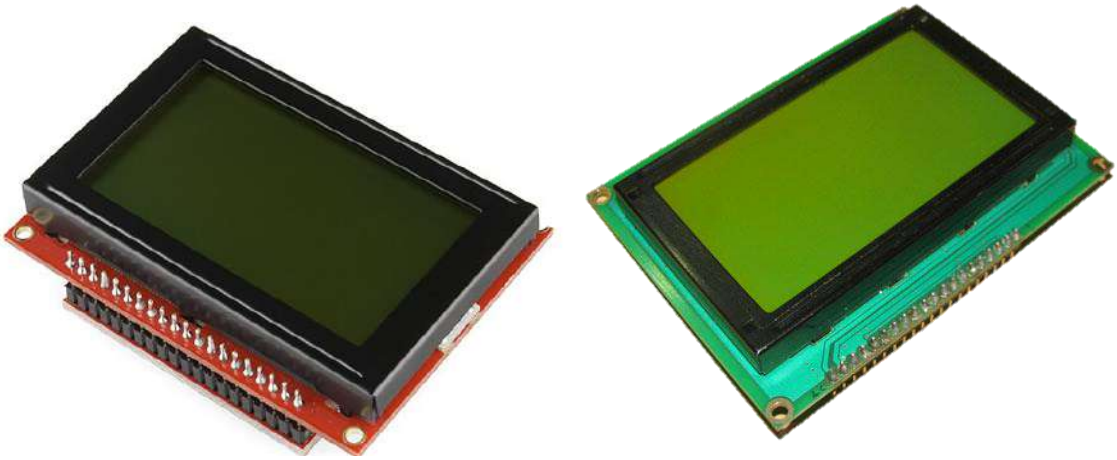
GRAPHICAL LCD 128x64 pixel

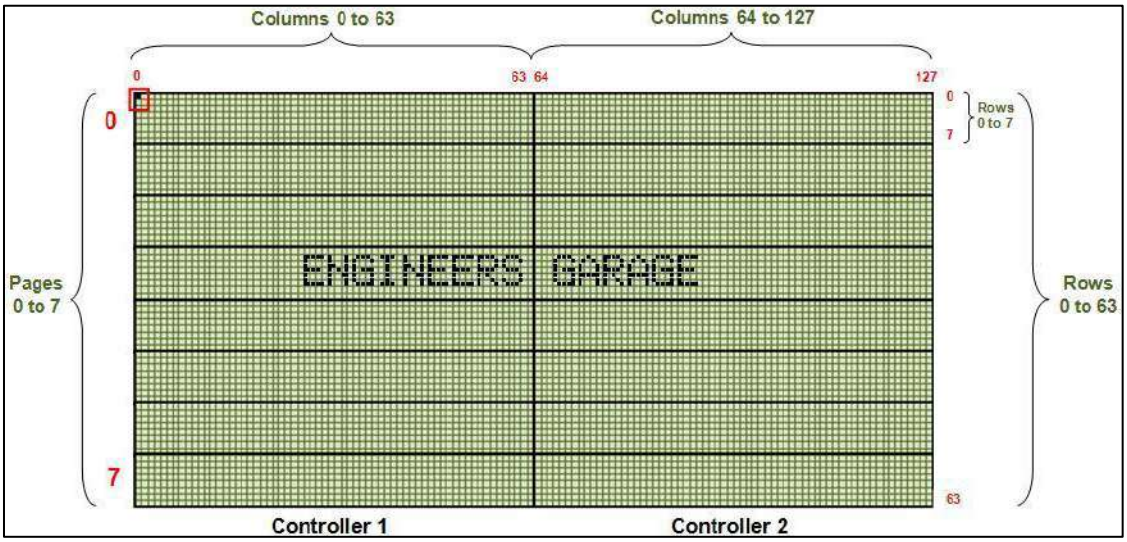
MODEL JHD12864E



BASIC ABOUT GRAPHICAL LCD

- **It use 2 KS0108 Controller to executes its internal operation**
- **128x64 graphical lcd is divided into two equal halves with each half being controlled by a separate KS0108 controller.**

- **This division is called paging scheme and is explain as follow:**



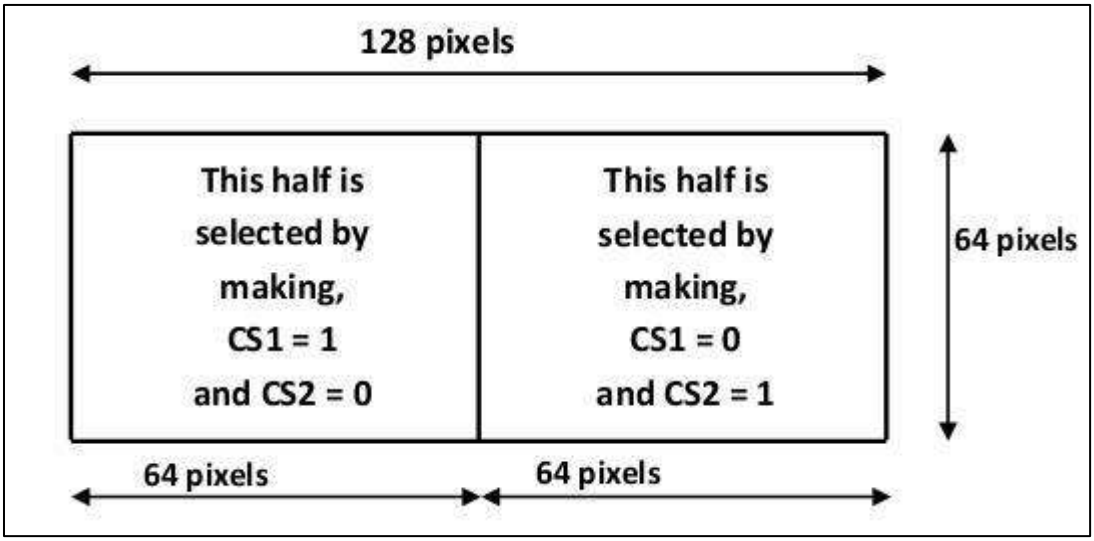
- **Each half is consist of 8 pages and each page consist of 8 row and 64 columns.**

Row 0	Row 0
Row 1	Row 1
Row 2	Row 2
Row 3	Row 3
Row 4	Row 4
Row 5	Row 5
Row 6	Row 6
Row 7	Row 7

Each row is 8 pixel thick

- **So two horizontal pages make 128 (64x2) columns and 8 vertical pages to makes 64 rows (8x8) and hense 128x64 = 8192 pixels.**

- **To select each half separately we have to use as following values of CS1 and CS2:**



PIN FUNCTION OF GLCD:

- **Graphical Lcd has Following Pins and their Functions are:**

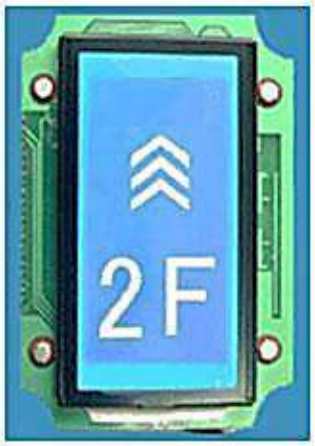
PIN NO.	SYMBOL	DESCRIPTION	FUNCTION
1	VSS	GROUND	0V (GND)
2	VDD	POWER SUPPLY FOR LOGIC CIRCUIT	+5V
3	V0	LCD CONTRAST ADJUSTMENT	
4	RS	INSTRUCTION/DATA REGISTER SELECTION	RS = 0 : INSTRUCTION REGISTER RS = 1 : DATA REGISTER
5	R/W	READ/WRITE SELECTION	R/W = 0 : REGISTER WRITE R/W = 1 : REGISTER READ
6	E	ENABLE SIGNAL	
7	DB0	DATA INPUT/OUTPUT LINES	8 BIT: DB0-DB7
8	DB1		
9	DB2		
10	DB3		
11	DB4		
12	DB5		
13	DB6		
14	DB7		
15	CS1	CHIP SELECTION	CS1=1,CHIP SELECT SIGNAL FOR IC1
16	CS2	CHIP SELECTION	CS2=1,CHIP SELECT SIGNAL FOR IC2
17	RST	RESET SIGNAL	RSTB=0,DISPLAY OFF,DISPLAY FROM LINE 0.
18	Vout	Connected to Port	
19	LED+	SUPPLY VOLTAGE FOR LED+	+5V
20	LED-	SUPPLY VOLTAGE FOR LED-	0V

GRAPHICAL LCD PICTURES:

FRONT SIDE **BACK SIDE**

GRAPHICAL LCD APPLICATION:

in cell phones



in lift (showing 2nd floor)

in video games

FUNCTION OF R/W AND RS:

R/W	RS	FUNCTION
0	0	SEND INSTRUCTION TO DDRAM
0	1	DATA WRITE FROM INPUT REGISTER TO DDRAM (ON LCD)
1	0	STATUS CHECK (BUSY READ)
1	1	DATA READ FROM DDRAM TO OUTPUT REGISTER

DDRAM: DATA DISPLAY RAM

BASIC PROCEDURE TO WORK ON GLCD:

1. LCD initialization
2. Page selection
3. Column selection
4. Data Display

1. LCD INTIALIZATION

a. Put these value in data resister

DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	**0**	**1**	**1**	**1**	**1**	**1**	**D**

D = 1 , LCD ON

D = 0 , LCD OFF (DISSAPPEARS DATA)

b. CS1 = 1, CS2 = 1 (Both halves Selected)

c. RS = 0, R/W = 0 (To select Instruction mode)

d. EN = 1 (ENABLE = 1)

e. DELAY

f. EN = 0 (To latch data into the input register)

2. PAGE SELECTION

a. Put these value in data resister

DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
1	**0**	**1**	**1**	**1**	**X3**	**X2**	**X1**

X3	X2	X1	PAGE NUMBER
0	0	0	PAGE 0
0	0	1	PAGE 1
0	1	0	PAGE 2
0	1	1	PAGE 3
1	0	0	PAGE 4
1	0	1	PAGE 5
1	1	0	PAGE 6
1	1	1	PAGE 7

b. CS1 = 1, CS2 = 1 (Both halves Selected)

c. RS = 0, R/W = 0 (To select Instruction mode)

d. EN = 1 (ENABLE = 1)

e. DELAY

f. EN = 0 (To latch data into the input register)

3. COLUMN SELECTION

a. Put these value in data resister

DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
0	**1**	**Y5**	**Y4**	**Y3**	**Y2**	**Y1**	**Y0**

Range of Column Selection is Column 0 to Column 63 for each halves.

CS1	CS2	FUNCTION
0	0	Neither Half Selected
0	1	Second Half Selected
1	0	First Half Selected
1	1	Both Half Selected

Y5	Y4	Y3	Y2	Y1	Y0	COLUMN NUMBER
0	0	0	0	0	0	COLUMN 0
0	0	0	0	0	1	COLUMN 1
0	0	0	0	1	0	COLUMN 2

: : : : : : :

: : : : : : :

1	1	1	1	0	1	COLUMN 61
1	1	1	1	1	0	COLUMN 62
1	1	1	1	1	1	COLUMN 63

b. RS = 0, R/W = 0 (To select Instruction mode)

c. EN = 1 (ENABLE = 1)

d. DELAY

e. EN = 0 (To latch data into the input register)

4. DISPLAY DATA

- After Page and Column are Selected Data can be written to that particular location of GLCD. For example if you want to display all 8 pixel of that particular column you can give data as “FF” So all 8 pixel will be darken.
- Data must be written by first selecting column address and then data can be given to it.

a. Put the any desire value in data resister

DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
X	X	X	X	X	X	X	X

b. Select CS1, CS2 based on requirement.

c. RS = 1, R/W = 0 (To select Data write mode)

d. EN = 1 (ENABLE = 1)

e. DELAY

f. EN = 0 (To latch data into the input register)

CONTROL WORD GENERATION

1.FOR LCD INITIALIZATION

DATA WORD

PA7	PA6	PA5	PA4	PA3	PA2	PA1	PA0	PORT A
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX DW
0	0	1	1	1	1	1	D	
0	0	1	1	1	1	1	1	**3F**

COMMAND WORD

PC7	PC6	PC5	PC4	PC3	PC2	PC1	PC0	PORT C
NC	NC	NC	CS2	CS1	EN	R/W	RS	FUNCTION
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX CW
0	0	0	1	1	1	0	0	**1C**

PC7	PC6	PC5	PC4	PC3	PC2	PC1	PC0	PORT C
NC	NC	NC	CS2	CS1	EN	R/W	RS	FUNCTION
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX CW
0	0	0	1	1	0	0	0	**18**

2.FOR PAGE 0 SELECTION

DATA WORD

PA7	PA6	PA5	PA4	PA3	PA2	PA1	PA0	PORT A
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX DW
1	0	1	1	1	X3	X2	X1	
1	0	1	1	1	0	0	0	**B8**

COMMAND WORD

NOTE: Command Word Remain Same For Lcd Initialization, Page Selection and Column Selection. It changes only for data display.

3.FOR COLUMN 0 SELECTION

DATA WORD

PA7	PA6	PA5	PA4	PA3	PA2	PA1	PA0	PORT A
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX DW
0	1	Y5	Y4	Y3	Y2	Y1	Y0	
0	1	0	0	0	0	0	0	**40**

4.FOR DATA DISPLAY "|"

i.e Straight line of 8 pixel on FIRST halves

DATA WORD

PA7	PA6	PA5	PA4	PA3	PA2	PA1	PA0	PORT A
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX DW
X	X	X	X	X	X	X	X	
1	1	1	1	1	1	1	1	**FF**

DATAWR1 WORD/CONTROL WORD

PC7	PC6	PC5	PC4	PC3	PC2	PC1	PC0	PORT C
NC	NC	NC	CS2	CS1	EN	R/W	RS	FUNCTION
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX CW
0	0	0	0	1	1	0	1	**0D**

PC7	PC6	PC5	PC4	PC3	PC2	PC1	PC0	PORT C
NC	NC	NC	CS2	CS1	EN	R/W	RS	FUNCTION
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	HEX CW
0	0	0	0	1	0	0	1	**09**

8255 PIN CONFIGURATION

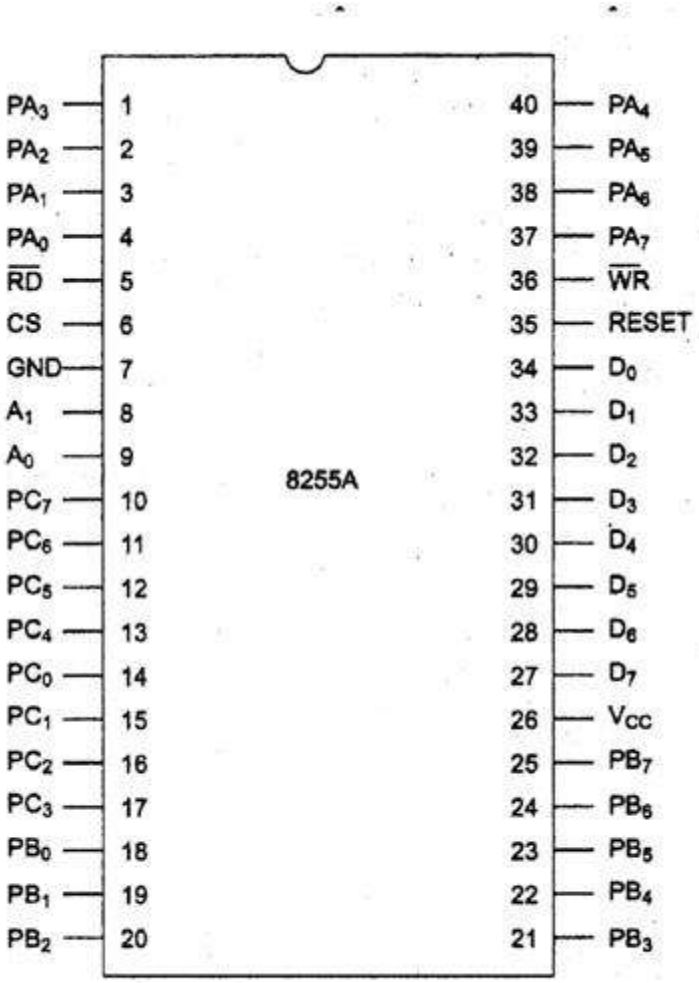


Fig. 5.17(b) *8255A Pin Configuration*

DATAWRITE CONTROL WORD

HEX CODE	FUNCTION
0D,09	SELECT FIRST HALF OF LCD
1D,19	BOTH HALF SELECTED
15,11	SECOND HALF SELECT

HARDWARE CONNECTION

LCD PIN FUNCTION	LCD PIN NO.	8255 26 PIN CONNECTOR/PIN NO.	8255 PIN FUNCTION	8255 IC PIN NO.
DB0	7	21	PORT A PA0	4
DB1	8	22	PA1	3
DB2	9	19	PA2	2
DB3	10	20	PA3	1
DB4	11	17	PA4	40
DB5	12	18	PA5	39
DB6	13	15	PA6	38
DB7	14	16	PA7	37
LEDK	20	GND		
GND	1	GND		
VCC	2	+5V		
V(contrast adust)	3	+5V (Variable through POT)		
LEDA	19	+5V(through Resister)		
RS	4	5	PORT C PC0	14
R/W	5	6	PC1	15
EN	6	3	PC2	16
CS1	15	4	PC3	17
CS2	16	1	PC4	13
RESET(active low)	17	ON SWITCH		
VOUT	18	ON PORT		

PROGRAM

PROGRAM TO DISPLAY "EXCEL TECHNOLOGIES" at center with square border on top and bottom of the GRAPHICAL LCD USING 8051 KIT WITH 8255

ADDRESS	OP CODE	LABEL	MNEMONICS	COMMENTS
6000	90280B	START:	MOV DPTR,#280B	CWR ADDRESS
6003	7480		MOV A,#80	CW OF 8255
6005	F0		MOVX @DPTR,A	OUT CW ON CWR
6006	902808		MOV DPTR,#2808	PORT A ADDRESS
6009	743F		MOV A,#3F	CW TO INTIALISE LCD
600B	F0		MOVX @DPTR,A	OUT CW ON PORT A
600C	1151		ACALL 6051	ACALL COMMAND
600E	5100		ACALL 6200	ACALL CLEAR LCD
6010	74B8		MOV A,#B8	PAGE 0 SELECT
6012	F0		MOVX @DPTR,A	OUT DATA
6013	1151		ACALL 6051	ACALL COMMAND
6015	7A40		MOV R2,#40	COLUMN ADDRESS
6017	7B08		MOV R3,#08	COUNTER
6019	7100	LP1:	ACALL 6300	ACALL SQUARE
601B	0A		INC R2	INCREMENT COLUMN ADDRESS
601C	DBFB		DJNZ R3,FB	DJNZ R3,LP1
601E	00		NOP	NO OPERATION
601F	74BF		MOV A,#BF	PAGE 7 SELECT
6021	F0		MOVX @DPTR,A	OUT DATA
6022	1151		ACALL 6051	ACALL COMMAND
6024	7A40		MOV R2,#40	COLUMN ADDRESS
6026	7B08		MOV R3,#08	COUNTER
6028	7100	LP2:	ACALL 6300	ACALL SQUARE
602A	0A		INC R2	INCREMENT COLUMN ADDRESS
602B	DBFB		DJNZ R3,FB	DJNZ R3,LP2
602D	00		NOP	NO OPERATION
602E	9100		ACALL 6400	ACALL EXCEL
6030	020006		LJMP 0006	STOP PROGRAM

SUBROUTINE 1 FOR DATAWRITE

ADDRESS	OP CODE	LABEL	MNEMONICS	COMMENTS
6040	90280A	DATAWR:	MOV DPTR,#280A	PORT C SELECTED
6043	741D		MOV A,#1D	DW
6045	F0		MOVX @DPTR,A	OUT DATA WORD
6046	1180		ACALL 6080	ACALL DELAY
6048	7419		MOV A,#19	DW
604A	F0		MOVX @DPTR,A	OUT DATA WORD
604B	1180		ACALL 6080	ACALL DELAY
604D	902808		MOV DPTR,#2808	PORT A SELECT
6050	22		RET	RETURN TO MAIN

SUBROUTINE 2 FOR COMMAND

ADDRESS	OP CODE	LABEL	MNEMONICS	COMMENTS
6051	90280A	COMMAND:	MOV DPTR,#280A	PORT C SELECTED
6054	741C		MOV A,#1C	CW
6056	F0		MOVX @DPTR,A	OUT COMMAND WORD
6057	1180		ACALL 6080	ACALL DELAY
6059	7418		MOV A,#18	CW
605B	F0		MOVX @DPTR,A	OUT WORD
605C	1180		ACALL 6080	ACALL DELAY
605E	902808		MOV DPTR,#2808	PORT A SELECT
6061	22		RET	RETURN TO MAIN

SUBROUTINE 3 FOR DATAWRITE1

ADDRESS	OP CODE	LABEL	MNEMONICS	COMMENTS
6062	90280A	DATAWR1:	MOV DPTR,#280A	PORT C SELECTED
6065	740D		MOV A,#0D	DW
6067	F0		MOVX @DPTR,A	OUT DATA WORD
6068	1180		ACALL 6080	ACALL DELAY
606A	7409		MOV A,#09	DW
606C	F0		MOVX @DPTR,A	OUT DATA WORD

606D	1180		ACALL 6080	ACALL DELAY
606F	902808		MOV DPTR,#2808	PORT A SELECT
6072	22		RET	RETURN TO MAIN

SUBROUTINE 4 FOR DELAY

ADDRESS	OP CODE	LABEL	MNEMONICS	COMMENTS
6080	00	DELAY:	NOP	NO OPERATION
6080	00		NOP	
6080	00		NOP	
6080	22	RET		RETRUN

SUBROUTINE 5 FOR DATAWRITE2

ADDRESS	OP CODE	LABEL	MNEMONICS	COMMENTS
6085	90280A	DATAWR2:	MOV DPTR,#280A	PORT C SELECTED
6088	7415		MOV A,#15	DW
608A	F0		MOVX @DPTR,A	OUT DATA WORD
608B	1180		ACALL 6080	ACALL DELAY
608D	7411		MOV A,#11	DW
608F	F0		MOVX @DPTR,A	OUT DATA WORD
6090	1180		ACALL 6080	ACALL DELAY
6092	902808		MOV DPTR,#2808	PORT A SELECT
6095	22		RET	RETURN TO MAIN

SUBROUTINE 6 FOR CLEAR LCD

ADDRESS	OP CODE	LABEL	MNEMONICS	COMMENTS
6200	7CBF	CLEAR LCD:	MOV R4,#BF	PAGE 7 ADDRESS
6202	7B08		MOV R3,#08	PAGE COUNTER
6204	EC	LOP2:	MOV A,R4	LOAD PAGE ADDRESS
6205	F0		MOVX @DPTR,A	OUT PAGE ADDRESS

				ON PORT A
6206	1151		ACALL 6051	CALL COMMAND
6208	7A7F		MOV R2,#7F	COLUMN 63 ADDRESS
620A	7D40		MOV R5,#40	COLUMN COUNT
620C	EA	LOP1:	MOV A,R2	LOAD COLUMN ADDRESS
620D	F0		MOVX @DPTR,A	OUT ADDRESS
620E	1151		ACALL 6051	CALL COMMAND
6210	7400		MOV A,#00	DATA FOR CLEAR LCD
6212	F0		MOVX @DPTR,A	OUT DATA
6213	1140		ACALL 6040	CALL DATAWR
6215	1A		DEC R2	DECREMENT COLUMN ADDRESS
6216	DDF4		DJNZ R5,F4	DJNZ R5,LOP1
6218	1C		DEC R4	DECREMENT PAGE ADDRESS
6219	DBE9		DJNZ R3,E9	DJNZ R3,LOP2
621B	22		RET	RETURN TO MAIN PROGRAM

SUBROUTINE 7 FOR SQUARE PRINT []

ADDRESS	**OP CODE**	**LABEL**	**MNEMONICS**	**COMMENTS**
6300	7C04	SQUARE:	MOV R4,#04	LOAD COUNT
6302	EA	AG1:	MOV A,R2	LOAD COLUMN ADDRESS
6303	F0		MOVX @DPTR,A	OUT ADDRESS ON PORT A
6304	1151		ACALL 6051	CALL COMMAND
6306	7400		MOV A,#00	LOAD DATA
6308	F0		MOVX @DPTR,A	OUT DATA ON PORT A
6309	1140		ACALL 6040	CALL DATAWR
630B	0A		INC R2	INCREMENT COLUMN ADDRESS
630C	DCF4		DJNZ R4,F4	DJNZ R4,AG1
630E	00		NOP	NO OPERATION
630F	EA		MOV A,R2	LOAD COLUMN ADDRESS

6310	F0		MOVX @DPTR,A	OUT ADDRESS ON PORT A
6311	1151		ACALL 6051	CALL COMMAND
6313	74FF		MOV A,#FF	LOAD DATA
6315	F0		MOVX @DPTR,A	OUT DATA ON PORT A
6316	1140		ACALL 6040	CALL DATAWR
6318	0A		INC R2	INCREMENT COLUMN ADDRESS
6319	7C02		MOV R4,#02	LOAD COUNT
631B	EA	AG2:	MOV A,R2	LOAD COLUMN ADDRESS
631C	F0		MOVX @DPTR,A	OUT ADDRESS ON PORT A
631D	1151		ACALL 6051	CALL COMMAND
631F	7481		MOV A,#81	LOAD DATA
6321	F0		MOVX @DPTR,A	OUT DATA ON PORT A
6322	1140		ACALL 6040	CALL DATAWR
6324	0A		INC R2	INCREMENT COLUMN ADDRESS
6325	DCF4		DJNZ R4,F4	DJNZ R4,AG2
6327	00		NOP	NO OPERATION
6328	EA		MOV A,R2	LOAD COLUMN ADDRESS
6329	F0		MOVX @DPTR,A	OUT ADDRESS ON PORT A
632A	1151		ACALL 6051	CALL COMMAND
632C	74FF		MOV A,#FF	LOAD DATA
632E	F0		MOVX @DPTR,A	OUT DATA ON PORT A
632F	1140		ACALL 6040	CALL DATAWR
6331	22		RET	RETURN TO MAIN

SUBROUTINE 8 TO PRINT "EXCEL TECHNOLOGIES"

ADDRESS	**OP CODE**	**LABEL**	**MNEMONICS**	**COMMENTS**
6400	902808	EXCEL:	MOV DPTR,#2808	PORT A ADDRESS
6403	74BB		MOV A,#BB	PAGE 3 ADDRESS
6405	F0		MOVX @DPTR,A	OUT PAGE ADDRESS
6406	1151		ACALL 6051	CALL COMMAND

6408	7865		MOV R0,#65	LOAD HIGHER 8 BIT OF MEMORY ADDRESS
640A	7900		MOV R1,#00	LOAD LOWER 8 BIT OF MEMORY ADDRESS
640C	7C40		MOV R4,#40	COLUMN COUNT
640E	7D40		MOV R5,#40	COLUMN ADDRESS
6410	ED	LP1:	MOV A,R5	LOAD COLUMN ADDRESS
6411	F0		MOVX @DPTR,A	OUT ADDRESS ON PORT A
6412	1151		ACALL 6051	CALL COMMAND
6414	8883		MOV 83,R0	MOV DPH,R0
6416	8982		MOV 82,R1	MOV DPL,R1
6418	E0		MOVX A,@DPTR	LOAD DATA FROM MEMORY
6419	902808		MOV DPTR,#2808	LOAD PORT A ADDRESS
641C	F0		MOVX @DPTR,A	OUT DATA FROM MEMORY TO PROT A USING A
641D	1162		ACALL 6062	ACALL DATAWR1
641F	09		INC R1	INCREMENT MEMORY ADDRESS
6420	0D		INC R5	INCREMENT COLUMN ADDRESS
6421	DCED		DJNZ R4,ED	DJNZ R4,LP1
6423	00		NOP	NO OPERATION
6424	7C40		MOV R4,#40	COLUMN COUNT
6426	7D40		MOV R5,#40	COLUMN ADDRESS
6428	ED	LP2:	MOV A,R5	LOAD COLUMN ADDRESS
6429	F0		MOVX @DPTR,A	OUT ADDRESS ON PORT A
642A	1151		ACALL 6051	CALL COMMAND
642C	8883		MOV 83,R0	MOV DPH,R0
642E	8982		MOV 82,R1	MOV DPL,R1
6430	E0		MOVX A,@DPTR	LOAD DATA FROM MEMORY
6431	902808		MOV DPTR,#2808	LOAD PORT A ADDRESS
6434	F0		MOVX @DPTR,A	OUT DATA FROM MEMORY TO PROT A USING A
6435	1185		ACALL 6085	ACALL DATAWR2
6437	09		INC R1	INCREMENT MEMORY ADDRESS
6438	0D		INC R5	INCREMENT COLUMN

				ADDRESS
6439	DCED		DJNZ R4,ED	DJNZ R4,LP2
643A	00		NOP	NO OPERATION
643C	22		RET	RETURN TO MAIN PROGRAM

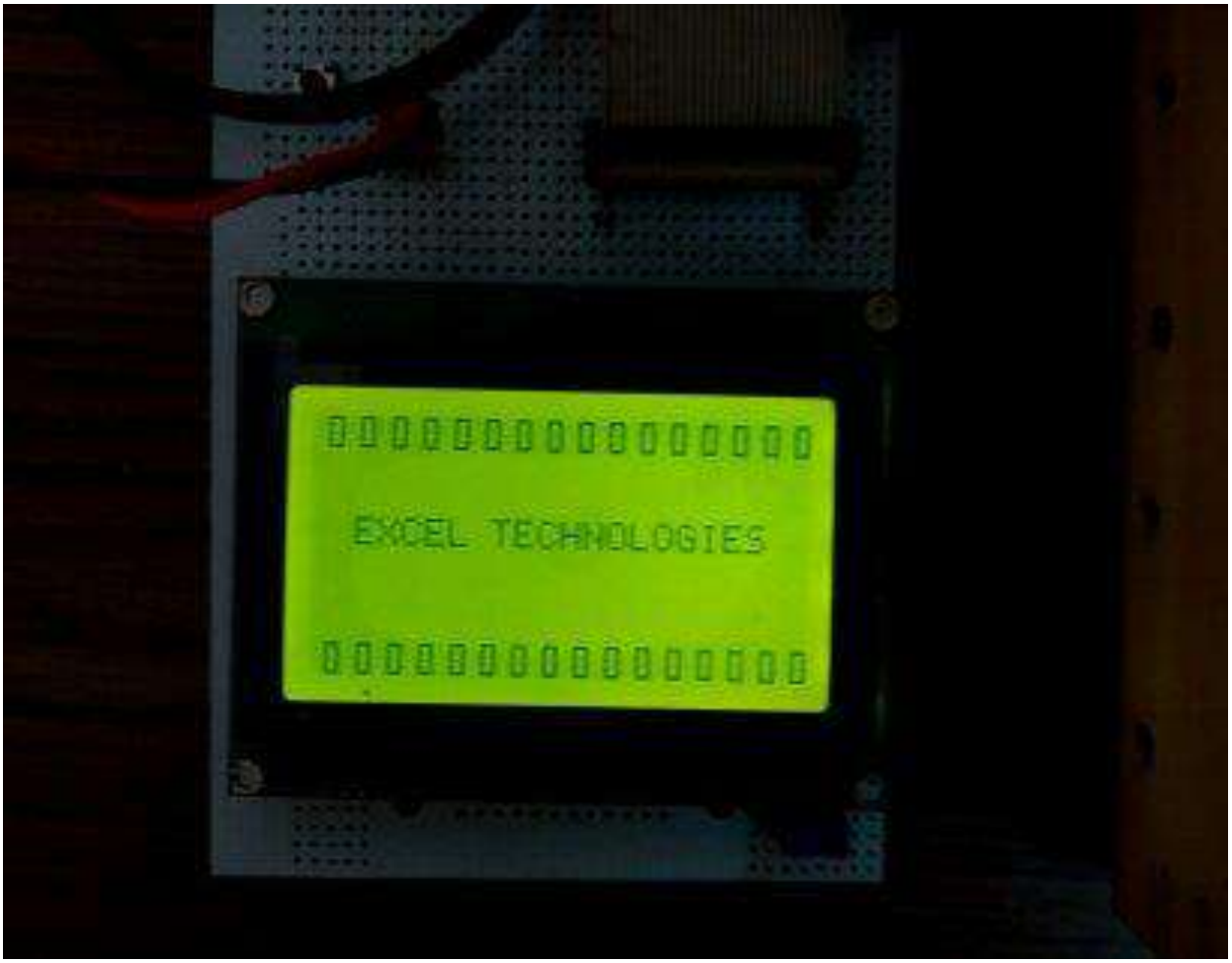
DATA ON MEMORY LOCATION 6500 TO 6580

CHARECTER	ADDRESS						
SPACE/BLANK	6500	00	00	00	00	00	00
SPACE/BLANK	6506	00	00	00	00	00	
E	650B	FE	92	92	92	82	00
X	6511	C6	28	10	28	C6	00
C	6517	7C	82	82	82	44	00
E	651D	FE	92	92	92	82	00
L	6523	FE	80	80	80	80	00
SPACE/BLANK	6529	00	00	00	00	00	
T	652E	02	02	FE	02	02	00
E	6534	FE	92	92	92	82	00
C	653A	7C	82	82	82	44	00
H	6540	FE	10	10	10	FE	00
N	6546	FE	08	10	20	FE	00
O	654C	7C	82	82	82	7C	00
L	6552	FE	80	80	80	80	00
O	6558	7C	82	82	82	7C	00
G	655E	7C	82	92	92	F4	00
I	6564	00	82	FE	82	00	00
E	656A	FE	92	92	92	82	00
S	6570	8C	92	92	92	62	00
SPACE/BLANK	6576	00	00	00	00	00	00
SPACE/BLANK	657C	00	00	00	00	00	00

NOTE: We have used 7 row and 5 columns to create a character.

RESULT:

EXPERIMENTAL SETUP



RESULT