

ARDU-8051 EDU-PRO

Student Laboratory Manual

Course Context

This laboratory manual is designed for **undergraduate microcontroller courses** where the **8051 architecture** is taught as a foundational platform. The **ARDU-8051 EDU-PRO** board combines traditional 8051 learning with Arduino-style hardware convenience and an integrated USBasp programmer.

Lab 0: Getting Started & Board Familiarization

Objectives

- Identify major sections of the ARDU-8051 EDU-PRO board
- Understand power, clock, and programming interfaces
- Prepare the board for first-time use

Required Equipment

- ARDU-8051 EDU-PRO board
- USB cable (Type-B or Type-C)
- PC with USBasp driver installed

Board Sections to Identify

- AT89S52 (8051 microcontroller)
- On-board USBasp programmer (ATmega8A)
- USB connector (Type-B / Type-C)
- Power regulation section
- Port headers (P0, P1, P2, P3)

Observation: Students should sketch a block-level diagram of the board in their lab notebook.

Lab 1: Blink LED Using 8051 (Basic GPIO Test)

Objective

To verify correct operation of the ARDU-8051 EDU-PRO board by executing a **Blink LED** program using Port-1 GPIO.

Learning Outcomes

After completing this experiment, students will be able to: - Configure an 8051 I/O pin as output - Generate software delay loops - Program an 8051 microcontroller using USBasp

Theory (Brief)

In the 8051 microcontroller, each port pin can be configured as an input or output. Writing logic `0` or `1` to a port pin controls the voltage level, which can be used to drive external devices such as LEDs. A delay loop is implemented using nested `for` loops to generate approximate time delays.

Hardware Required

- ARDU-8051 EDU-PRO board
 - USB cable
 - LED (external, if on-board LED is not used)
 - $330\ \Omega$ resistor
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Circuit Connection

Option A: On-board LED - LED is pre-connected to P1.0

Option B: External LED

```
P1.0 → 330 Ω → LED → GND
```

Note: The LED is assumed to be **active-low**.

Software Tools

- Keil µVision (recommended)
 - USBasp programming utility (ProgISP / Extreme Burner / avrdude)
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Program Code (Blink LED)

```
#include <reg52.h>

sbit LED = P1^0;
```

```

void delay_ms(unsigned int ms)
{
    unsigned int i, j;
    for(i = 0; i < ms; i++)
        for(j = 0; j < 1275; j++);
}

void main(void)
{
    while(1)
    {
        LED = 0;      // LED ON
        delay_ms(500);
        LED = 1;      // LED OFF
        delay_ms(500);
    }
}

```

Procedure

1. Connect the ARDU-8051 EDU-PRO board to the PC using a USB cable.
2. Verify that the power LED on the board is ON.
3. Open **Keil µVision** and create a new project.
4. Select **AT89S52** as the target device.
5. Add the Blink LED source code.
6. Enable **Create HEX File** in project options.
7. Build the project to generate the HEX file.
8. Open the USBasp programming software.
9. Select programmer as **USBasp** and device as **AT89S52**.
10. Load the HEX file and program the device.
11. Observe the LED behavior.

Expected Result

- The LED connected to P1.0 turns ON for approximately 0.5 seconds
- The LED turns OFF for approximately 0.5 seconds
- The process repeats continuously

Troubleshooting

Problem	Possible Cause	Solution
LED not blinking	Wrong port pin	Verify LED connection

Problem	Possible Cause	Solution
Programming fails	USBasp not detected	Check driver installation
No HEX file	HEX generation disabled	Enable HEX option
Board not powered	USB cable issue	Try different cable/port

Viva / Review Questions

1. Why is Port-1 preferred for simple LED experiments in 8051?
 2. What determines the delay time in the software loop?
 3. Why is USBasp suitable for educational use?
 4. What happens if the crystal frequency is changed?
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Lab Assignment

1. Modify the program to blink the LED at a 1-second interval.
 2. Connect an LED to another Port-1 pin and blink alternately.
 3. Rewrite the delay using Timer-0 instead of software loops.
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Notes for Instructors

- This experiment serves as a **hardware health check**.
 - Subsequent labs may include **ADC0804 interfacing, timers, interrupts, LCD, and UART**.
 - Students should retain this board for the entire semester.
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End of Experiment