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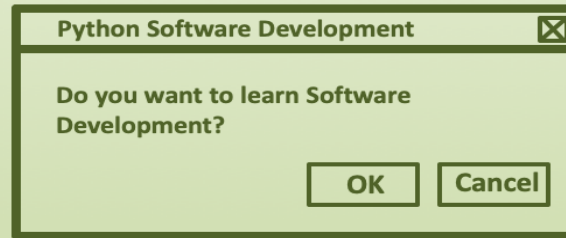
Python Integration with LabVIEW

Hans-Petter Halvorsen

Free Textbook with lots of Practical Examples

Python for Software Development

Hans-Petter Halvorsen



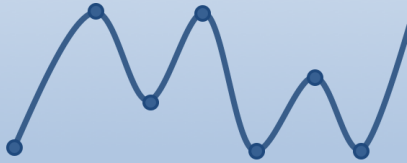
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Additional Python Resources

Python Programming

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Python for Science and Engineering

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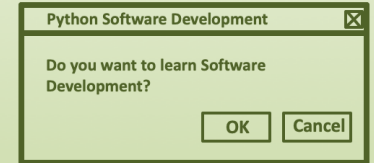
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Contents

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 - Python
 - LabVIEW

It is recommended that you know how to write Modules and Functions in Python. If not, see the Tutorial “Create Functions with Python”

Python

- Python is a fairly old Programming Language (1991) compared to many other Programming Languages like C# (2000), Swift (2014), Java (1995), PHP (1995).
- Python has during the last 10 years become more and more popular.
- Today, Python has become one of the most popular Programming Languages.
- Cross Platform: Python can be used on all platforms (Windows, macOS and Linux).
- Python is highly extendable due to its high number of free available Python Packaged and Libraries

Python Example

Spyder (Python 3.7)

Editor - /Users/halvorsen/OneDrive/Documents/Python/Python Programming/Code Examples/Plotting

untitled0.py | air_heater_stability_analysi... | plot_dynamic_syste...

```
1 import math as mt
2 import numpy as np
3 import matplotlib.pyplot as plt
4
5
6 # Model Parameters
7 T = 5
8 a = -1/T
9
10 # Simulation Parameters
11 x0 = 1
12 t = 0
13
14 tstart = 0
15 tstop = 25
16
17 increment = 1
18
19 x = []
20 x = np.zeros(tstop+1)
21
22 t = np.arange(tstart,tstop+1,increment)
23
24
25 # Define the Function
26 for k in range(tstop):
27     x[k] = mt.exp(a*t[k]) * x0
28
29
30 # Plot the Simulation Results
31 plt.plot(t,x)
32 plt.title('Simulation of Dynamic System')
33 plt.xlabel('t')
34 plt.ylabel('x')
35 plt.grid()
36 plt.axis([0, 25, 0, 1])
37 plt.show()
```

Variable explorer

Name	Type	Size	Value
T	int	1	5
a	float	1	-0.2
increment	int	1	1
k	int	1	24
t	int64	(26,)	[0 1 2 ... 23 24 25]
tstart	int	1	0
tstop	int	1	25
x	float64	(26,)	[1. 0.81873075 0.67032005 ... 0.01005184 0.00822975 0. ...]
x0	int	1	1

Variable explorer | File explorer | Help

IPython console

Console 1/A

Python 3.7.0 (default, Jun 28 2018, Type "copyright", "credits" or "lic...)

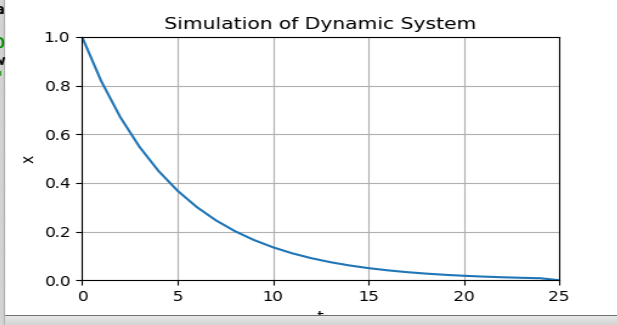
IPython 7.8.0 -- An enhanced Interac...

In [1]: runfile('/Users/halvorsen/0...
Plotting/plot_dynamic_system.py', w...
Programming/Code Examples/Plotting')

In [2]:

Figure 1

Simulation of Dynamic System



IPython console | History log

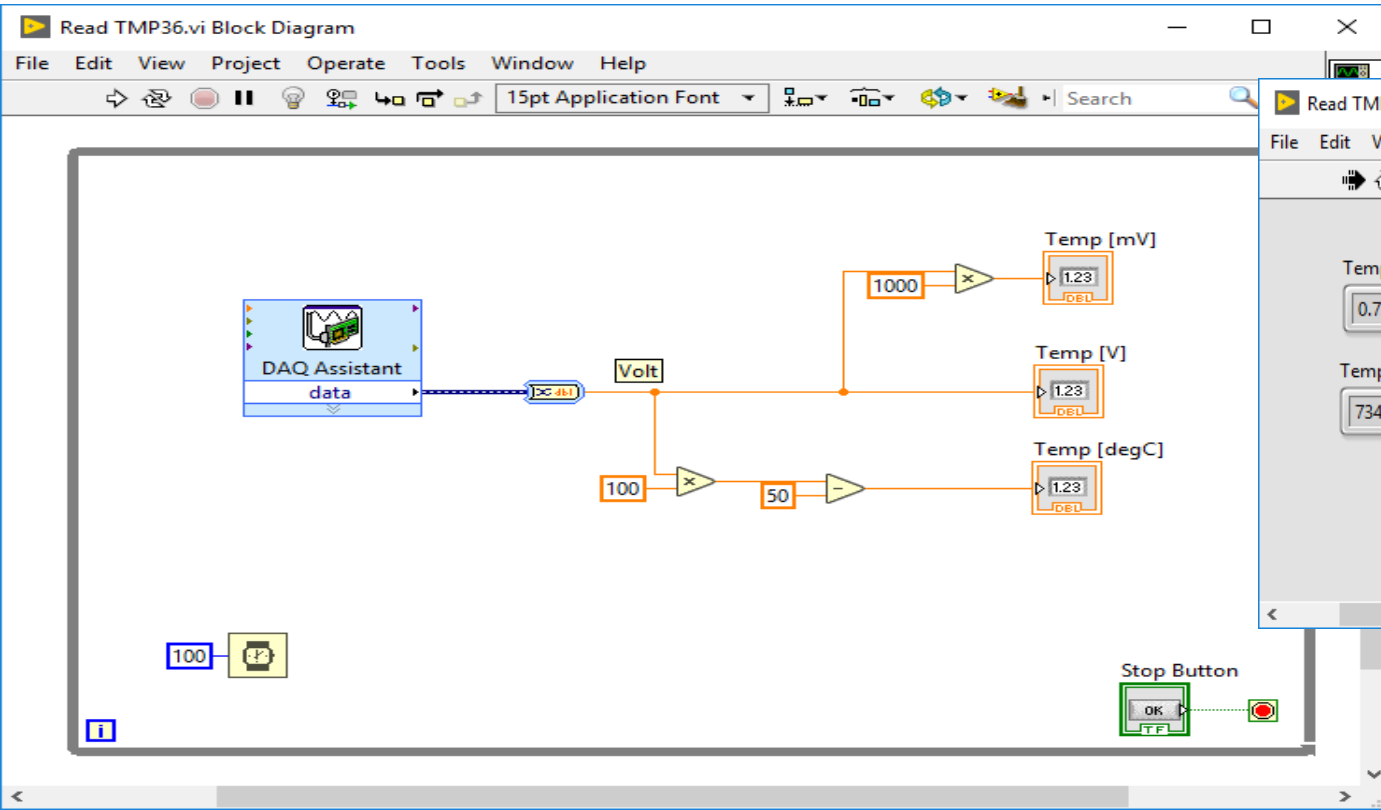
Run file | Permissions: RW | End-of-lines: LF | Encoding: ASCII | Line: 1 | Column: 1 | Memory: 73 %

LabVIEW

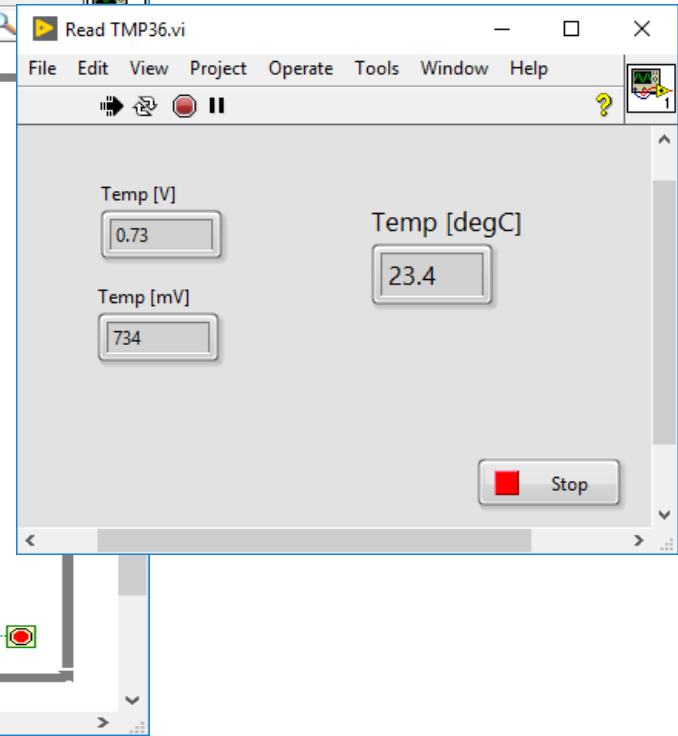
- LabVIEW is a graphical programming language, and it has powerful features for simulation, control and DAQ applications
- LabVIEW is a fully functional programming language which you can use to create many different kinds of applications. In addition it can also integrate with many other programming languages like MATLAB and Python
- Go to my web site in order to learn more about LabVIEW:
<https://www.halvorsen.blog>
<https://www.halvorsen.blog/documents/programming/labview/>
- Her you find information about LabVIEW, you find lots of resources like training material, videos, code examples, etc.

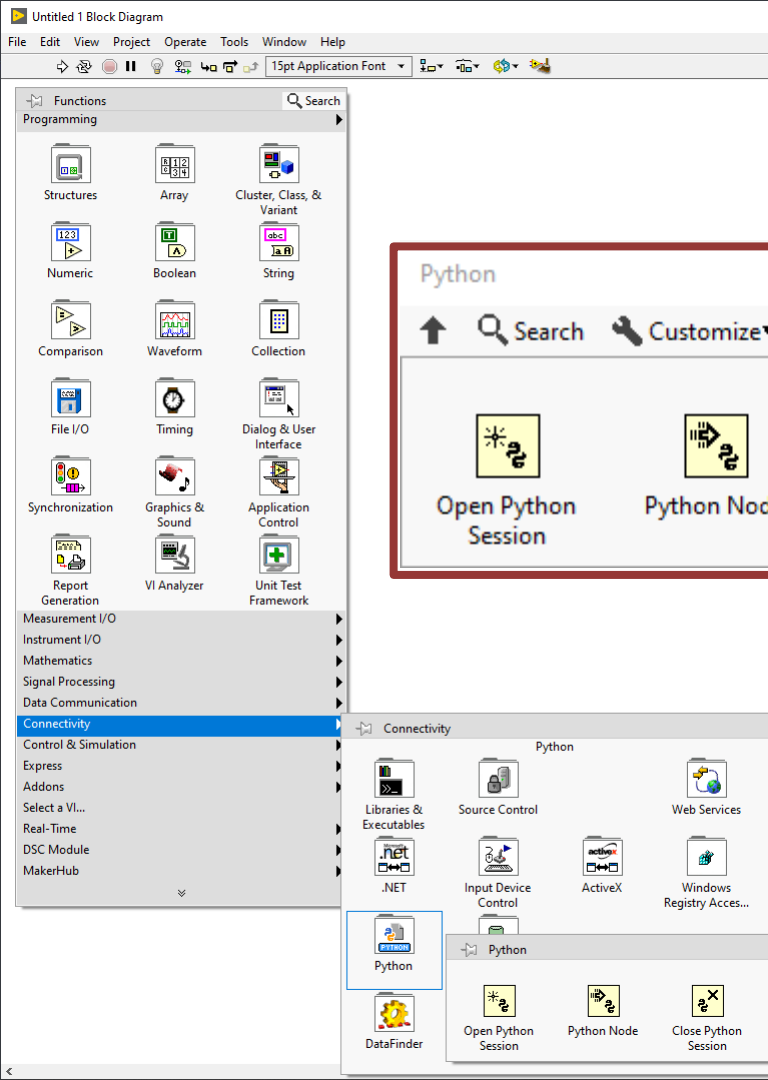
LabVIEW Example

Block Diagram (Code)



Front Panel (GUI)





Python in LabVIEW

We can use the Python functions to call Python code directly from LabVIEW

Note! Ensure that the bitness of Python corresponds to the bitness of LabVIEW installed on the machine. This means if you have LabVIEW 32 bit, you should use Python 32 bit and if you have LabVIEW 64 bit, you should use Python 64 bit.

Celsius to Fahrenheit Example

We create a Python Module that has functions for converting from **Celsius to Fahrenheit** and from **Fahrenheit to Celsius**

Then we will call these functions from LabVIEW

Necessary Formulas to implement in the Python code:

$$T_f = (T_c \times 9/5) + 32$$

$$T_c = (T_f - 32) \times (5/9)$$

Create Python Code

First, we create a Python module with the following functions (“fahrenheit.py”):

fahrenheit.py

```
def c2f(Tc) :  
    Tf = (Tc * 9/5) + 32  
    return Tf  
  
def f2c(Tf) :  
    Tc = (Tf - 32) * (5/9)  
    return Tc
```

Test Python Code

Then, we create a Python script for testing the functions ("test_fahrenheit.py"):

The results becomes:

Fahrenheit: 32.0

Celsius: 0.0

```
from fahrenheit import c2f, f2c
```

```
Tc = 0
```

```
Tf = c2f(Tc)
```

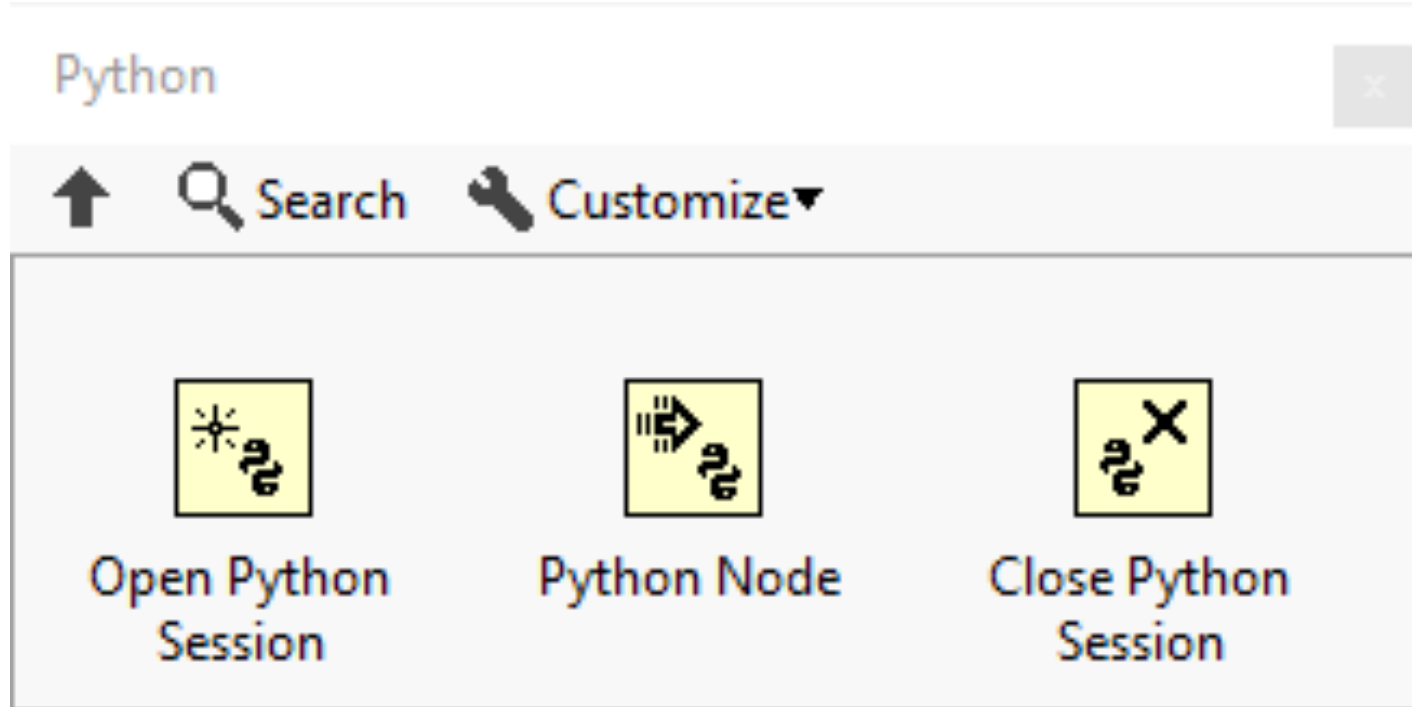
```
print("Fahrenheit: " + str(Tf))
```

```
Tf = 32
```

```
Tc = f2c(Tf)
```

```
print("Celsius: " + str(Tc))
```

LabVIEW

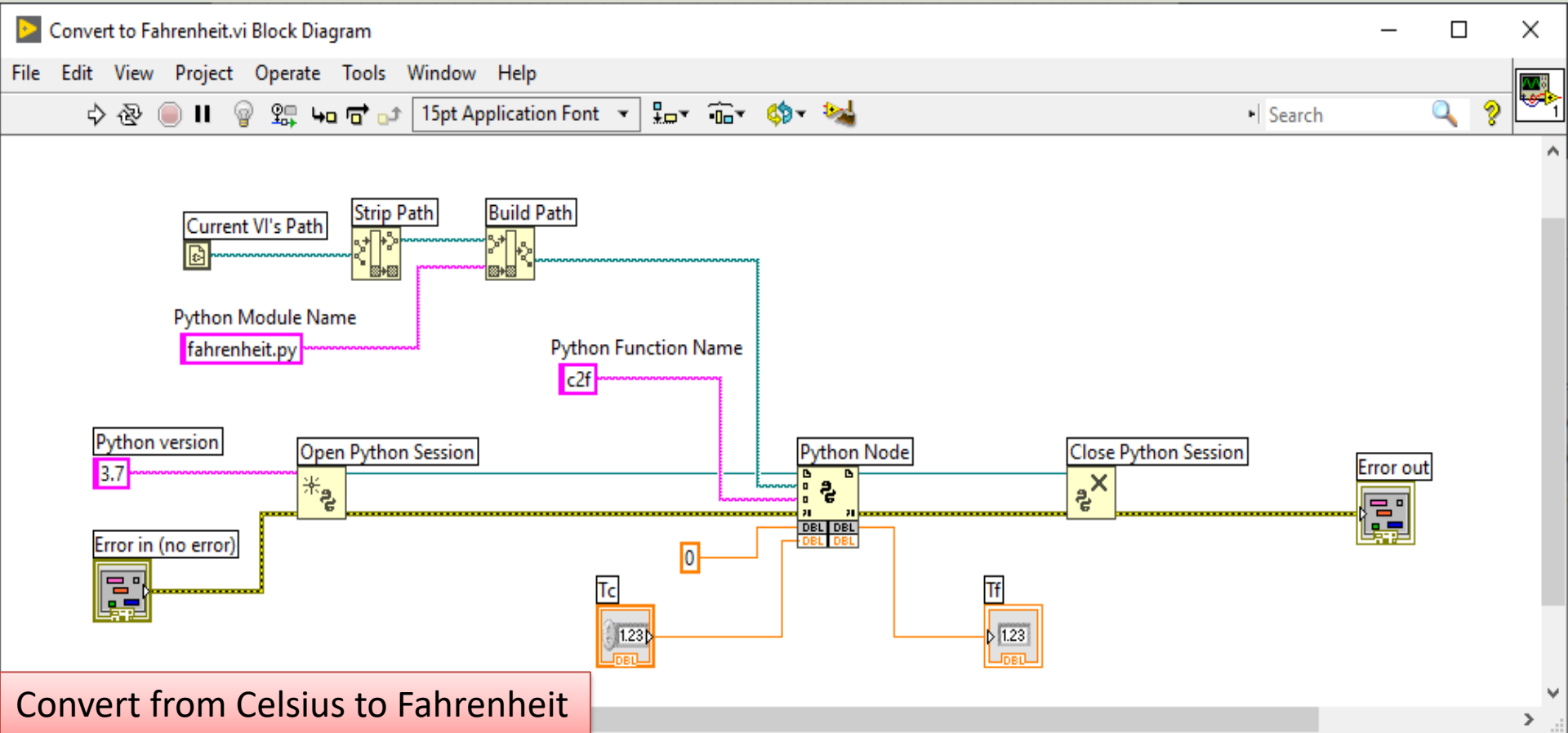


LabVIEW Programming

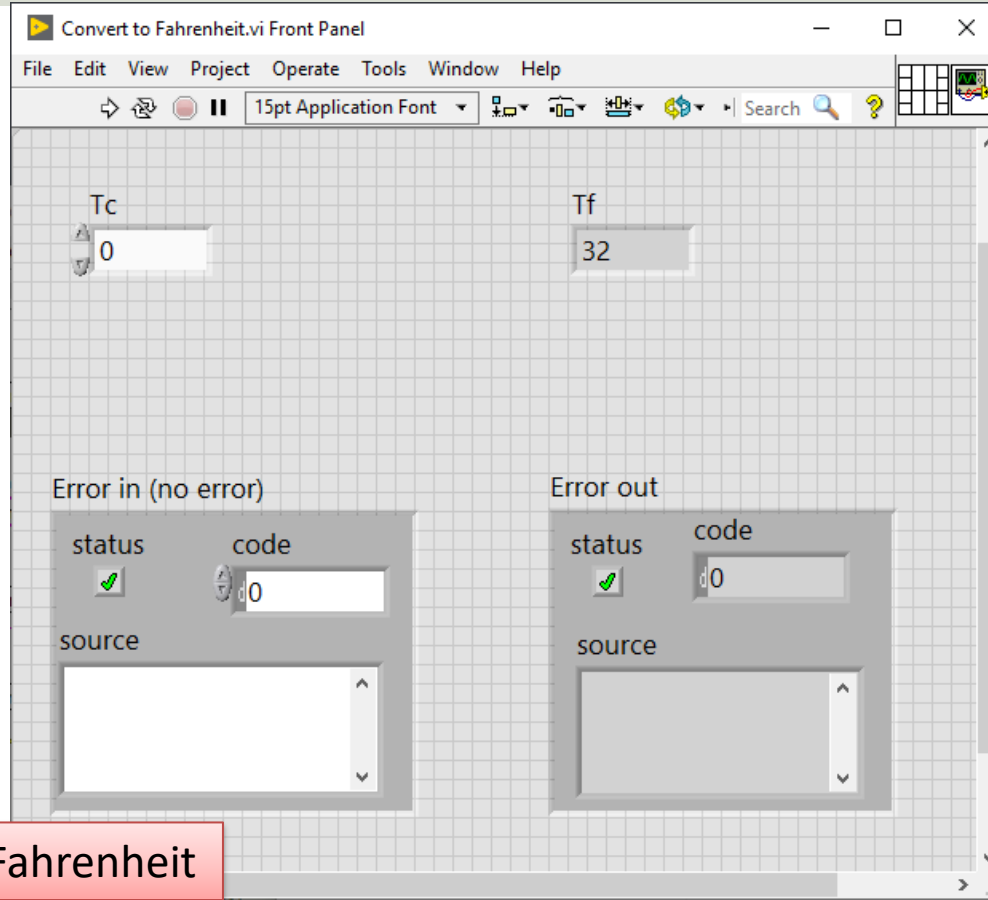
Short Introduction to the fundamentals in LabVIEW Programming

Front Panel, Block Diagram, Controls, Indicators, Functions, Wiring, etc.

LabVIEW – Block Diagram

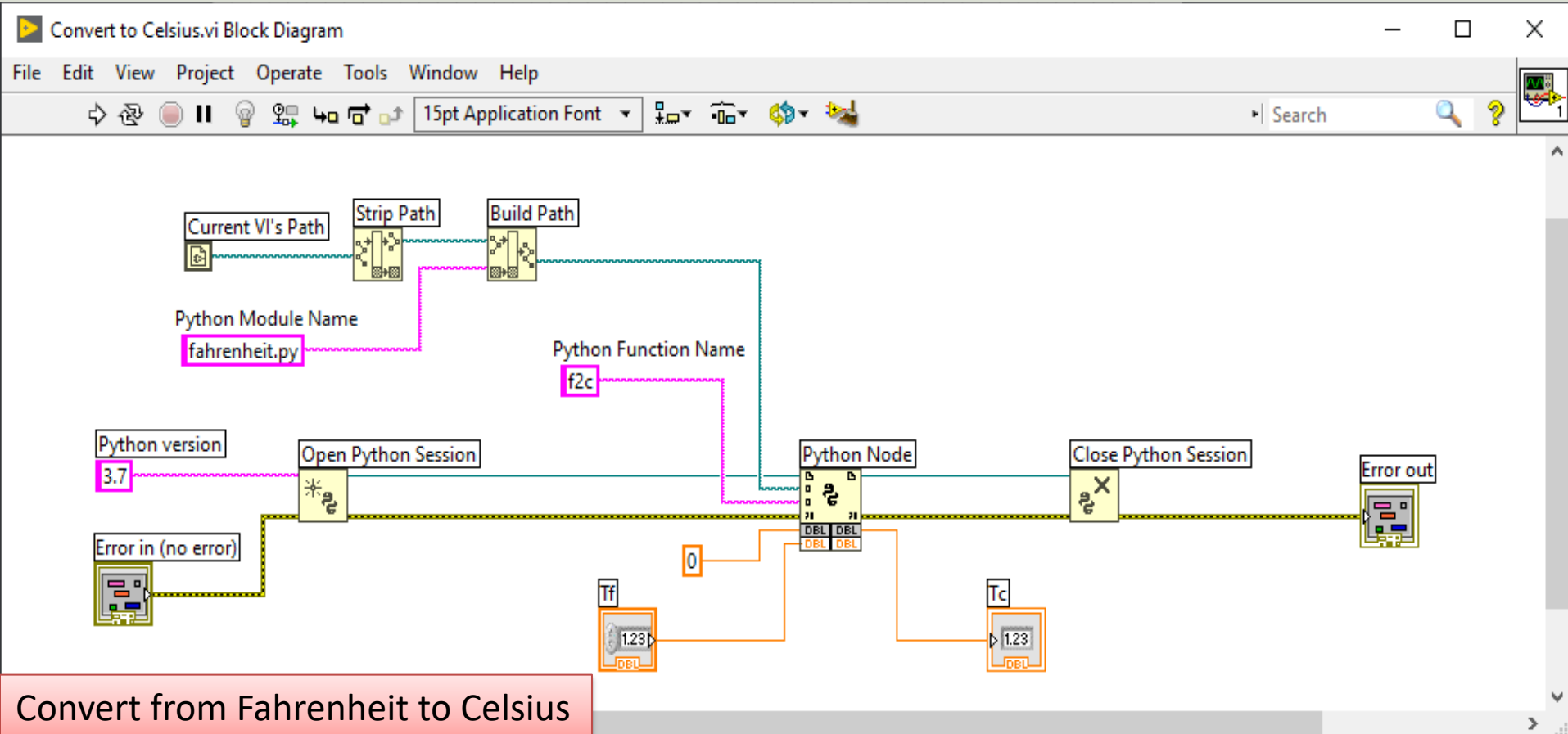


LabVIEW – Front Panel

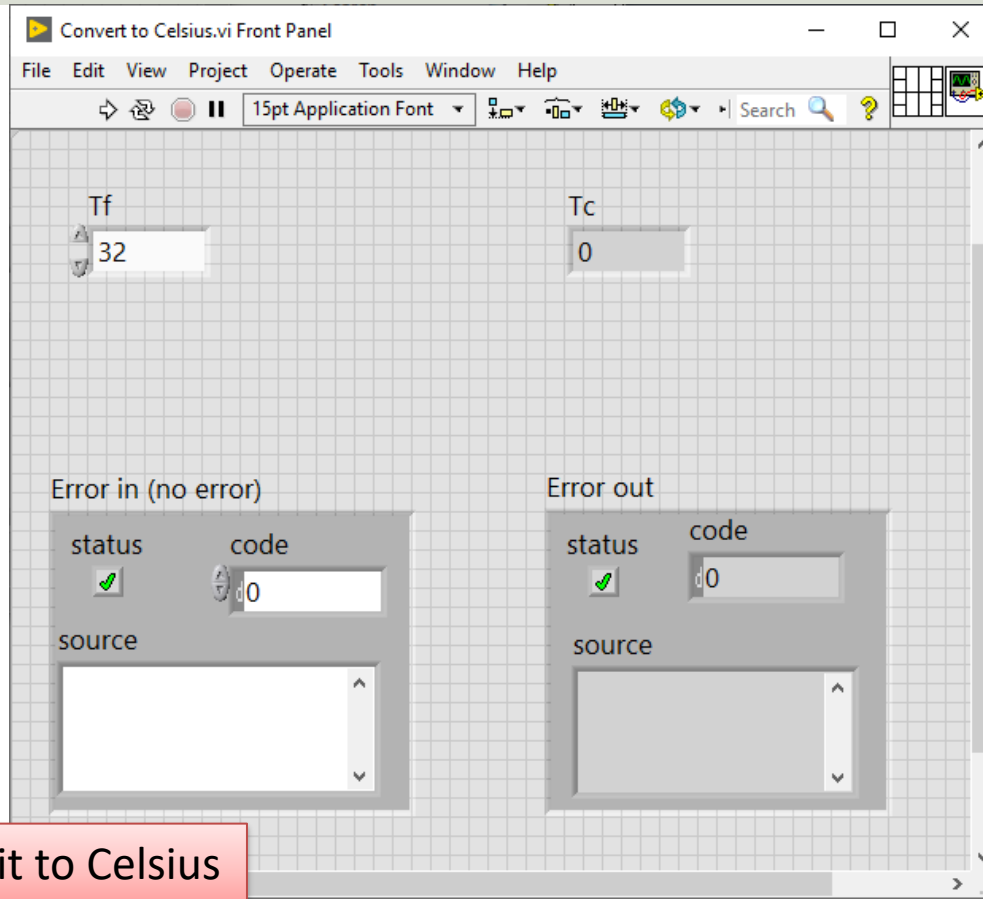


Convert from Celsius to Fahrenheit

LabVIEW – Block Diagram



LabVIEW – Front Panel

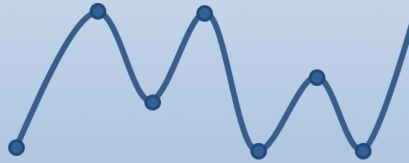


Convert from Fahrenheit to Celsius

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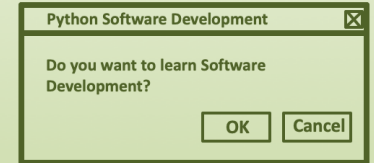
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