Lab 12
Serial Interface with PIC Microcontroller

Objectives

1. To know what is Serial Communication.
5. To realize how 16F877A microcontroller deals with serial communication.
6. To get familiar with interfacing Computer COM Port for serial communication to P I C 16F877A and send and receive data.
7. To get familiar with MAX232 IC and how to interface it with PIC Microcontroller.

Tools

16F877A microcontroller, MAX232, Computer, MIKROC software, PROTEUS software, USB Programmer.

Theory

Serial Communication

Unlike parallel communication, where several bits are send at one time, Serial Communication is a process of transmitting data bit by bit. In this tutorial, you will learn how to serially communicate a PC or any other device with a PIC microcontroller. You will also study the use of a communication component – UART (Universal Asynchronous Receiver Transmitter) present within the microcontroller.


Lab Work

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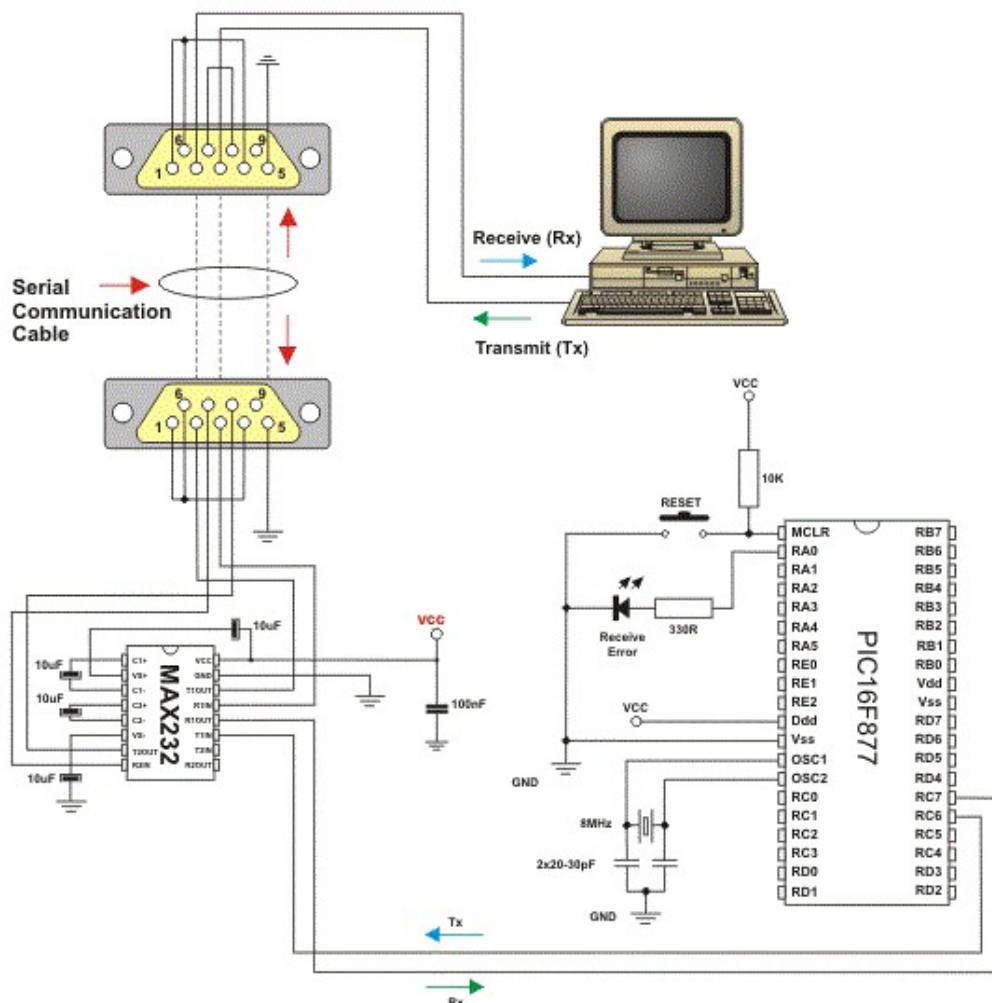
Serial Communication is the process of sending data one bit at a time. It is achieved by using the UART feature within the pic microcontroller. UART (Universal Asynchronous Receiver Transmitter) is a serial communication interface which is used for transmitting and receiving data. The UART feature is first initialized and then it can be used for transferring data. One of the serial communication architecture includes RS232 standard. It is commonly used in computer serial ports. Using RS232 interface, the communication between a microcontroller and a PC or two microcontrollers can be made possible.

Lab Work

In order to make the communication possible between PIC and a PC, a DB9 connector (female) is used as shown in the schematic, whose male part is connected to the PC. The voltage levels of RS232 protocol are different from that of UART. The voltage level generally used in MCU is HIGH=5V and LOW=0V. Whereas the RS232 working voltages are HIGH=+12V and LOW=-12V.

In order to use the RS232 protocol, we will need a level converter. A level converter will convert the ±12V coming from PC into 5V which can be fed to the controller and vice versa. The level converter used here is called ICMAX232. All the connections of IC with
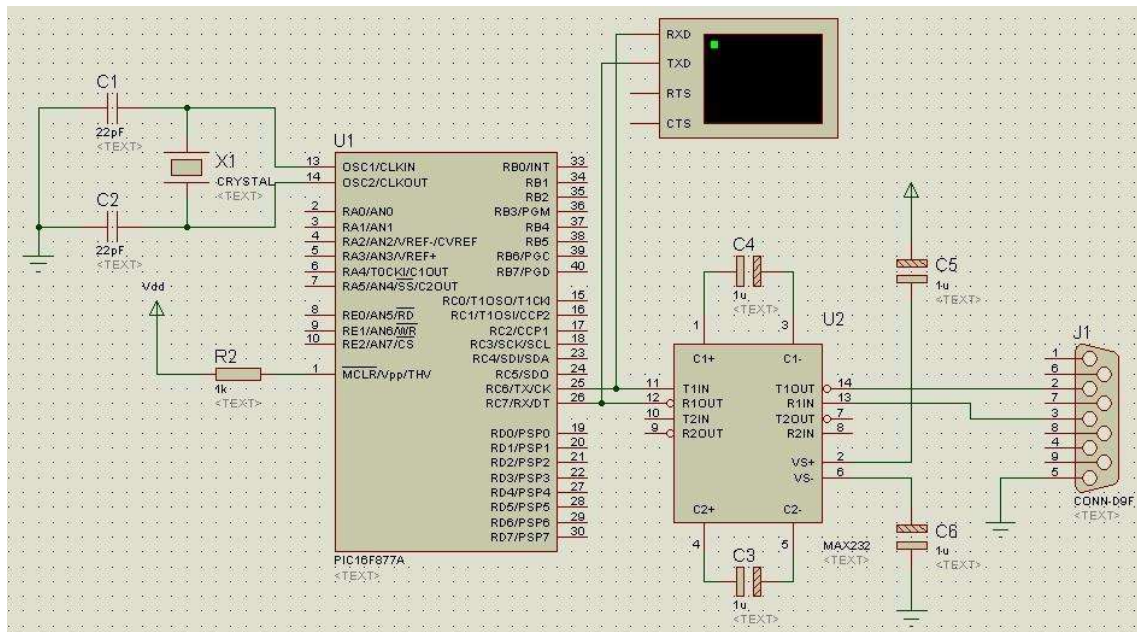
the controller and also with the DB9 connector are shown in the circuit diagram above. RC6/TX and RC7/RX pins of the microcontroller are connected to the T1IN and R1OUT pins of the ICMAX232 respectively. Similarly, the T1OUT and R1IN pins of MAX232 are connected to the DB9 pins 2 (RX) and 3(TX) respectively. Pin 5 of the DB9 connector is grounded. A virtual terminal is connected to the RX and TX pics of the microcontroller to display the transmitting and receiving data.

Hints about the program

1) The idea of the program is to use the built in libraries to make serial communication easier.
2) Initialize UART module at baud rate 19200 bps

UART1_Init(19200); //

3) You must add a delay to allow the UART Module to stabilize
   Delay_ms(100);

4) Write data using this function
   UART1_Write_Text("Enter Data");
5) To check if data is received or not
   if (UART1_Data_Ready())
6) To read incoming data
   UART1_Read(); // read the received data
11) For more information about these functions, refer to the help of MikroC.

Procedure

Part 1: Write and read data

- Write a C program to send data to a computer then receive data from it and display it as it is on portb.
- Simulate the program using the circuit shown in figure via Proteus software. Verify it operates properly when simulated
- Program a PIC 16F877A using the QL2006 programmer.
- Build the circuit using the programmed PIC 16F877A and then observe its operation. Demonstrate the circuits operation to the instructor.

Part 2

- Present your results in a lab report including a copy of the source codes