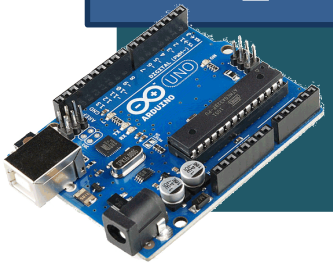
2022년 IoT기반 스마트 솔루션 개발자 양성과정



Firmware [펌웨어]

15-RTC DS1302

담당 교수 : 유근택

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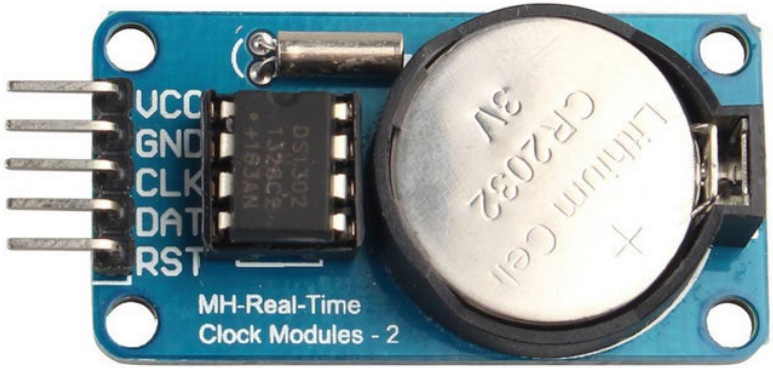
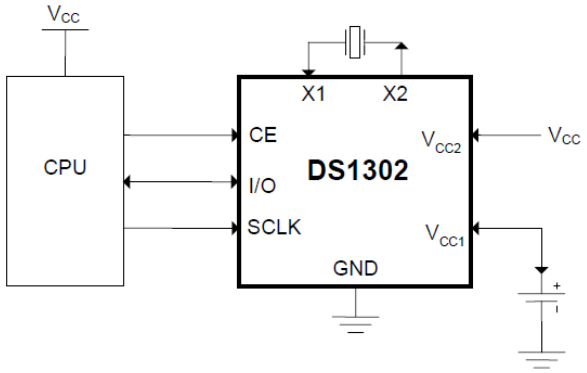
DS1302

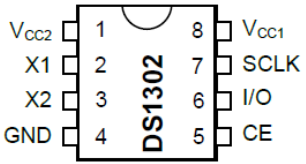

VCC
GND
CLK
DAT
RST
MH-Real-Time
Clock Modules - 2
Lithium Cell
CR2032
3V

DS1302 Trickle-Charge Timekeeping Chip

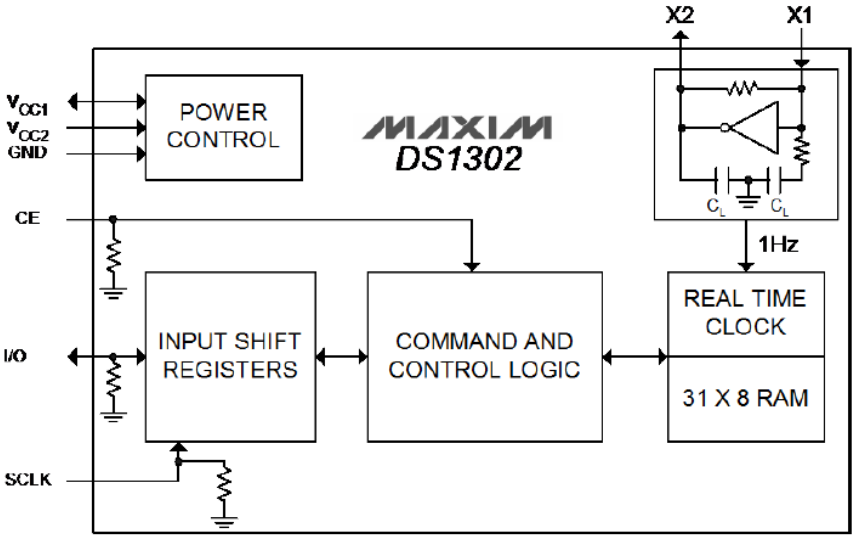
- Completely Manages All Timekeeping Functions
  - Real-Time Clock Counts Seconds, Minutes, Hours, Date of the Month, Month, Day of the Week, and Year with Leap-Year Compensation Valid Up to 2100
  - 31 x 8 Battery-Backed General-Purpose RAM
- Simple Serial Port Interfaces to Most Microcontrollers
  - Simple 3-Wire Interface
  - TTL-Compatible (VCC = 5V)
  - Single-Byte or Multiple-Byte (Burst Mode) Data Transfer for Read or Write of Clock or RAM Data
- Low Power Operation Extends Battery Backup Run Time
  - 2.0V to 5.5V Full Operation
  - Uses Less Than 300nA at 2.0V

Architecture



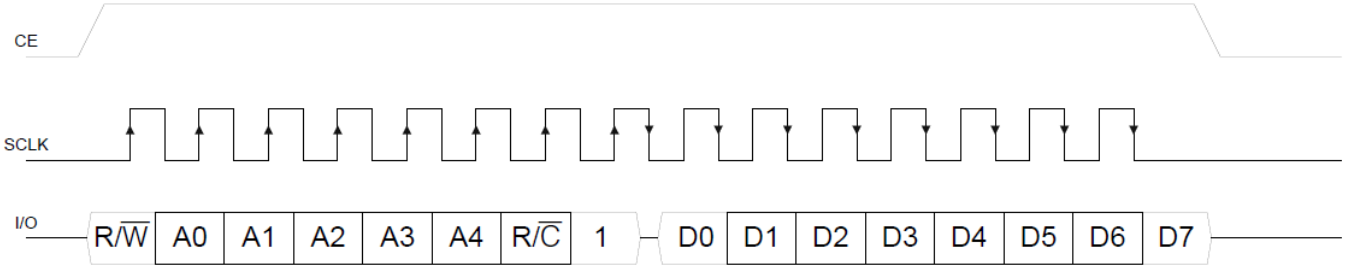


DIP (300 mils)

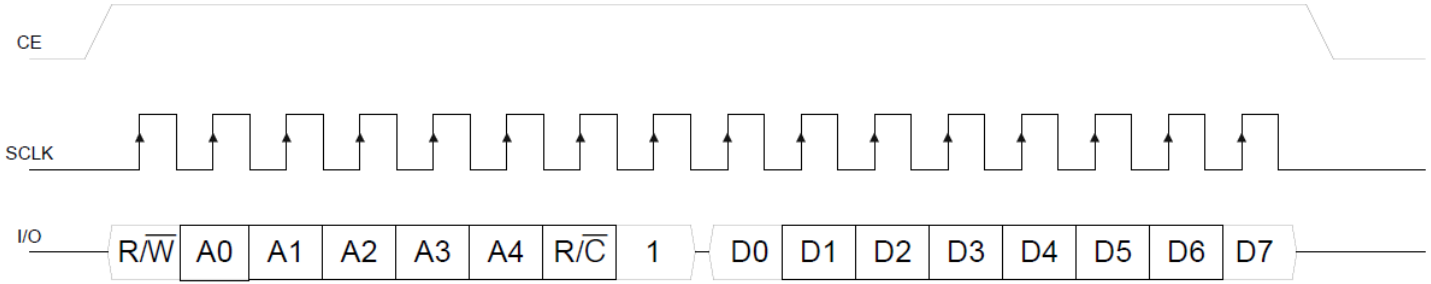


Data Transfer Summary

SINGLE-BYTE READ



SINGLE-BYTE WRITE



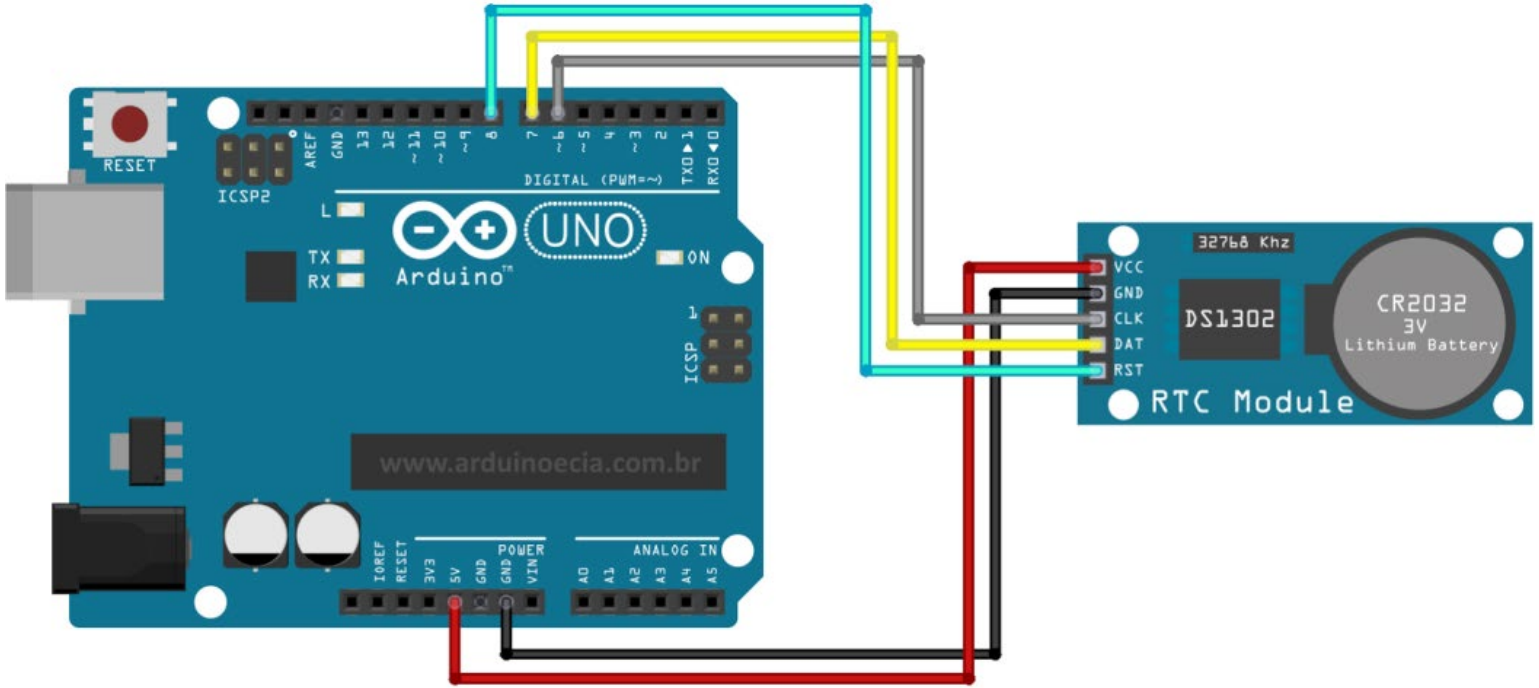
NOTE: IN BURST MODE, CE IS KEPT HIGH AND ADDITIONAL SCLK CYCLES ARE SENT UNTIL THE END OF THE BURST.

Register Address/Definition

RTC

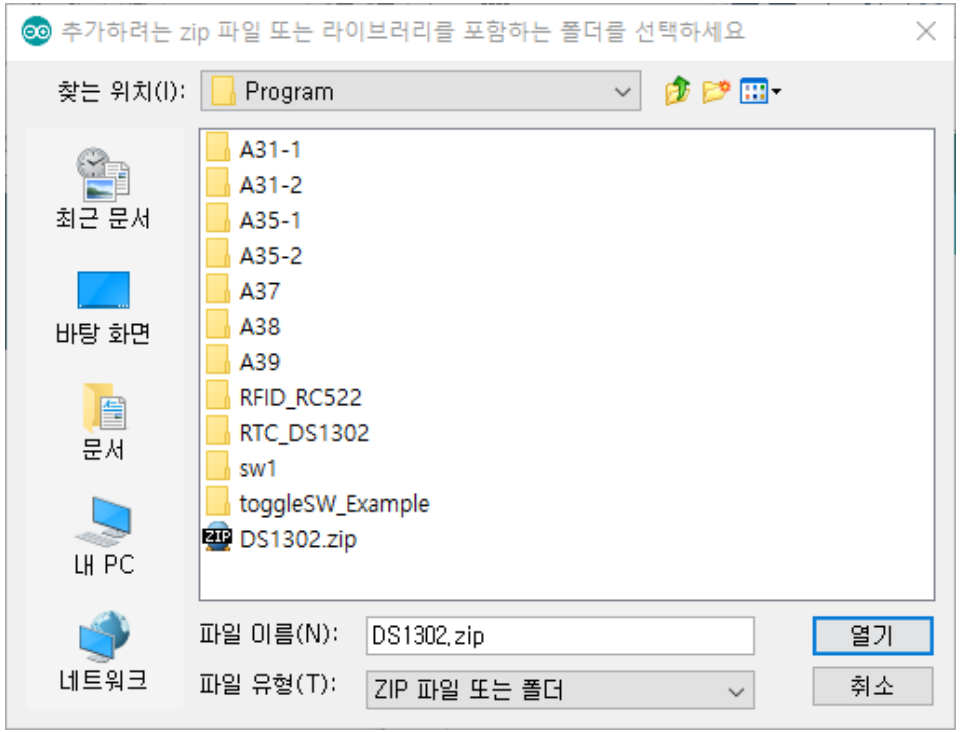
READ	WRITE	BIT 7	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0	RANGE
81h	80h	CH	10 Seconds			Seconds				00–59
83h	82h		10 Minutes			Minutes				00–59
85h	84h	12/$\overline{24}$	0	10 $\overline{\text{AM}}$/PM	Hour	Hour				1–12/0–23
87h	86h	0	0	10 Date		Date				1–31
89h	88h	0	0	0	10 Month	Month				1–12
8Bh	8Ah	0	0	0	0	0	Day			1–7
8Dh	8Ch	10 Year				Year				00–99
8Fh	8Eh	WP	0	0	0	0	0	0	0	—
91h	90h	TCS	TCS	TCS	TCS	DS	DS	RS	RS	—

Wiring


RESET
ICSP2
AREF
GND
13
12
~11
~10
~9
8
7
~6
~5
4
~3
2
TX→1
RX←0
DIGITAL (PWM=~)
L
TX
RX
UNO
Arduino™
ON
ICSP
www.arduinoecia.com.br
POWER
ANALOG IN
IOREF
RESET
3V3
5V
GND
GND
VIN
A0
A1
A2
A3
A4
A5
32768 Khz
VCC
GND
CLK
DAT
RST
DS1302
CR2032
3V
Lithium Battery
RTC Module

ZIP 라이브러리 추가

- 메뉴 [스케치].[라이브러리 포함하기].[.ZIP 라이브러리 추가]



Functions

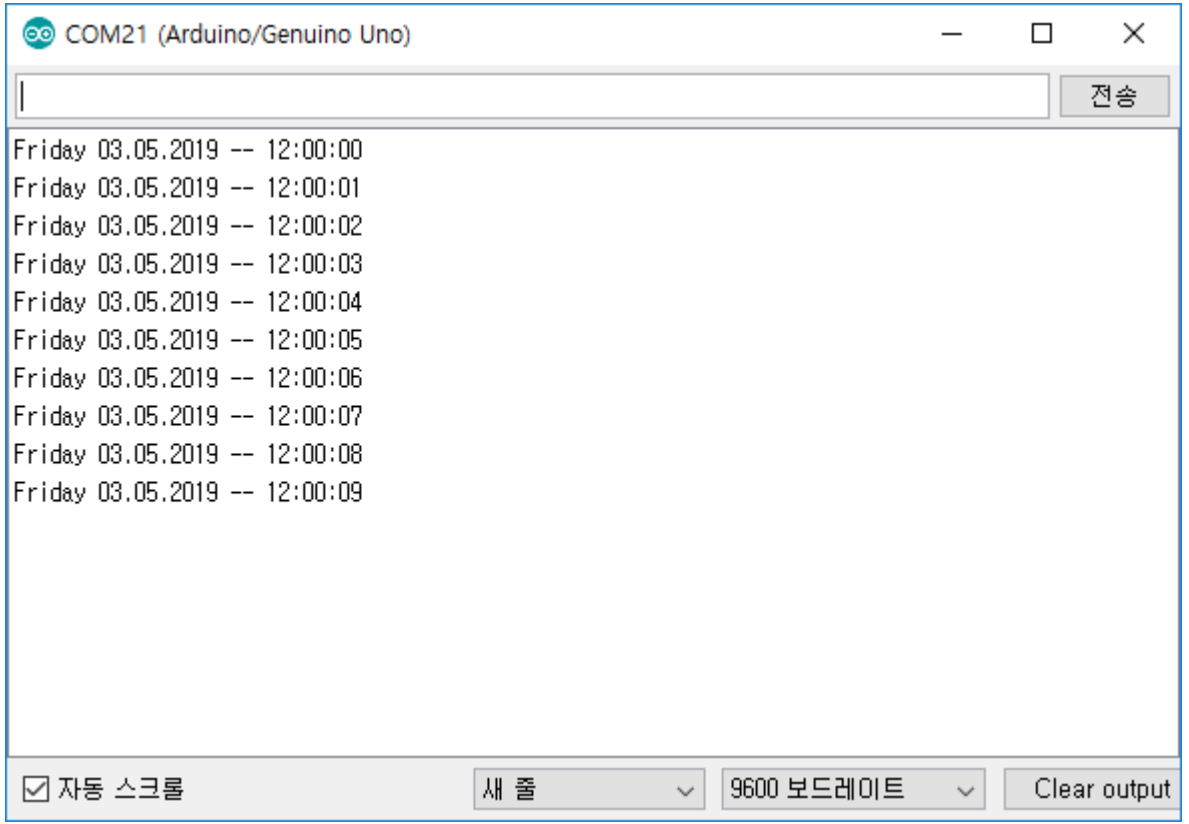
- DS1302(CE,IO,SCLK)
- t = rtc.getTime();
- setTime(hour,min,sec);
- setDate(data,mon,year);
- setDOW(dow); //set the day of the week
- getTimeStr(foramat);
- getDateStr([slformat[,eformat[,divider]]]);
- getDOWStr([format]);
- getMonthStr([format]);
- halt(value); //true or false, CH flag

  rtc.halt(true)
- writeProtect(enable); true or false, WP bit
- poke(address,value); // Write one single bye to on-chip RAM
- peek(address,value); // Read one single bye to on-chip RAM

DS1302_Serial-1

```
#include <DS1302.h>
DS1302 rtc(8, 7, 6);

void setup( ){
  rtc.halt(false);
  rtc.writeProtect(false);

  rtc.setDOW(FRIDAY);
  rtc.setTime(12, 0, 0);          // 12:00:00 (24hr format)
  rtc.setDate(09, 05, 2022);  // 2019-05-03
  Serial.begin(9600);
}

void loop( ) {
  Serial.print(rtc.getDOWStr());
  Serial.print(" ");
  Serial.print(rtc.getDateStr());
  Serial.print(" -- ");
  Serial.println(rtc.getTimeStr());

  delay (1000);
}
```

Run

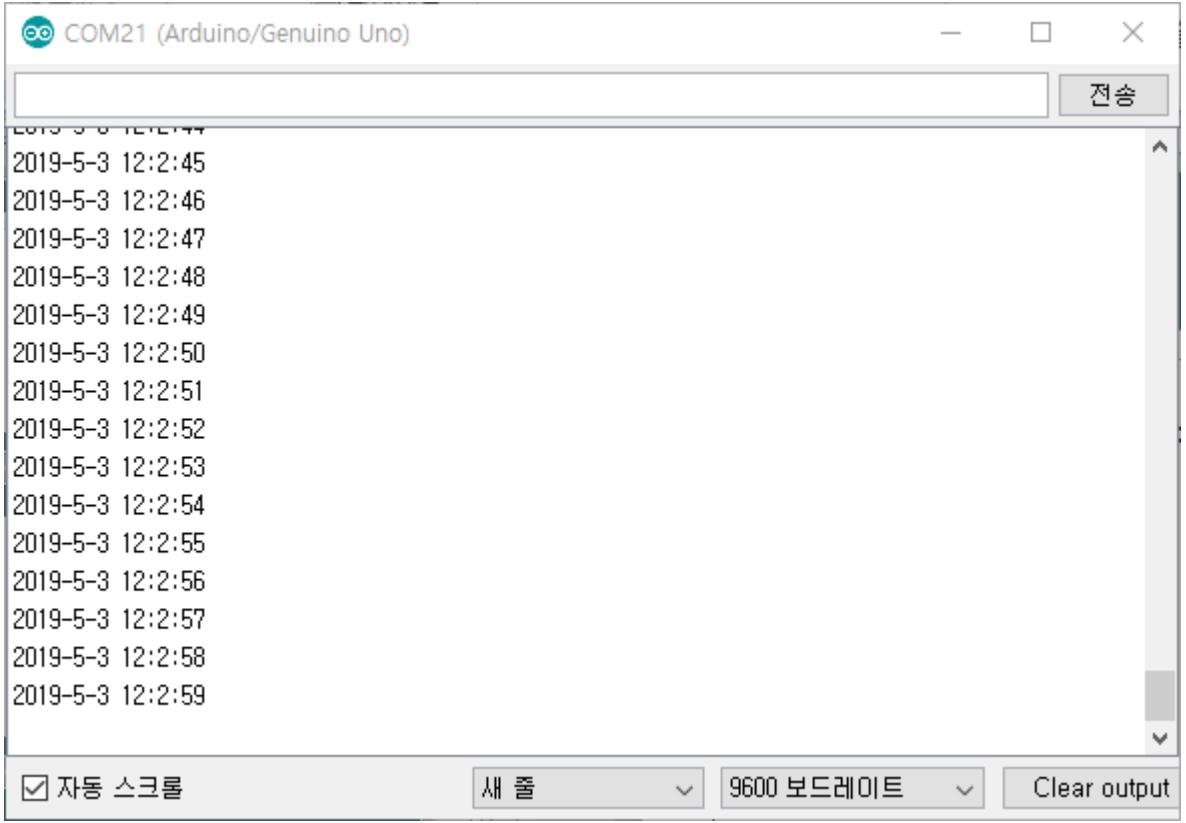

COM21 (Arduino/Genuino Uno)
전송
Friday 03.05.2019 -- 12:00:00
Friday 03.05.2019 -- 12:00:01
Friday 03.05.2019 -- 12:00:02
Friday 03.05.2019 -- 12:00:03
Friday 03.05.2019 -- 12:00:04
Friday 03.05.2019 -- 12:00:05
Friday 03.05.2019 -- 12:00:06
Friday 03.05.2019 -- 12:00:07
Friday 03.05.2019 -- 12:00:08
Friday 03.05.2019 -- 12:00:09
자동 스크롤
새 줄
9600 보드레이트
Clear output

DS1302_Serial-2

```
#include <DS1302.h>
#define SCK_PIN 6
#define IO_PIN 7
#define RST_PIN 8

DS1302 rtc(RST_PIN, IO_PIN, SCK_PIN);
Time thisTime;

void setup( ){
  rtc.halt(false);
  rtc.writeProtect(false);

  rtc.setDOW(MONDAY);      // Set Day-of-Week to MONDAY
  rtc.setTime(12, 0, 0);     // Set the time to 12:00:00 (24hr format)
  rtc.setDate(9, 5, 2022);   // Set the date to April 3th, 2019

  Serial.begin(9600);
}
```

```
void loop( ){
  thisTime = rtc.getTime();

  Serial.print(thisTime.year, DEC);
  Serial.print("-");
  Serial.print(thisTime.mon, DEC);
  Serial.print("-");
  Serial.print(thisTime.date, DEC);
  Serial.print(" ");

  Serial.print(thisTime.hour, DEC);
  Serial.print(":");
  Serial.print(thisTime.min, DEC);
  Serial.print(":");
  Serial.println(thisTime.sec, DEC);

  delay (1000);
}
```

Run


COM21 (Arduino/Genuino Uno)
전송
2019-5-3 12:2:45
2019-5-3 12:2:46
2019-5-3 12:2:47
2019-5-3 12:2:48
2019-5-3 12:2:49
2019-5-3 12:2:50
2019-5-3 12:2:51
2019-5-3 12:2:52
2019-5-3 12:2:53
2019-5-3 12:2:54
2019-5-3 12:2:55
2019-5-3 12:2:56
2019-5-3 12:2:57
2019-5-3 12:2:58
2019-5-3 12:2:59
자동 스크롤
새 줄
9600 보드레이트
Clear output

Time Setting

- Serial 통신으로 시간을 설정해 보자
- 예
  - 2019-05-08 THURSDAY 12:10:00

2	0	1	9	-	0	5	-	0	8		T	H	U	T	S	D	A	Y		1	2	:	1	0	:	0	0	₩R	₩N

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
7	1	2	3	4	5	6

Syntax

- indexOf : 문자열 검색
  - atPosition =myString.indexOf(val, from)
  - val : the value to search for - char or String
- Substring : 문자열 자르기
  - subStr=myString.substring(from, to)
- compareTo ; 문자열 비교
  - myString.compareTo(myString2)
  - Returns
    - a negative number: if myString comes before myString2
    - 0: if String equals myString2
    - a positive number: if myString comes after myString2

DS1302_Serial-3 : setup / main

```
#include <DS1302.h>

#define SCK_PIN 6
#define IO_PIN 7
#define RST_PIN 8

DS1302 rtc(RST_PIN, IO_PIN, SCK_PIN);
Time thisTime;
String DOW[ ]={"SUNDAY", "MONDAY", "TUESDAY", "WEDNESDAY", "THURSDAY", "FRIDAY", "SATURDAY", "SUNDAY"};

void setup( ){
  Serial.begin(9600);
}

void loop( ){
  if (Serial.available( )){
    SetSerialTime( );
  }else{
    thisTime = rtc.getTime( );
    Serial.print("Now ");
  }
  SendSerialTime( );
  delay (1000);
}
```

DS1302_Serial-3 : SetSerialTime

```
void SetSerialTime( ){
    String Rxd;
    int LastPoint,FistPoint;

    Rxd=Serial.readStringUntil('₩r₩n');

    LastPoint=Rxd.indexOf('-');
    thisTime.year=Rxd.substring(0,LastPoint).toInt();
    FistPoint=LastPoint+1;
    LastPoint=Rxd.indexOf('-',FistPoint);
    thisTime.mon=Rxd.substring(FistPoint,LastPoint).toInt();
    FistPoint=LastPoint+1;
    LastPoint=Rxd.indexOf(' ',FistPoint);
    thisTime.date=Rxd.substring(FistPoint,LastPoint).toInt();

    FistPoint=LastPoint+1;
    LastPoint=Rxd.indexOf(' ',FistPoint);
    thisTime.dow=DayOfWeekNo(Rxd.substring(FistPoint,LastPoint));
```

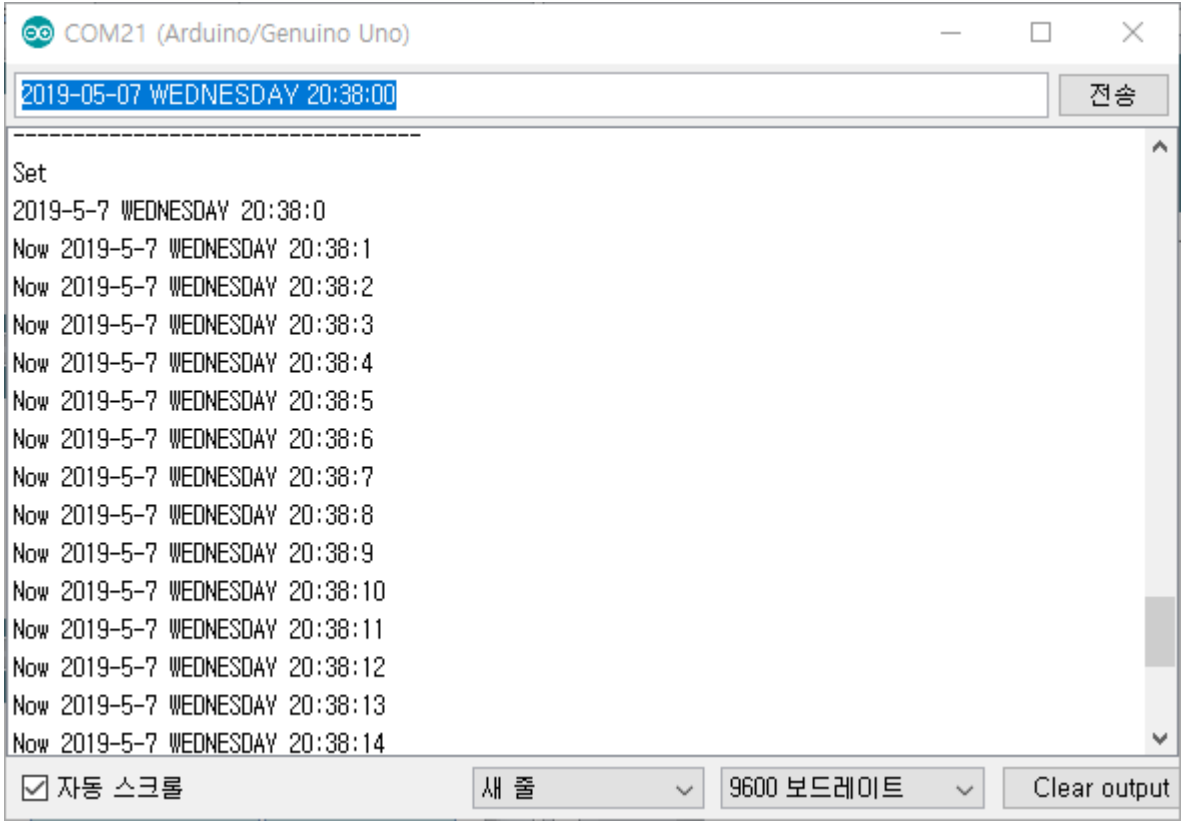
```
    FistPoint=LastPoint+1;
    LastPoint=Rxd.indexOf(':',FistPoint);
    thisTime.hour=Rxd.substring(FistPoint,LastPoint).toInt();
    FistPoint=LastPoint+1;
    LastPoint=Rxd.indexOf(':',FistPoint);
    thisTime.min=Rxd.substring(FistPoint,LastPoint).toInt();
    FistPoint=LastPoint+1;
    LastPoint=Rxd.indexOf(':',FistPoint);
    thisTime.sec=Rxd.substring(FistPoint,LastPoint).toInt();

    rtc.halt(false);
    rtc.writeProtect(false);
    rtc.setTime(thisTime.hour, thisTime.min, thisTime.sec);
    rtc.setDOW(thisTime.dow);
    rtc.setDate(thisTime.date, thisTime.mon, thisTime.year);
    rtc.writeProtect(true);

    Serial.println("---------------------------------");
    Serial.println("Set ");
}
```

DS1302_Serial-3 : SendSerial / Dow

```
void SendSerialTime( ){
  Serial.print(thisTime.year, DEC);
  Serial.print("-");
  Serial.print(thisTime.mon, DEC);
  Serial.print("-");
  Serial.print(thisTime.date, DEC);
  Serial.print("  ");

  Serial.print(DOW[thisTime.dow]);
  Serial.print("  ");

  Serial.print(thisTime.hour, DEC);
  Serial.print(":");
  Serial.print(thisTime.min, DEC);
  Serial.print(":");
  Serial.println(thisTime.sec, DEC);
}
```

```
int DayOfWeekNo(String strDow){
  if (strDow.compareTo("SUNDAY")==0) return 7;
  else if (strDow.compareTo("MONDAY")==0) return 1;
  else if (strDow.compareTo("TUESDAY")==0) return 2;
  else if (strDow.compareTo("WEDNESDAY")==0) return 3;
  else if (strDow.compareTo("THURSDAY")==0) return 4;
  else if (strDow.compareTo("FRIDAY")==0) return 5;
  else if (strDow.compareTo("SATURDAY")==0) return 6;
  else return 0;
}
```

Run


COM21 (Arduino/Genuino Uno)
2019-05-07 WEDNESDAY 20:38:00
전송
Set
2019-5-7 WEDNESDAY 20:38:0
Now 2019-5-7 WEDNESDAY 20:38:1
Now 2019-5-7 WEDNESDAY 20:38:2
Now 2019-5-7 WEDNESDAY 20:38:3
Now 2019-5-7 WEDNESDAY 20:38:4
Now 2019-5-7 WEDNESDAY 20:38:5
Now 2019-5-7 WEDNESDAY 20:38:6
Now 2019-5-7 WEDNESDAY 20:38:7
Now 2019-5-7 WEDNESDAY 20:38:8
Now 2019-5-7 WEDNESDAY 20:38:9
Now 2019-5-7 WEDNESDAY 20:38:10
Now 2019-5-7 WEDNESDAY 20:38:11
Now 2019-5-7 WEDNESDAY 20:38:12
Now 2019-5-7 WEDNESDAY 20:38:13
Now 2019-5-7 WEDNESDAY 20:38:14
자동 스크롤
새 줄
9600 보드레이트
Clear output

Alarm Setting

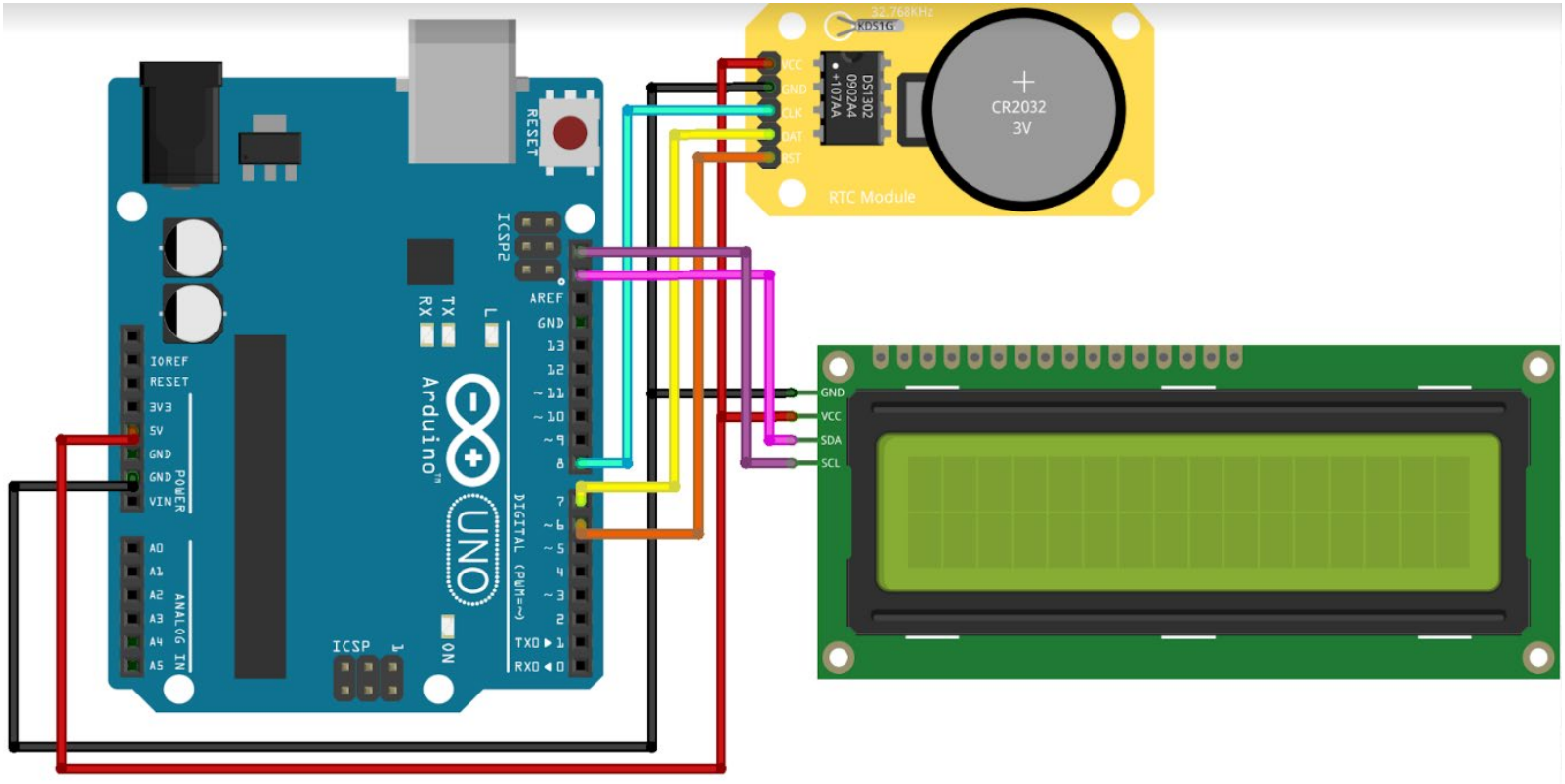
- Serial을 통하여 시간 설정과 Alarm설정을 해보자
- 예
  - @ 2019-05-08 THURSDAY 12:10:00 : 시간설정

@		2	0	2	2	-	0	5	-	0	9		M	O	N	D	A	Y		1	2	:	1	0	:	0	0	₩R	₩N

  - * 12:10:00 : Alarm 설정

*		1	2	:	1	0	:	0	0	₩R	₩N

DS1302 - I2C LCD



```
#include <DS1302.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>

#define  SCK_PIN 6          //  2
#define  IO_PIN   7         //  4
#define  RST_PIN 8          //  5

DS1302 rtc(RST_PIN, IO_PIN, SCK_PIN);

LiquidCrystal_I2C lcd(0x27,16,2);

void setup() {
  // put your setup code here, to run once:

  Serial.begin(9600);

  lcd.init();
  lcd.backlight();

  rtc.setDOW(MONDAY);     //요일 설정
  rtc.setTime(11,36,0); // 시간설정(시간,분,초)
  rtc.setDate(02,05,2022); //날짜 설정(일, 월, 년)
}
void loop() {
  Serial.print(rtc.getDOWStr());
  Serial.print(rtc.getDateStr());
  Serial.print(" -- ");
  Serial.println(rtc.getTimeStr());

  lcd.clear();
  data();
  printTime();
  delay(1000);
}

void data(){
  lcd.setCursor(0,0);
  lcd.print(rtc.getDOWStr());
  lcd.setCursor(3,1);
  lcd.print(rtc.getDateStr());
  }

  void printTime(){
    lcd.setCursor(8,0);
    lcd.print(rtc.getTimeStr());
   }
```