

WAVEWIN

NEW FEATURES

Updated: August 10th, 2022

SOFTSTUF INC.

SOFTSTUF, INC.

SOFTWARE STRUCTURE FOR UNLIMITED FUNCTIONALITY

P.O. Box 40245

PHILADELPHIA, PA 19106-0245

1-800-818-3463 · 215-922-6880

www.softstuf.com

www.wavewin.net

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1. Data Plotting – SEL Specific Views:

Updated August 10th, 2022

Added support to have a view for each type of SEL Relay. The view can also be automatically applied when the SEL files are opened. To create the SEL views first select the SEL file in the File Manager. Next open a summary of the file by selecting Summaries under the Options Tab/Menu. The Device Type listed under the File Information section shows the name of the SEL view file.

* File Information:

* -----

```

Station: MCC 202
Device: MCC SUB
File Name: C:\FAULTLIB\TEST\150428,070428709,-5,Station,SUB,Comp,AG,-XY.CEV
File Size: 92496 Bytes
Prefault Time: 4/28/2021 07:04:28.629834
Fault Time: 4/28/2021 07:04:28.709000
Save Time: 04/29/2021 07:47:06
Process Time: 08/05/2022 13:36:37
Start Date & Time: 04/28/2021 07:04:28.629834
End Date & Time: 04/28/2021 07:04:29.692334
File Duration: 1 Sec(s) - 62 Mils(s) - 500 Mics(s)
Sampling Frequency: 240.000000, 4166.667 Microsecond Rate
Line Frequency: 60.000000
Device-Type: SEL-751A

```

For the above summary the SEL view must be named SEL-751A.VIW. To set up the view open the SEL file in the Data Plotting Window.

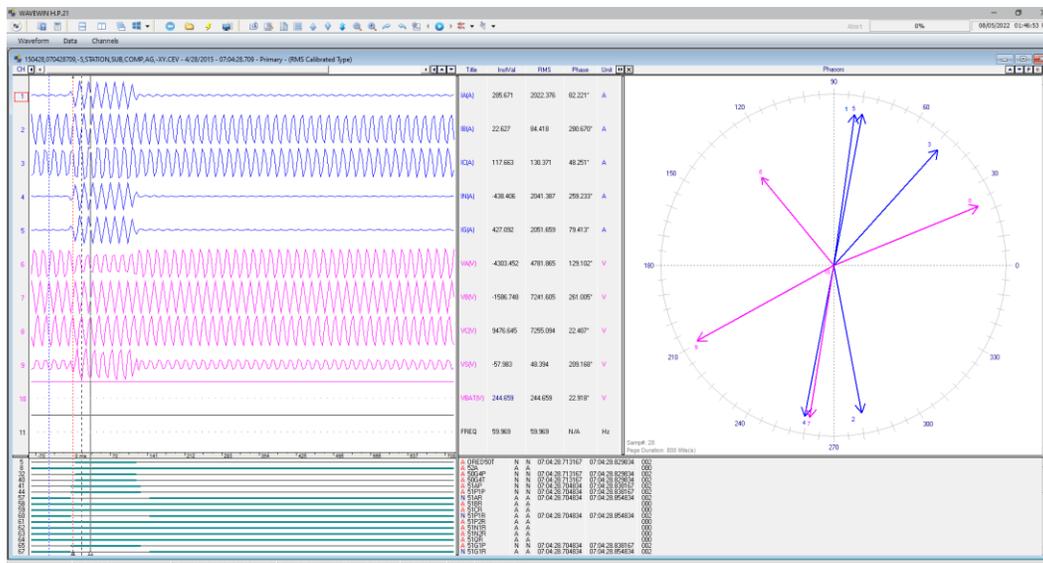


Figure-1: SEL Views

Once the file is open setup the view.

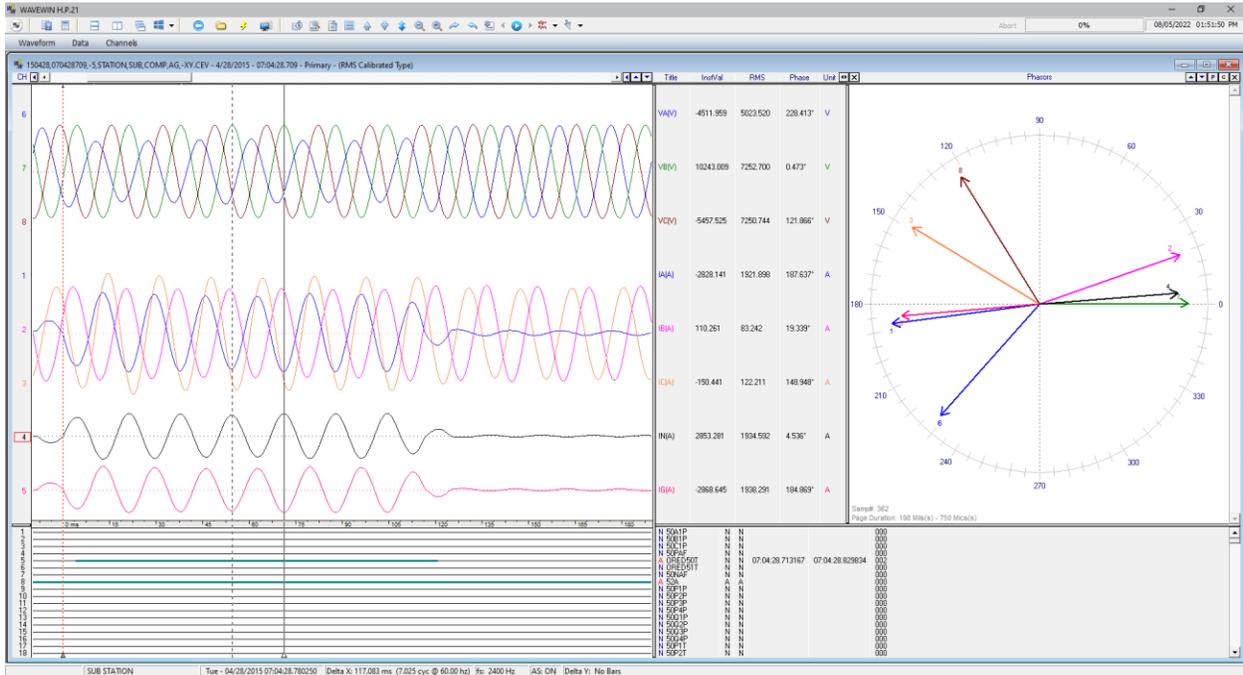


Figure-2: Setup SEL Views

In the view above the voltage channels were moved to the top. The VS, VBAT and FREQ channels were deleted. Each channel was assigned a color and the sampling frequency was increased from 240 samples per second to 2400. The 3 voltage channels were super imposed and the 3 phase currents were super imposed. The analog channel table was resized to show Title, InstVal, RMS, Phase and Units. To move the analog table columns open the Properties dialog and select the Analog Table tab.

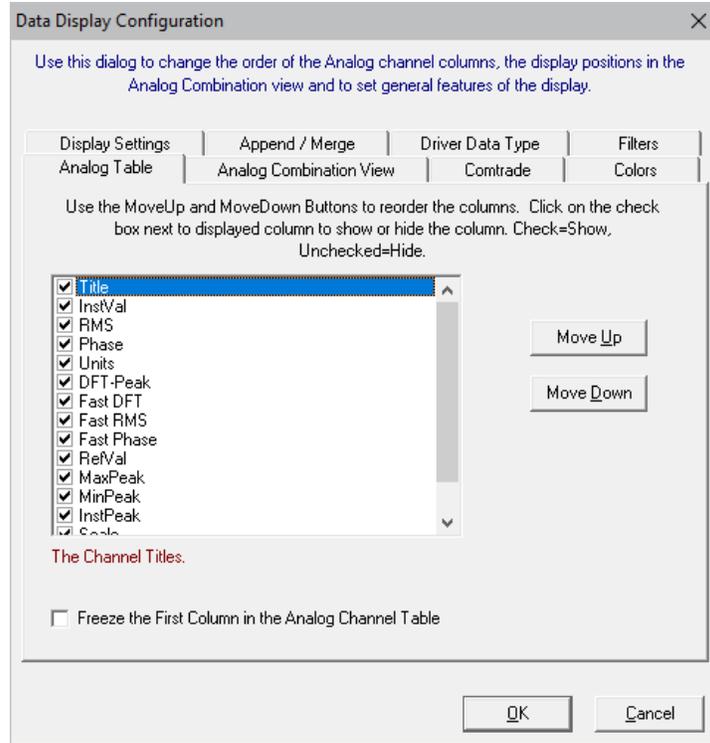


Figure-3: Properties Dialog/Analog Table Tab

When the View is complete select the Save View menu option under the Waveform tab.

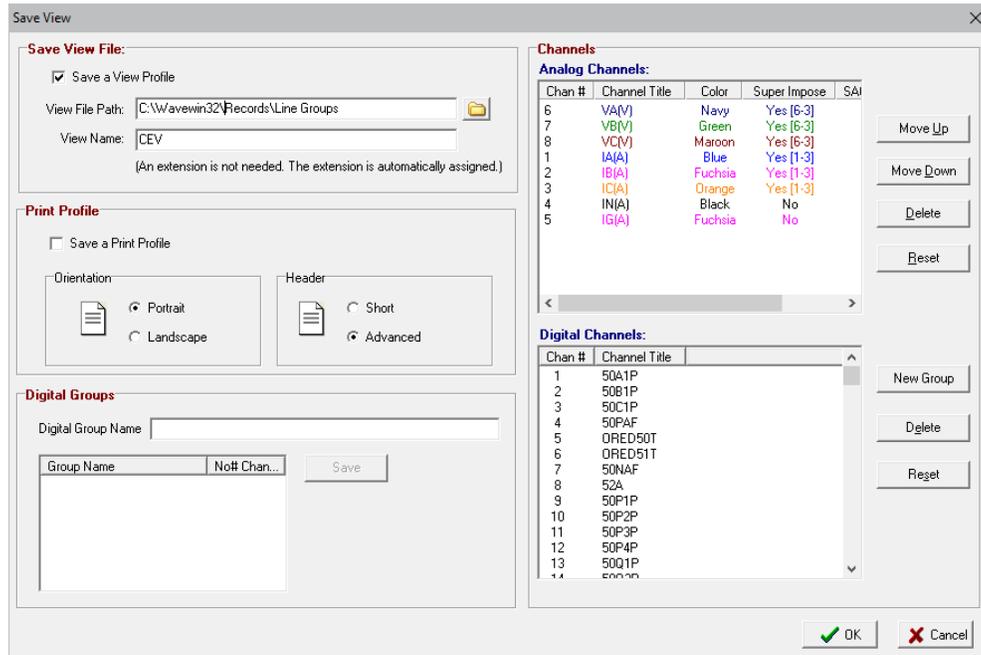


Figure-4: Save View Dialog

Enter the SEL Device type displayed in the Summary window: SEL-751A. The extension is not needed. It will be automatically assigned the .VIW extension. Select the path where the View will be saved in the View File Path field. All SEL view files can be saved in a single path accessible to all Wavewin users. To set the path where Wavewin will look for the SEL view files select the Driver Config menu option under the Options tab in the File Manager.

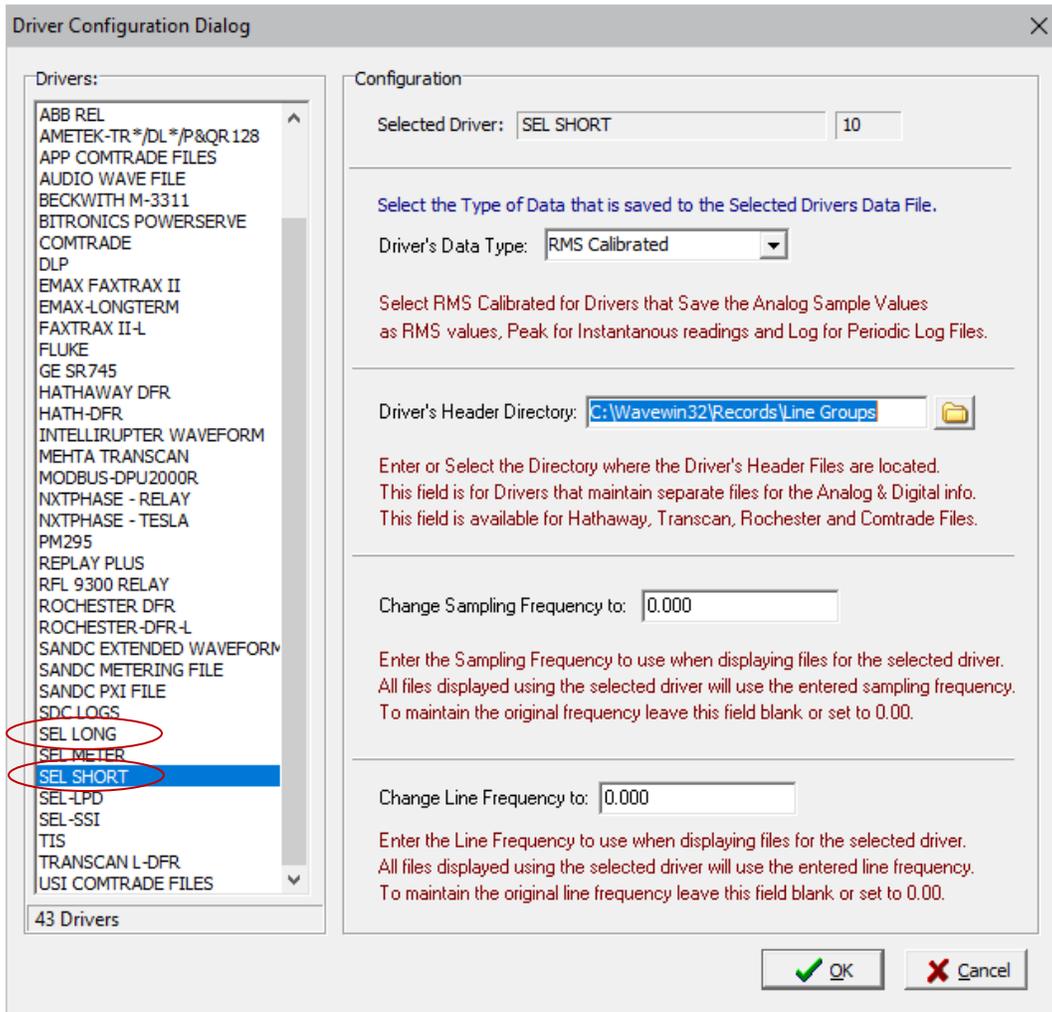


Figure-5: Driver Configuration Dialog

Set the Driver's Header Directory to the path where the SEL View files are saved. Set it for both the SEL Long and SEL Short drivers.

To have the view automatically opened when and SEL file is opened select the Display Properties menu option under the Options tab.

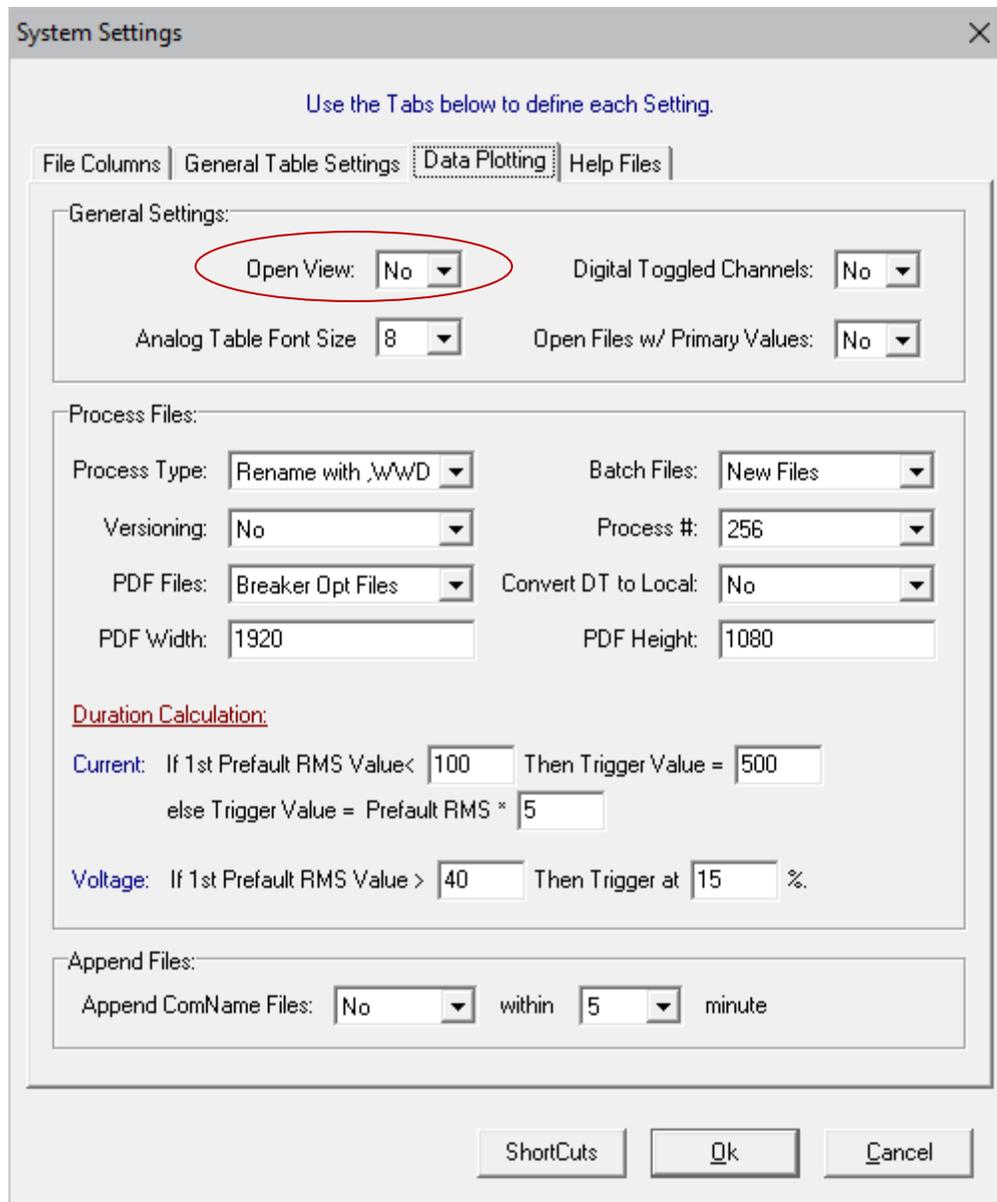


Figure-6: Display Properties Dialog

Select the Data Plotting tab. Change the first field, Open View, in the General Settings section to Yes. This setting will apply the SEL Views when the files are opened.

2. Data Plotting – Invert Marked Channels:

Updated August 1st, 2022

Added a new option in the data plotting's right click popup menu to automatically invert all the marked analog channels. To activate, first mark the desired analog channels using the spacebar or mouse. Next right click on the analog channel table and select the Invert Marked Channels menu option. If there are no analog channels marked then this option will be disabled.

All of the marked channels scale factor will be multiplied by -1. To restore the original, mark the channels again and select the popup menu option Invert again.

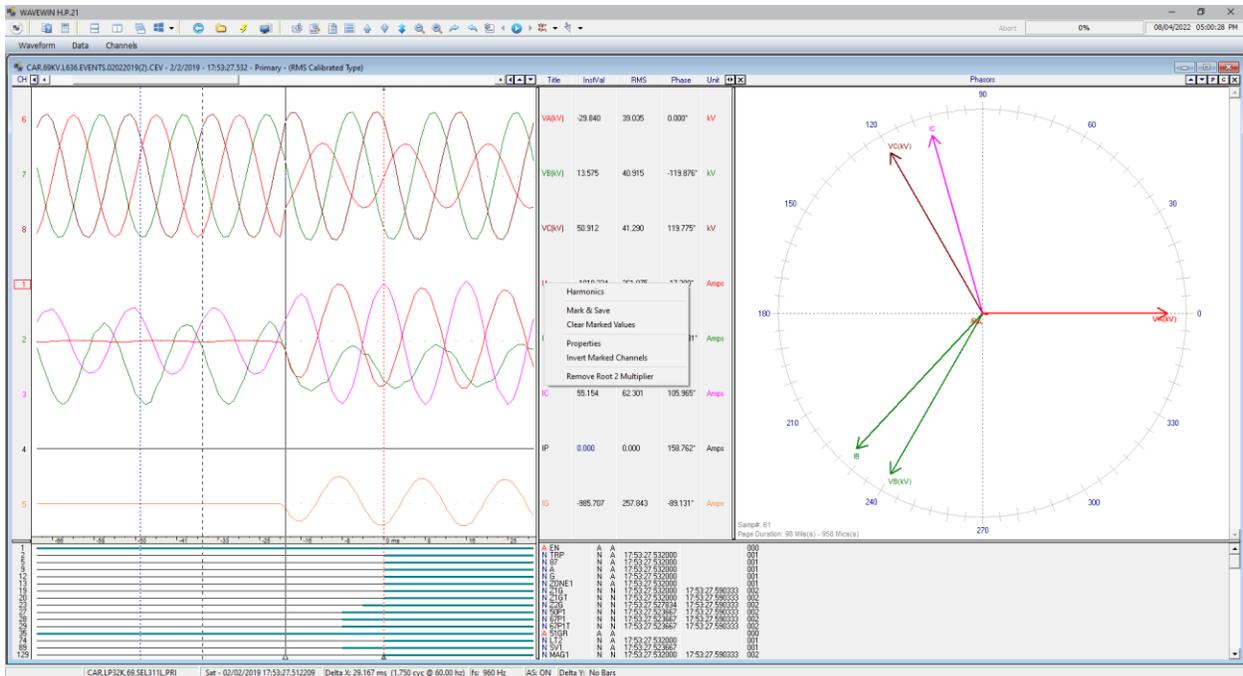


Figure-7: Invert Marked Channels Popup Menu

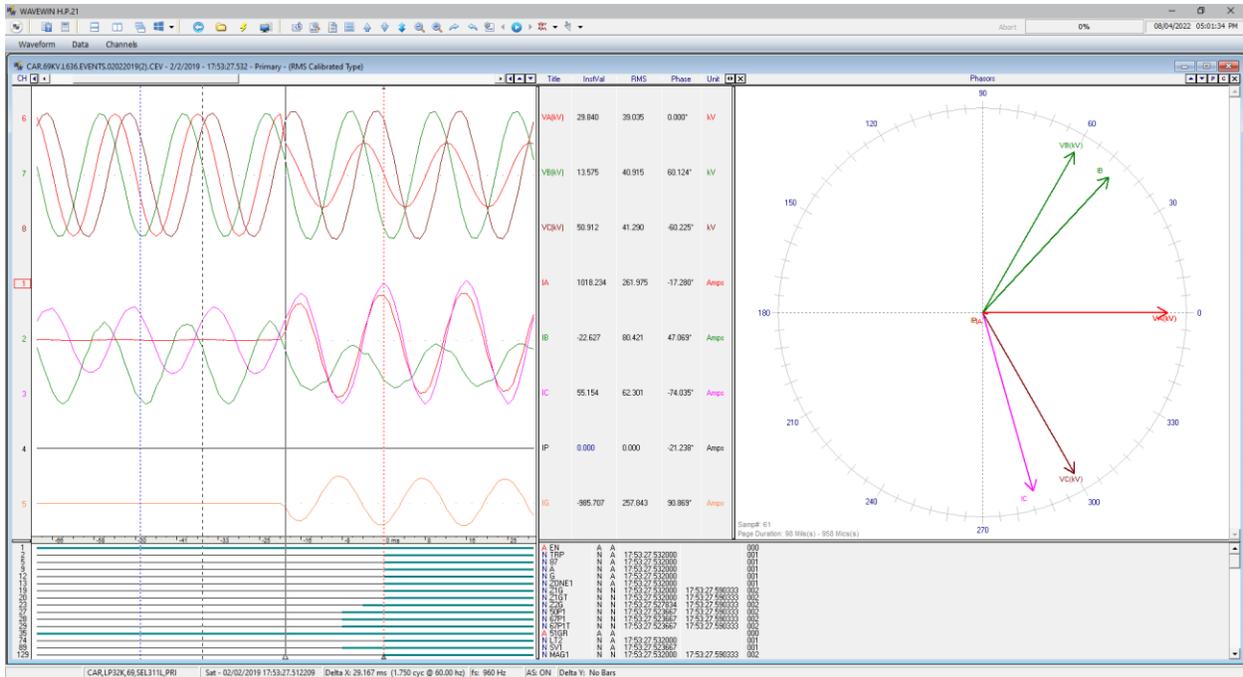


Figure-8: Inverted Channels

3. File Manager/Data Plotting – Save As:

Updated April 3rd, 2022

Changed the Save As Comtrade in the File Manager to a generic Save As feature. The Save As Comtrade menu option under the Options menu has been changed to Save As. The new Save As dialog allows for directly selecting the Save As format (Comtrade 1991, 1999, 2013 Ascii or Binary, RMS, Instantaneous Values, Vector Values and Summaries). Also added a Save As menu option under the File menu. The new Save As dialog has a drop down list box to select the format and radio buttons to select the files to process.

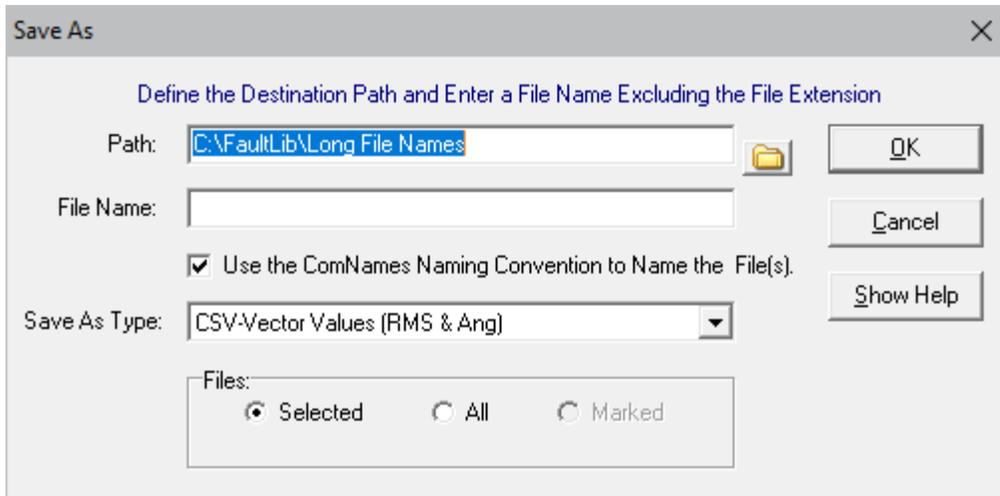


Figure-9: Save As from the File Manager

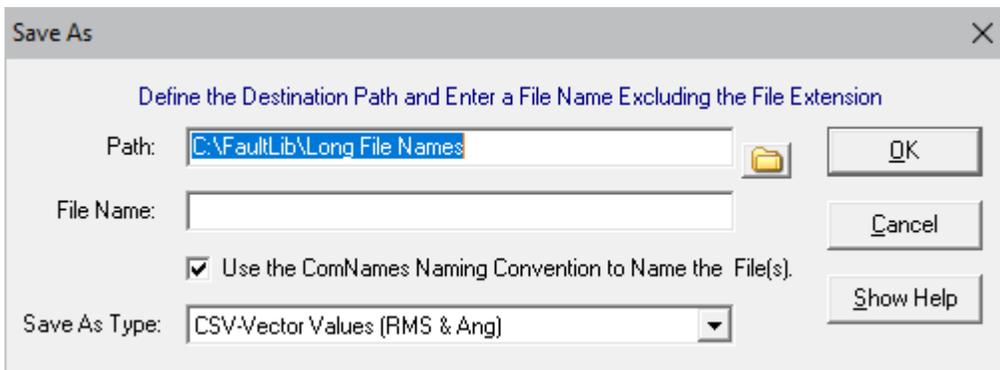


Figure-10: Save As from the Data Plotting Window

4. Device Manager – SFTP Client:

Updated February 2nd, 2022

Added a new file transfer protocol to extract files from an SFTP Server. The new SSH FTP Client works the same as the current FTP Client with the addition of password authentication. To specify an SFTP connection select Ethernet in the connection Types section of the Device Configuration dialog. Then select SFTP in the Protocol list box. The SFTP Client connects to the SFTP Server using the username and password defined in the device configuration dialog. Once the connection is established the SFTP Client requests a DIR list for the specified remote path. It then parses each file/folder in the list. All files that have a date and time greater than the Current date and time displayed in the Change Polling Start Date & Time dialog are marked for retrieval.

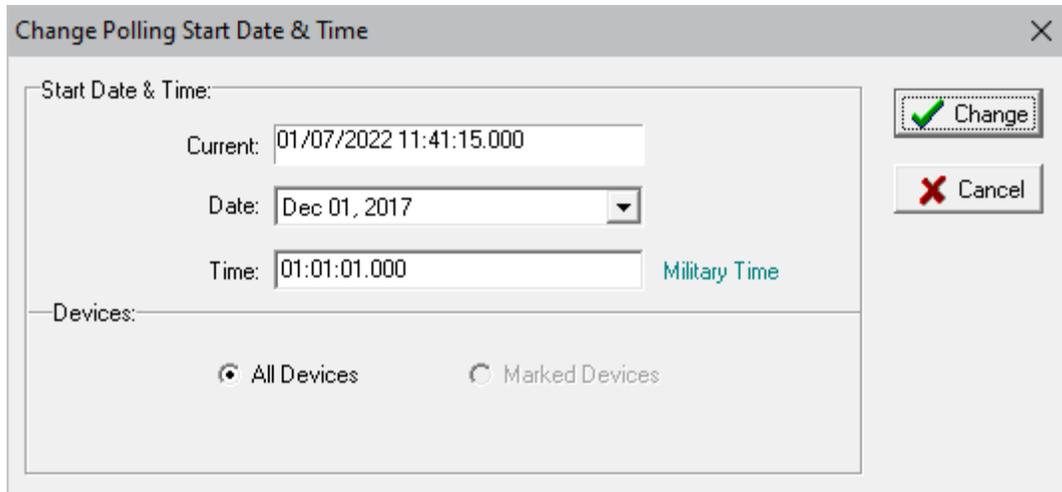


Figure-11: Change Polling Start Time Dialog

If the File Names field in the device configuration dialog is set to Rename to ComNames then each file extracted will be assigned a date and time in the first 2 fields of the filename. If the files being extracted are Comtrade files then the fault date and time listed in the CFG file is used for the files date and time. If they are not Comtrade Files then the date and time listed in the DIR from the SFTP server is used. The directory listing from the FTP server will include the date and time if the file's save date is within the last 6 months. All other files only list the date. For files that only have a date in the listing the software will assign the file a time of 01:00:00.000. And if there is the same date for consecutive files then the milliseconds are incremented.

Device Configuration for WAVEWIN- SFTP

Device Information:

Device Number: 221 Password 1: 0 (CMND1)
 Data Type: ASCII Password 2: 0 (CMND2)
 Title: WAVEWIN- SFTP Event File Type: Default (CMND5)
 Driver: LAN-DIRECT, SFTP-EVENTS Save Path: C:\FAULTLIB\SDCSAVE (CMND6)
 Stn-Group: SOFTSTUF NJ Log Variables: ON (CMND4)
 Group ID: 1 Time Code: -4h

Communication Information:

Connection Type: Serial Virtual Port Ethernet RAS Protocol: FTP Client
 Session: COM220 Telnet Client
 Address: Remote Path: /home/wavewin/public_html/Wavewin Events
 Back Out: 0 (CMND3) File Extensions: *.CFG*.DAT*.HDR*.SEL
 IP: 142.4.6.240 File Names: Rename to ComName
 IP Port: 22 Delete Source: Maintain Original Filename
 User Name: wavewin File Transfer Mode: Passive
 Password: Zhznza@03 Zip Files: No

Save Cancel

Figure-12: SFTP Configuration Dialog

5. Data Plotting – Restore Original View:

Updated February 2nd, 2022

Added a new feature that will restore the analog channels, digital channels, phasors, and the analog table back to the original view when the file was first opened. To restore the original view select the Restore Original View menu option under the View menu in the Menu based system or click the Restore Original View icon in the View section under the Waveform tab in the Ribbon System.

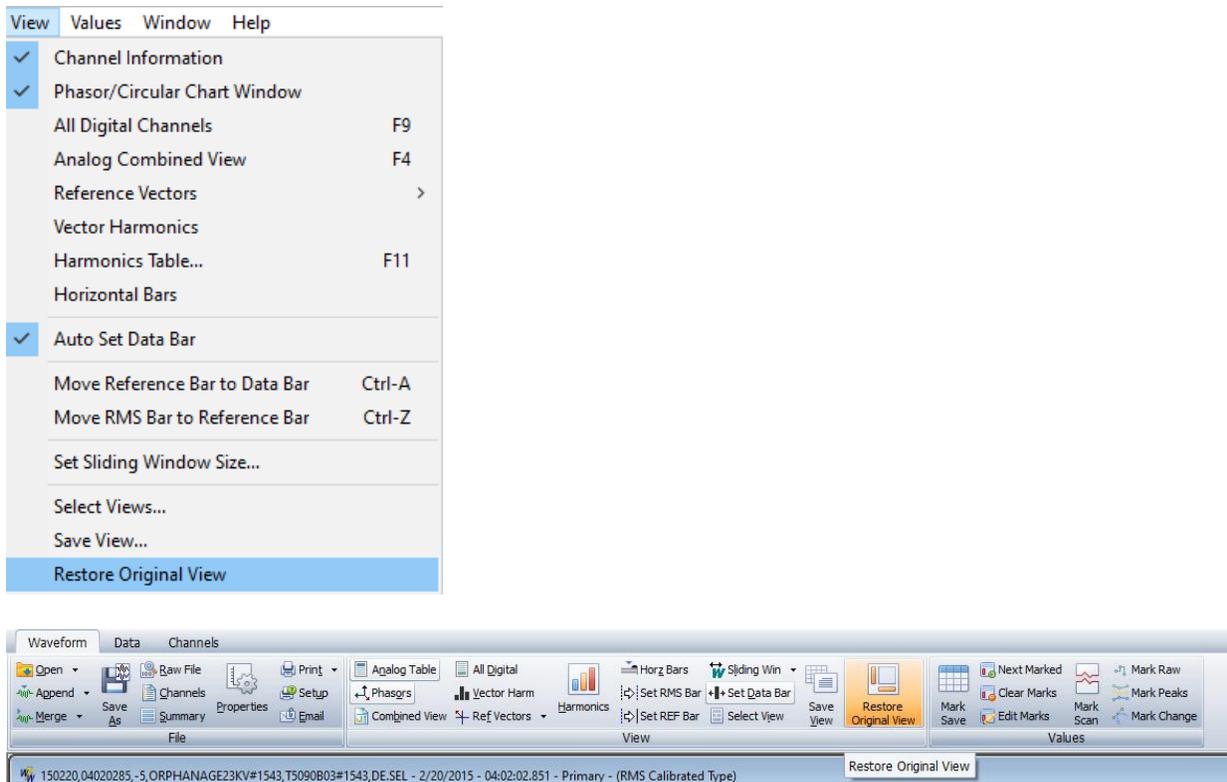


Figure-13: Restore Original View Menu Options

6. Device Manager – New SSHClient Component:

Updated December 1st, 2021

Replaced the existing SSHClient component with a more reliable component. The previous SSHClient was designed to work with ASCII communications only. The new component supports both ASCII and Binary communications. The new component also has a better support team.

7. Data Plotting – Sort Digital Channels:

Updated December 1st, 2021

Added a new feature that will sort the Digital Channels according to the change of state. This new feature will sort the first change in state in Ascending order or sort the first change in state in Descending order. There is also an option to restore the order of the Digital Channels when the file was first opened. In the menu system there is a new submenu under the Channels menu called Sort Digital Channels and in the ribbon system a new drop down menu was added to the Channel tab under the Arrange section.

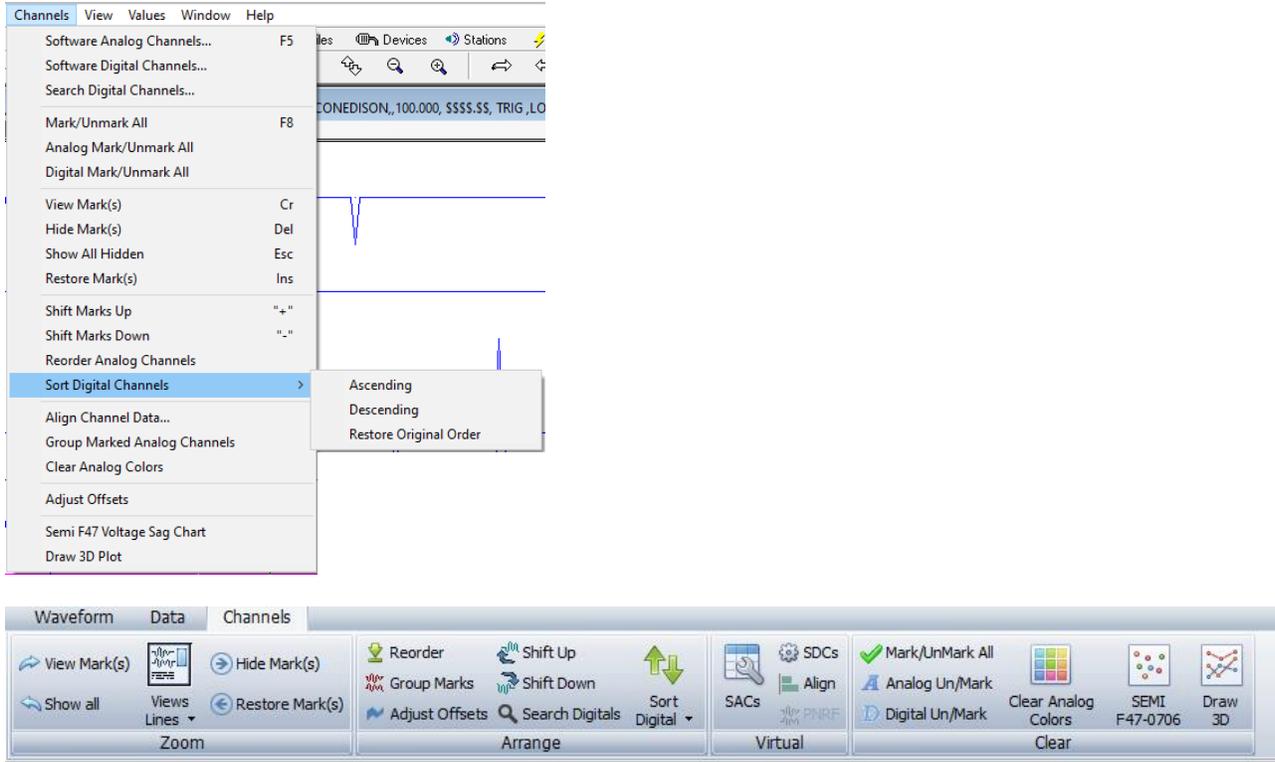


Figure-14: Sort Digital Channels Menu Options

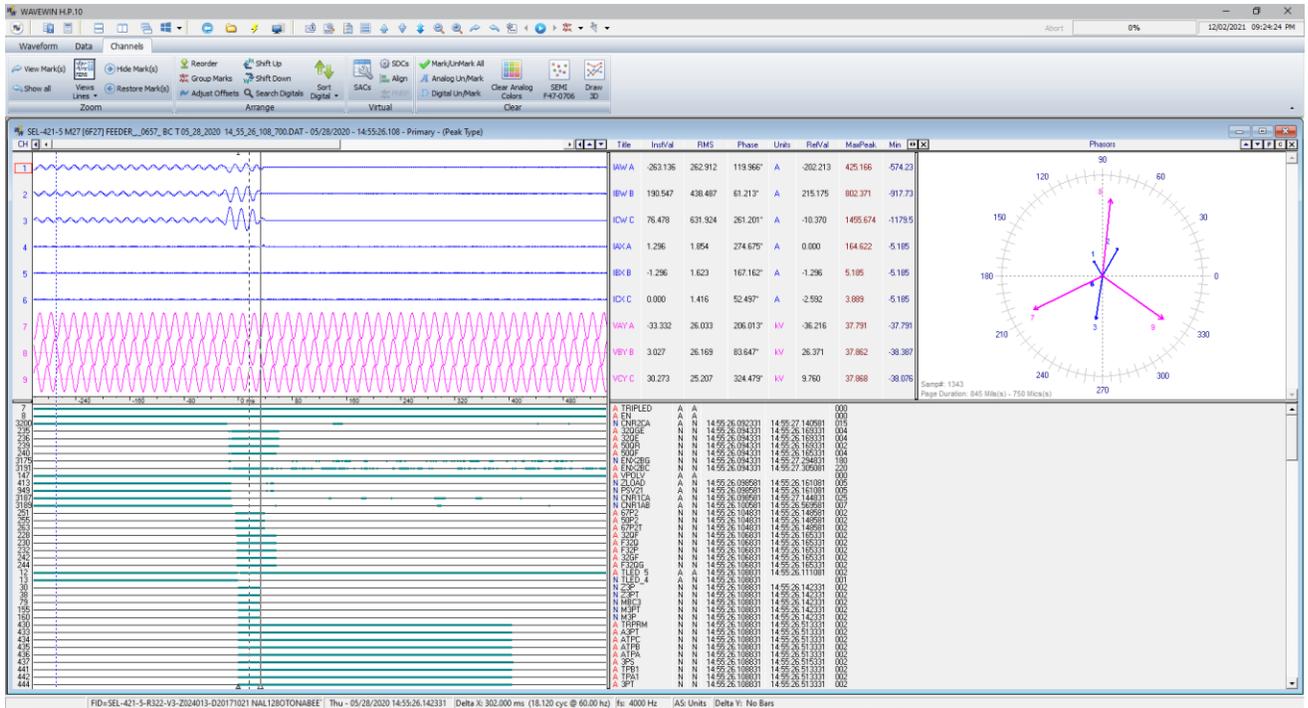


Figure-15: Sort Digital Channels in Ascending Order

8. Data Plotting – Append Files:

Updated December 1st, 2021

When Appending files only the files that have matching analog and digital channel titles are appended. The scale factor has been added as an additional check to make sure all analog channels appended have matching scale factors.

9. Data Plotting – Sequence Components Calculator:

Updated December 1st, 2021

Added an option inside the Sequence Components calculator to always use the displayed channels that are selected in the voltage and current drop down lists. A new checkbox has been added under the phasor diagram to specify that the channels selected in the drop down boxes be preselected when opening the sequence components calculator.

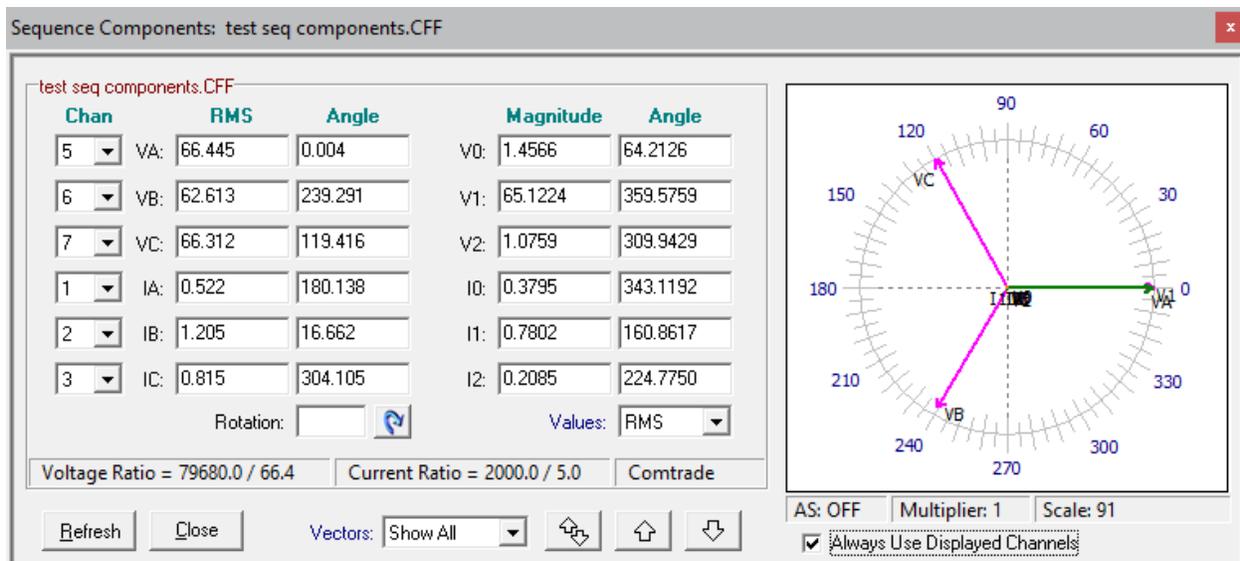


Figure-16: Always Use Displayed Channels in the Sequence Components Calculator

10. Device Manager – Relay Tech Polling Configuration:

Updated January 20th, 2021

Created a generic polling configuration for relay techs to poll relays in the station without having to edit the configuration to add the station and device names. The station name and device name for each record in the device manager lists the type of data to retrieve from the relay. For example, one record

will have Compressed Raw in the Device Name field and Event in the Station name. When the device is activated to poll the relay will download all the new Compressed Raw event files from the relay and name the event files using the IEEE Comnames format. The device name and station name will be automatically populated with the Relay ID and Station ID fields listed in the event file. Below are examples of the Relay and Station Fields defined in a compressed format and an ASCII format located in the event file. When an event is extracted from the relay the SEL driver will automatically look for the Relay and Station ID fields and put the fields inside 2 variables: RID and TRMID. The RID variable will replace the Device field in the IEEE long filename and the TRMID variable will be used for the Station field in the filename. The Device and Stn-Group fields will be added to the IEEE long filename in the 7th field, right after the Company Name field, see the example filename below.

Wavewin will only perform the automatic naming of the files using the Relay and Station ID fields from inside the event files if a file named Relay_Techs.INI exists in the path where Wavewin is running from. The Relay_Techs.INI file lists all the possible titles a relay would use to label the Relay and Station ID. If a relay uses another title to represent the Station and Relay IDs add them under the proper section. The Relay_Techs.INI file lists all the possibilities for the Relay IDs under the [RELAYIDS] section and all the possibilities for the Station IDs under the [STATIONIDS] section. The two sections must be separated by a blank line. See the Relay_Techs.INI File Contents section to see the format of the file.

Compressed Format

```
"FID","RID","SID","03E2"
```

```
"FID=SEL-421-R113-V0-Z004005-D20050119","Relay 1","Station A","0f13"
```

ASCII Formats

```
SID := "Station A"
```

```
RID := "Relay 1"
```

```
RID =FEEDER 1
```

```
TID =STATION A
```

Example Filename

```
181003,21272145,-5,Station A,Relay 1,Softstuf,Event-Compressed Raw,100.000,$$$,$$,TRIG.SEL
```

Relay_Techs.INI File Contents

```
[RELAYIDS]
```

```
MID
```

```
RELID
```

```
RID
```

```
[STATIONIDS]
```

TID
TRMID
SID

11. Device Manager – Event File Type Field:

Updated January 20th, 2021

Added an option to add event commands to the Event File Type Field's drop down list using a file called SEL Event File Type.INI. When the Device Manager is open, it will check if the SEL Event File Type.INI exists in the path where Wavewin is running from. If it does not exist then it will create the file with the default event commands that currently exist in the Event File Type drop down list. The Event File Type Field is stored in the Command field. Currently the field stored in the Command field is a letter or number that corresponds to each title listed in the Event File Type drop down box. The current letters are listed below with its corresponding title and outgoing command.

<u>Storied Letter/Number</u>	<u>Title</u>	<u>Outgoing Command</u>
O	Default	EVE #
S	Short	EVE #
L	Long	EVE # L
R	Raw (Unfiltered)	EVE # R
C	Compressed Raw	CEV # R
X	Compressed Raw L60	CEV # R L60
D	Compressed Default	CEV #
B	Compressed B Command	CEV # B
A	ASCII EVE B Command	EVE # B

The # in the outgoing command represents the Event number. The system now stores the number that represents the position in the drop down list box. For example, the new stored values are listed below:

<u>New Storied Number</u>	<u>Title</u>	<u>Outgoing Command</u>
0	Default	EVE #
1	Short	EVE #
2	Long	EVE # L
3	Raw (Unfiltered)	EVE # R
4	Compressed Raw	CEV # R
5	Compressed Raw L60	CEV # R L60
6	Compressed Default	CEV #
7	Compressed B Command	CEV # B
8	ASCII EVE B Command	EVE # B

Following is what the Command field for an SEL-421 Relay used to be stored in the configuration:

```
0~OTTER~TAIL~0~0~C~IP=196.72.197.177:4097
```

The C in the 6th position indicates to use the Compressed Raw event command. The new command now looks like the below:

```
0~OTTER~TAIL~0~0~4~IP=196.72.197.177:4097
```

The 4 replaced the C and indicates to use the 5th field in the drop down list. The index into the drop down list starts with 0 so the 4 is equal to the 5th field.

Backward compatibility is also preserved. When the MID window is opened it will check if the Event File Type field stored in the Command field is a letter and convert it to its new number.

The new SEL Event File Type.ini allows for adding up to a maximum of 50 commands. When the file is read all lines that start with a ; is ignored. The ; allows for adding comments to the file. The format of the file is the title That will be placed in the drop down list box then the command separated by a comma. Add a # in the outgoing command field where the event number goes. When the command is sent to the relay the system will search for the # in the outgoing command string and replace it with the proper event number.

It is recommended to compose the list of commands before configuring the devices, so the order is preserved. If new commands are needed, add them to the end of the file. If new commands are added in the middle or beginning of the file then existing configurations will not have the proper commands.

SEL Event File Type.IN File Contents

;The list of all the SEL event commands that will be available under the Event File Type drop down list.

;in the Device Configuration Dialog. There are two fields below separated by a comma.

;The first field is the name that will appear in the File Type drop down list box.

;The second field is the command sent to the relay. Put a # where the event number appears in the

;command.

;A maximum of 50 commands are supported.

Default,EVE #

Short,EVE #

Long,EVE # L

Raw (Unfiltered),EVE # R

Compressed Raw,CEV # R

Compressed Raw L60,CEV # R L60

Compressed Default,CEV #

Compressed B Command,CEV # B

ASCII EVE B Command,EVE # B

12. Data Plotting – Digital Channel Titles:

Updated December 17th, 2020

Increased the Digital Channel title characters from 80 to 90.

13. Data Plotting – Auto Process Templates:

Updated December 17th, 2020

Added 2 new fields in Display dialog under the Data Plotting tab. These 2 new fields are called PDF Width and PDF Height. When running Wavewin as a service the monitor coordinates for the PDF are not exact. These fields allow for changing the width and height to fit the PDF report properly.

14. Device Manager – SEL/FTP Events:

Updated December 17th, 2020

Added the ability to connect to a SEL Relay using the TCPIP connection to check if there are new files for download. If there are new files then the FTP connection is used to download the new files. This was required because the level 2 password is used to logon to the FTP server and that causes alarms sent to SCADA. This will eliminate a majority of the alarms by only logging on to FTP server if there are new events to download.

15. File Manager – Automatically Rename Files:

Updated September 17th, 2020

Added a new feature to Automatically rename waveform/load files to the IEEE ComNames format. This new feature monitors a folder for waveform/load files with user defined extensions. When a file is detected in the source path or in its included folders it will first move the original file to the Archive path then read the file's configuration information and rename the file to the destination path. To activate this feature select the Auto Rename Files option under the Options menu/tab. A dialog will be displayed. Enter the Source Path, click the Include Sub Folders check box if needed. Enter the Destination and Archive Paths. Enter all file extensions (*.DAT,*.CEV,*.CFF) and the scan period. If this feature needs to start when Wavewin runs click the Automatically Start Auto Rename Files at Run Time checkbox. The bottom section of the dialog gives a status update on the activity of the process. It displays the last scan

time, the original and Renamed filenames and when the next scan will start in minutes. To start the process click the Start Rename button.

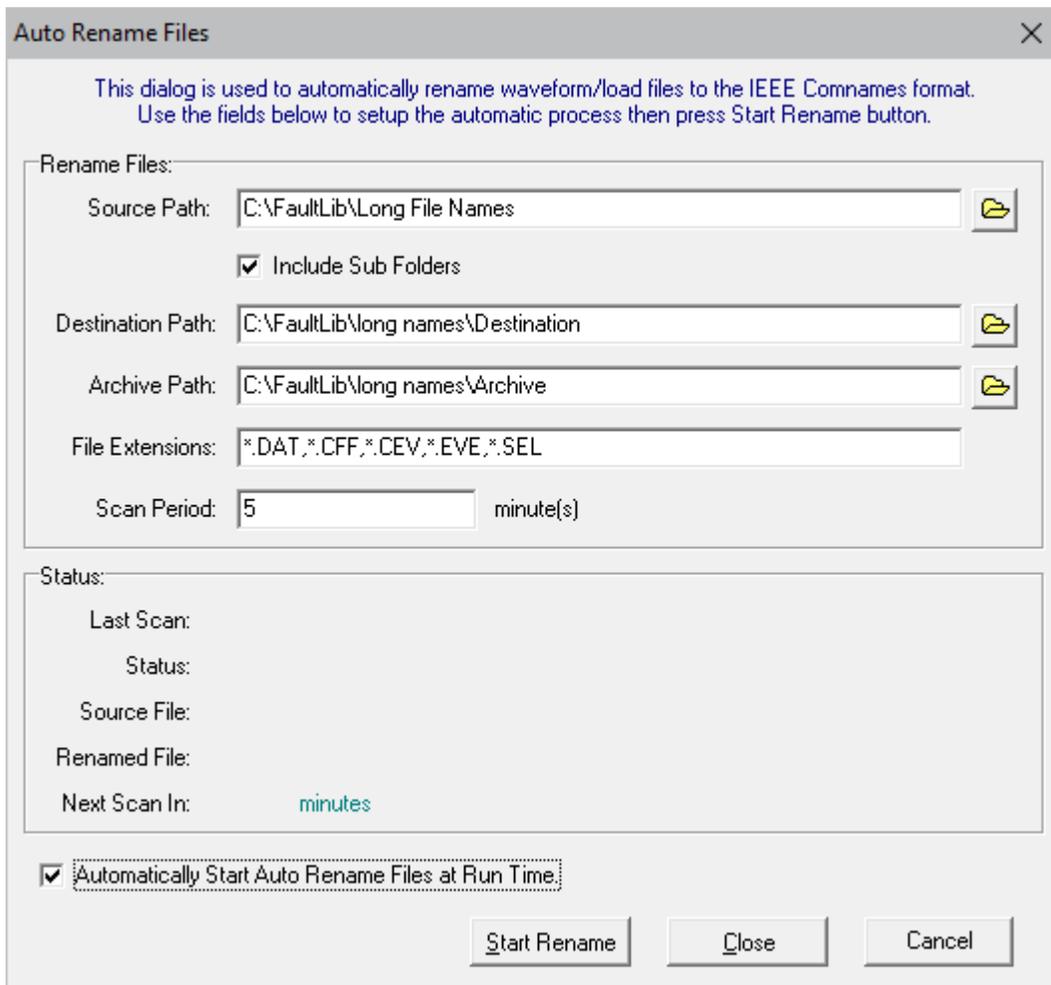


Figure-17: Automatically Rename Files Dialog

16. File Manager/Process Templates – SER Reports:

Updated August 29th, 2020

Added a new feature to create SER files for each waveform file. This new feature monitors a folder for waveform files with user defined extensions. When a file is detected it will read the file and create a comma delimited SER file from the digital channel activity. The SER file will have the same name as the original waveform file.

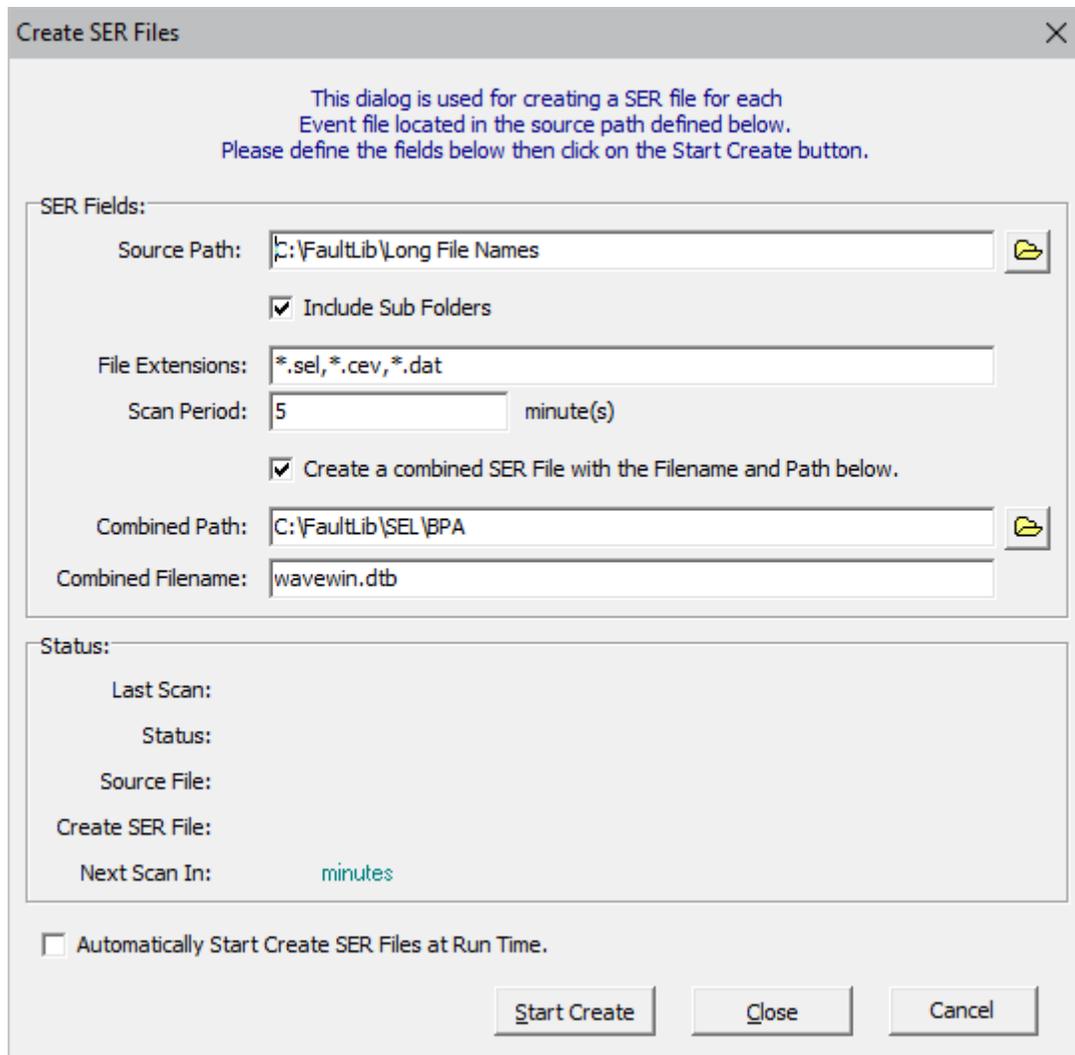


Figure-18: Create SER File Dialog

To activate this feature select the Create SER Files option under the Options menu/tab. A dialog will be displayed. Enter the Source Path, click the Include Sub Folders check box if needed, enter the file extensions (*.DAT, *.CEV, *.CFF) and the scan period. If this feature needs to start when Wavewin runs click the Automatically Start Create SER File at Run Time checkbox. The bottom section of the dialog gives a status update on the activity of the process. It displays the last scan time; the original and SER filename being processed and when the next scan will start in minutes. To start the process click the Start Create button.

To create an SER file with all the digital activity from all processed Waveform files click on the Create a Combined SER File check box. Select or enter the path of the Combined file and enter its filename. This allows for adding the SER information into a database from one single file.

To create the SER files for each file being processed by the Auto Process Templates add a /SER to each line in the Format files being processed.

17. Data Plotting – Auto Process Templates:

Updated: June 15th, 2020

Added a few new checks and features to the auto process template engine.

1. When Comtrade files are automatically collected using the device manager the Comtrade .DAT file maybe collected first before the .CFG file is collected. If this happens then Wavewin will see the .DAT file as a Replay Plus file which causes an error in the system. To remedy this Wavewin will not process a Comtrade .DAT file until the .CFG file is collected.
2. Again, when files are automatically collected using the device manager it may be possible that Wavewin will try to process the file before the full file is collected. To fix this, files are only processed if they have a save time greater than one minute from the current time. This was added to avoid conflict with reading files when they are being written to.
3. In previous versions Wavewin would process 256 files at a time. Before the process begins Wavewin would bin into memory all the information needed to process each file including renaming the file with a WWD added to the last field in the filename. Renaming the file with the WWD tag indicates the file has been processed. This was done to ensure the filename added to the DIG processed file's information matched the filename on disk. This was causing a problem if Wavewin was shut down during a process session. All of the files that were not processed but were renamed never got reprocessed. To avoid this, renaming of the file occurs after the file is processed.
4. Corrected a problem when opening waveform files from the processed DIG file. Since the filename is now marked as processed (adds a WWD in the last field in the filename) after the file is processed then it's not writing the correct filename into the table at process time. To correct this when a double click occurs in the DIG file, the system checks if the file exists, if it does not exist it adds the WWD to the filename in the DIG file and tries to open that file.
5. Added a new way to process files. In the past Wavewin would add a WWD to the last field in the filename to indicate a file has been processed. When using third party backup software to move files from one folder to another the third party's software was constantly copying back files that were previously processed. It was doing this because it could not find the files since they were renamed by Wavewin. A second option was added to process files according to the file's save date. In the System Settings dialog under the Data Plotting tab a new field was added to specify the process type, see Figure 1. If Rename with ,WWD is selected in the Process Type drop down field then the field to the right of the Process Type field changes to Batch Files. The batch Files drop down allows for selecting New Files (Files that do not have a WWD as the last field) or All

Files. If the By Save Date drop down option is selected then the field to the right of the Process Type field changes to Start DT. The Start DT allows for setting what Date and Time to start at when processing the files. For example, to process just the last 30 days of files set the date and time to 30 days prior to the current date and time.

6. Another field was added to give control over how many files get processed during a single session. The Process # field allows for selecting 1 to 256 files per session.
7. Softstuf supplies a Fault Report template to process waveform files for fault information. In the Fault Report template there is a field for producing PDF files that gives a fault summary and a screen dump of the faulted area, refer to Appendix A. These PDF files were being produced for all fault files collected and processed. A large number of PDF files were being created that were not necessary. An option was added to select what files would produce a PDF. The new field is in the System Settings dialog under Data Plotting tab in the Process File section. The available options are All Files, No Files or Breaker Opt Files. In the fault report template there are 4 columns used to monitor up to 4 breaker digital channels. If one of the 4 breakers operated then a PDF will be saved.

System Settings ✕

Use the Tabs below to define each Setting.

File Columns | General Table Settings | Data Plotting | Device Manager | Help Files

General Settings:

Open View: Digital Toggled Channels:

Analog Table Font Size Open Files w/ Primary Values:

Process Files:

Process Type: Start DT:

Versioning:
 Process #:

PDF Files:

Duration Calculation:

Current: If 1st Prefault RMS Value < Then Trigger Value =
 else Trigger Value = Prefault RMS *

Voltage: If 1st Prefault RMS Value > Then Trigger at %.

Append Files:

Append ComName Files: within minute

Figure-19: Auto Process Template Fields

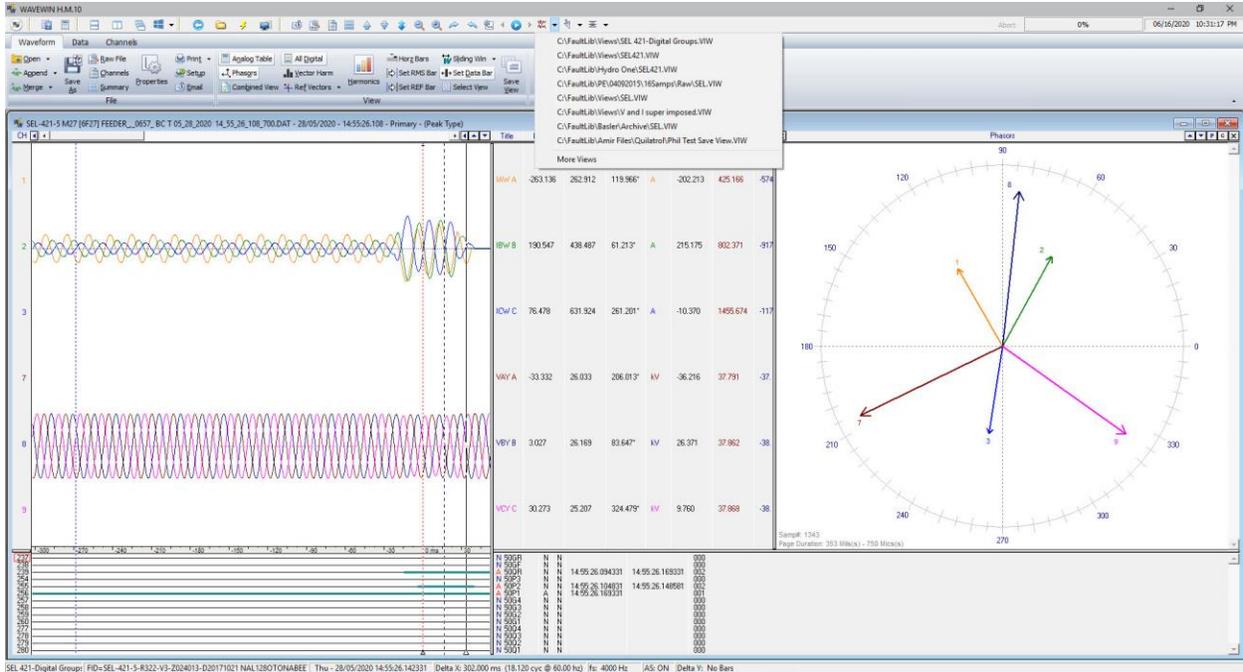


Figure-21: Select View



Figure-22: Digital Group Drop Down Menu

In the Data Plotting window select the View that was saved with the Digital Groups. A new drop down button is added to the Data Plotting main toolbar. The new drop down lists all the Digital Groups in the View. To display a digital group select the group from the drop down menu. By default Wavewin only displays the triggered digital channels for each group. To view all the digital channels in the group click on the All Digital ribbon item in the Waveform tab.

A View can also be selected from the Select View Dialog. Click on the Select View ribbon item under the Waveform tab. When the view is selected under the View Files section a new list is displayed next to the Digital Channel list box. It lists all the Digital Group Names and if the digital group is compatible with the displayed file. The group is compatible if it's digital number and name in the group match the digital channels name and number in the file.

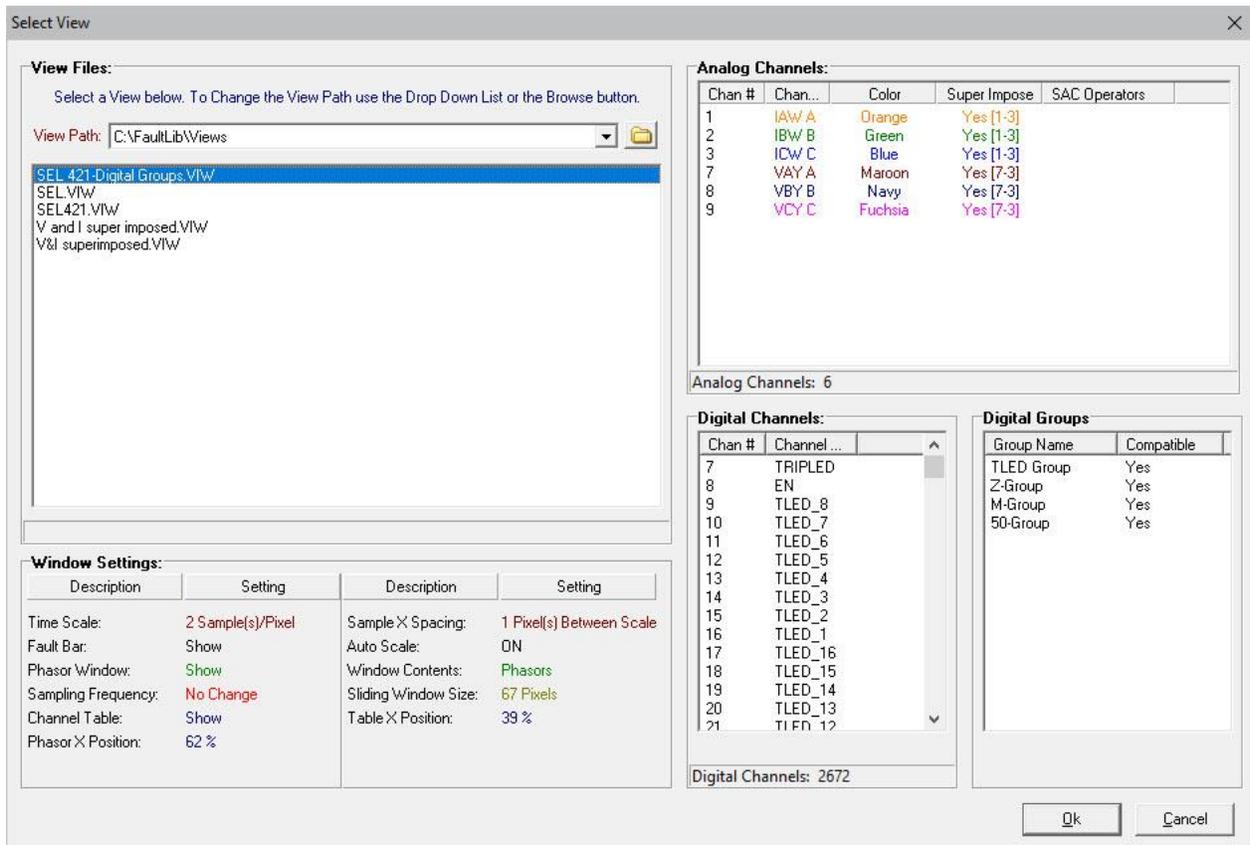


Figure-23: Select View Dialog

19. Data Plotting – Auto Play Waveform:

Updated: June 15th, 2020

A feature to auto play the analog and digital channels has been added to Wavewin. In the ribbon system three new buttons were added to the data plotting's main toolbar along with a new Replay section in the Ribbon under the data tab. In the menu system there are 3 new menu options under the data tab. The new options will auto play the displayed analog and digital channels. This new feature will move the channels to the left keeping the data cursor fixed at one cycle from the beginning of the display. In the Ribbon system the button to the left of the auto play button is used to slow the speed of the waveform movement and to the right is a button to increase the speed of the waveform. In the Menu System use the menu items increase/decrease to control the speed of the waveforms.

All values in the tables are the values at the data bar.

The auto play Waveform does extensive drawing to the screen. To minimize flicker and slow drawing select a maximum of 7 channels and expand the time scale to see a smooth transition when the analog channels are played. The drawing is done in the background. This allows for marking, deleting, expanding, contrasting, scaling channels and more while the Waveform is being played.

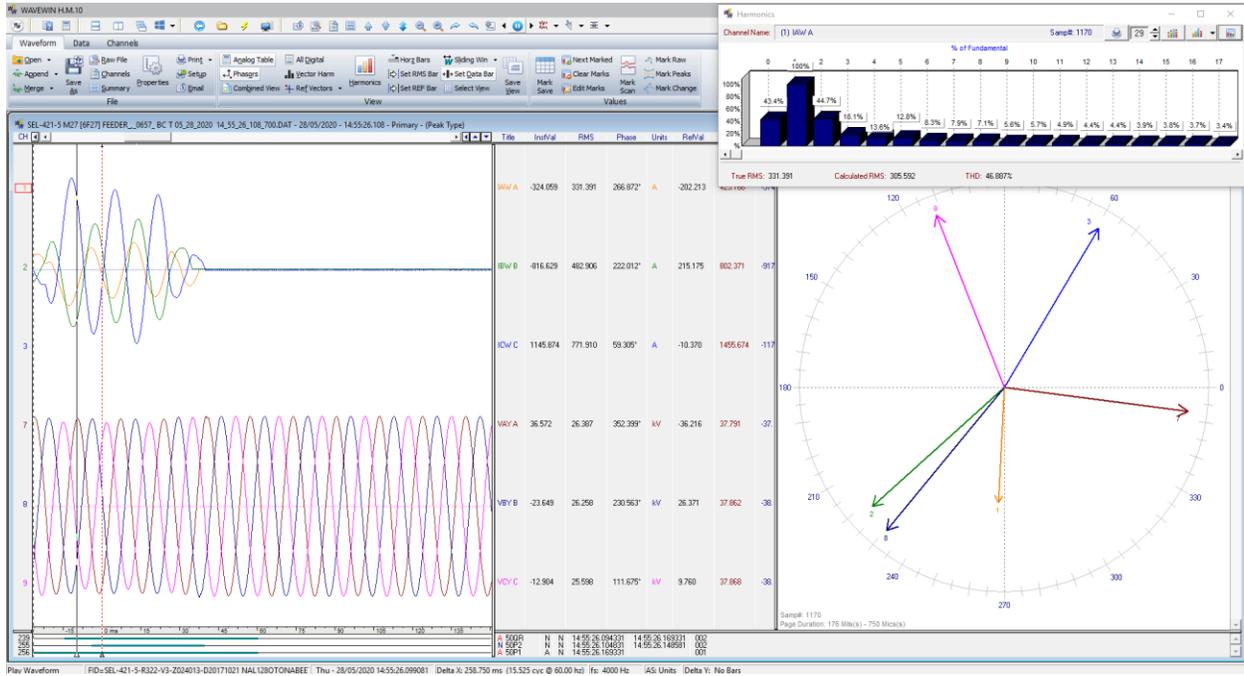


Figure-24: Auto Play Waveform



Figure-25: Auto Play Waveform Menu Buttons

20. Data Plotting – Digital Channels:

Updated: June 15th, 2020

Increased the number of digital channels from 2048 to 4096.

21. File Manager – Change Filename:

Updated: June 15th, 2020

A new feature was added that allows for changing the contents of a long filename. It can add or remove information from the marked files in the active folder or all the files in the active folder. The add feature adds the entered information as a new field to the right of the existing last field. This feature is helpful for adding the Company name to long filenames if it did not exist.

It also allows for removing information from long filenames. This feature is helpful for processing waveform files that have already been processed by the Wavewin process template feature. If the process template use the Rename with, WWD then to reprocess the files the ,WWD added to the end of each filename can easily be removed using the Remove check box.

To add or remove information from long filename in a folder, first checked the desired checkbox, Remove or Add. Next enter the information to remove or add in the File String field. Next select what file to act on, Marked Files or All Files. If there are no marked files in the active folder then the Marked Files radio button is disabled. Click the OK button to activate.

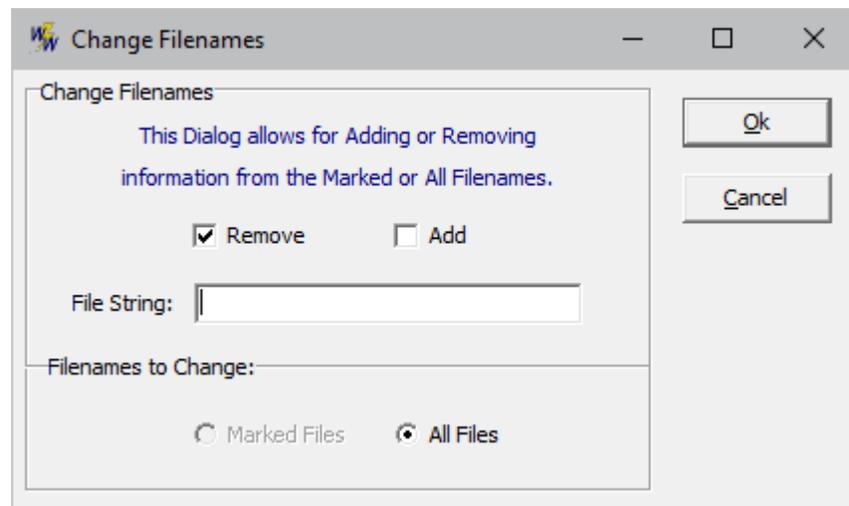


Figure-26: Change Filenames Dialog

22. File Manager – Rename Files to ComName Format:

Updated: June 15th, 2020

Removed a 14 character limitation for the station and device names in the ComName format when renaming files to the long format either directly from the File Manager or through the Auto Convert to Comtrade.

23. File Manager – Auto Convert to Comtrade:

Updated: June 15th, 2020

When the auto convert to Comtrade copies waveform files to the destination path it was not copying the support files with the data file. This applied to Comtrade files, Emax files, Transcan file and Rochester files. It now copies all support files to the destination path.

24. Device Manager – SEL Fault Report:

Updated: March 20th, 2020

Added an option to create an SEL Fault Report text file for each fault file retrieve from the SEL Relays. To activate this new feature open the Display Dialog under the Options menu/tab in the File Manager. Click on the Device Manager tab. Click on the Create a Fault Report for each SEL Fault Retrieved check box. Next, select or enter the path where the fault report files will be saved. The contents of the report are listed below:

```
Date: 07/14/20
Time: 12:38:32.18
Station: BAIN SOUTH
Device: SOUTH STREET SET #2
Event: CG T
Location: +21.62
LineLen: 72.71
Targets: INST SOTF Level1 EN C G
```

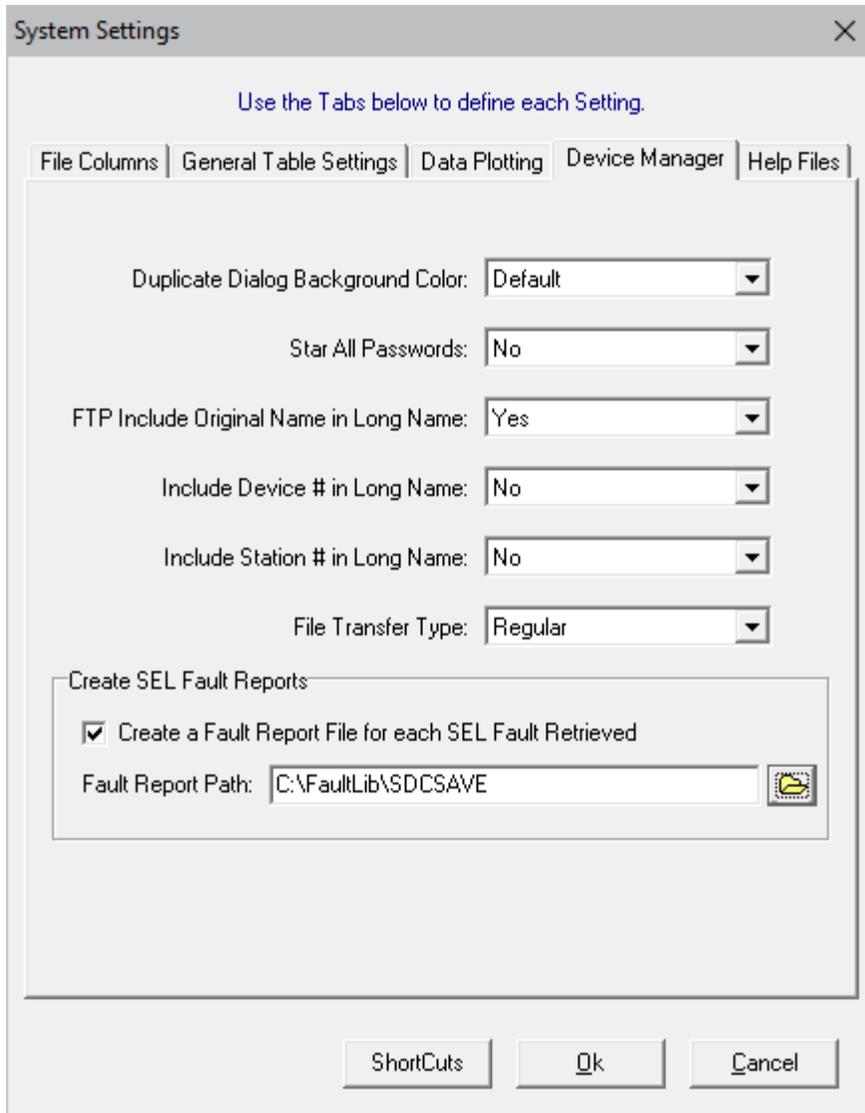


Figure-27: SEL Fault Report Dialog

25. File Manager – Auto Convert to Comtrade:

Updated: October 28th, 2019

The Auto Convert to Comtrade feature converts all files with extensions matching the ones specified in the File Extensions field.

The converted files are saved following the Comtrade Revision specified in the Properties Dialog under the Comtrade tab. All revisions of the Standard are supported including the latest single file format (CFF) which has helped solve many of the problems associated with managing very large volumes of Comtrade records.

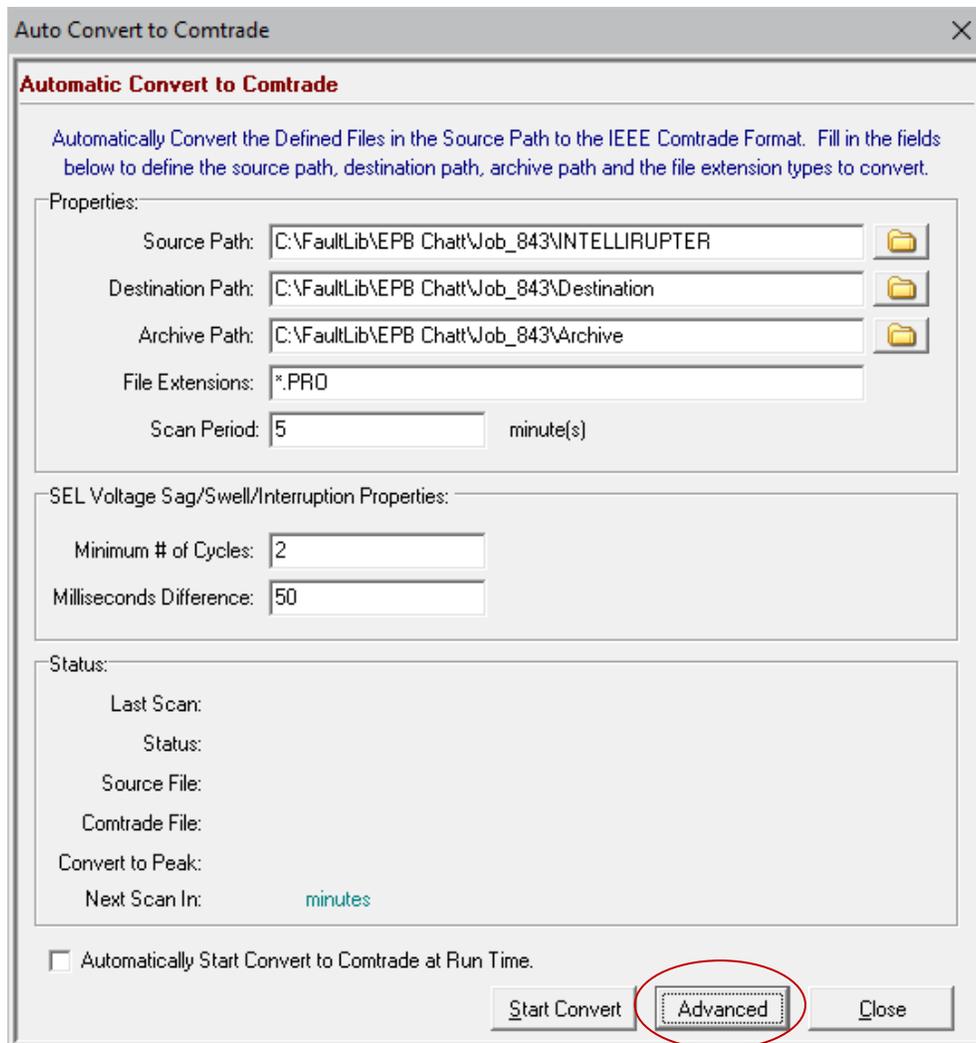


Figure-28: Auto Convert to Comtrade Dialog with New Advanced Setting Button

In addition, a new Advanced Settings feature allows for including subfolders and for automatically appending files from the same device which enables long term displays of both transient and periodic data.

The new Advanced Settings feature also allows for automatically renaming the converted files to the standard IEEE Comname format. Setting details are provided in the following sub sections.

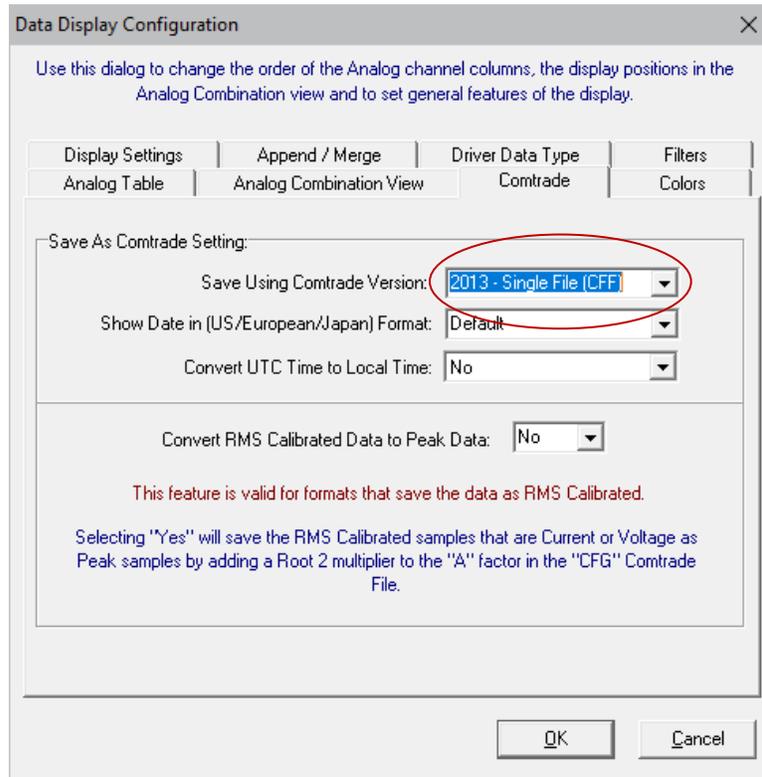


Figure-29: Data Display Properties Dialog with CFF 2013 Revision Selected

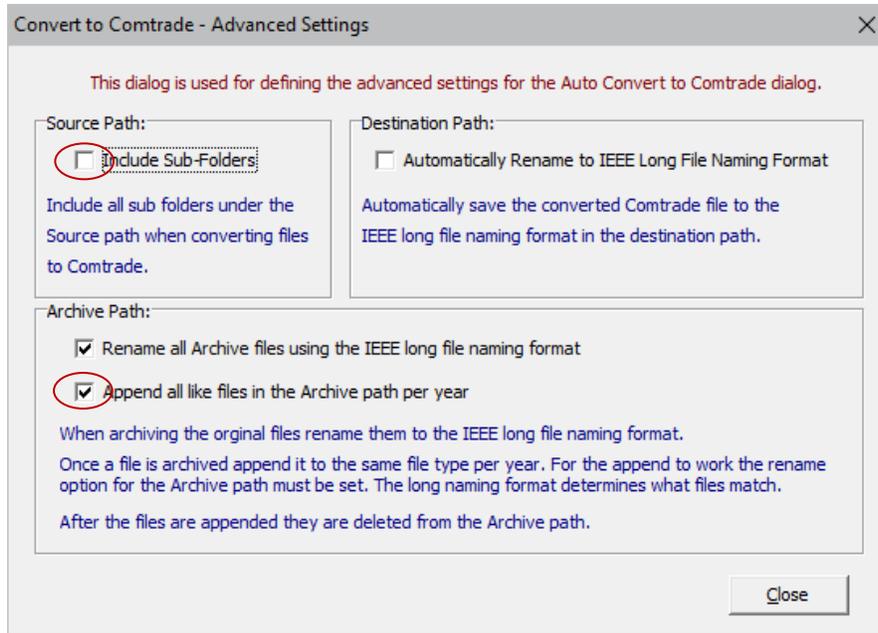


Figure-30: New Advanced Setting Dialog

Advance Settings:

The Advanced Settings dialog has 3 sections, one for the Source path, one for the Destination Path and one for the Archive path. The Source path section allows for including Sub-folders when scanning for files to convert to Comtrade. The Destination and Archive sections allow for renaming to the Comname format. The Archive section also allows for appending all like files into one Comtrade file per year. If the append is checked then after each append the original archive files are deleted.

Source Path:

If Include Subfolders is selected, then the system reads all of the subfolders and their subfolders under the source path and puts them into a string list (the source path is included on top of the list). When scanning for new files, it starts at the first path in the list and then repeats for each subsequent path (multiple nests deep) (the number of nests is limited by the length of the path name, maximum allowable length is 128 characters).

Destination Path:

When a new file is found, it is first copied to the archive path and then it is converted to Comtrade and saved to the destination path. If the original file name is not based on a unique and readable naming scheme then the file name can be renamed to Comname in the destination path.

Archive Path:

The file names in the archive path can also be renamed to Comname. If Rename is selected, then the renamed files can be automatically appended (1 file/device/year) by selecting the Append option.

The appending process starts after the Conversion process is complete (for all of the paths in the list). This ensures that the conversion process is not delayed. The appending process scans the archive path and appends all of the files that have the same year, station, and device fields in the file name.

The appended files are saved in the selected Comtrade version and are also named following the Comname format. After all of the files have been appended, the originating files are deleted from the archive path.

26. Appending files from the File Manager and Data Display:

Updated: October 28th, 2019

The append engine is invoked from the file manager, from the data display, and now from the auto Convert to Comtrade feature. In support of the new features, the append engine was upgraded to allow for appending up to 400 files at a time (previous limit was 100). For periodic data, the 400 limit is just right because typically up to 366 files may be collected per year per device. For oscillography files, the 400 limit provides large margins. Care must be taken when appending large numbers of files because of memory limitations. Typically each byte on disk corresponds to 10 bytes in memory.

In addition, the file name in the data display window header was revised to show the number of appended files along with the name of the first appended file. For example, if 28 files were appended then the appended file name in the window header would look like:

28 Appended Files – The first file’s original name – Date and time – Values – (File type)

27. File Manager – Options Menu Item, Display Option, System Settings Dialog:

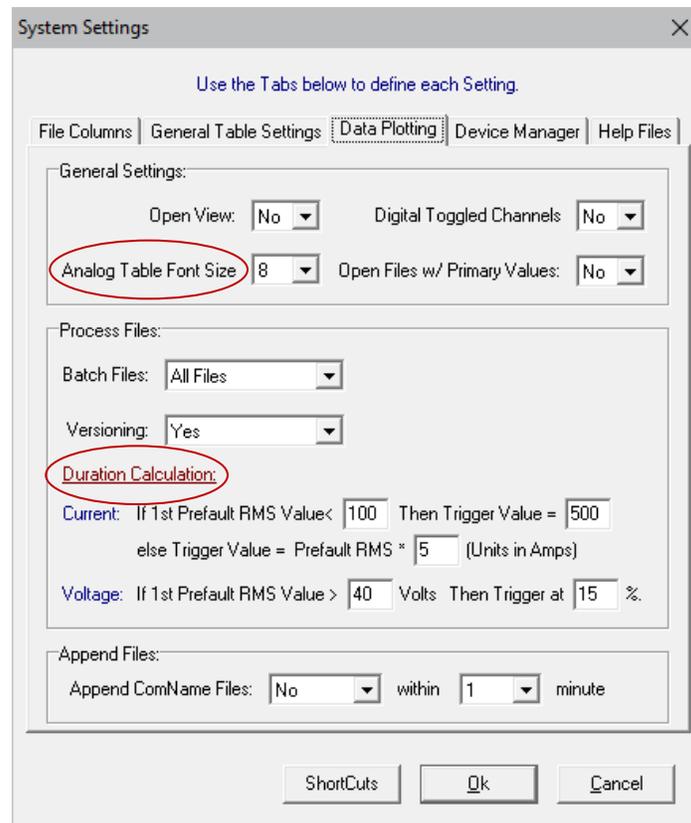


Figure-31: System Settings Dialog with New Data Plotting Settings

Updated: October 28th, 2019

A number of new fields have been added to the System Settings dialog under the Data Plotting tab. The first feature is the ability to change the size of the font of the measurements shown in the data display. A drop down list is provided for selecting up to 16 font size (the default is 8).

The second feature is a new, change detection algorithm to automatically measure duration and magnitude of evolving fault conditions within the same record (maximum/minimum over/under voltage and current magnitude and duration are calculated). The ability to set triggers for seeding the algorithm is provided under the Duration Calculation section. When a file is open a true RMS value is calculated at each sample using a running, recursive RMS calculation. After the first full cycle is processed, the algorithm kicks in and compares the calculated RMS values to the specified trigger values.

28. Data Plotting – New Semi F47-0706 Voltage Sag Chart:

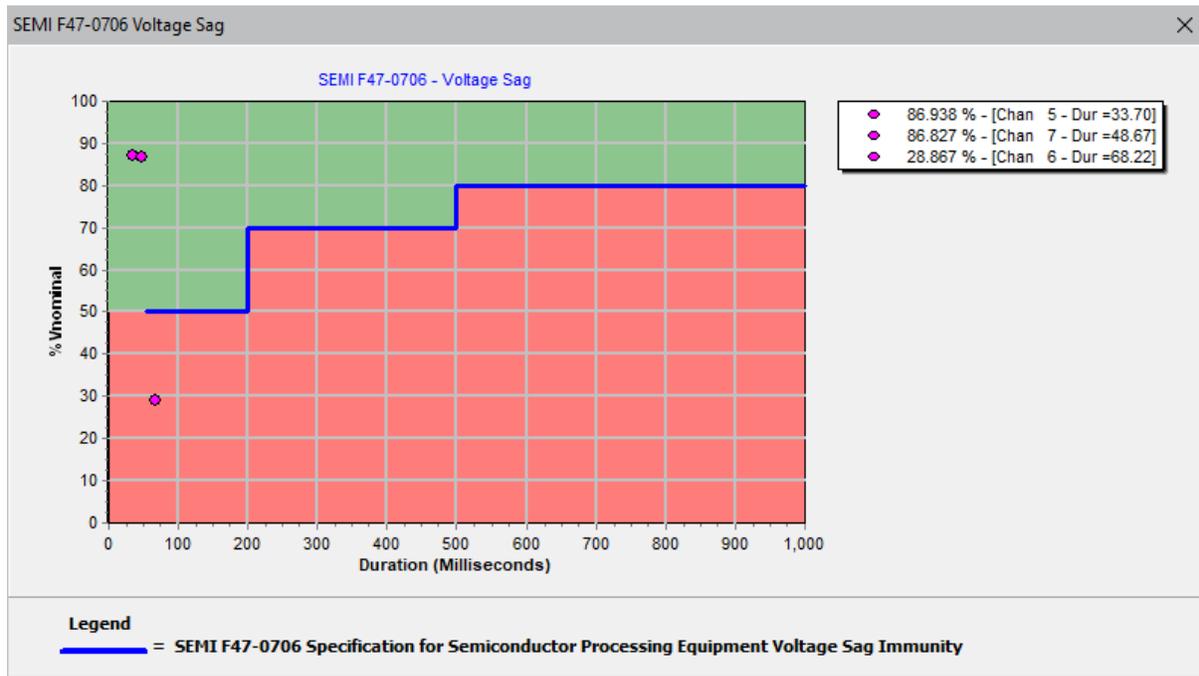


Figure-32: SEMI F47 0706 Voltage Sag Chart

Updated: October 28th, 2019

The SEMI F47-0706 Voltage Sag display shows the sag immunity chart. The chart depicts the required voltage sag ride-through capability curve. The unaffected region is the green area, and the miss operation region is the red area.

To view the chart, first mark the voltage channels then click on the SEMI F47 option from the Channels menu.

To the right of the chart is the sag percentage which is calculated for each voltage channel using the following equation: $(\text{Nominal RMS} * 100) / (\text{Lowest Sag RMS})$. Each displayed percentage is followed by the channel number and the duration in milliseconds.

The trigger value for the duration calculation is set in the System Settings dialog (refer to Figure-4). The default setting is 15% of nominal.

29. Data Plotting - 3-D Plots:

Updated: October 28th, 2019

The Plot 3-D feature plots a maximum of 3 channels. To plot in 3-D, first mark the channels then click on the Draw 3-D icon under the Channels menu.

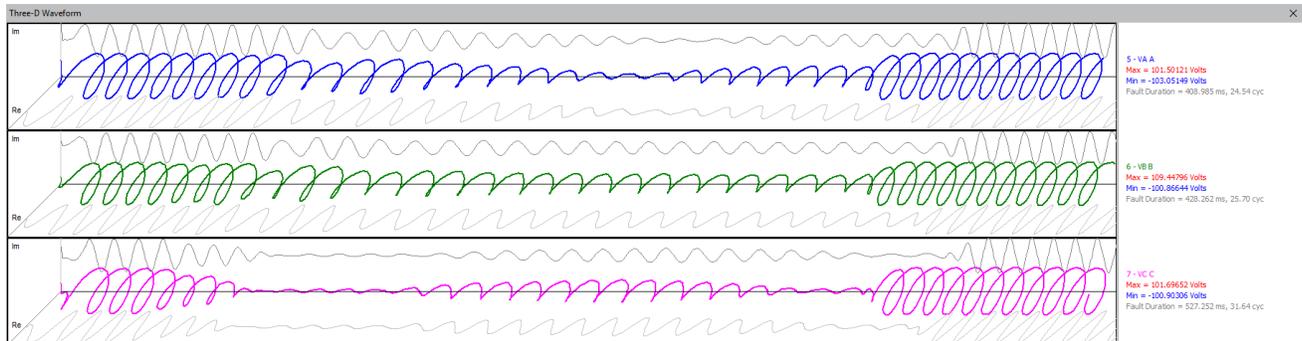


Figure-33: Plot 3-D Window

To the right of each channel is the channel number, the channel title, the instantaneous maximum and minimum values of the entire channel and the duration of the fault in cycles and milliseconds.

The trigger values for the duration calculation are set in the System Settings dialog. The default setting is 15% of nominal for the voltage channels, and times 5 of nominal per unit for the current channels.

30. Data Plotting – Rose Charts:

Updated: October 28th, 2019

The Rose charts feature plots the waveform signal using the circular charts. To plot a rose chart, first mark the channels to plot then hit enter to isolate the channels. Next, click on the C button above the phasor diagram. The rose charts displays a small circle the same color as the signal color if the value is a negative value. To return to the phasor display click on the P button above the rose chart.

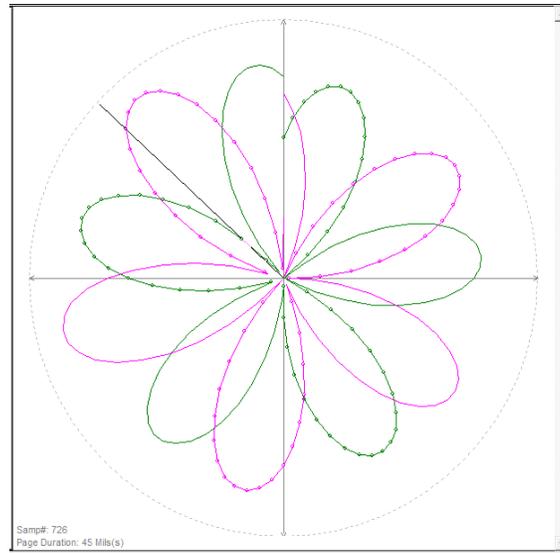


Figure-34: Rose Charts

31. Data Plotting – Power Calculator:

Updated: October 28th, 2019

The Power Calculator measures the harmonics for a voltage and current channel. To open the power calculator first mark a voltage and current channel in the data plotting window. Next select the Power Calculator menu option under the Data tab in the menu system. In the ribbon system select the Power Calculator under the Data tab. A table is displayed listing the Voltage harmonics, Current harmonics, the angle difference between the current and voltage, the calculated MWatts and MVars. The MWatts and MVars calculations are below:

$$\text{MWatts} = (V * I) * \text{Cos}(\phi_V - \phi_I)$$

$$\text{MVars} = (V * I) * \text{Sin}(\phi_V - \phi_I)$$

Power Calculator

The Power Calculator uses the 1st marked Volatge and the 1st marked Current channels.

Sample Number:

Volatge Channel:

Current Channel:

Harmonic	Voltage (kV)	Current (A)	Angle Diff	MWatts	MVars
1	64.02392	173.87355	92.170	-0.42142488	11.12408684
2	0.37086	3.57452	143.376	-0.00106391	0.00079083
3	0.32233	0.84491	-40.247	0.00020787	-0.00017596
4	0.16242	1.75248	218.862	-0.00022163	-0.00017859
5	0.16429	1.90364	175.541	-0.00031181	0.00002431
6	0.09665	2.30900	241.569	-0.00010625	-0.00019624
7	0.20629	1.42925	160.671	-0.00027822	0.00009759
8	0.07221	0.34300	258.315	-0.00000502	-0.00002425
9	0.05488	2.11600	47.863	0.00007791	0.00008611
10	0.03054	1.36666	-54.723	0.00002410	-0.00003407
11	0.09918	0.24636	222.486	-0.00001802	-0.00001650
12	0.04358	2.31134	289.273	0.00003324	-0.00009508
13	0.05459	0.61756	126.048	-0.00001984	0.00002726
14	0.04676	1.67584	13.317	0.00007625	0.00001805
15	0.02262	1.89807	215.162	-0.00003510	-0.00002473
16	0.02756	1.53681	78.669	0.00000832	0.00004153
17	0.02577	2.00950	2.569	0.00005172	0.00000232
18	0.04161	2.46311	232.478	-0.00006242	-0.00008128
19	0.03997	1.03800	-9.147	0.00004096	-0.00000660
20	0.02769	1.22752	51.515	0.00002115	0.00002661
21	0.03115	0.42098	32.996	0.00001100	0.00000714
22	0.02868	2.06190	294.112	0.00002416	-0.00005397
23	0.03397	0.66608	122.212	-0.00001206	0.00001914
24	0.05125	3.24892	20.662	0.00015580	0.00005875
25	0.02439	1.98336	31.346	0.00004131	0.00002516
26	0.03388	1.51217	80.426	0.00000852	0.00005052
27	0.03472	1.98545	-25.562	0.00006219	-0.00002974
28	0.03026	4.16533	251.010	-0.00004102	-0.00011919
29	0.01413	1.84780	-165.343	-0.00002526	-0.00000661
30	0.01928	1.03153	263.647	-0.00000220	-0.00001976

Figure-35: Power Calculator

32. Data Plotting – RMS Calibrated Channels:

Updated: October 28th, 2019

In RMS Calibrated Files added an option in the analog table popup menu to remove the root 2 multiplier from all of the marked analog channels. In the Channel display window added a * in front of each analog channel's number to show the channel is multiplied by root 2.

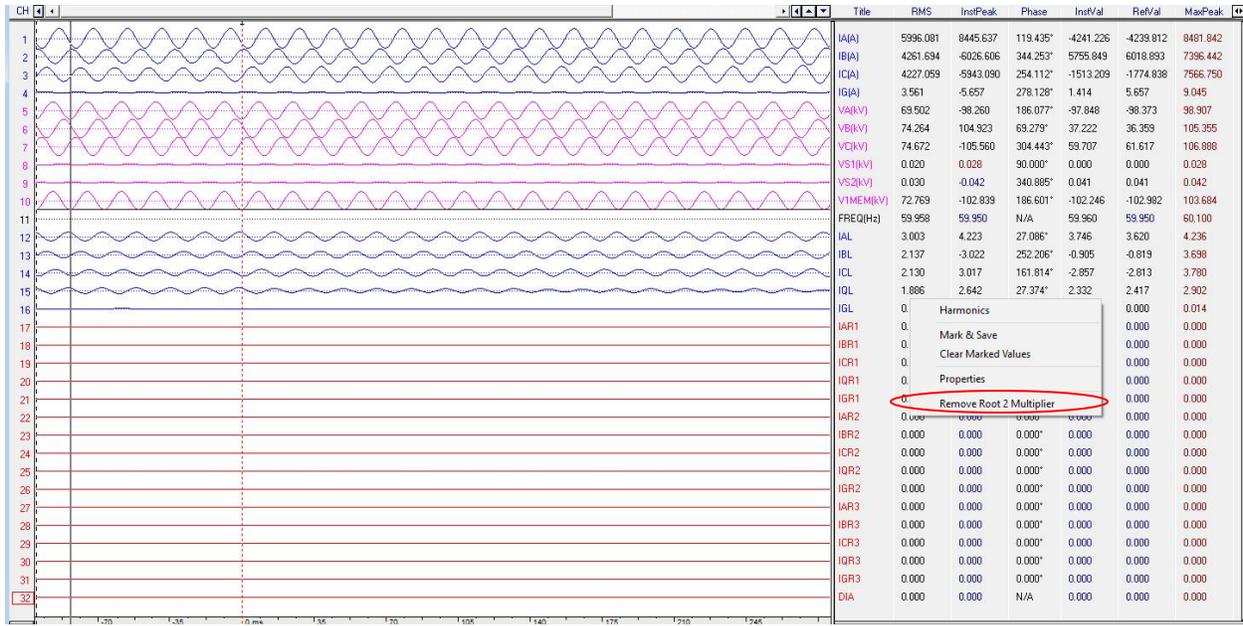


Figure-36: Remove Root 2 Multiplier

In RMS Calibrated files a new menu option was added to the analog table popup menu to Remove Root 2 Multiplier from the marked analog channels.

Channel Title	Full Scale Value
Channel Title Information for Device: 250	
Station: East 179 St Substation	
->Analog Titles	Full Scale Value
*001 IA (A)	0.00100000
*002 IB (A)	0.00100000
*003 IC (A)	0.00100000
*004 IG (A)	0.00100000
*005 VA (kV)	0.00100000
*006 VB (kV)	0.00100000
*007 VC (kV)	0.00100000
*008 VS1 (kV)	0.00100000
*009 VS2 (kV)	0.00100000
*010 V1MEM (kV)	0.00100000
011 FREQ (Hz)	0.00100000
*012 IAL	0.00100000
*013 IBL	0.00100000
*014 ICL	0.00100000
*015 IQL	0.00100000
*016 IGL	0.00100000
*017 IAR1	0.00100000
*018 IBR1	0.00100000
*019 ICR1	0.00100000
*020 IQR1	0.00100000
*021 IGR1	0.00100000
*022 IAR2	0.00100000
*023 IBR2	0.00100000
*024 ICR2	0.00100000
*025 IQR2	0.00100000
*026 IGR2	0.00100000
*027 IAR3	0.00100000
*028 IBR3	0.00100000
*029 ICR3	0.00100000
*030 IQR3	0.00100000
*031 IGR3	0.00100000
032 DIA	0.00100000
033 DIB	0.00100000
034 DIC	0.00100000
035 DIQ	0.00100000
036 DIG	0.00100000
037 DIA2M	0.00100000

Figure-37: Mark Channel's when root 2 Multiplier applied

In the Channel Window a star is placed in front of the analog channel number if has a root 2 multiplier applied.

33. Data Plotting – Search Digital Channels:

Updated: October 28th, 2019

Modified the search digital channels option to mark and move the digital channels found to the top of the digital channels list.

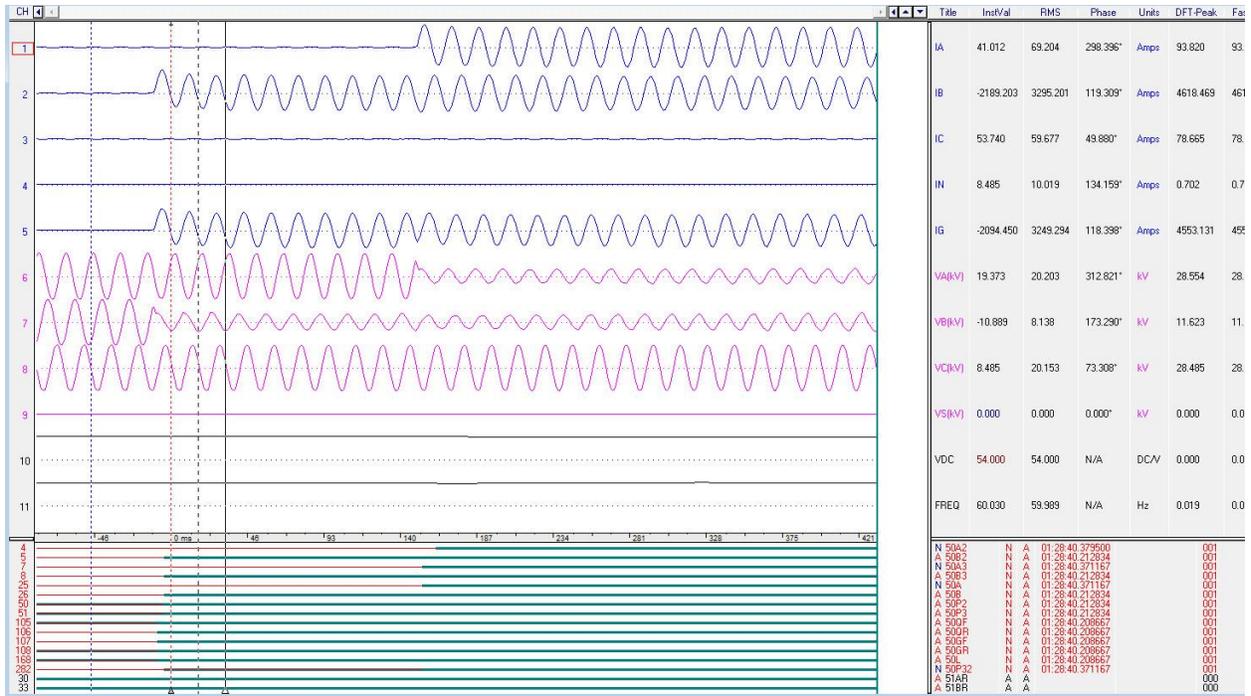


Figure-38: Mark and Move Search Digital Channels

34. Data Plotting – Save View Path:

Updated: October 28th, 2019

Defaulted the save view path to be the path where the file is located. In the past versions it would be the last path a view was saved in.

35. Device Manager – Device Idle Report (Last Waveform Extracted):

Updated: October 28th, 2019

Added a new report in the Device Manager that displays a table listing the number of days idle since a waveform was extracted. The table columns are, Device #, Group #, Days Idle, Last Date, Station, Title and Driver Name.

Text Table: C:\My Web Pages\new\ Wavewin new\wwfull\Test Software\Menu\Waveform Extraction.RPT

De...	Group #	Days Idle	Last Date	Station	Title	Driver
1	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
2	1	4227	04/01/2008	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
3	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
4	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
5	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
8	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
9	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
10	10	1761	01/01/2015	PHILADELPHIA	SCHEDULER	POLL DEVICES (START)
11	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
12	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
13	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
14	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
15	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
16	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
17	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
18	80	1761	01/01/2015	SOFTSTUF NJ	BITRONICS-FTP-2 (FTP)	LAN-DIRECT FTP-EVENTS
19	80	1761	01/01/2015	SOFTSTUF NJ	BITRONICS-FTP-1 (FTP)	LAN-DIRECT FTP-EVENTS
20	80	1761	01/01/2015	SOFTSTUF NJ	FTP-2 (FTP)	LAN-DIRECT FTP-EVENTS
21	21	1761	01/01/2015	PHILADELPHIA	LAB SEL-351-1 (351)(D)	LAN-DIRECT SEL-EVENTS
22	22	758	9/30/2017	PHILADELPHIA	LAB SEL-321-2 (321)(D)	LAN-DIRECT SEL-EVENTS
23	23	1761	01/01/2015	PHILADELPHIA	LAB SEL-321-3 (321)(D)	LAN-DIRECT SEL-EVENTS
24	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
25	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
26	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
27	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
28	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
29	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
30	30	1761	01/01/2015	PHILADELPHIA	LAB SEL-2020	LAN-SWITCH SEL-EVENTS
31	30	1761	01/01/2015	PHILADELPHIA	LAB SEL-351-1 (351)(S)	LAN-SWITCH SEL-EVENTS
32	30	1761	01/01/2015	PHILADELPHIA	LAB SEL-321-2 (321)(S)	LAN-SWITCH SEL-EVENTS
33	30	1761	01/01/2015	PHILADELPHIA	LAB SEL-321-3 (321)(S)	LAN-SWITCH SEL-EVENTS
34	30	1761	01/01/2015	PHILADELPHIA	GE-8-SERIES RELAY (8-S)	DYNAMIC UPDATE
37	30	1761	01/01/2015	PHILADELPHIA	GE-EPM7000 RELAY (7000)	SEL CHECK SER
38	38	1761	01/01/2015	PHILADELPHIA	GE-F35 RELAY (F35)	LAN-DIRECT GE-D60 EVES
39	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
40	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
41	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
42	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
43	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
44	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
45	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
46	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
47	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
48	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
49	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
50	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
51	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
52	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
53	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
54	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
55	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
56	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
57	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
58	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
59	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
60	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
61	1	1761	01/01/2015	MAIN OFFICE	SOFTSTUF WEB SITE	LAN-DIRECT FTP-EVENTS
62	1	1761	01/01/2015	MAIN OFFICE	FAULTNET WEB SITE	FTP EVENTS
63	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
64	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
65	1	1761	01/01/2015	MAIN OFFICE	WAVEGRID WEB SITE	LAN-DIRECT FTP-EVENTS
66	1	1761	01/01/2015	MAIN OFFICE	WAVEWIN WEB SITE	FTP EVENTS
=	=	=	=	=	=	=

Figure-39: Device Manager – Days Idle Report

Prepared By:
 Maria Rothweiler
 August 10th, 2022
 Revision: 17

Appendix A - Fault Report

> Fault Report:

Station: South Arkey
 Fault Time: 03/08/2017 03:57:42.006317
 Equipment: Feeder 1202
 Breakers Operated: Breaker 2 Closed
 Fault Type: A, N
 Fault Duration(CyCs): 3.893
 Fault Mag(Amps): 14851.230
 Voltage Dip(%): NA
 V2(Volts): 18883.702
 I2(Amps): 5226.823
 VA(Volts): 26949.568 @0.000°
 VB(Volts): 76249.703 @-106.062°
 VC(Volts): 84881.925 @133.488°
 IA(Amps): 14851.230 @-55.586°
 IB(Amps): 1374.458 @99.968°
 IC(Amps): 375.488 @41.528°
 IN(Amps): 13622.515 @-51.698°

> Event Report:

Start Time	Duration(ms)	Description
03:57:42.009	NA	Breaker 2 Closed
03:57:41.972	99	R3-Any Trip
03:57:41.971	66	Diff Trip A
03:57:41.996	29	Zone 1 A Trip
03:57:41.996	29	Zone 1 N Trip
03:57:41.984	70	Diff InterTrip
03:57:41.993	767	86-1 Operated

> Location Report:

Line Length: 11.12 Miles
 Z1(Ohms): 2.600 @75.499°
 Z0(Ohms): 10.001 @52.500°
 SE Radial: 3.851 Miles
 SE Reactance: 4.022 Miles
 DE Sequence: NA

