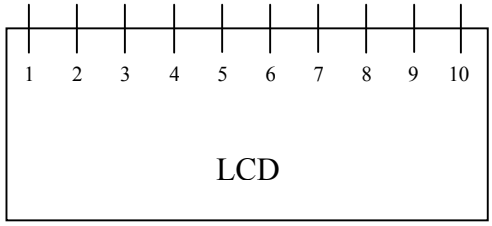
LCD Interface Notes

LCD Pinout



Note1: Verify Pin #1 on your LCD. There should be a 1 next to pin 1 and a 10 next to pin 10.

Note2: RS signal is similar to an address line input on the device and can be connected directly to CPU A0.

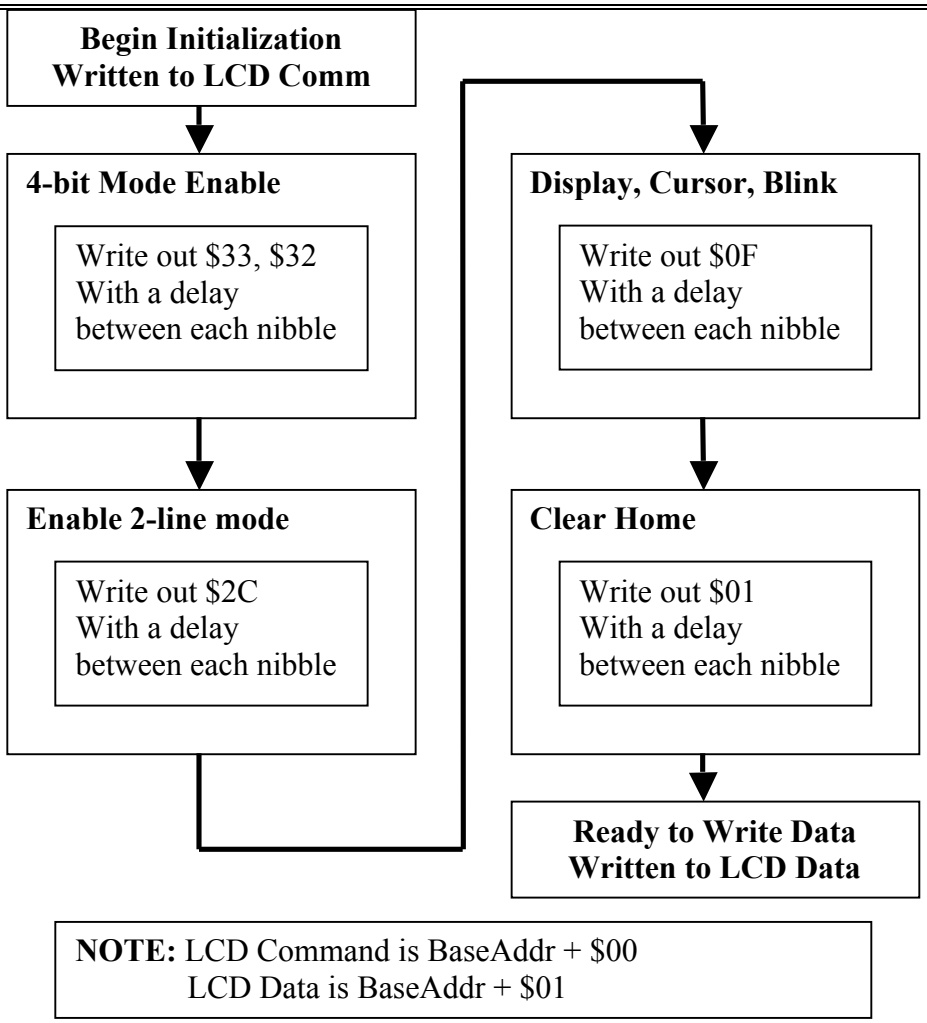
Note3: E is the enable or CS for the device. A memory mapped decoded CS signal needs to be created for enabling/disabling this signal. Consider it a write-only device.

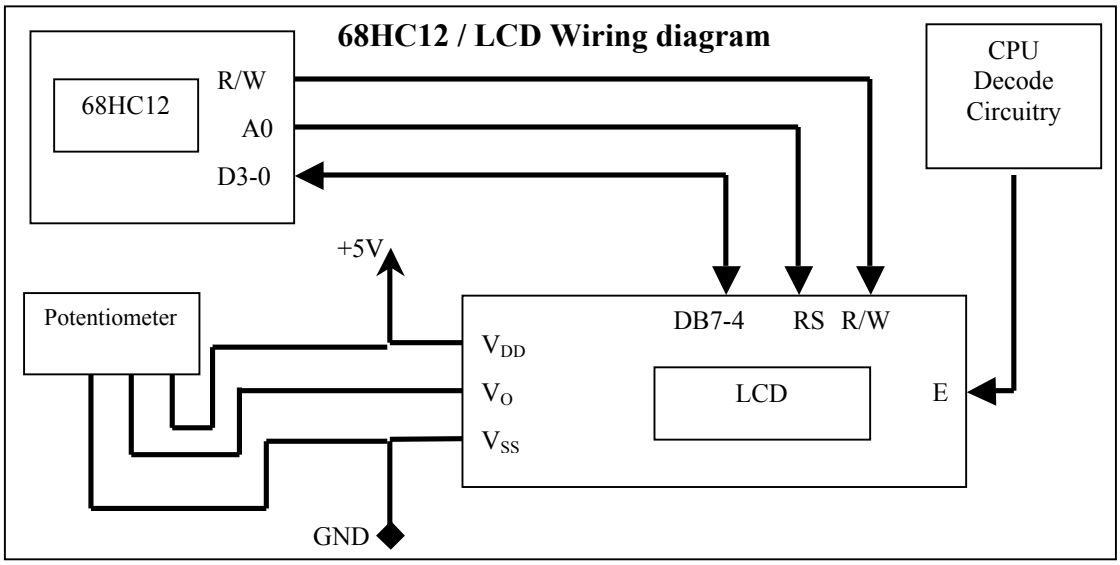
LCD Pin assignments			
Adapted from the Densitron LM2022 LCD SpecSheet			
Pin No.	Symbol	I/O	Function
1	V_{SS}	-	Ground (0V)
2	V_{DD}	-	Logic Supply Voltage (+5V)
3	V_O	-	LC Drive voltage for contrast adjustment
4	RS	I	Register Select 0: Command Register 1: Data Register
5	R/W	I	Read/Write 0: Data Write (Module ← MPU) 1: Data Read (Module → MPU)
6	E	I	Enable Signal Active High
7	DB4	I/O	Bi-directional data bus line 4 (LSB)
8	DB5	I/O	Bi-directional data bus line 5
9	DB6	I/O	Bi-directional data bus line 6
10	DB7	I/O	Bi-directional data bus line 7 (MSB)

Important Notes regarding 4-bit mode:

The difference between 4-bit and 8-bit LCD operation is that data is sent out as **nibbles** instead of a single **byte**. DB7:DB4 are used to transfer nibbles to/from the LCD module (DB7 is the MSB). Commands and data are still 8 bits long, but are transferred as two 4-bit nibbles on the LCD data bus lines DB7:DB4. **The most significant nibble should be transferred first, followed by the least significant nibble.** There must be a delay (approx. 1.5 ms) between each nibble transfer. The optimal contrast for the LCD (Vo) is 3.3 - 3.7V.

LCD Interface Notes





LCD Interface Notes

LCD Character Codes[1]

[1] Schwartz, Eric M. "EEL 4744: Microprocessor Applications." LCD Character Set. 28 Feb. 2002. <http://mil.ufl.edu/4744/docs/lcdmanual/characterset.html>.

SUMMARY OF LCD COMMANDS[2]

Instruction	Code										Description
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Clear display	0	0	0	0	0	0	0	0	0	1	Clears display and returns cursor to the home position (address 0).
Cursor home	0	0	0	0	0	0	0	0	1	*	Returns cursor to home position (address 0). Also returns display being shifted to the original position. DDRAM contents remains unchanged.
Entry mode set	0	0	0	0	0	0	0	1	I/D	S	Sets cursor move direction (I/D), specifies to shift the display (S). These operations are performed during data read/write.
Display On/Off control	0	0	0	0	0	0	1	D	C	B	Sets On/Off of all display (D), cursor On/Off (C) and blink of cursor position character (B).
Cursor/display shift	0	0	0	0	0	1	S/C	R/L	*	*	Sets cursor-move or display-shift (S/C), shift direction (R/L). DDRAM contents remains

[2] Schwartz, Eric M. "EEL 4744: Microprocessor Applications." LCD Commands. 17 Mar. 2002. <http://mil.ufl.edu/4744/docs/lcdmanual/commands.html>.

LCD Interface Notes

											unchanged.
Function set	0	0	0	0	1	DL	N	F	*	*	Sets interface data length (DL), number of display line (N) and character font(F).
Set CGRAM address	0	0	0	1	CGRAM address						Sets the CGRAM address. CGRAM data is sent or received after this setting.
Set DDRAM address	0	0	1	DDRAM address							Sets the DDRAM address. DDRAM data is sent or received after this setting.
Read busy-flag and address counter	0	1	BF	DDRAM address							Reads Busy-flag (BF) indicating internal operation is being performed and reads address counter contents.
Write to CGRAM or DDRAM	1	0	write data								Writes data to CGRAM or DDRAM.
Read from CGRAM or DDRAM	1	1	read data								Reads data from CGRAM or DDRAM.