

EIE3810 Microprocessor System Design  
Laboratory

Laboratory Report #4

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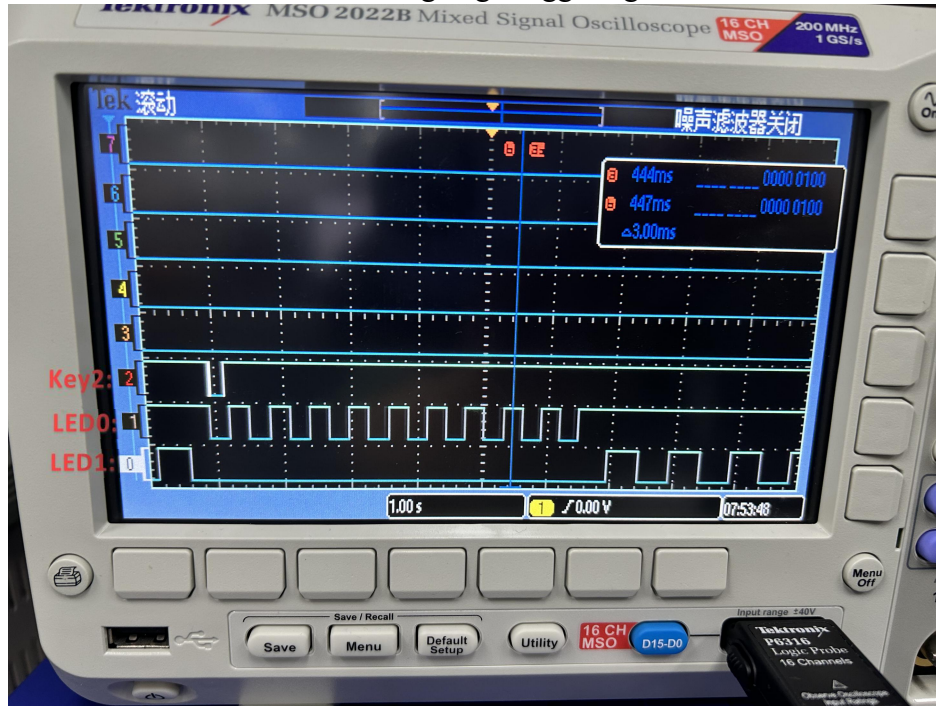
The Chinese University of Hong Kong, Shenzhen

- Experiment 1: EXTI2 interrupt and onboard Key2
- Experiment 2: EXTI interrupt and on board Key\_Up
- Experiment 3: Test interrupts priority
- Experiment 4: UART reading based on interrupt

## 1. Experiment 1

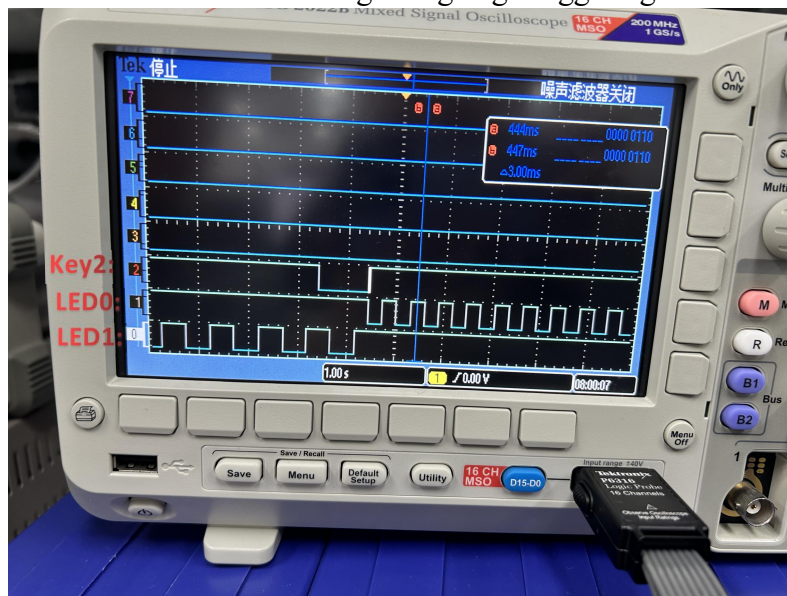
### 1.1 Result

#### A. Use falling edge triggering:



LED1 can be interrupted by Key2, and Key2 leads to 10 times flashes of LED0.

#### B. Using rising edge triggering:



LED1 can be interrupted by Key2, and Key2 leads to 10 times flashes of LED0.

## 1.2 Questions

1) We set NVIC->IP[8] = 0x65 here. What other values can have the same priority effect as pre-emption priority=0b01, and subpriority=0b10?

- 0x60,0x61,0x62,0x63,0x64,0x66,0x67,0x68,0x69,0x6A,0x6B,0x6C,0x6D,0x6E,0x6F
- Cortex-M3 implement 4 bits, so only higher 4 bits works. And priority group is 5, which means [5:4] corresponds to subpriority and [7:6] corresponds to pre-emption priority. Since 0x6=0b0110, pre-emption priority is 0b01 and subpriority is 0b10.

2) What is the difference in the observed signals on the logic analyzer screen for falling edge triggering and rising edge triggering?

- The difference is the time of triggering EXIT2.
- For falling edge triggering, when you press Key2, the level will be changed from high to low, which is falling edge. The falling edge will trigger 10 times flashes of LED0. Namely, even if you keep pressing Key2, EXIT2 is still triggered.
- For rising edge triggering, when you press and release Key2, the release of Key2 makes level from low to high, which is rising edge. The rising edge will trigger 10 times flashes of LED0. Namely, if you keep pressing Key2, EXIT2 is not triggered.

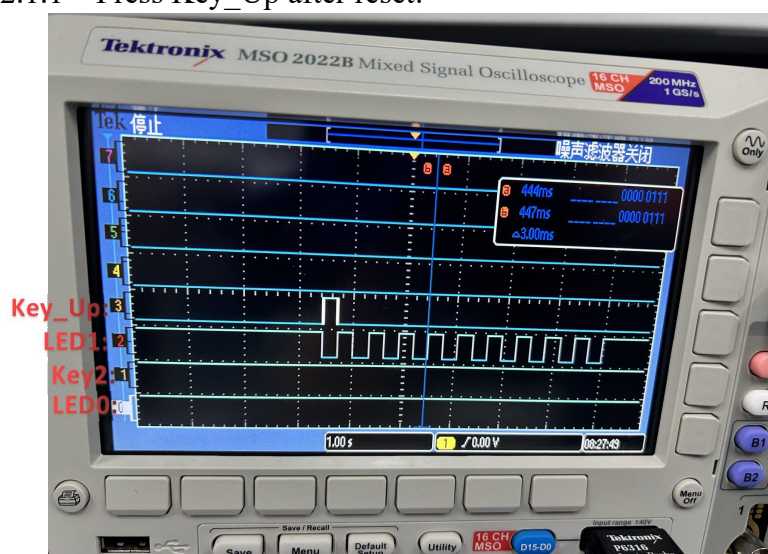
3) When you use the rising edge to trigger the interrupt, you will sometimes get the signals like in Fig. 20. Do you see the problem (falling edge trigger, instead of rising edge trigger)? Investigate this problem and explain why that occurs?

- Yes. The problem is resulted by the instant turbulence when pressing the Key2. Namely, there are both rising edge and falling edge in a very short time, although the figure looks like only one edge. So falling-like edge may lead to rising edge trigger.

## 2. Experiment 2

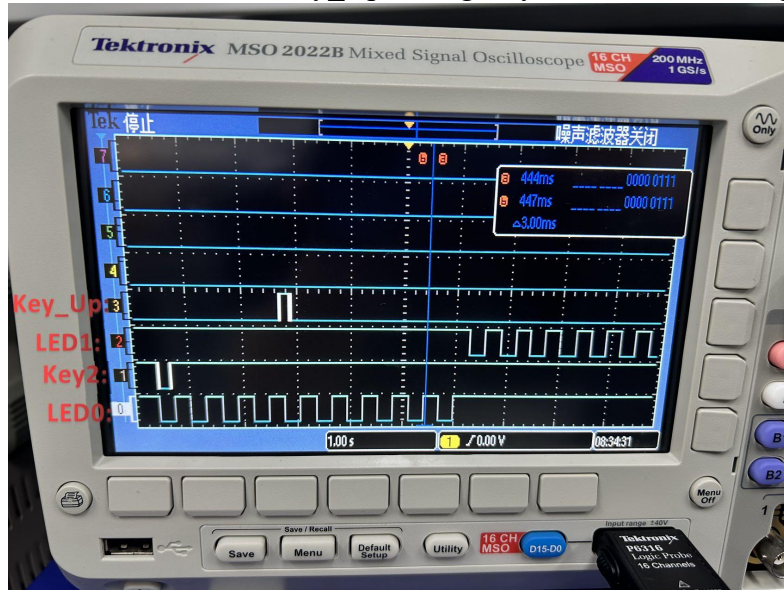
### 2.1 Result

#### 2.1.1 Press Key\_Up after reset:



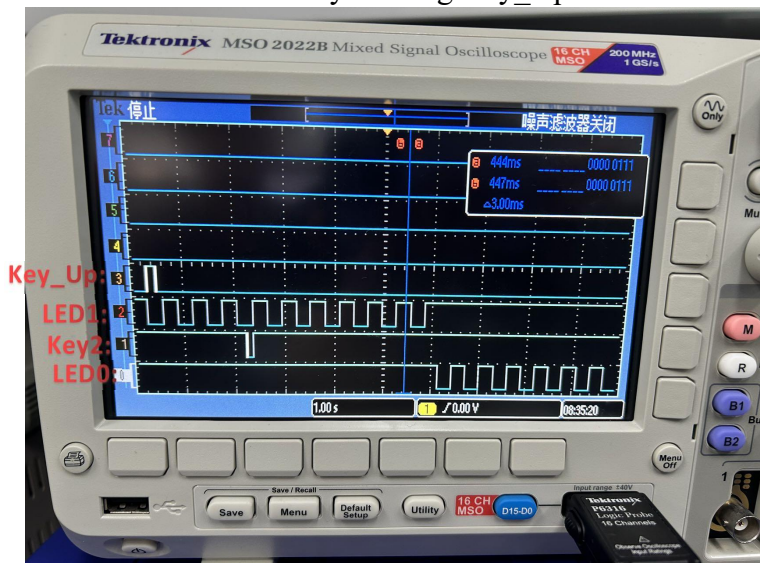
Pressing Key\_Up trigger EXIT0.

## 2.1.2 Press Key\_Up during Key2 handler is running:



Pre-emption priority of both Key\_Up and Key2 is 0b01. They can not interrupt each other. So Key\_Up needs to pend.

## 2.1.3 Press Key2 during Key\_Up handler is running:



Pre-emption priority of both Key\_Up and Key2 is 0b01. They can not interrupt each other. So Key2 needs to pend.

## 2.2 Questions

1) Do you think it is better to set a rising edge trigger or a falling edge trigger for Key\_Up? Why?

a. I think it is better to set a rising edge trigger for Key\_Up. Because there are some instant turbulence when pressing the Key2. There may be both rising edge and falling edge. This may lead to rising-like edge triggering falling edge event if we set a falling edge trigger.

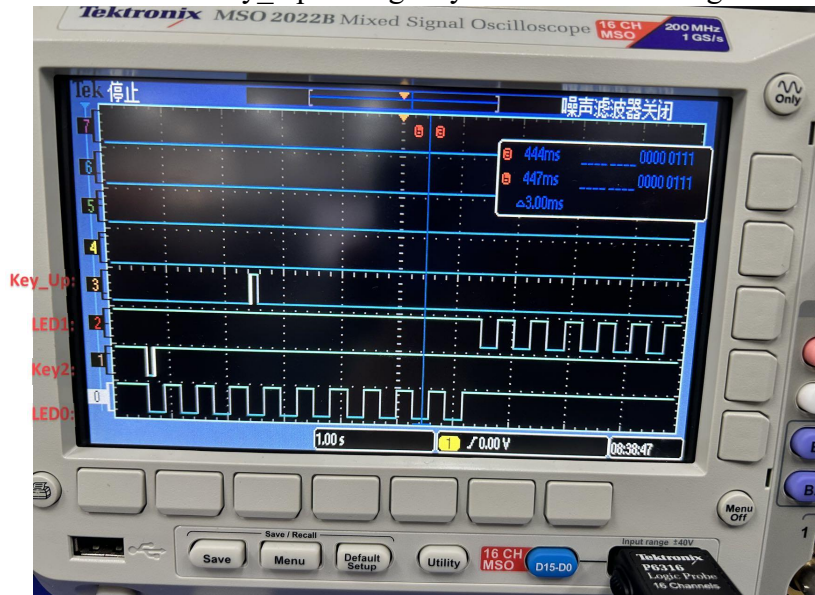


### 3. Experiment 3

#### 3.1 Result

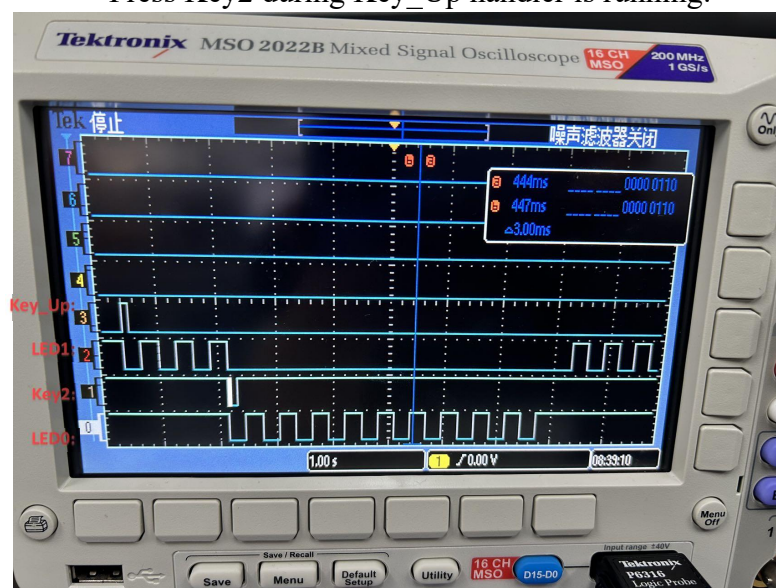
Set the priority of Key\_Up to 0x95:

Press Key\_Up during Key2 handler is running:



Pre-emption priority of Key\_Up is 0b10 and Key2 is 0b01. Key\_Up can not interrupt Key2. So Key\_Up needs to pend.

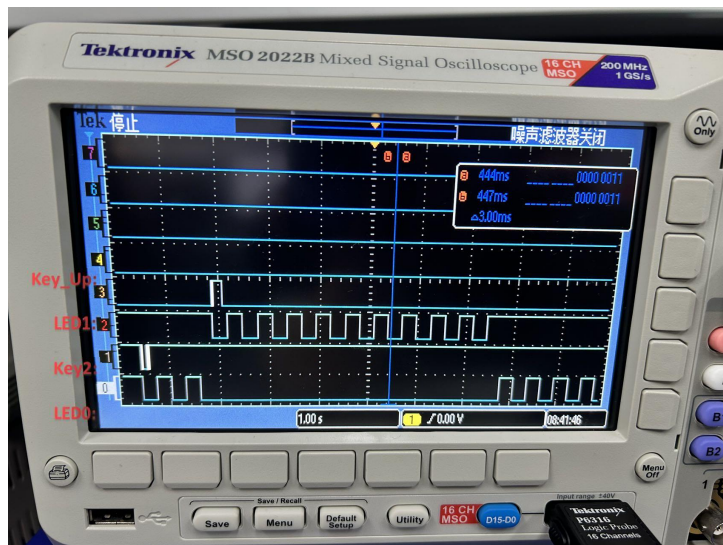
Press Key2 during Key\_Up handler is running:



Pre-emption priority of Key\_Up is 0b10 and Key2 is 0b01. Key2 can interrupt Key\_Up.

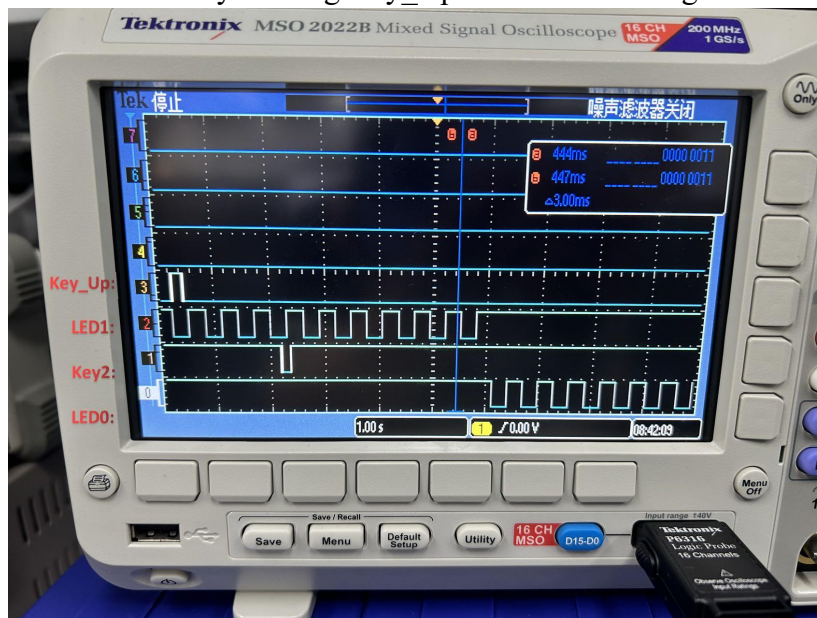
Set the priority of Key\_Up to 0x35:

Press Key\_Up during Key2 handler is running:



Pre-emption priority of Key\_Up is 0b00 and Key2 is 0b01. Key\_Up can interrupt Key2.

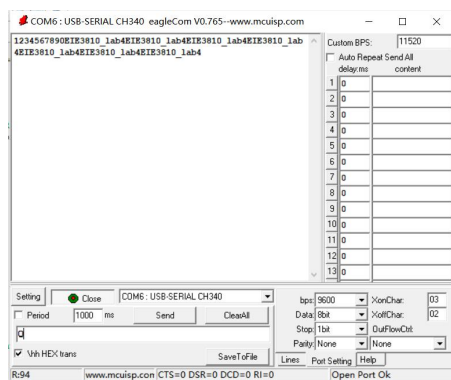
Press Key2 during Key\_Up handler is running:



Pre-emption priority of Key\_Up is 0b00 and Key2 is 0b01. Key2 can not interrupt Key\_Up. So Key2 needs to pend.

## 4. Experiment 4

### 4.1 Result



The output of USART, and send "Q".

[illegible]A close-up photograph of the ALIENTEK 4.3" TFT LCD module. The blue PCB features a red RESET button and four yellow push-buttons labeled KEY2, KEY1, and KEY0. A black ribbon cable is connected to the top. The text "ALIENTEK 4.3" TFTLCD" is printed on the board.

COM6: USB-SERIAL CH340 eagleCom V0.765-www.mcuisp.com

Custom BPS: 11520

Auto Repeat Send All  
delay:ms content

1	0	
2	0	
3	0	
4	0	
5	0	
6	0	
7	0	
8	0	
9	0	
10	0	
11	0	
12	0	
13	0	

Setting COM6: USB-SERIAL CH340

☐ Period 1000 ms

☐ Vrh HEX trans

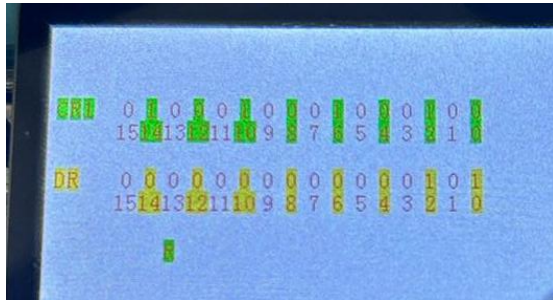
bps: 9600 XonChar: 03  
Data: 8bit XoffChar: 02  
Stop: 1bit OutFlowCtrl:  
Parity: None None

Lines Port Setting Help

R:754 S:3 CTS=0 DSR=0 DCD=0 RI=0 Open Port Ok



We will see CR1, DR and a “R”:



## 5. Conclusion

I have learned how to use external interrupt and arrange the pre-emption priority and subpriority of EXTIx. This helps us to understand operating system works. And interrupt is an efficient method to execute programs. I also have learn how to set priority of EXTIx. And I also know what situation will lead to pending and interrupt.