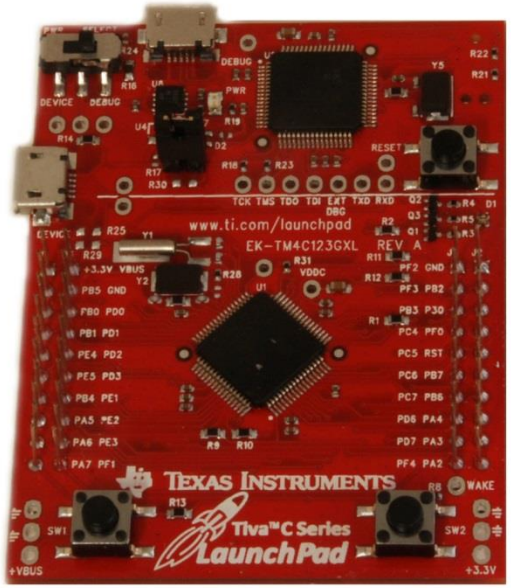
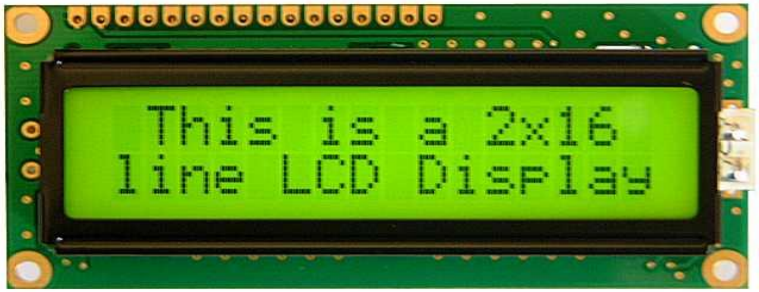
ELEC 3662: Embedded Systems

The Mini-Project

Project Description

Interface the Tiva LaunchPad with a Keypad and LCD to display simple calculations.





Software

Step 1: Create the Project

- Create a new Keil-v5 project, with relevant preprocessors directives and GPIOs defines, header files, etc.
- Since lots of delays are required, its recommended to use a 80 MHz clock frequency (PLL) for ease of calculations.
- For better organization and code re-use, create separate files (.c and .h)

Step 2: KEYPAD Functions

- Create a function *keypadInit()*: PORTD and PORTE setup and number of rows/columns of the matrix.
- Create a function *unsigned char readKeypad()*: This function returns the key pressed in the keypad matrix.
- Create a function *char decodeKeyPress(unsigned char k)*: This function returns the value of the pressed keypad button.

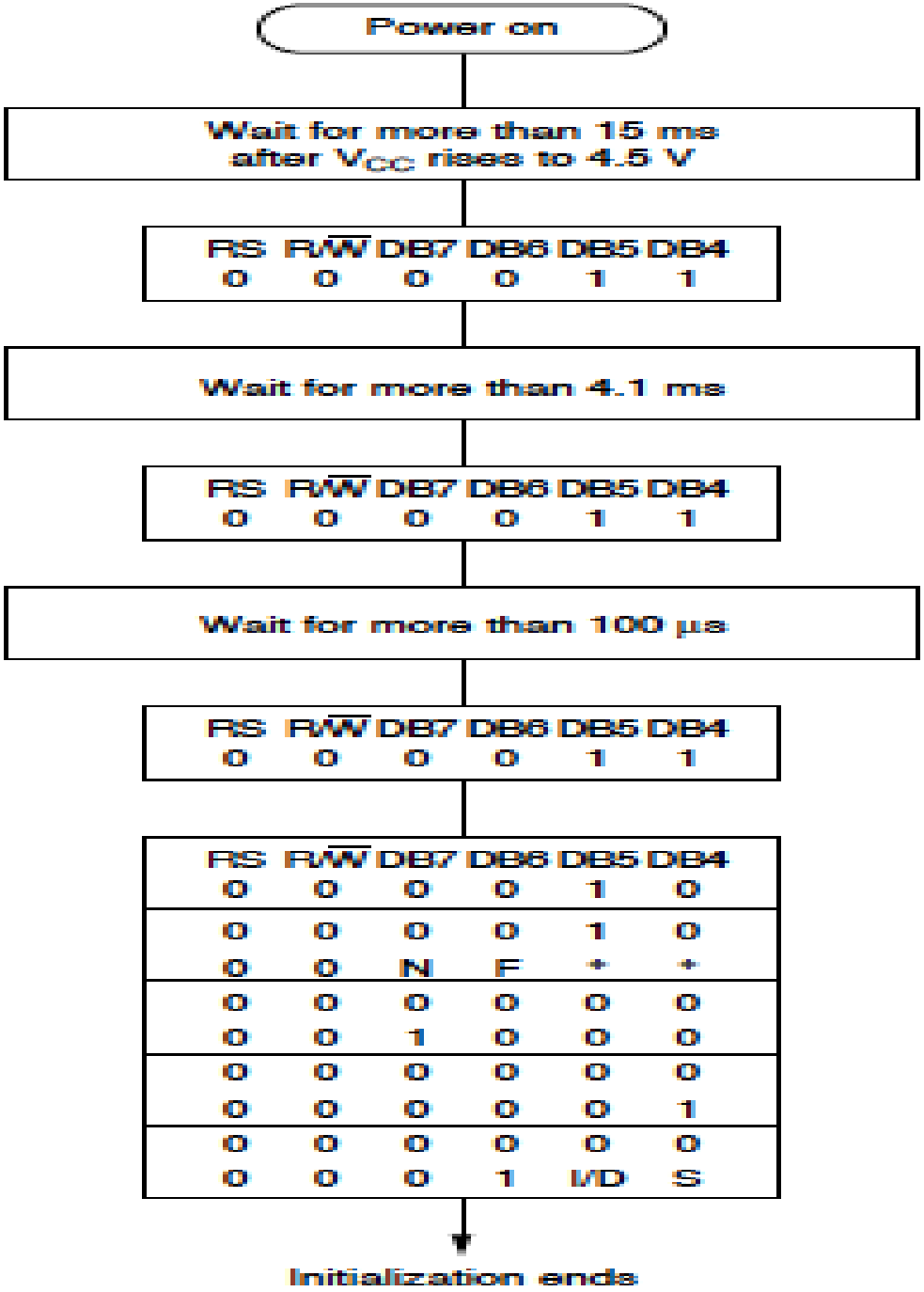
→ The previous 2 functions could be combined into just one function.

Step 2: LCD initialisation

- Create a function *lcdInit()*
- Check the 'Initializing by Instruction' section in HD44780 data sheet (pg. 45-46).
- Pin and port settings using some "*#define*"s
- Find out the correct delay, for min 15 ms, 4.1 ms and 100 ys.
- RS set to 0 (1 for data), RW to 0 (GND)
- Create a *lcdENPulse()* to latch commands
- Follow & understand Fig 24, pg. 46 Datasheet!

lcdInit()

- Refer to Data sheet, pg.46
- Interface set to 4-bit mode
- Special instructions are 8-bit!



Step 3: Set-up Inst

- Check Data sheet ("Instruction Description") for set-up instructions
- Create a function *lcdWriteCommand(unsigned char c)*
- Remember, we are sending 4-bit data at a time, "nibble", 2 line with a 5x8 font.
- Set up: 001DL NF** accordingly
- Set up the Display, Cursor and Blink ON

LCD Functions

- *lcdClearScreen()*: clear and home the LCD display
- *lcdGoto(unsigned char address)*: move the position of the cursor to a specified DDRAM address

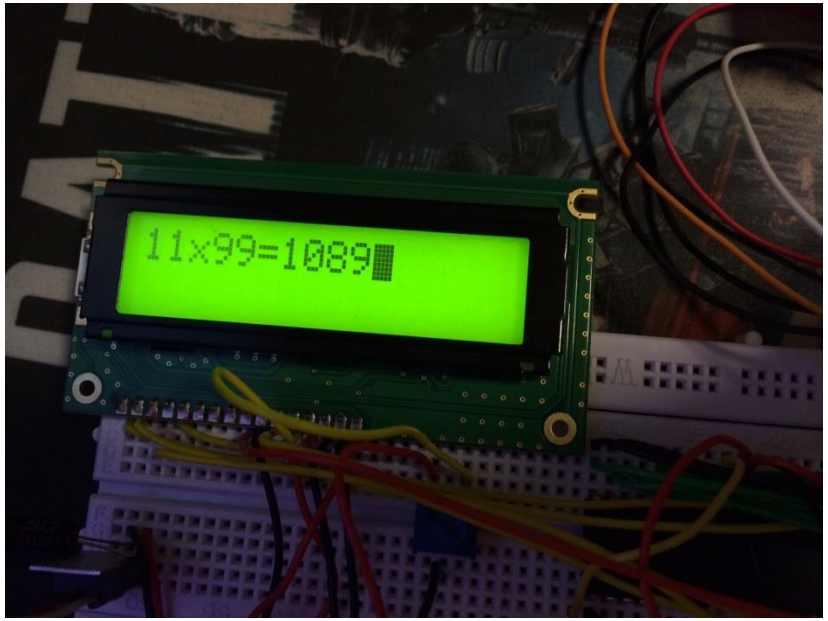
→ You can use more functions (your own)

Writing Data/Command:

- *lcdWriteData(char c) & lcdWriteCommand(unsigned char c)*

Calculation Functions

- Create a calculator function that outputs the result of simple calculations, such as adding, subtracting, multiplying or dividing two numbers.

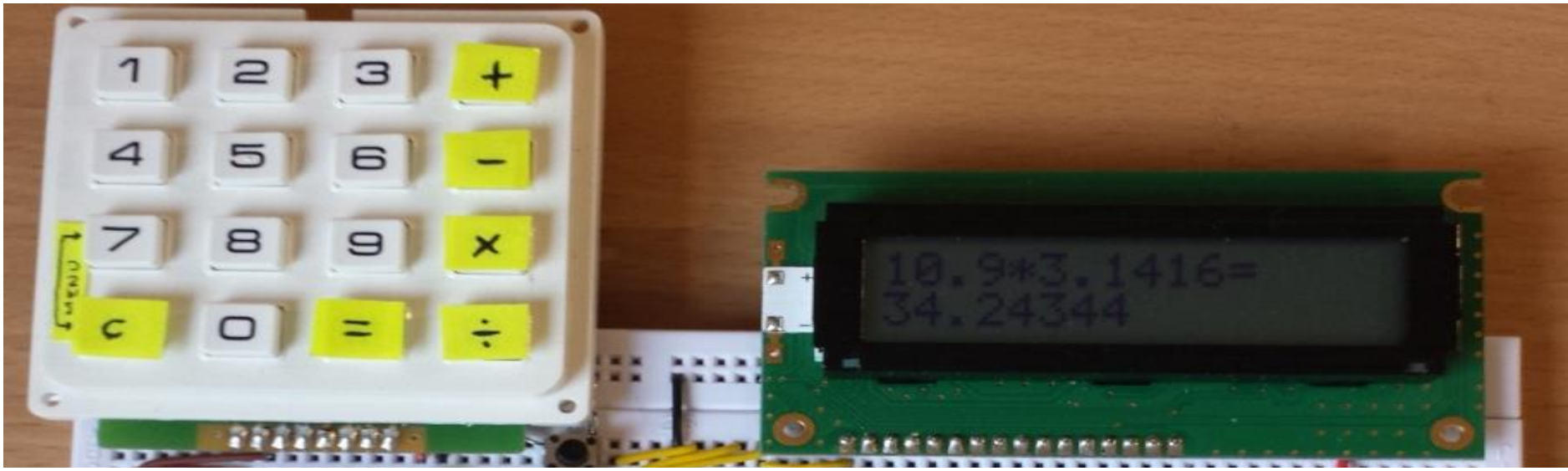


Demo

- You are required to create a demo where you display the results of the keypad input buttons (calculations) on the LCD screen to prove you have correctly implemented the above functions.

- **Extras (ask Module leader for approval)…**
  - Create *password* to access the keypad, and add an option for the user to change the password.
  - Display Graphics on the LCD.

example



Floating point operations