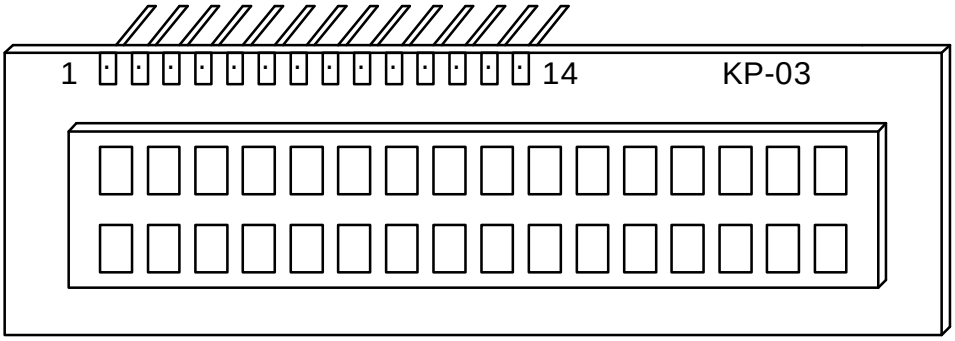
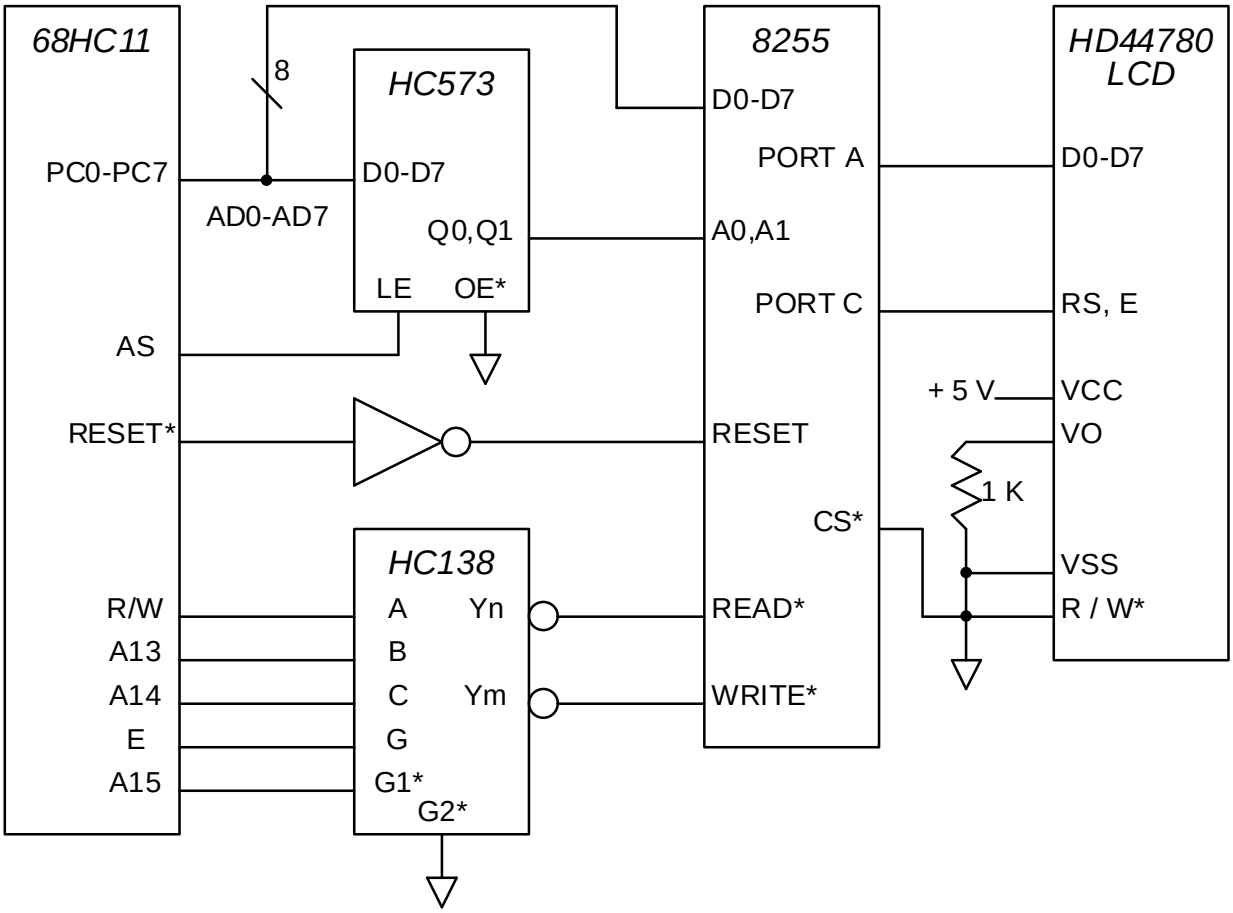
HITACHI HD44780 DOT MATRIX LCD MODULE
16 CHARACTER, 2 LINE DISPLAY
Marked KP-01 or KP-03 on top, SMC-1622A on back



PIN	SYMBOL	FUNCTION
1	Vss	Ground
2	Vdd	+5 Volts
3	Vo	1 K resistor to ground
4	RS	0=instruction 1=data
5	R / W	0=write 1=read
6	E	Enable display logic
7	D0	Data 0
8	D1	Data 1
9	D2	Data 2
10	D3	Data 3
11	D4	Data 4
12	D5	Data 5
13	D6	Data 6
14	D7	Data 7

DATA AND CONTROL INPUTS ARE TTL AND HC COMPATIBLE

68HC11 EXPANDED MODE TO 8255 TO LCD INTERFACE



EXAMPLE PROGRAM USING 8255 and HD44780:

Definitions:

- 8255 mode word makes ports A and C outputs
- 8255 port A used to write data or instruction to LCD
- 8255 port C used to write control bits to LCD
    - Bit 0 = E
    - Bit 1 = RS
- Remember: 8255 requires 850 ns minimum between writes or reads
- LCD pin 5 = ground (disables LCD reads)
- LCD pin 3 through 1 K resistor to ground to set display contrast
- Three delay routines:
    - 1 second, 5 ms, 120 μs

Initialization:

- Wait 1 second after power-up for the display to stabilize
- Store $00 to 8255 port C ;end any write to LCD
- Wait 15 ms
- Load instruction value $38 and jump to instruction subroutine ;just do it
- Wait 5 ms
- Load instruction value $38 and jump to instruction subroutine ;just do it
- Wait 120 μs
- Load instruction value $38 and jump to instruction subroutine ;just do it
- Load instruction value $38 and jump to instruction subroutine ;2-line display, 5 X 7 dots
- Load instruction value $08 and jump to instruction subroutine ;display off
- Load instruction value $01 and jump to instruction subroutine ;clear display
- Wait 5 ms
- Load instruction value $06 and jump to instruction subroutine ;+1 increment, no shift
- Load instruction value $02 and jump to instruction subroutine ;cursor home
- Wait 5 ms
- Load instruction value $0F and jump to instruction subroutine ;display on, cursor on, blink on
- Load instruction value $80 and jump to instruction subroutine ;1st line, 1st column

Instruction subroutine:

- Push appropriate registers
- Store instruction value to 8255 port A ;see instruction set next page
- Store $01 to 8255 port C
- Wait 120 μs
- Store $00 to 8255 port C
- Pull appropriate registers
- Return

Data subroutine:

- Push appropriate registers
- Store data value to 8255 port A ;see instruction set next page
- Store $03 to 8255 port C
- Wait 120 μs
- Store $02 to 8255 port C
- Pull appropriate registers
- Return

Now the LCD display should show a blinking cursor at the left-most character, top line.

INSTRUCTION SET:

FUNCTION	WRITE	D7	D6	D5	D4	D3	D2	D1	D0	WAIT TIME
Clear Display	Instruction	0	0	0	0	0	0	0	1	5 ms after write
Cursor Home	Instruction	0	0	0	0	0	0	1	N/A	5 ms after write
Entry mode	Instruction	0	0	0	0	0	1	I/D	S	120 µs
Display on/off	Instruction	0	0	0	0	1	D	C	B	120 µs
Cursor & display shift	Instruction	0	0	0	1	S/C	R/L	N/A	N/A	120 µs
Function set	Instruction	0	0	1	DL	N	F	N/A	N/A	120 µs
Set cursor address	Instruction	1	A	A	A	A	A	A	A	120 µs
Write data to cursor location	Data	D	D	D	D	D	D	D	D	120 µs

NOTES:

- I/D = 1 (increment) , I/D = 0 (decrement)
- S = 1 (accompanies display shift)
- D = display, C = cursor, B = blink (ON = 1, OFF = 0)
- S/C = 1 (display shift), S/C = 0 (cursor move)
- R/L = 1 (shift right), R/L = 0 (shift left)
- DL = 1 (8 bit data), DL = 0 (4 bit data)
- N = 1 (2 line display), N = 0 (1 line display)
- F = 1 (5 X 10 dots, 1 line display only), F = 2 (5 X 7 dots)

CURSOR ADDRESS:

- Upper left cursor address is $80
- Second line left cursor address is $C0
- First line of cursor memory is 40 characters long, although only 16 are displayed
- Second line of cursor memory is 40 characters long, although only 16 are displayed

CHARACTER DATA: (Note: Lower case alpha is supported. $22 and $27 not supported by IASM11.)

Low		High	Nibble	
Nibble	2	3	4	5
0	SP	0	@	P
1	!	1	A	Q
2		2	B	R
3	#	3	C	S
4	$	4	D	T
5	%	5	E	U
6	&	6	F	V
7		7	G	W
8	(	8	H	X
9	)	9	I	Y
A	*	:	J	Z
B	+	;	K	[
C	,	<	L	
D	-	=	M	]
E	.	>	N	^
F	/	?	O	_

Example: Write data $42 puts a B in the cursor address position.