

2.5 Summary of LCD Controller Commands

LSI Controller is used to take care of all the low level control signals required for proper interface with the LCD. The following information in Figure 2.2 is taken from the data sheet of *HD 44780 Dot Matrix LCD-II Controller & Driver LSI*.

Instruction Word for the LCD Controller & Driver (Hitachi's HD44780)

Instruction	Code										Description	Execution Time (when fcp or fosc is 250 kHz)	
	RS	R/W	DB ₇	DB ₆	DB ₅	DB ₄	DB ₃	DB ₂	DB ₁	DB ₀			
Clear Display	0	0	0	0	0	0	0	0	0	1	1	Clears all display and returns the cursor to the home position (Address 0).	1.64 ms
Return Home	0	0	0	0	0	0	0	0	0	1	*	Returns the cursor to the home position (Address 0). Also returns the display being shifted to the original position. DD RAM contents remain unchanged.	1.64 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	S	Set the cursor move direction and specifies or not to shift the display. These operations are performed during data write and read.	40 us
Display ON/OFF control	0	0	0	0	0	0	1	D	C	B	B	Sets ON/OFF of all display (D), cursor ON/OFF (C), and blink of cursor position character (B).	40 us
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	*	*	*	Moves the cursor and shifts the display without changing DD RAM contents.	40 us
Function Set	0	0	0	0	1	DL	N	F	*	*	*	Sets interface data length (DL), number of display lines(L) and character font (F).	40 us
Set CG RAM Address	0	0	0	1	A _{CG}						Sets the CG RAM address. CG RAM data is sent and received after this setting.	40 us	
Set DD RAM Address	0	0	1	A _{DD}						Sets the DD RAM address. DD RAM data is sent and received after this setting.	40 us		
Read Busy Flag & Address	0	1	BF	AC						Reads Busy flag (BF) indicating internal operation is being performed and reads address counter contents.	0 us		
Write Data to CG or DD RAM	1	0	Write Data						Write data into DD RAM or CG RAM.	40 us			
Read Data from CG or DD RAM	1	1	Read Data						Read data from DD RAM or CG RAM.	40 us			
	I/D = 1: Increment I/D = 0: Decrement S = 1: Accompanies display shift S/C = 1: Display shift S/C = 0: Cursor move R/L = 1: Shifts to the right R/L = 0: Shifts to the left DL = 1: 8 bits, DL = 0: 4 bits N = 1: 2 lines, N = 0: 1 line F = 1: 5x10 dots, F = 0: 5x7 dots BF = 1: Internally operating BF = 0: Can accept instruction										DD RAM: Display data RAM CG RAM: Character generator RAM A _{CG} : CG RAM address A _{DD} : DD RAM address A _{DD} corresponds to cursor address. AC: Address counter used for both of DD and CG RAM address	Execution time changes when frequency changes. (Example) When fcp or fosc is 270 kHz: $40\mu\text{s} \times \frac{250}{270}$ = 37 us	

* Don't Care

Figure 2.2: Summary of Commands for the HD44780 type Controller