MISR UNIVERSITY FOR SCIENCE AND TECHNOLOGY
COLLEGE OF ENGINEERING
MECHATRONICS DEPARTMENT

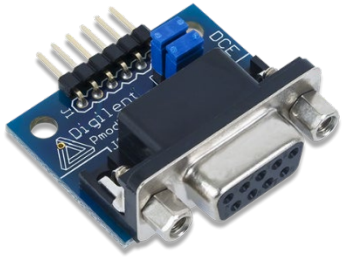
MTE 405 SENSORS AND MEASUREMENTS

LAB 3 – SPRING 2019

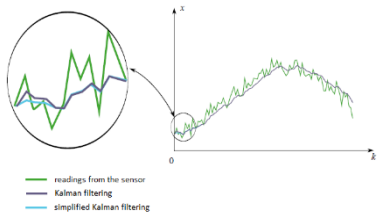
Lab 3

Goals Of The Lab

Introduction to Sensors and Signal Conditioning with Virtual Prototyping



RS-232 Serial Communication



Characteristics of Measurements

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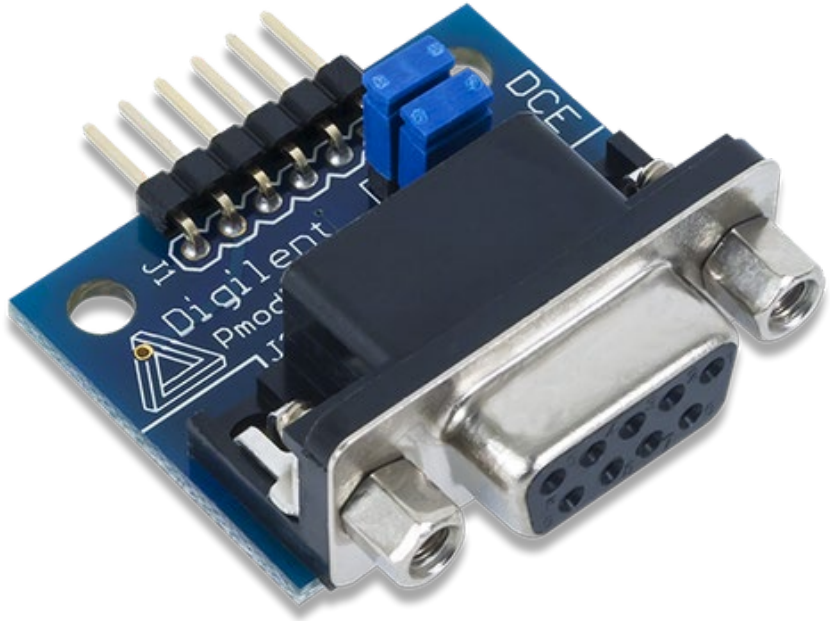
Serial Communication

RS-232 Protocol

Learning outcome

- Serial data protocol
- Acquiring sensor data.



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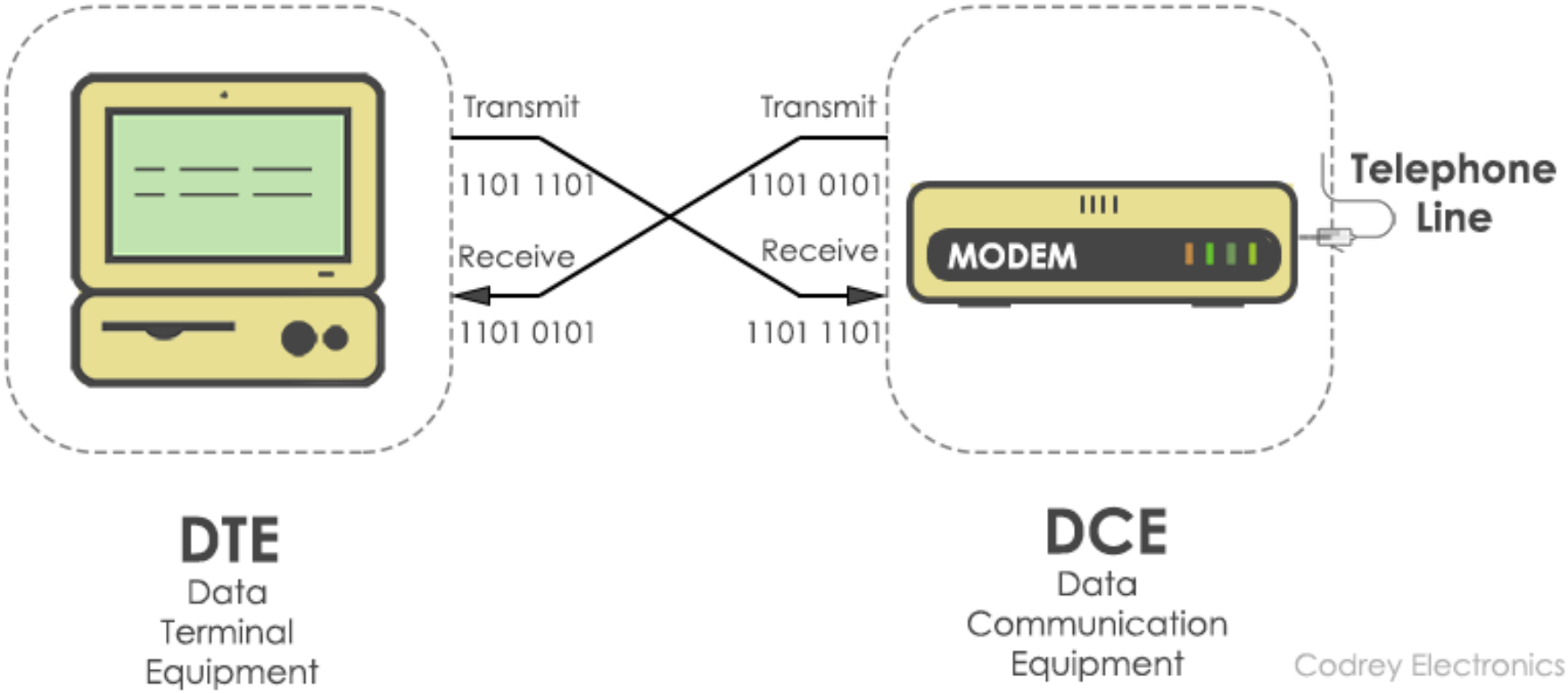
Serial Data Transfer

RS -232



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Serial Data Transfer

RS -232

Signal Voltage Levels	Logical State
-3 to -25	OFF (0)
+3 to +25	ON(1)

Control Signal Voltage Levels (Volts)	Logical State
-3 to -25	OFF (1)
+3 to +25	ON (0)

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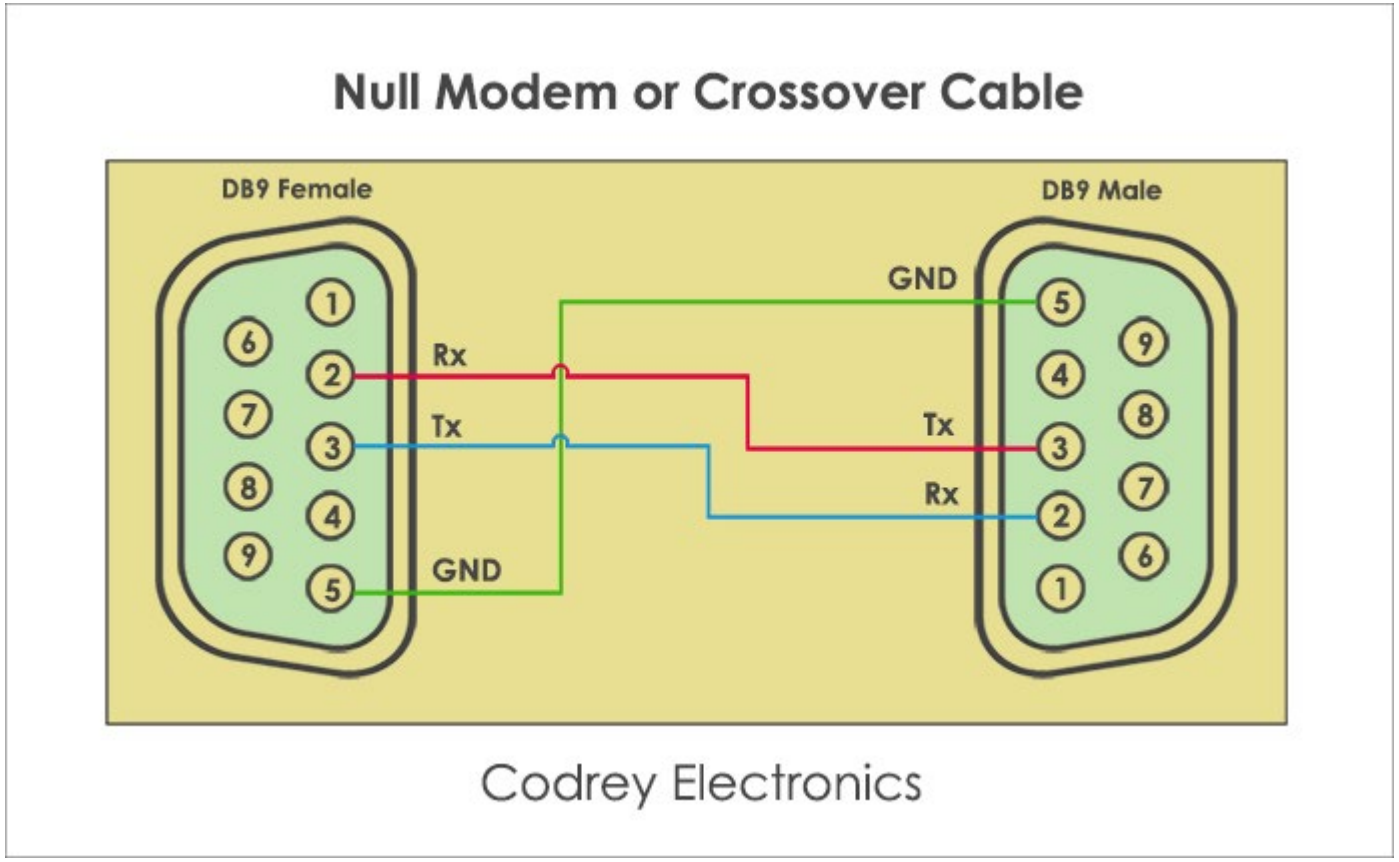
Serial Data Transfer

RS -232



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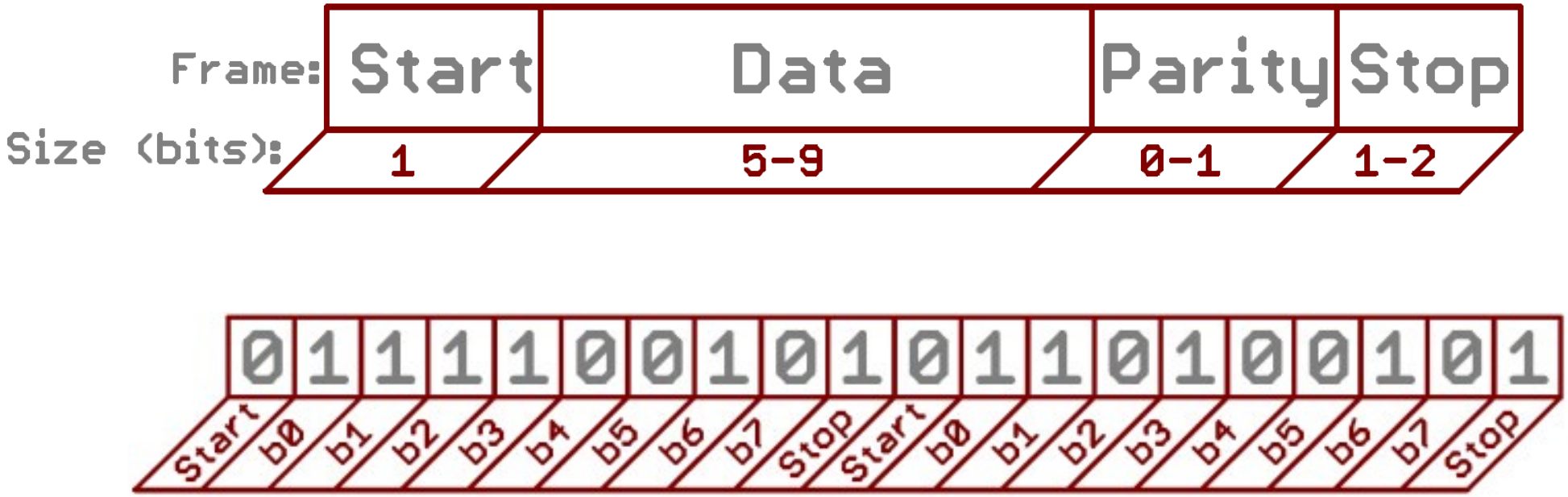
Serial Data Transfer

RS -232



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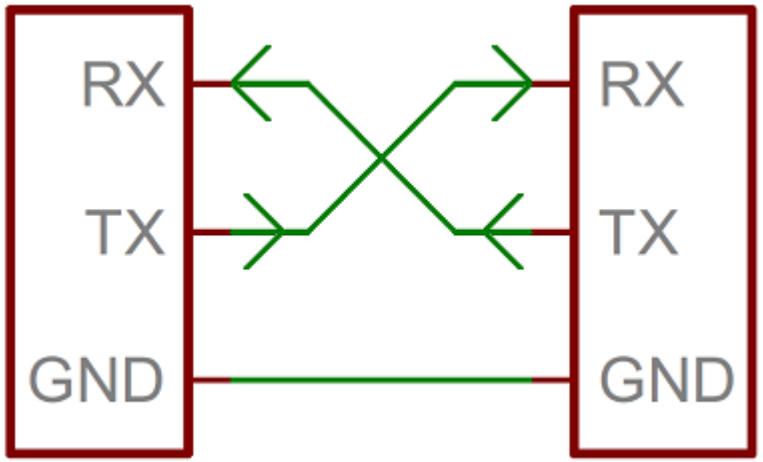
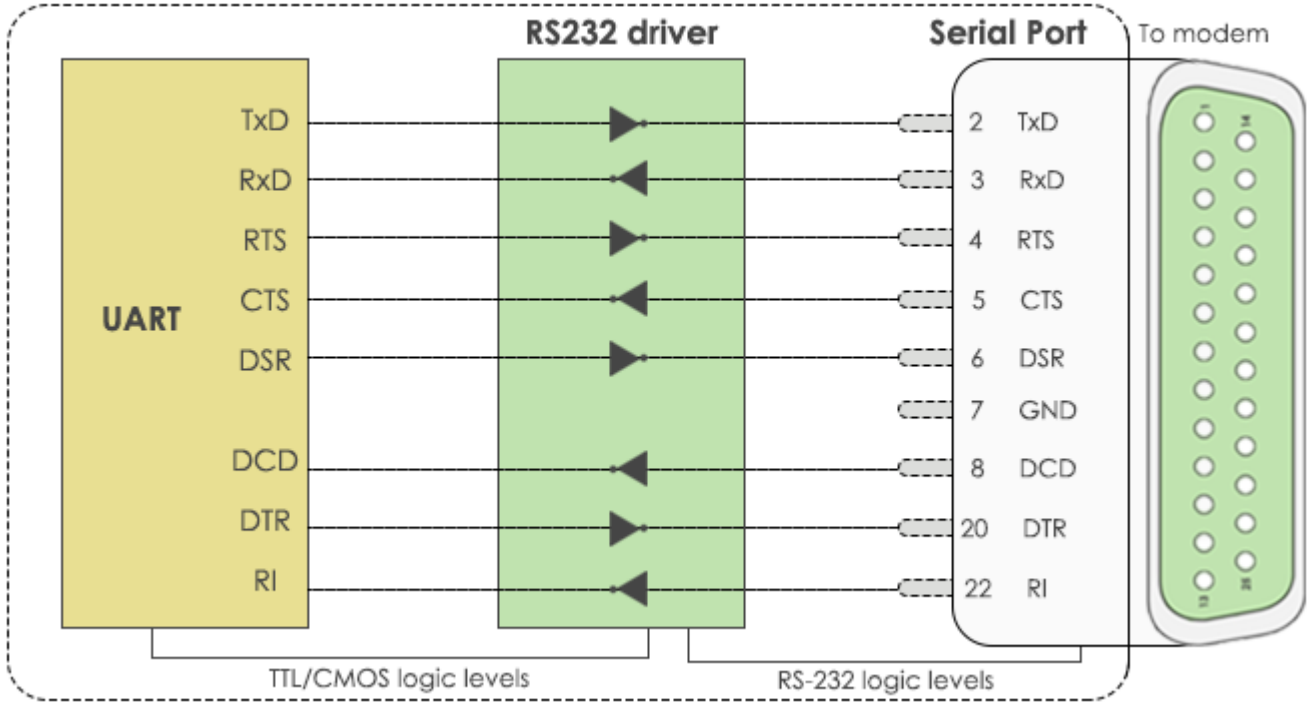
Serial Data Transfer

RS -232





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Arduino UART

RS -232

```
void setup()
{
// Start serial port with 115200 bps
PORT.begin(115200);
}
```

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Arduino UART

RS -232

```
void serialEvent()
{
// Read command characters until \n is received
auto command = PORT.readStringUntil('\n');
command = command.substring(0,
command.indexOf(','));
PORT.flush();
// Parsing command
if (command == "start")
{
// Start streaming data
Timer1.initialize(100000); // every 100 ms
//Attach ISR
Timer1.attachInterrupt(timer_one_isr);
}
if (command == "stop")
{
// Stop stream
//Attach ISR
Timer1.detachInterrupt();
}
}
```

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Arduino UART

RS -232

```
// Timer Interrupt Service Routine
void timer_one_isr()
{
//Check if simulation mode or real time mode
if (IS_SIMULATION == true)
{
// Proteus Simulation with noise
// Convert acquired LM35 voltage into temperature
lm35_temperature = (analogRead(lm35_pin) * (5.0 / 1023.0)) * (1000 / 10.0);
lm35_temperature = lm35_temperature + random(-2, 2);
PORT.println(lm35_temperature);
}
else
{
// Realtime acquisition from physical sensor
// Convert acquired LM35 voltage into temperature
lm35_temperature = (analogRead(lm35_pin) * (5.0 / 1023.0)) * (1000.0 / 10.0);
PORT.println(lm35_temperature);
}
}
```

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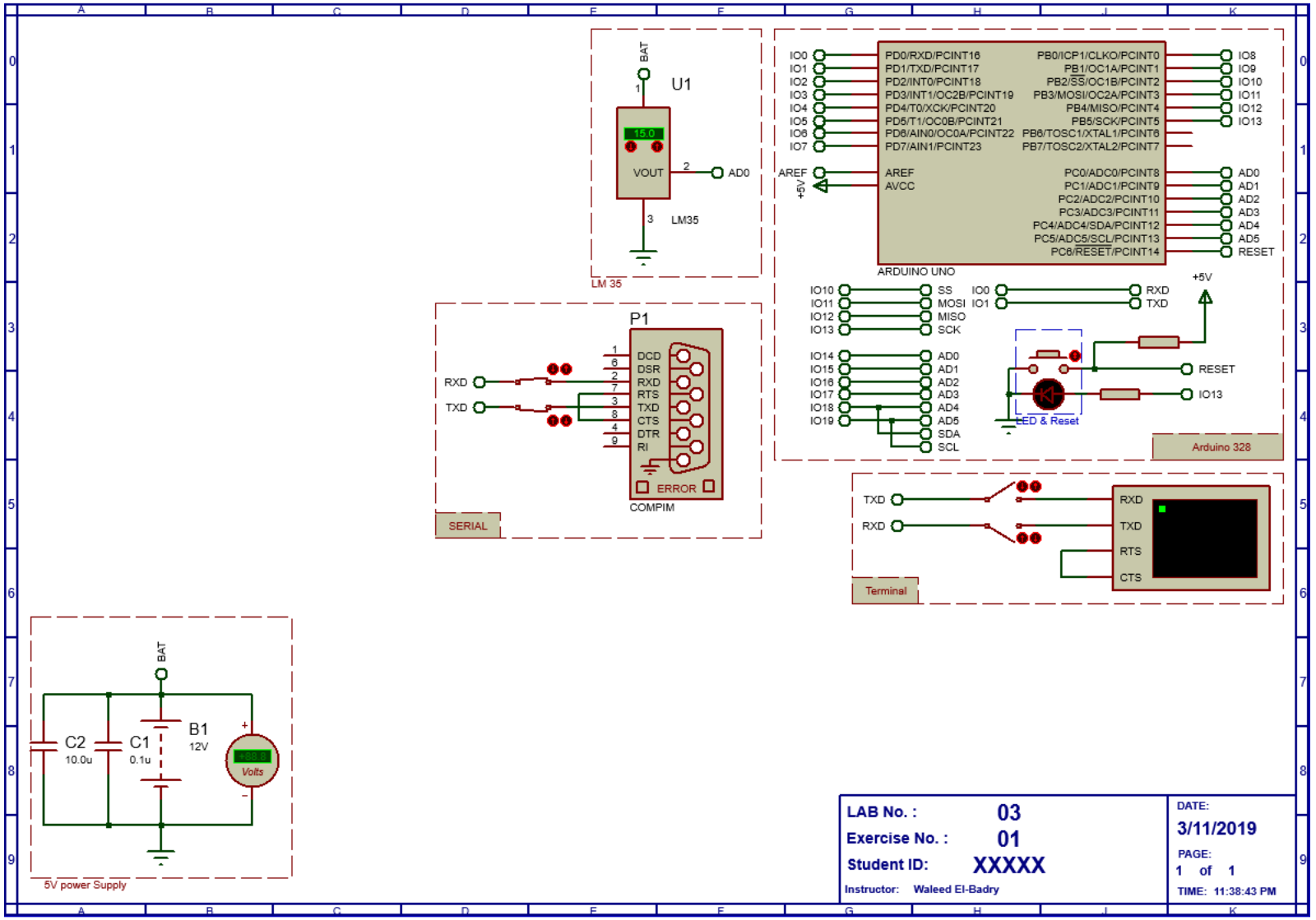
Arduino UART

RS -232



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Measurements Characteristics

MATLAB analysis

$$Mean\ \mu = \frac{1}{m}\sum_{i=0}^{m} x(i)$$

$$Standard\ Deviation\ \sigma = \sqrt{\frac{1}{m-1}\sum_{i=0}^{m}(x(i)-\mu)^2}$$

$$Data\ Nornalization\ z = \frac{x\ -\ \mu}{\sigma} \rightarrow \mu(z) \cong 0\ and\ \sigma(z) = 1$$

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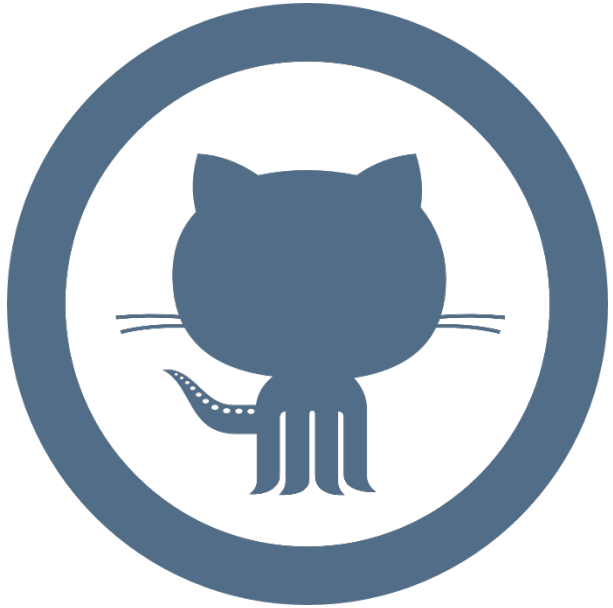

Don’t forget to pull the lab update from.

http://github.com/wbadry/mte405

END OF Lab 3