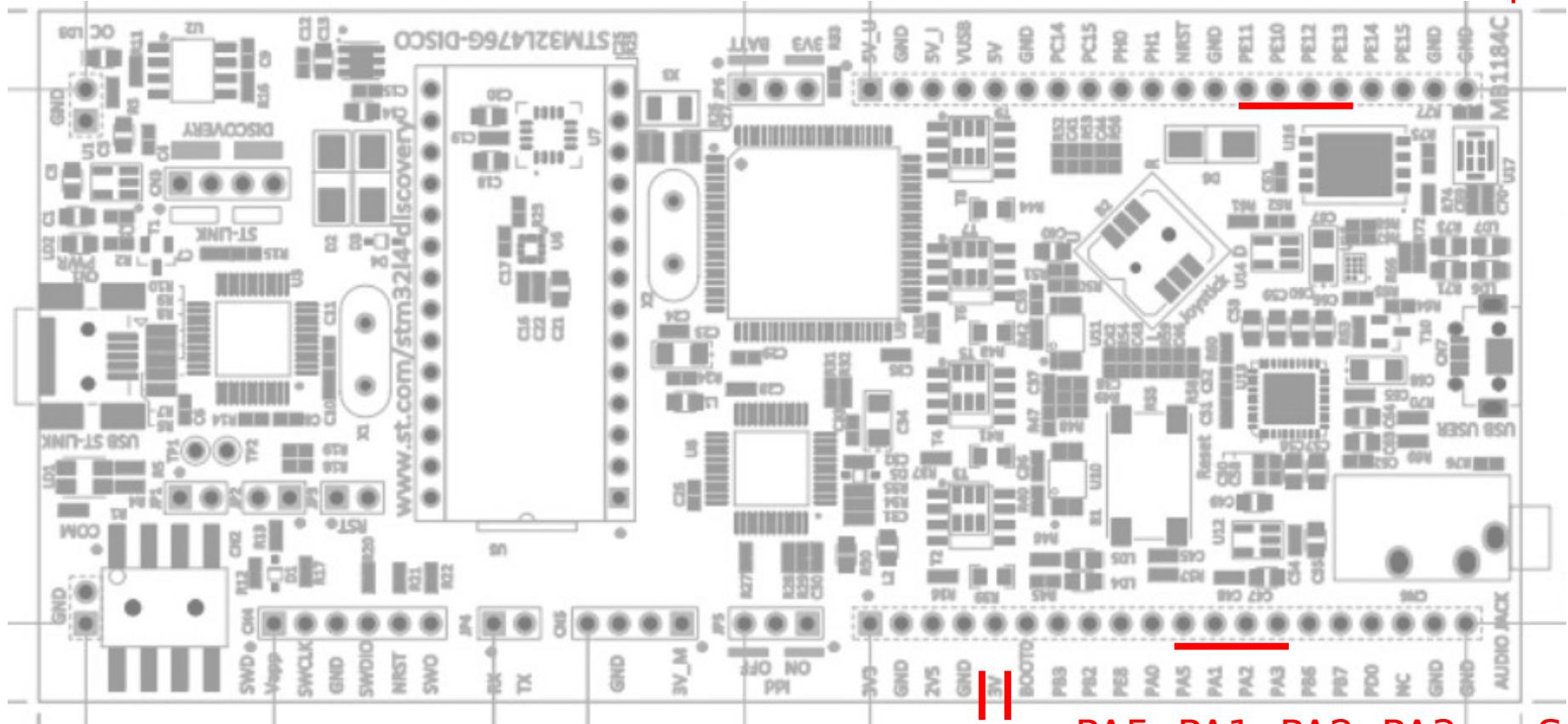
Physical connection



# Connecting the keypad with the STM32 Discovery Kit



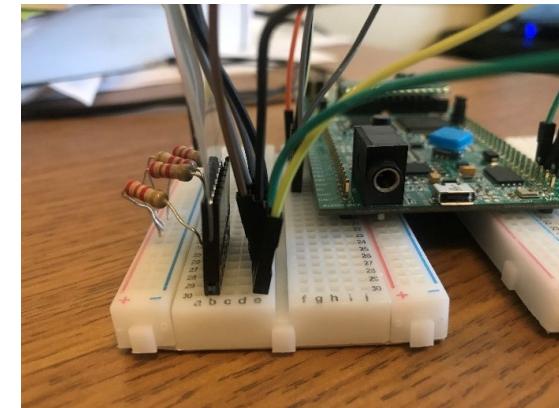
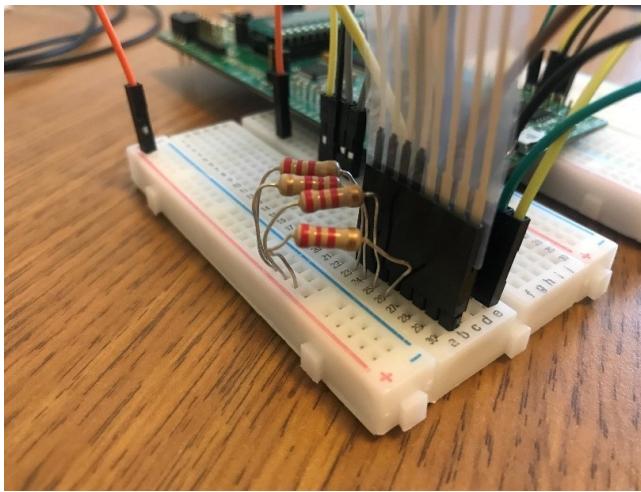
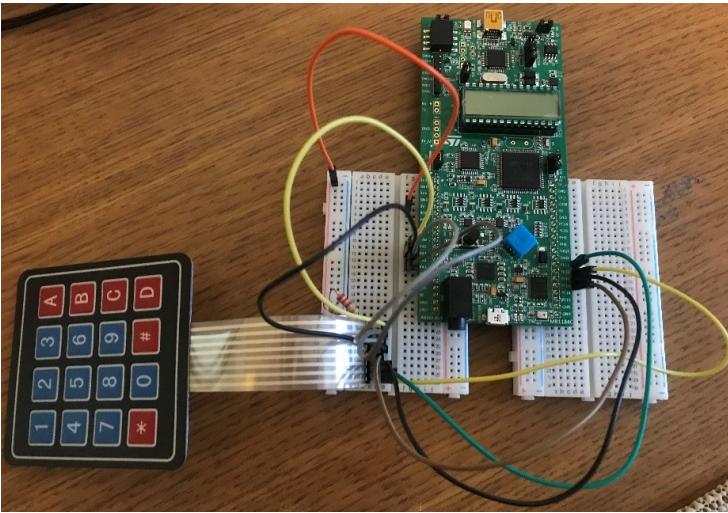
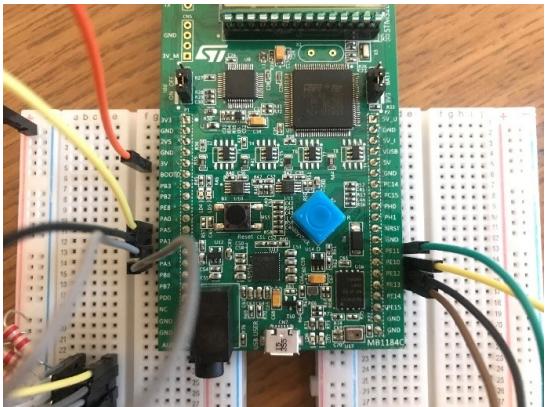
PE11, PE10, PE12, PE13 → Set as outputs



+3V

PA5, PA1, PA2, PA3 → Set as inputs

# Connecting the keypad with the STM32 Discovery Kit

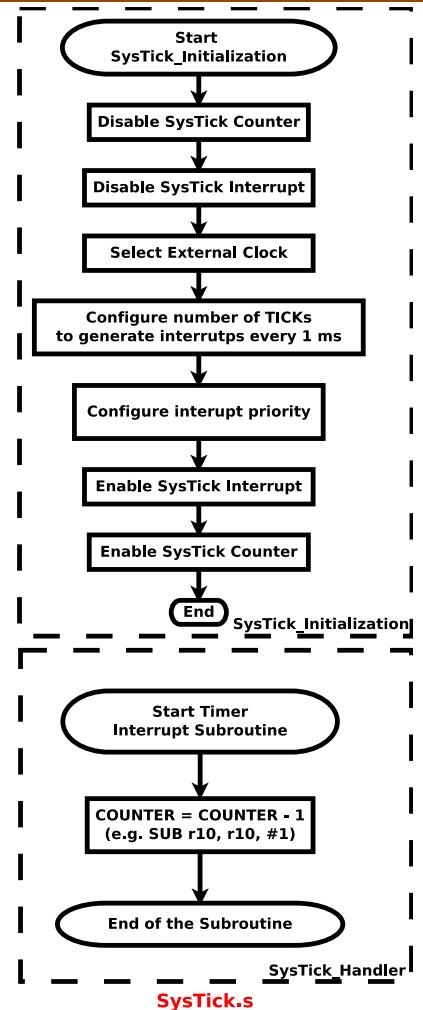
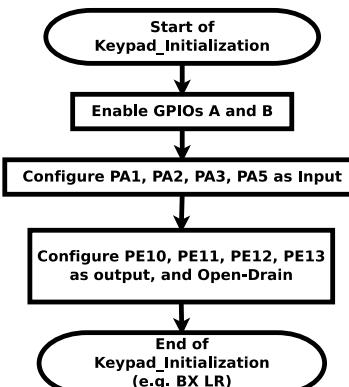
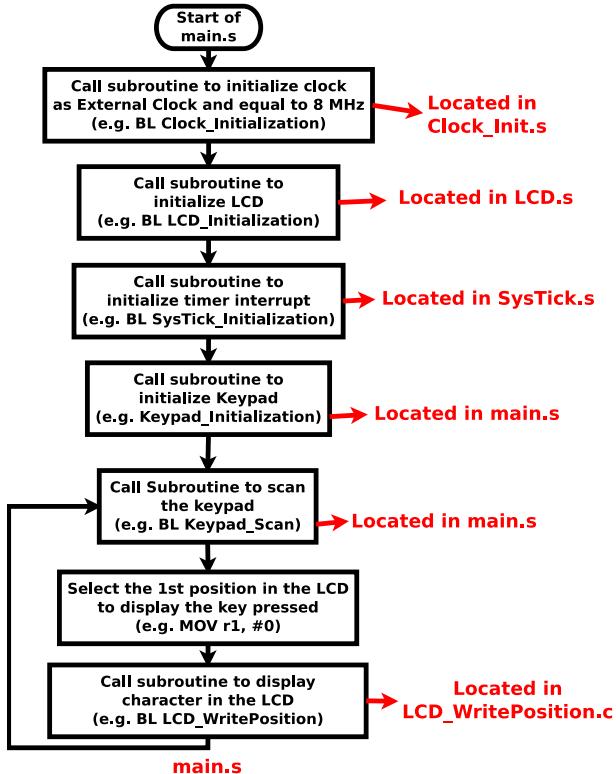


# Lab 6: Start-up Code

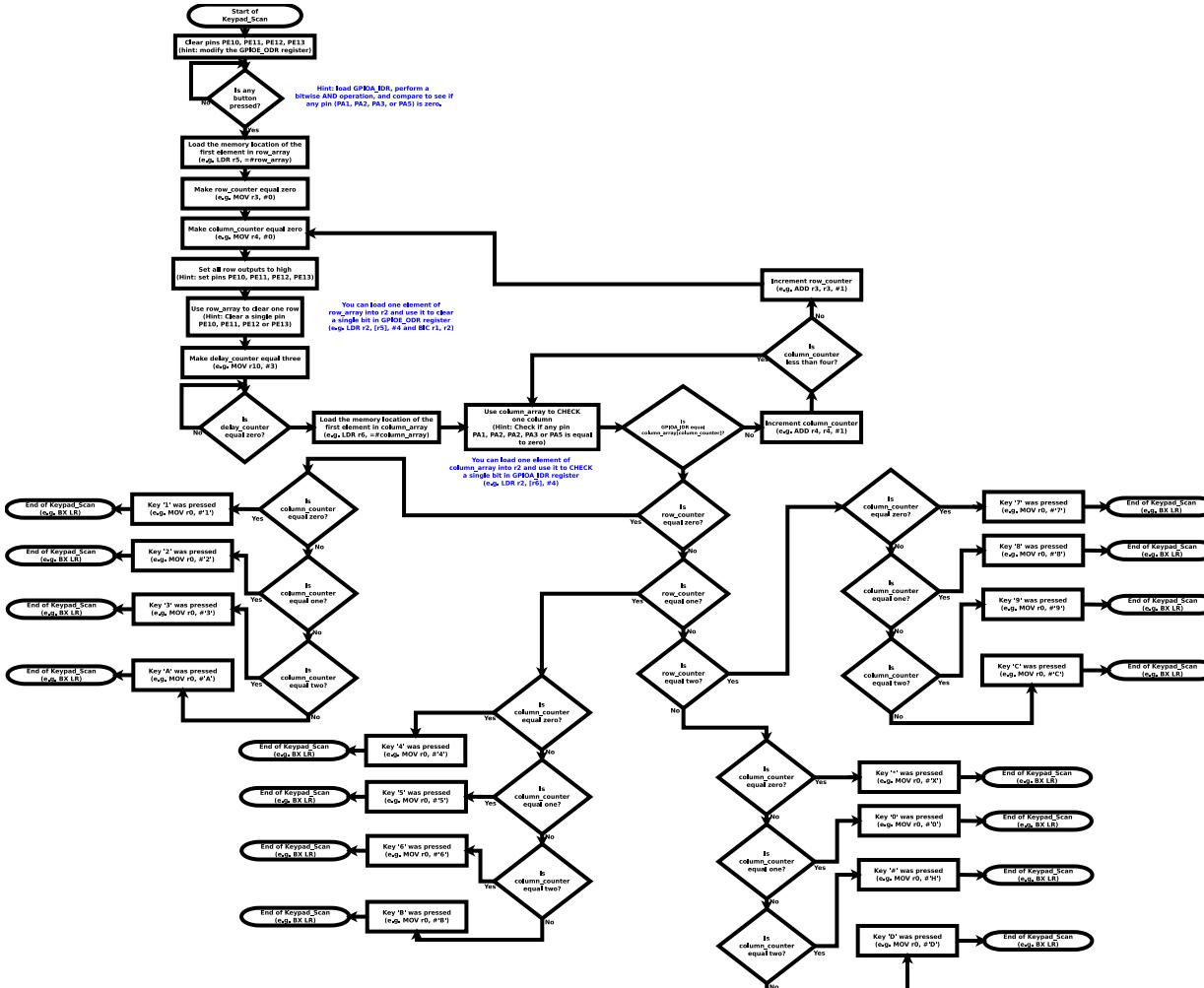


- A startup code in a zip-file (filename: **Lab 6 – Startup Code.zip**) is available on Canvas. It contains the following files:
  - **Clock\_Init.s** → You don't need to change anything in this file!
  - **LCD.s** → You don't need to change anything in this file!
  - **LCD\_WritePosition.c** → You don't need to change anything in this file!
  - **stm32l476xx\_constants.s** → You don't need to change anything in this file!
  - **main.s** → You have to write all missing code!
  - **SysTick.s** → You have to write all missing code!
- Download and **EXTRACT** the startup code.
- Create a new project from scratch using the STM32CubeIDE.
- Move ALL files to you project's **src** folder, and follow the standard steps to create set up a new project.

# Lab 6: Flowchart



# Lab 6: Flowchart – Keypad\_Scan Subroutine



You can find the  
PDF version of  
this flowchart on  
Canvas.

# Lab 6: Arrays



```
.section .data
row_array:    .word 0x400, 0x???, 0x???, 0x???
column_array: .word 0x2C, 0x???, 0x???, 0x???
```

**row\_array** is used to TURN OFF (Clear)  
a single row in each iteration  
(e.g. clear only PE10, PE11, PE12, or PE13)

$0x400 \rightarrow 0b1000000000$   
(Only PE10 is selected  
to be cleared)

**column\_array** is used to check if  
a single column is equal to zero  
(e.g. the array will have 1's in three  
columns and a 0 in only one column)

$0x2C \rightarrow 0b101100$   
(Only PA1 should be equal  
to zero)