

Name: _____

ID: _____

NYU Tandon School of Engineering

During the COVID pandemic, one of the most monitored biometric parameter measured was blood oxygen saturation, or SpO_2 . One of the most available sensors to make this measurement, as well as heart rate is the MAX30100 chip. Attached is the datasheet for your review.

Review the I2C section of the datasheet.

The objective of this exam is to connect to the MAX30100 chip and retrieve SP02 information (Red LED and IR LED) from the FIFO buffer. We also wish to capture the interrupt and toggle the onboard LED every time a measurement is received.

1. Read the relevant parts of attached datasheet to familiarize yourself to the device. Specifically focus on the serial communications part (pages 23-26), the register map shown on page 10.
 2. Using the pin diagram on Page 8, sketch a schematic that connects you Adafruit Classic I2C bus to the correct pins on the MAX30100. Don't forget pull up resistors. Also connect the INT pin from the sensor to a generic GPIO pin (you can choose which one). Pick wisely though since you will need to write an interrupt handler for this pin to capture when an SP02 measurement is ready.
 3. Start a new project in PlatformIO, chose your Adafruit Classic, and select Arduino framework.
 4. Write the setup code to:
 - a. Start the I2C bus.
 - b. Configure the onboard LED (Red) as an output to control the LED. Do this by setting the correct DDR register.
 - c. Start the Serial bus so that we can display the MAX30100 LED Values in the serial terminal.
 - d. Configure the sensor:
 - i. Configure the GPIO pin connected to the sensor's INT pin as an input
 - ii. Configure the GPIO pin to handle the interrupt (configure EICRA/EIMSK, etc.) Also prepare the handler `ISR(xxx_vect) {}`
 - iii. Configure the MAX30100 interrupt pin (register addresses 0x00 and 0x01)
 - iv. Set sensor mode to SP02 (See register address 0x06, MODE BITS)
 - v. Leave default settings in SP02 Config register (0x07)
 5. Write a function called `GetData()` that communicates I2C to the chip and retrieves (and returns) the values of the sensor's Red LED and the IR LED. This involves:
 - a. Reading the FIFO Data register (0x05). Be sure to fully read the DATASHEET pages 12-15 to understand fully how the FIFO works and how the data for the 2 sensor LEDs are provided. Pseudo code is provided in the datasheet as well. You can use any of the Wire Library functions ([Wire - Arduino Reference](#))
 6. Write the ISR for the external interrupt that you configured to receive the SP02 Measurement RDY interrupt. You can call `GetData()` from 5. Also write the code to display the SHORT value of both the Red LED and the IR LED to the terminal. You should also blink the on board Red LED each time the interrupt is received.
 7. Submit 2 files, your schematic and your code file (with full comments please!)
- Good luck!