

Experiment – 3

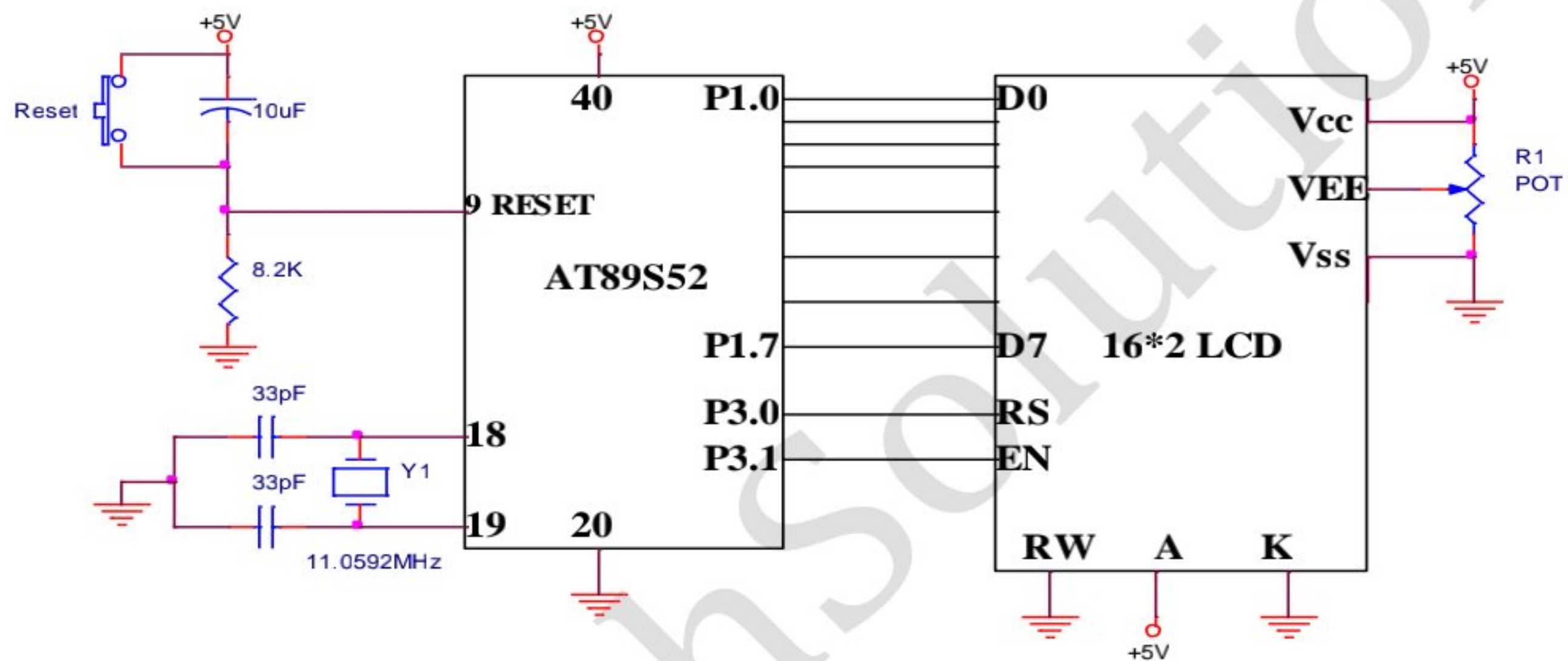
Title: Interfacing LCD to 8051Microcontroller.

Aim: To interface 16*2 LCD display to 8051 and display message on both lines of LCD.

Objectives:

- To study concept of LCD.
- To study 8051, keil μ vision & ECE flash.
- To study LCD interfacing, flowcharts & programs using C.

Block Diagram:



Theory:

LCD: A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). They are used in a wide range of applications including: computer monitors, television, instrument panels, aircraft, cockpit display, signage, etc. It is an electronically modulated device made up of any number of pixels filled with liquid crystals. LCD has become very popular option for displaying in Embedded Applications. Since they are very cheap and easy to interface with microcontrollers, they are widely found in devices like telephones, vending machines, washing machines, toys etc. LCD comes in several varieties i.e. 16*2, 20*2, 20*4 etc. These different LCD varieties can display different number of characters i.e. 16*2 can display 32 characters at a time. The 16*2 model has 2 lines and 16 columns of display blocks. Each block can be used to display 1 character. So there are total 32 such blocks. One block has 8*5 pixels. Depending on which pixel is ON and which is OFF we can display several Alpha-Numeric characters. LCD also has a backlight, which helps us to see the display even in dark. In reality this module consists of a controller chip, a segment driver chip, LCD display and some passive components. There are total 16 pins in the LCD module. While using LCD, we can think a simple analogy for its operation. Each of the 32 blocks is a memory, as soon as we write an ASCII number into one of these 32 memory locations the corresponding

character is displayed on that block. The function of displaying the character after decoding the data is done by an onboard controller chip. The following table shows the LCD pin diagram, LCD commands.

INTERFACING LCD TO 8051		Pin Descriptions for LCD			
		Pin	Symbol	I/O	Descriptions
LCD Pin Descriptions - Send displayed information or instruction command codes to the LCD - Read the contents of the LCD's internal registers		1	VSS	--	Ground
		2	VCC	--	+5V power supply
		3	VEE	--	Power supply to control contrast
		4	RS	I	RS=0 to select command register, RS=1 to select data register
		5	R/W	I	R/W=0 for write, R/W=1 for read
		6	E	I/O	Enable
		7	DB0	I/O	The 8-bit data bus
		8	DB1	I/O	The 8-bit data bus
		9	DB2	I/O	The 8-bit data bus
		10	DB3	I/O	The 8-bit data bus
		11	DB4	I/O	The 8-bit data bus
		12	DB5	I/O	The 8-bit data bus
		13	DB6	I/O	The 8-bit data bus
		14	DB7	I/O	The 8-bit data bus

Figure: LCD pin diagram

COMMAND	COMMAND CODE										COMMAND CODE	E-CYCLE f _{osc} =250KHz
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
SCREEN CLEAR	0	0	0	0	0	0	0	0	0	1	Screen Clear, Set AC to 0 Cursor Reposition	1.64ms
CURSOR RETURN	0	0	0	0	0	0	0	0	1	*	DDRAM AD=0, Return, Content Changeless	1.64ms
INPUT SET	0	0	0	0	0	0	0	1	I/D	S	Set moving direction of cursor, Appoint if move	40us
DISPLAY SWITCH	0	0	0	0	0	0	1	D	C	B	Set display on/off, cursor on/off, blink on/off	40us
SHIFT	0	0	0	0	0	1	S/C	R/L	*	*	Remove cursor and whole display, DDRAM changeless	40us
FUNCTION SET	0	0	0	0	1	DL	N	F	*	*	Set DL, display line, font	40us
CGRAM AD SET	0	0	0	1	ACG						Set CGRAM AD, send receive data	40us
DDRAM AD SET	0	0	1	ADD						Set DDRAM AD, send receive data	40us	
BUSY/AD READ CT	0	1	BF	AC						Executing internal function, reading AD of CT	40us	
CGRAM/ DDRAM DATA WRITE	1	0	DATA WRITE						Write data from CGRAM or DDRAM		40us	
CGRAM/ DDRAM DATA READ	1	1	DATA READ						Read data from CGRAM or DDRAM		40us	
<div>I/D=1: Increment Mode; I/D=0: Decrement Mode S=1: Shift S/C=1: Display Shift; S/C=0: Cursor Shift R/L=1: Right Shift; R/L=0: Left Shift DL=1: 8D DL=0: 4D N=1: 2R N=0: 1R F=1: 5x10 Style; F=0: 5x7 Style BF=1: Execute Internal Function; BF=0: Command Received</div> <div>DDRAM: Display data RAM CGRAM: Character Generator RAM ACG: CGRAM AD ADD: DDRAM AD & Cursor AD AC: Address counter for DDRAM & CGRAM</div> <div>E-cycle changing with main frequency. Example: if fcp or f_{osc}=270KHz 40us x 250/270 =37us</div>												

Figure: LCD commands

Procedure:

- Connect DC power adaptor to the MGTechSolution 8051 Target board.
- Start Keil IDE and follow the steps mention in the “Steps to use of Keil IDE software”.
- Compile the written program, if there are no errors connect the PC to the programmer placed on the MGTechSolution 8051 Target board; by using USB cable.
- Follow the procedure mention in the “Steps to use of WLPRO software”. Upload the program.
- Make necessary connections as shown in the circuit diagram.
- Observe the output.

Program:

```
#include<reg51.h>
sbit RS=P3^0;
sbit EN=P3^1;
void LCDcmd()
{
RS=0;
EN=1;
EN=0;
}
void LCDdata()
{
RS=1;
EN=1;
EN=0;
}
void delay()
{
int i;
for(i=0;i<30000;i++);
}
void main()
{
P1=0x38;
LCDcmd();
delay();
P1=0x0E;
LCDcmd();
delay();
P1=0x06;
LCDcmd();
delay();
P1=0x01;
LCDcmd();
delay();
```

```
P1=0x80;  
LCDcmd();  
delay();
```

```
P1='W';  
LCDdata();  
delay();  
P1='E';  
LCDdata();  
delay();  
P1='L';  
LCDdata();  
delay();  
P1='C';  
LCDdata();  
delay();  
P1='O';  
LCDdata();  
delay();  
P1='M';  
LCDdata();  
delay();  
P1='E';  
LCDdata();  
delay();  
while(1);  
}
```

Result: Interfacing of 16*2 LCD with 8051 microcontroller is done successfully and message displayed on both lines of LCD.

Teacher's Sign.
