LCD Technical FAQ

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shift register (74LS164) and an 8-bit D-flipflop (74LS244). MOSI and SCK are connected to the SR's data in and clock pins, /SS is connected to the clock of the FF. Outputs 7-4 are D7-D4, out 3 is Enable, out 2 is RS, R/W is tied to ground. Delays are based on an 8 MHz clock.

[MOT20x1.ASM] (link to file)

4.3.2) Interfacing to the Microchip PIC microcontrollers

Sample program and schematics appear in the application note AN587 in the Microchip Embedded Control Handbook for 1994/95.

A program for driving an LCD with a PIC appears in the <u>/pub/picsrc</u> directory of the Parallax FTP site <u>ftp://ftp.parallaxinc.com</u> It is written for the Parallax 8051-lookalike assembler.

Sample program and a schematic appear in the "PIC16C84 sub-page" of Peer Ouwehand's "How to control HD44780-based Character-LCD" at <u>http://www.iaehv.nl/users/pouweha/lcd.htm</u> programmed in PIC assembly language.

4.4) Serial Interface

A way to save even more I/O space is to use a serial interface, requiring just 3 digital output port pins. It uses a shift register with serial-in, parallel-out, and output latch. This setup allows the convenient coding

of a parallel interface (just writing the data to the USART transmit buffer) and low pin count of a serial interface.



Note: 74LS595 can be substituted by 74LS164 + 74LS244.

The Amateur Robitics column in June '94 Nuts & Volts demonstrated how to use this technique with the 68hc11's SPI port, using MOSI, SCK, and /SS. This would be especially handy with a nonnetworked 68HC11-based Miniboard single-board computer, which has MOSI, MISO, SCK, and /SS conveniently routed to the top left corner where resistor pack 2 goes. The experimenter could put the contrast potentiometer and latch on a daughterboard mounted underneath the LCD module.

An alternative with a less expensive shift register has the low pincount advantage, but requires bit manipulation of port pins:



http://www.repairfaq.org/filipg/LINK/F_Tech_LCD5.html (2 of 7) [23/10/2544 16:40:16]

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Save another I/O line with this idea from Robert Rolf:

"On your SPI example, you can free up the latch line by using the clock line with a diode, pullup, and capacitor. I use the SPI in normally high mode, rising clock for data bits. 10K pullup, 10nF to GND, and the clock through diode pulls it low. After all the bits are shifted in, the RC times-out, and clocks [latches] the '595."

4.5) LCD Serial Backpack

The LCD Serial Backpack from Scott Edwards Electronics lets you communicate with a one- or two-line LCD over an asynchronous serial port at 2400 or 9600 bps. Both TTL and RS-232 voltage levels are supported. The Backpack is a tiny daughterboard with an onboard processor, fitting neatly behind any LCD module, having solder pads for both 2x7 and 1x14 hookups. Backpacks are sold alone or with a variety of LCDs. Call (520) 459-4802.

Chapter 5) LCD Controller chip pinout

NEC UPD44780 LCD Display Controller Pinouts:

PIN	DEFINITION	
===	=========	
1	SEG 22	
2	SEG 21	
3	SEG 20	
4	SEG 19	6666655555555544444444
5	SEG 18	432109876543210987654321

http://www.repairfaq.org/filipg/LINK/F_Tech_LCD5.html (3 of 7) [23/10/2544 16:40:16]

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6	SEG	17	65	40
7	SEG	16	66	39
8	SEG	15	67	38
9	SEG	14	68	37
10	SEG	13	69	36
11	SEG	12	70	35
12	SEG	11	71	34
13	SEG	10	72	33
14	SEG	9	73 UPD44780 TOP	32
15	SEG	8	74	31
16	SEG	7	75	30
17	SEG	б	76	29
18	SEG	5	77	28
19	SEG	4	78 NOTCHED CORNER	27
20	SEG	3	79 /AND POSSIBLE DOT	26
21	SEG	2	80 0	25
22	SEG	1	\ 11111111122222	2
23	GND		123456789012345678901234	ł
24	OSC	1		
		-		
25	OSC	2		
26	V1			
27	V2			
28	V3			
29	V4			
30	V5			
31	CL	1		
32	CL	2		
33	VCC			
34	М		-	
35	D		-	
36	RS		- Reset, assert once	
37	R/W	*	- Hold low for write operation	
38	Ε		- Clock low to latch data.	
39	DB	0	- The data bus	
40	DB	1	-	
<u>/</u> 1	סח	2		
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43 11	פע פת	ч Г	_	
±4 ∕\⊑	פת	5	-	
ч Э Л С	פת פת	0 7	_	
40	DВ	/	-	

4	7	COM	1
4	8	COM	2
4	9	COM	3
5	0	COM	4
5	1	COM	5
5	2	COM	6
5	3	COM	7
5	4	COM	8
5	5	COM	9
5	б	COM	10
5	7	COM	11
5	8	COM	12
5	9	COM	13
6	0	COM	14
6	1	COM	15
6	2	COM	16
6	3	SEG	40
6	4	SEG	39
Č	-	510	55
6	5	SEG	38
6 6	5 6	SEG SEG	38 37
6 6 6	5 6 7	SEG SEG SEG	38 37 36
6 6 6 6 6	5 6 7 8	SEG SEG SEG SEG	38 37 36 35
6 6 6 6 6 6 6	5 6 7 8 9	SEG SEG SEG SEG SEG	38 37 36 35 34
6 6 6 6 6 7	5 6 7 8 9 0	SEG SEG SEG SEG SEG SEG	38 37 36 35 34 33
6666777	5 6 7 8 9 0 1	SEG SEG SEG SEG SEG SEG SEG	38 37 36 35 34 33 32
66666777	5 6 7 8 9 0 1 2	SEG SEG SEG SEG SEG SEG SEG SEG	38 37 36 35 34 33 32 31
666667777	5 6 7 8 9 0 1 2 3	SEG SEG SEG SEG SEG SEG SEG SEG SEG	38 37 36 35 34 33 32 31 30
6666677777	5 6 7 8 9 0 1 2 3 4	SEG SEG SEG SEG SEG SEG SEG SEG SEG	38 37 36 35 34 33 32 31 30 29
666667777777	5 6 7 8 9 0 1 2 3 4 5	SEG SEG SEG SEG SEG SEG SEG SEG SEG SEG	38 37 36 35 34 33 32 31 30 29 28
6666677777777	5 6 7 8 9 0 1 2 3 4 5 6	SEG SEG SEG SEG SEG SEG SEG SEG SEG SEG	38 37 36 35 34 33 32 31 30 29 28 27
6666677777777777	5 6 7 8 9 0 1 2 3 4 5 6 7	SEG SEG SEG SEG SEG SEG SEG SEG SEG SEG	 38 37 36 35 34 33 32 31 30 29 28 27 26
66666777777777777	5 6 7 8 9 0 1 2 3 4 5 6 7 8	SEG SEG SEG SEG SEG SEG SEG SEG SEG SEG	38 37 36 35 34 33 32 31 30 29 28 27 26 25
666667777777777777	567890123456789	SEG SEG SEG SEG SEG SEG SEG SEG SEG SEG	 38 37 36 35 34 33 32 31 30 29 28 27 26 24
666667777777777778	5678901234567890	SEG SEG SEG SEG SEG SEG SEG SEG SEG SEG	 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23

(Section 6 by Frank Hausman)

Chapter 6) FTP and other sites

- This FAQ.
 - <u>ftp://ftp.armory.com/pub/user/rstevew/LCD/lcdfaq.zip</u> (other LCD references here, too)
 - <u>http://www.repairfaq.org/filipg/LINK/F_LCD_tech.html</u> (other LCD references here, too)
- LCDFAQ: Liquid Crystal Display physics & principles of operation by Scott M. Bruck, August 1993.
 - o ftp://ftp.ee.ualberta.ca/pub/cookbook/faq/LCD2.doc
 - o http://www.repairfaq.org/filipg/LINK/F_LCD_theory.html
- How to control HD44780-based Character-LCD by Peer Ouwehand, 2/22/96. A good tutorial and referenceR, with examples.
 - o http://www.iaehv.nl/users/pouweha/lcd.htm
- LCD Module tutorial and reference by Ian Harries, including examples such as driving LCD with the IBM PC parallel port and other application ideas.
 - o http://www.doc.ic.ac.uk/~ih/doc/lcd/
- 4-bit interface sample in-line assembly code, by Jordan Nicol, for implementation under Dunfield's Micro-C for the Miniboard. It uses port pins PA7-PA3 for 4-bit data and PC6 and PC7 for RS and E.
 - o <u>ftp://cher.media.mit.edu</u>
- Parallax Basic Stamp applications.
 - o <u>ftp://wpi.wpi.edu/stamp</u>
 - o <u>ftp://ftp.parallaxinc.com/pub/stamp</u>
- Jeff Sampson's graphic LCD controller info page.
 - o <u>http://www.skypoint.com/~jeffs39/lcdindex.htm</u>
- Chris Hirsch's LCD page.

- o <u>http://www.cs.colostate.edu/~hirsch/LCD.html</u>
- LCD Forum discussion list.
 - o http://www.eio.com/public/lcd

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