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LabVIEW and ThingSpeak

Hans-Petter Halvorsen

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Introduction

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Introduction

- In this Tutorial we will see how we can use ThingSpeak in combination with LabVIEW
- ThingSpeak is an IoT service that lets you collect and store sensor data in the cloud
- LabVIEW is a popular graphical programming environment
- Lots of LabVIEW Examples will be provided for writing Data to ThingSpeak and Reading Data from ThingSpeak

ThingSpeak™

ThingSpeak

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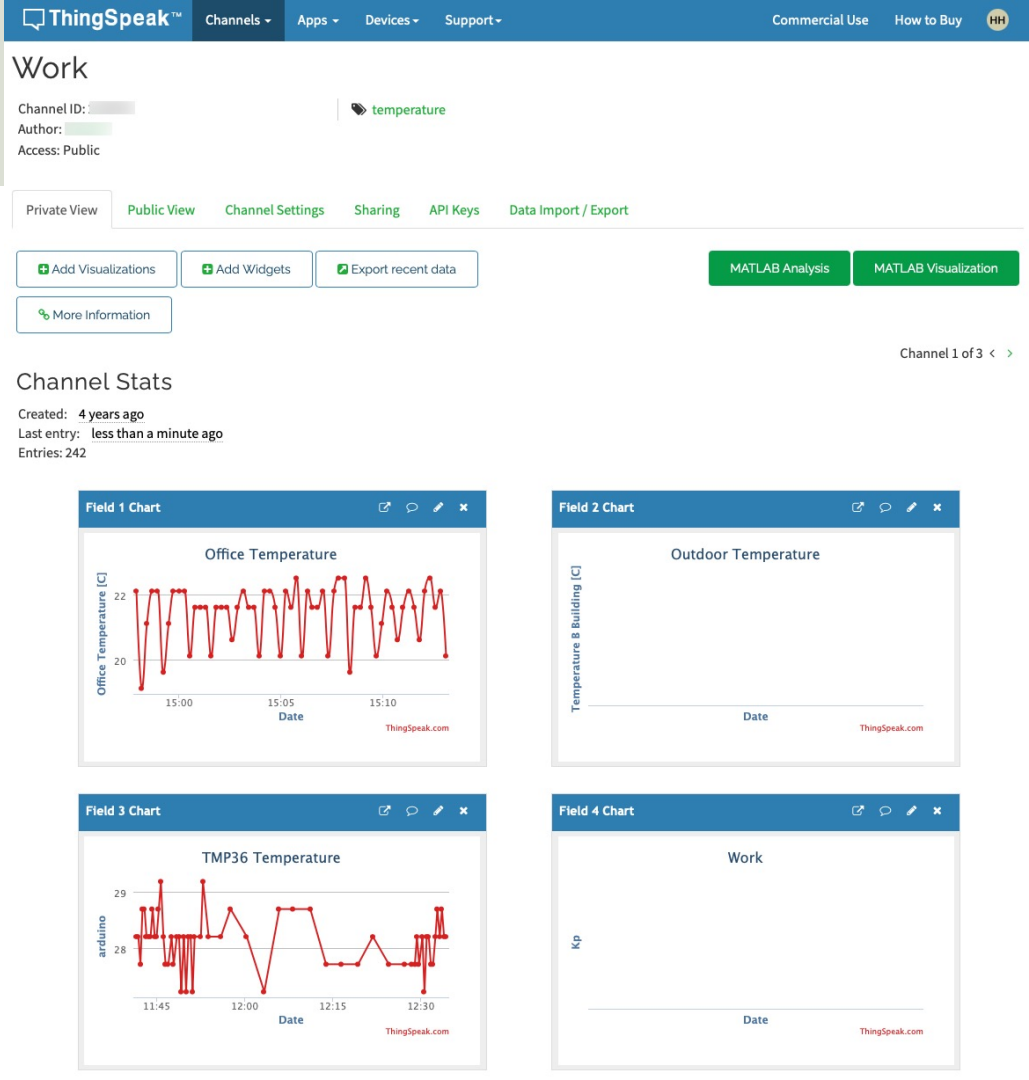
ThingSpeak

- ThingSpeak is an IoT service that lets you collect and store sensor data in the cloud and develop Internet of Things applications.
- ThingSpeak is free for small non-commercial projects
- In addition, they offer different types of licenses where you pay a monthly fee
- ThingSpeak is owned by MathWorks, the same vendor that develop the MATLAB software
- https://thingspeak.com

ThingSpeak

Here you see an example of how Data can be presented in the ThingSpeak Web page

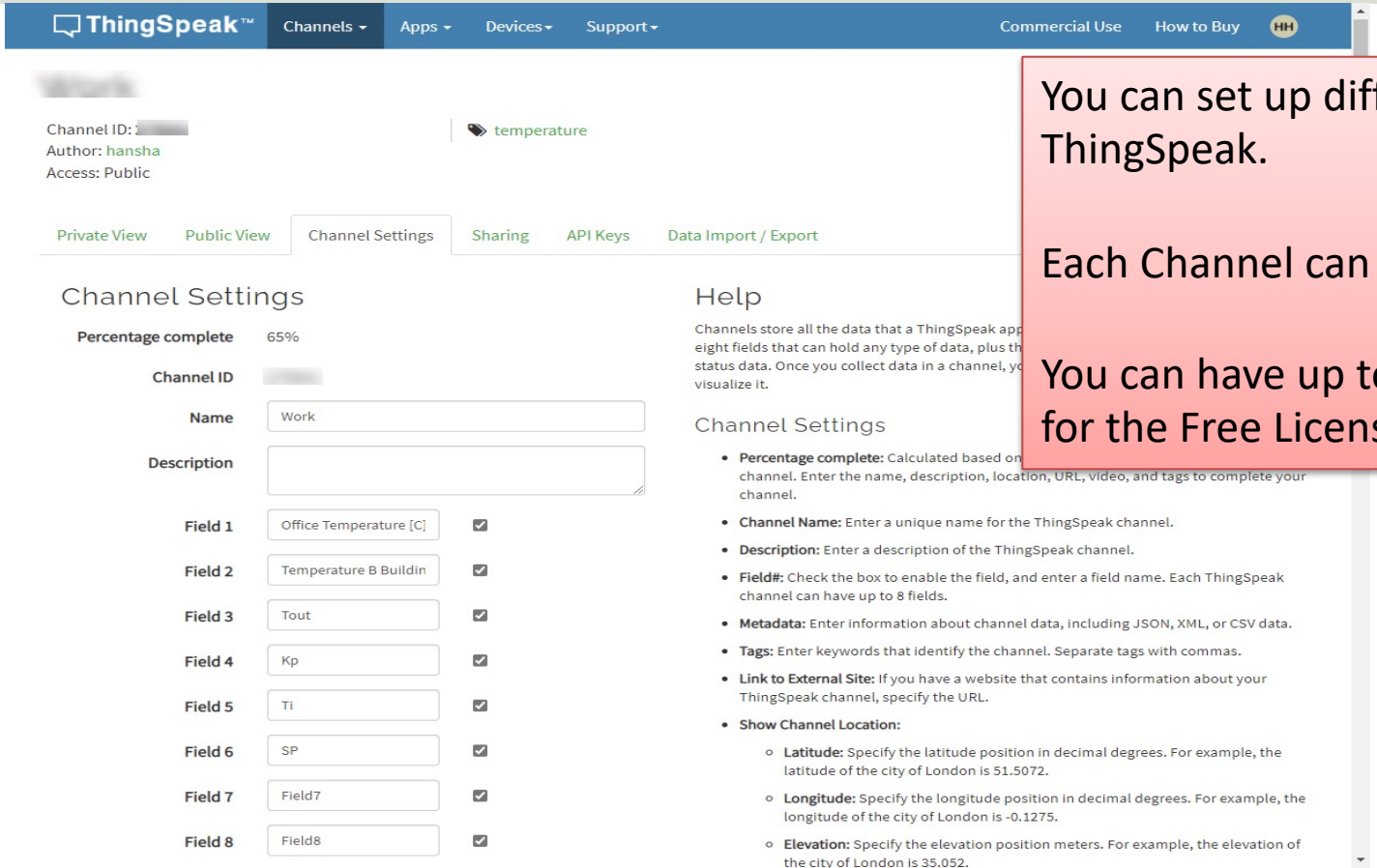
https://thingspeak.com



ThingSpeak

- It works with Arduino, Raspberry Pi and MATLAB (premade libraries and APIs exists).
- But it should work with all kind of Programming Languages, since it uses a **REST API** and **HTTP**.
- **LabVIEW** has built-in **HTTP Client** functions that you can use for this purpose
- **MQTT** API also available

ThingSpeak – Channel Settings

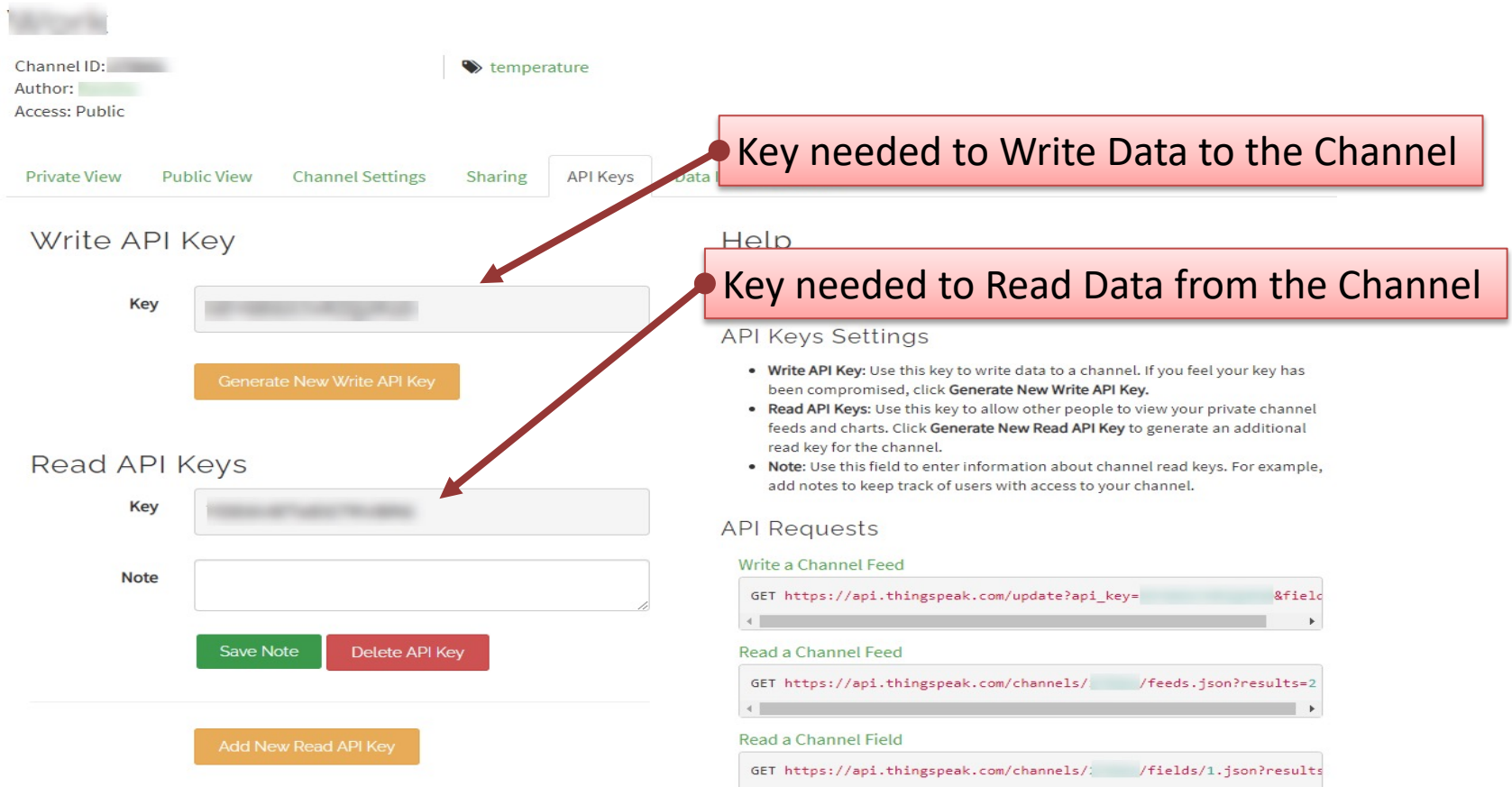


You can set up different Channels in ThingSpeak.

Each Channel can have up to 8 Fields.

You can have up to 4 different Channels for the Free License.

ThingSpeak - REST API



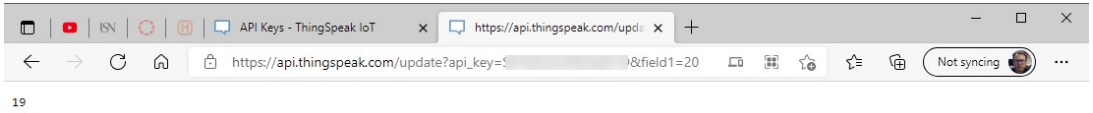
Key needed to Write Data to the Channel

Key needed to Read Data from the Channel

REST API – Write Data

Use your standard Web Browser (e.g., Microsoft Edge, or Google Chrome) and enter the following:

https://api.thingspeak.com/update?api_key=XXXXXXXXXXXXXXXX&field1=20



Value

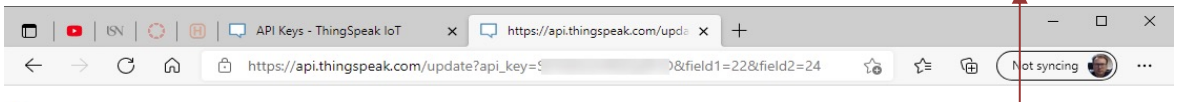
Field Number 1-8

Your **Write API Key**

REST API – Write Multiple Fields

Use your standard Web Browser (e.g., Microsoft Edge, or Google Chrome) and enter the following:

https://api.thingspeak.com/update?api_key=XXXXXXXXXXXXXXXX&field1=21&field2=24



Your **Write API Key**

Field + Value

Field + Value

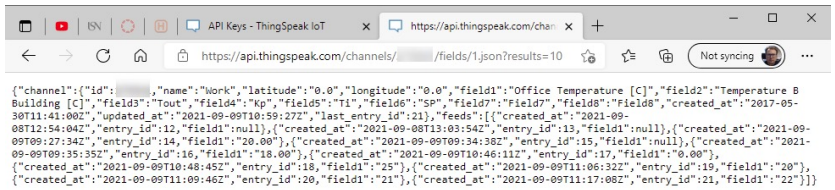
Etc.

REST API – Read Data

Use your standard Web Browser (e.g., Microsoft Edge, or Google Chrome) and enter the following:

Data Format (JSON or XML)

https://api.thingspeak.com/channels/xxxxxx/fields/1.json?results=10



Your **Channel ID**

Field Number

Resulting JSON String with Data

Number of Data Points, e.g., 1 for only the last value, 10 for the last 10 values, etc.

REST API – Read Data (JSON)

https://api.thingspeak.com/channels/xxxxxx/fields/1.json?results=10

{"channel":{"id":xxxxxx,"name":"Work","latitude":"0.0","longitude":"0.0","field1":"Office Temperature [C]","field2":"Temperature B Building [C]","field3":"Tout","field4":"Kp","field5":"Ti","field6":"SP","field7":"Field7","field8":"Field8","created_at":"2017-05-30T11:41:00Z","updated_at":"2021-09-09T10:59:27Z","last_entry_id":21},
"feeds":[
{"created_at":"2021-09-08T12:54:04Z","entry_id":12,"field1":null},
{"created_at":"2021-09-08T13:03:54Z","entry_id":13,"field1":null},
{"created_at":"2021-09-09T09:27:34Z","entry_id":14,"field1":"20.00"},
{"created_at":"2021-09-09T09:34:38Z","entry_id":15,"field1":null},
{"created_at":"2021-09-09T09:35:35Z","entry_id":16,"field1":"18.00"},
{"created_at":"2021-09-09T10:46:11Z","entry_id":17,"field1":"0.00"},
{"created_at":"2021-09-09T10:48:45Z","entry_id":18,"field1":"25"},
{"created_at":"2021-09-09T11:06:32Z","entry_id":19,"field1":"20"},
{"created_at":"2021-09-09T11:09:46Z","entry_id":20,"field1":"21"},
{"created_at":"2021-09-09T11:17:08Z","entry_id":21,"field1":"22"}
]}

Values

We need to parse the JSON string in order to get the actual Values

LabVIEW

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LabVIEW

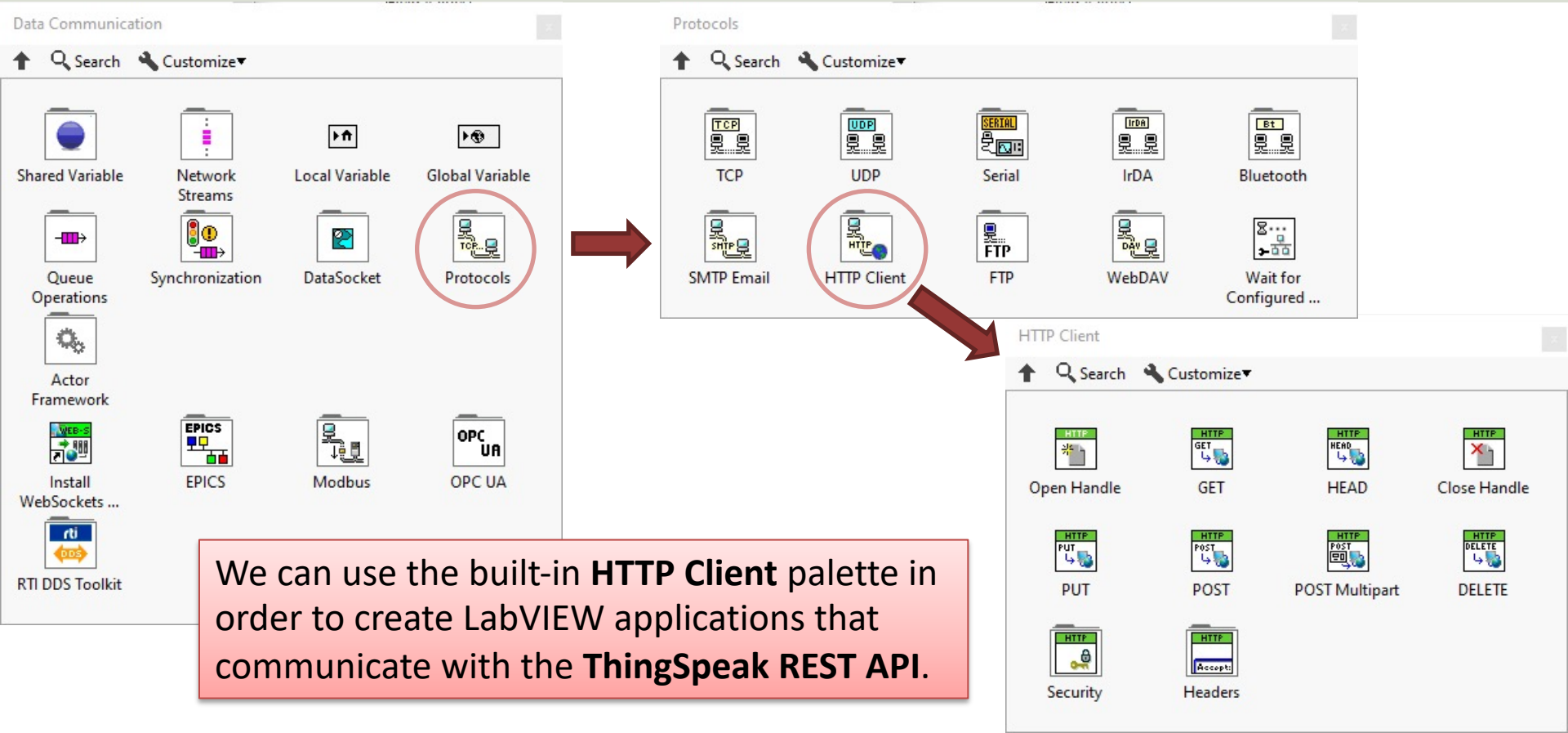
- LabVIEW is a graphical programming language
- LabVIEW is created by National Instruments (now just NI)
- LabVIEW has powerful features for Simulation, Control and DAQ Applications

Want to learn LabVIEW?

- LabVIEW Resources: https://www.halvorsen.blog/documents/programming/labview/labview
- LabVIEW in Automation: https://www.halvorsen.blog/documents/teaching/courses/labview_automation.php
- LabVIEW Community Edition - free for non-commercial use: https://www.ni.com/en-no/shop/labview/select-edition/labview-community-edition.html

LabVIEW and ThingSpeak

LabVIEW HTTP Client palette



We can use the built-in **HTTP Client** palette in order to create LabVIEW applications that communicate with the **ThingSpeak REST API**.

LabVIEW Examples

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- Write Single Value to ThingSpeak
- Read Single Value from ThingSpeak
- Datalogging – Read Data from a Temperature Sensor and Log Data to ThingSpeak
- Read Historical Data from ThingSpeak

LabVIEW Examples

Write Single Value to ThingSpeak

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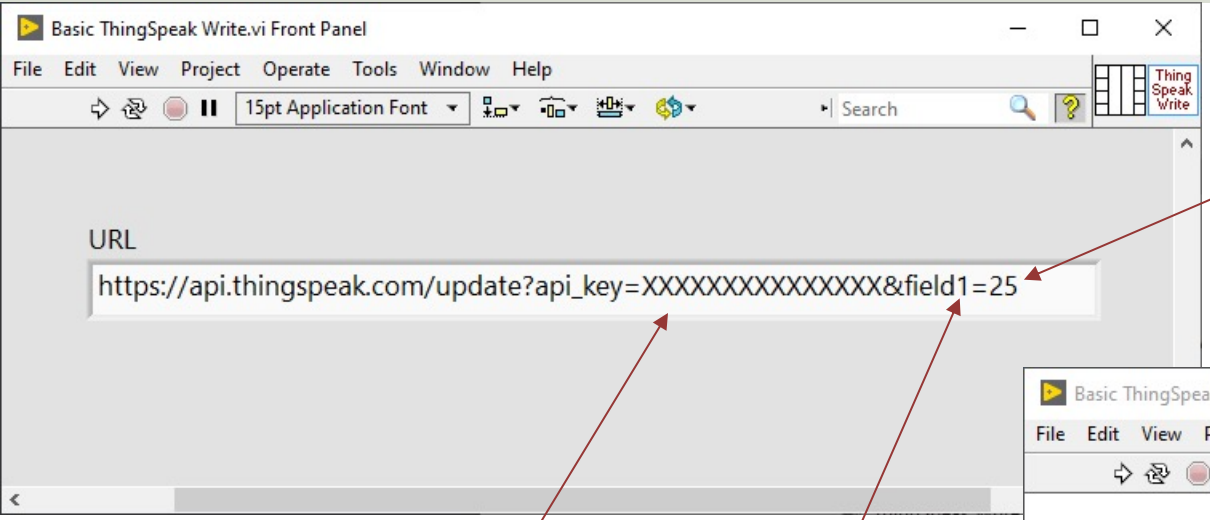
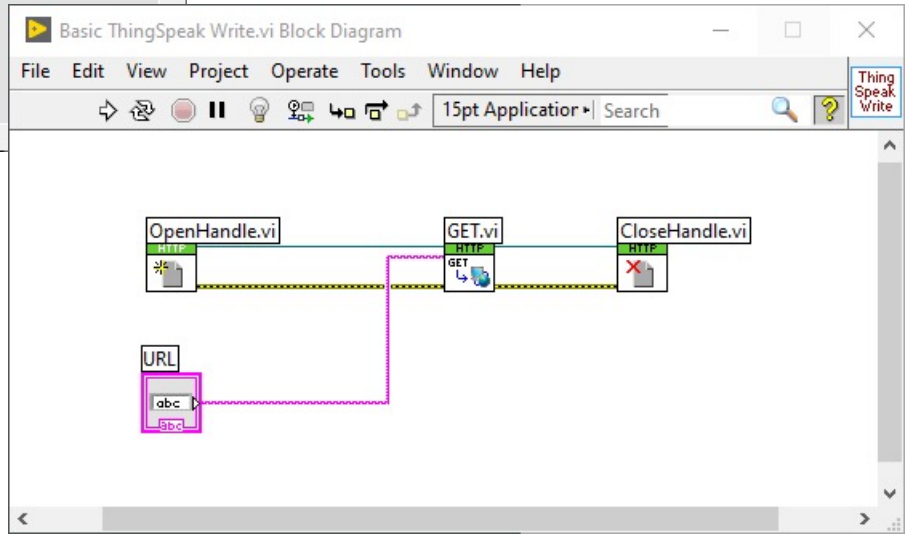
Write Single Field Value



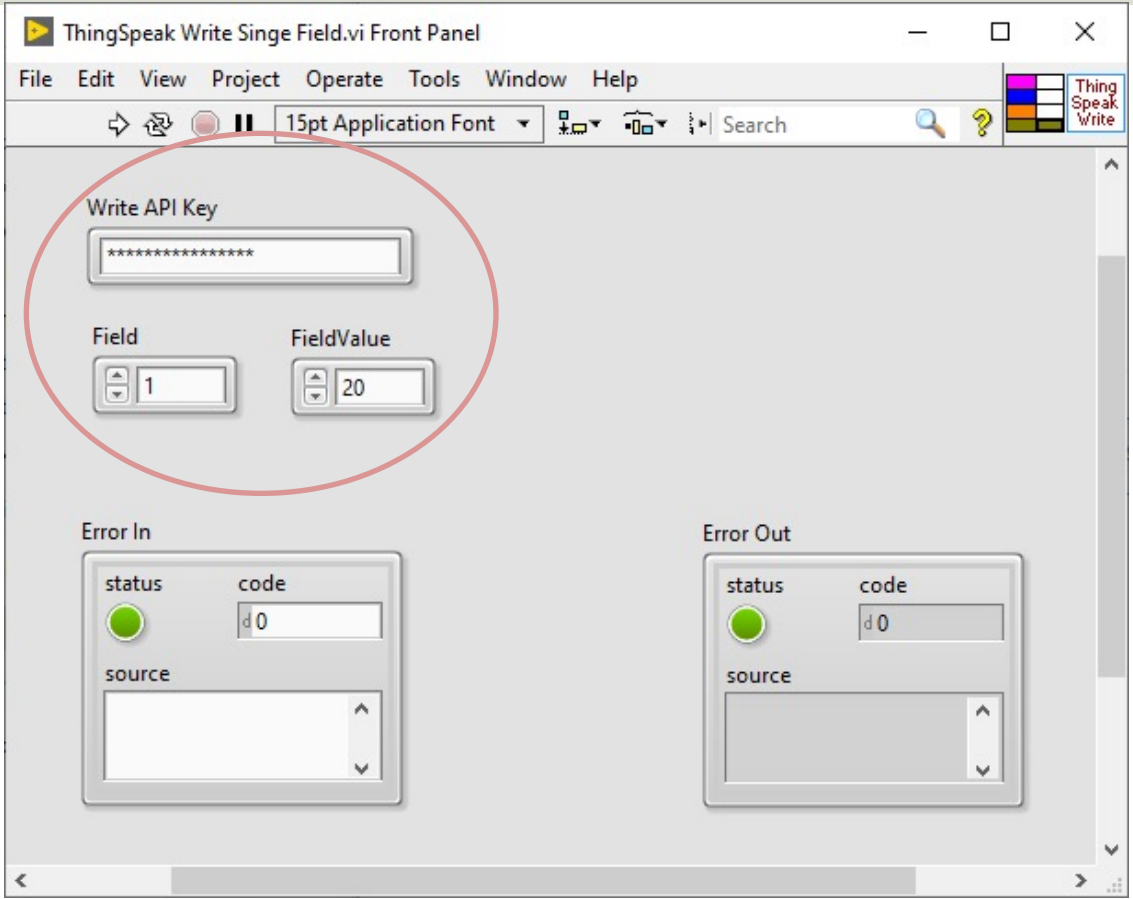
Value

Your **Write API Key**

Field Number 1-8

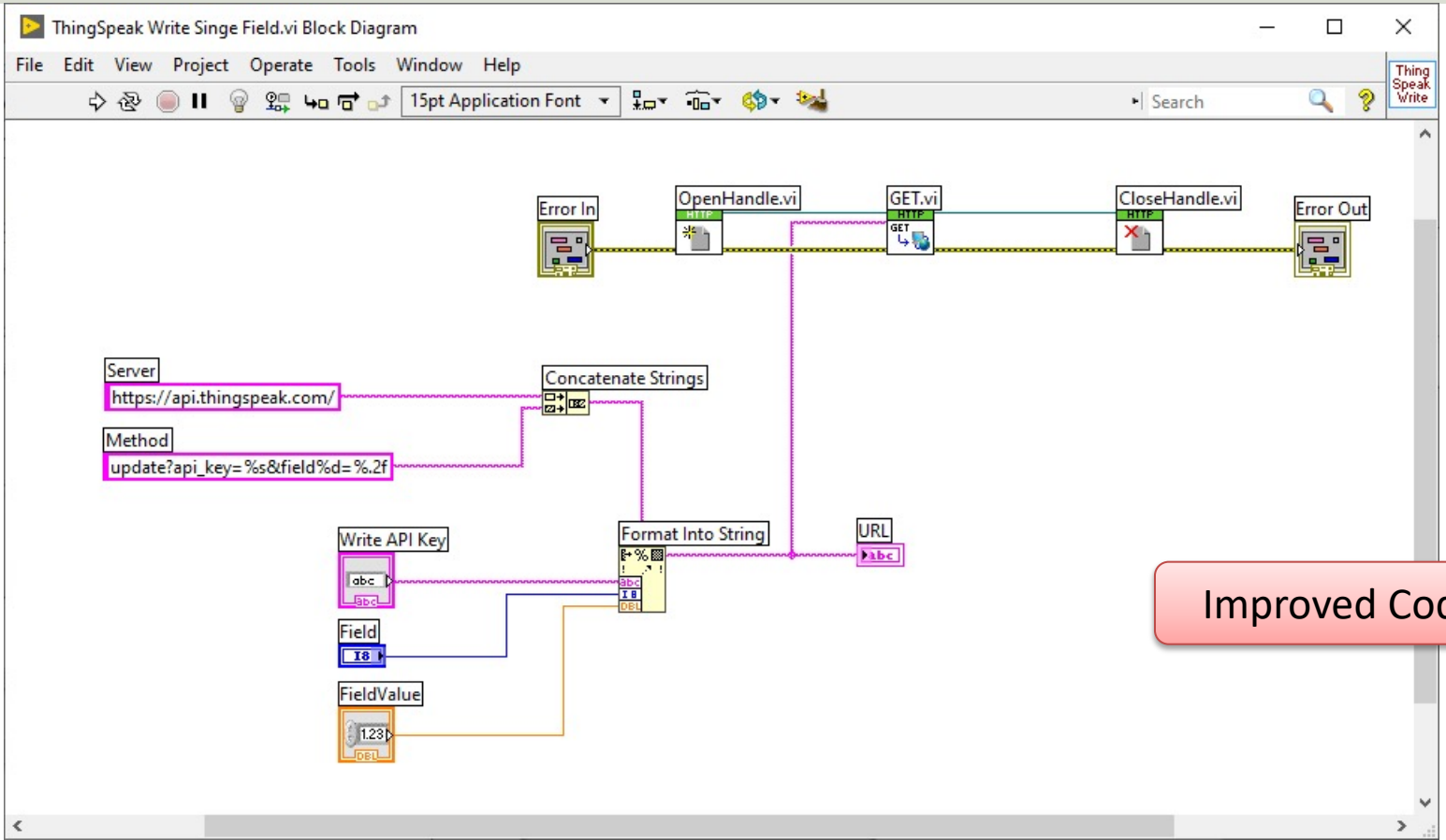


Write Single Field Value

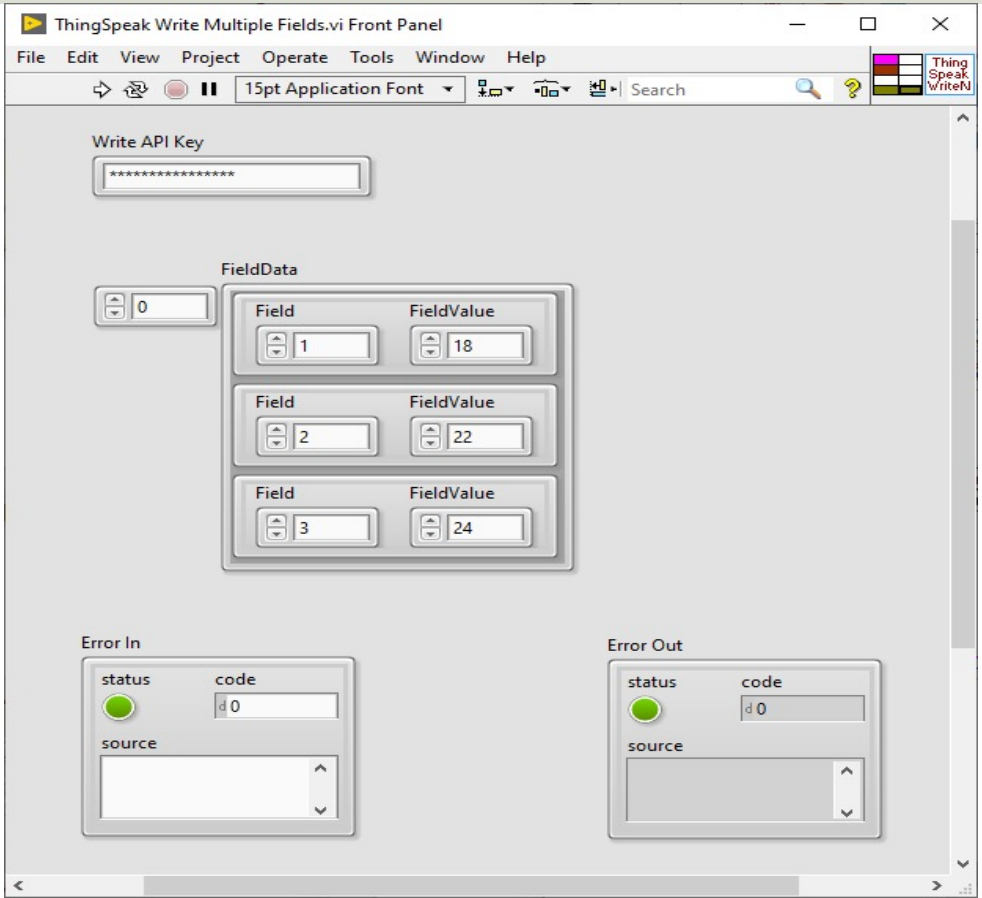


Improved Code

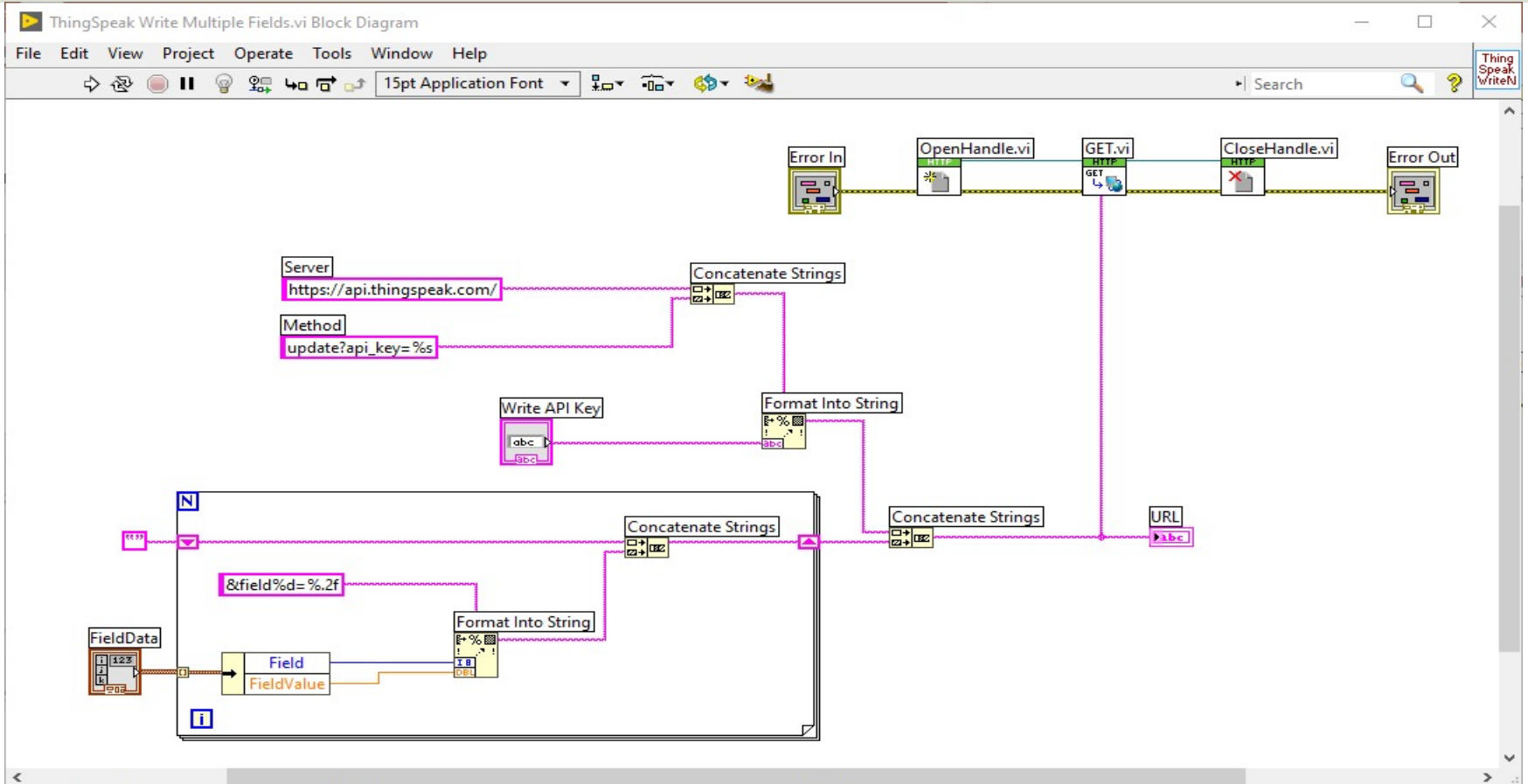
Block Diagram



Write Single Value to Multiple Fields



Block Diagram



LabVIEW Examples

Read Single Value from ThingSpeak

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Read Single Field Value(s)

https://api.thingspeak.com/channels/xxxxxx/fields/1.json?results=10

Basic ThingSpeak Read.vi Front Panel

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15pt Application Font | Search | Speak Read

URL

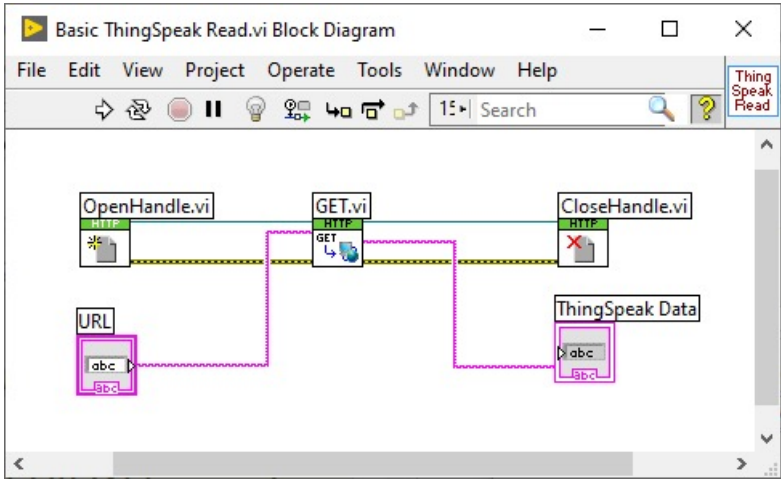
https://api.thingspeak.com/channels/[redacted]/fields/1.json?results=10

ThingSpeak Data

{"channel":{"id":[redacted]1,"name":"Work","latitude":"0.0","longitude":"0.0","field1":"Office Temperature [C]","field2":"Temperature B Building [C]","field3":"Tout","field4":"Kp","field5":"Ti","field6":"SP","field7":"Field7","field8":"Field8","created_at":"2017-05-30T11:41:00Z","updated_at":"2021-09-09T10:59:27Z","last_entry_id":21},"feeds":[{"created_at":"2021-09-08T12:54:04Z","entry_id":12,"field1":null},{"created_at":"2021-09-08T13:03:54Z","entry_id":13,"field1":null},{"created_at":"2021-09-09T09:27:34Z","entry_id":14,"field1":"20.00"},{"created_at":"2021-09-09T09:34:38Z","entry_id":15,"field1":null},{"created_at":"2021-09-09T09:35:35Z","entry_id":16,"field1":"18.00"},{"created_at":"2021-09-09T10:46:11Z","entry_id":17,"field1":"0.00"},{"created_at":"2021-09-09T10:48:45Z","entry_id":18,"field1":"25"},{"created_at":"2021-09-09T11:06:32Z","entry_id":19,"field1":

JSON String retrieved from ThingSpeak

ThingSpeak Data in JSON Format



Read Single Field Value(s)

https://api.thingspeak.com/channels/xxxxxx/fields/1.xml?results=10

Basic ThingSpeak Read - XML.vi Front Panel

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URL

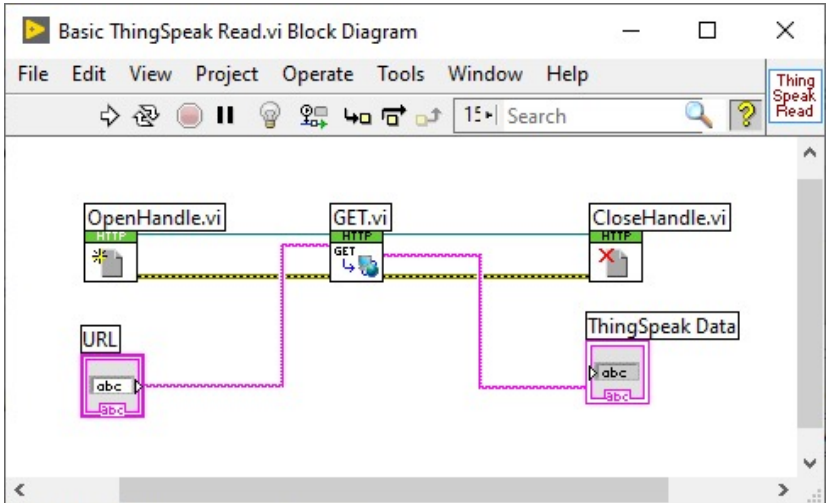
https://api.thingspeak.com/channels/ /fields/1.xml?results=10

ThingSpeak Data

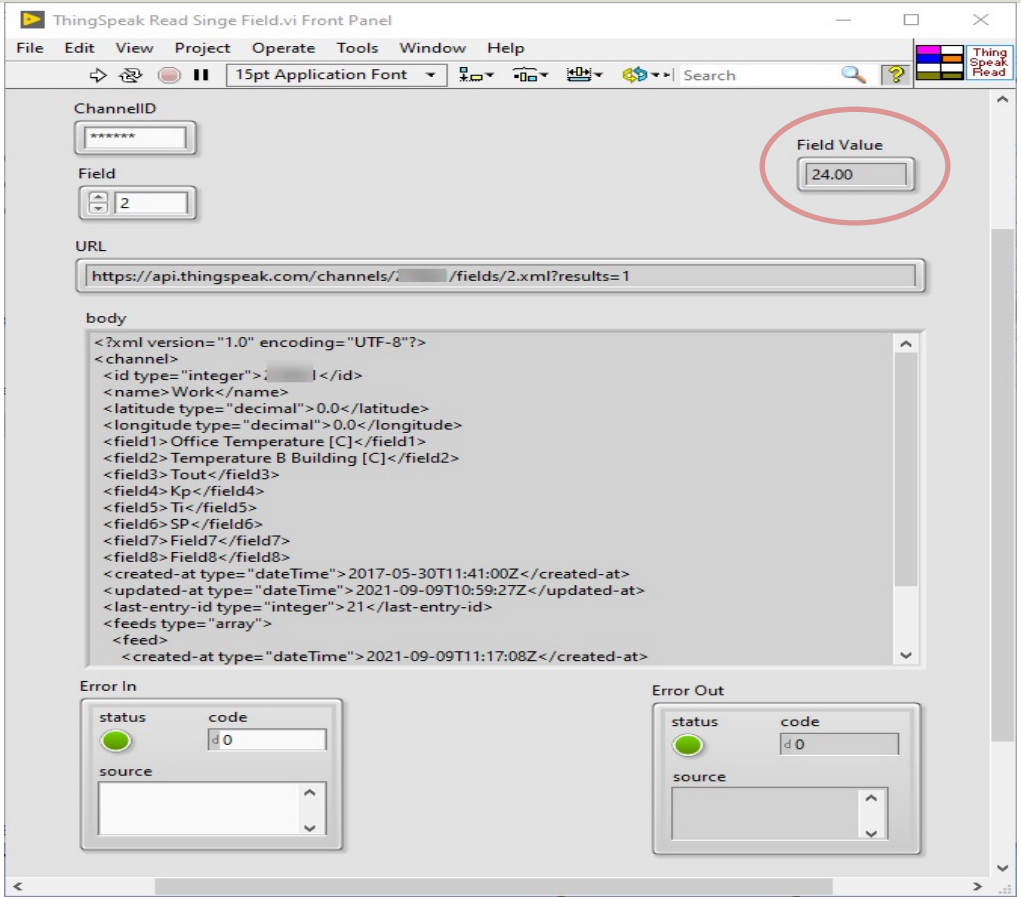
```
<?xml version="1.0" encoding="UTF-8"?>
<channel>
  <id type="integer">279941</id>
  <name>Work</name>
  <latitude type="decimal">0.0</latitude>
  <longitude type="decimal">0.0</longitude>
  <field1>Office Temperature [C]</field1>
  <field2>Temperature B Building [C]</field2>
  <field3>Tout</field3>
  <field4>Kp</field4>
  <field5>Ti</field5>
  <field6>SP</field6>
  <field7>Field7</field7>
```

XML String retrieved from ThingSpeak

ThingSpeak Data in XML Format



Read Single Field Value



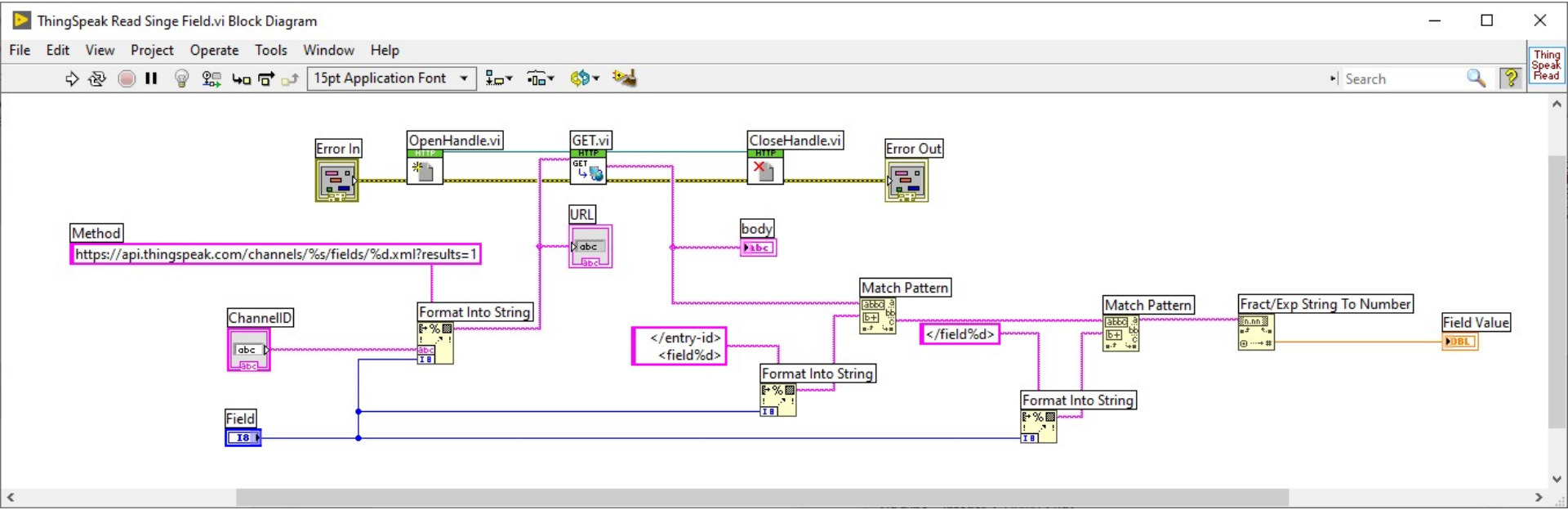
Parsing XML String

I this example, the XML string is parsed in order to find the last updated value for a given Channel and a given Field within that Channel.

You can see the LabVIEW code in detail on the next page.

Block Diagram

Parsing the XML String to get the actual Value



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LabVIEW Examples

Datalogging

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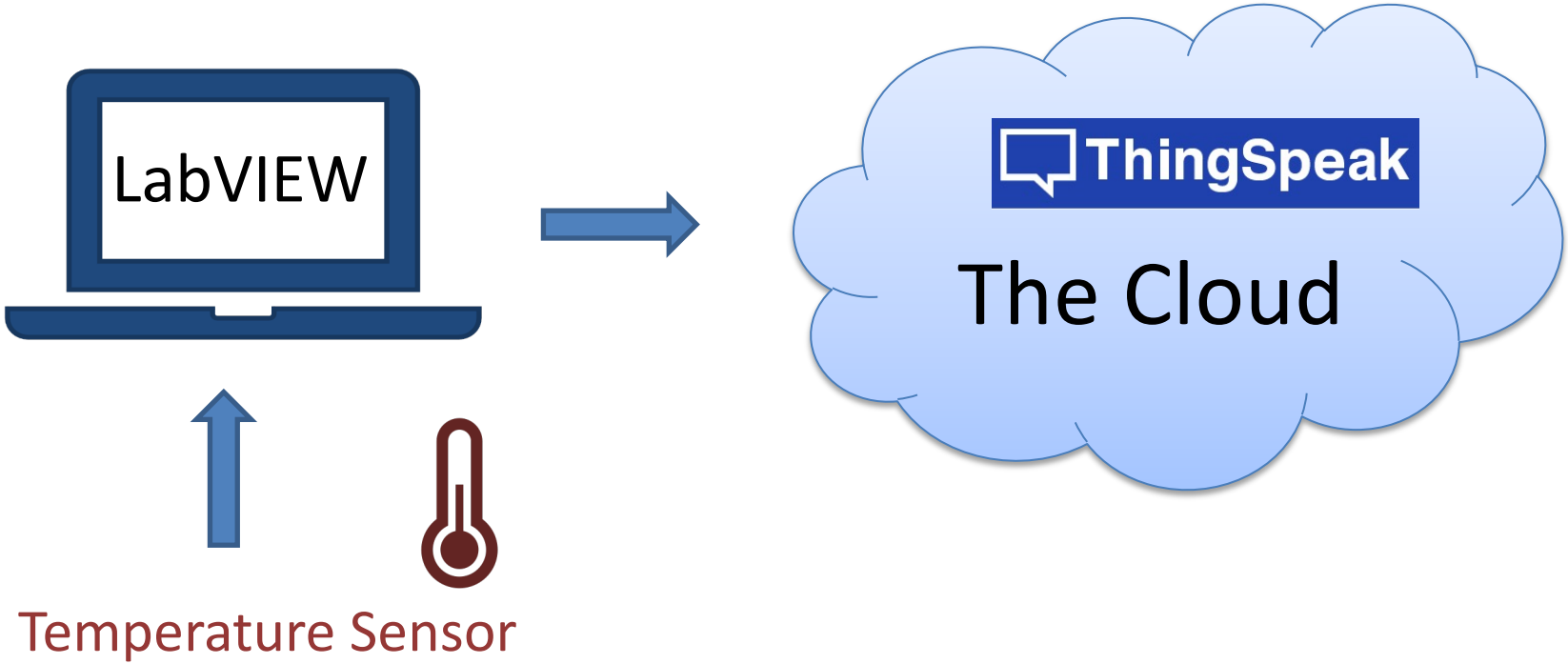
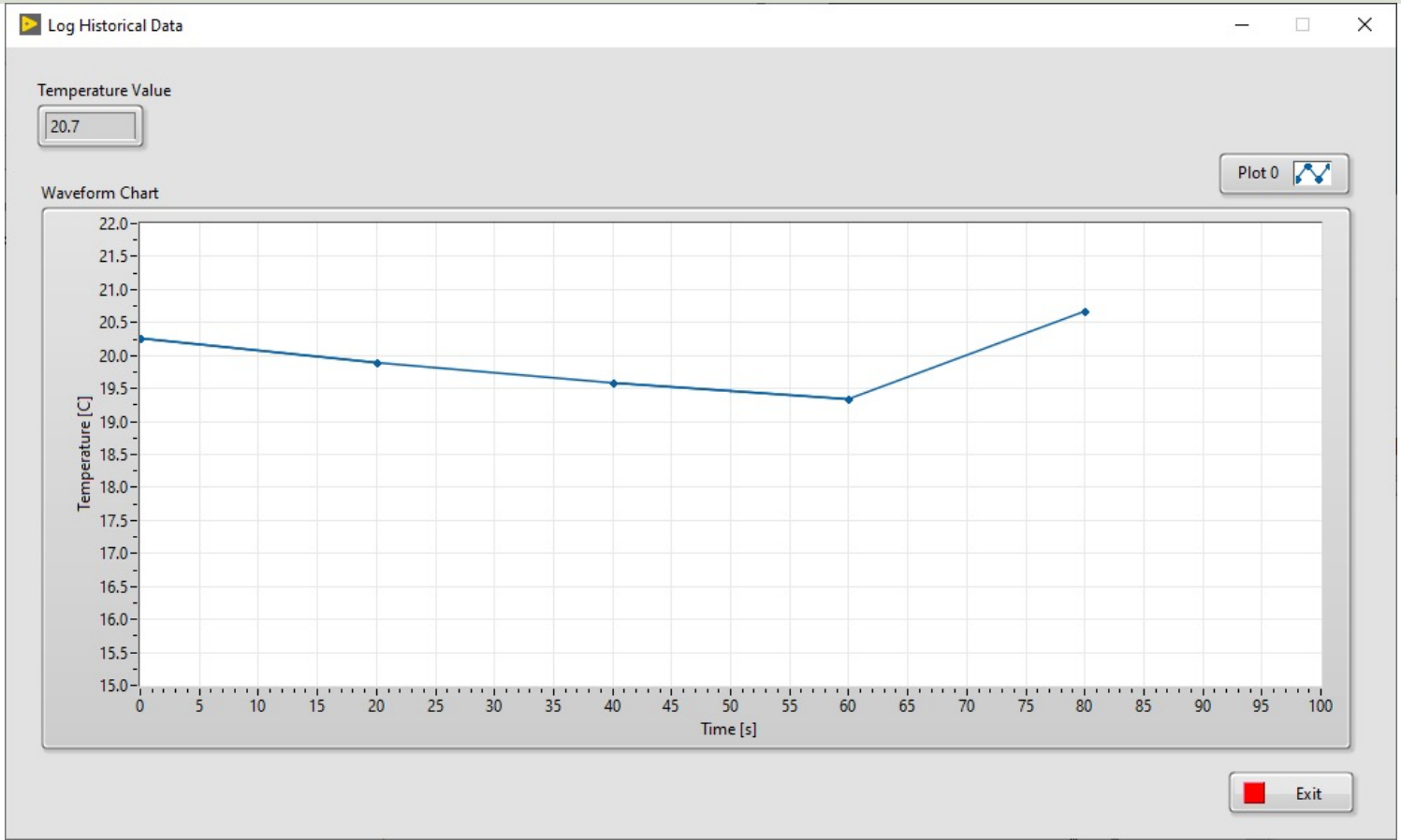
Datalogging Example

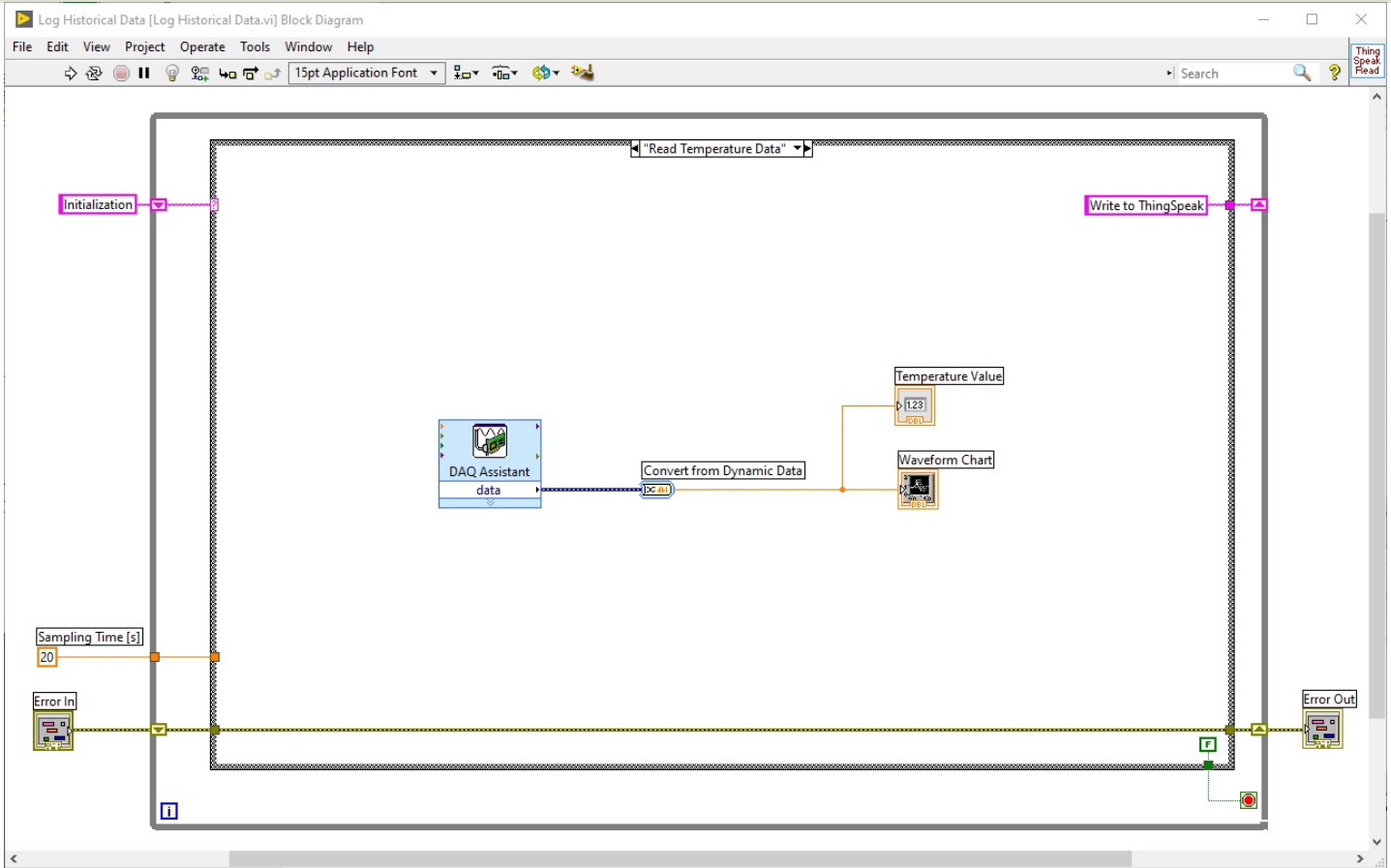


(In this Tutorial a TC-01 Thermocouple Temperature Sensor from National Instruments will be used, but any kind of sensor can be used)

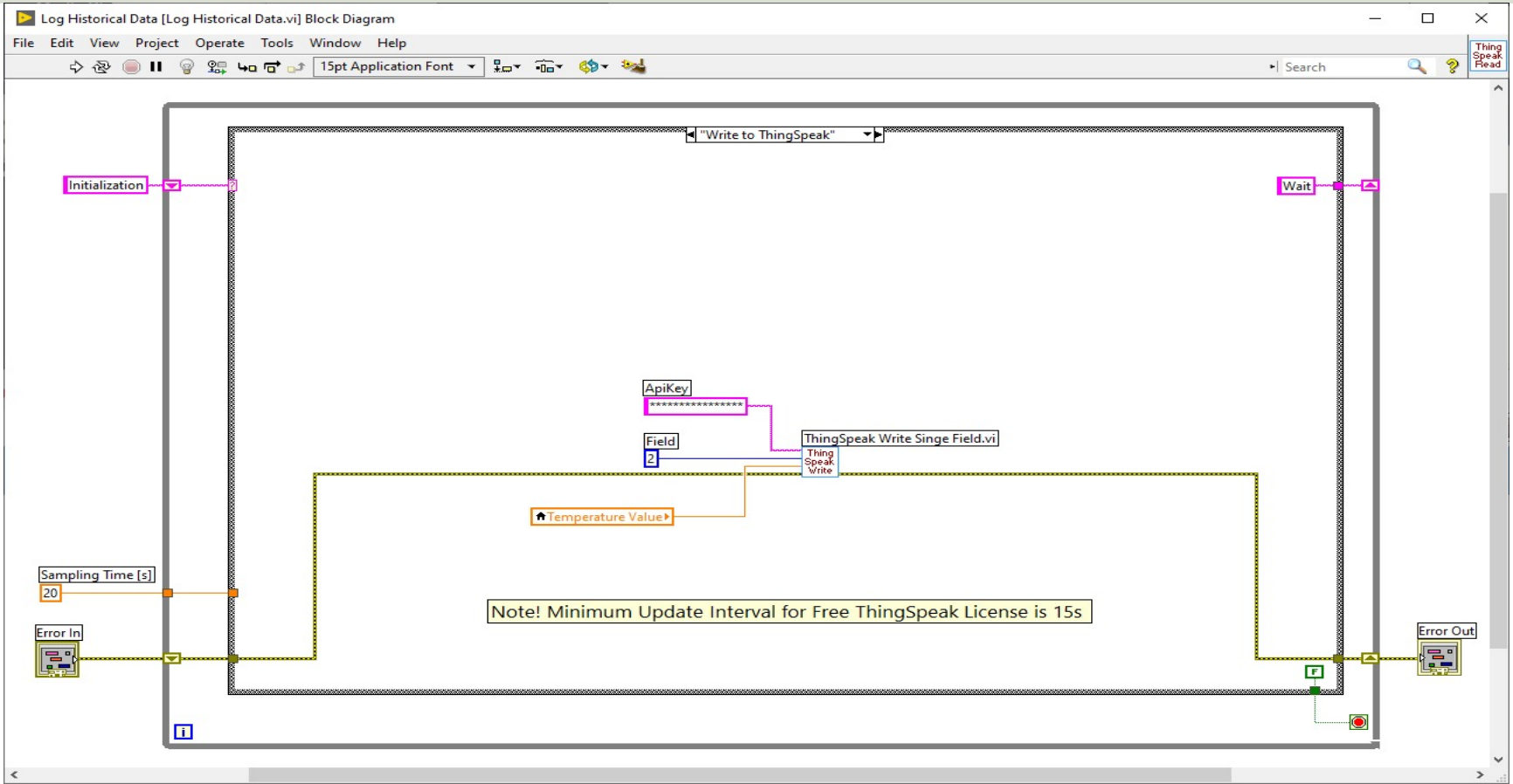
Datalogging Example



Block Diagram – Read Temperature



Block Diagram – Write to ThingSpeak



LabVIEW Examples

Read Historical Data from ThingSpeak

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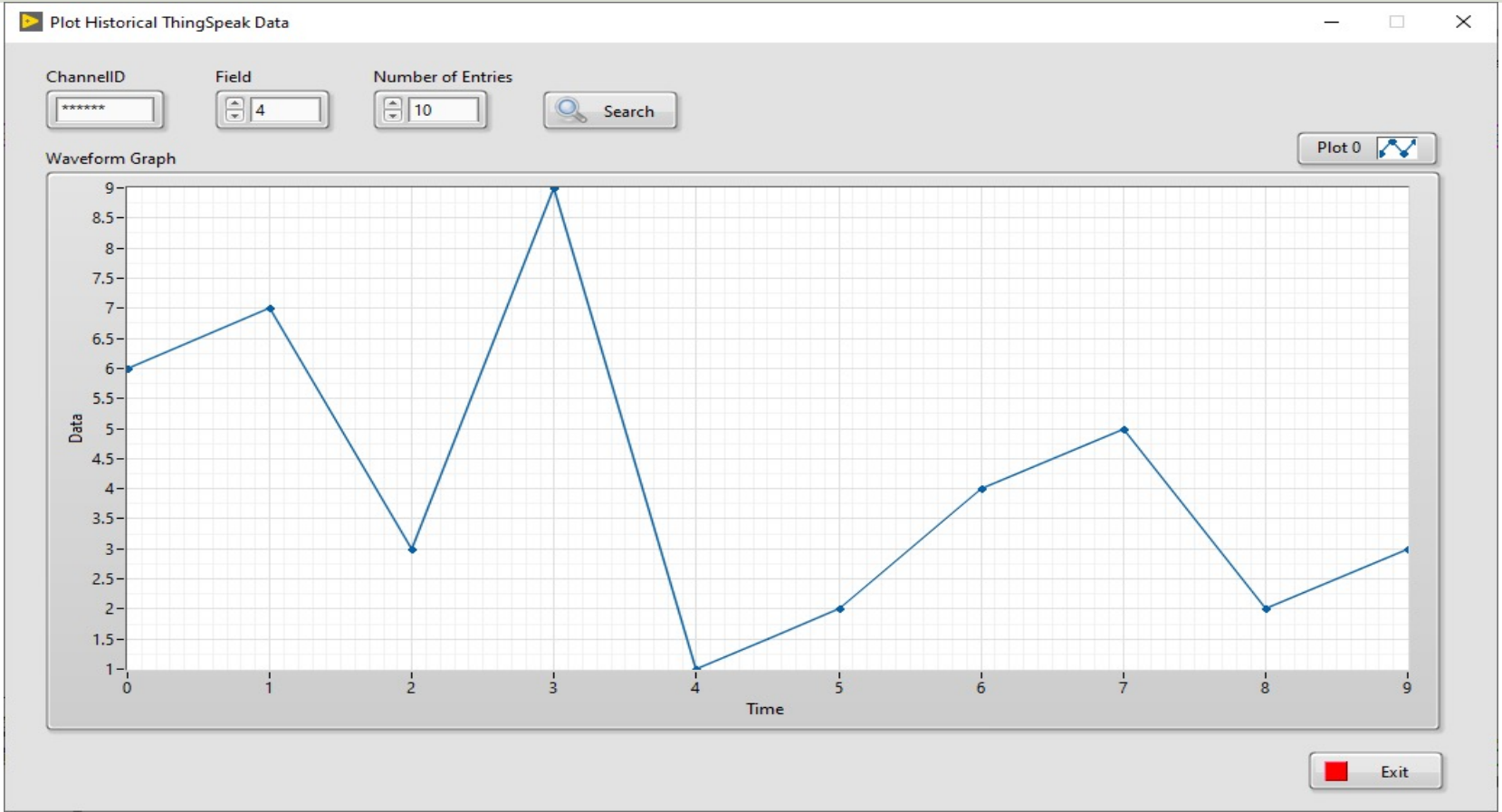
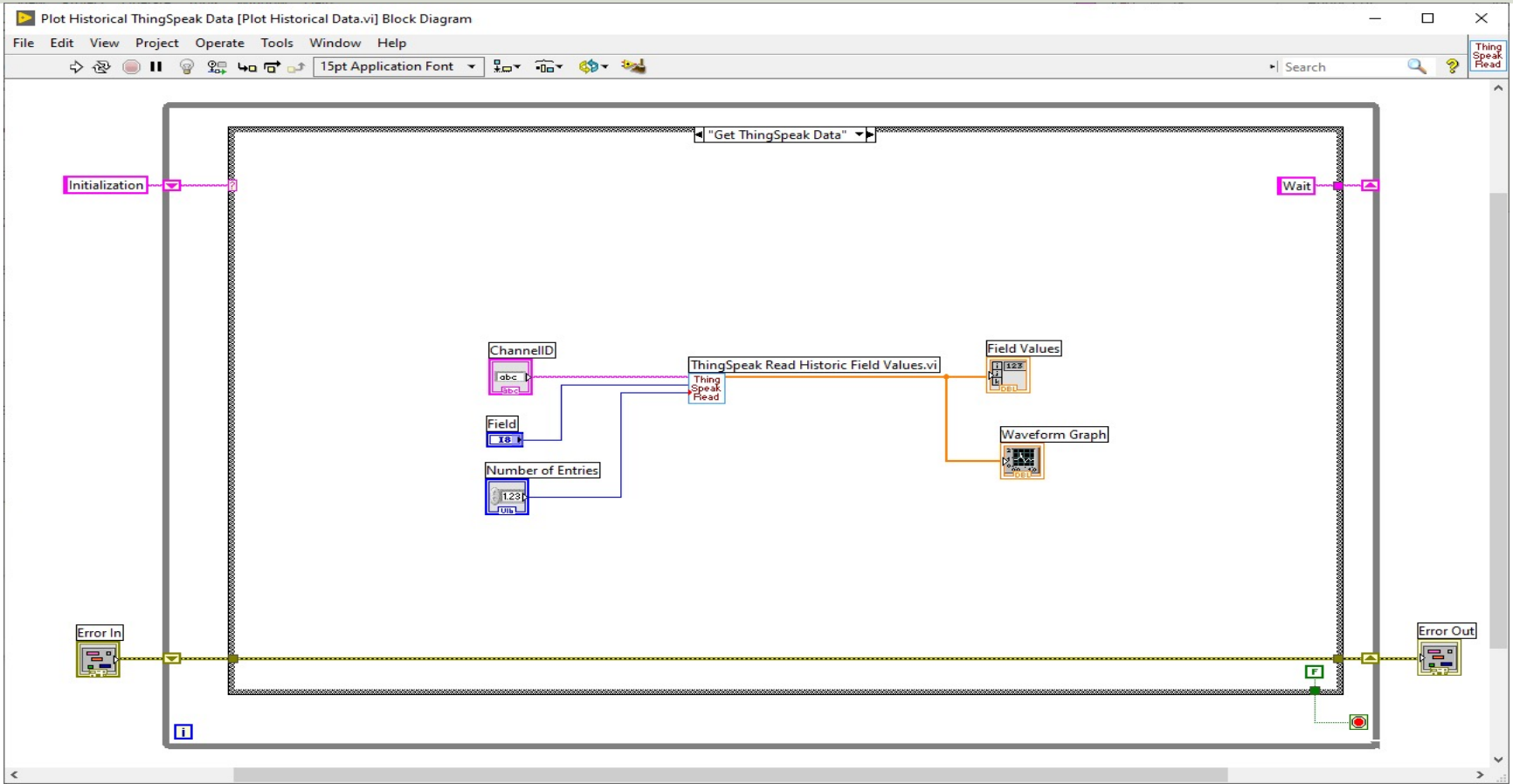
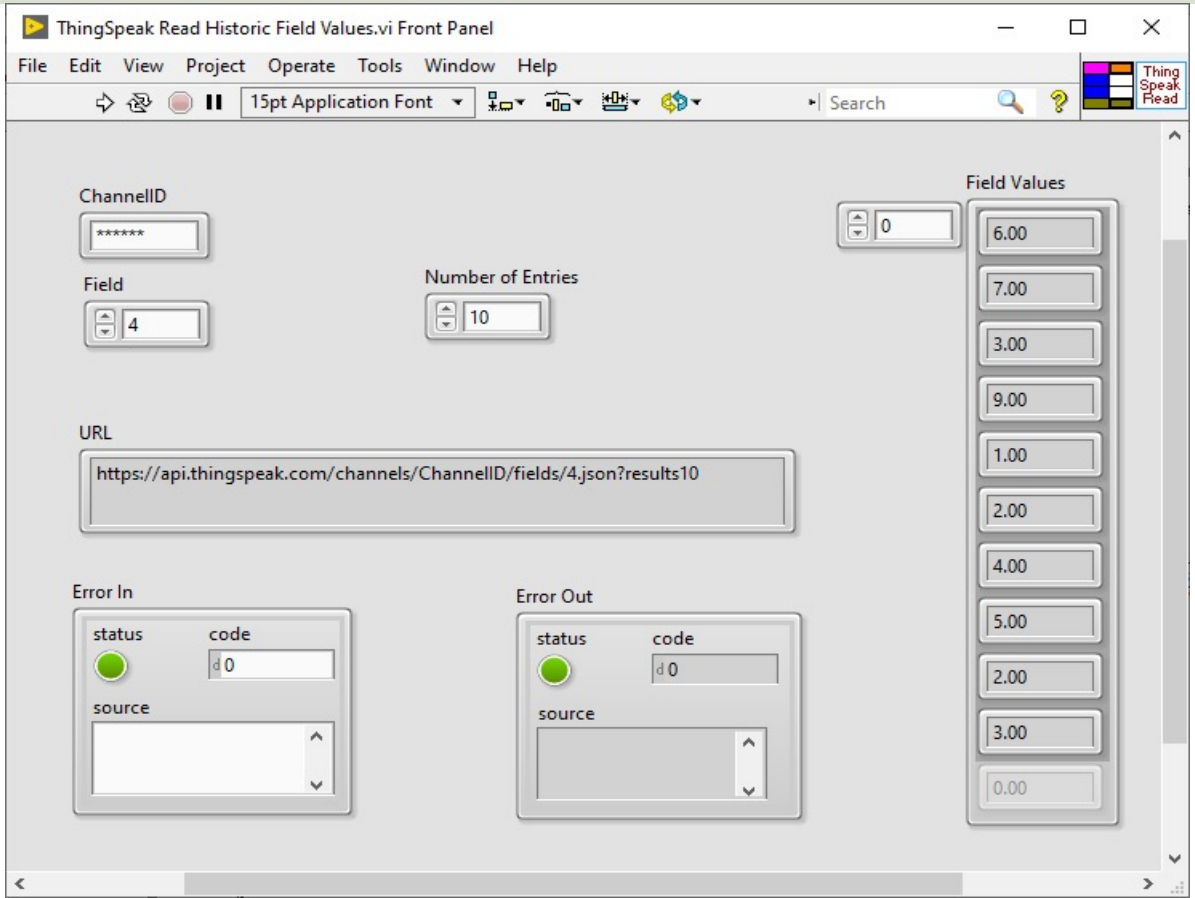
Plot Historical Data



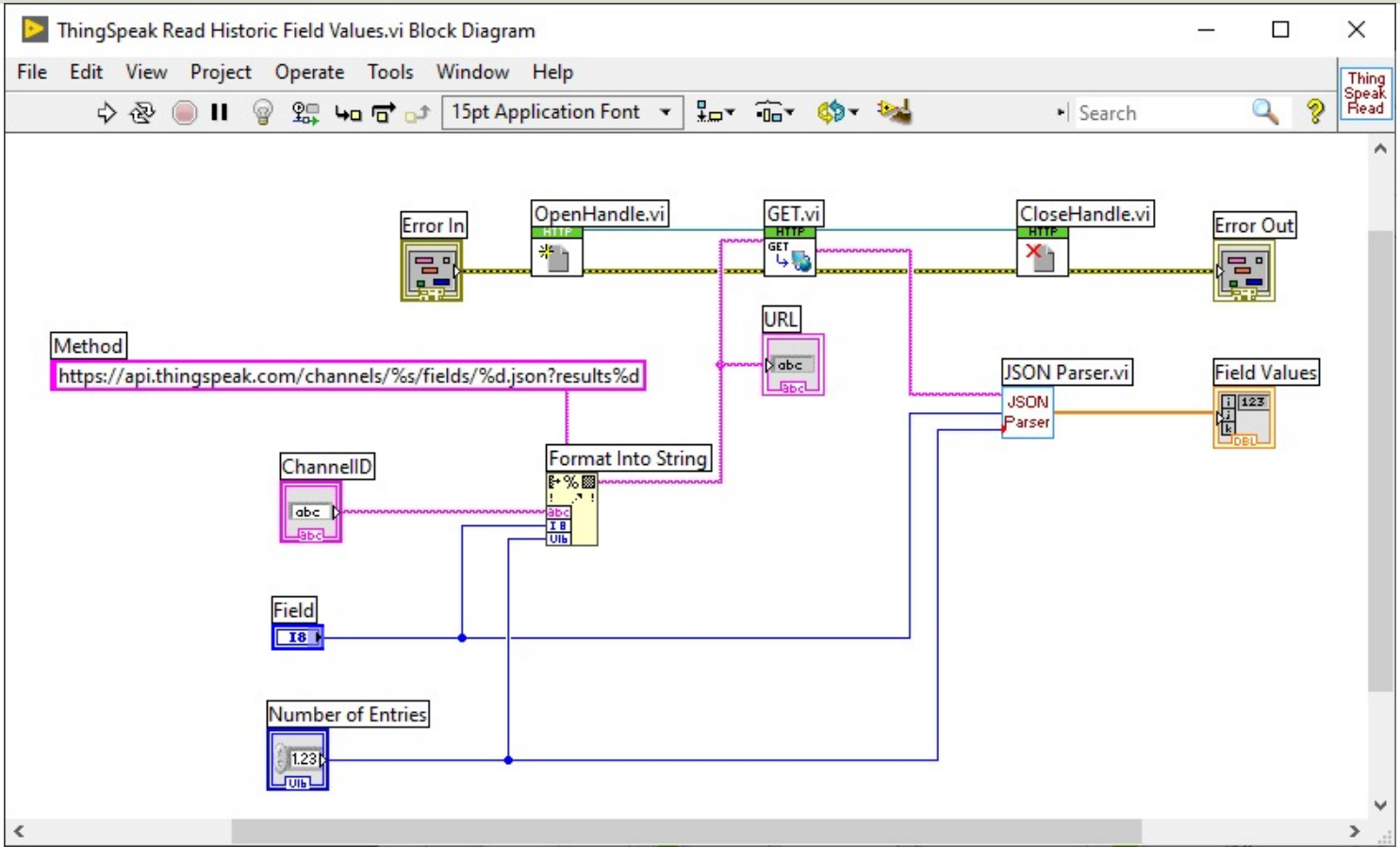
Block Diagram



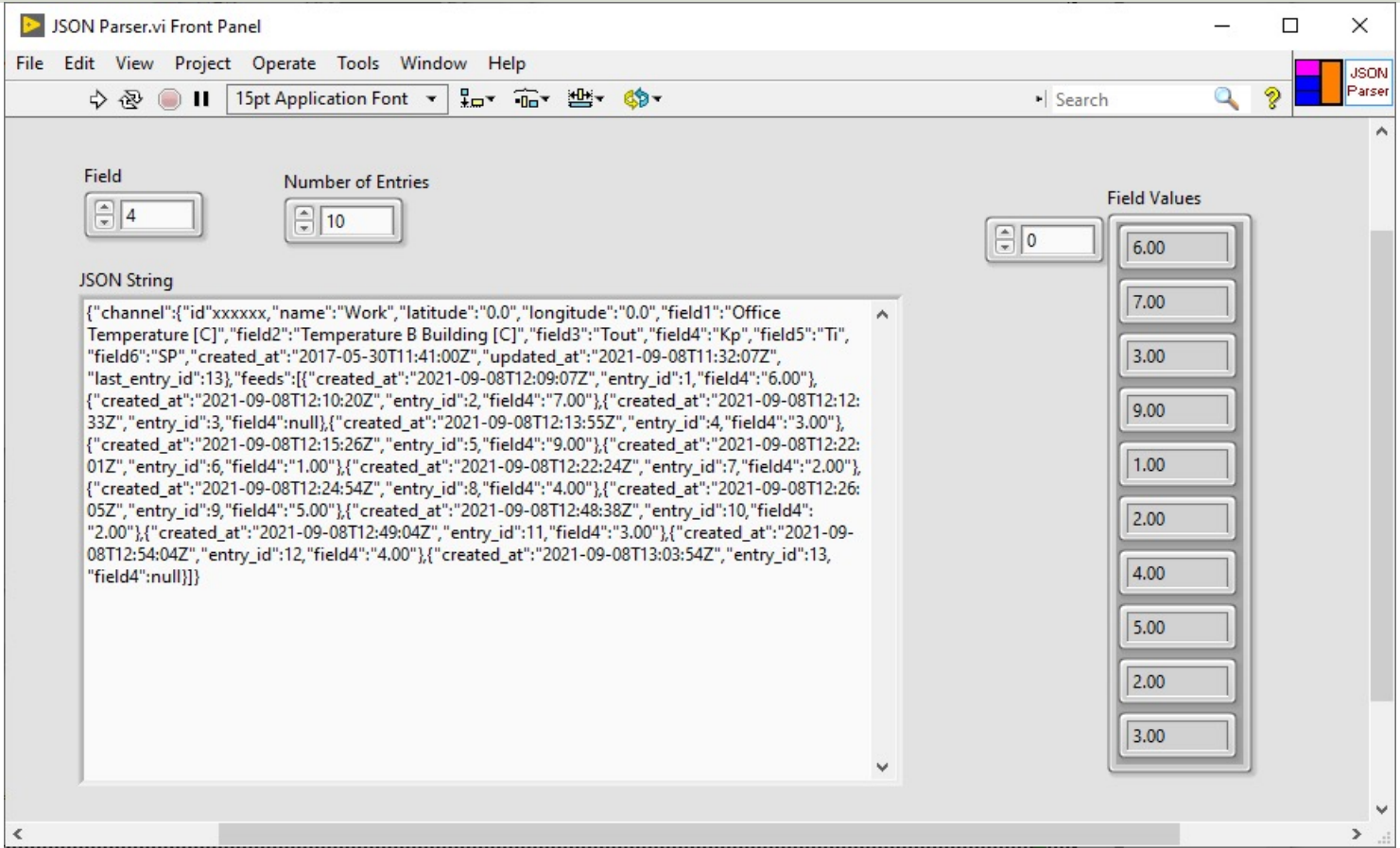
Read Historic Field Values



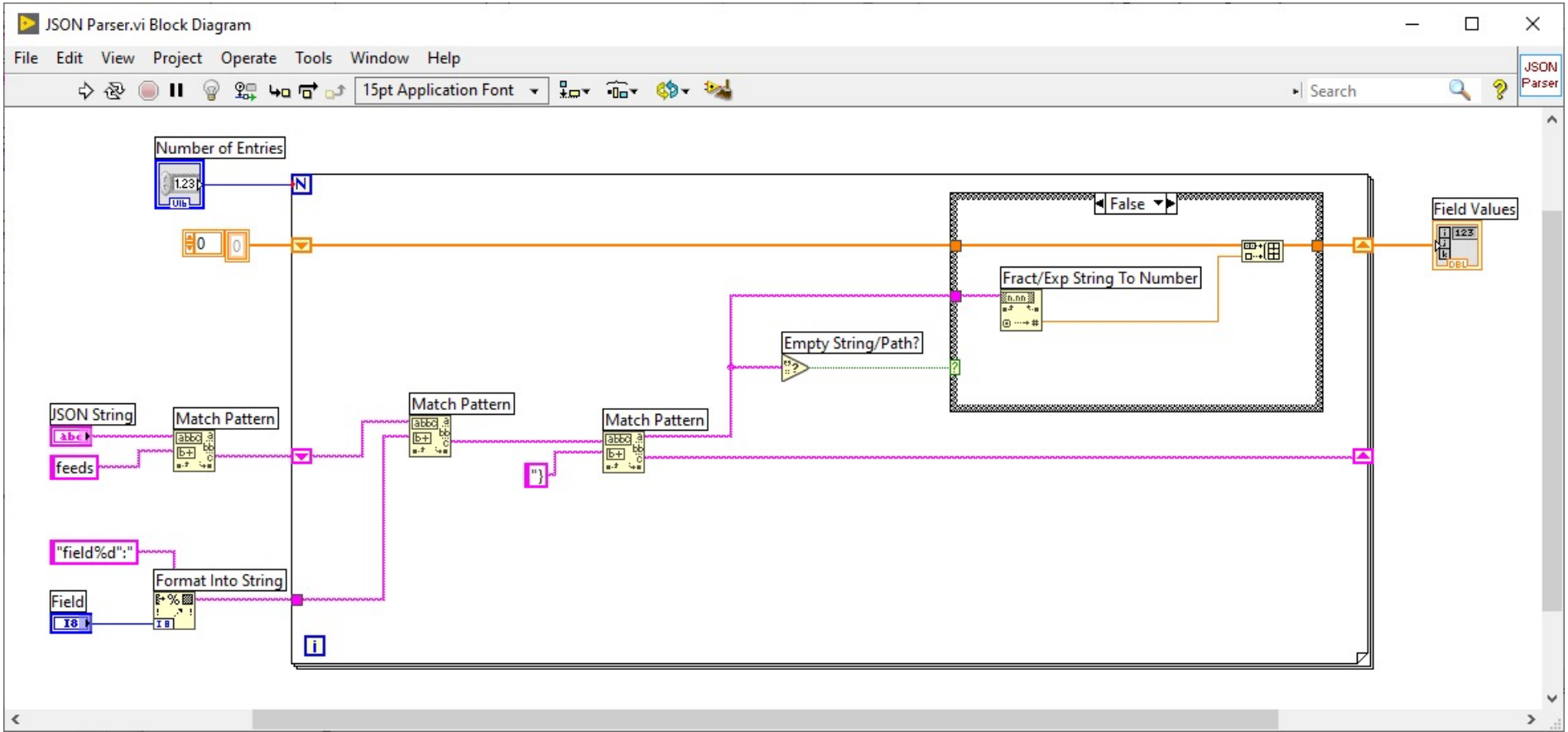
Block Diagram



JSON Parser


JSON Parser.vi Front Panel
File Edit View Project Operate Tools Window Help
15pt Application Font
Search
JSON Parser
Field
4
Number of Entries
10
JSON String
{"channel":{"id"xxxxxx,"name":"Work","latitude":"0.0","longitude":"0.0","field1":"Office Temperature [C]","field2":"Temperature B Building [C]","field3":"Tout","field4":"Kp","field5":"Ti","field6":"SP","created_at":"2017-05-30T11:41:00Z","updated_at":"2021-09-08T11:32:07Z","last_entry_id":13},"feeds":[{"created_at":"2021-09-08T12:09:07Z","entry_id":1,"field4":"6.00"},{"created_at":"2021-09-08T12:10:20Z","entry_id":2,"field4":"7.00"},{"created_at":"2021-09-08T12:12:33Z","entry_id":3,"field4":null},{"created_at":"2021-09-08T12:13:55Z","entry_id":4,"field4":"3.00"},{"created_at":"2021-09-08T12:15:26Z","entry_id":5,"field4":"9.00"},{"created_at":"2021-09-08T12:22:01Z","entry_id":6,"field4":"1.00"},{"created_at":"2021-09-08T12:22:24Z","entry_id":7,"field4":"2.00"},{"created_at":"2021-09-08T12:24:54Z","entry_id":8,"field4":"4.00"},{"created_at":"2021-09-08T12:26:05Z","entry_id":9,"field4":"5.00"},{"created_at":"2021-09-08T12:48:38Z","entry_id":10,"field4":"2.00"},{"created_at":"2021-09-08T12:49:04Z","entry_id":11,"field4":"3.00"},{"created_at":"2021-09-08T12:54:04Z","entry_id":12,"field4":"4.00"},{"created_at":"2021-09-08T13:03:54Z","entry_id":13,"field4":null}]}
Field Values
0
6.00
7.00
3.00
9.00
1.00
2.00
4.00
5.00
2.00
3.00

Block Diagram



Summary

- ThingSpeak is an IoT service that lets you collect and store sensor data in the cloud and develop Internet of Things applications.
- LabVIEW has powerful features for Simulation, Control and DAQ Applications
- Both ThingSpeak (with limitations, update rate, etc.) and LabVIEW (LabVIEW Community Edition) can be used for free for non-commercial small projects, in addition you can buy a professional license.

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