2022년 IoT기반 스마트 솔루션 개발자 양성과정

Embedded Application

5-MQ5 Gas Sensor

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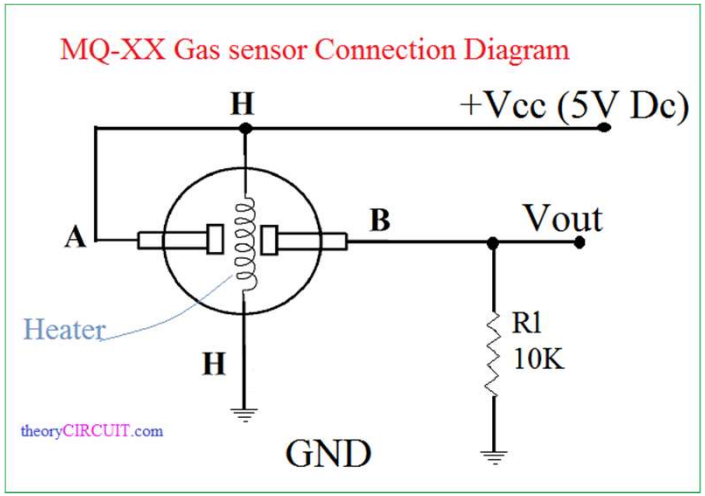
Gas Sensor

- 가스의 누설, 농도의 측정, 가스의 종류들을 판별
- 가스 센서는 실내 오염공기(담배연기, 연료용-LPG/NG, 유기용제 등)를 피해 한계치 이하에서 감지가 가능 하도록 개발된 센서

MQ-XX Gas Sensor



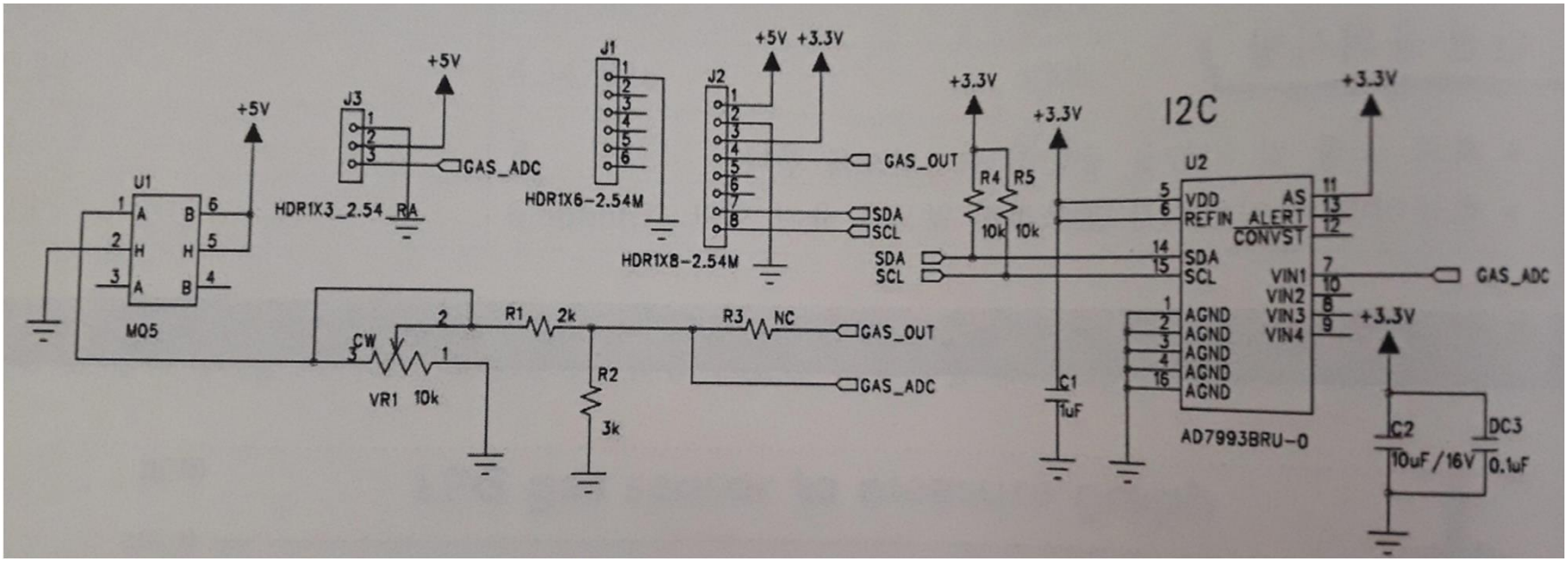
MQ-XX Sensor Serise

- MQ-2 = flammable gases such as LPG and propane;
- MQ-3 = ethanol;
- MQ-4 = methane (CH4) and natural gas;
- MQ-5 = LPG and methane;
- MQ-6 = LPG and methane;
- MQ-7 = carbonic monoxide (CO) and hydrogen (H2);
- MQ-8 = hydrogen (H2);
- MQ-135 = gaseous ammonia (NH3), benzene, ethyl alcohol and carbonic dioxide (CO2).

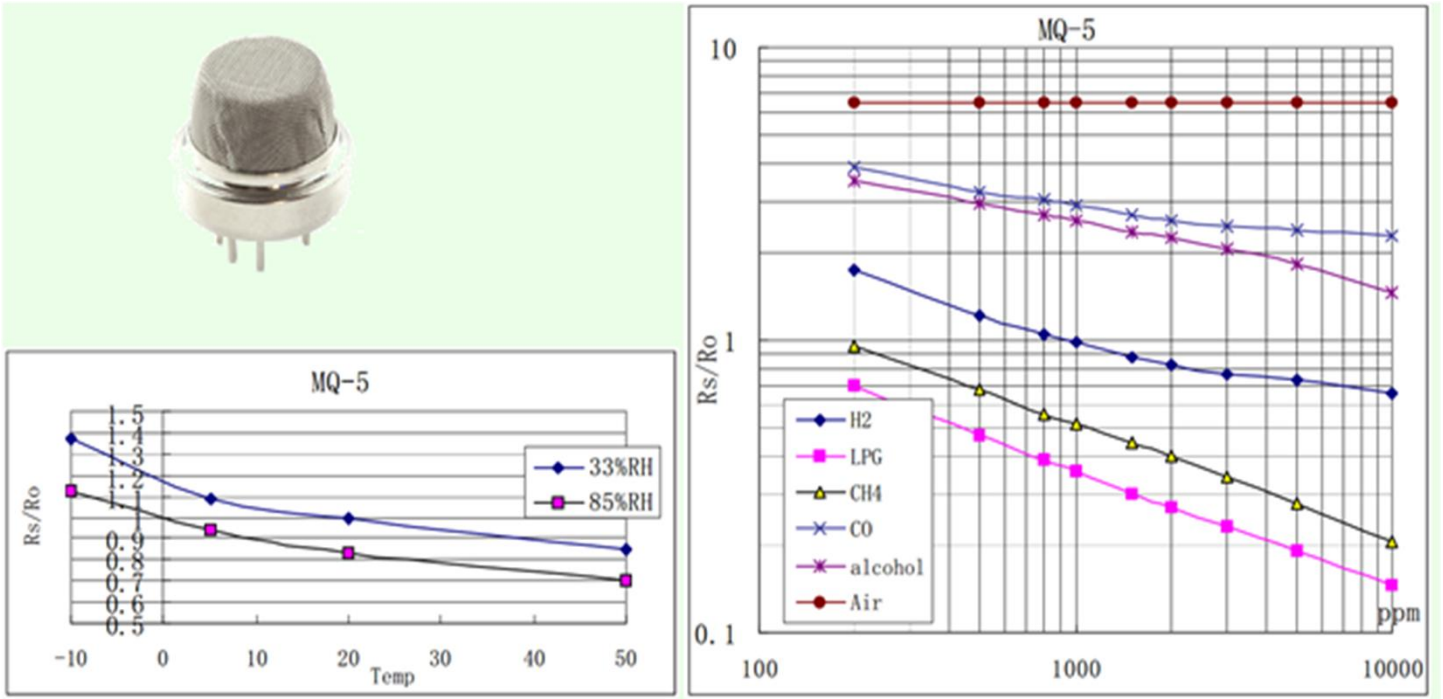
MQ5 Gas Sensor

센서 모듈 외형	모듈 항목	모듈 항목의 내용
	가스 센서	MQ-5
	높은 감도	LPG, Natural gas, Town gas
	낮은 감도	Alcohol, Smoke
	동작 전압	5V
	입력/출력	3pin Header (2.54mm pitch)
LPG, 천연가스, 석탄, 부탄, 알코올, 담배연기 등을 감지하는 센서 모듈		

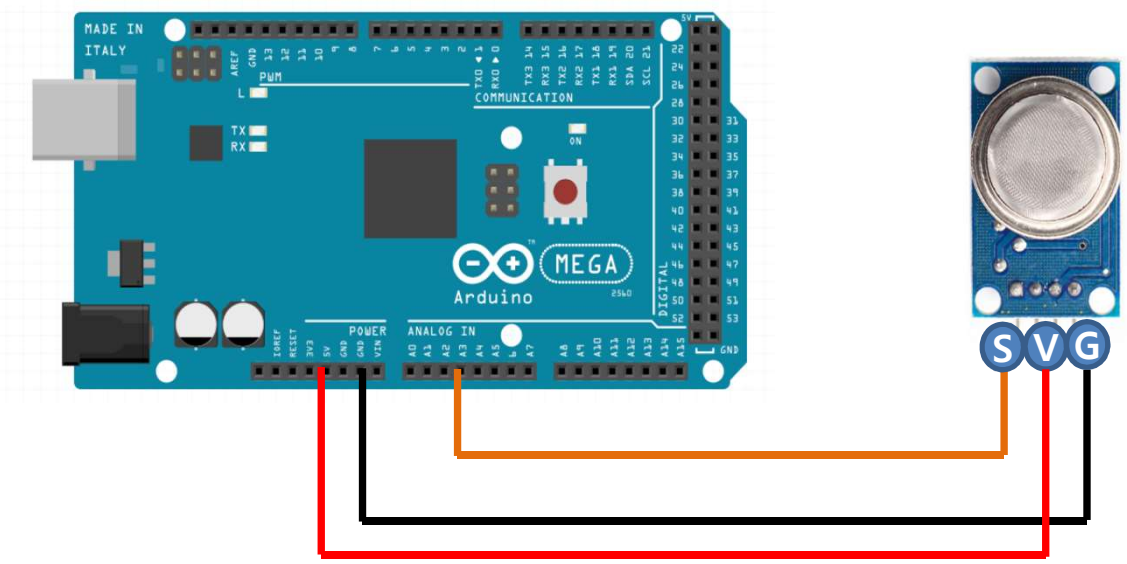
MQ5 Gas Sensor Circuit



MQ5 Gas Sensor 특성



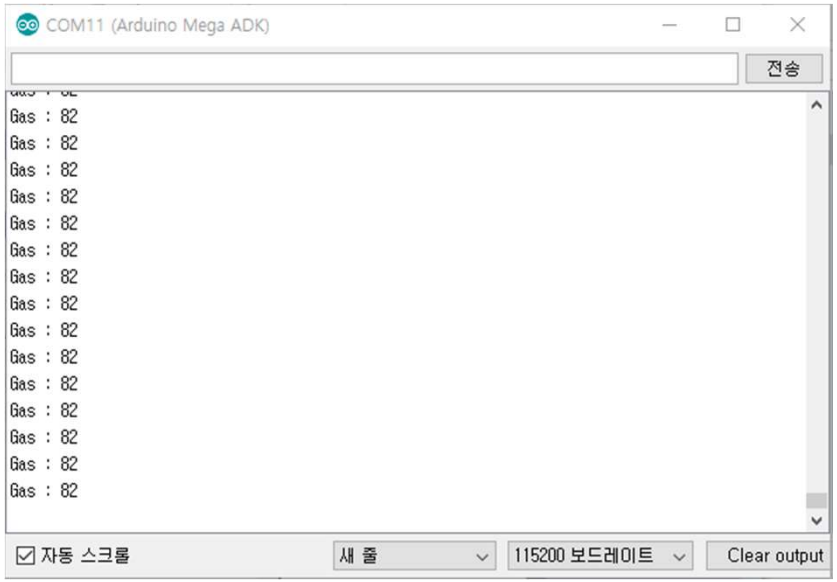
Wiring


MADE IN
ITALY
PWM
COMMUNICATION
TX
RX
ON
MEGA
Arduino
POWER
ANALOG IN
DIGITAL
S
V
G

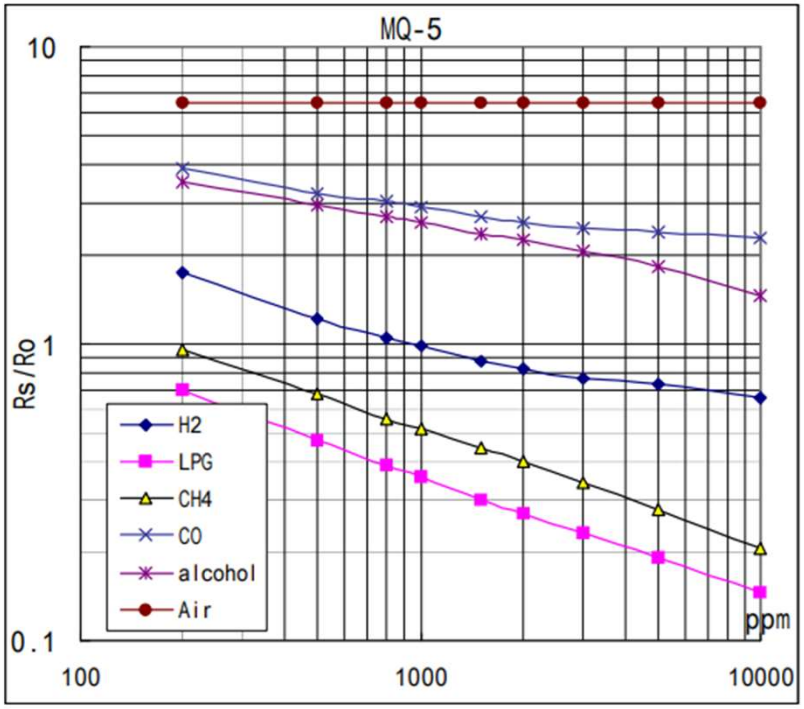
MQ5 : Gas sensor

```
#define MQ5   A3
unsigned int GasValue;

void setup( ) {
  Serial.begin(115200);
  pinMode(MQ5, INPUT);
}

void loop( ) {
  GasValue = analogRead(MQ5) ;
  Serial.print("Gas : ");
  Serial.println(GasValue);
  delay(200);
}
```

MQ5 : Serial Monitor



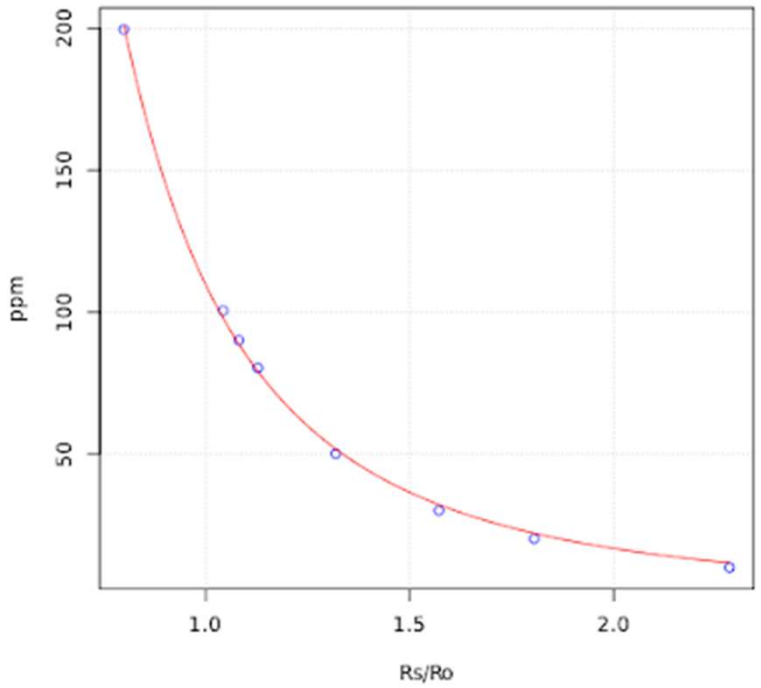
MQ5 sensitivity characteristics



Ro: sensor resistance at 1000ppm of H2 in the clean air.
Rs: sensor resistance at various concentrations of gases.

Calibration

- ppm = 119.37 e^0.7201 * Rs/Ro

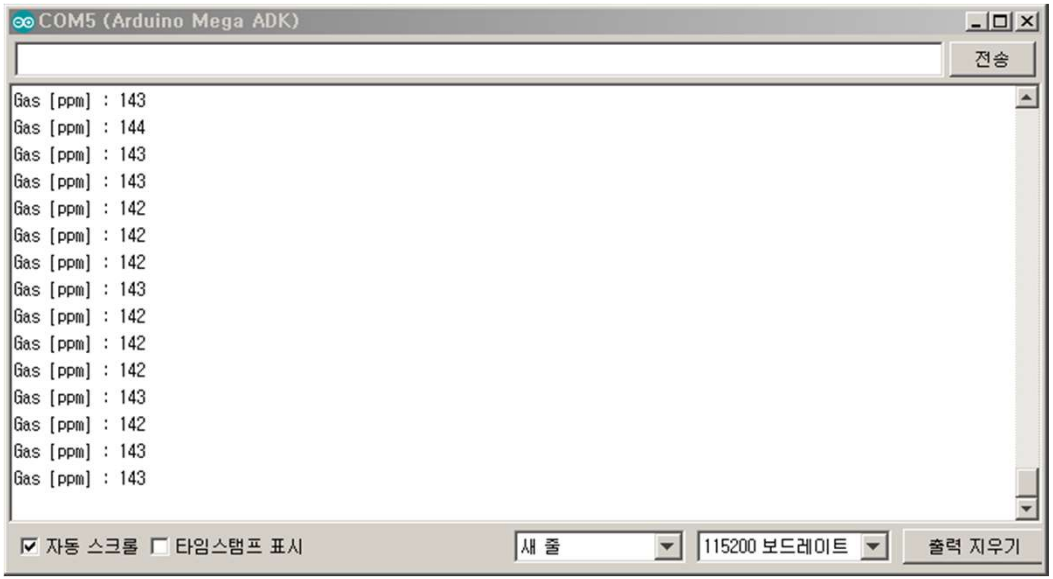


MQ5 : Gas ppm

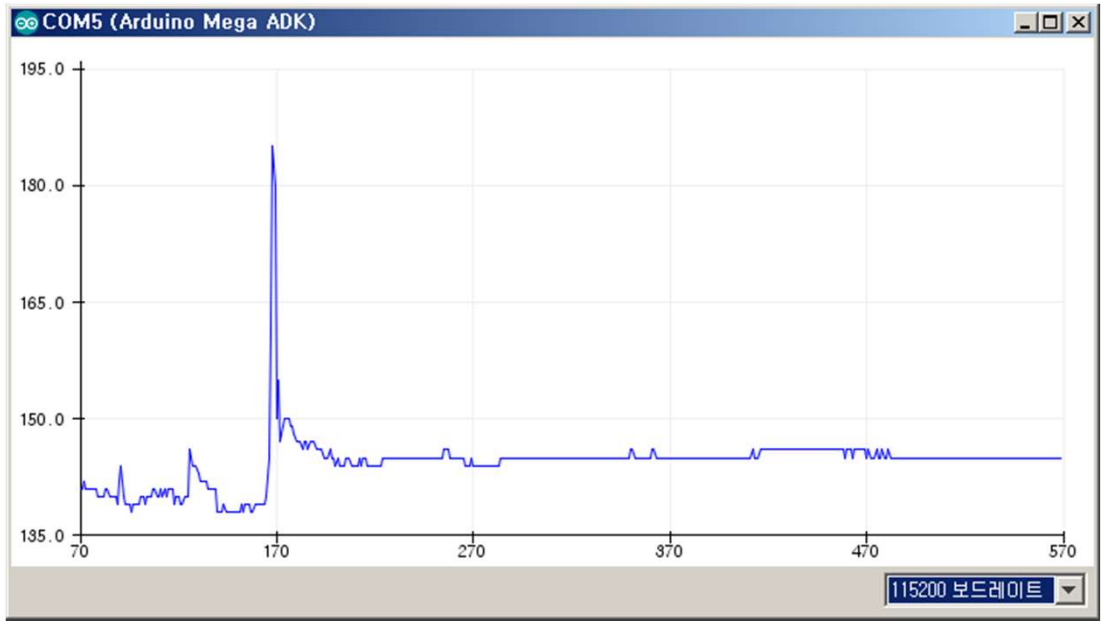
```
#define MQ5   A3
unsigned int GasValue;

void setup( ) {
  Serial.begin(115200);
  pinMode(MQ5, INPUT);
}

void loop( ) {
  GasValue = MQ5_ppm( );
  Serial.print("Gas [ppm] : ");
  Serial.println(GasValue);
  delay(200);
}
```

```
unsigned int MQ5_ppm( ){
  unsigned int ADValue = analogRead(MQ5) / 0.6;      //<- 2k//3k
  float Ratio = ADValue/(614-ADValue);                // 1024*0.6
  if (Ratio > 6.7) Ratio=6.7;
  unsigned int ppm=pow(2.71828182, 0.7201 * Ratio) * 119.37;
  if (ppm > 10000) ppm=10000;
  return ppm;
}
```

MQ5 : Serial Monitor



MQ5 : Serial Plotter



MQ5 : Processing

'@'	'G'	10000	1000	100	10	1	'₩n'

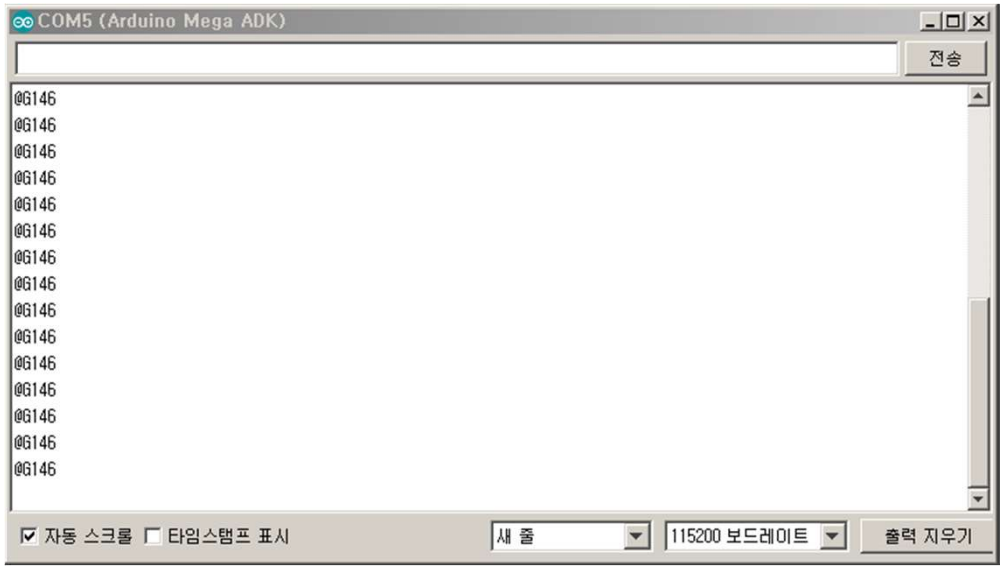
MQ5 : Gas ppm Packet

```
#define Packet_length 7
unsigned char TxData[Packet_length] = {'@', 'G', 0x00, 0x00, 0x00, 0x00, '₩n' };

#define MQ5   A3
unsigned int GasValue;

void setup( ) {
  Serial.begin(115200);
  pinMode(MQ5, INPUT);
}

void loop( ) {
  GasValue = MQ5_ppm( );
  TxPacket(GasValue);
  Serial.write(TxData,Packet_length);
  delay(500);
}
```

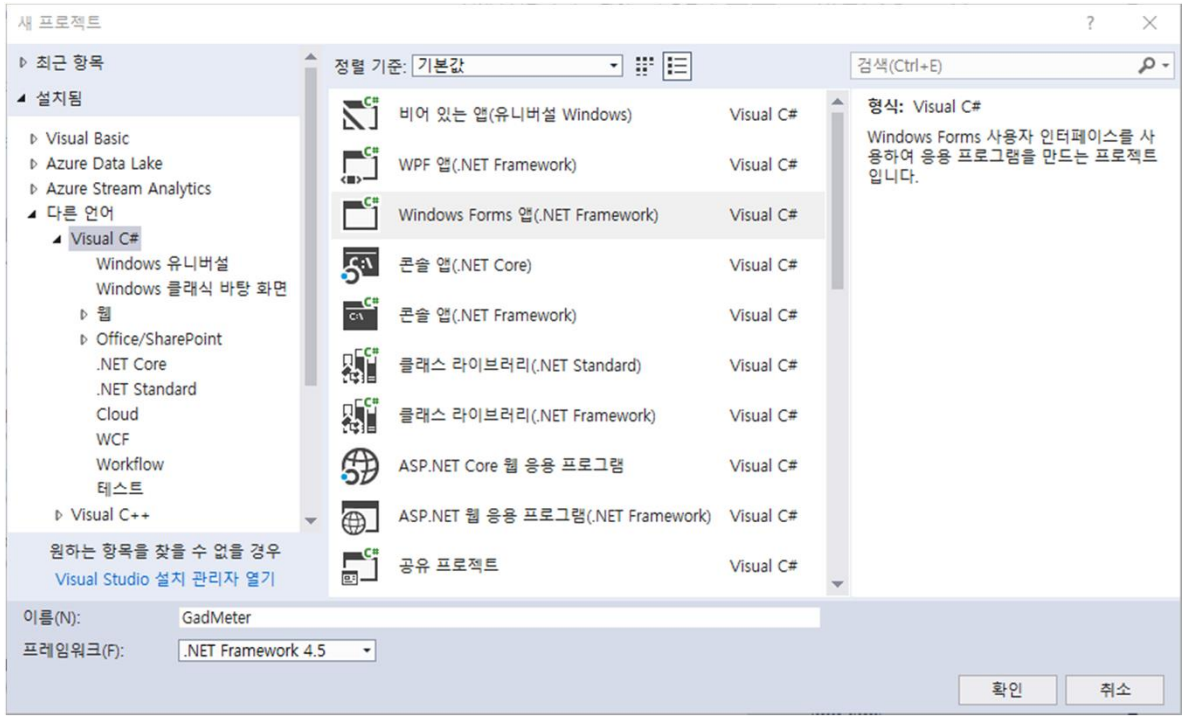
MQ5 : Gas ppm Packet

```
void TxPacket(int Value ){
  int temp=Value;
  TxData[2]=(temp/1000)|0x30;
  temp=temp%1000;
  TxData[3]=(temp/100)|0x30;
  temp=temp%100;
  TxData[4]=(temp/10)|0x30;
  TxData[5]=(temp%10)|0x30;
}

unsigned int MQ5_ppm( ){
  unsigned int ADValue = analogRead(MQ5)/0.6;
  float Ratio = ADValue/(614.0-ADValue);
  if (Ratio > 6.7) Ratio=6.7;
  unsigned int ppm=pow(2.71828182, 0.7201 * Ratio) * 119.37;
  if (ppm > 1000) ppm=1000;
  return ppm;
}
```

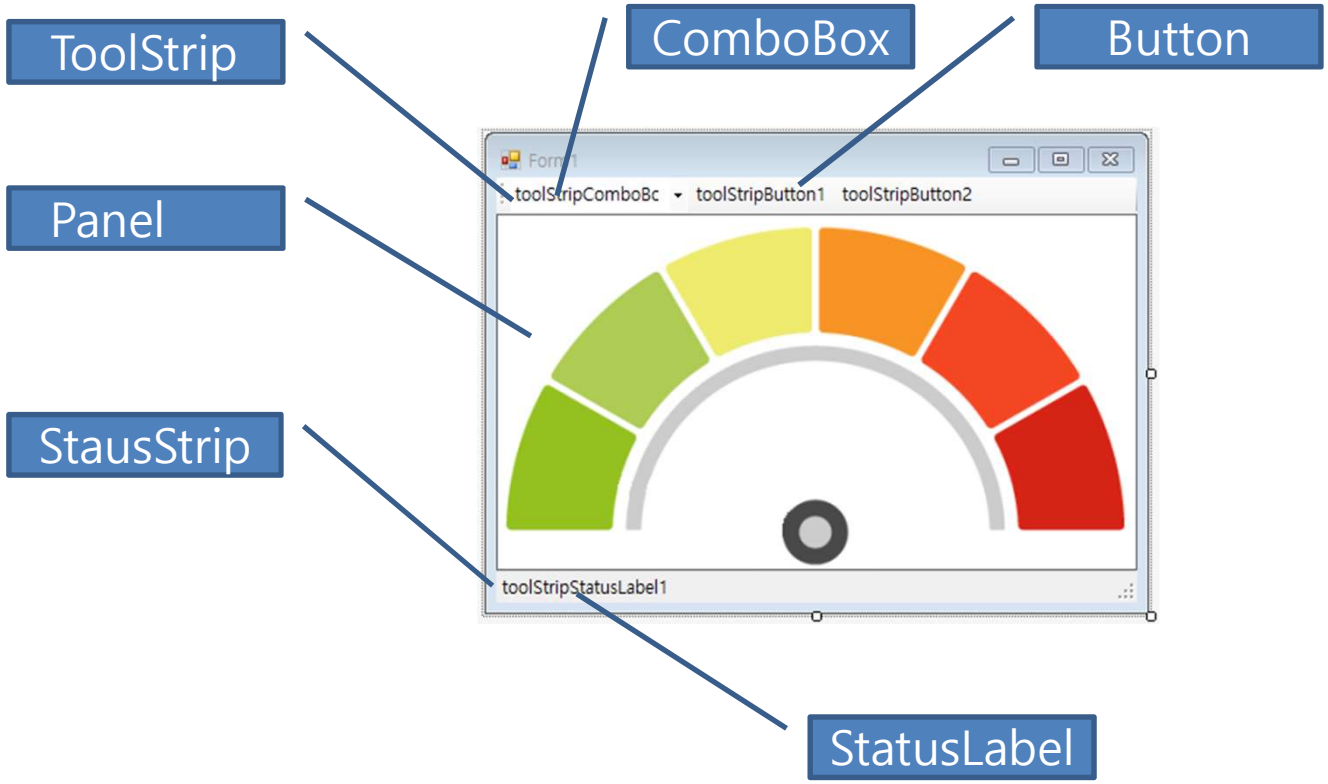
MQ5 : Serial Monitor



C# GasMeter - 새프로젝트



Form Design


ToolStrip
ComboBox
Button
Panel
StausStrip
StatusLabel
toolStripComboBc
toolStripButton1
toolStripButton2
toolStripStatusLabel1

Property

Form1	
Text	MQ5 GasMeter
MaximizeBox	False
MinimizeBox	False
Panel1	
BackGroundimage	**Gauge.png**
Dock	Fill
ToolStripComboBox1	
Name	cmbComPort
ToolStripButton1	
Name	btnConnect
Text	Connect
ToolStripStatusLabel1	
Name	Status
Text	Close

Define

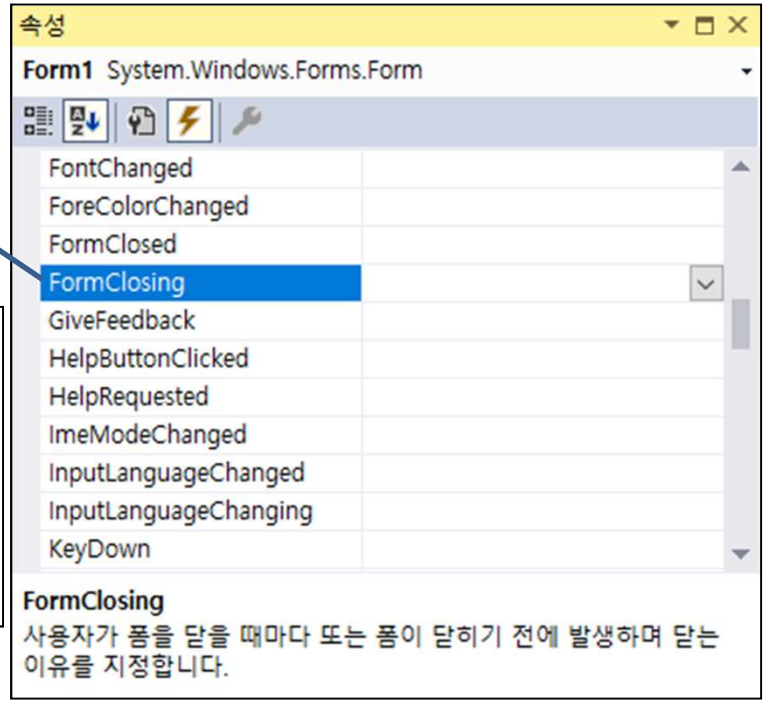
```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;
using System.IO.Ports;

namespace MQ5GasMeter
{
    public partial class Form1 : Form
    {
        SerialPort ComPort = new SerialPort();
        private delegate void SetTextDelegate(string getString);

        Graphics g;             // Graphics 객체
        private Point Center;   // 중심점
        private double radius;  // 반지름
```

Form

```
public Form1()
{
    InitializeComponent();
    ComPort.DataReceived += new SerialDataReceivedEventHandler(DataReceived);
}

private void Form1_Load(object sender, EventArgs e)
{
    cmbComPort.Items.Clear();
    var portName = System.IO.Ports.SerialPort.GetPortNames();
    cmbComPort.Items.AddRange(portName);
    cmbComPort.SelectedIndex = cmbComPort.Items.Count - 1;

    g = panel1.CreateGraphics();

    Center = new Point(panel1.Width / 2, (int)(panel1.Height * (89.0/100.0)));
    radius = (panel1.Height * (80.0 / 100)) ;

}
```

Form Closing Event

Double Click




```
private void Form1_Closing(object sender, FormClosingEventArgs e)
{
    if (ComPort.IsOpen)
    {
        ComPort.Close();
        ComPort.Dispose();
        ComPort = null;
    }
    Status.Text = "Form Closing.";
}
```

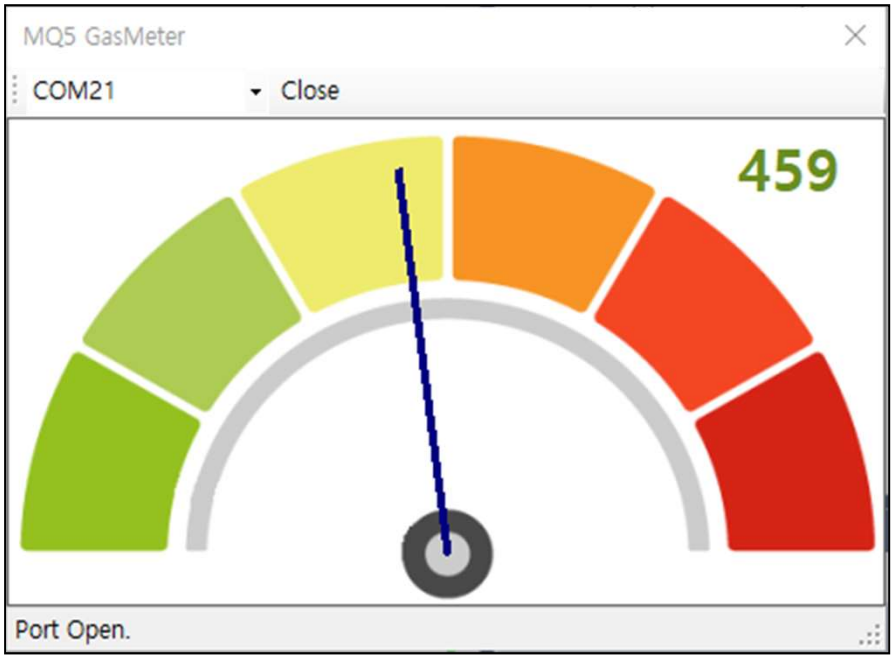
btnConnect_Click

```
private void btnConnect_Click(object sender, EventArgs e)
{
    if (btnConnect.Text == "Connect")
    {
        if (ComPort.IsOpen)
        {
            Status.Text = "Already used.";
        }
        else
        {
            ComPort.PortName = cmbComPort.Text;
            ComPort.BaudRate = 115200;
            ComPort.DataBits = 8;
            ComPort.Parity = Parity.None;
            ComPort.StopBits = StopBits.One;
            ComPort.Handshake = Handshake.None;
            ComPort.Open( );
            ComPort.DiscardInBuffer( );
            btnConnect.Text = "Close";
            Status.Text = "Port Open.";
        }
    }
    else
    {
        ComPort.Close( );
        Status.Text = "Port Close.";
        btnConnect.Text = "Connect";
    }
}
```

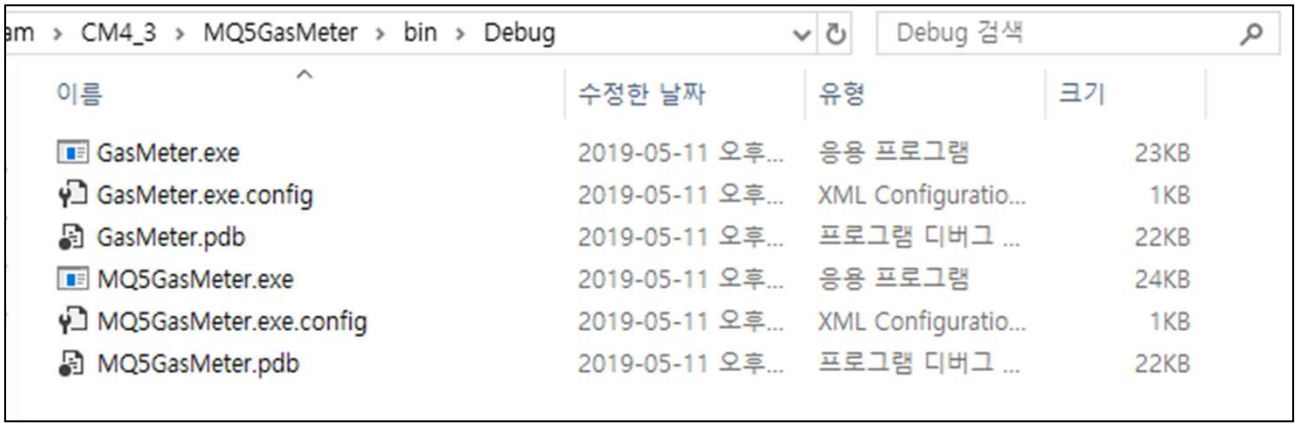
DataReceived

```
        private void DataReceived(object sender, System.IO.Ports.SerialDataReceivedEventArgs e)
        {
            string rxd = ComPort.ReadTo("₩n");
            this.BeginInvoke(new SetTextDelegate(SerialReceived), new object[] { rxd });
        }

        private void SerialReceived(string inString)
        {
            panel1.Refresh();

            int PPM = Convert.ToInt16(inString.Substring(2, inString.Length - 2));
            double HandsAngle = 2* Math.PI* ((PPM*(180.0/1000.0))-180)/360;
            int HandsX = Center.X + (int)(radius * Math.Cos(HandsAngle));
            int HandsY = Center.Y + (int)(radius * Math.Sin(HandsAngle));
            Pen p = new Pen(Brushes.Navy , 4);
            g.DrawLine(p, HandsX, HandsY, Center.X, Center.Y);

            label1.Text = PPM.ToString();
        }
    }
}
```

Debug Run



Files


am › CM4_3 › MQ5GasMeter › bin › Debug
Debug 검색
이름
수정한 날짜
유형
크기
GasMeter.exe 2019-05-11 오후... 응용 프로그램 23KB
GasMeter.exe.config 2019-05-11 오후... XML Configuratio... 1KB
GasMeter.pdb 2019-05-11 오후... 프로그램 디버그 ... 22KB
MQ5GasMeter.exe 2019-05-11 오후... 응용 프로그램 24KB
MQ5GasMeter.exe.config 2019-05-11 오후... XML Configuratio... 1KB
MQ5GasMeter.pdb 2019-05-11 오후... 프로그램 디버그 ... 22KB