https://www.halvorsen.blog

Serial Communication between Arduino and LabVIEW

Using LabVIEW as a Graphical User Interface

Hans-Petter Halvorsen

Contents

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Serial Communication with Arduino

Hans-Petter Halvorsen

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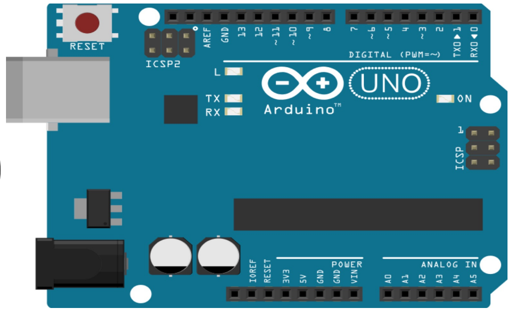
Arduino UNO

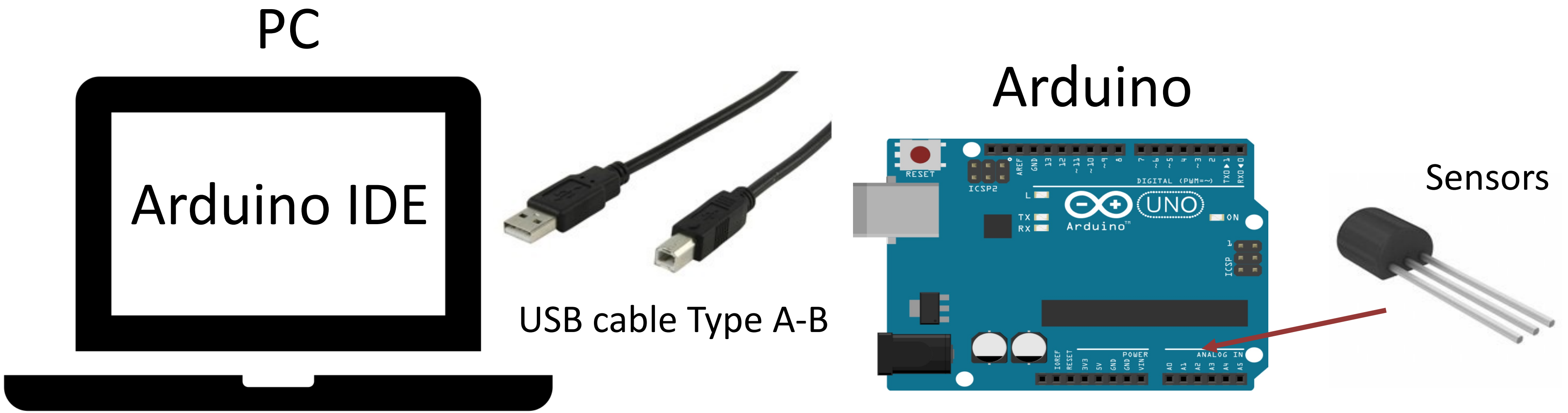
- Arduino is a Microcontroller
- Arduino is an open-source platform with Input/Output Pins (Digital In/Out, Analog In and PWM)
- Price about $20
- Arduino Starter Kit ~$40-80

with Cables, Wires, Resistors, Sensors, etc.



Configuration

PC with the Arduino Programming Environment



Arduino Programming Environment

Upload Code to Arduino Board

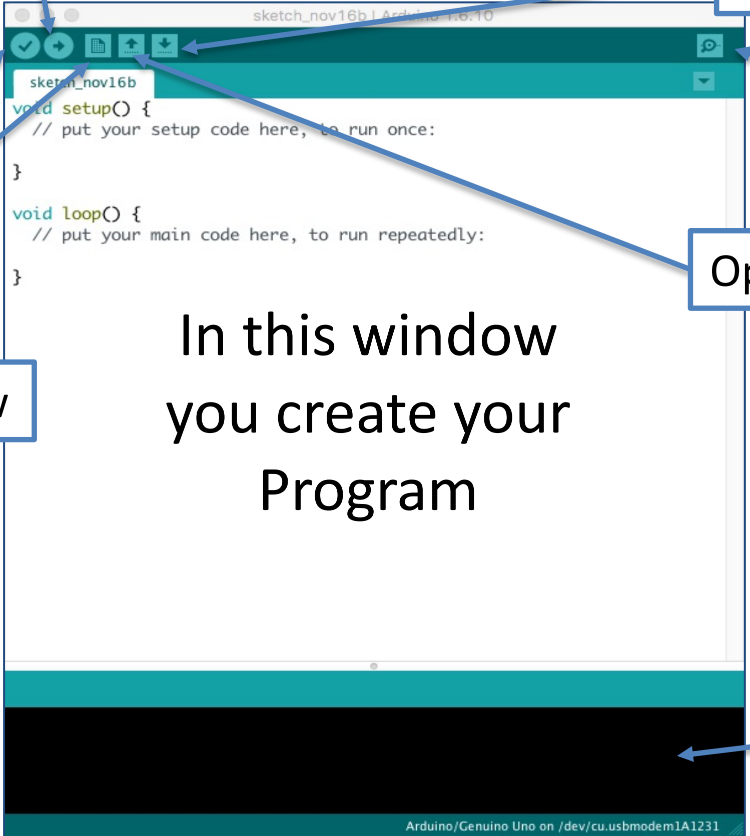
Save

Open Serial Monitor

Compile and Check if Code is OK

Open existing Code

Creates a New Code Window



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

}

void loop() {
  // put your main code here, to run repeatedly:

}
```

Arduino/Genuino Uno on /dev/cu.usbmodem1A1231

In this window you create your Program

Error Messages can be seen here

The software can be downloaded for free:

www.arduino.cc

Serial Communication

Speed: Baud Rate in bits per second

- Serial.begin(9600)
  - Open the Serial Port and set Baud rate
- Serial.print(“Hello”)
- Serial.println(“Hello”)
- https://www.arduino.cc/reference/en/language/functions/communication/serial/

Arduino Example

```
int x = 0;
void setup()
{
  Serial.begin(9600);
}

void loop()
{
  Serial.print(x);
  x++;
  delay(1000);
}
```

Serial Monitor

Hans-Petter Halvorsen

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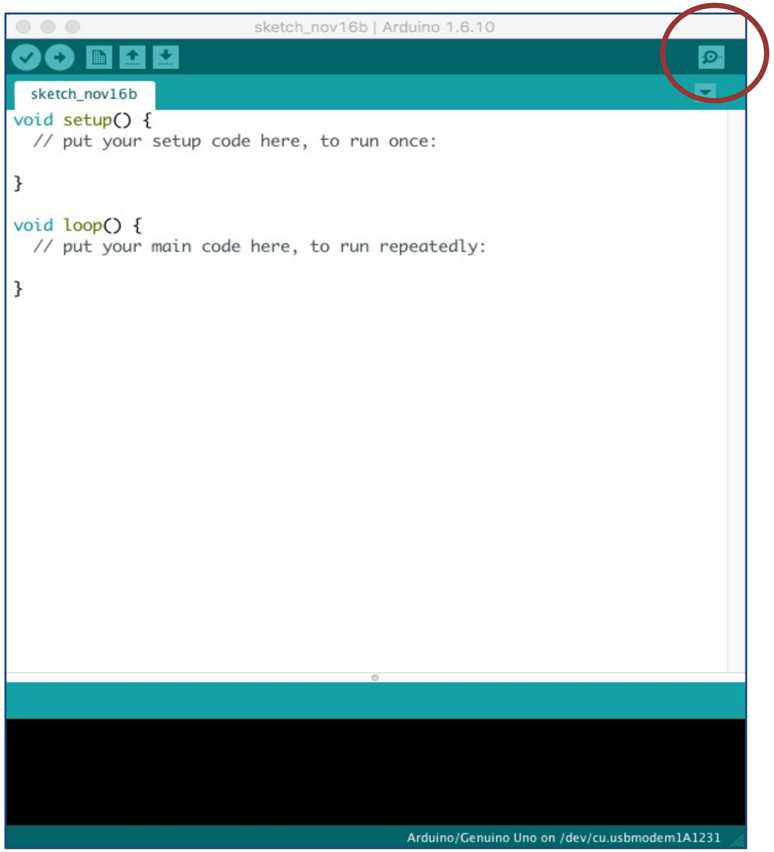
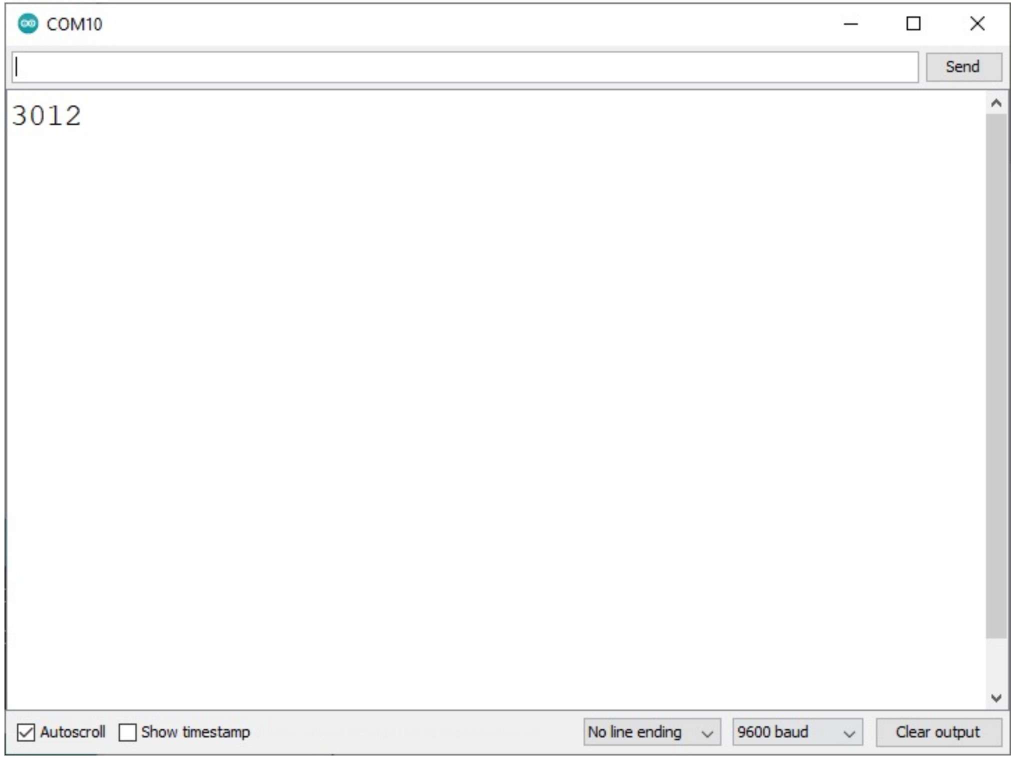
Serial Monitor

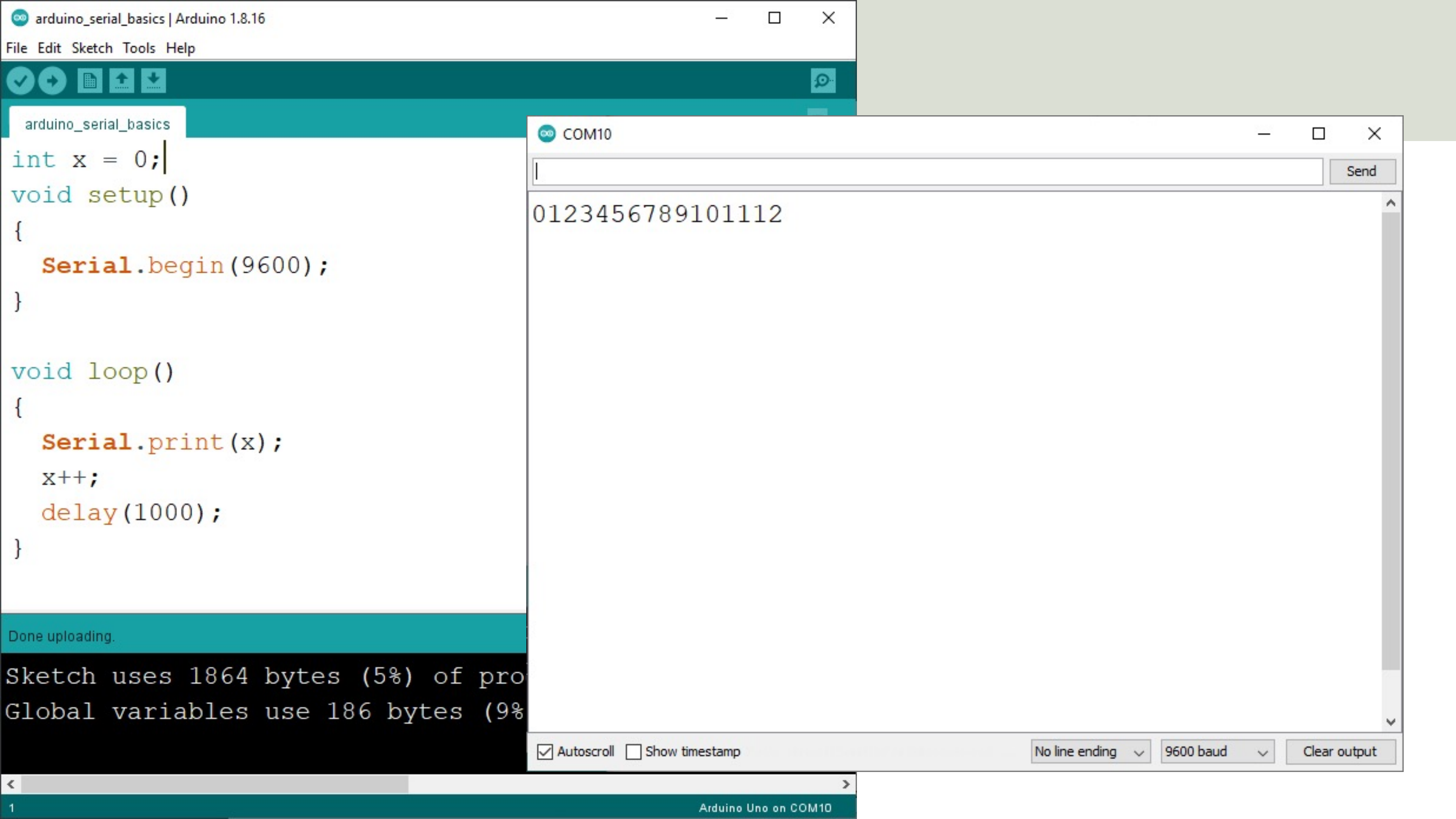


```
void setup() {
  // put your setup code here, to run once:

}

void loop() {
  // put your main code here, to run repeatedly:

}
```

Arduino/Genuino Uno on /dev/cu.usbmodem1A1231



```
3012
```



```
int x = 0;
void setup()
{
  Serial.begin(9600);
}

void loop()
{
  Serial.print(x);
  x++;
  delay(1000);
}
```

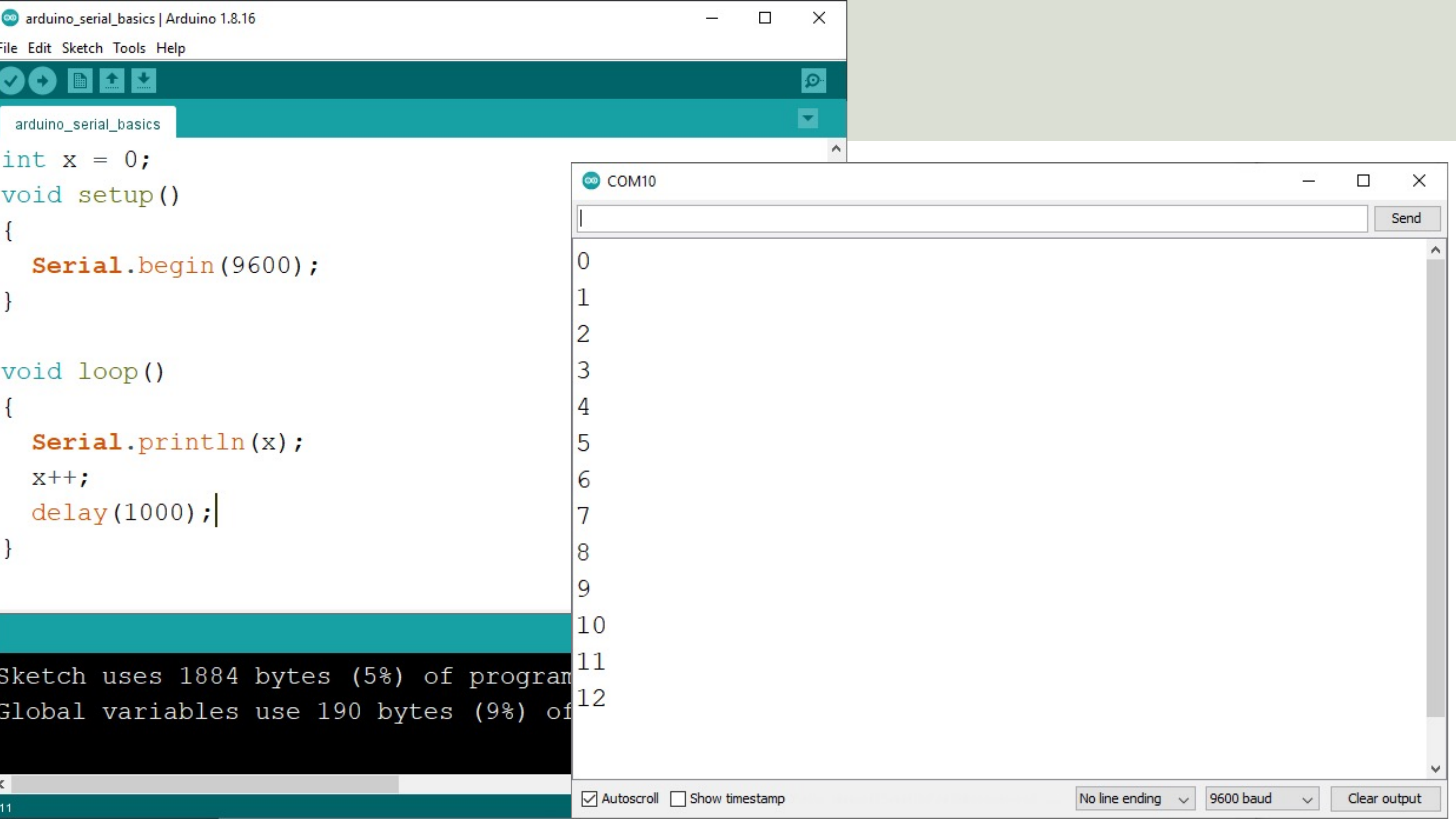
Done uploading.

```
Sketch uses 1864 bytes (5%) of pro
Global variables use 186 bytes (9%
```

```
0123456789101112
```

Arduino Example

```
int x = 0;
void setup()
{
  Serial.begin(9600);
}

void loop()
{
  Serial.println(x);
  x++;
  delay(1000);
}
```



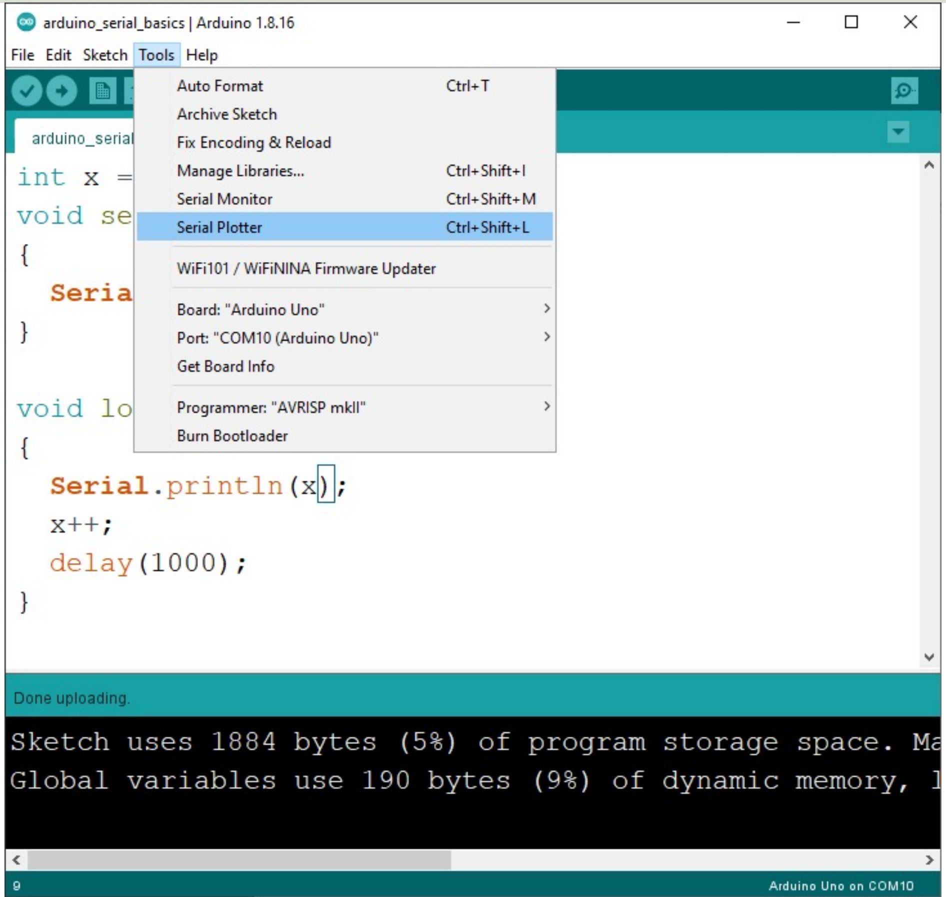
```
int x = 0;
void setup()
{
  Serial.begin(9600);
}

void loop()
{
  Serial.println(x);
  x++;
  delay(1000);
}
```

```
Sketch uses 1884 bytes (5%) of program
Global variables use 190 bytes (9%) of
```

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

Serial Plotter

Serial Plotter


arduino_serial_basics | Arduino 1.8.16

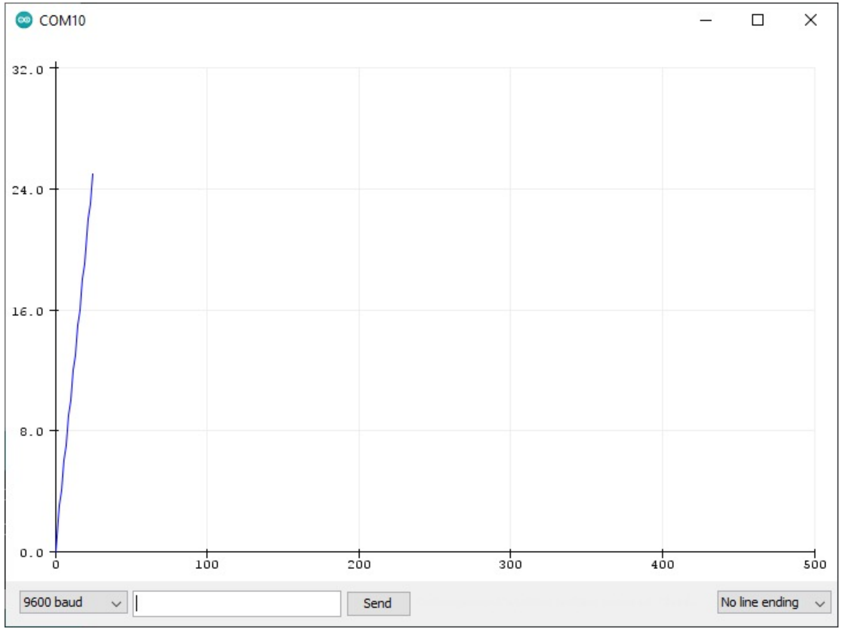
File Edit Sketch Tools Help
Auto Format Ctrl+T
Archive Sketch
Fix Encoding & Reload
Manage Libraries... Ctrl+Shift+I
Serial Monitor Ctrl+Shift+M
Serial Plotter Ctrl+Shift+L
WiFi101 / WiFiNINA Firmware Updater
Board: "Arduino Uno"
Port: "COM10 (Arduino Uno)"
Get Board Info
Programmer: "AVRISP mkII"
Burn Bootloader
arduino_serial

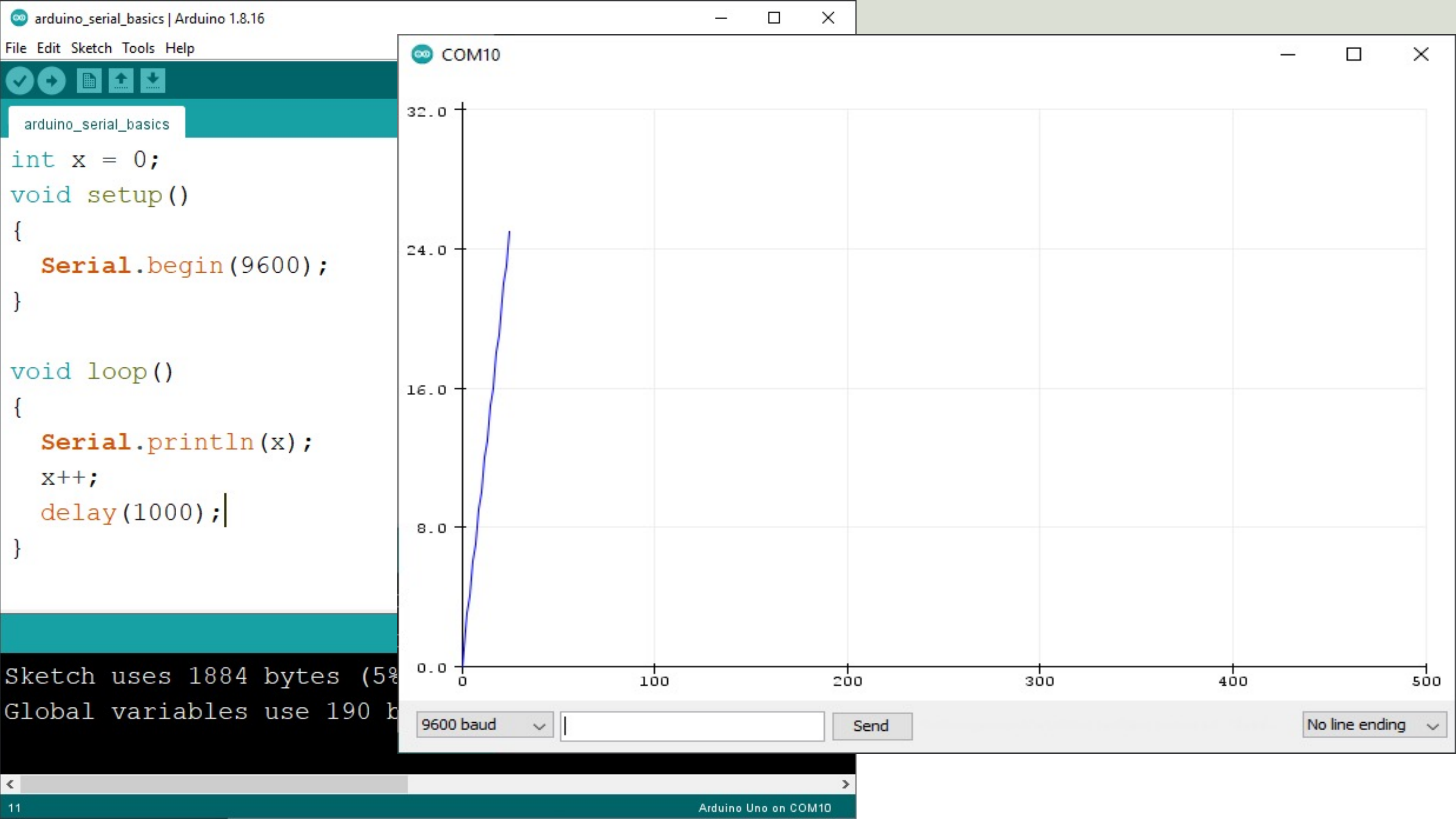
```
int x =
void se
{
  Seria
}

void lo
{
  Serial.println(x);
  x++;
  delay(1000);
}
```

Done uploading.

```
Sketch uses 1884 bytes (5%) of program storage space. Ma
Global variables use 190 bytes (9%) of dynamic memory, l
```

9 Arduino Uno on COM10


COM10

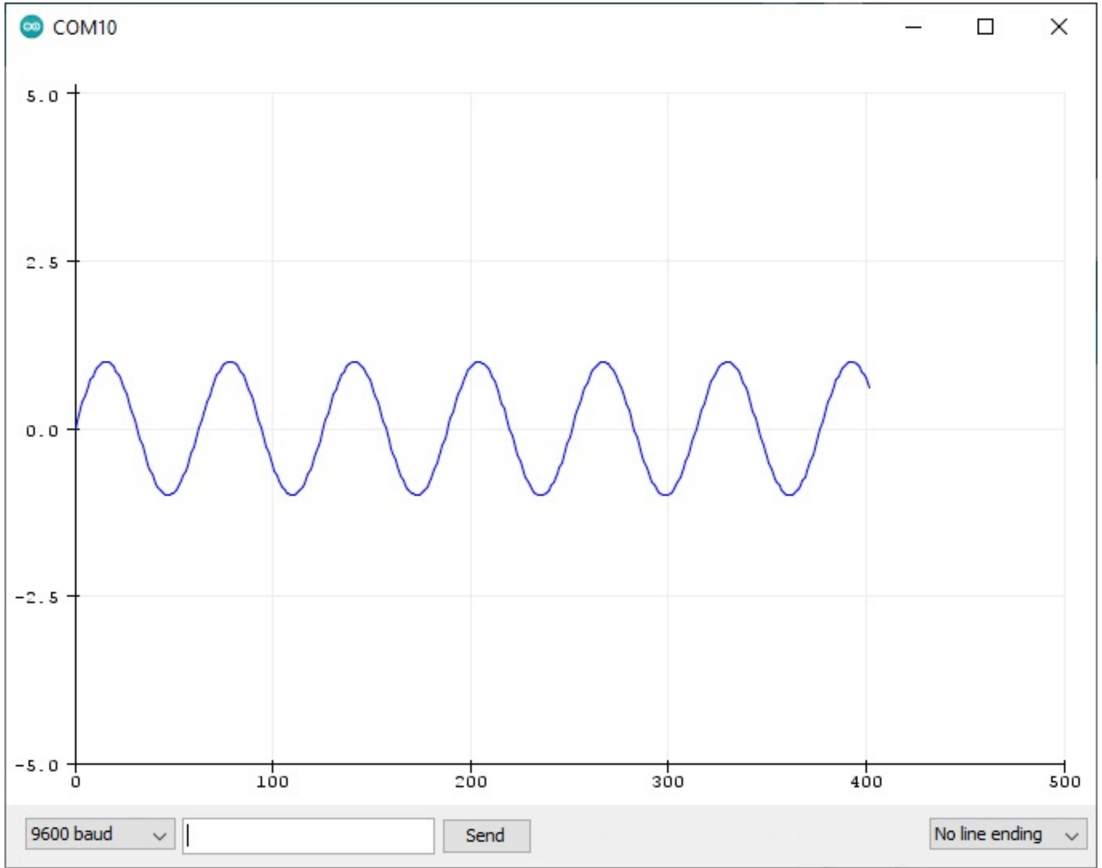


```
int x = 0;
void setup()
{
  Serial.begin(9600);
}

void loop()
{
  Serial.println(x);
  x++;
  delay(1000);
}
```

```
Sketch uses 1884 bytes (5%
Global variables use 190 b
```

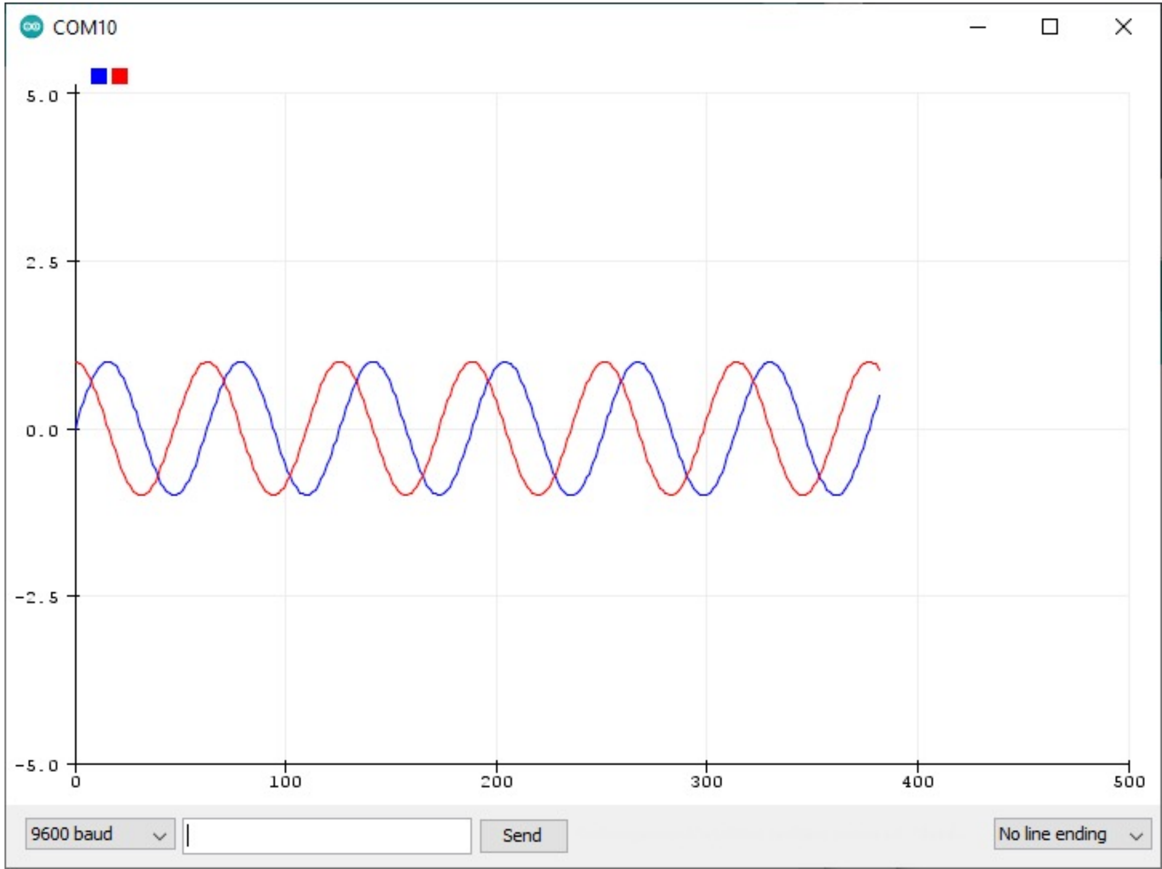
Arduino Example

```
float x = 0;
float y;

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

void loop()
{
  y = sin(x);
  Serial.println(y);

  x = x + 0.1;
  delay(100);
}
```



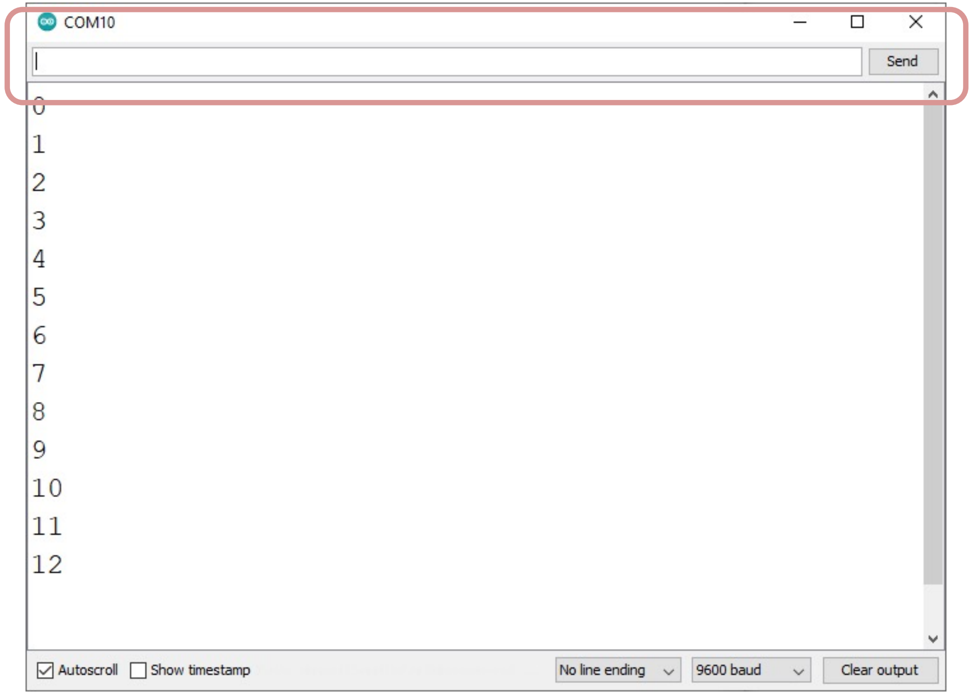
Arduino Example

```
float x = 0;
float y;

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

void loop()
{
  y = sin(x);
  Serial.print(y);

  y = cos(x);
  Serial.print("\t");
  Serial.println(y);

  x = x + 0.1;
  delay(100);
}
```



Send Serial Data

Send Serial Data



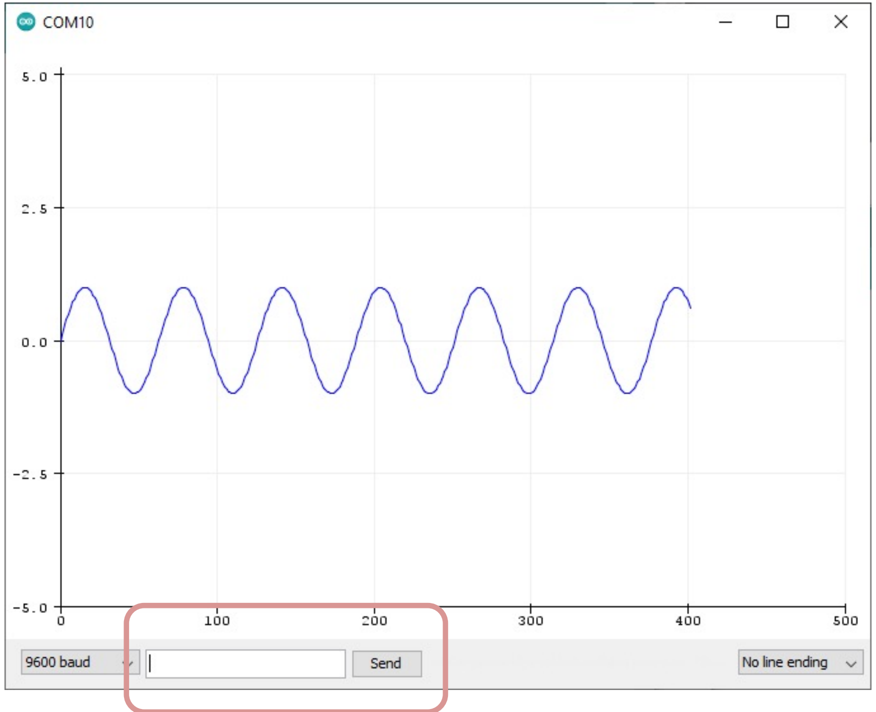
COM10

Send

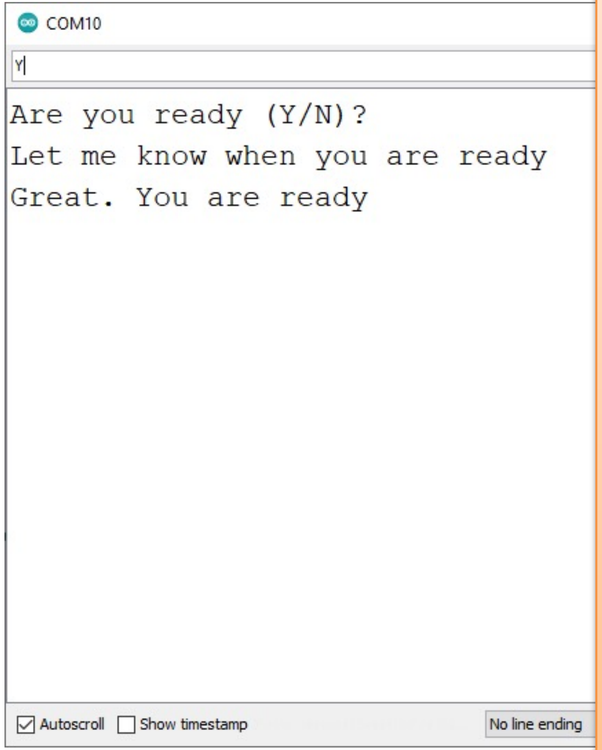
```
0
1
2
3
4
5
6
7
8
9
10
11
12
```

☑ Autoscroll ☐ Show timestamp No line ending 9600 baud Clear output

We can also send Serial Data using the Serial Monitor or the Serial Plotter



Exampl



COM10

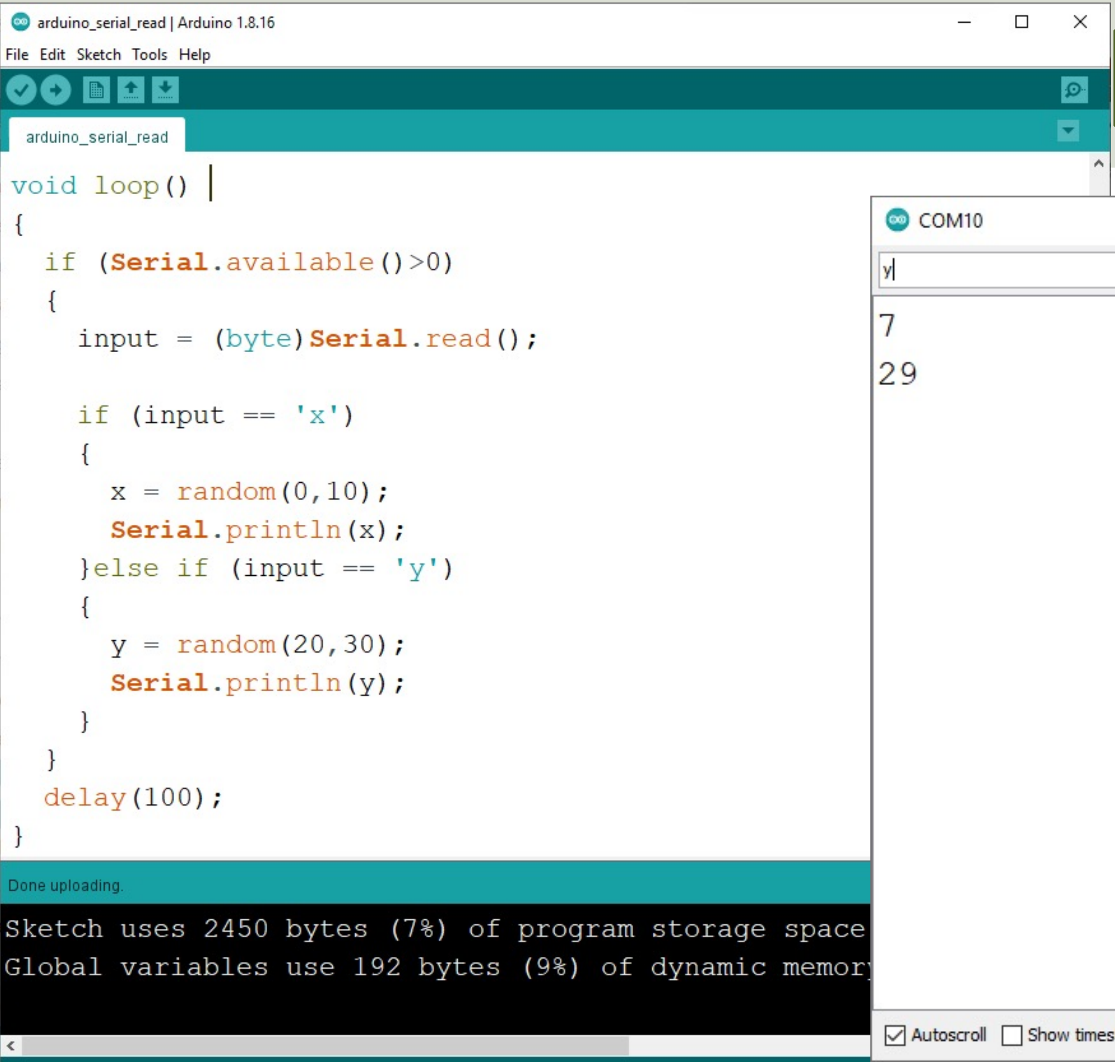
Y

```
Are you ready (Y/N)?
Let me know when you are ready
Great. You are ready
```

Autoscroll Show timestamp No line ending

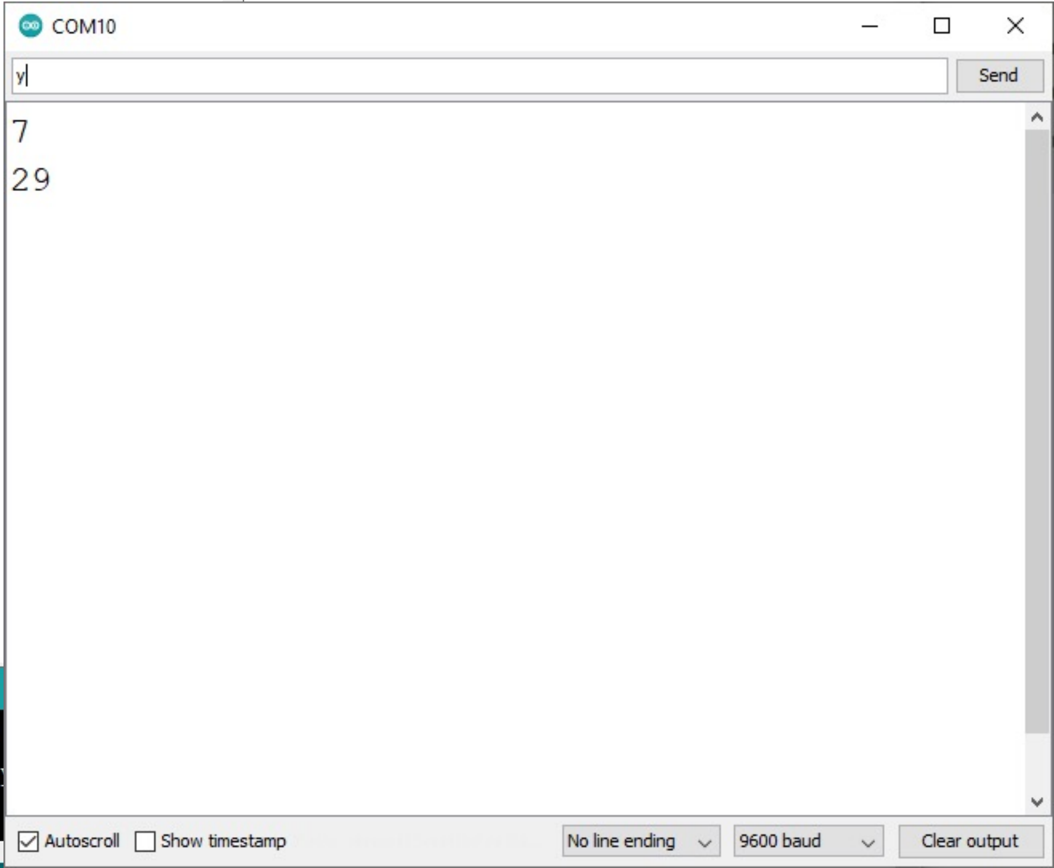
```
char input;

void setup()
{
  Serial.begin(9600);
  Serial.println("Are you ready (Y/N)?");
}

void loop()
{
  if (Serial.available()>0)
  {
    input = (byte)Serial.read();

    if (input == 'Y')
    {
      Serial.println("Great. You are ready");
    }else if (input == 'N')
    {
      Serial.println("Let me know when you are ready");
    }
  }
  delay(100);
}
```

le


arduino_serial_read | Arduino 1.8.16
File Edit Sketch Tools Help
arduino_serial_read

```
void loop()
{
  if (Serial.available()>0)
  {
    input = (byte)Serial.read();

    if (input == 'x')
    {
      x = random(0,10);
      Serial.println(x);
    }else if (input == 'y')
    {
      y = random(20,30);
      Serial.println(y);
    }
  }
  delay(100);
}
```

```
Done uploading.
Sketch uses 2450 bytes (7%) of program storage space
Global variables use 192 bytes (9%) of dynamic memory
```



```
7
29
```

Example

```
char input;
int x;
int y;

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

void loop()
{
  if (Serial.available()>0)
  {
    input = (byte)Serial.read();

    if (input == 'x')
    {
      x = random(0,10);
      Serial.println(x);
    }else if (input == 'y')
    {
      y = random(20,30);
      Serial.println(y);
    }
  }
  delay(100);
}
```

LabVIEW Serial Arduino Plotter

Hans-Petter Halvorsen

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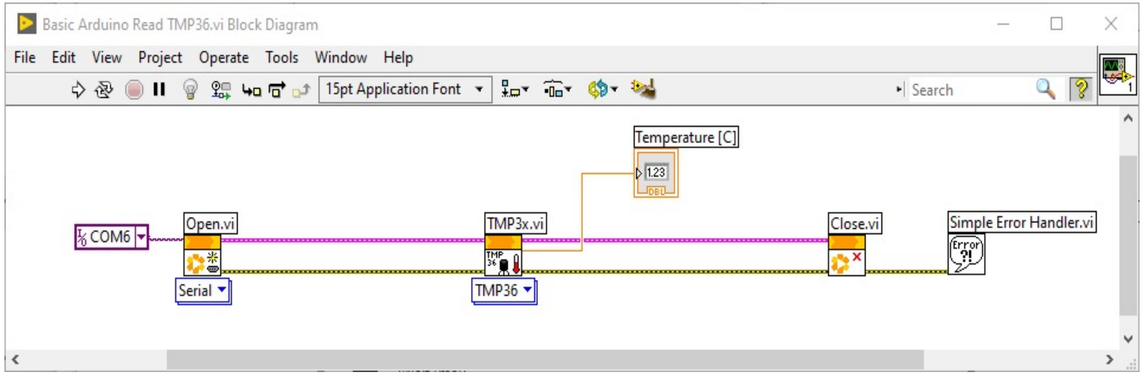
LabVIEW

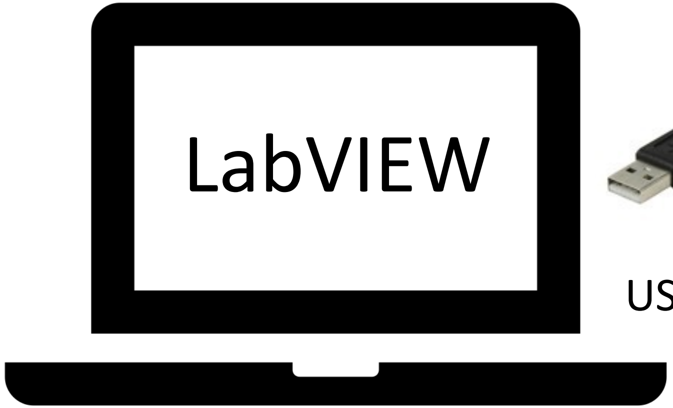
- LabVIEW is Graphical Software
- LabVIEW has powerful features for simulation, control and DAQ applications

Basic LabVIEW Example:



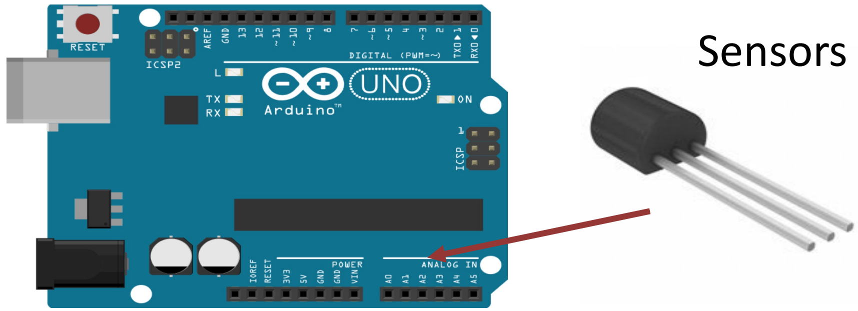
Configuration

PC



USB cable Type A-B

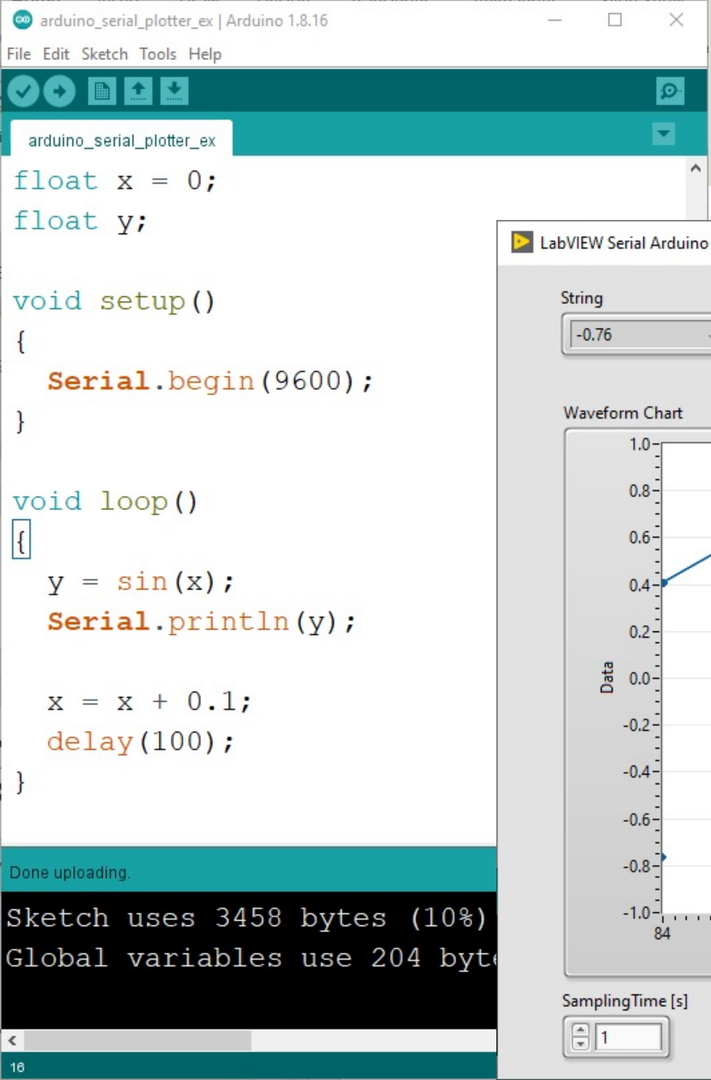
Arduino



Arduino Code

```
float x = 0;
float y;

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

void loop()
{
  y = sin(x);
  Serial.println(y);

  x = x + 0.1;
  delay(100);
}
```

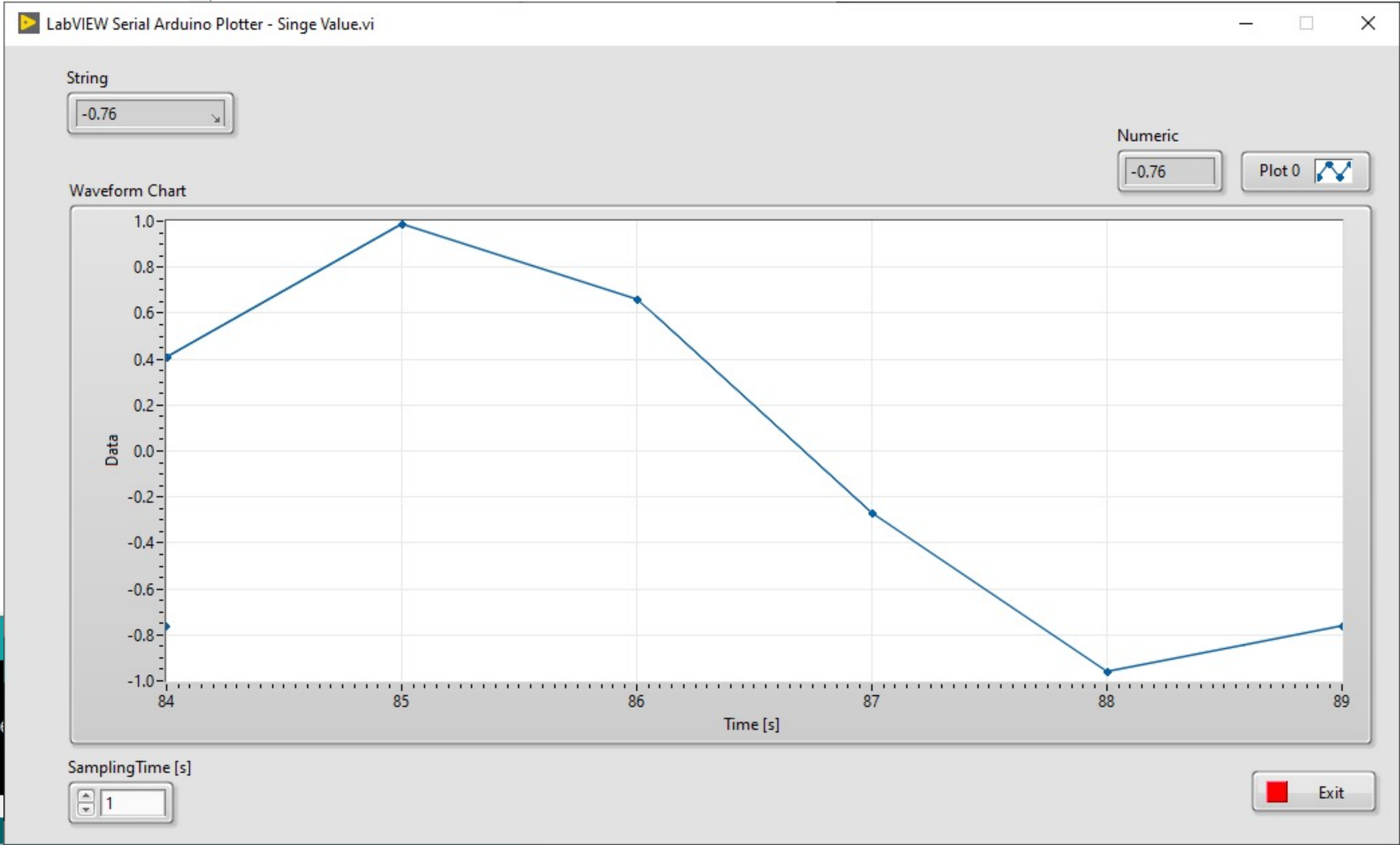
Running Example


arduino_serial_plotter_ex | Arduino 1.8.16
File Edit Sketch Tools Help
arduino_serial_plotter_ex

```
float x = 0;
float y;

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

void loop()
{
  y = sin(x);
  Serial.println(y);

  x = x + 0.1;
  delay(100);
}
```

Done uploading.

```
Sketch uses 3458 bytes (10%)
Global variables use 204 byte
```

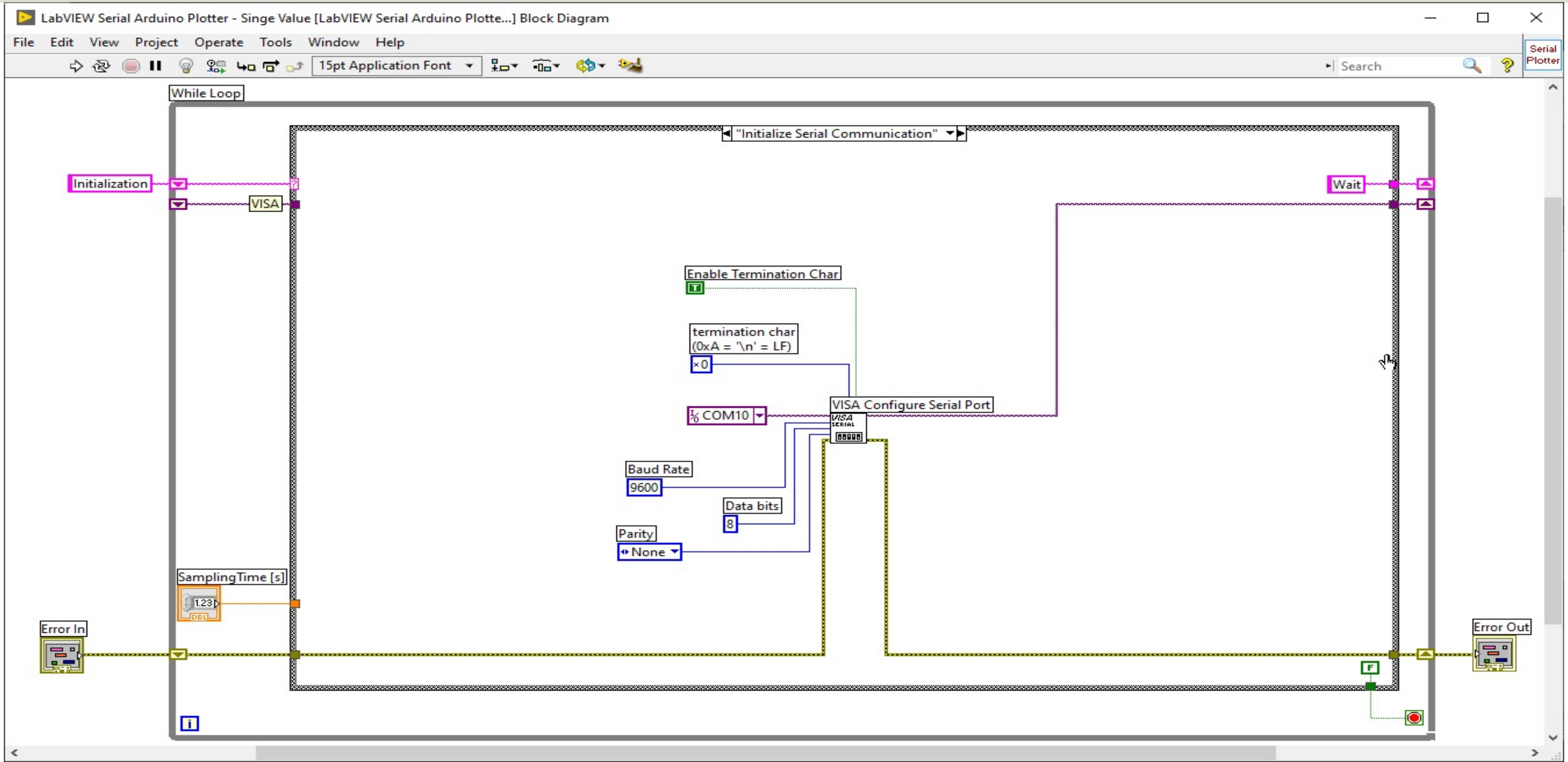


String: -0.76

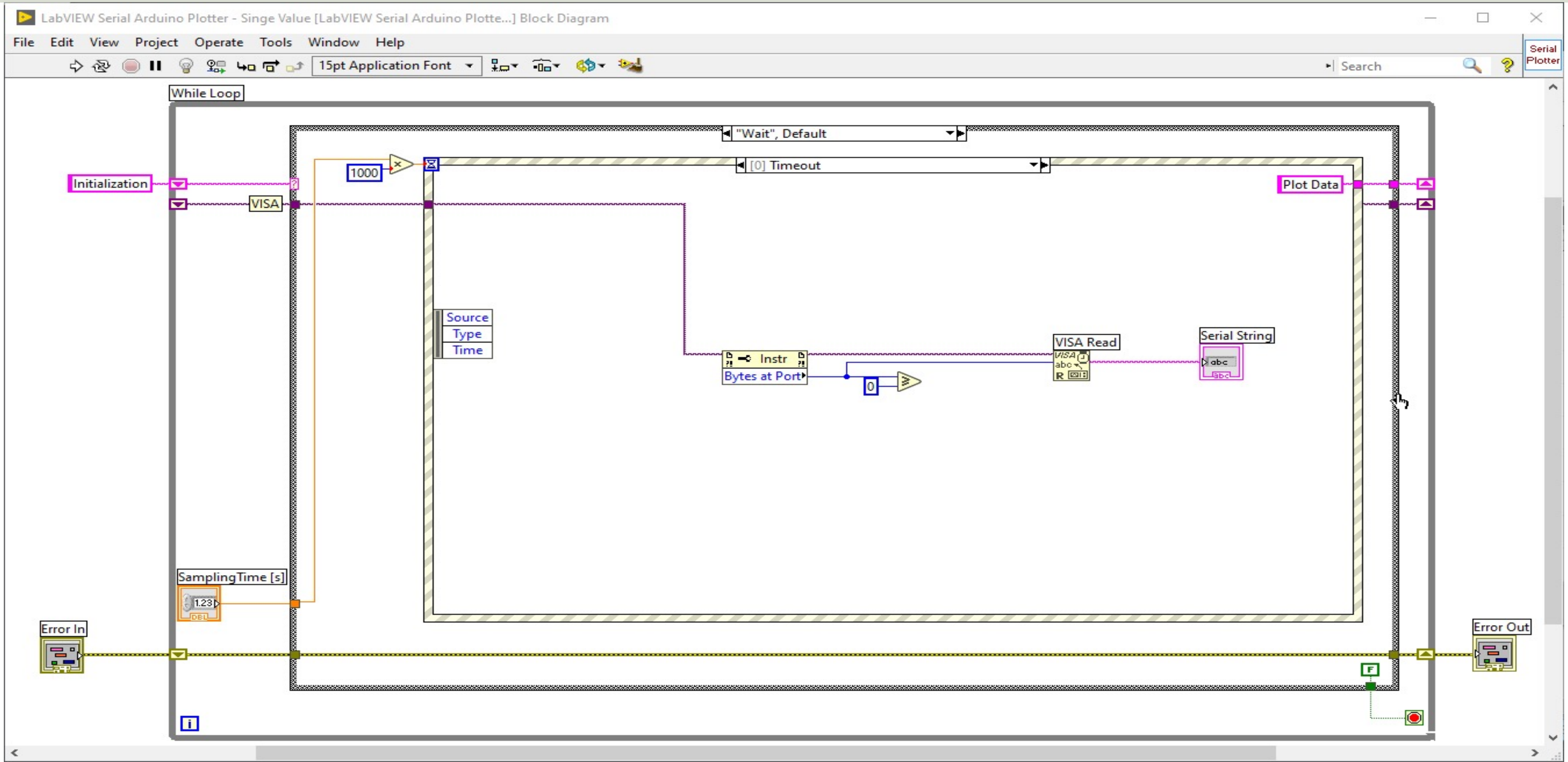
Numeric: -0.76

SamplingTime [s]: 1

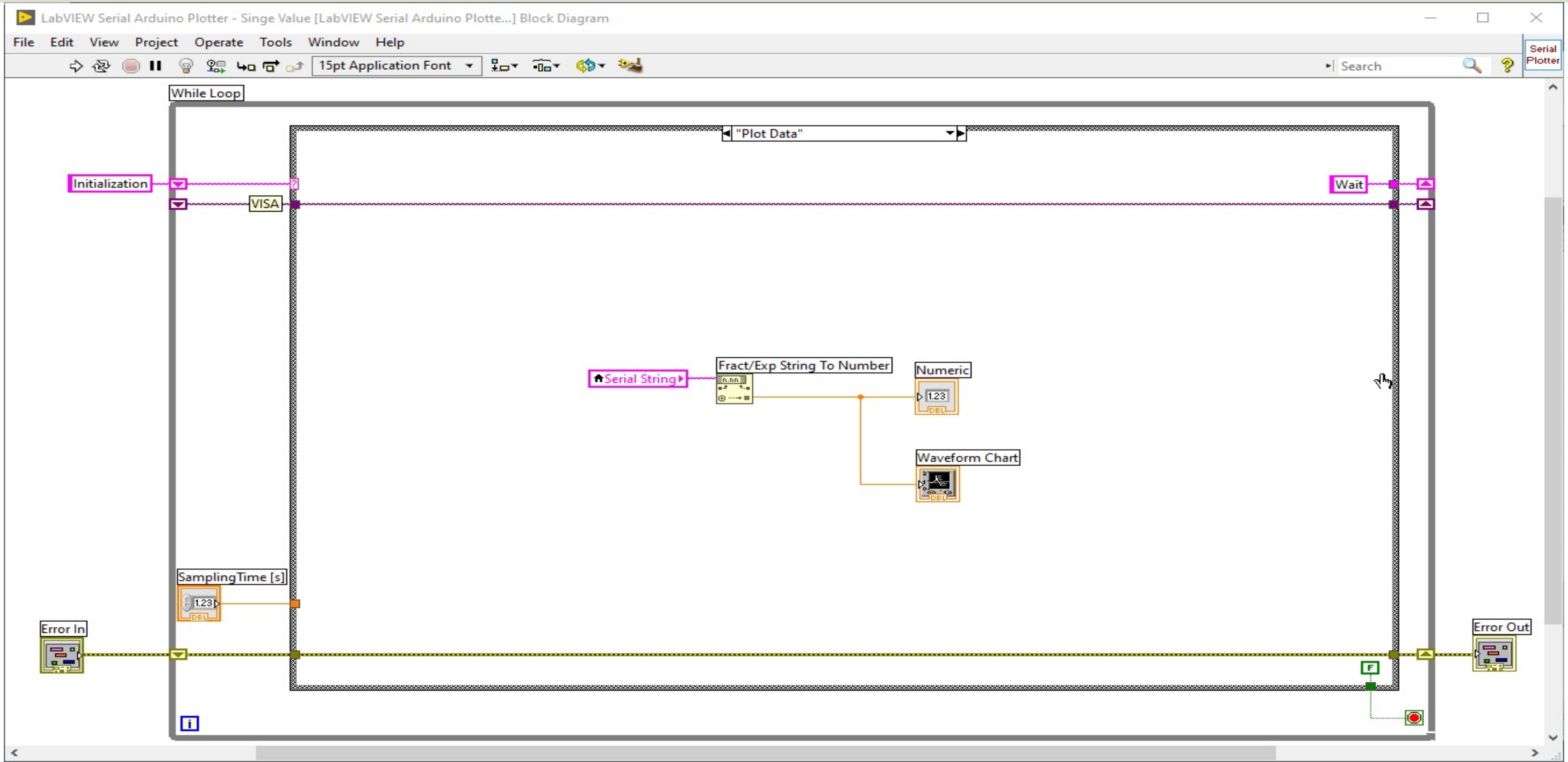
LabVIEW Code


LabVIEW Serial Arduino Plotter - Singe Value [LabVIEW Serial Arduino Plotte...] Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
Serial Plotter
While Loop
"Initialize Serial Communication"
Initialization
VISA
Wait
Enable Termination Char
termination char (0xA = '\n' = LF)
x0
COM10
VISA Configure Serial Port
Baud Rate
9600
Data bits
8
Parity
None
SamplingTime [s]
1.23
Error In
Error Out
F
i

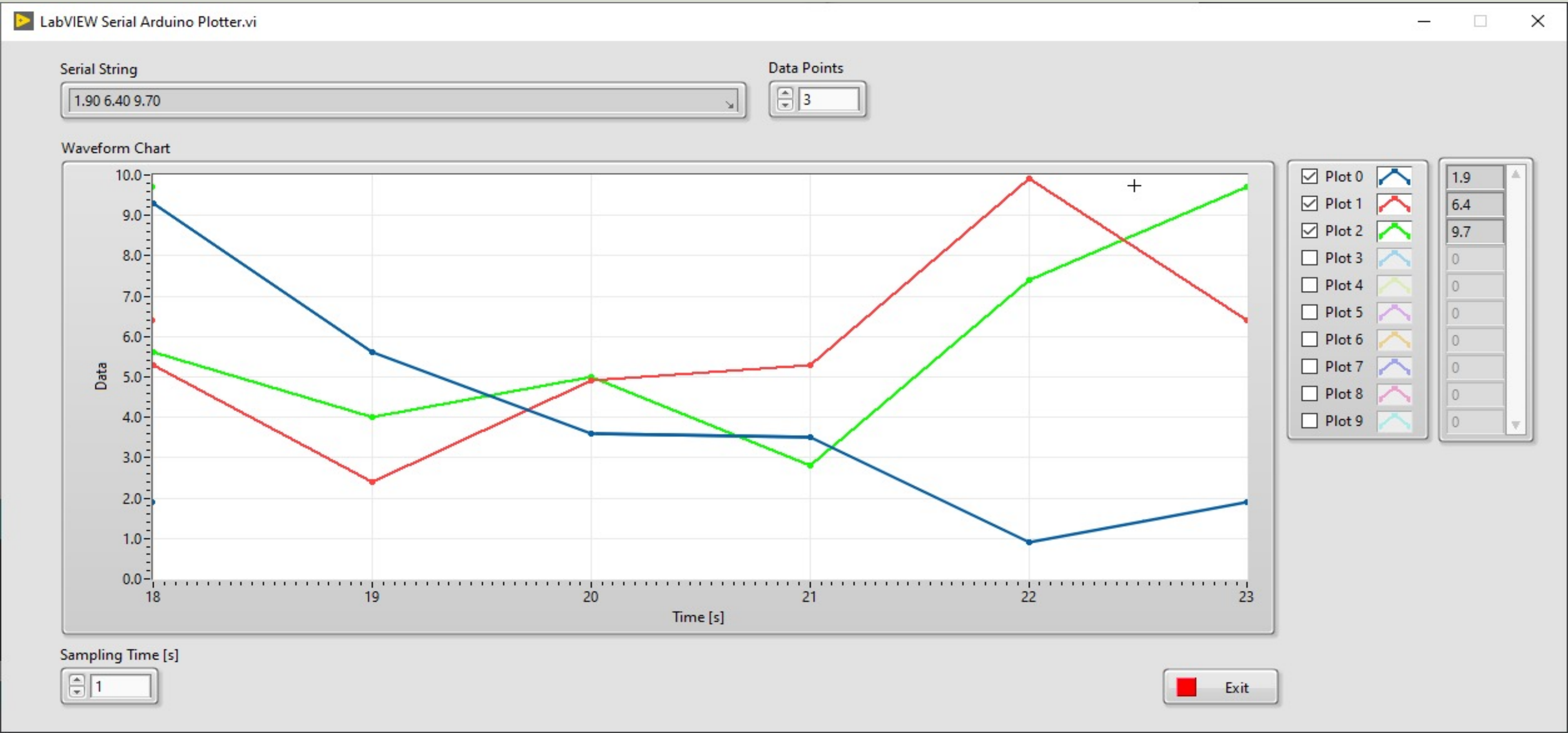
LabVIEW Code



LabVIEW Code



Multiple Data



LabVIEW Serial Arduino Plotter.vi

Serial String: 1.90 6.40 9.70

Data Points: 3

Waveform Chart

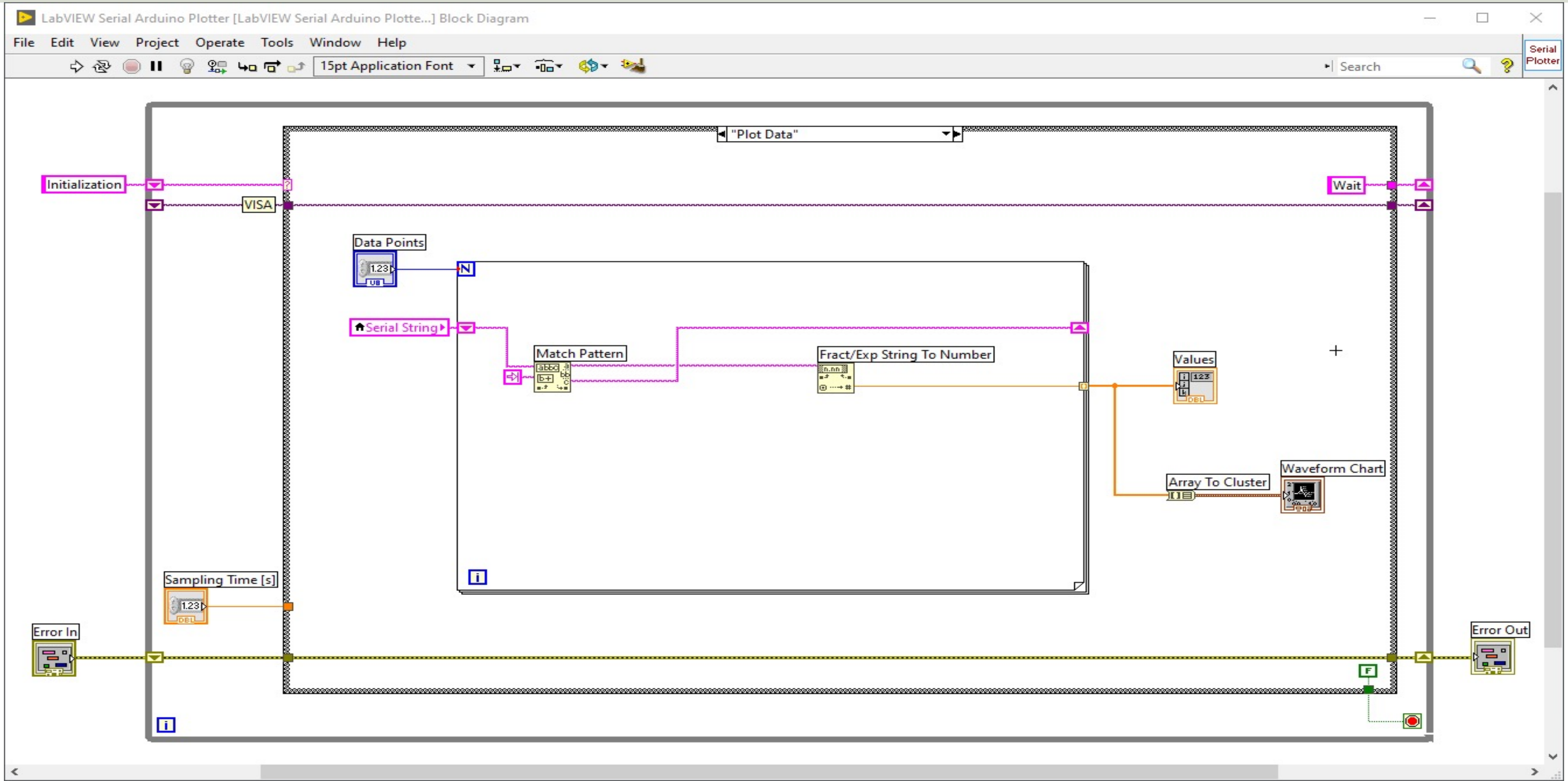
✓ Plot 0	1.9
✓ Plot 1	6.4
✓ Plot 2	9.7
Plot 3	0
Plot 4	0
Plot 5	0
Plot 6	0
Plot 7	0
Plot 8	0
Plot 9	0

Sampling Time [s]: 1

Arduino Code

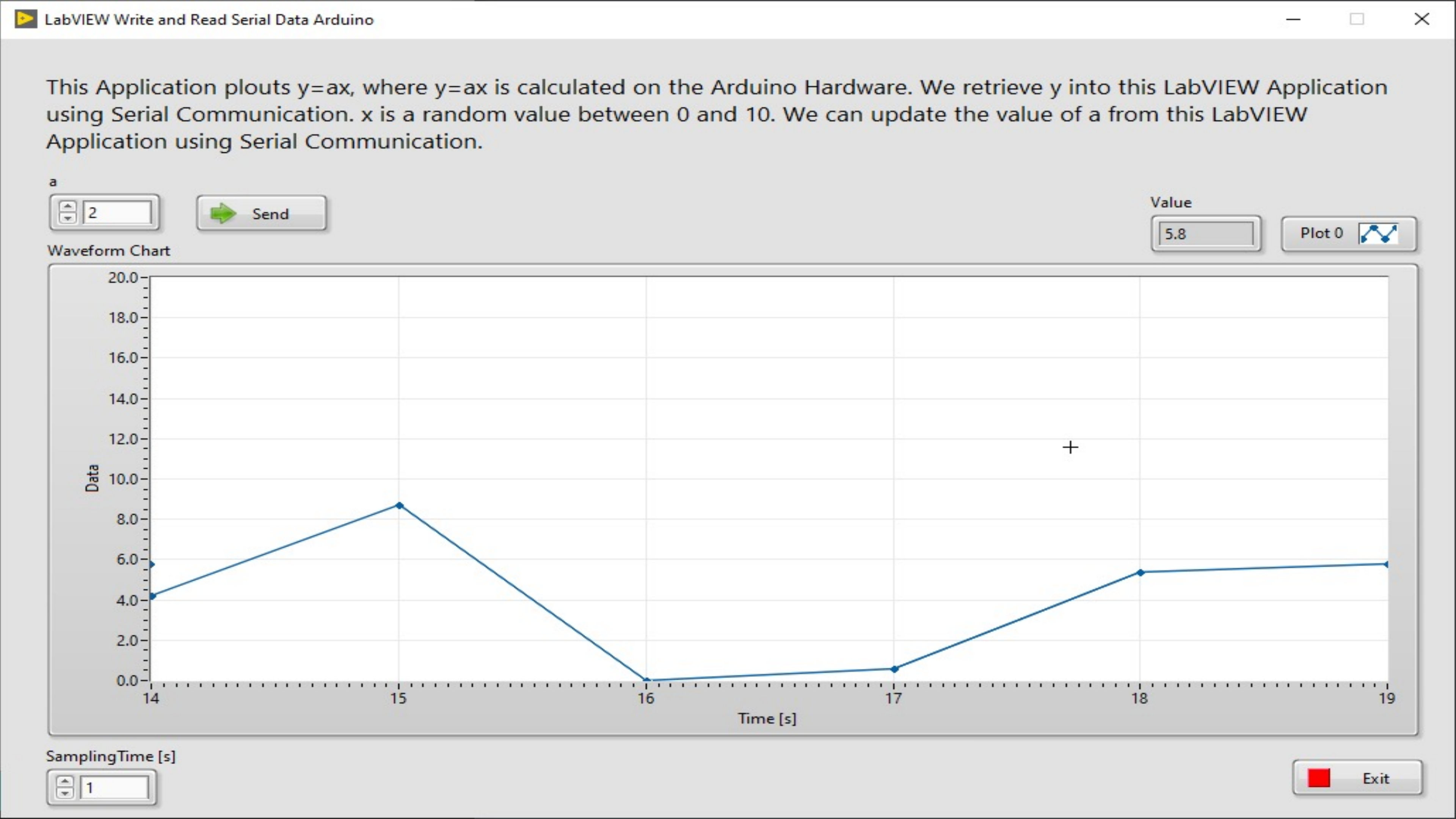
```
double x = 5;
void setup()
{
  Serial.begin(9600);
}

void loop()
{
  x = random(1,100)/10.0;
  Serial.print(x);

  x = random(1,100)/10.0;
  Serial.print("\t");
  Serial.print(x);

  x = random(1,100)/10.0;
  Serial.print("\t");
  Serial.println(x);
  delay(1000);
}
```

LabVIEW Code



LabVIEW GUI Interface

LabVIEW GUI Interface that Communicates with the Arduino Code


LabVIEW Write and Read Serial Data Arduino

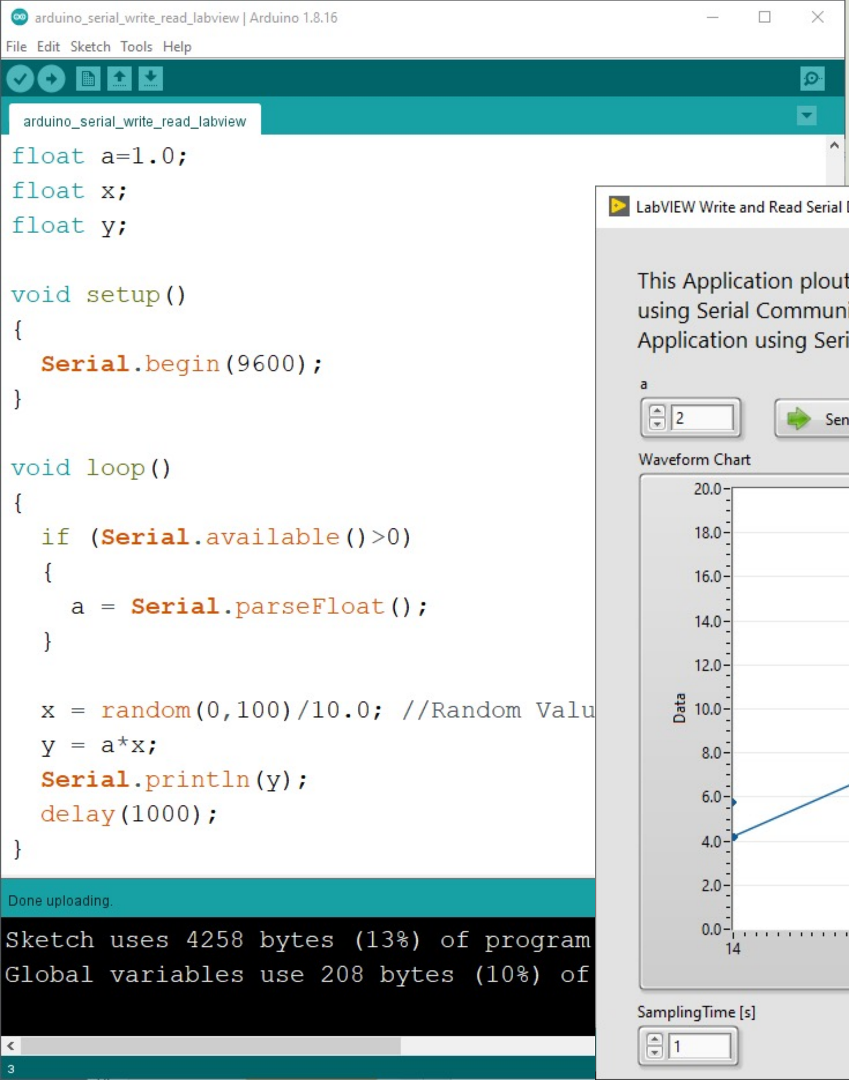
This Application plouts y=ax, where y=ax is calculated on the Arduino Hardware. We retrieve y into this LabVIEW Application using Serial Communication. x is a random value between 0 and 10. We can update the value of a from this LabVIEW Application using Serial Communication.

a: 2

Value: 5.8

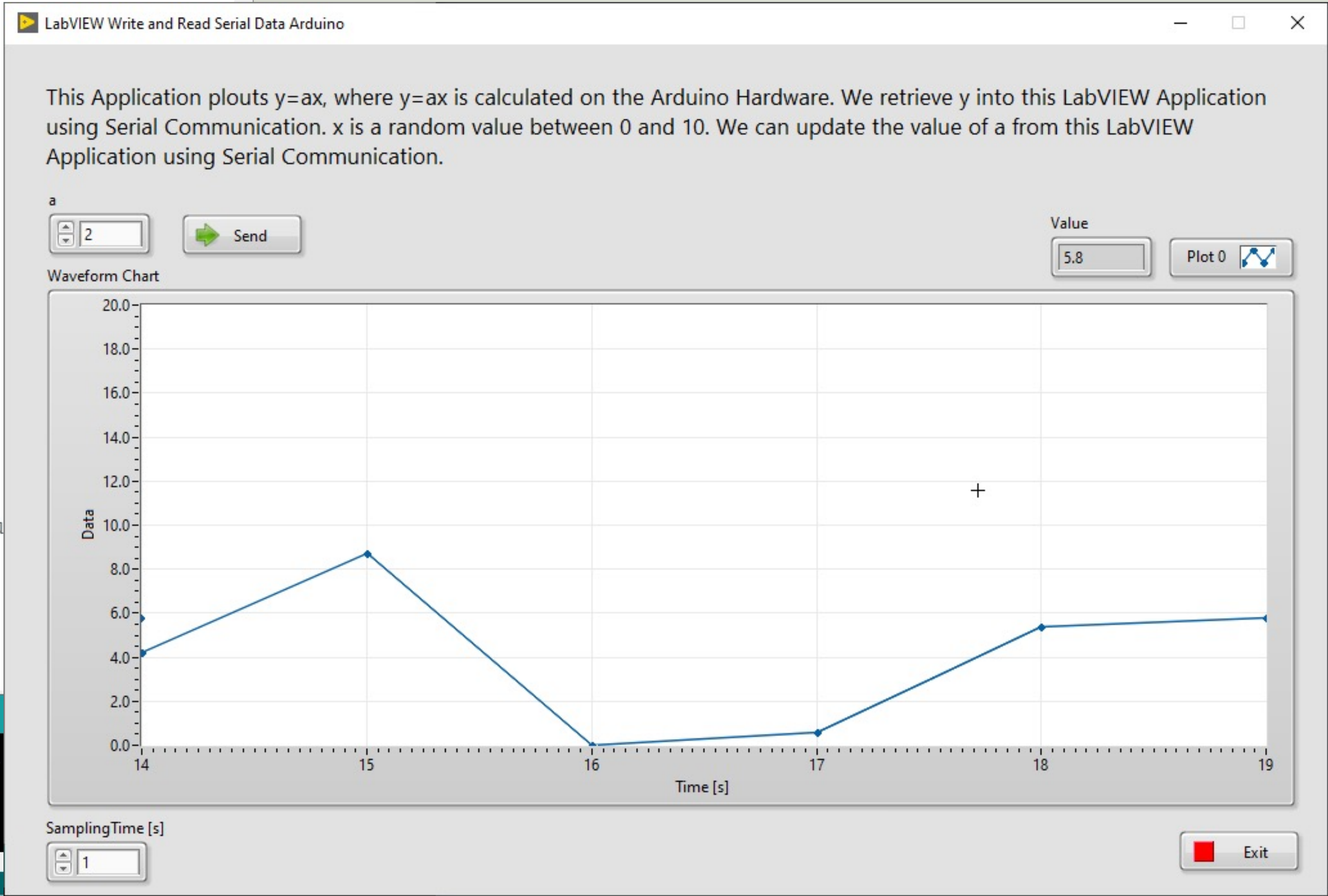
SamplingTime [s]: 1

Running Example


arduino_serial_write_read_labview | Arduino 1.8.16
File Edit Sketch Tools Help
arduino_serial_write_read_labview

```
float a=1.0;
float x;
float y;

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

void loop()
{
  if (Serial.available()>0)
  {
    a = Serial.parseFloat();
  }

  x = random(0,100)/10.0; //Random Valu
  y = a*x;
  Serial.println(y);
  delay(1000);
}
```

```
Done uploading.
Sketch uses 4258 bytes (13%) of program
Global variables use 208 bytes (10%) of
```



This Application plouts y=ax, where y=ax is calculated on the Arduino Hardware. We retrieve y into this LabVIEW Application using Serial Communication. x is a random value between 0 and 10. We can update the value of a from this LabVIEW Application using Serial Communication.

a: 2

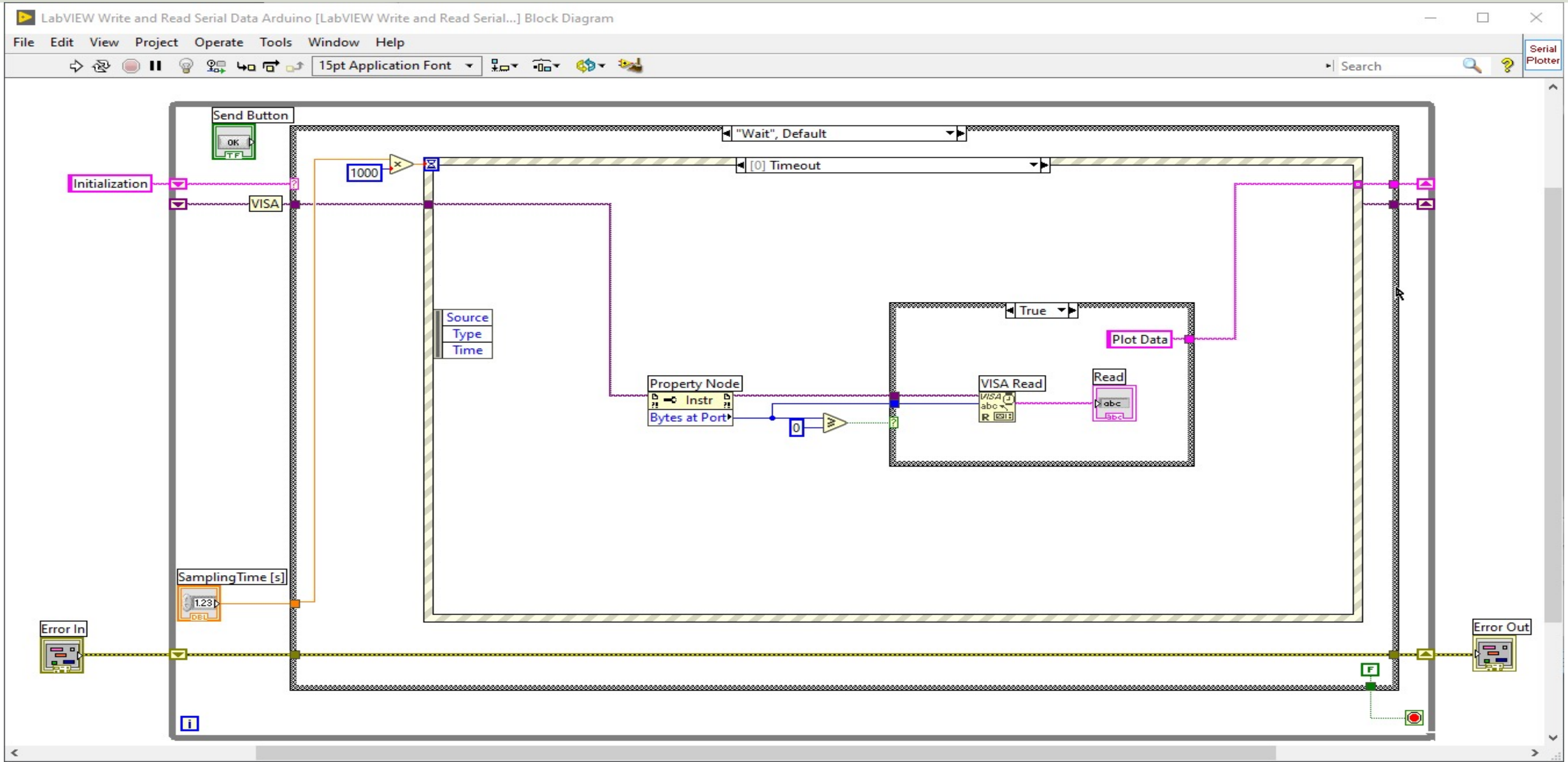
Value: 5.8

SamplingTime [s]: 1

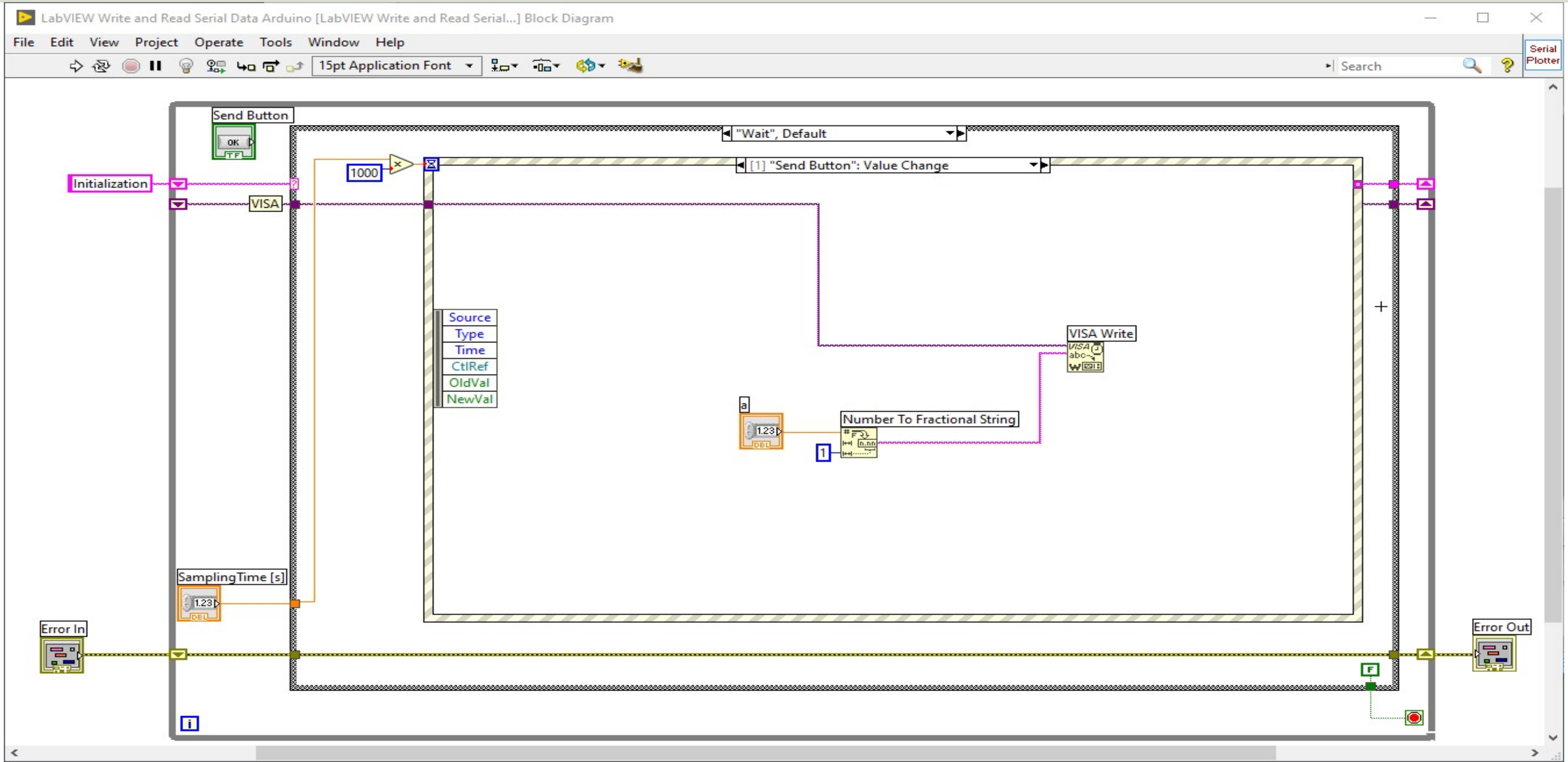
Arduino

```
float a=1.0;
float x;
float y;

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

void loop()
{
  if (Serial.available()>0)
  {
    a = Serial.parseFloat();
  }

  x = random(0,100)/10.0; //Random Value between 0-10
  y = a*x;
  Serial.println(y);
  delay(1000);
}
```

LabVIEW Code

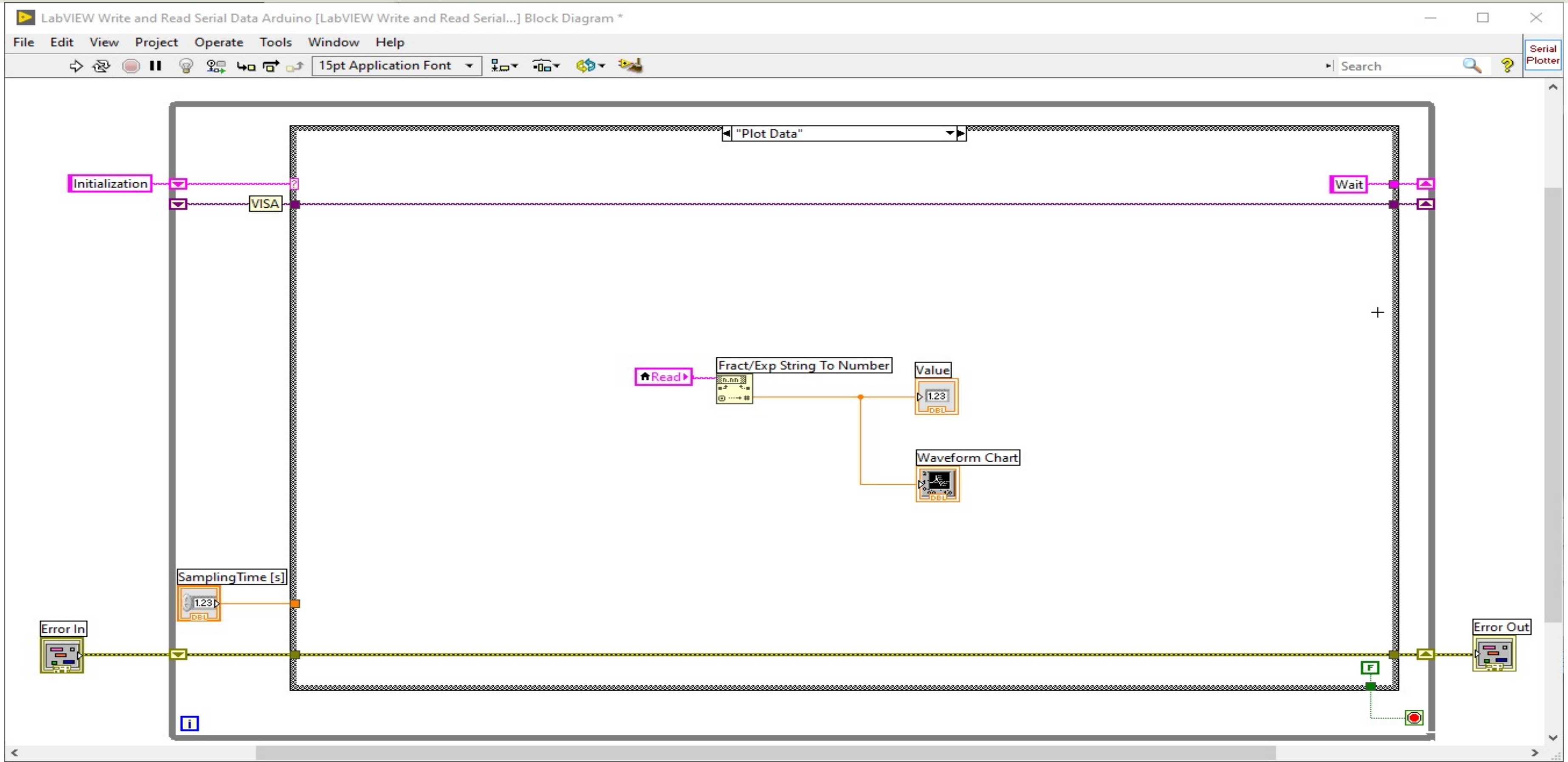


LabVIEW Code



LabVIEW Write and Read Serial Data Arduino [LabVIEW Write and Read Serial...] Block Diagram
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
Serial Plotter
Send Button
OK
"Wait", Default
1000
[1] "Send Button": Value Change
Initialization
VISA
Source
Type
Time
CtlRef
OldVal
NewVal
VISA Write
a
1.23
Number To Fractional String
1
SamplingTime [s]
1.23
Error In
Error Out
F
i

LabVIEW Code



LabVIEW LINX

Hans-Petter Halvorsen

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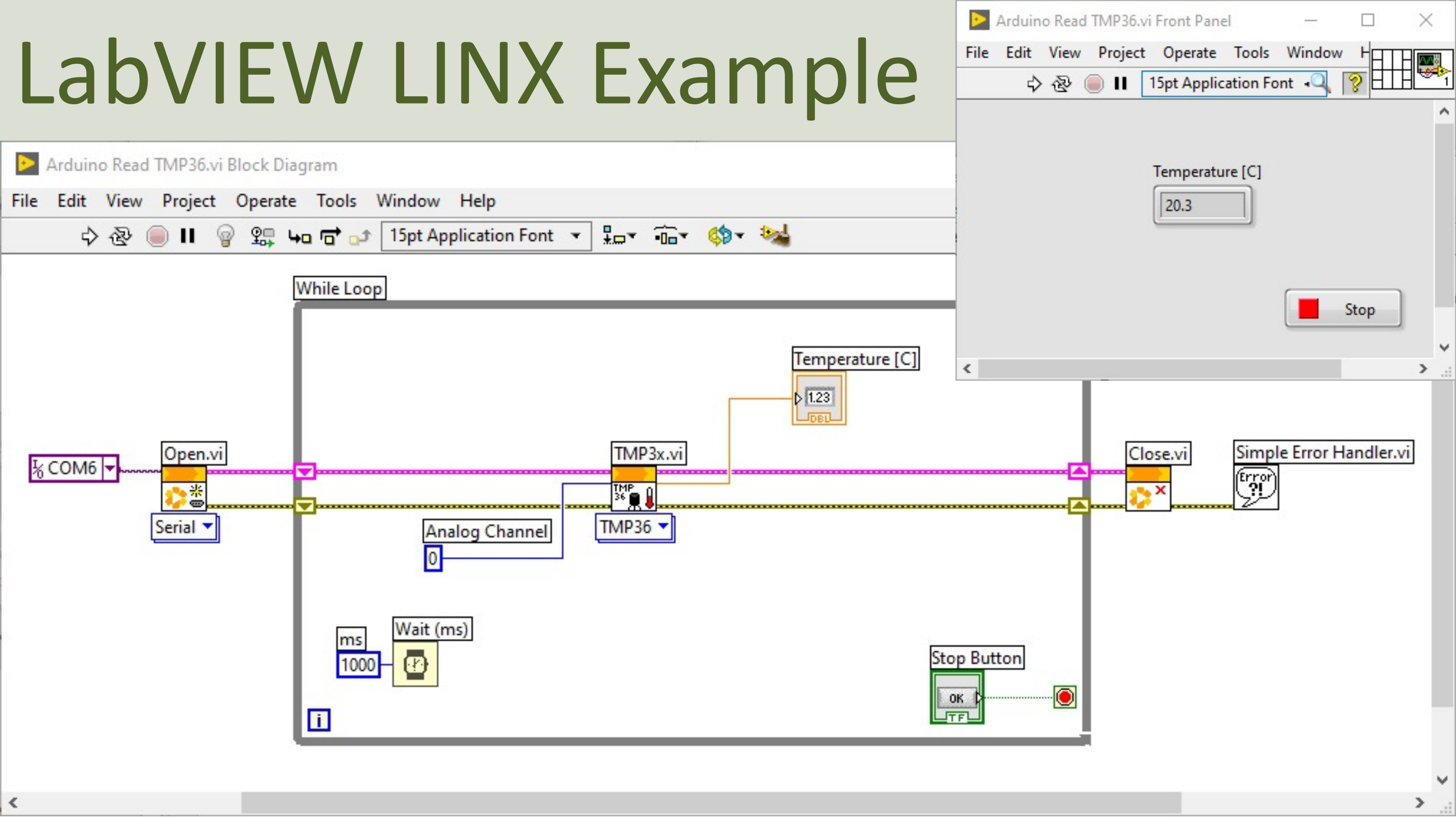
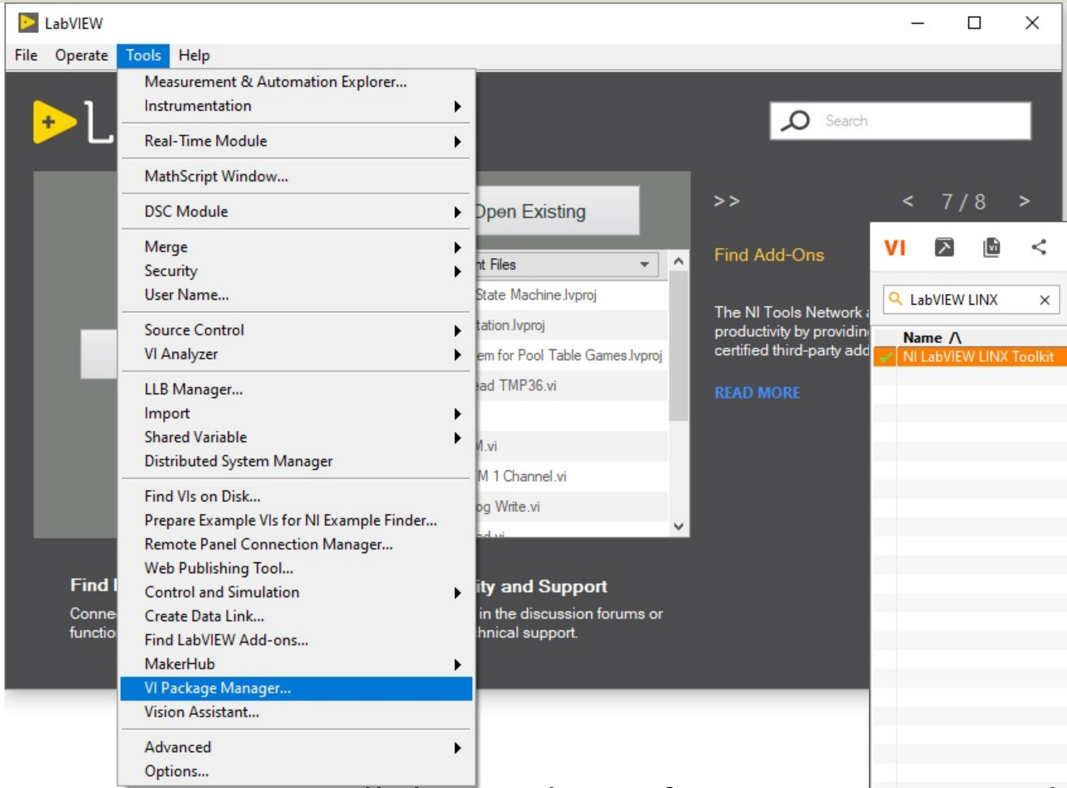
LabVIEW LINX

- The LabVIEW LINX Toolkit adds support for Arduino
- This means we use LabVIEW Programming instead of Arduino Programming
- In this Tutorial we have just used LabVIEW as an interface for communication with your existing Arduino code
- If use want to use LabVIEW 100% in your application, LabVIEW LINX is a good alternative to the examples provided in this Tutorial
- I have made several other Tutorials and Videos where I introduce and use LabVIEW LINX
  – https://www.youtube.com/IndustrialITandAutomation
  – https://www.halvorsen.blog

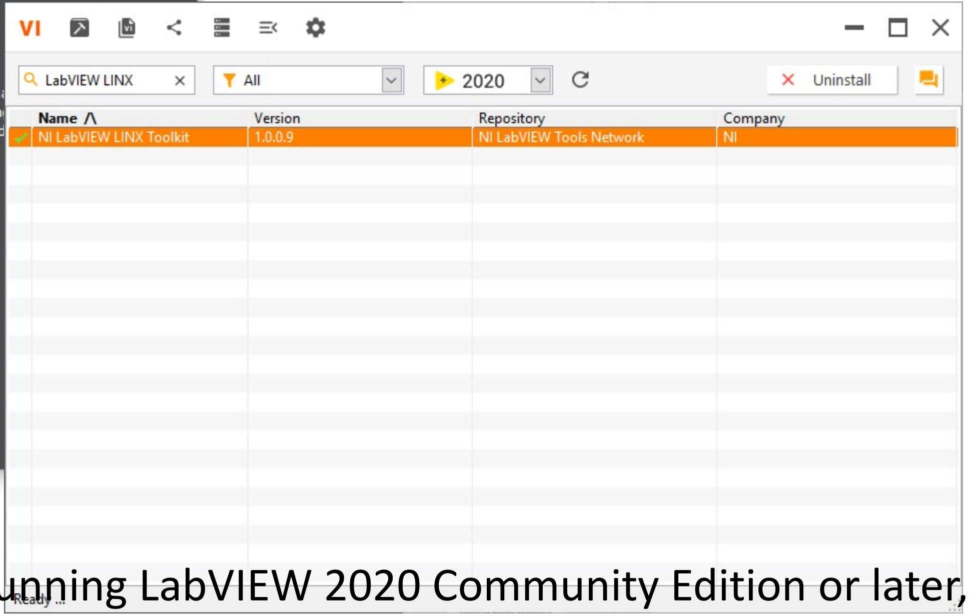
LabVIEW LINX Example



Installing LabVIEW LINX Toolkit



Use VI Package Manger



Name	Version	Repository	Company
NI LabVIEW LINX Toolkit	1.0.0.9	NI LabVIEW Tools Network	NI

Note: Do not install this package if you are running LabVIEW 2020 Community Edition or later, as the Community Edition already includes the LabVIEW LINX Toolkit

Summary

- Arduino is great, but it lacks a Graphical User Interface (GUI)
- We have the Serial Monitor and Serial Plotter, but they are very limited
- I this Tutorial LabVIEW has been used to extend the Arduino by creating a GUI in LabVIEW, both for view/plotting data and for updating variables
- An even more flexible extension can be to use LabVIEW LINX, which I demonstrate and use in many other Tutorials and Videos

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Web: https://www.halvorsen.blog