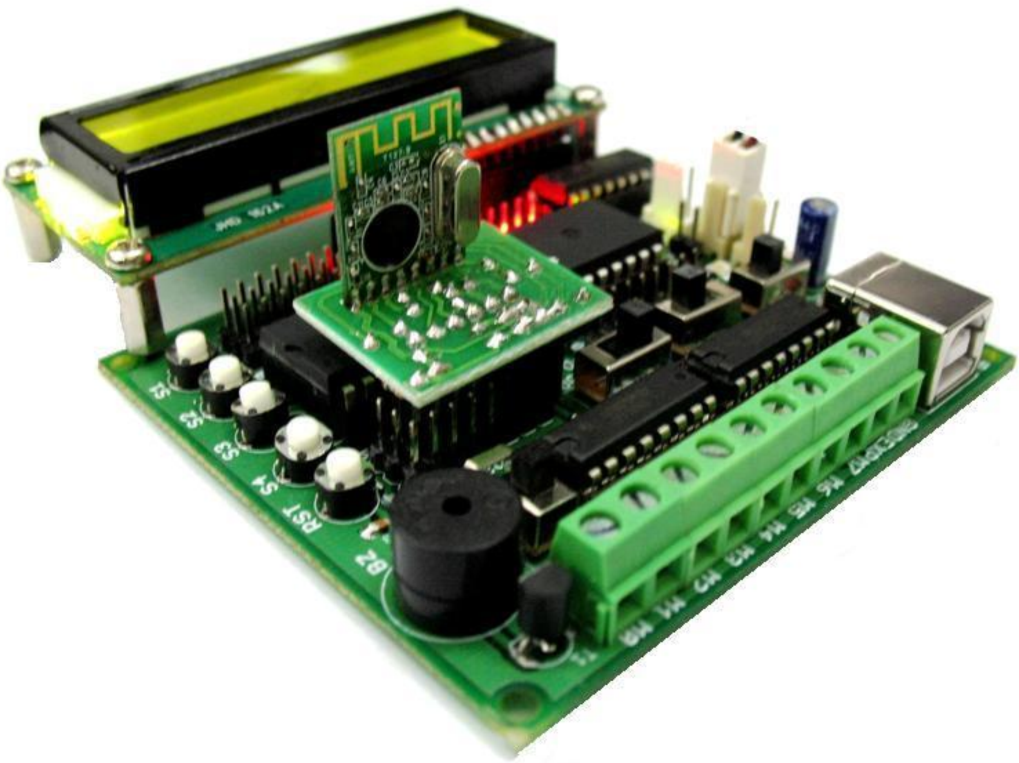
AVR
Development Board
(107010)

User’s Manual



Technophilia

Research | Invention | Execution

About the User Guide

AVR Development Board 107010 is especially designed for the students having interest in electronics, embedded system, robotics and industrial-automation. This board is made in such a way that it becomes easier for any body to learn about AVR micro controllers. This board can also be used in various applications and hobby projects.

PROPRIETARY NOTICE

This document contains proprietary information furnished for evaluation purposes only; except with the express written permission of Technophilia, such information may not be published, disclosed, or used for any other purpose. You acknowledge and agree that this document and all portions thereof, including, but not limited to, any copyright, trade secret and other intellectual property rights relating thereto, are and at all times shall remain the sole property Technophilia and that title and full ownership rights in the information contained herein and all portions thereof are reserved to and at all times shall remain with Technophilia. You acknowledge and agree that the information contained herein constitutes a valuable trade secret of Technophilia. You agree to use utmost care in protecting the proprietary and confidential nature of the information contained herein.

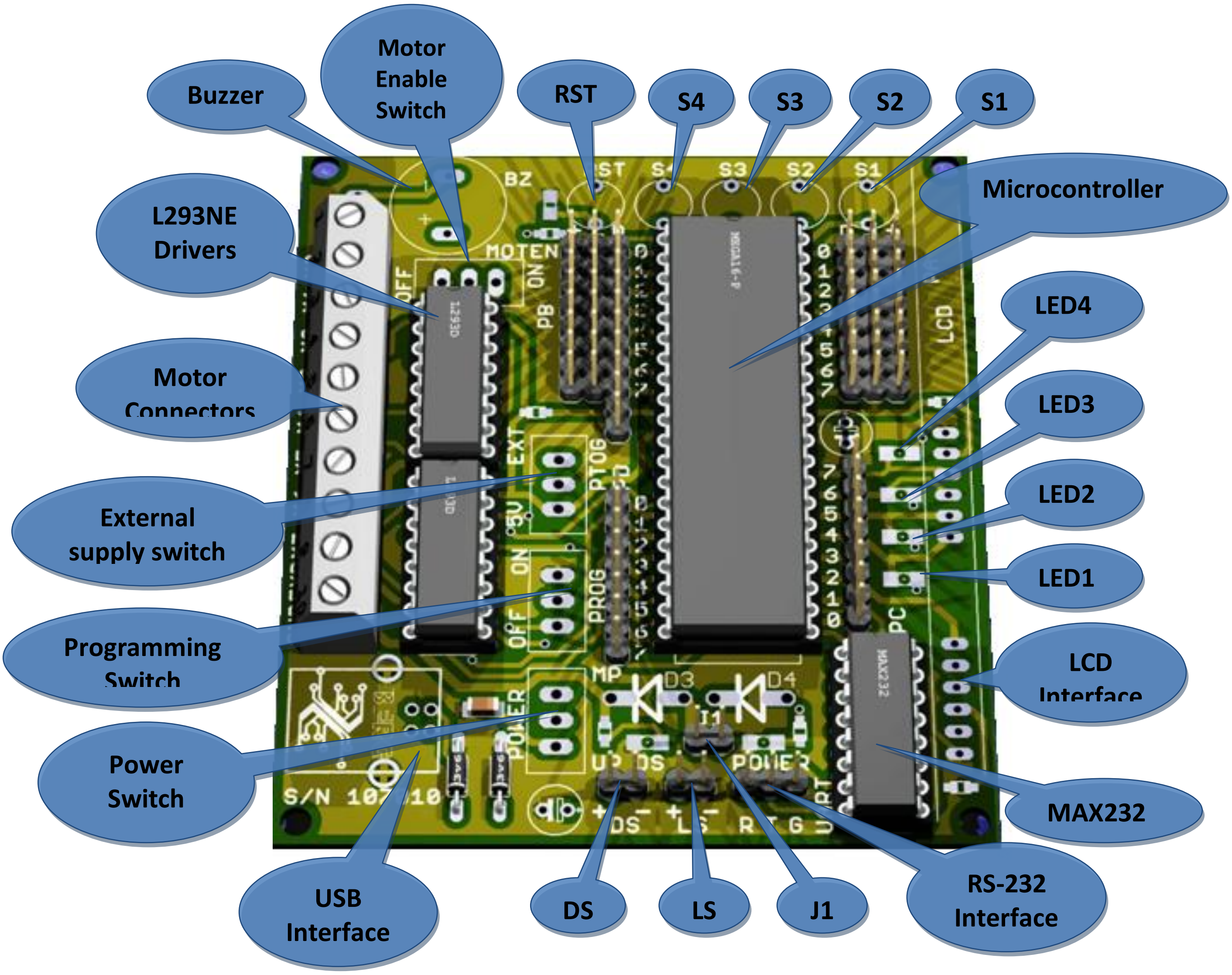
Contents

1. Product Description:

1.1. AVR Development Board 107010:

- Includes Atmel's ATmega16 Microcontroller with 16kb flash memory working at 16MIPS or ATmega8535 Microcontroller with 8kb flash memory working at 16MIPS.
- Compatible with all AVR 40 pin micro controllers.
- On-board LCD interface (it can also be used for any other general purpose application).
- On-board Motor Driver for connecting 4 DC motors or 2 Stepper motors
- Onboard servo interface
- On-board regulated power supply.
- PC interface through UART.
- On-board Buzzer.
- 16 MHz external crystal.
- Exposed all 32 I/O pins.
- Exposed 8 channel I/O pins for ADC and sensors with 5V/1A power supply.
- Exposed 8 channel I/O pins for servo and sensors with dual power supply.
- Five tact switches for external input and reset.
- Four test surface mounted LEDs for status and debugging purpose.
- Two supply indicator LEDs.
- Dual power supply through DC source (6V to 16V) or USB powered.
- On board USB programmer.
- Dual or single power supply option.
- Exposed ISP pins for programming.

2. Parts Identification



2.1. Microcontroller

It is a micro computer chip which stores our programs executes them and takes necessary action. The chip used hear is Atmels popular AVR micro controller.

2.2. 1117 VOLTAGE REGULATOR

It is a three terminal 5V voltage regulator IC used to provide a constant voltage supply of 5V to the micro controller and other peripherals (i.e. sensors etc.) attached in the main board.

2.3. MAX232

This IC takes care of voltage conversion needed for the communication between the PC's RS-232 (Serial/COM) port and AVR Development board.

2.4. L293NE MOTOR DRIVER

This is basically a motor driver IC which takes input from microcontroller and is able to drive the DC and stepper motors by using separate power supply.

2.5. 16 X 2/16 X 1 LCD INTERFACE

The LCD interface can be use to interface any 16x2 or 16x1 character LCD display in 4 bit mode. The LCD display can be used to display any message, status or also can be used for debugging purpose.
The LCD interfacing can also be used as a general purpose input output port. The pin connections for interfacing an LCD to the board are given below:

RS -	PortC0
RW -	PortC1
E -	PortC2
D5 -	PortC4
D6 -	PortC5
D7 -	PortC6
D8 -	PortC7

2.6. SWITCHES

Four tact switches along with a Reset switch are present on the board in order to provide an external input to the board. The switches are connected in the following manner:

S1 -	PortA4
S2 -	PortA5
S3 -	PortA6
S4 -	PortA7

RST (Reset switch):

The Reset switch is basically used to reset a running program right to the beginning it is same as the reset switch of a PC.

MOTEN (Motor Enable Switch):

It is basically a toggle switch which toggles the enables or disables of the motor drivers by setting the switch in either ON or OFF mode.

POWER (Power On Switch):

It is basically a toggle switch used to provide power supply to the main board. The power can be supplied either by a battery power supply (through LS) or can be USB powered. Thus, the POWER switch can be made to toggle between MP (Main Power) or UP (USB Power).

PTOG (Power Toggle Switch):

It is basically a toggle switch which toggles the power for the devices connected to PORTB either to use the internal power supply (5V) of the main board (by setting the switch in 5V mode) or to use any other external power source connected in DS for the high power applications like servo motors (by setting the switch in EXT mode).

PROG (Programming Switch):

It is also a toggle switch for programming the microcontroller using on board USB programmer. For programming mode it should be ON then RESET button should be pressed. For normal operation it should be off.

2.7. POWER SUPPLY

LS (Logic Supply):

It consist of two pins one is +ve and another is –ve. A battery or a AC adaptor can be connected here to provide power suply to the mother board it provides regulated power supply to all the peripherials present in the mother board and also to the external periphrials connected to the motherboard through a voltage regulator. The DC voltage provided to this terminal should be lies in between 6 to 16 volt. To use the supply connected in LS pin the power switch should be toggled towards "MP" (Main power).

DS (Driving Supply):

It consist of two pins one is +ve and another is –ve.It is basically use to provide a separate high current power supply to the Motors. For operating DC motors you may provide here a Power supply of 5 to 40 volt. For operating a servo motor you may suppose to provise any suitable power supply as per the requirement of your motors (mostly servos works at 4.5 to 6 volt). Power from this pins are directly goes to the driving supply of the motor driver and to the supply pins of PortB if PTOG switch is toggled towards EXT.

J1 (Jumper 1):

It is a simple jumper which can be use to use a sinle power supply for DS and LS. If you put here a jumper then you have to provide supply only on DC or LS and your board will get both the power supply.

USB socket:

It is basically used for USB communication with the PC. It also provides necessary logic supply to the motherboard. In order to use the USB supply the POWER switch should be toggled towards UP (USB power). When using the USB power some prequtions should be taken such as any heavy load should not be connected to the board directly and Don't use the J1.

2.8. LED's

Active high:

RED LED1 –	PORTC4
RED LED2 –	PORTC5
RED LED3 –	PORTC6
RED LED4 –	PORTC7
GREEN LS -	Logic Power ON indicator
GREEN DS -	Driver Power ON indicator

2.9. BZ (BUZZER)

It can be easily used to get an audible feedback from the controller. It is connected in an active high mode, i.e., the buzzer beeps when the data given to it is 1.

The Buzzer is connected to the pin PORTC3 of the microcontroller.

2.10. ISP (IN-SYSTEM PROGRAMMING) INTERFACE

It is the In-System Programming interface of the main board which can be used to connect any ISP programmer to download the programs in the microcontroller. It can also be used in SPI (Serial Peripheral Interface) communication. The pins provided for ISP are given below:

MO-	Master Out Slave in	PortB5
MI-	Master in Slave out	PortB6
SCK-	Serial clock	PortB7
RST-	Reset	Reset
GND-	Ground	Ground

2.11. RS – 232 INTERFACE

These is a 3-pin interface that can be used for PC controlled applications, debugging purpose, data communication with PC and for inter board data communication.

The port consists of three pins, namely,

R -	Receiver
T -	Transmitter
G -	Ground.

2.12. PA (PORTA)

It is a general purpose I/O port. This port contains eight pins that can be used as digital input, ADC in and digital out put. These pins are in the form, DATA-VCC-GROUND (denoted as D + - respectively on the board). The Data pins are towards the microcontroller. The VCC and Ground pins are provided with a 5V/1A power supply.

2.13. PB (PORTB)

It is a general purpose I/O port. This port contains eight pins that can be used as digital input and digital out put. These pins are in the form, DATA-VCC-GROUND (denoted as D + - respectively on the board). The VCC and Ground pins are provided with a 5V/1A power supply or the suply to this pins can also be switched to external supply connected in DS pin through EXT switch.

2.14. MOTOR DRIVER CONNECTIONS

The motor drivers are used to run the DC motors or stepper motors that may be connected to the board according to the data from the microcontroller. The motor drivers link with micro controller is shown bellow.

M0 -	PortB0
M1 -	PortB1
M2 -	PortB2
M3 -	PortB3
M4 -	PortD4
M5 -	PortD5
M6 -	PortD6
M7 -	PortD7

3. The AVR Microcontrollers:

3.1. Description

The **AVR** is a Modified Harvard architecture 8-bit RISC single chip microcontroller which was developed by Atmel in 1996. The AVR was one of the first microcontroller families to use on-chip flash memory for program storage, as opposed to One-Time Programmable ROM, EPROM, or EEPROM used by other microcontrollers at the time.

Atmel's low power, high performance AVR microcontrollers handle demanding 8 and 16-bit applications. With a single cycle instruction RISC CPU, innovative Pico Power® technology, and a rich feature set, the AVR architecture ensures fast code execution combined with the lowest possible power consumption.

Whether you program in C or assembly, the tuned AVR instructions decrease program size and development time. The well-defined I/O structure limits the need for external components and reduces development cost. A variety of internal oscillators, timers, UARTs, SPIs, Pulse Width Modulation, pull-up resistors, ADCs, Analog Comparators and Watch-Dog Timers are some of the features available for creative engineers.

The AVR microcontrollers are divided into 4 families tiny AVR, mega AVR, XMEGA and Application specific AVR. Among these 4 families of AVR here we are going to use a microcontroller of mega AVR family “ATmega16”.

3.2. Programming

WinAVR is a suite of executable, open source software development tools for the Atmel’s AVR series of RISC microcontrollers hosted on the Windows platform. It includes the GNU GCC compiler for C and C++.

Steps for writing a code using WinAVR

1. Open the Programmer’s Notepad and write your code.
2. Create a new folder and save your code in that folder with extension name “.c”
3. Now open the make file and edit it as mentioned bellow:
4. Make file→ main filename (give your file name here without extension)
5. Make file→ MCU type→ ATmega→ (chose your UC)
6. Make file→ Debug format→ AVR-ext-COFF
7. Make file→ Programmer→ select your programmer (if your programmer is not in the list then follow the step3.d)
8. Make file→ port→ (select the port where you have connected your programmer)
9. Make file→ enable editing make file→ then in your make file edit the following things
10. F_CPU = 16000000 (change it as for your crystal frequency)
    AVRDUDE_PROGRAMMER = stk500 (here write down you programmers name)
11. Save the make file in your folder without changing its name.
12. Now open the programmer’s notepad.
13. To compile your code and to generate hex file (Tools→ make all).
14. To upload your code into your UC (Tools → program).

3.3. Sample codes

Code1. Program to switch on the entire test LEDs

```
    #include<avr/io.h>              //basic header file for AVR micro controllers
    int main(void)
    {
            PORTC=0x00;             // initialization of port C as all bits low.
            DDRC=0xF0;              // data direction declaration of port C lower bits as o/p port.

            PORTC=0xF0;

            while(1)
             {

             }
            return 0;
    }
```

Code2. Program to blink all the LEDS connected in PortC

```
    #include<avr/io.h>                      //This is the header for AVR Microcontroller.
    #include “ delay.h”                     //header file to generate time delay.
    int main(void)
     {
            PORTC=0x00;                     // Port C initiallization as allbits low.
            DDRC=0xFF;                      // Port C data direction declaration as out put.
            while(1)                        //This is for the the infinity loop.
            {
             PORTC=0xF0;
             delayms(1000);
             PORTC=0x00;
             delayms(1000);
            }
            return 0;
    }
```

Code3.Taking input from a port

```
#include<avr/io.h>                  //This is the header for AVR Microcontroller.
int main(void)
{
        PORTD=0x00;                 // Port C initialization as all bits low
        DDRC=0xFF;                  // Port C data direction configuration as output port
        PORTA=0xFF;                 // configuring the PORTA in pull-up mode.
        DDRA=0x00;                  // Port A data direction configuration as input port.
        while(1)
        {
                if((PINA & 0x10)==0x00)
                {
                        PORTC=0x01;
                }
                else if((PINA & 0x20)==0x00)
                {
```

```
                PORTC=0x02;
            }
            else if((PINA & 0x40)==0x00)
            {
                PORTC=0x04;
            }
            else if((PINA & 0x80)==0x00)
            {
                PORTC=0x00;
            }
        }
        return 0;
}
```

Code 4.Interfacing 16x2 LCD

```
#include<avr/io.h>
#include“delay.h”                        //header file to generate time delay.
#include“lcd.h”                          //header file for interfacing LCD
int main()
 {
  lcd_init();
  lcd_string("TECHNOPHILIA");    // function to print a string
  while(1)
   {
   }
return 0;
}
```

Website: -www.technophilia.co.in
Email: - info@technophilia.co.in
Last modified: -September 2010