LIGHT EMITTING BAR (LED BAR)

EVBU LAB EXPERIMENT

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Class

_____

Instructor / Professor

xiom
anufacturing
™

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CONTENTS

1 GETTING STARTED

The following section has been designed to help users to quickly learn proper setup and operation of the lab experiment.

1.1 Introduction

The experiment requires a single board development system that is fully assembled and fully functional from Axiom Manufacturing. Development boards CME11E9 Evbu is supported in this experiment. The system comes complete with schematic and instructions. All software, drawings, and manuals are contained on the CD.

1.2 Software

The CD comes with AxIDE, which is an integrated development environment designed exclusively for use with Axiom development boards, providing an interface to programs running on these boards. AxIDE also makes uploading programs and easy via the COM port. Read your board manual for setting up AxIDE.

1.3 Support Software

There are many useful programs on the included CD that can make developing projects easier. The CD also contains example software programs for this experiment on each board. . You can also download the latest software free from our web site at:
http://www.axman.com.

1.4 Hardware

The following hardware is required:

Axiom CME11E9 EVBU
Windows based PC
LED BAR Lab Kit
- LED BAR HLMP-2550
- Four resistors ½w
- Five jumpers

2.0 Visual

Devices used in this lab are static sensitive and are easy damaged by mishandling. Use caution when installing wires and devices on the breadboard to prevent the bending of leads. Experiments should be laid out in a orderly fashion. Start your lab time with the bench clean and free of metal objects. Leave the lab area in a clean condition by picking up loose parts, wires and small objects.

3.0 Theory

Axiom's development board is designed for quickly and effectively learning the basics of microcontrollers. This lab will walk the student though the steps of using the development board for its intended purpose, controlling devices. A LED BAR is one device that is controllable by a microcontroller. In this lab, a four element LED BAR is used for the experiment. A LED is a solid state device that when current is forced though the device, will emit a light. The port on the microcontroller will output a +5 volt high signal. This signal is apply to the anode of the LED. The cathode of the LED is connected though a resistor to ground. The resistor is a current limiting resistor for the port. This limits the current flow on the port to its rated value, otherwise the port would over heat and possibly damage the port. LED intensity is depended on the current flow. Driving LEDS at a higher intensity would require external drivers rated for the LED being used. PROJECT BOARD is one such board that includes the on board drivers. A LED BAR is a good indicator for applances, machinary, cars, & alarms plus many others. They come in several colors such as red and green. One element of the LED BAR can be used as power on indicator, another as a flashing alarm indicator, still another as a fault indicator.

4.0 Procedure

The procedure is arranged in a series of steps. Each step is to be completed before moving on to the next step. As each step is built on prior steps, the student's will increase their knowledge for other labs or self-study. The student should go though the steps as many times as necessary to master the subject. As an aid in keeping track of location, the check box next to each step should be checked as completed.

4.1 Description

You will be using PORT B on the HC11E9 microcontroller. In single chip mode, PORT B is a output only port. Bits 4, 5, 6, 7 are used as the drive for the four LEDS. This port is located at address $1004 on the HC11. Writing directly to this port will change the level of each pin. Writing a binary one will turn the LED on and writing a binary zero will turn LED off.

EVBU Setup:

Connect jumper wires between the following:

EVBU P4		Breadboard
GND	to	GND
PB4	to	D1
PB5	to	D2
PB6	to	D3
PB7	to	D4

4.2 Detailed Steps

- [ ] Note in the following steps: PORTB refers to address $1004
- [ ] Verify power is not applied to EVBU.
- [ ] Install the LED BAR and the four resistors on the breadboard area per drawing.
- [ ] Install ModA jumper. Disable ModB jumper. Disable MEM_EN jumper. This will configure EVBU for single chip operation.
- [ ] Apply power to the EVBU.
- [ ] Write $00 to PORTB, verify all segment of the LED BAR are off. This forces all outputs low, thus removing the drive for all the LEDS.
- [ ] Write $10 to PORTB, verify LB1 on the LED BAR is on. This forces PORTB bit 0 high, thus applying a drive for LB1.
- [ ] Write $20 to PORTB, verify LB2 on the LED BAR is on. This forces PORTB bit 1 high, thus applying a drive for LB2.
- [ ] Write $40 to PORTB, verify LB3 on the LED BAR is on. This forces PORTB bit 2 high, thus applying drive for LB3.
- [ ] Write $80 to PORTB, verify LB4 on the LED BAR is on. This forces PORTB bit 3 high, thus applying a drive for LB4.

4.3 Conclusion

In conclusion, by using the four bits of port B as drive for the four LEDS in the LED BAR, the LEDS are directly set on or off. Any combination of LEDS can be set. All on at once or only one , two, three LEDS on. In development, one can assign each LED a function. Maybe one LED as a “Run” indicator. One as a “FAULT” indicator. Still another as a cycle indicator, example would be “RINSE” in a washing machine. Last would indicate a “Spin” cycle. The LED brightness is not readable in strong light levels. Normally a driver is provided between the microcontroller and LEDS. This increases the current, which increases the intensity of the LEDS.

5.0 Software Control of LEDS

5.1 Program Description

The program starts my loading X register with the address of port B. Using equates LEDB1, LEDB2, LEDB3, LEDB4 as a mask, bits 4, 5, 6, 7 of port B are cleared. This turns all LEDS off. The next step uses mask bit “LEDB1” to set LEDB1 on. The LED is made visual by calling a delay routine. This delay is long enough for a human to see the LED as being on. The next step uses the same mask bit “LEDB1” to turn LEDB1 off. The remaining steps turn LEDS 2,3,4 on and off in the same way. Final the program jumps back to the beginning and repeats forever.

5.2 Running LED11 Program

- ☐ Load program LEDB1P.S19 into EVBU. This program is located at $0100, which is internal memory. The source is show below.
- ☐ Program is executed by entering “CALL 0100” on EVBU and pressing enter.
- ☐ The program will flash each element of the LED BAR forever.

5.3 LED BAR Source

```
* File LEDB1P.asm
* Four Blinking LEDS
* Using Port B bit 4 thru 7
*          equates
PORTB:     equ $1004
LEDB1:     equ $10          * PB4 select
LEDB2:     equ $20          * PB5 select
LEDB3:     equ $40          * PB6 select
LEDB4:     equ $80          * PB7 select
*
           org $0100
*
Main:
           ldx  #PORTB      * load x with address of PortB
           bclr 0,x LEDB1+LEDB2+LEDB3+LEDB4   * turn all LEDS off
LB1ON:                      * turn led one on
           bset 0,x LEDB1
           bsr  Delay
LB1OFF:                     * turn led two off
           bclr 0,x LEDB1
           bsr  Delay

* Turn on Led Two
LB2ON:                      * turn led two on
```

```
            bset 0,x LEDB2
            bsr  Delay

* Turn off Led Two
LB2OFF:                     * turn led two off
            bclr 0,x LEDB2
            bsr  Delay
LB3ON:                      * turn led three on
            bset 0,x LEDB3
            bsr  Delay
LB3OFF:                     * turn led three off
            bclr 0,x LEDB3
            bsr  Delay
LB4ON:                      * turn led four on
            bset 0,x LEDB4
            bsr  Delay
LB4OFF:                     * turn led 4 off
            bclr 0,x LEDB4
            bsr  Delay
            bra  Main       * loop forever
*
* Delay
Delay:
            ldy  #$ffff
DelayA:
            dey
            bne  DelayA
            rts             * return
```

6.0 Quiz

Question One

Where is the program LED11.S19 located in memory?

A. External memory C. Eprom
B. Internal memory D. Rom

Question Two

Writing $40 to PORTB, turns what LED BAR on?

A. BAR1 C. BAR3
B. BAR2 D. BAR4

Question Three

What causes a LED to emit light?

A. Current C. Voltage
B. Resistor D. Diode

Question Four

Is PORTB?

A. Input Only C. Bi_Directional
B. Output Only D. Wired Or

Question Five

How many BARS can be on at one time?

A. 1 C. 3
B. 2 D. 4

Bonus Question

What is the purpose of X register in LEDB1P.ASM?

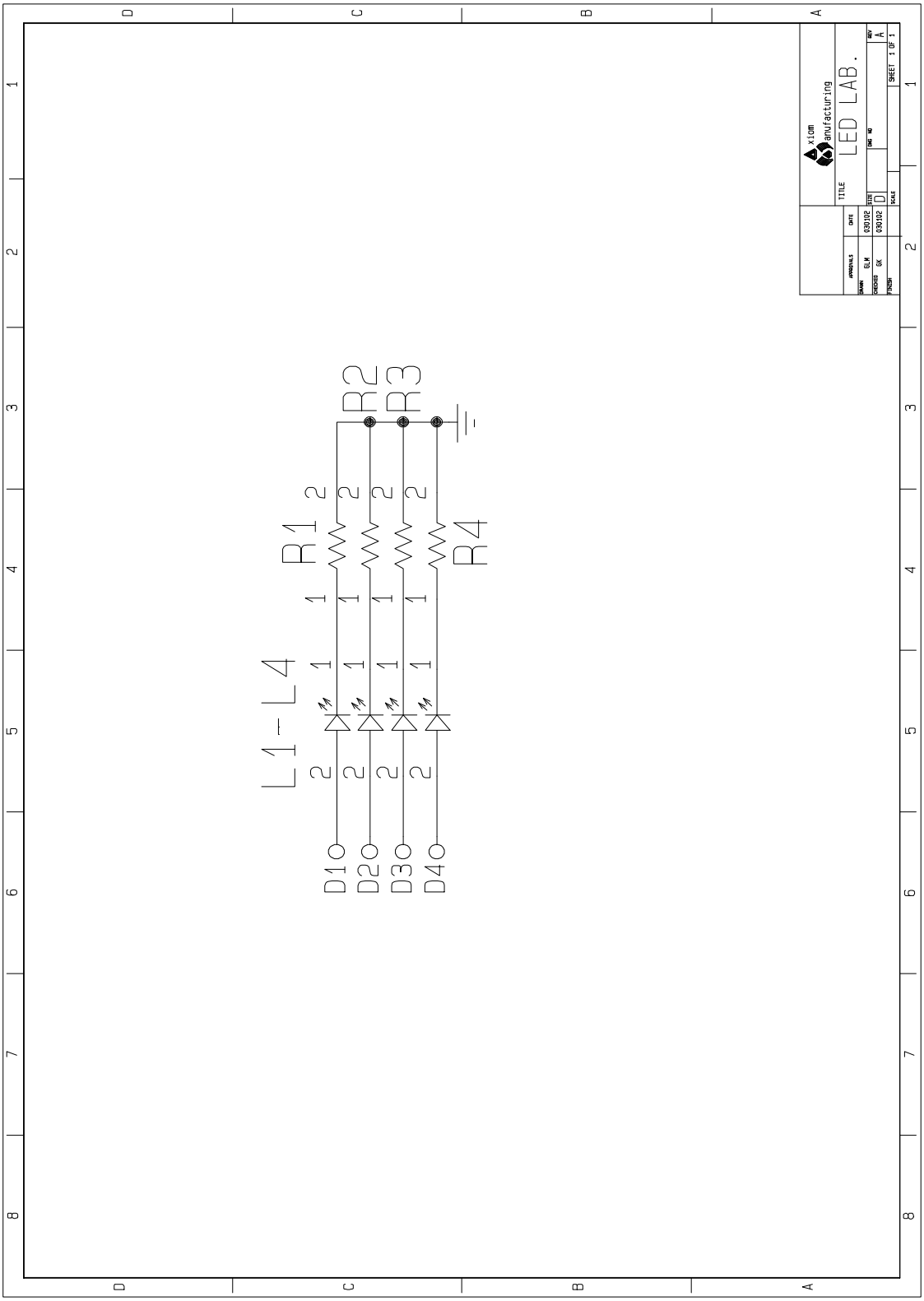
A. Counter C. Pointer
B. Adder D. Faults

7.0 TROUBLESHOOTING

The development system is fully tested and operational before shipping. If it fails to function properly, consult the troubleshooting section of your user manual.

8.0 Tips and Suggestions

Following are a number of tips, suggestions and answers to common questions that will solve most problems users have with the CME11E9 development system. You can download the latest software from the Support section of our web page at: www.axman.com


L1 - L4
R1
R2
R3
R4
D10
D20
D30
D40
x-lab
manufacturing
TITLE
LED LAB.
DWG NO
REV
A
SHEET 1 OF 1
SCALE
DATE
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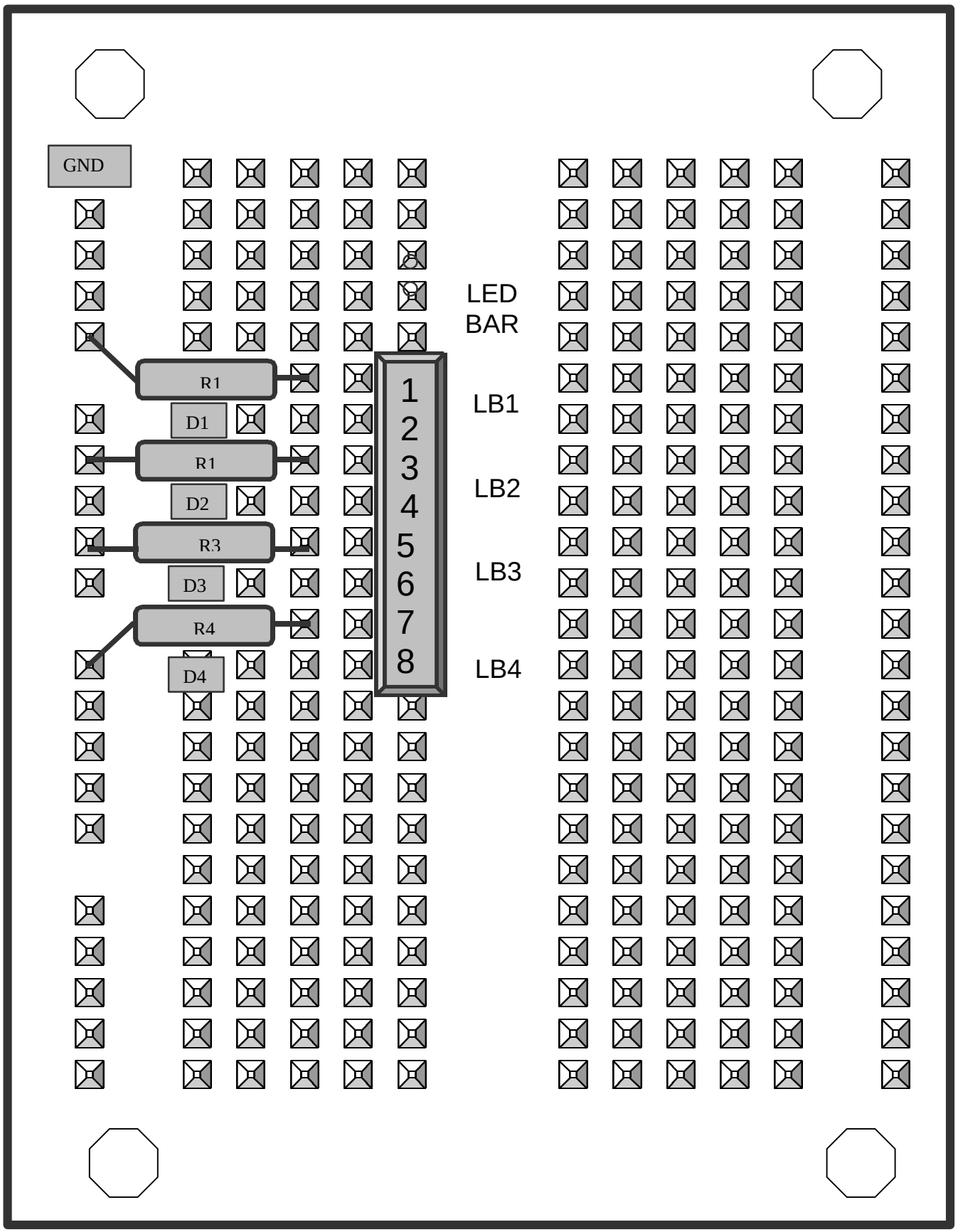
DRAWN
CHECKED
APPROVALS


GND
R1
D1
R1
D2
R3
D3
R4
D4
LED
BAR
1
2
3
4
5
6
7
8
LB1
LB2
LB3
LB4