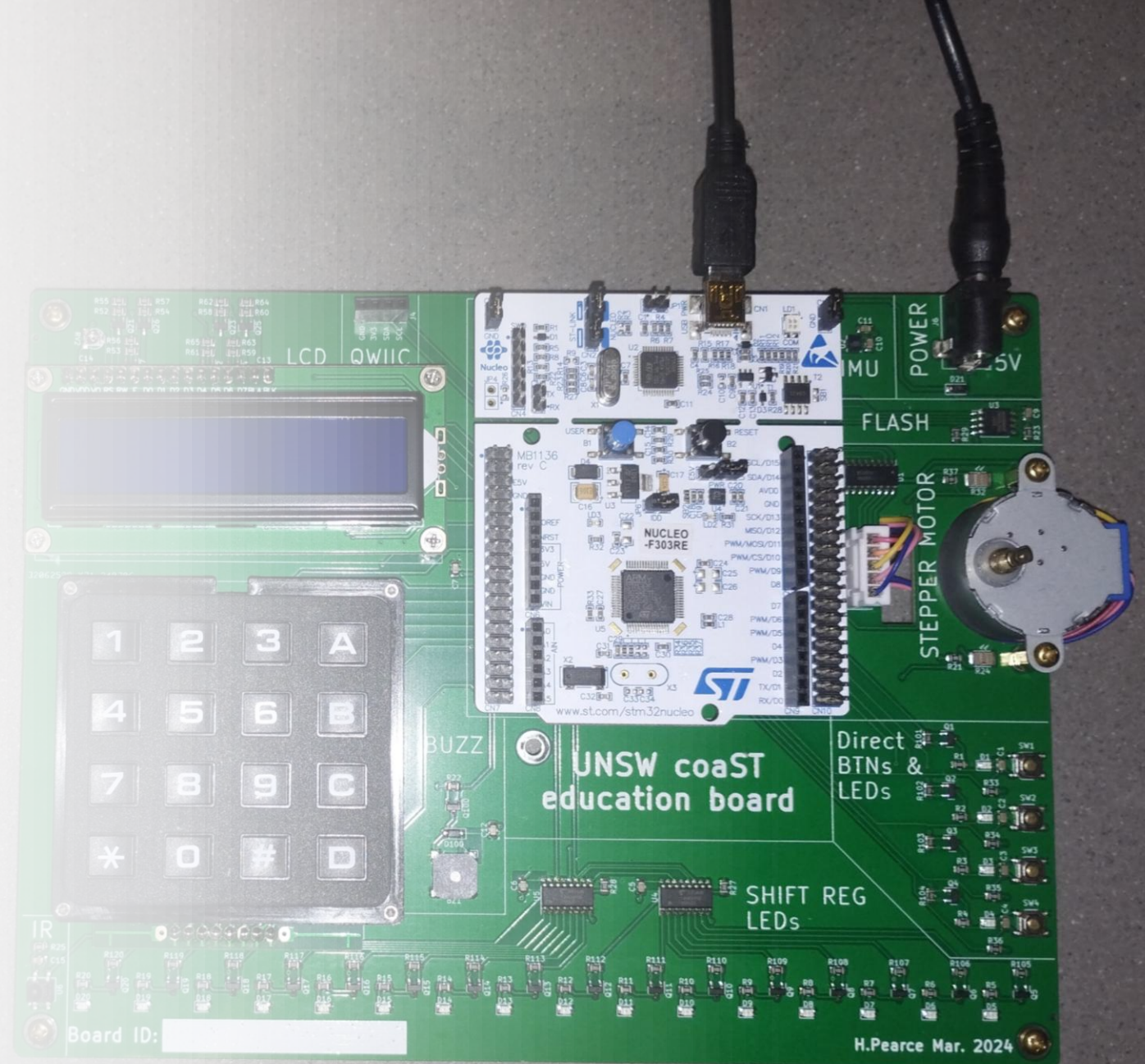


DESN2000
(Computer
Engineering)
2025 T2

HD44780 LCD
Controller

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Note!

- First see the lecture video for what was covered on the whiteboard:
 - Keypad
 - LCD basic concepts
- These slides do not cover those basics

Pinouts

Pin	Description
Vss	Power Supply Ground
Vcc	Power Supply (+3.3 or +5 V depending on module)
Vee	Contrast Adjustment (analogue input)
RS	Register Select (0 = command, 1 = data)
R/W	Read/Write (0 = write to display module, 1 = read from display module)
E	Clock Enable (falling-edge triggered)
DB0- DB3	Data Bit 0 to 3 (grounded in 4-bit operation)
DB4-DB7	Data Bit 4 to 7
LED+	Backlight +
LED-	Backlight -

HD44780 LCD Controller Block Diagram

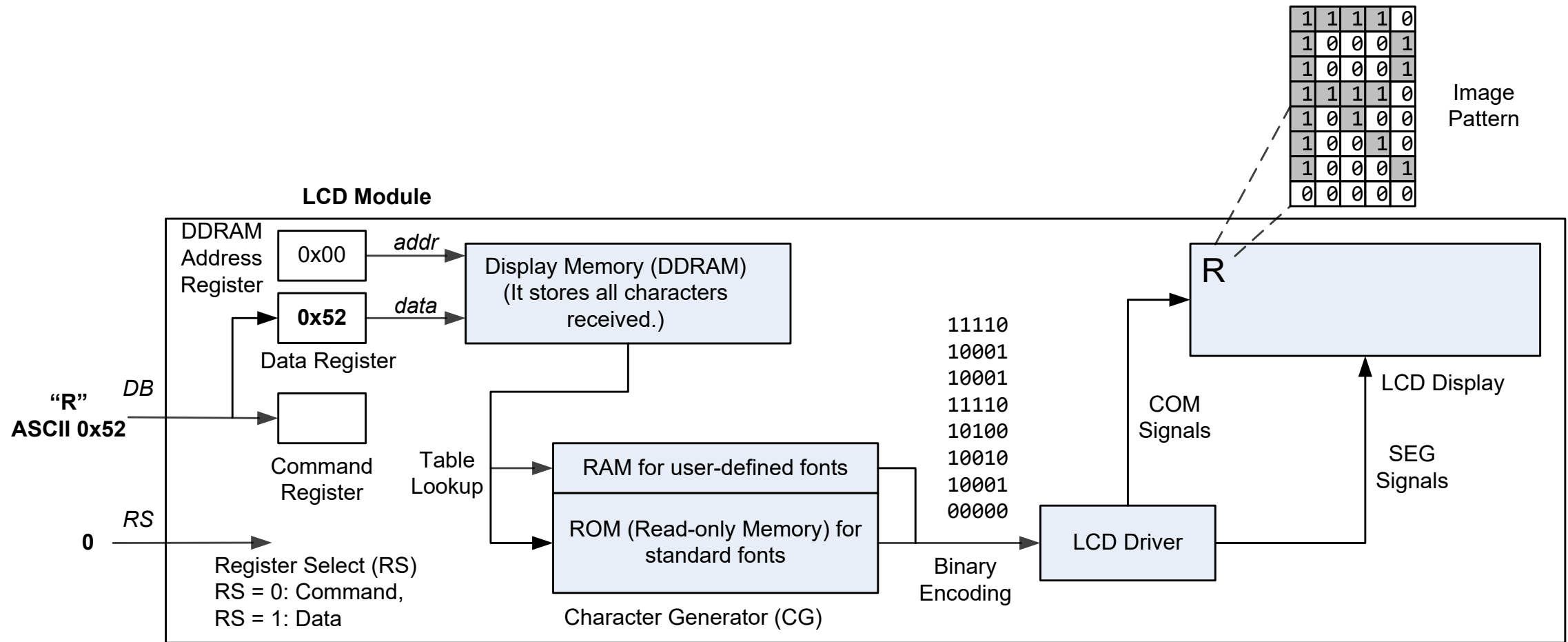


Figure adapted from: Yifeng Zhu, Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C

Instructions

	RS	R/ $\overline{W}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Function set	0	0	0	0	1	DL	N	F	*	*

- Sets the interface data length, the number of lines, and the character font.
 - DL: interface data length
 - DL = 0: 4 bits
 - DL = 1: 8 bits
 - N: Sets the number of lines
 - N = 0: 1 line display
 - N = 1: 2 line display
 - F: Sets character font.
 - F = 0: 5 x 8 dots
 - F = 1: 5 x 10 dots

Instructions

		RS	R/ $\overline{W}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Clear display	Code	0	0	0	0	0	0	0	0	0	1

- The display clears and the cursor or blink moves to the upper left edge of the display.
- The execution of clear display instruction sets entry mode to increment mode.

		RS	R/ $\overline{W}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Return home	Code	0	0	0	0	0	0	0	0	1	*	Note: * Don't care.

- The cursor or the blink moves to the upper left edge of the display. Text on the display remains unchanged.

Instructions

		RS	R/ $\overline{W}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Entry mode set	Code	0	0	0	0	0	0	0	1	I/D	S

- Sets the Increment/Decrement and Shift modes to the desired settings.
 - I/D: Increments (I/D = 1) or decrements (I/D = 0) the DDRAM address by 1 when a character code is written into or read from DDRAM
 - The cursor or blinking moves to the right when incremented by 1 and to the left when decremented by 1.
 - The same applies to writing and reading of CGRAM.
 - S: Shifts the entire display either to the right (I/D = 0) or to the left (I/D = 1) when S is 1. The display does not shift if S is 0.

Instructions

		RS	R/ $\overline{W}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
Display on/off control	Code	0	0	0	0	0	0	1	D	C	B

- Controls the display ON/OFF status, Cursor ON/OFF and Cursor Blink function.
 - D: The display is ON when D = 1 and OFF when D = 0.
 - C: The cursor displays when C = 1 and does not display when C = 0.
 - B: The character indicated by the cursor blinks when B=1.

Instructions

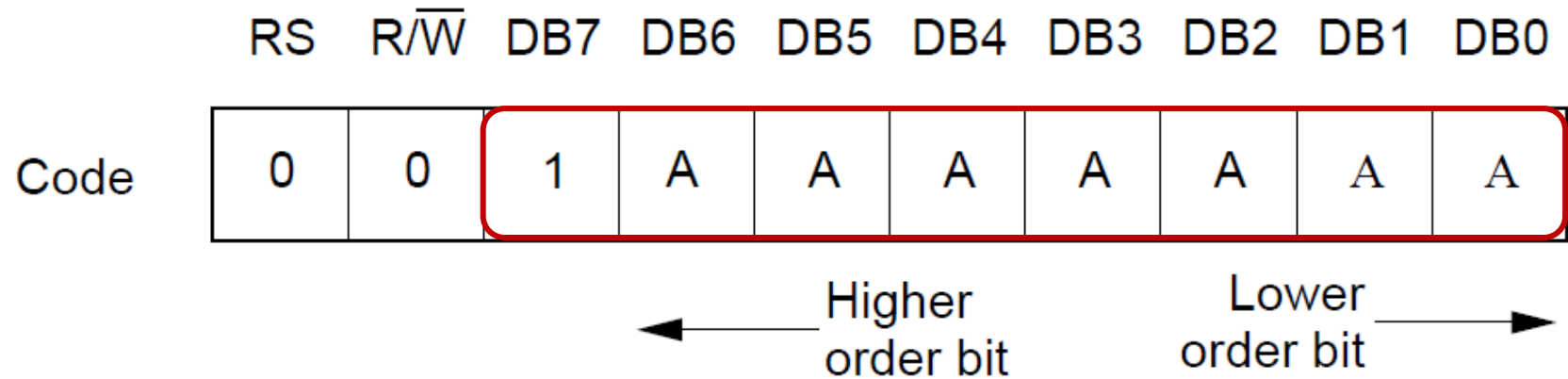
		RS	R/ $\overline{W}$	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Note: * Don't care.
Cursor or display shift	Code	0	0	0	0	0	1	S/C	R/L	*	*	

- Shifts the cursor position or display to the right or left without writing or reading display data.

S/C R/L		
0	0	Shifts cursor position to the left
0	1	Shifts cursor position to the right
1	0	Shifts the entire display to the left. The cursor follows the display shift.
1	1	Shifts the entire display to the right. The cursor follows the display shift.

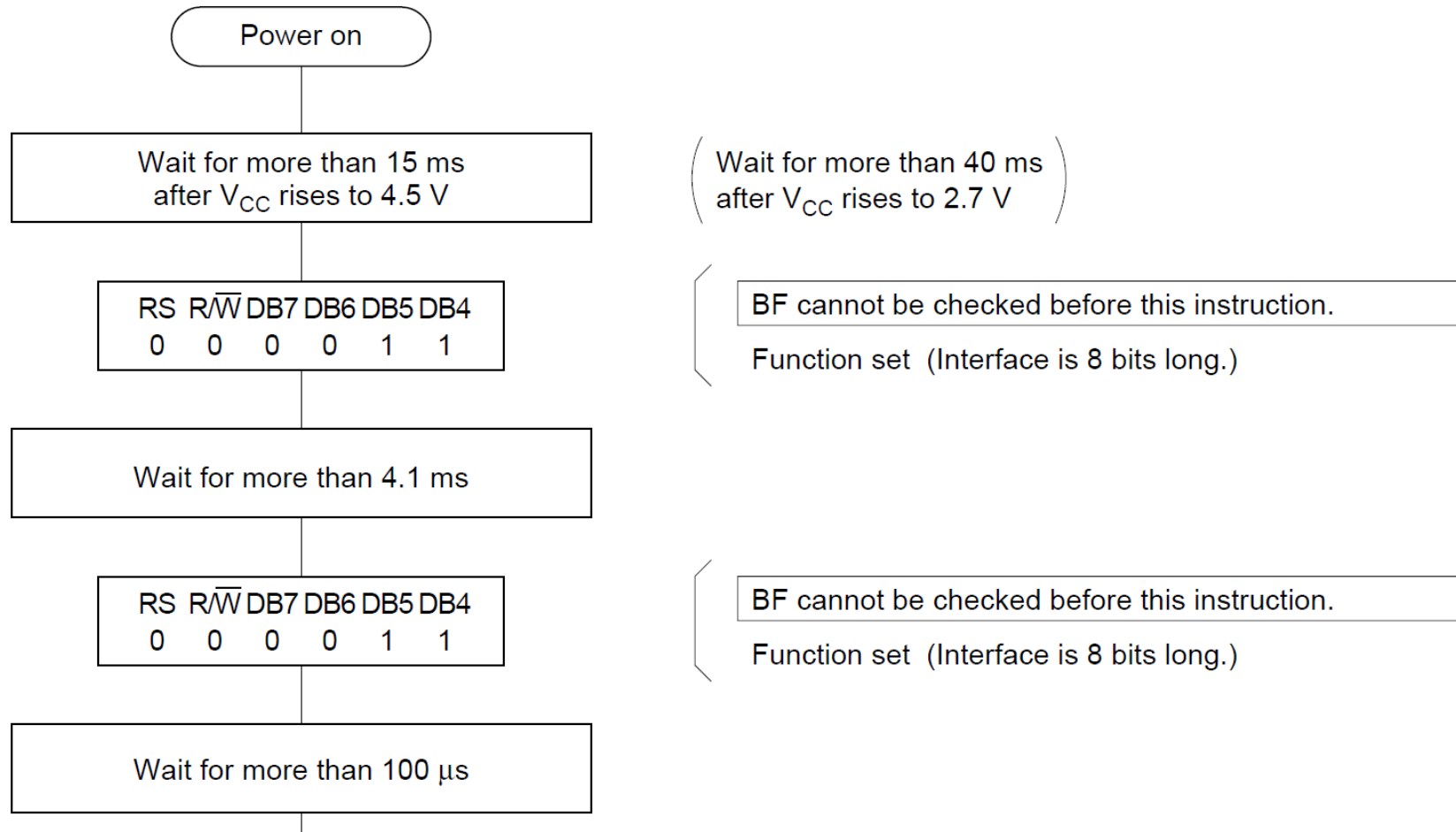
Instructions

Set DDRAM
Address

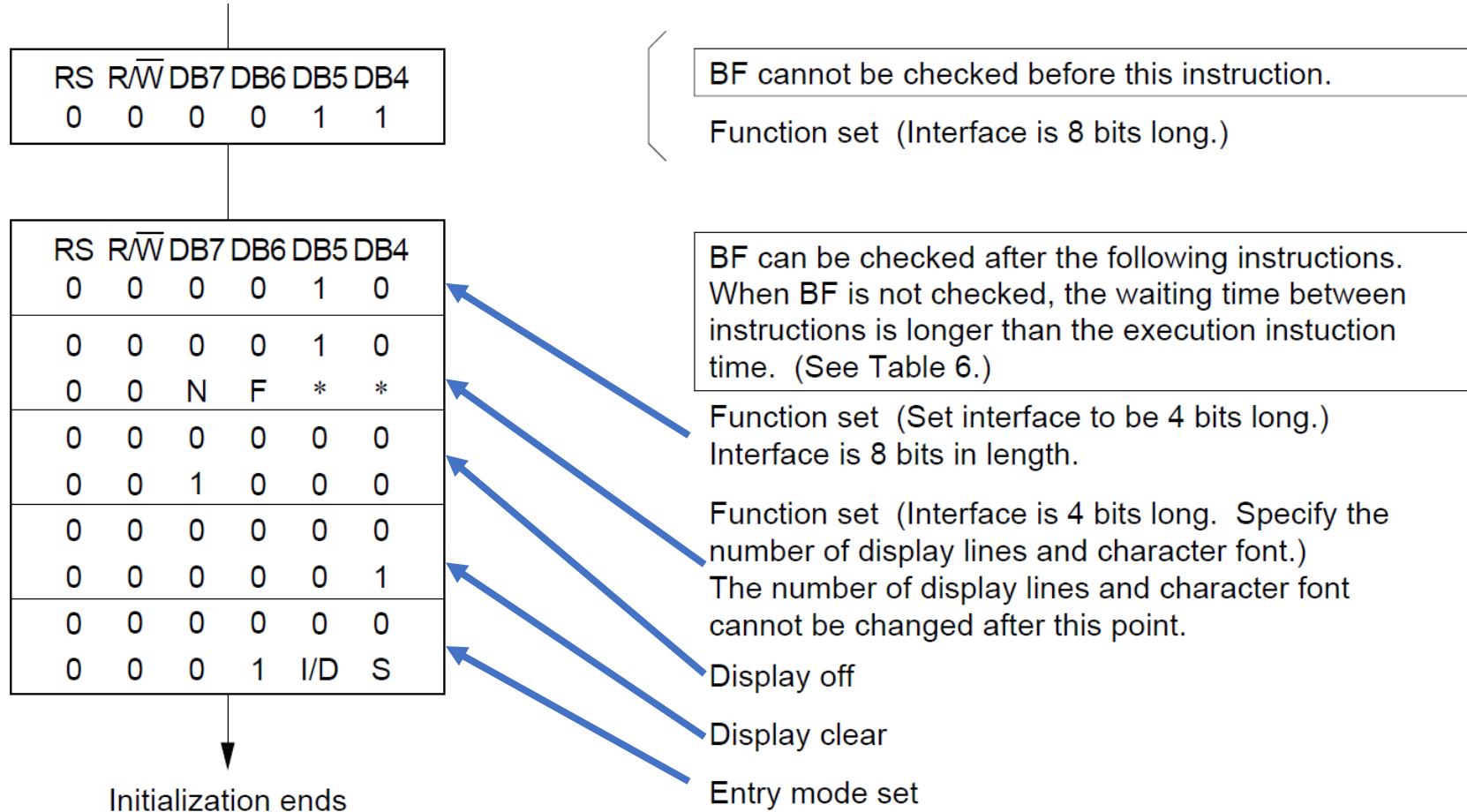


- 1100 0000 will take to the start of the second line

4-bit Mode Initialisation



4-bit Mode Initialisation



Refer to

- Datasheet of the LCD controller (available on webCMS) under lab 2
- Yifeng Zhu, Embedded Systems with ARM Cortex-M Microcontrollers in Assembly Language and C
 - Chapter 15 – keypad and the LCD sections
 - https://unsw.alma.exlibrisgroup.com/leganto/nui/lists/68311758100001731?institute=61UNSW_INST&institute=61UNSW_INST&auth=SAML&continue=