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Diagnostic Data Viewer User Manual

Revision 4.0

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1. Introduction

Diagnostic Data Viewer is a standalone application for analyzing and evaluating Diagnostic Data from Cascadia Motion inverters. The Diagnostic Data is a snap shot of high-speed internal data from the inverter. The data is recorded at the PWM frequency of the inverter. Normally data is stored for 160 PWM periods and is typically stopped 5 PWM periods after a fault occurs. Diagnostic Data is obtained from inverters by using the GUI application which has a Download Diagnostic Data feature or from CAN (not CAN data must be translated into the GUI format to be used by this viewer).

To use the Viewer copy DiagDataViewer.exe to a folder on the host computer along with the 2 application extension library files DevComponents.DotNetBar.Charts.dll and DevComponents.DotNetBar2.dll.

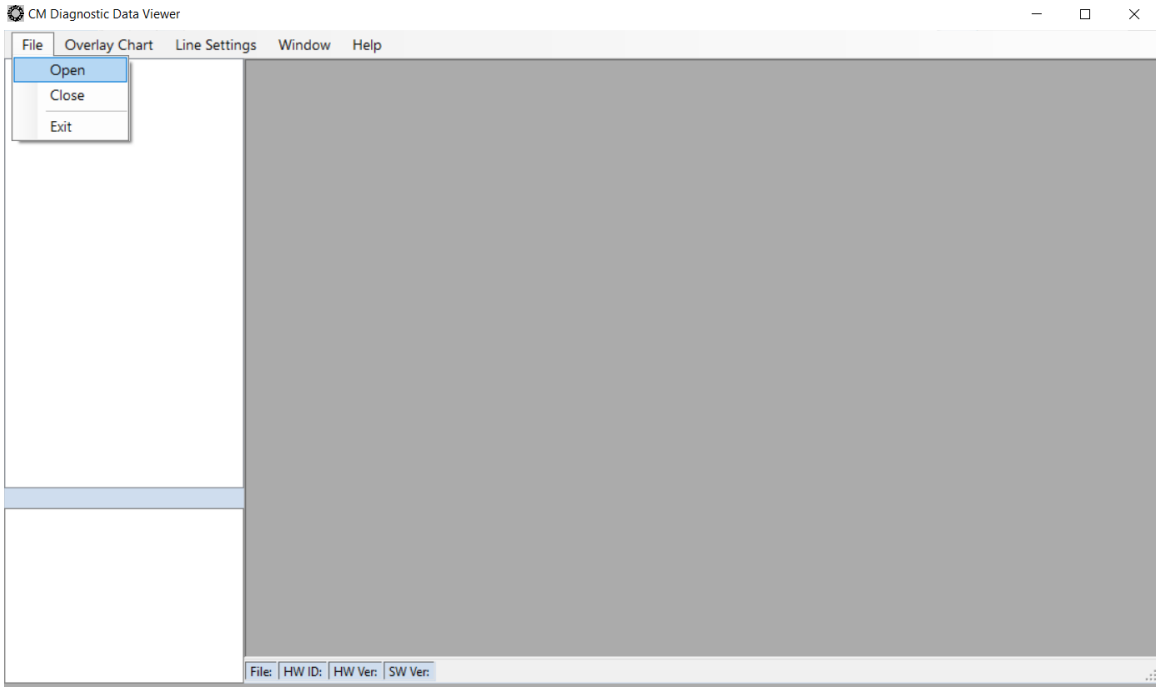
Click on DiagDataViewer.exe to run the application.

2. Startup

Diagnostic Data Viewer will appear blank when first launched. Use the File menu to Open a diagnostic data file. An Open File Dialog box will pop up. Navigate to a folder where a diagnostic data file was saved. Typically, diagnostic data files are saved into the same folder as the GUI or a sub-folder below the GUI application that was used to create the diagnostic file.

Data files are created by using the RMS GUI or the newer CM GUI. Data files may or may not have the ".txt" extension added.

The Diag Data file contains a series of comma separated values arranged in a series of lines. The file is in the standard CSV data format, typically with some header information at the beginning. Each line represents the data from one PWM period. Each element is a different internal variable.



2.1 Diag Data Format Definition

The Diag Data variables sent by the inverter can vary from depending on the particular firmware in the inverter. Not all firmware versions will have the same variables output. The Diag Data Viewer will search for a defsyms file that matches the date code in the header of the Diag Data file. If it finds a matching file the Diag Data Viewer will search for a definition of the Diag Data fields within the defsyms file. An example of this definition is shown below. If the matching defsyms file is not found (or it doesn't contain the definition) then the viewer will make an assumption about what each field is. For many firmware versions this is adequate.

Below is an example of a data definition list from a symbol file.

```
################################################################################
# Diagnostic Data
# Not displayed on GUI
# Must have a '#' sign in the beginning
# The keywords #FF_ DIAGDATA _LIST and #FF_ DIAGDATA _LIST_ENDS must cover the
# entire list. Do not use commas in the Description field.
# Format:[Variable Name],[Multiplier],[Units],[Sign],[Description]
################################################################################
#FF_DIAGDATA_LIST,
#Gamma Resolver,10,Deg,uint,Instantaneous angle calculated from the resolver feedback. (0 = 0 degrees
1.0 = 360 degrees),
#Gamma Observer,10,Deg,uint,Resolver feedback after filtering of observer,
```

#Sin Corr,100,Volts,int,Resolver Sin input,
#Cos Corr,100, Volts,int,Resolver Cos input,
#Ia Corr,10,Amps,int,Phase A adjusted current value,
#Ib Corr,10,Amps,int,Phase B adjusted current value,
#Ic Corr,10,Amps,int,Phase C adjusted current value,
#Vdc,10,Volts,int,DC Bus voltage,
#Iq Cmd,10,Amps,int,Q-axis current command,
#Id Cmd,10,Amps,int,D-axis current command,
#Modulation,10000,uint,Index,Modulation Index,
#Weakening Current,10,A,int,Amount of field weakening current,
#Vq Cmd,10,Volts,int,Q-axis voltage command,
#Vd Cmd,10,Volts,int,D-axis voltage command,
#Vqs Cmd,10,Volts,int,Q-axis voltage command in stationary reference frame,
#Vds Cmd,10,Volts,int,D-axis voltage command in stationary reference frame,
#Run Faults (Low),1,Value,uint,Run Faults Low Byte,
#Run Faults (High),1,Value,uint,Run Fault High Byte,
#FF_DIAGDATA_LIST_ENDS,

Below is an example of raw diagnostic data downloaded from a Cascadia inverter.

```
# 8/14/2020 11:23:53 AM
# Firmware Date-code: 202000115
# Firmware Version  : 2024
# Hardware Version  : 73
# Hardware ID       : G4+
# Com Port          : COM3

002812,002812,064779,059875,001451,065482,065474,000000,000000,000000,000017,000000,000000,000000,000000,001212,000000,000000
002813,002812,064779,059875,001451,065484,065472,000000,000000,000000,000017,000000,000000,000000,000000,001212,000000,000000
002814,002813,064779,059875,001455,065486,065474,000000,000000,000000,000017,000000,000000,000000,000000,001212,000000,000000
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002819,002818,064779,059875,001447,065486,065472,000004,000000,000000,000018,000000,000000,000000,000000,001212,000000,000000
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002821,002820,064779,059875,001416,065484,065474,000006,000000,000000,000018,000000,000000,000000,000000,001226,000000,000000
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002822,002822,064779,059875,001416,065489,065476,000000,000000,000000,000019,000000,000000,000000,000000,001226,000000,000000
002822,002822,064779,059875,001416,065487,065474,000004,000000,000000,000019,000000,000000,000000,000000,001226,000000,000000
002822,002823,064779,059875,001414,065484,065474,000006,000000,000000,000019,000000,000000,000000,000000,001226,000000,000000
002823,002823,064779,059875,001410,065481,065479,000004,000000,000000,000019,000000,000000,000000,000000,001226,000000,000000
```
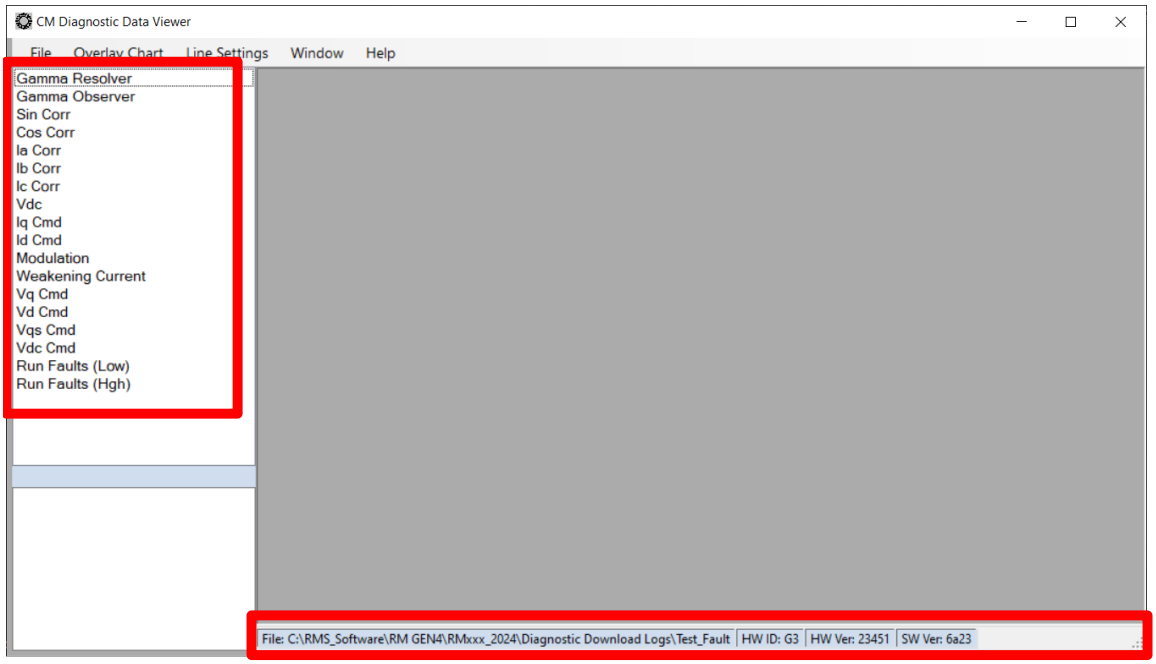

Normal text file | length : 20,489 | lines : 168 | Ln : 1 | Col : 1 | Sel : 0 | 0 | Windows (CR LF) | UTF-8 | INS

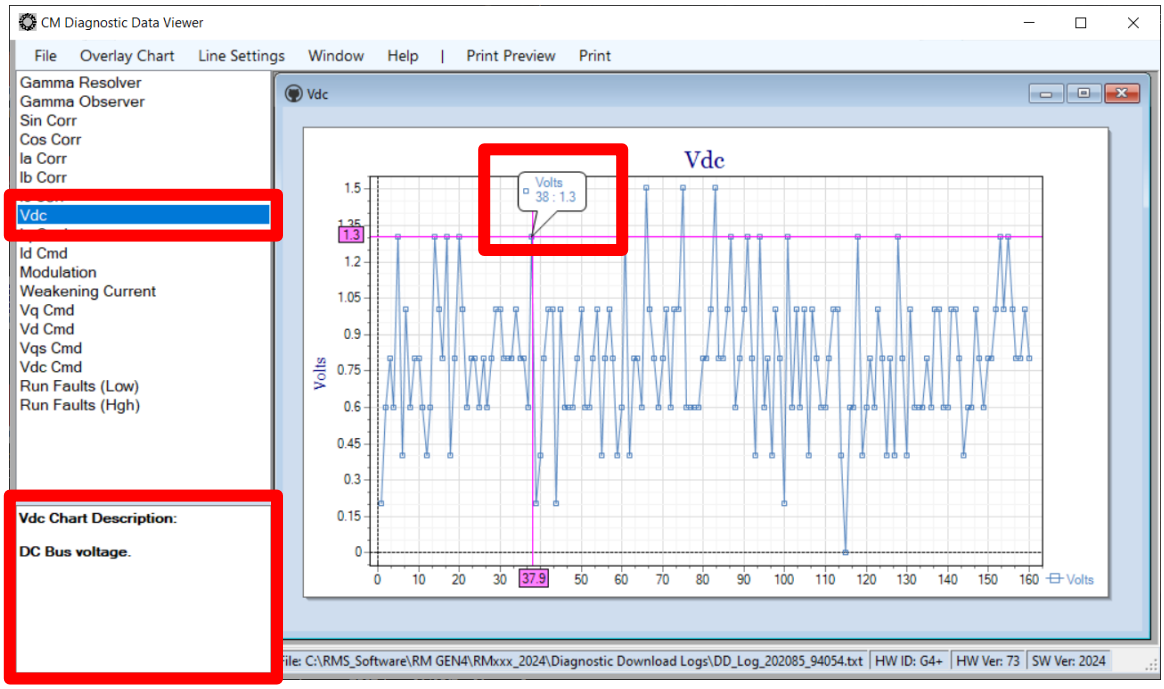
The time between each line of data is the PWM period at the time. It is important to note that if the PWM frequency changes during a Diag Data capture then the amount of time between samples will also change. When looking at Gamma Resolver (motor electrical angle) this will look like the slope of the sawtooth waveform suddenly changing.

2.2 Operation

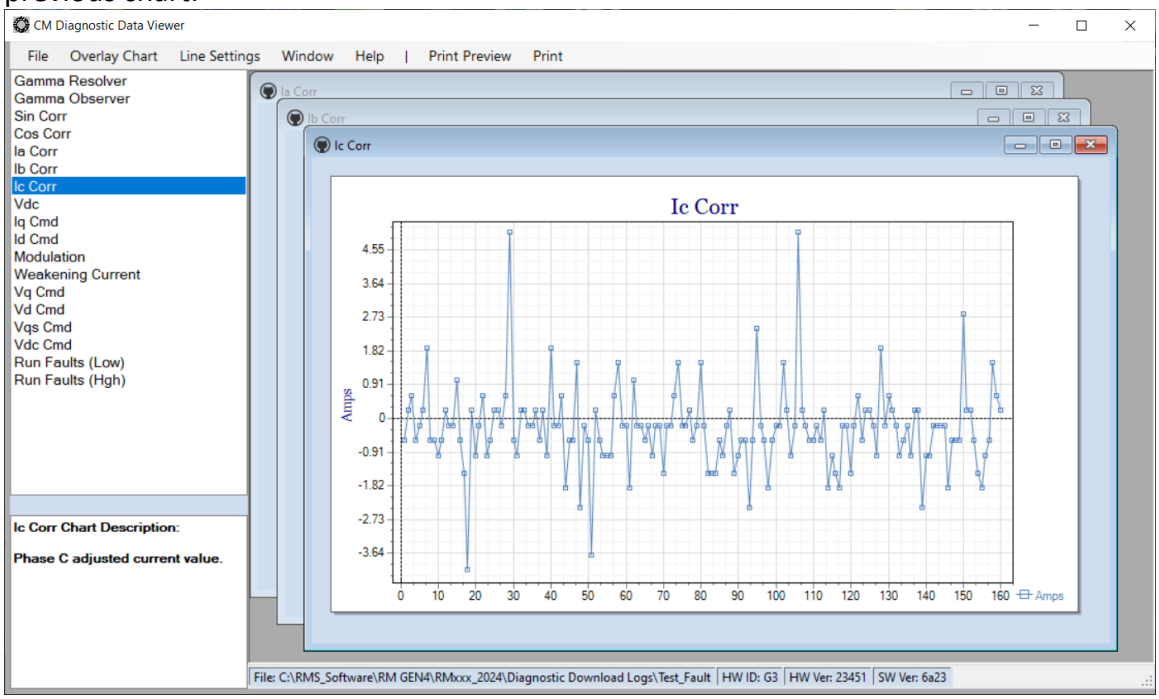
Once the data file has been loaded, signal names for each data set will be loaded into a listbox control on the left side of the screen. The signal names may change depending on the latest firmware and either the default parameters or the loaded parameters. The File path along with the HW ID, HW Version and SW Version of the device that created the data can be found in the status bar at the bottom of the screen.



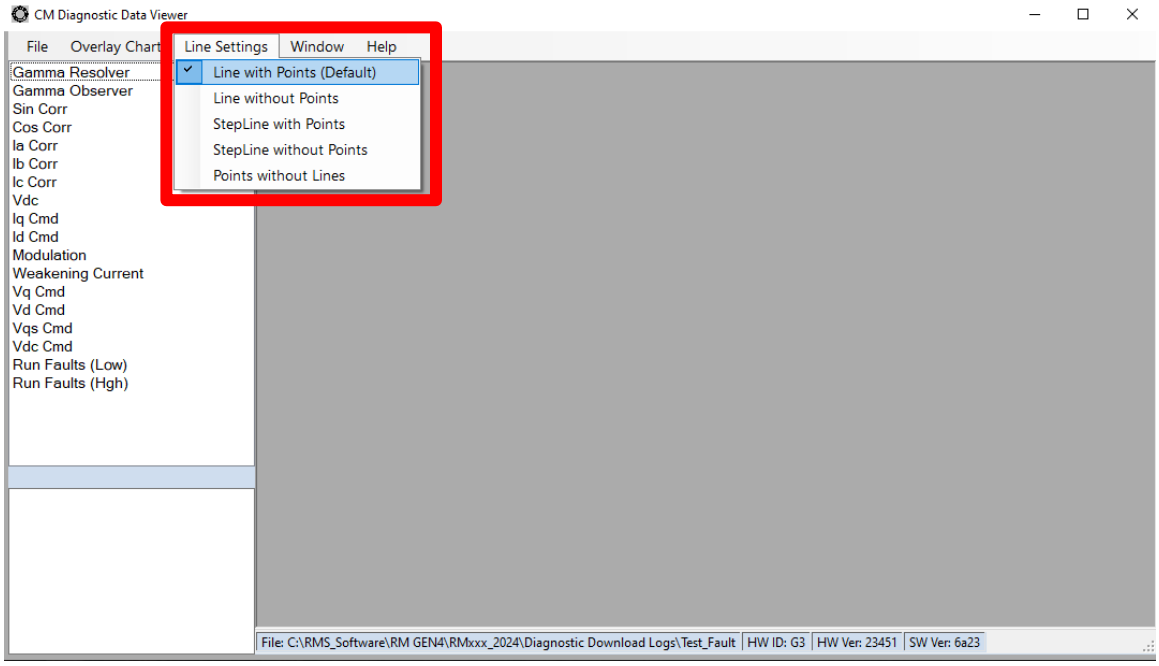
To view a data set, click on the signal in the listbox and a new chart will pop up in the window on the right. A description of the data set will also be displayed at the bottom left of the screen. A data point balloon with xy data will appear by hovering the mouse near any data point on the graph.



Each time a signal is selected a new window with that data set will cascade next to the previous chart.

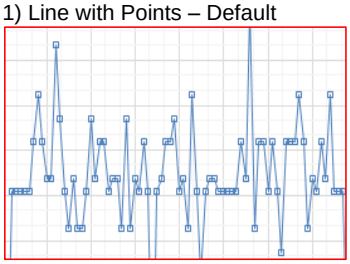


Line styles for graph data can be selected from the main menu under Line Settings:

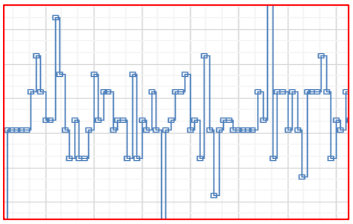


Data can be displayed in 5 different ways:

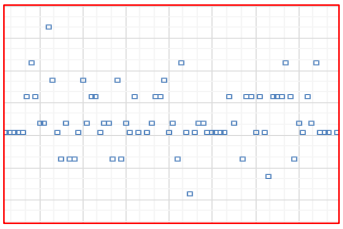
1) Line with Points – Default



3) StepLine with Points

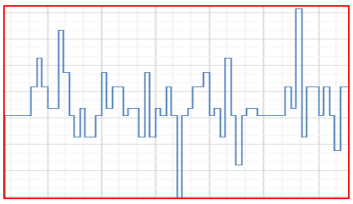


5) Points without Lines

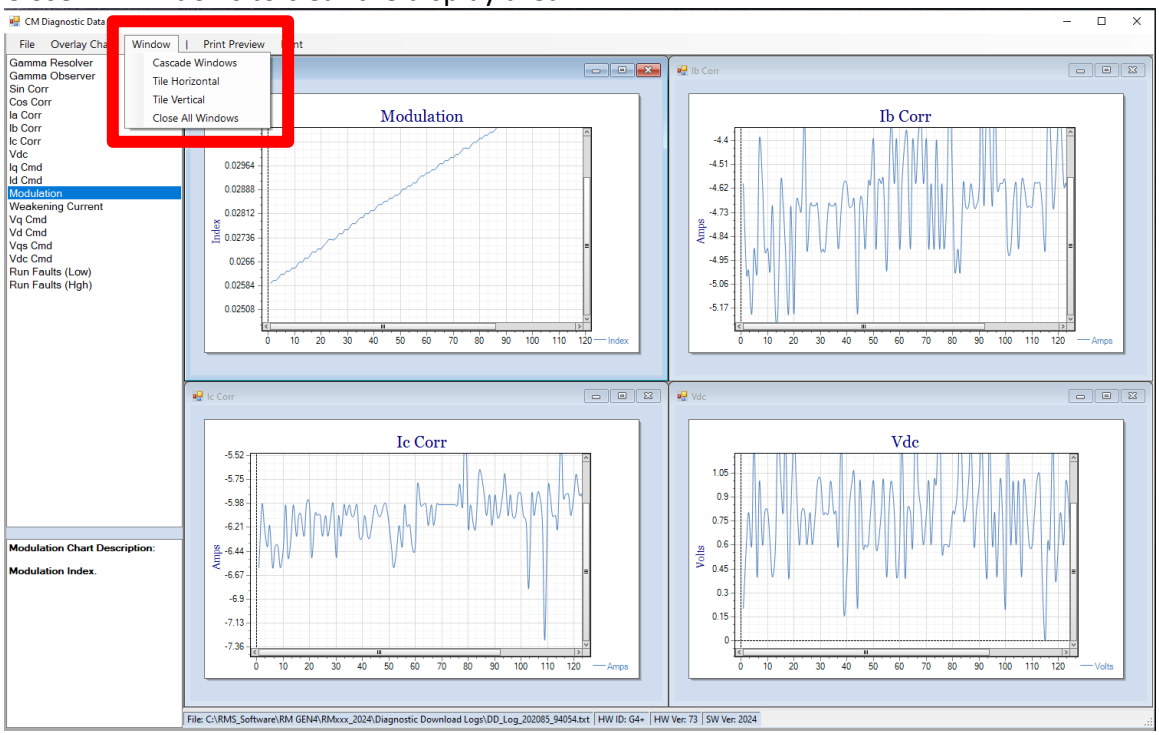


2) Line without Points

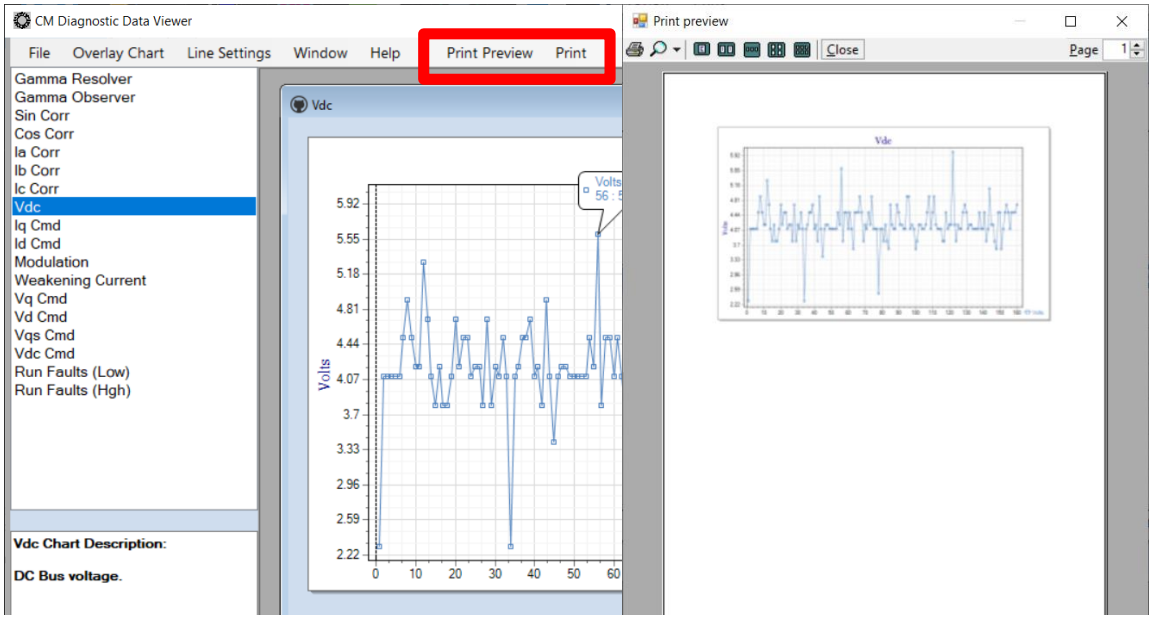
4) StepLine without Points



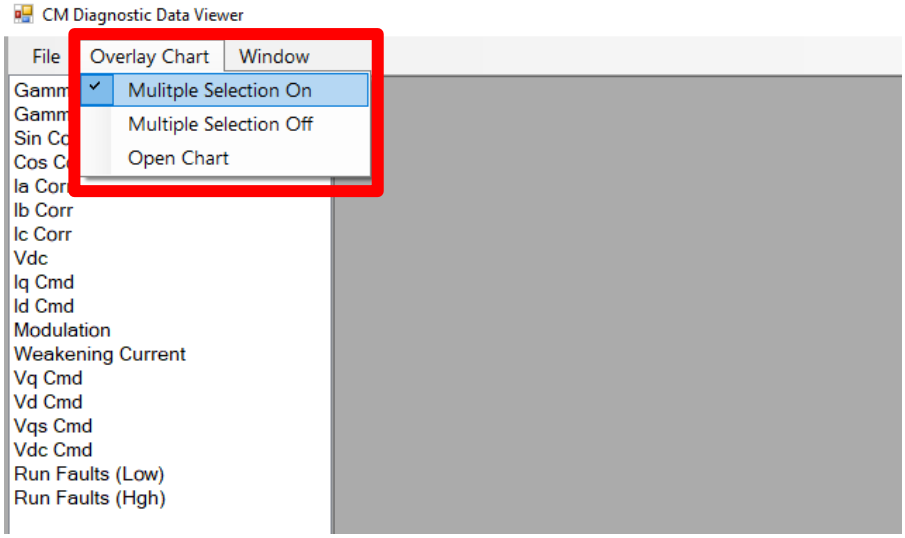
Charts can be rearranged by selecting Windows>>Tile Vertical or Tile Horizontal. Click on Close All Windows to clear the display area.



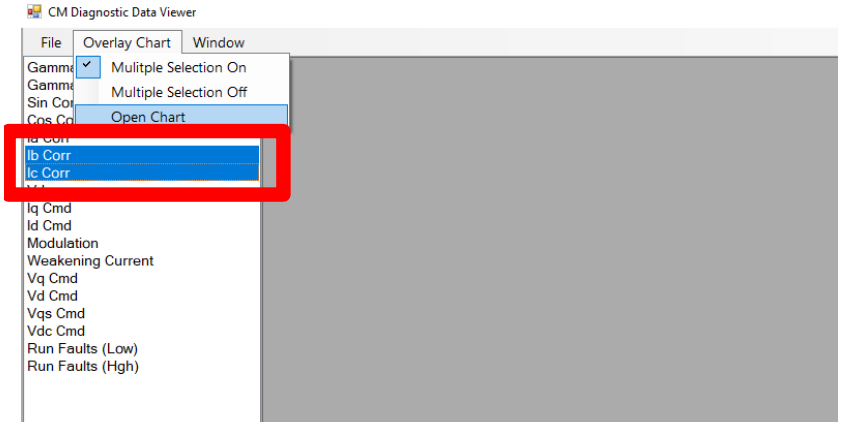
Once a chart is displayed in the window area some additional menu options may also be available. Print Preview allows you to see how any selected chart looks before choosing a printer. Click Print to save a PDF of the selected chart.



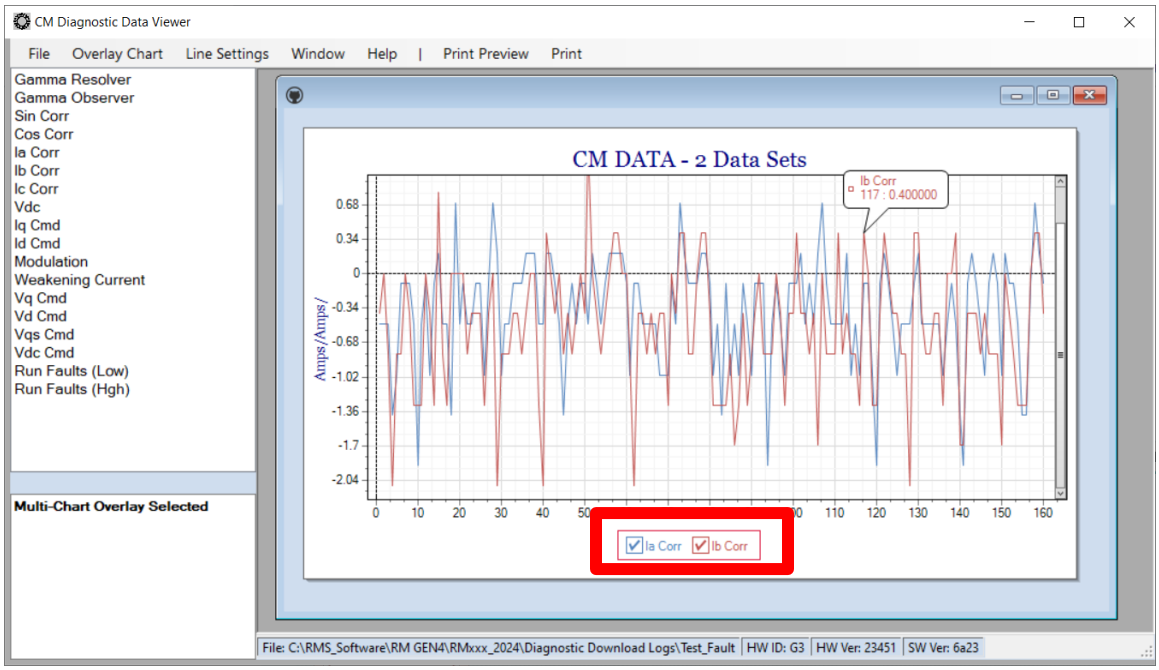
To view multiple signals on the same chart, select “Multiple Selection On” under the “Overlay Chart” menu item. This will allow multiple items to be selected in the listbox



Each signal that is selected will be highlighted. There is no need to hold down the Control key typically used for selecting multiple items. It is best to select signals that are measured in the same types of units to keep the values in scale.

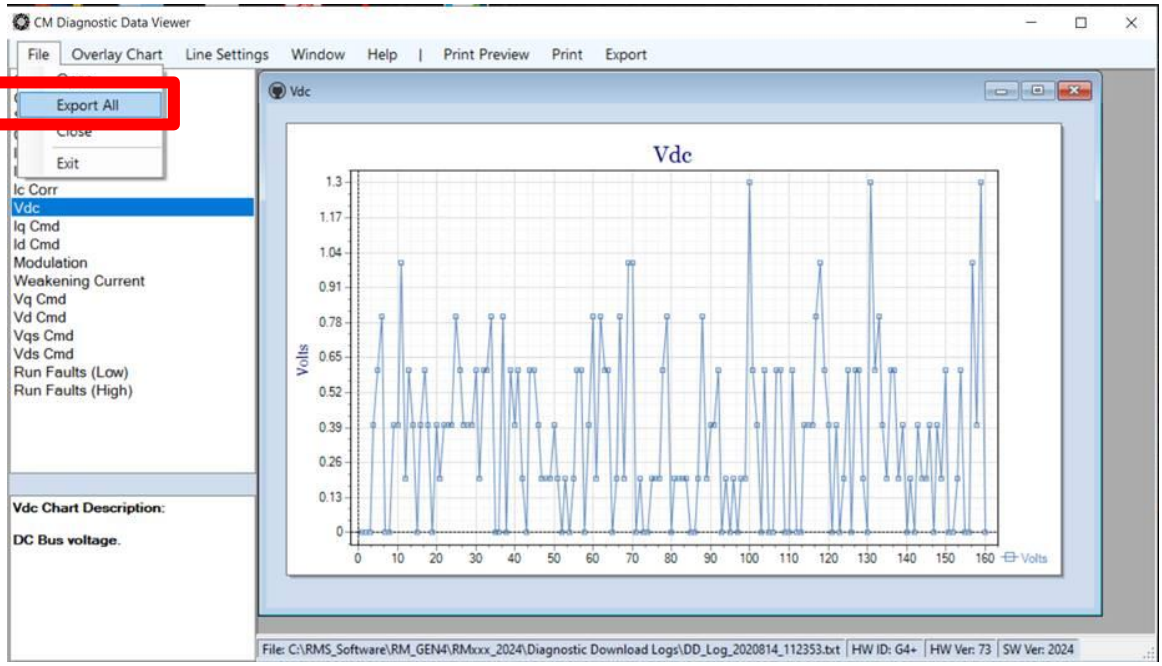


Click Overlay Chart>>Open Chart when you are done selecting which data sets to view. The chart will automatically set the Min and Max ranges to that of the highest and lowest values of all of the data sets selected. You will be able to turn on/off each set of lines by using the checkboxes located at the bottom of the chart window. The units used for each data set will appear on the y-axis legend separated by a backslash “/” in their respective order. Line style will default to No Points to facilitate a less cluttered view of the graphed data

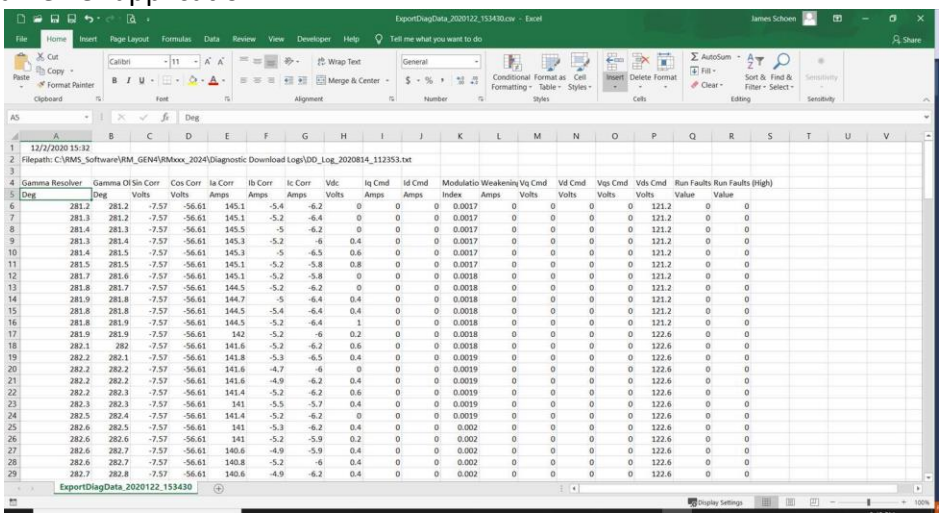


2.3 Export Data

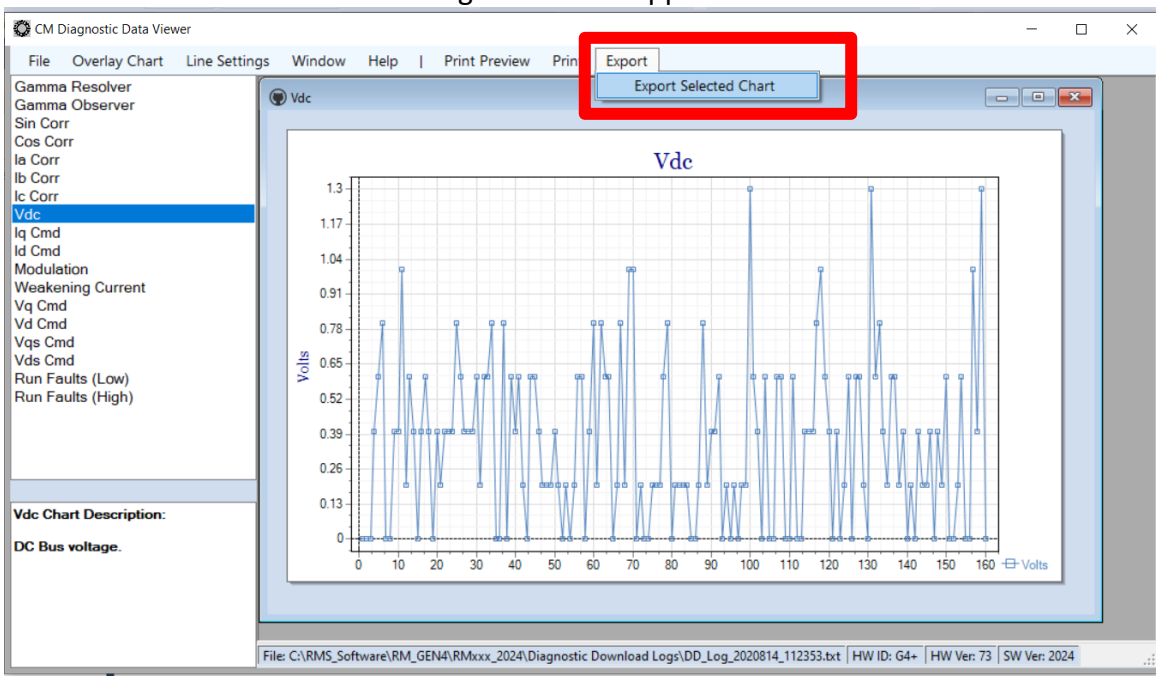
The data in the Diag Data can be exported to a CSV file, converted to the engineering units assigned by the either the default data definitions or those loaded by the defsyms file. To export all data in a diagnostic file select Export All from the File menu.



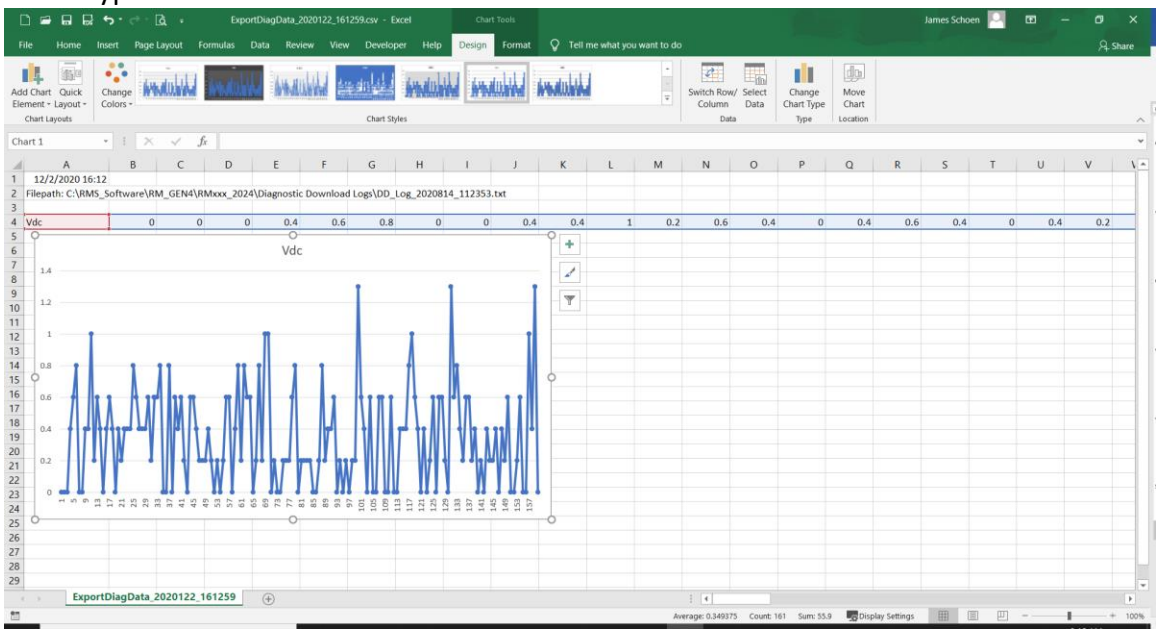
Data will be exported in a CSV format. Once opened in ™Excel the data will be represented in a tabulated column format. Each column will be headed by the signal name and unit of measure. Exported files will be saved in the same folder as the DiagDataViewer application.



Data from any type of chart (single or multi-point) can be exported as well. First select a chart then click on Export menu and select Export Selected Chart. Exported files will be saved in the same folder as the DiagDataViewer application.



Data from this Export will be represented in rows prefaced with the signal name. To recreate the graph in the spreadsheet click on the data row, then select Insert and the Chart Type.

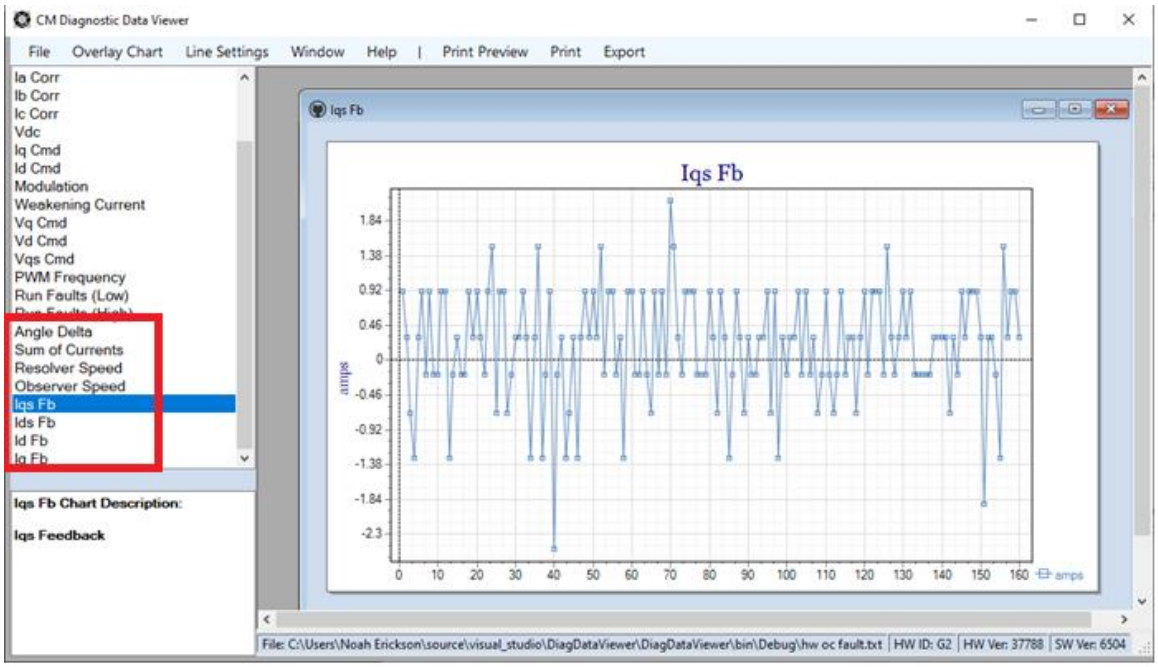


2.4 Calculated Parameters

To facilitate analysis of the Diag Data several new parameters are calculated from the data. The calculated parameters assume that the data is in the default configuration.

The following parameters are made available:

- Angle Delta[n] = Gamma Resolver[n] – Gamma Observer[n]
  Units: Degrees
- Sum of Currents[n] = Ia Corr[n] + Ib Corr[n] + Ic Corr[n]
  Units: amps
- Resolver Speed[n] = Gamma Resolver[n] – Gamma Resolver[n-1]
  Units: degrees/pwm period
- Observer Speed[n] = Gamma Observer[n] – Gamma Observer[n-1]
  Units: degrees/pwm period
- Iqs Fb[n] = Ia Corr[n]
  Units: Amps
- Ids Fb[n] = -(Iqs Fb[n] + 2*Ib Corr[n]) * (1/sqrt(3))
  Units: Amps
- Id Fb[n] = Ids Fb[n]*cos(Gamma Observer[n]) + Iqs Fb[n]*sin(Gamma Observer[n])
  Units: Apk
- Iq Fb[n] = Iqs Fb[n]*cos(Gamma Observer[n]) - ids Fb[n]*sin(Gamma Observer[n])
  Units: Apk


CM Diagnostic Data Viewer
File
Overlay Chart
Line Settings
Window
Help
Print Preview
Print
Export
Ia Corr
Ib Corr
Ic Corr
Vdc
Iq Cmd
Id Cmd
Modulation
Weakening Current
Vq Cmd
Vd Cmd
Vqs Cmd
PWM Frequency
Run Faults (Low)
Angle Delta
Sum of Currents
Resolver Speed
Observer Speed
Iqs Fb
Ids Fb
Id Fb
Iq Fb
Iqs Fb Chart Description:
Iqs Feedback
Iqs Fb
Iqs Fb
amps
1.84
1.38
0.92
0.46
0
-0.46
-0.92
-1.38
-1.84
-2.3
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
amps
File: C:\Users\Noah Erickson\source\visual_studio\DiagDataViewer\DiagDataViewer\bin\Debug\hw oc fault.txt
HW ID: G2
HW Ver: 37788
SW Ver: 6504

Revision History

Version	Description of Versions / Changes	Responsible Party	Date
1.0	Initial version.	Jim Schoen	8/17/2020
2.0	Fixed typographical errors, added export capability.	Jim Schoen	12/2/2020
3.0	Added calculated parameters to graph view.	Noah Erickson	2/23/2022
4.0	Updated format of document. Clarified some text. Updated info about how byte data is displayed.	Chris Brune	3/27/2023