visualisation

March 29, 2020

1 Data Visualisation of datasets in Group A

Set 2 contains 2 datasets of data collected of 2 identical cells with the same load profile

1.0.1 Import necessary libraries

[1]:
```
import pandas as pd
import copy
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
```

[2]:
```
# import codebase
import thermalModel_LDPRF as tm_LDPRF
import importlib
importlib.reload(tm_LDPRF)
```

[2]:
```
<module 'thermalModel_LDPRF' from
'C:\\Users\\user\\Anaconda3\\lib\\thermalModel_LDPRF.py'>
```

1.0.2 Load 'AhCha','AhDch','Amb','Temp' data for both datasets

[3]:
```
AhData_2097_df = tm_LDPRF.load_csv(filename = 'LDPRF_2097.csv',
                                   features_list =␣
 ↪['second','AhCha','AhDch','Amb','Temp'], mode = 0)

AhData_2098_df = tm_LDPRF.load_csv(filename = 'LDPRF_2098.csv',
                                   features_list =␣
 ↪['second','AhCha','AhDch','Amb','Temp'], mode = 0)
```

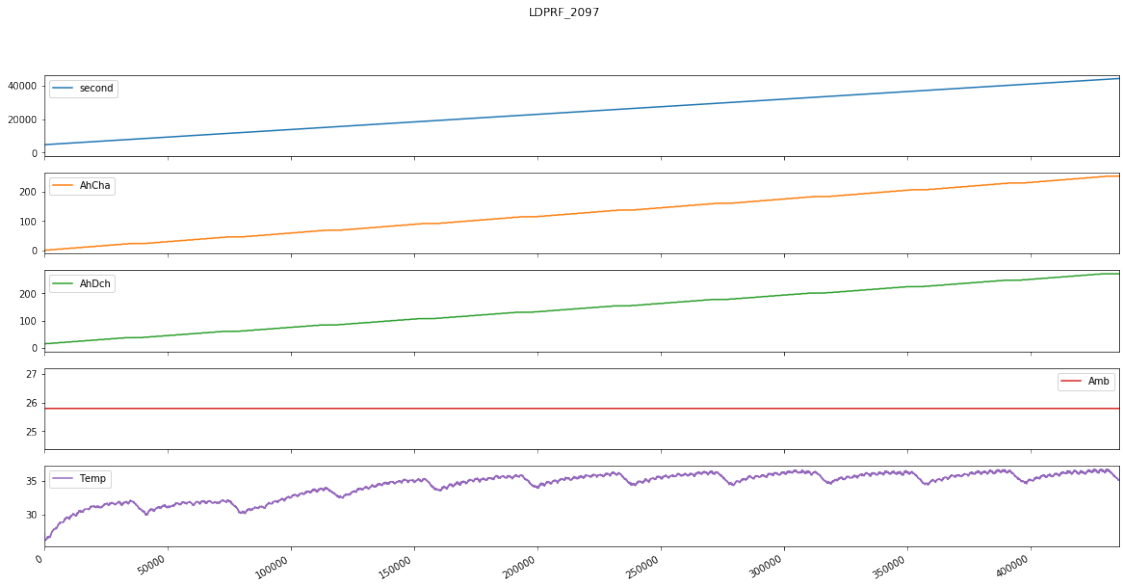
```
C:\Users\user\Anaconda3\lib\thermalModel_LDPRF.py:47: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy
  df['second'][set_index[index]:set_index[index+1]] =
df['second'][set_index[index]:set_index[index+1]] + second_increment[index]
```

```
C:\Users\user\Anaconda3\lib\thermalModel_LDPRF.py:49: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy
  df['second'][set_index[index]:] = df['second'][set_index[index]:] +
second_increment[index]
C:\Users\user\Anaconda3\lib\thermalModel_LDPRF.py:56: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy
  df['second'][set_index[index]:] = df['second'][set_index[index]:] +
seconds_summation[index]
```

1.0.3 Visualise 'AhCha','AhDch','Amb','Temp' data for both datasets

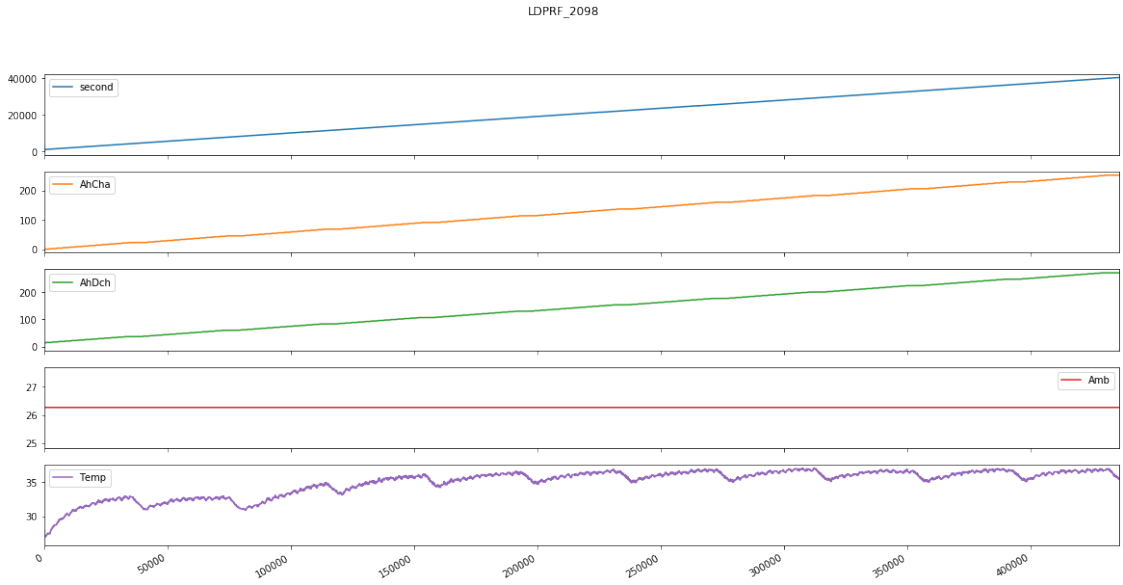
[20]:
```
AhData_2097_df.plot(title='LDPRF_2097', subplots=True, figsize=(20,10))
```

[20]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9BA71860>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9BA4E208>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9BACCBE0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9BAFDBA8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9BE02B70>],
      dtype=object)
```



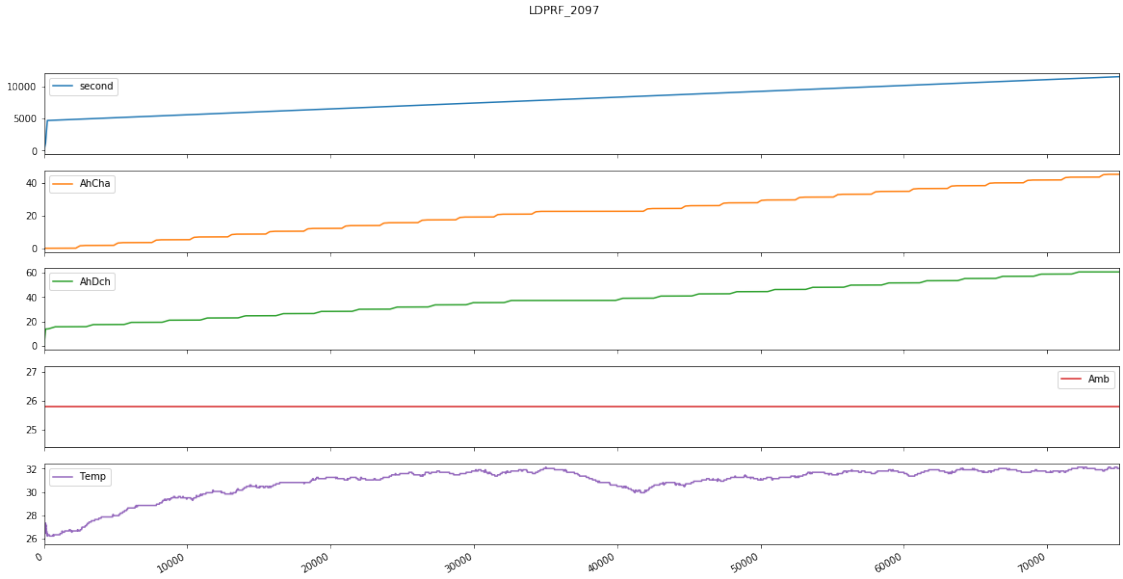
[5]:
```
AhData_2098_df.plot(title='LDPRF_2098', subplots=True, figsize=(20,10))
```

[5]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF8D03208>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF881A7B8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF4E6EC18>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF64F60B8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF80FA518>],
      dtype=object)
```



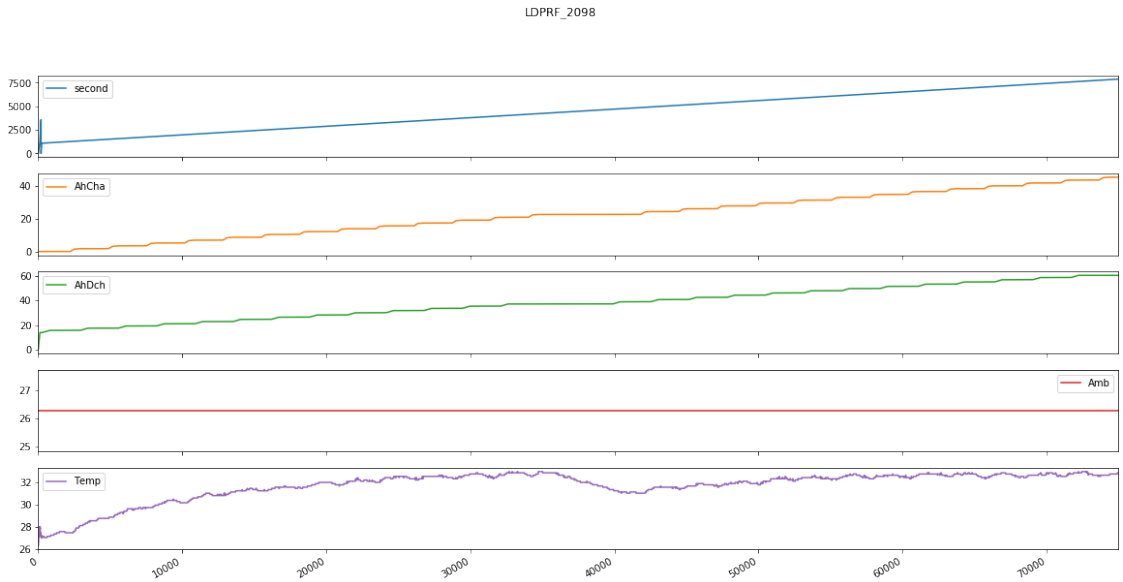
[6]:
```
AhData_2097_df[:75000].plot(title='LDPRF_2097', subplots=True, figsize=(20,10))
```

[6]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DFFC9AFA90>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFFA464E10>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF6A39D68>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF8826B320>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF882304A8>],
      dtype=object)
```



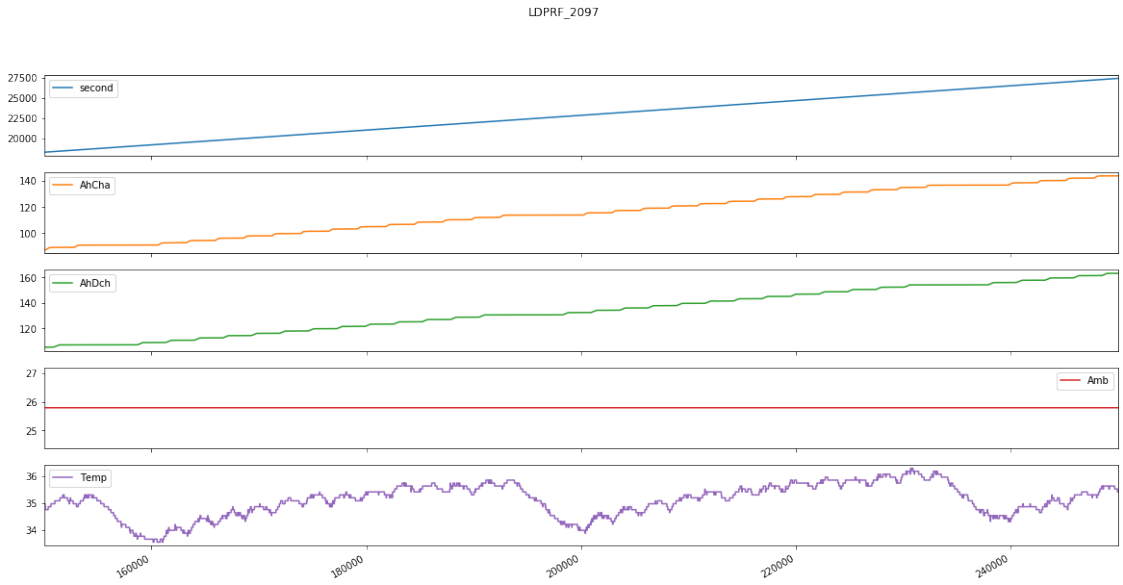
[7]:
```
AhData_2098_df[:75000].plot(title='LDPRF_2098', subplots=True, figsize=(20,10))
```

[7]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF8E69160>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFFC43D9E8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF0BF7E48>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF6445D30>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF8DEC6748>],
      dtype=object)
```



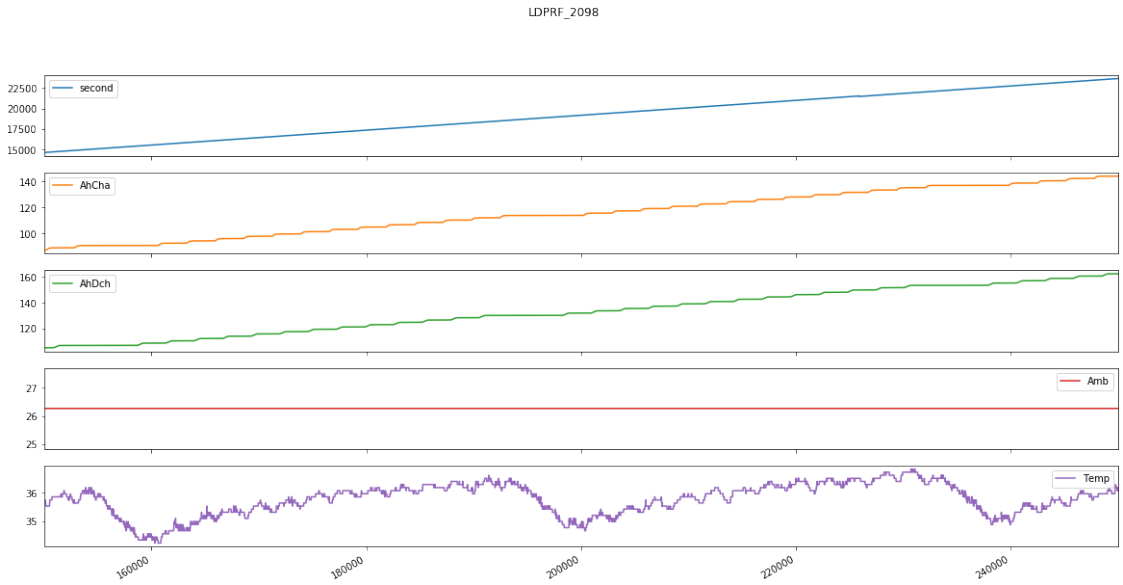
[8]:
```
AhData_2097_df[150000:250000].plot(title='LDPRF_2097', subplots=True,␣
↪figsize=(20,10))
```

[8]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF8E692E8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFFCD83DA0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF0A7FDD8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF6916978>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFF68F8B00>],
      dtype=object)
```



[9]:
```
AhData_2098_df[150000:250000].plot(title='LDPRF_2098', subplots=True,␣
↪figsize=(20,10))
```

[9]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DF80350E48>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF8062F8D0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF806729B0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF809A5E10>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF809E12B0>],
      dtype=object)
```



[10]:
```
AhData_2097_df.describe()
```

[10]:

	second	AhCha	AhDch	Amb	Temp
count	435839.000000	435839.000000	435839.000000	4.358390e+05	435839.000000
mean	24468.740483	126.363856	144.644944	2.579465e+01	34.312581
std	11440.765250	72.924632	74.703530	2.402277e-10	2.060416
min	0.000000	0.000000	0.000000	2.579465e+01	25.794650
25%	14564.850000	64.452000	81.299000	2.579465e+01	33.008410
50%	24470.300000	126.039000	145.061000	2.579465e+01	35.085100
75%	34375.750000	187.997000	208.479000	2.579465e+01	35.850190
max	44280.800000	252.040000	272.253000	2.579465e+01	36.724590

[11]:
```
AhData_2098_df.describe()
```

[11]:

	second	AhCha	AhDch	Amb
count	435839.000000	435839.000000	435839.000000	4.358390e+05
mean	20773.140869	126.437695	143.968215	2.626750e+01
std	11367.928295	72.927347	74.268447	6.600594e-11
min	0.000000	0.000000	0.000000	2.626750e+01
25%	10905.200000	64.531000	80.996500	2.626750e+01

```
50%     20810.600000     126.152000     144.421000  2.626750e+01
75%     30596.250000     188.089000     207.443000  2.626750e+01
max     40501.400000     252.044000     270.765000  2.626750e+01

                Temp
count  435839.000000
mean       34.934164
std         1.938317
min        26.267500
25%        33.803260
50%        35.741030
75%        36.386950
max        37.032870
```

1.0.4 Load 'Current','Voltage','Temp' data for both datasets

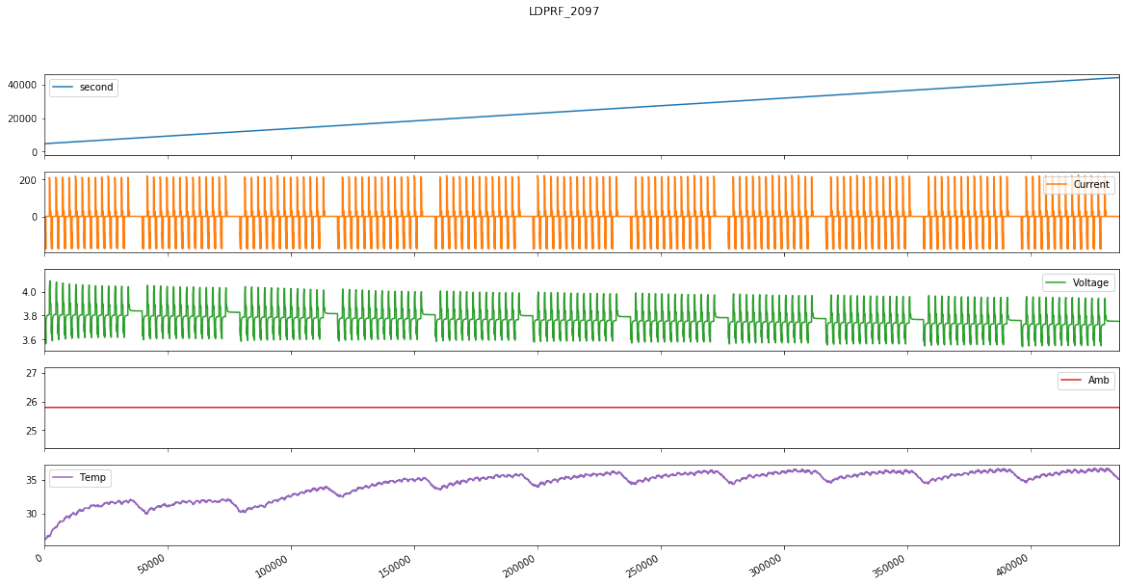
[12]:
```
IVData_2097_df = tm_LDPRF.load_csv(filename = 'LDPRF_2097.csv',
                                   features_list =␣
 ↪['second','Current','Voltage','Amb','Temp'], mode = 1)

IVData_2098_df = tm_LDPRF.load_csv(filename = 'LDPRF_2098.csv',
                                   features_list =␣
 ↪['second','Current','Voltage','Amb','Temp'], mode = 1)
```

```
C:\Users\user\Anaconda3\lib\thermalModel_LDPRF.py:47: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy
  df['second'][set_index[index]:set_index[index+1]] =
df['second'][set_index[index]:set_index[index+1]] + second_increment[index]
C:\Users\user\Anaconda3\lib\thermalModel_LDPRF.py:49: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy
  df['second'][set_index[index]:] = df['second'][set_index[index]:] +
second_increment[index]
C:\Users\user\Anaconda3\lib\thermalModel_LDPRF.py:56: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: http://pandas.pydata.org/pandas-
docs/stable/indexing.html#indexing-view-versus-copy
  df['second'][set_index[index]:] = df['second'][set_index[index]:] +
seconds_summation[index]
```

1.0.5 Visualise 'Current','Voltage','Temp' data for both datasets

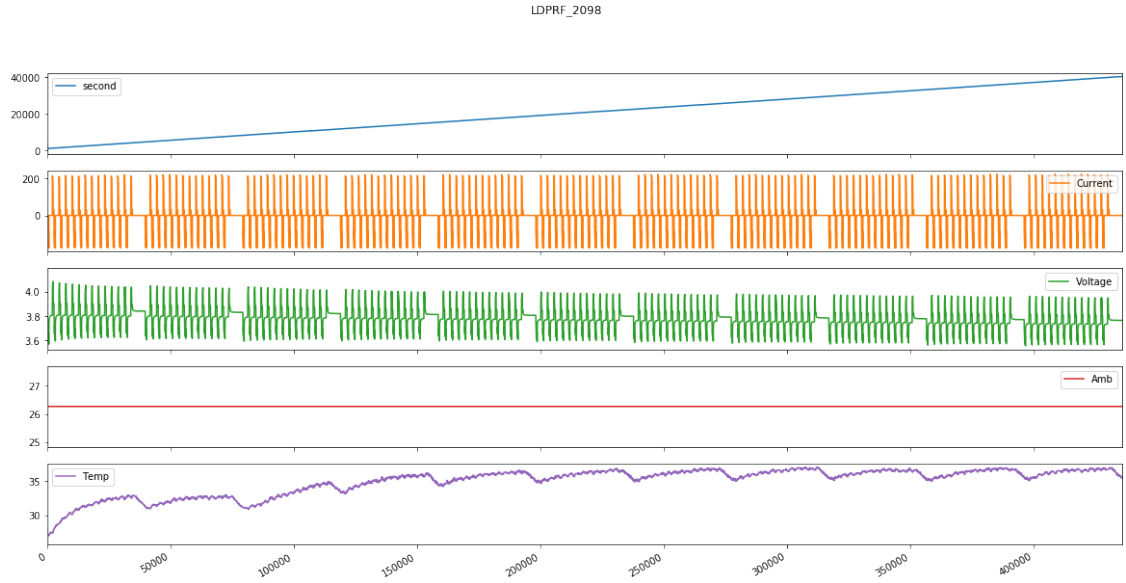
[13]:
```
IVData_2097_df.plot(title='LDPRF_2097', subplots=True, figsize=(20,10))
```

[13]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DF974C20F0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF81F5F9E8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFA61210B8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9BA0D240>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFA2E3C6A0>],
      dtype=object)
```



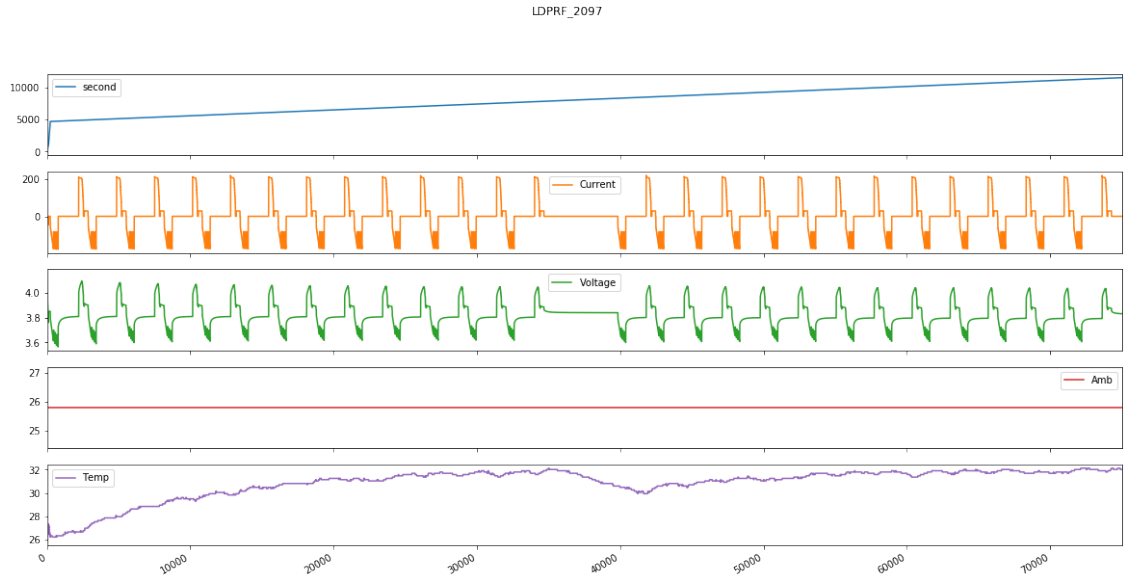
[14]:
```
IVData_2098_df.plot(title='LDPRF_2098', subplots=True, figsize=(20,10))
```

[14]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DFAD85BF28>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFAD881470>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFA37C58D0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DFA3B3DD30>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9781B1D0>],
      dtype=object)
```



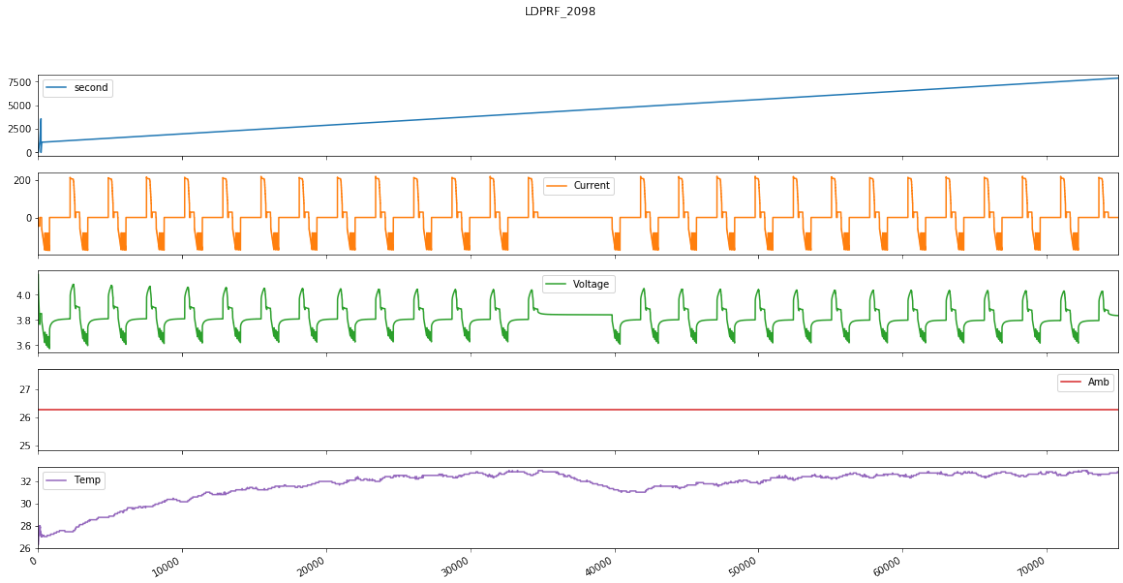
[15]:
```
IVData_2097_df[:75000].plot(title='LDPRF_2097', subplots=True, figsize=(20,10))
```

[15]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DFAD858278>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF81FF2FD0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF84E76470>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF84EA98D0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF84EDBD30>],
      dtype=object)
```



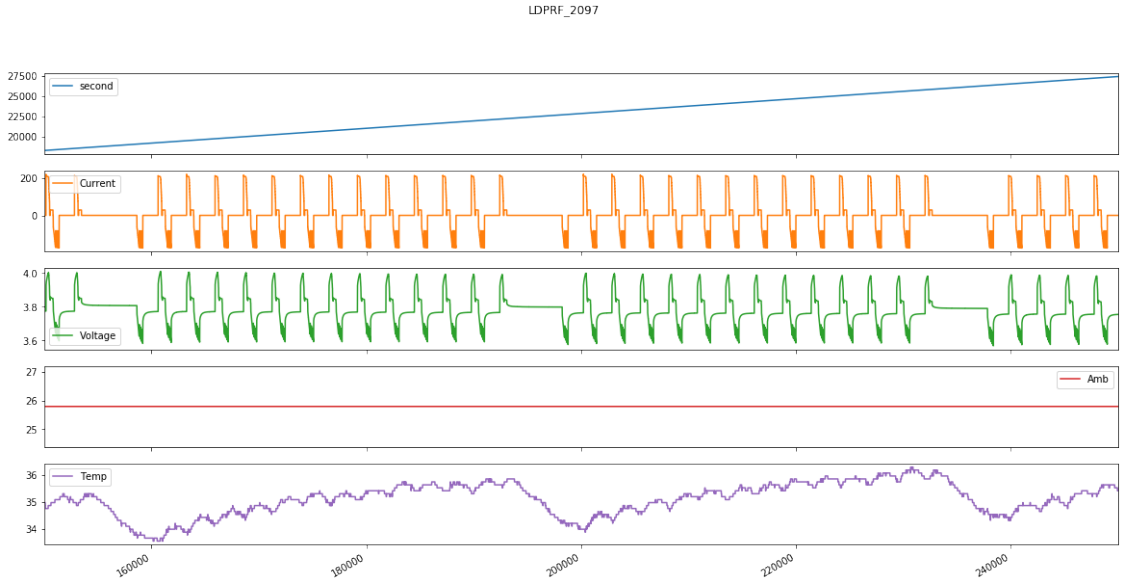
[16]:
```
IVData_2098_df[:75000].plot(title='LDPRF_2098', subplots=True, figsize=(20,10))
```

[16]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DF974D8198>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF8DE4ABA8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF8E9A2048>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF8E9D34A8>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF8EA03908>],
      dtype=object)
```



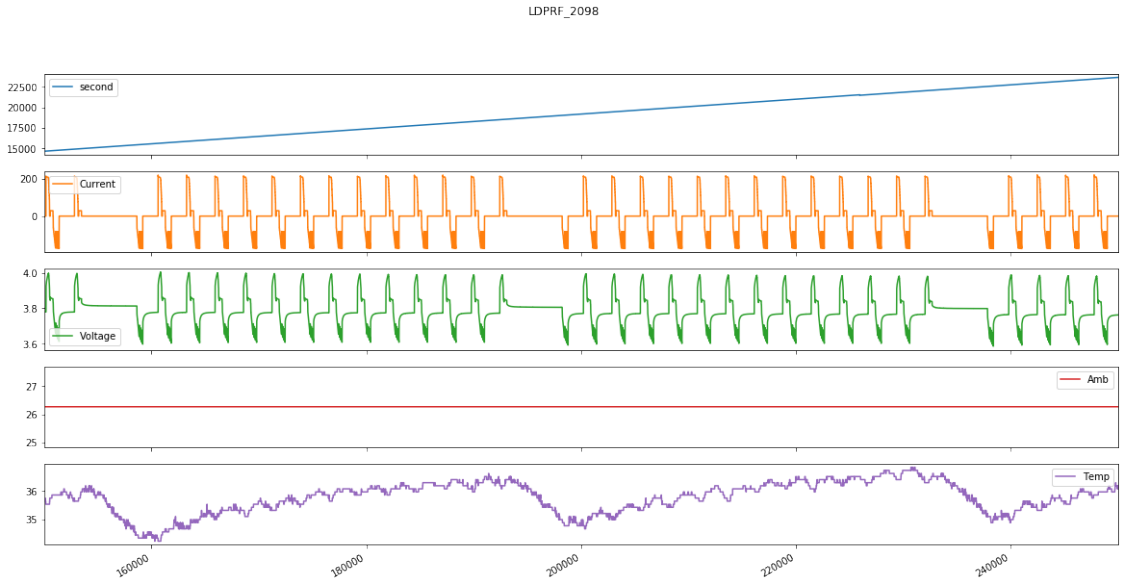
[17]:
```
IVData_2097_df[150000:250000].plot(title='LDPRF_2097', subplots=True,␣
↪figsize=(20,10))
```

[17]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DF8C4DF668>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF977D6CC0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9780C160>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9787D5C0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF978AEA20>],
      dtype=object)
```



[18]:
```
IVData_2098_df[150000:250000].plot(title='LDPRF_2098', subplots=True,␣
↪figsize=(20,10))
```

[18]:
```
array([<matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9753E1D0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9B475080>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9B4A24E0>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9B920940>,
       <matplotlib.axes._subplots.AxesSubplot object at 0x000001DF9B955DA0>],
      dtype=object)
```



[19]:
```
IVData_2097_df.describe()
IVData_2098_df.describe()
```

[19]:

	second	Current	Voltage	Amb	\
count	435839.000000	435839.000000	435839.000000	4.358390e+05	
mean	20773.140869	-0.497548	3.782469	2.626750e+01	
std	11367.928295	85.732075	0.086605	6.600594e-11	
min	0.000000	-176.603480	3.557440	2.626750e+01	
25%	10905.200000	0.009560	3.741410	2.626750e+01	
50%	20810.600000	0.009560	3.773560	2.626750e+01	
75%	30596.250000	0.009560	3.813390	2.626750e+01	
max	40501.400000	222.893370	4.161120	2.626750e+01	

	Temp
count	435839.000000
mean	34.934164
std	1.938317
min	26.267500
25%	33.803260
50%	35.741030
75%	36.386950
max	37.032870