LCD DISPLAY INTERFACING MODULE (ET-LCD)

The LCD Display Interfacing Module (ET-LCD) will demonstrate to the student that as to how a LCD display device can be configured through I/O lines of 8255 to display the desired information.

DESCRIPTION

L C D stands for LIQUIED CRYSTAL DISPLAY and is a commonly used as O/P device for the microprocessor based system. As compared to the other commonly used O/P devices i.e. light Emitting Diode (LED) Display, they consume very less power and they don't emit their own light but use ambient light.

The LCD module used here is CTS-1612. It is a 16 character * 2 line display module, without backlight. A character is displayed using 5*7 dots format. It is compatible with both 4 and 8 bit microprocessor. This LCD module has 14 pins. The various signals on them can be classified into 3 groups, namely Power signals, Control signals & Data signals.

- Signals constituting the power signals are:

1. Vss (1) : Ground
2. Vdd (2) : Supply voltage for logic and LCD. It should be 5v +-5%
3. V0 (3) : Supply voltage for LCD. By varying this contrast can be varied.

- Signal forming the control group are :

1. RS (4): It stands for Registered selection. Depending upon its status, the contents of the data bus are treated as an instruction code or data. A High on this pin means that contents of the data bus are to be treated as the data while low on it means that their contents are to be treated as an instruction code.

2. R/W (5): Status of this pin indicates whether the MPU will read or write data, from or to, the LCD module. A high on this pin will initiate a read cycle, while a low on it will initiate a write cycle.

3. E (6): This is the Enable signal. While performing either read or writes operation, a High and then High to Low transition has to be provided on this pin.

Above-mentioned control signal can be connected to 3 I/O lines.

- Eight signals forming the data bus signal is:

1. DB0 – DB7 (7-14): These can be connected to B I/O port lines. DB0 is the LSB & DB7 is the MSB.

Dot matrix LCD controller used in this LCD module is KS 0066. It automatically initializes (reset), when power is turn on, using the internal reset ckt. However when the

power supply conditions are not met, MPU will reset the LCD module by issuring a sequence of instruction show under the heading "Initialization by instruction". It has internal memory called Display Data Ram (80 * 8 bits).

HOW TO DISPLAY A STRING OF CHARACTERS

A character can be display by writing its ASCII code into the DISPLAY DATA RAM (DDRAM), which can hold a maximum of 80 character code. RAM is divided in two groups. Starting address of the 1st group is (refer to table 2) 80H while that of 2nd group is A9H. Contents of 1st 8 locations of group 1 are displayed at 1st 8-display position, while those of 2nd group are displayed at next 8-display position. Now that the display is full, if we go to the SHIFT mode, 1st 8-display position shows the character whose code is 81h-88h, after a write operation. The 2nd 8 display position now show the characters whose code are at AAh-B1h. Like this characters are shifted with each write/read operation. Through **RESTORE** command, contents of 80-87h at 1st 8-display position and A9-B0 at next 8-display position can be brought back.

Also the DDRAM is more of a sequential memory than a random memory. It is so since, memory location can be accessed serially only. For example, say we want to write something at 87h which belongs to 1st group of DDRAM. To get there we would have to initialize address counter of DDRAM at 80h (start of 1st group of DDRAM), perform 7 dummy write operation and then write what we intended to write at 87h, which is presently pointed by the address counter for the DDRAM. Same is true for the 2nd group of memory, whose starting address is A9h.

Another point to be noted is that, say presently contents of 88-8F & B1-B8 are being displayed and a write operation is performed at 80-87, the changes due to these write operation won't be visible immediately. It could be seen only if the display is restored i.e. contents of 80-87h are put on display. However if this write operation is continued till 8FH then the changes from 88-8F would be visible immediately, since their contents are currently being displayed, at 1st 8-display position.

Keeping these points in mind a program has been written to display contents of memory starting from 2600H till 00 is encountered.

The Sample program display the character stored in the memory location 2600H onwards of microprocessor/micro-controller kit on LCD till it encounter "00" (End of file character). The program first initializes the LCD. The LCD is set to no shift and +1 increment entry mode. It means that when one character gets display on LCD, the next character entered will be written at next LCD RAM address and display next to the previous character on LCD. The display setting are make as display = ON, cursor = ON and blinking of cursor = OFF. These setting are done by referring to table 2. The display will look like this:

The program calls a subroutine named "write 1". This routine is required since for write operation of LCD, RS & R/W signals should be low initially. Then the enable signal should go high for a period of minimum 220 n.s. After this the enable signals should go to

low position again. Then the R/W signal is pulled high. HL pointer initialized to point to first character i.e. 2600H and address counter of LCD is set to first memory location i.e. 80H. This address is set by using table 2. The program display first character on LCD from 80H-87H.

```
+------------------------------------------------------------+
                      A B C D FE F G H
+------------------------------------------------------------+
```

The next 8 character are written at 88H-8FH location but are not displayed on LCD since, the display is set to no shift mode. The HL pointer is set to 2610H. The HL is then moved back by 8 character. These 8 characters are written at A9-B0H. Then all 16 character is display by this time.

```
 80H          87H A9H              B0H
 +-------------------------------------------+
   A B C D E F G H I J K L M N O P
 +-------------------------------------------+
 LSB          MSB LSB              MSB
```

Now put the display in shift mode. At the end of previous operation, the pointer of LCD RAM was at B1H. The program, then moves the next character from kit memory to LCD RAM address. At this movement, the character of group1 will be shifted by 1 position. Therefore “A” character gets lost and 1 character get displayed at H position since we have copied these characters at 88H-8Fh location (refer to loop 5 in program). This same way all character is moved from kit memory to LCD RAM and is displayed one by one on LCD.

The display become:

```
  88h              8FH B1                 B8
+-------------------------------------------------+
    I J K L M N O P Q R S T U V W X
+-------------------------------------------------+
```

Now to enter the next 8 character the contents from 88H-8FH are copied in 80H-87H. The contents of B1H-B8H are copied to 88H-8FH. Then a restore operation is performed which display the contents of 80H-87H & A9H-B0H. The contents at A9H-B0H location are rewritten as were written at B1H-B8H location. The program then is ready to accept next 8 character. The following procedure gives detail description.

Refer to start of loop9 for the following:

At this moment, HL points to B9H location. In the next instruction, HL is decremented by 16 so that is point to the character, which was written at 88H-8FH location. A copy of

these characters is made in 80H-87H location but are not display since at present contents of 88H-8FH are being display still looks like this:

```
 88H              8FH B1H              B8H
+-------------------------------------------------+
   I J K L M N O P Q R S T U V W X
+-------------------------------------------------+
```

A copy of B1-B8H is made in 88H to 8FH location. Since contents of 88H-8FH are presently on display, so these write operation will be seen on screen, if delay between 2 writes is increased and the display will look like this:

```
 88H              8FH B1H              B8H
+-------------------------------------------------+
   Q R S T U V W X Q R S T U V W X
+-------------------------------------------------+
```

Now restore operation is performed. Then the display is restored to the initial memory locations, 80H-87H & A9-B0H. The memory location 80H-87H consists of copied contents of A9-B0. The memory location 80H-87H consists of copied contents of A9-B0. The display may looks like this, if the delay is increased.

```
 80H              87H A9H              B0H
+-------------------------------------------------+
   I J K L M N O P I J K L M N O P
+-------------------------------------------------+
```

Both group of display fields display the same group of character. The next instruction write to A9-B0H so that the screen displays the same 16 characters that are was showing at the start of loop9. The LCD is now ready to accept next 8 character.

INITIALIZING BY INSTRUCTION

If the power supply condition for correctly operation the internal reset circuit are not met, initialization by instruction is required.

Use the following STEPS for initialization:

TABLE 1

```
+--------------------+
   POWRE ON
+--------------------+
```

When Interface is 8 bits long.

```
+---------------------------------------+
   WAIT MORE THAN 15 M.S.
  AFTER VDD RISES TO 4.5V
+---------------------------------------+
```

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
0	0	0	0	1	1	.	.	.	.	Function set (internal is 8 bits long)

WAIT MORE THAN 4.1 M.S.

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
0	0	0	0	1	1	.	.	.	.	Function set (interface is 8 bits long)

WAIT MORE THAN 100 U.S.

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB	
0	0	0	0	1	1	.	.	.	.	Function set (interface is 8 bits long)

RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
0	0	0	0	1	1	N	F	.	.	Function set (interface is 8 bits long. Specify the no. of display lines and character font.) The no. of display lines &character font can't be changed afterward.
0	0	0	0	0	0	1	0	0	0	Display OFF
0	0	0	0	0	0	0	0	0	1	Display ON
0	0	0	0	0	0	0	1	I/D	S	Entry Mode Set

INITIALIZATION ENDS

1. Display Clear

2. Function Set
   DL = 1 : 8 bit interface data

DL = 0 : 4 bit
F = 0 : 5 * 7 dot character font
N = 1 : 1/16 Duty
N = 0 : 1/18 Duty, 1/11 Duty

3. Display ON/OFF Control
   D = 0 : Display OFF
   C = 0 : Cursor OFF
   B = 0 : Blink OFF

4. Entry Mode Set
   I/D = 1 : +1 (increment)
   S = 0 : No shift

INSTRUCTIONS

TABLE-2

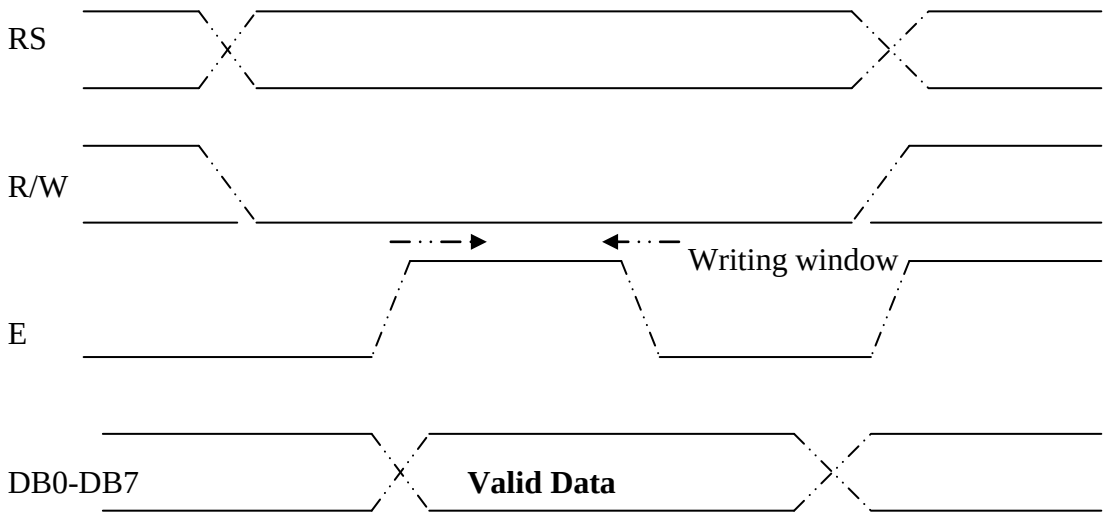
Instruction	Code										Description
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	
Clear Display	0	0	0	0	0	0	0	0	0	1	Clear all display and returns the cursor to the home position (Address 0)
Entry mode set	0	0	0	0	0	0	0	1	I/D	1	Sets the cursor move direction and specifies or not to shift the display. These operation are performed during data write and read.
Display On/Off Control	0	0	0	0	0	0	1	D	C	B	Sets On/Off all display (D) cursor On/Off (C), and blink of cursor position character (B).
Cursor/ Display Shift	0	0	0	0	0	0	S/C	R/L	.	.	Moves the cursor and shifts the display without changing DDRAM contents.

Function Set	0	0	0	0	1	DL	N	F	.	.	Sets interface data length (DL) number of display lines (L) and character font (F).
DDRAM Address Set	0	0	1	ADD							Sets the DDRAM address, DDRAM data is sent and received after this setting.
DDRAM Data Write	1	0	Write Data								Write data into DDRAM or CGRAM.

CODE

I/D = 1 : Increment
I/D = 0 : Decrement
S = 1 : With display shift
ADD DDRAM Address Corresponds to Cursor Address

FIG .1 WRITE CYCLE



PROGRAM LISTING

A: 8085.TBL		CPU	8085	
2000		ORG	2000h	

0000 =		Port A:	Equ	00h
0002 =		Port C:	Equ	02h
0003 =		Cwr:	Equ	03h

### L C D M O D U L E ###				
Interfacing to 8255 (P P I)				
			DBO	PA0
			DB7	PA7
			RS	PC0
			R/W	PC1
			E	PC2

NOTE: -Listing of program for various models of Microprocessor and Micro controller kits is given below. Please select the model of kit being used before entering the program into the kit.

SETUP FOR THE EXPERIMENT

This explanation as well as the explanation of the Program under the heading " Description of the Program" is for 8085 LED Kit. However if you are interfacing the LCD Module to other Kits, then also refer to the specific instruction before the program listing for that particular Kit also

1) Connect the ET-LCD interfacing module to the 8255-1 port connector **J1** of the kit using 26-pin flat FRC cable. The pin No.1 of the connector on the module as well as the kit is marked. Please ensure that the pin no. 1 of the connector is connected to pin no. 1 of the module.

2) Connect the +5V,GND to the Module either through the Kit or Externally.

3) Enter the program given below from the memory location mentioned in the program.

4) Execute the program.
5) A message " EXCEL " will be displayed on the LCD on the first line and a message " WELCOME" will be displayed on the 2nd line

LISTING OF THE PROGRAM OF LCD MODULE TO INTERFACE WITH 8085 KITS HAVING LED AND LCD DISPLAY)

ADDRESS	OP-CODE	LABEL	MNEN\MONIC	REMARKS
2000	3E 80	START	MVI A 80	DEFINE ALL PORTS OF 8255 AS OUTPUT
2002	D3 03		OUT 03	
2004	3E 38		MVI A 38	Refer to the LCD data sheet for the initialization sequence of the 16*2 LCD display with 8 bit data, 5*7 matrix dots
2006	CD 48 20		CALL WR_CMD	
2009	3E 38		MVI A 38	
200B	CD 48 20		CALL WR_CMD	
200E	3E 38		MVI A 38	
2010	CD 48 20		CALL WR_CMD	
2013	3E 0C		MVI A 0C	
2015	CD 48 20		CALL WR_CMD	
2018	3E 06		MVI A 06	
201A	CD 48 20		CALL WR_CMD	
201D	3E 85		MVI A 85	Set address to 85 (6^{th} position of first line of the display
201F	CD 48 20		CALL WR_CMD	
2022	21 72 20		LXI H,MSG1	Start writing character to the first line of the LCD
2025	7E	LINE1	MOV A,M	
2026	FE 00		CPI 00	
2028	CA 32 20		JZ NEXT_LINE	
202B	CD 56 20		CALL WR_CHAR	
202E	23		INX H	
202F	C3 25 20		JMP LINE1	
2032	3E C4	NEXT_LINE	MVI A C4	Set address to C4 (5^{th} position of the 2^{nd} line of the display)
2034	CD 48 20		CALL WR_CMD	
2037	21 78 20		LXI H,MSG2	Start writing character to the 2nd line of the LCD
203A	7E	LINE2	MOV A,M	
203B	FE 00		CPI 00	
203D	CA 47 20		JZ EXIT	
2040	CD 56 20		CALL WR_CHAR	
2043	23		INX H	
2044	C3 3A 20		JMP LINE2	

2047	EF	EXIT	RST 5	Break Point to Restart the monitor Program
2048	D3 00	WR_CMD	OUT 03	
204A	3E 04		MVI A 04	Send Instruction code Data through portA; RS=0, R/W=0, E=1
204C	D3 02		OUT 02	
204E	3E 00		MVI A 00	Send Instruction code Data through portA; RS=0, R/W=0, E=0
2050	D3 02		OUT 02	
2052	CD 6B 20		CALL DELAY2	Wait due to internal Execution time of LCD
2055	C9		RET	
2056	D3 00	WR_CHAR	OUT 00	
2058	3E 05		MVI A 05	Send Character through portA; RS=1, R/W=0, E=1
205A	D3 02		OUT 02	
205C	3E 01		MVI A 01	Send Character through portA; RS=1, R/W=0, E=0
205E	D3 02		OUT 02	
2060	CD 64 20		CALL DELAY1	Wait due to internal Execution time of LCD
2063	C9		RET	
2064	0E 40	DELAY1	MVI C 40	
2066	0D	LOOP_1	DCR C	
2067	C2 66 20		JNZ LOOP_1	
206A	C9		RET	
206B	0E FF	DELAY2	MVI C FF	
206D	0D	LOOP_2	DCR C	
206E	C2 6D 20		JNZ LOOP_2	
2071	C9		RET	
2072	45 58 43 45 4C 00	MSG1	DFB “EXCEL”,0	
2078	57 45 4C 43 4F 4D 45 00	MSG2	DFB “WELCOME”,0	

NOTE: On executing the program a message will be displayed on the two lines of the LCD Display of the module.

2) PROGRAM FOR 8086 KITS HAVING LED DISPLAY:

FOR ET-8086:

Connect the J3 of the Kit to the Module through 26 Pin FRC Cable. Ensure that the pin-1 of the J3 at the Kit end is connected to the pin-1 of the Module connector. Enter the program from address 0000:0200.

FOR ET-8086AD:

Connect the J1 of the Kit to the Module through 26 Pin FRC Cable. Ensure that the pin-1 of the J1 at the Kit end is connected to the pin-1 of the Module connector. Enter the program from address 0000:0200.

The Program should be entered at location 0000:0100 ie 0000 as segment address and 0100 as offset address. Execute the program from 0000:0100

LISTING OF THE PROGRAM OF LCD DISPLAY MODULE (ET-LCD) TO INTERFACE WITH 8086 KIT HAVING LED DISPLAY)

ADDRESS	OPCODE	LABEL	MNEMONICS	REMARKS
0000:0100	B0 80		MOV AL,80	Initialize the 8255 Ports As Output Port
0102	BA FE FF		MOV DX,FF FE	
0105	EE		OUT DX, AL	
0106	B0 00		MOV AL,00	
0108	BA F8 FF		MOV DX,FF F8	
010B	EE		OUT DX, AL	
010C	BA FC FF		MOV DX,FF FC	
010F	EE		OUT DX,AL	
0110	E8 3D 01		CALL 250	Call DELAY
0113	B0 30		MOV AL,30	WRITE 30 TO DISPLAY
0115	E8 E8 01		CALL 300	
0118	E8 E5 01		CALL 300	
011B	E8 32 01		CALL 250	CALL DELAY
011E	B0 30		MOV AL,30	WRITE 30 TO DISPLAY
0120	E8 DD 01		CALL 300	
0123	B0 38		MOV AL,38	WRITE 38 TO DISPLAY
0125	E8 D8 01		CALL 300	
0128	B0 08		MOV AL,08	WTITE 08 TO DISPLAY
012A	E8 D3 01		CALL 300	
012D	B0 01		MOV AL,01	WRITE 01 TO DISPLAY
012F	E8 CE 01		CALL 300	

0132	E8 1B 01		CALL 250	CALL DELAY
0135	B0 06		MOV AL,06	WRITE 06 TO DISPLAY
0137	E8 C6 01		CALL 300	
013A	B0 0E		MOV AL,0E	WRITE 0E TO DISPLAY
013C	E8 C1 01		CALL 300	
013F	E8 0E 01		CALL 250	CALL DELAY
0142	B0 80		MOV AL,80	WRITE 80 TO DISPLAY
0144	E8 B9 01		CALL 300	
0147	E8 06 01		CALL 250	CALL DELAY
014A	E8 B3 02		CALL 300	
014D	B0 0E		MOV AL,0E	
014F	BA F8 FF		MOV DX,FF F8	
0152	EE		OUT DX,AL	
0153	E8 AA 01		CALL 300	
0156	BE 00 05		MOV SI,0500	Read The Data To Be Displayed
0159	B0 80		MOV AL,80	Point To First Address Of The Display
015B	EE		OUT DX,AL	
015C	E8 A1 01		CALL 300	
015F	8A 04		MOV AL,[SI]	
0161	3C 00		CMP AL,00	COMPARE WITH 00
0163	74 34		JZ 199	
0165	BA F8 FF		MOV DX,FF F8	
0168	EE		OUT DX,AL	
0169	B0 01		MOV AL,01	
016B	E8 B7 01		CALL 325	
016E	46		INC SI	
016F	EB EE		JMP 015F	LOOP BACK

Now Enter the program from Address 0000:0250				
0000:0250	B9 FF 20	DELAY	MOV CX,20FF	Give delay decided by CX
0253	49		DEC CX	
0254	75 FD		JNZ 253	
0256	C3		RET	

Now Enter the Program from Address 0000:0300 onward				
0000:0300	BA F8 FF	WRITE:	MOV DX,FF F8	Load the Address of display
0303	EE		OUT DX,AL	
0304	E8 19 00		CALL 320	
0307	C3		RET	
0308	BA FC FF		MOV DX,FF FC	
030B	EE		OUT DX,AL	
030C	C3		RET	
030D	E8 F8 FF		CALL 308	
0310	E8 3D FF		CALL 250	Call delay
0313	B0 00		MOV AL,00	
0315	E8 F0 FF		CALL 308	
0318	C3		RET	

Now Enter the Program from Address 0000:0320 0nward				
0000:0320	B0 00		MOV AL,00	
0322	E8 E3 FF		CALL 308	
0325	0C 04		OR AL,04	
0327	E8 DE FF		CALL 308	
032A	E8 23 FF		CALL 250	Call delay
032D	24 FB		AND AL,FB	
032F	EE		OUT DX,AL	
0330	0C 02		OR AL,02	
0332	EE		OUT DX,AL	
0333	C3		RET	

Now Enter the program from Address 0000:0400 onward				
0000:0400	B0 01	CLEAR:	MOV AL,01	CLEAR THE DISPLAY
0402	E8 FB FE		CALL 300	
0405	E8 48 FE		CALL 250	
0408	B3 00		MOV BL,00	
040A	B0 80		MOV AL,80	
040C	E8 F1 FE		CALL 300	
040F	E8 3E FE		CALL 250	
0412	C3		RET	

Now Enter the Data to be displayed from address 0000:0500 onward	
0000:0500	41 42 43 44 45 46 47 48 00

NOTE: On executing the program a message of eight character will be displayed on the LCD Display of the module lying at location 0500 to 0507. However if it comes across a code 00 as the data, it ends the display of the program there ie suppose we store a code 00 at location 503, then the system will display only three characters.

3) PROGRAM FOR 8086 KITS HAVING LCD DISPLAY

FOR - ET-8086LCD

Connect the J2 of the Kit to the Module through 26 Pin FRC Cable. Ensure that the pin-1 of the J2 at the Kit end is connected to the pin-1 of the Module connector. Enter the program from address 1000:0100. Execute the Program from address 1000:0100

FOR - ET-8086 – AD-LCD

Connect the J1 of the Kit to the Module through 26 Pin FRC Cable. Ensure that the pin-1 of the J1 at the Kit end is connected to the pin-1 of the

Module connector. Enter the program from address 1000:0100. Execute the Program from address 1000:0100

LISTING OF THE PROGRAM OF LCD DISPLAY MODULE (ET-LCD) TO INTERFACE WITH 8086 KIT HAVING LCD KIT)

ADDRESS	OPCODE	LABEL	MNEMONICS	REMARKS
1000:0100	B0 80		MOV AL,80	Initialize the 8255 Ports As Output Port
0102	BA 07 88		MOV DX, 8807	
0105	EE		OUT DX, AL	
0106	B0 00		MOV AL,00	
0108	BA 01 88		MOV DX,8801	
010B	EE		OUT DX, AL	
010C	BA 05 88		MOV DX, 8805	
010F	EE		OUT DX,AL	
0110	E8 3D 01		CALL 250	Call DELAY
0113	B0 30		MOV AL,30	WRITE 30 TO DISPLAY
0115	E8 E8 01		CALL 300	
0118	E8 E5 01		CALL 300	
011B	E8 32 01		CALL 250	CALL DELAY
011E	B0 30		MOV AL,30	WRITE 30 TO DISPLAY
0120	E8 DD 01		CALL 300	
0123	B0 38		MOV AL,38	WRITE 38 TO DISPLAY
0125	E8 D8 01		CALL 300	
0128	B0 08		MOV AL,08	WTITE 08 TO DISPLAY
012A	E8 D3 01		CALL 300	
012D	B0 01		MOV AL,01	WRITE 01 TO DISPLAY
012F	E8 CE 01		CALL 300	
0132	E8 1B 01		CALL 250	CALL DELAY
0135	B0 06		MOV AL,06	WRITE 06 TO DISPLAY
0137	E8 C6 01		CALL 300	
013A	B0 0E		MOV AL,0E	WRITE 0E TO DISPLAY
013C	E8 C1 01		CALL 300	
013F	E8 0E 01		CALL 250	CALL DELAY
0142	B0 80		MOV AL,80	WRITE 80 TO DISPLAY
0144	E8 B9 01		CALL 300	
0147	E8 06 01		CALL 250	CALL DELAY
014A	E8 B3 02		CALL 300	
014D	B0 0E		MOV AL,0E	
014F	BA 01 88		MOV DX,8801	
0152	EE		OUT DX,AL	
0153	E8 AA 01		CALL 300	
0156	BE 00 13		MOV SI,0013	Read The Data To Be Displayed
0159	B0 80		MOV AL,80	Point To First Address Of The Display
015B	EE		OUT DX,AL	
015C	E8 A1 01		CALL 300	

015F	8A 04		MOV AL,[SI]	
0161	3C 00		CMP AL,00	COMPARE WITH 00
0163	74 34		JZ 199	
0165	BA 01 88		MOV DX, 8801	
0168	EE		OUT DX,AL	
0169	B0 01		MOV AL,01	
016B	E8 B7 01		CALL 325	
016E	46		INC SI	
016F	EB EE		JMP 015F	LOOP BACK
Now Enter the program from Address 1000:0250				
1000:0250	B9 FF 20	DELAY	MOV CX,20FF	Give delay decided by CX
0253	49		DEC CX	
0254	75 FD		JNZ 253	
0256	C3		RET	
Now Enter the Program from Address 1000:0300 onward				
1000:0300	BA 01 88	WRITE:	MOV DX,8801	Load the Address of display
0303	EE		OUT DX,AL	
0304	E8 19 00		CALL 320	
0307	C3		RET	
0308	BA 05 88		**MOV DX,8805**	
030B	EE		OUT DX,AL	
030C	C3		RET	
030D	E8 F8 FF		CALL 308	
0310	E8 3D FF		CALL 250	Call delay
0313	B0 00		MOV AL,00	
0315	E8 F0 FF		CALL 308	
0318	C3		RET	
Now Enter the Program from Address 1000:0320 0nward				
1000:0320	B0 00		MOV AL,00	
0322	E8 E3 FF		CALL 308	
0325	0C 04		OR AL,04	
0327	E8 DE FF		CALL 308	
032A	E8 23 FF		CALL 250	Call delay
032D	24 FB		AND AL,FB	
032F	EE		OUT DX,AL	
0330	0C 02		OR AL,02	
0332	EE		OUT DX,AL	
0333	C3		RET	
Now Enter the program from Address 1000:0400 onward				
1000:0400	B0 01	CLEAR:	MOV AL,01	CLEAR THE DISPLAY
0402	E8 FB FE		CALL 300	
0405	E8 48 FE		CALL 250	
0408	B3 00		MOV BL,00	
040A	B0 80		MOV AL,80	
040C	E8 F1 FE		CALL 300	
040F	E8 3E FE		CALL 250	
0412	C3		RET	

Now Enter the Data to be displayed from address 0000:1300 onward	
0000:1300	41 42 43 44 45 46 47 48 00

NOTE: On executing the program a message of eight characters will be displayed on the LCD Display of the module lying at location 1300 to 1307. However if it comes across a code 00 as the data, it ends the display of the program there ie suppose we store a code 00 at location 1303, then the system will display only three characters.

4) PROGRAM FOR 8051 KITS HAVING LCD DISPLAY

MODEL ET-8051LCD / ET-8051AD-LCD

Connect the J1 of the Kit to the Module through 26 Pin FRC Cable. Ensure that the pin-1 of the J1 at the Kit end is connected to the pin-1 of the Module connector. Enter the program from address 6000. Execute the Program from address 6000

ADDRESS	CODES	LABEL	MNEMONICS	COMMENTS
6000	75 81 58	START:	MOV 81,#58	
6003	90 28 0B		MOV DPTR,#280B	; initialize all ports as o/p
6006	74 80		MOVA,#80	
6008	F0		MOVX @DPTR,A	
6009	90 28 08		MOV DPTR,#2808	
600C	74 00		MOVA,#00H	
600E	F0		MOVX @DPTR,A	; CLK goes low
600F	A3		INC DPTR	
6010	A3		INC DPTR	
6011	F0		MOVX @DPTR,A	
6012	11 5B		ACALL 5B	
6014	74 30		MOVA,#30H	
6016	11 64		ACALL 64	; CLK goes high
6018	11 5B		ACALL 5B	
601A	74 30		MOVA,#30H	; Display the characters
601C	11 64		ACALL 64	
601E	11 5B		ACALL 5B	
6020	74 30		MOVA,#30	
6022	11 64		ACALL 64	
6024	74 38		MOVA,#38	
6026	11 64		ACALL 64	
6028	74 08		MOVA,#08	
602A	11 64		ACALL 64	
602C	74 01		MOVA,#01H	

602E	11 64		ACALL 64	
6030	11 5B		ACALL 5B	
6032	74 06		MOVA,#06H	
6034	11 64		ACALL 64	
6036	74 0E		MOVA,#0E	
6038	11 64		ACALL 64	
603A	11 5B		ACALL 5B	
603C	74 80		MOVA,#80	
603E	11 64		ACALL 64	
6040	11 5B		ACALL 5B	
6042	90 60 D0		MOV DPTR,#60D0	
6045	78 40		MOV R0,#40H	
6047	E0	CONT1	MOVA,@DPTR	
6048	F6		MOV @R0,A	
6049	08		INC R0	
604A	A3		INC DPTR	
604B	B8 50 F9		CJNE R0,50,CONT1	
604E	11 A6		ACALL A6	
6050	78 40		MOV R0,#40	
6052	E6	CONT2	MOVA,@R0	
6053	11 88		ACALL 88	
6055	08		INC R0	
6056	B8 50 F9		CJNE R0,50	
6059	80 FE		SJMP FE	
605B	7F 0E		MOV R7,#0E	
605D	7E 30		MOV R6,#30	
605F	DE FE		DJNZ R6,FE	
6061	DF FA		DJNZ R7,FA	
6063	22		RET	
6064	90 28 08		MOV DPTR,#2808	
6067	F0		MOVX @DPTR,A	
6068	11 79		ACALL 79	
606A	22		RET	
606B	90 28 0A		MOV DPTR,#280A	
606E	F0		MOVX @DPTR,A	
606F	22		RET	
6070	11 6B		ACALL 6B	
6072	11 5B		ACALL 5B	
6074	74 00		MOVA,#00	
6076	11 6B		ACALL 6B	
6078	22		RET	
6079	74 00		MOVA,#00	
607B	11 6B		ACALL 6B	
607D	44 04		ORLA,#04	
607F	11 6B		ACALL 6B	
6081	54 03		MOVA,#03	
6083	F0		MOVX @DPTR,A	
6084	44 02		ORLA,#02	

6086	F0		MOVX @DPTR,A	
6087	22		RET	
6088	90 28 08		MOV DPTR,#2808	
608B	F0		MOVX @DPTR,A	
608C	74 01		MOVA,#01	
608E	11 6B		ACALL 6B	
6090	11 9B		ACALL 9B	
6092	0D		INC R5	
6093	BD 08 04		CJNE R5,08	
6096	74 C0		MOVA,#C0	
6098	11 64		ACALL 64	
609A	22		RET	
609B	44 04		ORLA,#04	
609D	11 6B		ACALL 6B	
609F	54 03		ANLA,#03	
60A1	F0		MOVX @DPTR,A	
60A2	44 02		ORLA,#02	
60A4	F0		MOVX @DPTR,A	
60A5	22		RET	
60A6	74 01		MOVA,#01	
60A8	11 64		ACALL 64	
60AA	11 5B		ACALL 5B	
60AC	74 0E		MOVA,#0E	
60AE	11 64		ACALL 64	
60B0	11 5B		ACALL 5B	
60B2	7D 00		MOV R5,00	
60B4	74 80		MOVA,#80	
60B6	11 64		ACALL 64	
60B8	11 5B		ACALL 5B	
60BA	22		RET	

DISCRIPTIONS:-

Now enter the data at location 60D0 – 60D4 as given below:

ADDRESS	DATA	Letter Being Displayed
60D0	45	E
60D1	58	X
60D2	43	C
60D3	45	E
60D4	4C	L
60D5	03	Code for END

After executing the program from address location 6000 the output on the display module will be as below:-

E X C E L

One can change the data of location 60D0 - 60D4 to display some other message.

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5) PROGRAM FOR 8051 KITS HAVING LED DISPLAY

MODEL ET-8051LED / ET-8051AD-LED

Connect the J4 of the Kit to the Module through 26 Pin FRC Cable. Ensure that the pin-1 of the J4 at the Kit end is connected to the pin-1 of the Module connector. Enter the program from address 2000.

ADDRESS	CODES	LABEL	MNEMONICS	COMMENTS
2000	75 81 58	START:	MOV 81,#58	
2003	90 FF 03		MOV DPTR,#FF03	; initialize all ports as o/p
2006	74 80		MOVA,#80	
2008	F0		MOVX @DPTR,A	
2009	90 FF 00		MOV DPTR,#FF00	
200C	74 00		MOVA,#00H	
200E	F0		MOVX @DPTR,A	; CLK goes low
200F	A3		INC DPTR	
2010	A3		INC DPTR	
2011	F0		MOVX @DPTR,A	

2012	11 5B		ACALL 5B	
2014	74 30		MOVA,#30H	
2016	11 64		ACALL 64	; CLK goes high
2018	11 5B		ACALL 5B	
201A	74 30		MOVA,#30H	; Display the characters
201C	11 64		ACALL 64	
201E	11 5B		ACALL 5B	
2020	74 30		MOVA,#30	
2022	11 64		ACALL 64	
2024	74 38		MOVA,#38	
2026	11 64		ACALL 64	
2028	74 08		MOVA,#08	
202A	11 64		ACALL 64	
202C	74 01		MOVA,#01H	
202E	11 64		ACALL 64	
2030	11 5B		ACALL 5B	
2032	74 06		MOVA,#06H	
2034	11 64		ACALL 64	
2036	74 0E		MOVA,#0E	
2038	11 64		ACALL 64	
203A	11 5B		ACALL 5B	
203C	74 80		MOVA,#80	
203E	11 64		ACALL 64	
2040	11 5B		ACALL 5B	
2042	90 20 D0		MOV DPTR,#20D0	
2045	78 40		MOV R0,#40H	
2047	E0	CONT1	MOVA,@DPTR	
2048	F6		MOV @R0,A	
2049	08		INC R0	
204A	A3		INC DPTR	
204B	B8 50 F9		CJNE R0,50,CONT1	
204E	11 A6		ACALL A6	
2050	78 40		MOV R0,#40	
2052	E6	CONT2	MOVA,@R0	
2053	11 88		ACALL 88	
2055	08		INC R0	
2056	B8 50 F9		CJNE R0,50	
2059	80 FE		SJMP FE	
205B	7F 0E		MOV R7,#0E	
205D	7E 30		MOV R6,#30	
205F	DE FE		DJNZ R6,FE	
2061	DF FA		DJNZ R7,FA	
2063	22		RET	
2064	90 FF 00		MOV DPTR,#FF00	
2067	F0		MOVX @DPTR,A	
2068	11 79		ACALL 79	
206A	22		RET	
206B	90 FF 02		MOV DPTR,#FF02	

206E	F0		MOVX @DPTR,A	
206F	22		RET	
2070	11 6B		ACALL 6B	
2072	11 5B		ACALL 5B	
2074	74 00		MOVA,#00	
2076	11 6B		ACALL 6B	
2078	22		RET	
2079	74 00		MOVA,#00	
207B	11 6B		ACALL 6B	
207D	44 04		ORLA,#04	
207F	11 6B		ACALL 6B	
2081	54 03		MOVA,#03	
2083	F0		MOVX @DPTR,A	
2084	44 02		ORLA,#02	
2086	F0		MOVX @DPTR,A	
2087	22		RET	
2088	90 FF 00		MOV DPTR,#FF00	
208B	F0		MOVX @DPTR,A	
208C	74 01		MOVA,#01	
208E	11 6B		ACALL 6B	
2090	11 9B		ACALL 9B	
2092	0D		INC R5	
2093	BD 08 04		CJNE R5,08	
2096	74 C0		MOVA,#C0	
2098	11 64		ACALL 64	
209A	22		RET	
209B	44 04		ORLA,#04	
209D	11 6B		ACALL 6B	
209F	54 03		ANLA,#03	
20A1	F0		MOVX @DPTR,A	
20A2	44 02		ORLA,#02	
20A4	F0		MOVX @DPTR,A	
20A5	22		RET	
20A6	74 01		MOVA,#01	
20A8	11 64		ACALL 64	
20AA	11 5B		ACALL 5B	
20AC	74 0E		MOVA,#0E	
20AE	11 64		ACALL 64	
20B0	11 5B		ACALL 5B	
20B2	7D 00		MOV R5,00	
20B4	74 80		MOVA,#80	
20B6	11 64		ACALL 64	
20B8	11 5B		ACALL 5B	
20BA	22		RET	

DISCRIPTIONS:-

Now enter the data at location 20D0 – 20D4 as given below:

ADDRESS	DATA	Letter Being Displayed
20D0	45	E
20D1	58	X
20D2	43	C
20D3	45	E
20D4	4C	L
20D5-20DF	20 20 20 20 20 20 20 20 20 20 20	

After executing the program from address location 2000 the output on the display module will be as below:-

E X C E L

One can change the data of location 20D0 - 20D4 to display some other message.

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