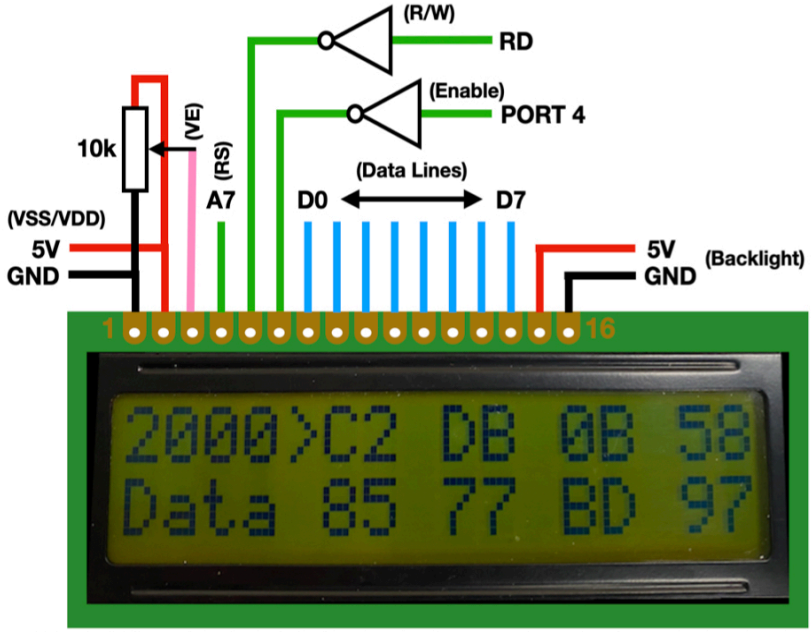
TEC LCD Cheat Sheet

Pin	Value	Function
1	VSS	GND
2	VDD	5V
3	V0	Contrast
4	RegSel	H=Data, L=Inst
5	R/W	H=Read, L=Write
6	Enable	H=Enable, L=Disable
7	DB0	Data Lines D0-D7
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	BLA	Backlight 5V
16	BLK	Backlight GND

Pinout for 16x2 and 20x4 are identical



Instruction Port = 0x04 **Data Port = 0x84**

Instruction Register

One Byte commands to configure the LCD Screen

When LCD turns on or resets, screen defaults with 0x01, 0x06, 0x08 and 0x30

OUT (04), A

Hex	Description	Hex	Description	Hex	Description
0x01	Clear Screen, Cursor reset	0x0F	Display On, Cursor On and Blink	0x40	Set CGRAM Address Pos 1
0x02	Return Cursor to top left	0x10	Move Cursor one to the left		(Address from 40-7F)
0x04	Decrement Cursor on write	0x14	Move Cursor one to the right		
0x06	Increment Cursor on write	0x18	Shift Display to the left	0x80	Set Row 1, Col 1 DDRAM Address
0x05	Display to Shift Right	0x1C	Shift Display to the right	0xC0	Set Row 2, Col 1 DDRAM Address
0x07	Display to Shift Left	0x30	8-Bit, 1 Line, 5x8 dots	0x94	Set Row 3, Col 1 DDRAM Address (20x4)
0x08	Display Off, Cursor Off	0x34	8-Bit, 1 Line, 5x11 dots	0xD4	Set Row 4, Col 1 DDRAM Address (20x4)
0x0C	Display On, Cursor Off	0x38	8-Bit, 2 Line, 5x8 dots		(Address from 80-A7, C0-E7)
0x0E	Display On, Cursor On	0x3C	8-Bit, 2 Line, 5x11 dots		See Screen Layout Below

OUT (84), A
to write a character to DDRAM

Only write while LCD is not busy

IN A, (84)
to read a character from DDRAM

IN A, (04)
read busy flag (bit 7)

BF	AC	AC	AC	AC	AC	AC	AC

Screen Layout

DDRAM Address Counter with Bit 7 set

Pos	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Row 1	80	81	82	83	84	85	86	89	88	89	8A	8B	8C	8D	8E	8F	90	91	92	93
Row 2	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF	D0	D1	D2	D3
Row 3	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F	A0	A1	A2	A3	A4	A5	A6	A7
Row 4	D4	D5	D6	D7	D8	D9	DA	DB	DC	DD	DE	DF	E0	E1	E2	E3	E4	E5	E6	E7

20x4

Pos	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Off Screen
Row 1	80	81	82	83	84	85	86	89	88	89	8A	8B	8C	8D	8E	8F	90-A7
Row 2	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF	D0-E7

16x2

Writing a character to the screen will increase/decrease the Address Counter automatically

To move the cursor to Row 2, Column 10 do LD A, 0xC9 / OUT (04), A

For IN A, (04), If Bit 7 is set, then LCD is Busy. Other bits are the current Address Counter

Creating Custom Characters

CGRAM Address	Character In DDRAM
40	0
48	1
50	2
58	3
60	4
68	5
70	6
78	7

0	0	0	0	0	0	0	1	0x01
0	0	0	0	0	0	1	1	0x03
0	0	0	0	0	1	0	1	0x05
0	0	0	0	1	0	0	1	0x09
0	0	0	0	1	0	0	1	0x09
0	0	0	0	1	0	1	1	0x0B
0	0	0	1	1	0	1	1	0x1B
0	0	0	1	1	0	0	0	0x18

Up to 8 Custom Characters can be programmed

Use Bits 0 to 4 only

After each byte is written CGRAM Address increases

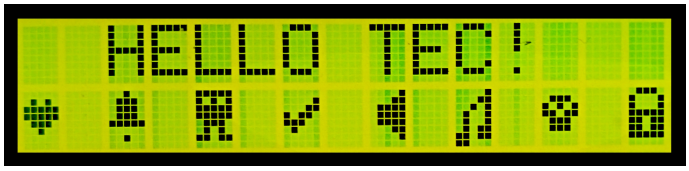
To display character use 0-7 in DDRAM

Use OUT (04), A to set the CGRAM address, where A is between 40h-7Fh
Then OUT (84), A to write one 5 pixel row

Character Table

Note: The user can specify any pattern for character-generator RAM.

Example using CGRAM and DDRAM

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LCD_IR:     EQU     04H  ;Instruction Port
LCD_DR:     EQU     84H  ;Data Port

START:
            ; LCD set up
            CALL    CHECK_BUSY          ;Check for LCD Busy
            LD      A,0CH               ;Display On, Cursor Off
            OUT     (LCD_IR),A          ;Send to Instruction Register (IR)
            CALL    CHECK_BUSY          ;Check for LCD Busy
            LD      A,38H               ;8-Bit, 2 Lines, 5x8 Characters
            OUT     (LCD_IR),A          ;Send to Instruction Register (IR)

            ; Tell the LCD that next data will be to CGRAM
            CALL    CHECK_BUSY          ;Check for LCD Busy
            LD      A,40H               ;CGRAM entry
            OUT     (LCD_IR),A          ;Send to Instruction Register (IR)

            ; Save multiple characters to CGRAM using lookup table and OUTI
            LD      BC,4000H | LCD_DR   ;B=40 (8 letters), C=84 (port number)
            LD      HL,TABLE            ;LCD custom character table
LOOP1:
            CALL    CHECK_BUSY          ;Check for LCD Busy
            OUTI                        ;Send (HL) to port C, Decrement B, Increment HL
            JR      NZ, LOOP1           ;OUTI sets zero if B=0

            ; Display first line text
            CALL    CHECK_BUSY          ;Check for LCD Busy
            LD      A,82H               ;Move Cursor to Row 1, Col 3
            OUT     (LCD_IR),A          ;Send to Instruction Register (IR)

            ; Send multiple characters using lookup table and OUTI
            LD      BC,0A00H | LCD_DR   ;B=0A (10 letters), C=84 (port number)
            LD      HL,TEXT             ;LCD text table
LOOP2:
            CALL    CHECK_BUSY          ;Check for LCD Busy
            OUTI                        ;Send (HL) to port C, Decrement B, Increment HL
            JR      NZ, LOOP2           ;OUTI sets zero if B=0

            ; Display new characters
            CALL    CHECK_BUSY          ;Check for LCD Busy
            LD      A,0C0H              ;Move Cursor to Row 2, Col 1
            OUT     (LCD_IR),A          ;Send to Instruction Register (IR)

            ; Send multiple characters using lookup table and OUTI
            LD      BC,0800H            ;B=08 (letters), C=0 (CGRAM ref)
LOOP3:
            CALL    CHECK_BUSY          ;Check for LCD Busy
            LD      A,C                 ;Send Custom Character
            OUT     (LCD_DR),A          ;Send to Data Register (DR)
            INC     C                   ;Increase C to next CGRAM ref in DDRAM
            CALL    CHECK_BUSY          ;Check for LCD Busy
            LD      A,20H               ;Send Space Character
            OUT     (LCD_DR),A          ;Send to Data Register (DR)
            DJNZ    LOOP3               ;Repeat for all 8 characters

            HALT                        ;Pause the CPU

TEXT:
            DB      "HELLO TEC!"
TABLE:
            DB      00H,0AH,1FH,1FH,0EH,04H,00H,00H     ;Heart
            DB      04H,0EH,0EH,0EH,1FH,00H,04H,00H     ;Bell
            DB      1FH,15H,1FH,1FH,0EH,0AH,1BH,00H     ;Alien
            DB      00H,01H,03H,16H,1CH,08H,00H,00H     ;Tick
            DB      01H,03H,0FH,0FH,0FH,03H,01H,00H     ;Speaker
            DB      01H,03H,05H,09H,09H,0BH,1BH,18H     ;Note
            DB      00H,0EH,15H,1BH,0EH,0EH,00H,00H     ;Skull
            DB      0EH,11H,11H,1FH,1BH,1BH,1FH,00H     ;Lock

            ; Routine to check the Busy Flag (Bit 7)
CHECK_BUSY:
            IN      A,(LCD_IR)          ;Read Busy Byte
            RLCA                        ;Put Bit 7 in Carry Flag
            JR      C, CHECK_BUSY       ;If Carry Set then LCD is busy
            RET
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