Master Station Data Analysis

Software Manual

for the

Model 2002 Multifunction DFR/SER

and

Model 3002 SER

Version 3.9.1

Date: 9/2/2011

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Revision History:

VERSION	DATE	DESCRIPTION
3.9.1	9-2-2011	Initial Release

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Foreword:

This manual covers the USIMaster© application Data Analysis Software (DAS) used in conjunction with the HT/LT 2000W Digital Fault Recorder (DFR), Model 2002 Disturbance Monitoring Equipment (DME), and the Model 3002 Sequence of Events recorder (SER). Functions of the Model 3002 SER are simply a subset of the Model 2002. Therefore, this manual has been geared for both DFR and SER users.

If you have purchased an **SER only** and do not intend to use the software with a USI Model HT-2000W or Model 2002 DFR, you should be primarily concerned with sections and subsections listed below.

This manual covers software releases up to and including version 3.9.1.

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Section 1: OPERATING THE MASTER STATION

The *USIMaster*© Data Analysis Software (DAS) is capable of interfacing with HT/LT2000W DFRs, Model 2002 DFR/SERs, and Model 3002 SERs. It is used to retrieve manually or automatically and display COMTRADE-formatted fault records from the Digital Fault Recorders (DFRs) and provides analysis tools for use on the displayed data. *USIMaster*© DAS also retrieves time sequenced data from Sequence of Events Recorders (SERs); generates and edits configuration files, and displays diagnostic reports.

Additionally, an optional feature of the *USIMaster*© automatically correlates Disturbance Monitoring Equipment (DME) fault records with lightning strikes and generates an event summary. This summary is retained as a part of the records summary and a copy is sent via E-mail. Note: this option is in cooperation with and requires a lightning strike data subscription with Vaisala.

One or more masters may be utilized in the overall system to operate multiple DFR and SER units. Communication with a DFR or SER may be done through a Local Area Network/Wide Area Network, through analog telephone lines using a wide array of Windows™ compatible modems, through an RS-232 serial bus, or through an RFL 9660 Digital Switch. The *USIMaster*© application may be used to program remote DFRs to send ***Quick Summary*** information, complete ***COMTRADE Records, Continuous Data*** and ***Sequence of Events*** data to the Master Station automatically within seconds of an occurrence. This data includes critical information such as triggered analog channels, triggered digital channels, fault ID number (FID), date, time, fault length, time sync status, and distance to the fault. *USIMaster*© also performs detailed fault analysis on complete fault data and can print the data graphically with a wide choice of options.

The software is menu-driven and provides on-line ***Help***. The latest *USIMaster*© software operates on any IBM-compatible PC with at least a Pentium® CPU and Windows *95*® or higher.

1.1 Master Station Data Analysis Software Installation

The *USIMaster©* software is provided free of charge to users of USI systems. It may be downloaded from the USI website at www.FaultRecorder.com or may be requested on CD-ROM or via E-mail. Contact USI if the software is required on other media.

Packages delivered via E-mail will be delivered compressed in WinZip™ format. To install using Windows Explorer®, browse to the location where the compressed installation file was saved. Open the compressed file and double-click on the installation file. Follow the instructions displayed by the Install Wizard to complete the installation.

The *USIMaster©* application and all its required files are installed by default onto the C-drive in a *USIMaster©* folder. If a different location is preferred, enter the desired path during installation and this directory will be created automatically by the installer application.

Warning: DO NOT install this software to the root directory, especially not to the root directory of the boot drive.

Once the *USIMaster©* application has been installed, run the software by clicking the Windows™ ***Start*** button and selecting *USIMaster©* from the Programs menu. The program can also be started by using Windows Explorer® to see the contents of the *USIMaster©* working directory, then selecting and running the ***Master.exe*** file.

A shortcut icon may be placed on the desktop by using Windows Explorer® to display the contents of the *USIMaster©* directory. Right click on the ***Master.exe*** file; select ***Send To;*** select *Desktop* (***Create Shortcut).***

1.2 Quick Start Guide

Using any software for the first time can be intimidating. However, USI has designed the *USIMaster©* application to make setup and first time use as simple as possible. The following Quick Start Guide takes the user through a series of steps designed both to minimize the manual entry of information and to accelerate the process of retrieving data.

Step 1 – Open Master Station Software

Select the *USIMaster©* application from the ***Start*** menu, or double-click on the *USIMaster©* icon on the desktop (if one has been created). The *USIMaster©* application momentarily displays the information screen shown in Figure 1-1. This screen contains release version information, copyright information, address, voice telephone and fax numbers and web addresses of Utility Systems, Inc. (USI).

Figure 1-1 Startup Screen

Step 2 – Acknowledge Initial Startup Message

When the program starts for the first time after being installed, a message box displays the message ***No R##.cal has been found*** (Figure 1-2). No Calibration Record was found because the program has not yet been configured and no DME systems have been created. Click ***OK*** to acknowledge this message, to begin the ***USIMaster© Configuration*** setup, and to begin configuration of DME systems.

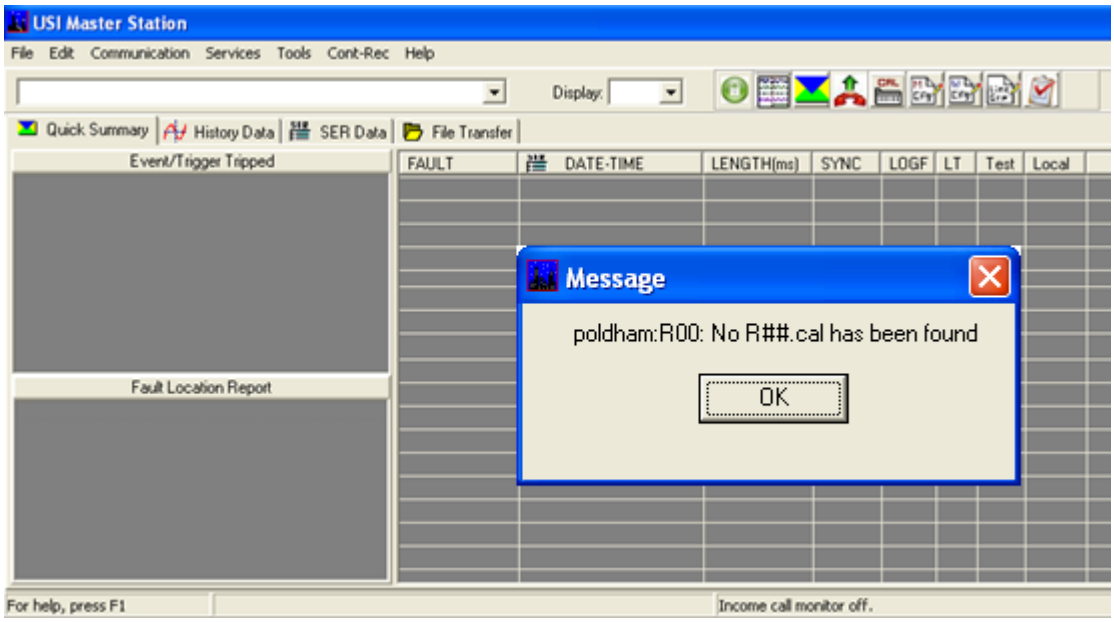


Figure 1-2 Initial Startup Message

Step 3 – Set USIMaster© Configuration

Click on the ***Edit*** menu and choose ***Master Configuration***. The screen shown in Figure 1-3 (***General*** tab) is displayed. Enter directory information for the ***Archive Path*** and, ***Cal. Rec. Path.*** Actual path locations will depend on the location where *USIMaster*© has been installed, and upon the drives and folders available on the host computer. If necessary, create the folders using Windows Explorer®. After the paths have been entered, click the ***Save*** button.

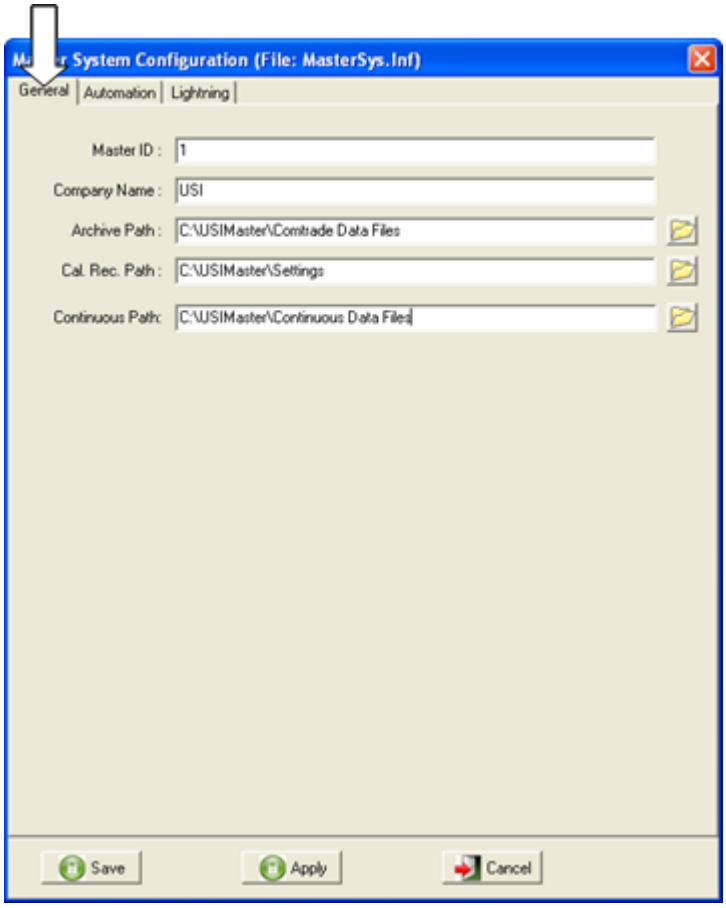


Figure 1-3 Master Configuration Screen – General Tab

Master Configuration Screen – General Tab

- **Archive Path**
  This directory path specifies the location where ***Transient, Long Term, and SER data Files*** will be stored after being retrieved.

- **Calibration Record (Cal. Rec.) Path**
  This directory path specifies the location where channel assignments of the DME

system will be stored. The channel assignments are called the Calibration Record (Cal Rec).

- ☑**Create unique subfolder for each DME under Archive and Backup paths** Check this checkbox to have the *USIMaster*© application automatically create a unique subfolder for each configured DME within the Archive Path and Backup Paths. The folder name assigned will be the station name as entered in the Calibration Record.

Note: ***Quick Start*** does not require any other settings on the Master Configuration Screen – ***General*** tab (Figure 1-3). Details for the remaining settings for this screen are detailed in Section 4.1.

Note: **Quick Start** also does not require settings on the ***Lightning*** and ***Automation*** screens (Figure 1-4). Settings for these screens are detailed in Section 4.1. ***Lightning Data Correlation***© is an optional feature. Other than during ***Quick Start***, the ***Lightning*** tab displays only when this option has been purchased. See Section 4.1.3.

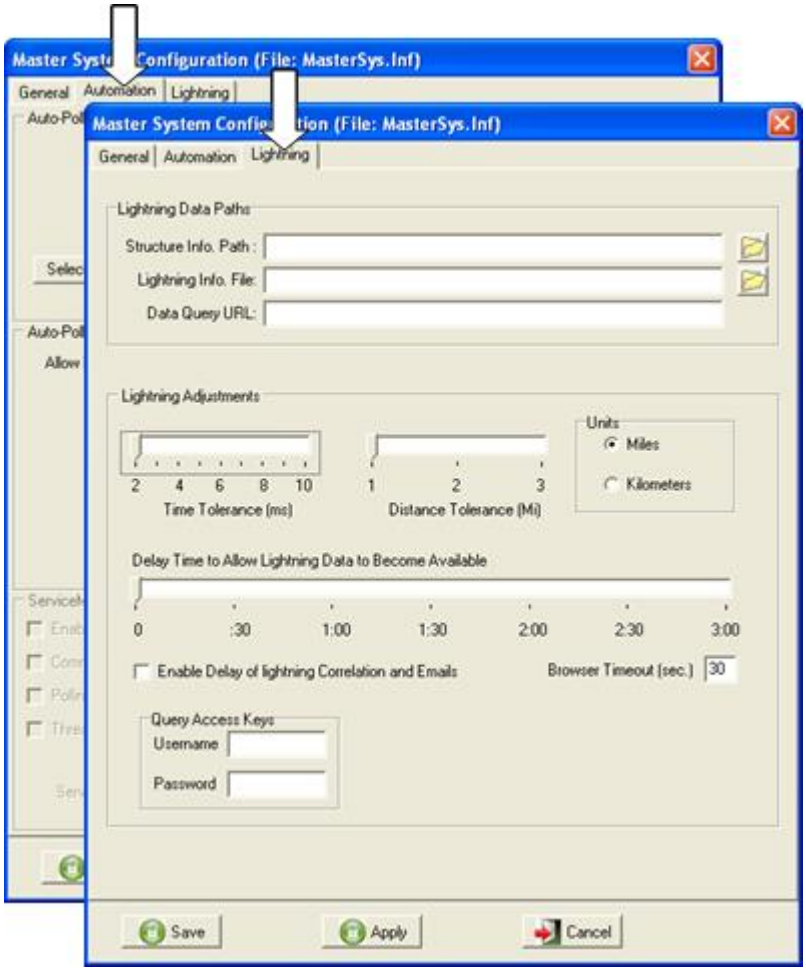


Figure 1-4 Master Configuration Screen – Lightning & Automation Tabs

These two screens are discussed in detail in Section 4.1, ***Master Configuration***.

Step 4 – Save Master Configuration

If the message box shown in Figure 1-5 displays, the Master Configuration file was saved but there is no Calibration Record present in the Cal Rec Path. Click ***OK***.

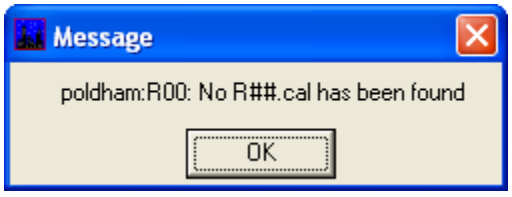


Figure 1-5 No R##.cal has been found Message

Step 5 – Set Up Calibration Record

USI provides customers with a Calibration Record containing the specific hardware settings for each purchased system. Additionally, if channel and trigger assignments are

provided to USI in another format, USI provides a Calibration Record with the provided settings pre-entered for user convenience.

The file provided from the factory is named ***R##.cal*** where ***##*** indicates the unique remote ID number. Copy this file directly to the ***Cal. Rec. Path*** assigned in Step 3 using Windows Explorer®, or click on the ***Edit*** menu and choose ***Calibration Record***, ***Restore Cal. Record*** and ***Restore Cal. Record from***. Then browse to and select the location of the ***R##.cal*** file to import it.

To edit or view the Calibration Record, click the ***Edit*** menu, choose ***Calibration Record*** and then ***Edit Cal. Record*** (see Section 4.2 for details).

To create a Calibration Record from scratch, see Section 4.

Step 6 – Enter Phone and Network List

Click on the ***Communication*** menu and select ***Phone and Network List.*** The window shown in Figure 1-6 will display. Select from the drop-down box the method to be used to communicate with the DME system. Then, in the field to the right, enter the phone number or IP Address of the DME system to be called. Click ***Add*** when finished.

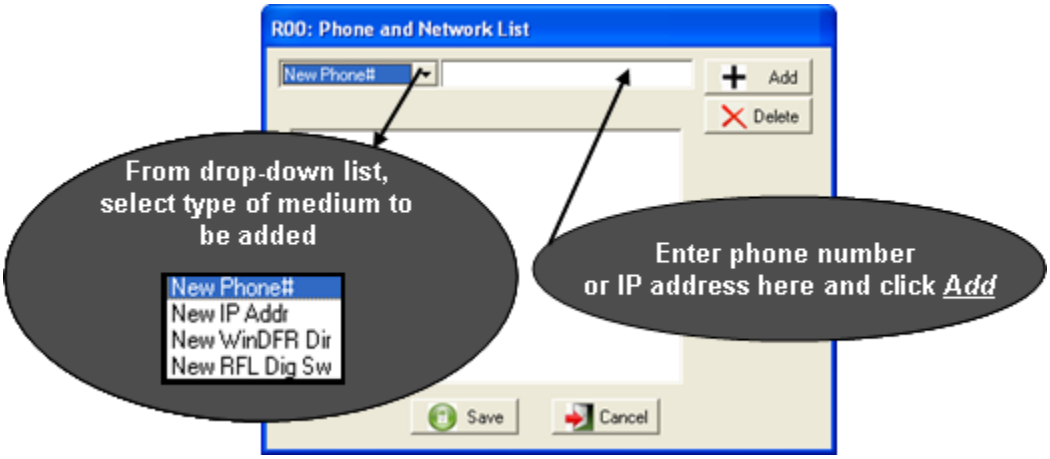


Figure 1-6 Phone and Network List – Select Type/Enter Number

Next, a dialog box displays requesting the password of the Disturbance Monitoring Equipment (DME) to be called (Figure 1-7). Enter the password or leave this field blank if there is none (by default from the factory, no password is assigned to the DME). Click OK ***OK;*** then click Save ***Save***.

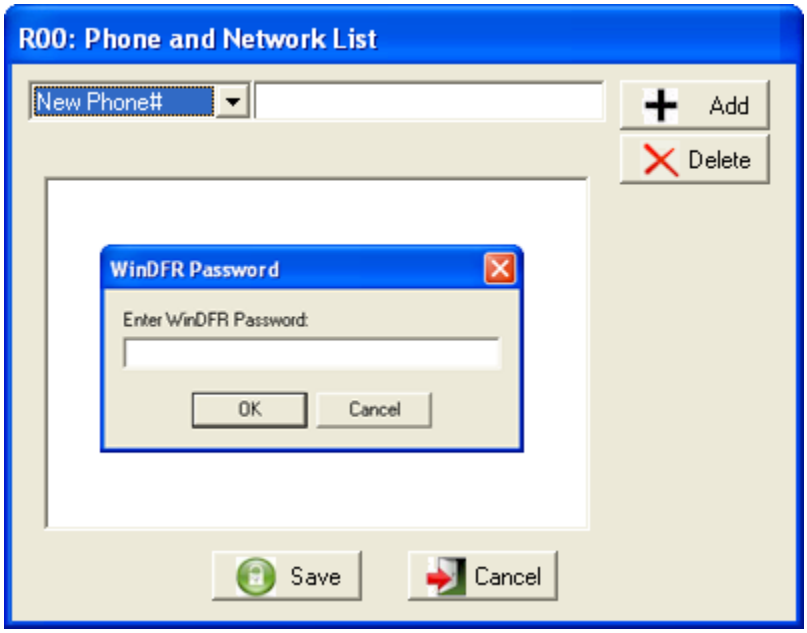


Figure 1-7 Enter the WinDFR© Password

Note: If communication with the DME system is to be via Ethernet, skip Step 7 and proceed to Step 8. Note that it will be necessary to ping the IP address of the DME system to communicate with it. If communication is to be via dial-up, continue with Step 7.

Step 7 – Choose Modems

Click on the ***Communication*** menu and select ***Modem/ Choose Modem*** (the master station computer must have an installed modem to complete this step). One or more modems may be listed. Select the modem to be used (Figure 1-8) and click OK ***OK***. The *USIMaster©* is now set up to communicate with the remote DME system.

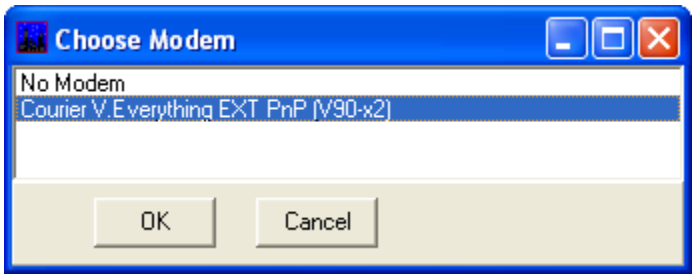


Figure 1-8 Choose Modem

Step 8 – Connect to Remote DME

Click on the ***Communications*** menu and select ***Call Remote***. The *USIMaster©* application will now connect to the remote DME system by the method selected in Step 6. The progress of communications and any file transfer may be watched using the ***Communication Status*** screen (Figure 1-9). To show the ***Communication Status*** screen, click on the ***Communications*** menu and select ***Show Comm. Screen***.

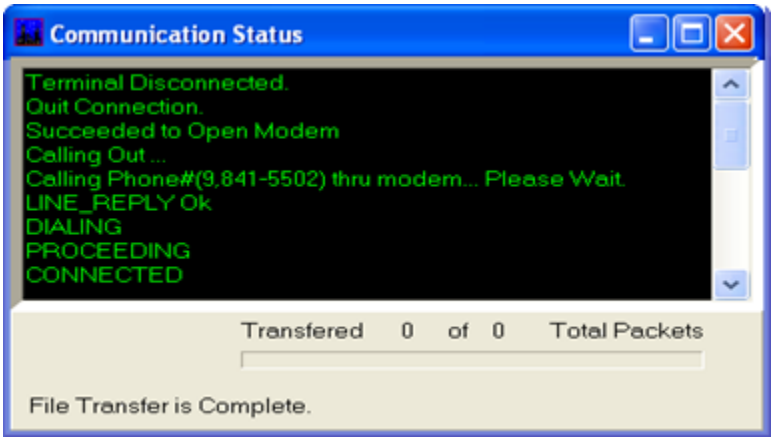


Figure 1-9 Communication Status Screen

Step 9 – Perform Communication Functions

If the connection to the remote DME is successful, the bottom right corner of the Master Station screen will show the message ***Logged into Remote*** (Figure 1-2). Once this message displays, the *USIMaster©* station is connected to the DME system and file transfers can begin (i.e. upload/download settings, upload data files, etc.).

The following functions can now be selected and performed:

- From the ***Edit*** menu: get or send Calibration Records; get or send Line Group Records; get *WinDFR©* Configuration files. See Section 2.1.2 - Edit for details.
- From the ***Services*** menu: select Test Run, Remote Diagnostic, or Polling Remote. See Section 2.1.4 - Services for details.
- From the ***Quick Summary screen – right-click*** menu: select Retrieve Quick Summary file or Retrieve History Data files. See Section 2.1.4 - Services for details.
- From the ***SER Data screen***: click the ***Retrieve Dates*** or ***Retrieve Files*** button (the remote DME must have at least one digital input configured as SER for the ***SER Data screen*** to be displayed). See Section 2.1.6 for details.
- From the ***Cont-Rec*** menu: retrieve continuous values for RMS, Frequency, Phase, or Oscillography data samples. See Section 2.1.6 for details.

Section 2: SCREENS AND MENUS

2.1 USIMaster© Application Menus

From the *USIMaster©* screen header, select from the following application drop-down menus (see Figure 2-1).

Figure 2-1 USIMaster Application Menus

2.1.1 File

The following selections are available on the ***File*** menu (Figure 2-2):

Figure 2-2 File Menu

- **Reinitialize**
  Reinitializes the *USIMaster©* application; updates the ***Quick Summary, History Data,*** and ***SER Data*** screens and hangs up the modem if it is connected

- **Printer Setup**
  Displays the standard Windows™ print setup screen. This window is used to select the *USIMaster©* default printer.

- **Print Screen Preview**
  Displays a preview of the screen that will be printed by selecting the ***Print Screen*** function

- **Print Screen**
  Sends the current screen display to the printer selected in the ***Printer Setup*** window

- **Exit**
  Closes the *USIMaster©* application window.

2.1.2 Edit

The following selections are available on the ***Edit*** menu (Figure 2-3):

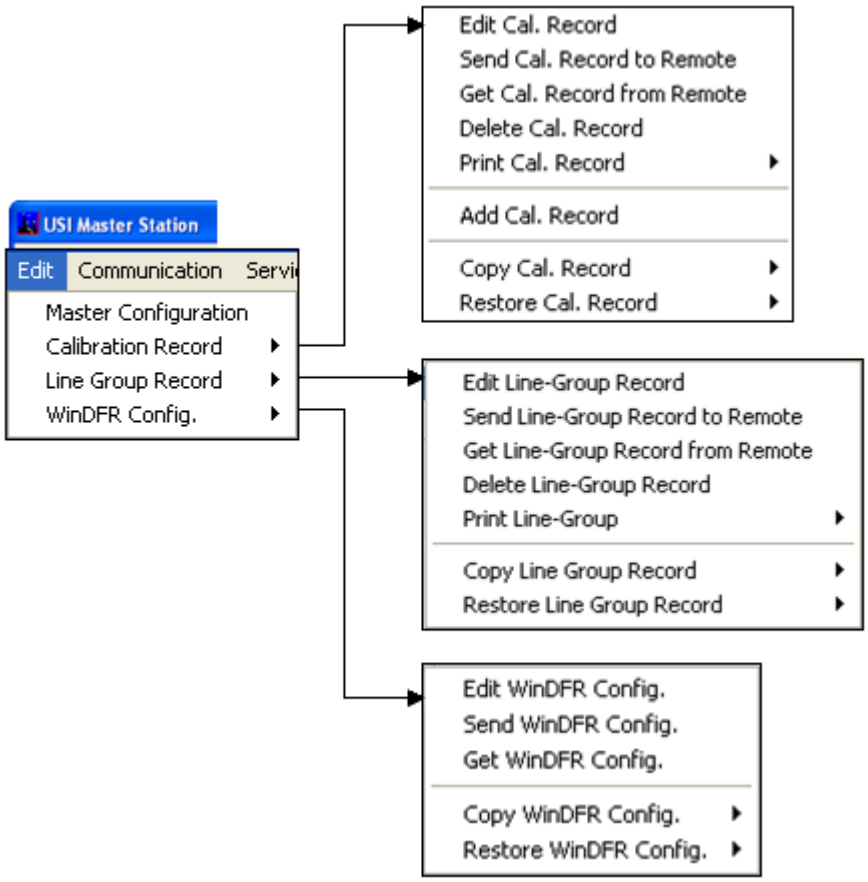


Figure 2-3 Edit Menu

- **Master Configuration**
  Select Master Configuration to open the ***Master System Configuration*** window and configure the *USIMaster©* application. Choose one of three separate screens: ***General***, ***Automation***, and ***Lightning***. For complete details on Master Configuration, see Section 4.1.

- **Calibration Record**
  The Calibration Record is a setup file which contains the DME system parameters for the analog and digital input channels as well as the analog trigger channels. For complete details on the Calibration Record menu, see Section 4.2.

  - Edit Cal. Record:
    Select to open the ***Edit Calibration Record*** window allowing users to

modify Analog, Digital, and Trigger channel assignments. For complete details on editing the Calibration Record, see Section 4.2

- Send Cal. Record to Remote:
  Select to initiate a communication connection with the DME system and send (upload) the Calibration Record to the currently selected DME System.

- Get Cal Record from Remote:
  Select to initiate a communication connection with the DME System and get (download) the Calibration Record from the currently selected DME System.

- Delete Cal. Record:
  Select to delete the currently selected Calibration Record thereby removing it from the DME system list (see Section 2.2.1).

Caution: ***Delete Cal. Record*** permanently removes all parameter settings for the selected DME system.

- Print Cal. Record:
  Choose to ***Preview*** or ***Print*** all the parameters of the Analog, Trigger, and Digital channels stored in the Calibration Record.

- Add Cal. Record:
  Select to display the ***Add Calibration Record*** window (see Figure 2-4) and prompt the user to enter a unique DME system remote identification number (abbreviated ***ID #***). Typically, the first DME system is Remote ***ID# 1***; the second is #***2***, etc. However, this entry is restricted to a number previously unassigned and from one to four digits in length. Click OK ***OK*** to acknowledge and proceed to the next prompt.

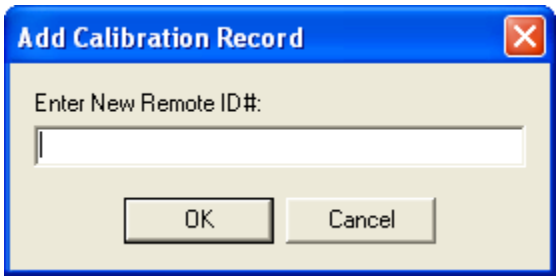


Figure 2-4 Enter Remote ID

After the new remote ID number has been entered, the dialog box in Figure 2-5 prompts the user to enter the number of units. Number of Units is typically ***1***. Number of Units refers to the number of computers running

the *USIRemote*© application on the DME. Only Model HT/LT2000 DFR Systems having more than 64 analog input channels or Model 2002 DME Systems having more than 128 analog input channels require Number of Units greater than one (1). Click OK ***OK*** to acknowledge and proceed to the next prompt.

Figure 2-5 Enter Number of Units

Enter the number of units. The dialog box in Figure 2-6 prompts the user to select the ***Calibration Record Format***.

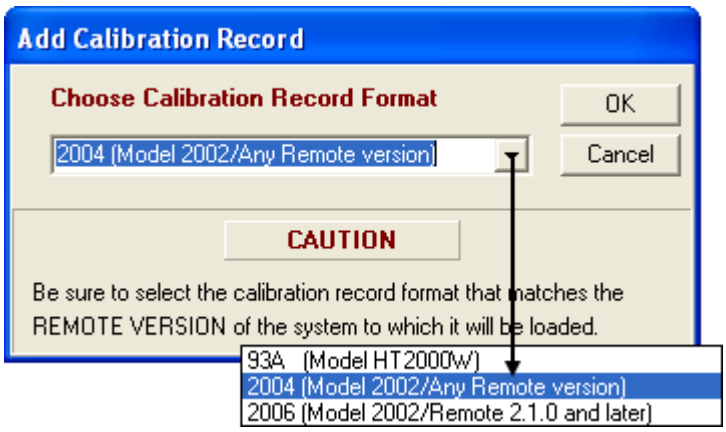


Figure 2-6 Choose Calibration Record Format

- Select ***93A (Model HT2000W)*** if creating a new Calibration Record for an HT/LT2000W DFR system.
- Select ***2004 (Model 2002/Any Remote version)*** if creating a new Calibration Record for a Model 2002 DME system running any version of *USIRemote*© application.
- Select ***2006 (Model 2002/Remote 2.1.0 and later)*** if creating a new Calibration Record for a Model 2002 DME system running *USIRemote*© V2.1.0 or later.

If you are creating a new Calibration Record for a Model 2002 DME system and are unsure of the *USIRemote*© version, select ***2004 (Model 2002/Any Remote version)***. The format may be converted from 2004 to

2006 format later from the ***Edit Calibration Record*** window (see Section 4.2 for details). Click OK ***OK*** to acknowledge and open the ***Edit Calibration Record*** window for the newly created Calibration Record (see Figure 2-7).

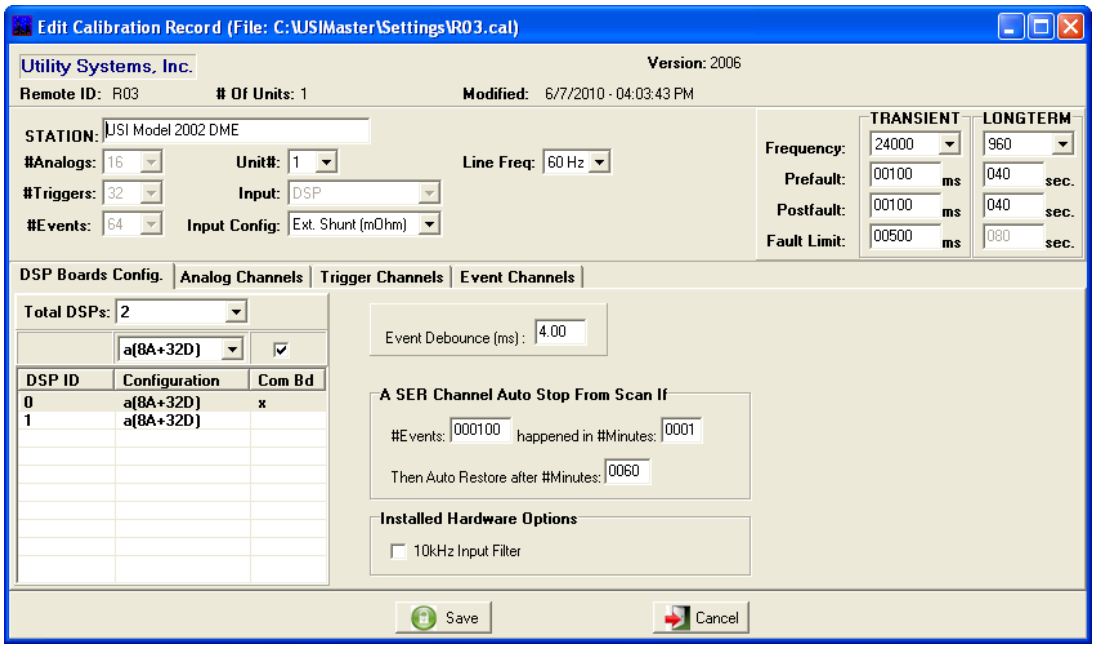


Figure 2-7 New Calibration Record

Click the Save ***Save*** button to store the newly created Calibration Record add it to the DME system list (see Figure 2-7). For complete details on editing the new Calibration Record see Section 4.2).

- Copy Cal. Record:
  Select ***Copy to Backup 1*** to send a copy of the Calibration Record, for the currently selected DME System, to the Backup 1 Path as configured in the Master System Configuration (see Section 4.1 for details).

  Select ***Copy to Backup 2*** to send a copy of the Calibration Record, for the currently selected DME system, to the Backup 2 Path as configured in the Master System Configuration (see Section 4.1 for details).

  Select ***Copy to …*** to open the ***Browse for folder*** window and to send a copy of the Calibration Record for the currently selected DME system to a user selected path.

- Restore Cal. Record:
  Select ***Restore from Backup 1*** to restore a copy of the Calibration Record, for the currently selected DME system, from the Backup 1 Path

as configured in the Master System Configuration (see Section 4.1 for details).

Select ***Restore from Backup 2*** to restore a copy of the Calibration Record**,** for the currently selected DME system, from the Backup 2 Path as configured in the Master System Configuration (see Section 4.1 for details).

Select ***Restore from …*** to open the ***Browse for folder*** window and to restore a copy of the Calibration Record, for the currently selected DME system, from a user selected path.

- **Line Group Record**
  The Line Group Record is a setup file used to group analog channels related to a specific transmission line or generator output (e.g., Va, Vb, Vc, Ia, Ib, Ic, In). Line Group files are used by the DME system to perform automatic distance-to-fault calculations and by the *USIMaster*© to perform manual distance-to-fault calculations and Graphic Signal Processing Data analysis. For complete details on the Line Group menu, see Section 4.3.

  - Edit Line Group Record:
    This selection displays the ***Edit Line-Group Record*** window allowing the user to add, delete, or edit Line Group parameters. For complete details on editing the Line Group Record, see Section 4.3

  - Send Line Group Record to Remote:
    Select to initiate a communication connection with the selected DME system and send (upload) the ***Line Group Record*** to it (Figure 2-8).

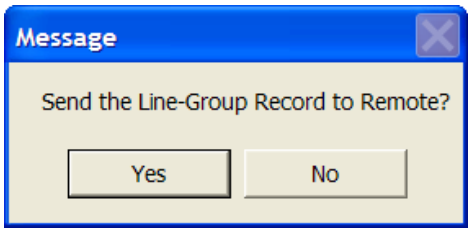


Figure 2-8 Send Line Group Record to Remote

  - Get Line Group Record from Remote:
    Select to initiate a communication connection with the selected DME system and get (download) the Line Group Record from it.

  - Delete Line Group Record:
    Select to delete the Line Group Record for the selected DME system (Section 4.3).

- Print Line Group Record:
  This selection is used to ***Preview*** or ***Print*** all the parameters of the Line Group Record to the default printer.

- Copy Line Group Record:
  Select ***Copy to Backup 1*** to send a copy of the Line Group Record, for the currently selected DME system, to the Backup 1 Path as configured in the Master System Configuration (Section 4.1).

  Select ***Copy to Backup 2*** to send a copy of the Line Group Record, for the currently selected DME system, to the Backup 2 Path as configured in the Master System Configuration (Section 4.1).

  Select ***Copy to …*** to open the ***Browse for folder*** window and send a copy of the Line Group Record, for the currently selected DME System, to a user selected path.

- Restore Line Group Record:
  Select ***Restore from Backup 1*** to restore a copy of the Line Group Record, for the currently selected DME system, from the Backup 1 Path as configured in the Master System Configuration (Section 4.1).

  Select ***Restore from Backup 2*** to restore a copy of the Line Group Record, for the currently selected DME system, from the Backup 2 Path as configured in the Master System Configuration (Section 4.1).

  Select ***Restore from …*** to open the ***Browse for folder*** window and restore a copy of the Line Group Record, for the currently selected DME system, from a user selected path.

- **WinDFR Config.**
  WinDFR© is an application that runs on the DME system. ***WinDFR Config*** is short for *WinDFR*© System Configuration. ***WinDFR Config*** is the file which contains the configuration settings for the *WinDFR*© application. For complete details on the ***WinDFR Config*** menu, see Section 4.4.

  - Edit WinDFR Config:
    This selection opens the ***WinDFR© System Configuration*** window allowing users to modify the DME system ***WinDFR© Configuration*** parameters. For complete details on editing the ***WinDFR© Configuration*** (Section 4.4).

  - Send WinDFR Config.:
    This selection initiates a communication connection to the selected DME system and sends (uploads) the ***WinDFR© Configuration*** to it.

- Get WinDFR Config:
  This selection initiates a communication connection to the DME System and gets (downloads) the ***WinDFR© Configuration*** from it.

- Copy WinDFR Config:
  Select ***Copy to Backup 1*** to send a copy of the ***WinDFR© Configuration,*** for the currently selected DME system, to the Backup 1 Path as configured in the Master System Configuration (Section 4.1 for details).

  Select ***Copy to Backup 2*** to send a copy of the ***WinDFR© Configuration,*** for the currently selected DME system, to the Backup 2 Path as configured in the Master System Configuration (Section 4.1 for details).

  Select ***Copy to…*** to open the ***Browse for folder*** window and send a copy of the Line Group Record, for the currently selected DME system, to a user selected path.

- Restore WinDFR Config.:
  Select ***Restore from Backup 1*** to restore a copy of the ***WinDFR© Configuration*** for the currently selected DME system from the Backup 1 Path as configured in the Master System Configuration (Section 4.1).

  Select ***Restore from Backup 2*** to restore a copy of the ***WinDFR© Configuration*** for the currently selected DME system from the Backup 2 Path as configured in the Master System Configuration (Section 4.1).

  Select ***Restore from…*** to open the ***Browse for folder*** window and restore a copy of the ***WinDFR© Configuration*** for the currently selected DME system from a user selected path.

2.1.3 Communication

The following selections are available on the ***Communication*** menu (Figure 2-9) of the *USIMaster©* header screen (Figure 2-1):

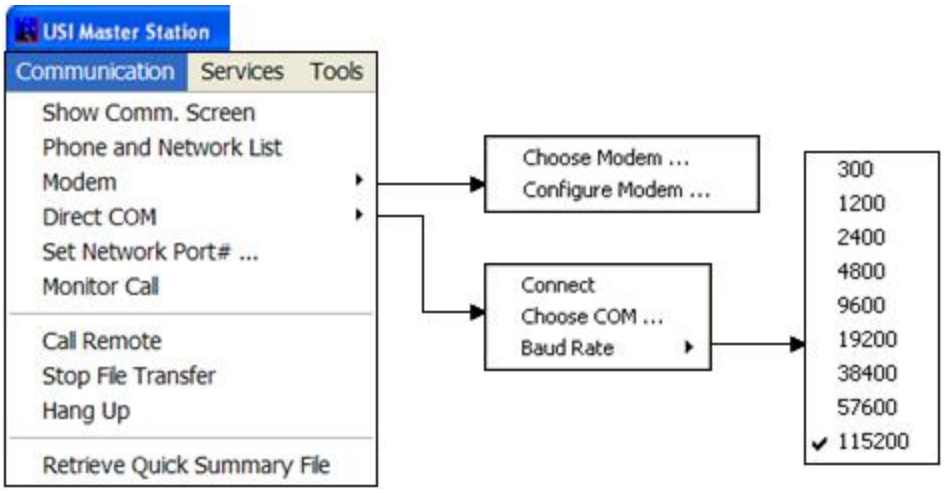


Figure 2-9 Communication Menu

- **Show Comm. Screen**
  Select Show Comm. Screen to display the ***Communication Status*** window. This window shows what the modem or network connection does when it is active. It also shows the transfer progress of files being uploaded to or downloaded from the DME system (Figure 2-10).

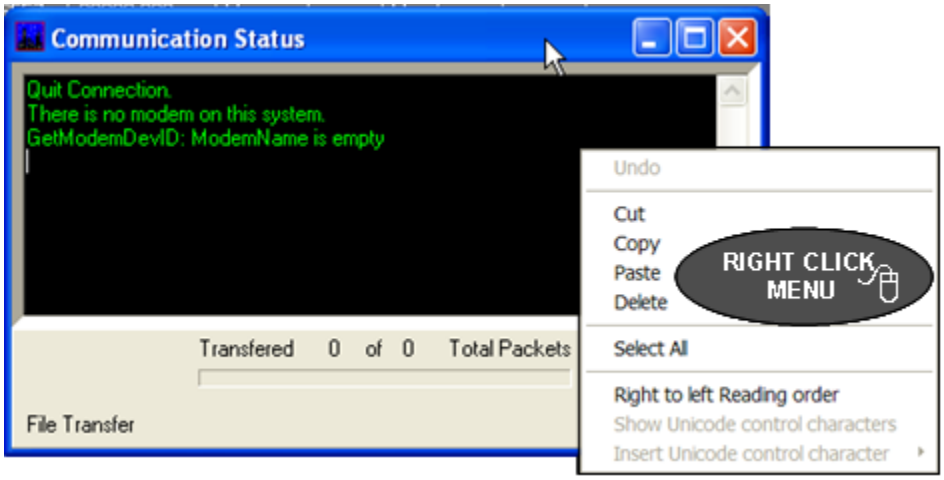


Figure 2-10 Communication Status Window

Note: The messages displayed in this window are automatically logged in an ASCII formatted file named ***CommTrace.wri***. This file is located in the working directory of the *USIMaster©* application. Additionally, a right-click in the ***Communication***

Status window displays a pop-up menu with the choices: ***Undo, Cut, Copy, Paste, Delete*** and ***Select All.*** These selections are used to copy the contents manually to a file for trouble-shooting.

Note: In this document, the mouse symbol denotes that a mouse-right-click is required to view the tagged object.

- **Phone and Network List**
  Select Phone and Network List to display the Phone and Network List window. This window is used to configure the communication medium and enter the phone number, IP address, or *WinDFR©* directory (Figure 2-11) for the selected DME system.

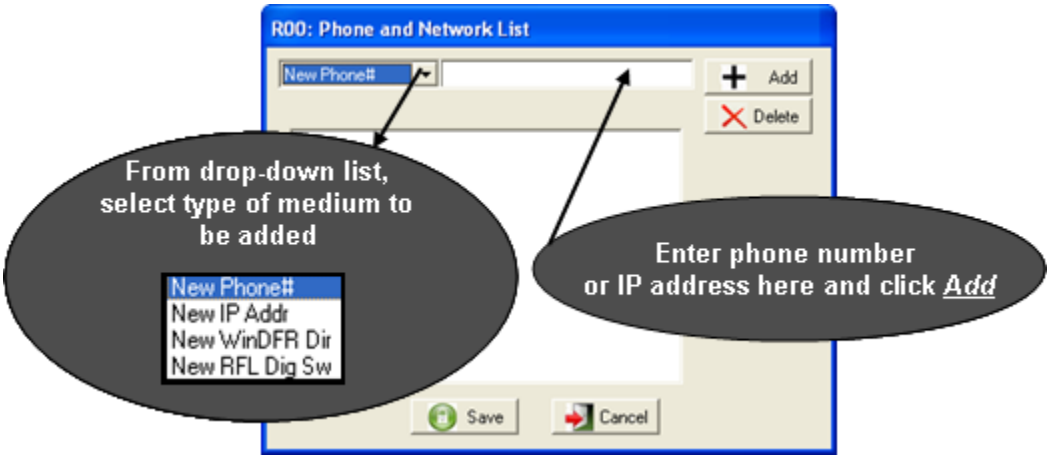


Figure 2-11 Phone and Network – Select Communication Medium

  - For communication via dial-up modem, Ethernet (LAN/WAN), or *WinDFR©* directory, enter the phone number, IP Address, or *WinDFR©* directory path into the text box directly to the right of the drop-down list (Figure 2-11), then click the Add ***Add*** button.

  - After adding the phone number or IP Address, the ***WinDFR Password*** window displays requesting the logon password of the selected DME system. The DME system logon password is set in the WinDFR Configuration (Section 4.4). Enter the password as assigned in the WinDFR Configuration or leave blank if no password has been assigned. The factory default is No Password Assigned to the Recorder. Click OK ***OK*** then click Save ***Save*** (Figure 2-12).

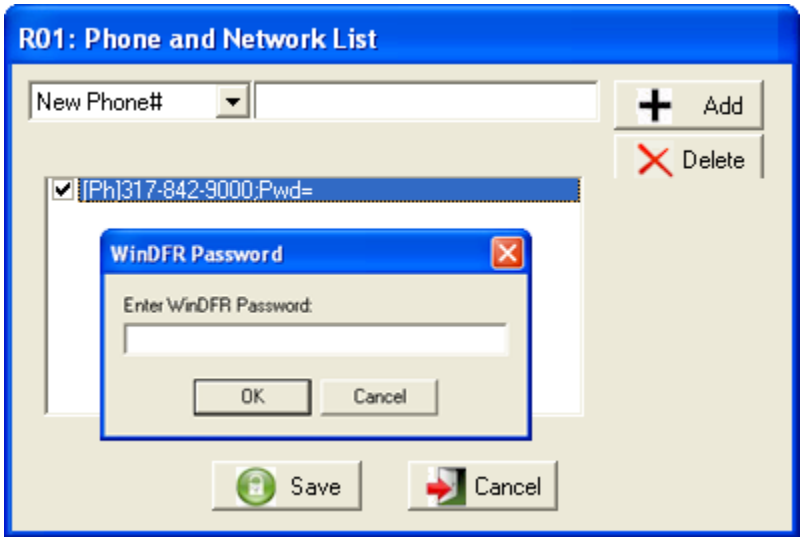


Figure 2-12 WinDFR© Password - Enter Password

- New Phone#:
  This selection is used when communication from *USIMaster*© to the selected DME system will be via modem. Choose ***New Phone#*** from the drop-down list (Figure 2-13) and enter the dial-up phone number for the selected DME system.

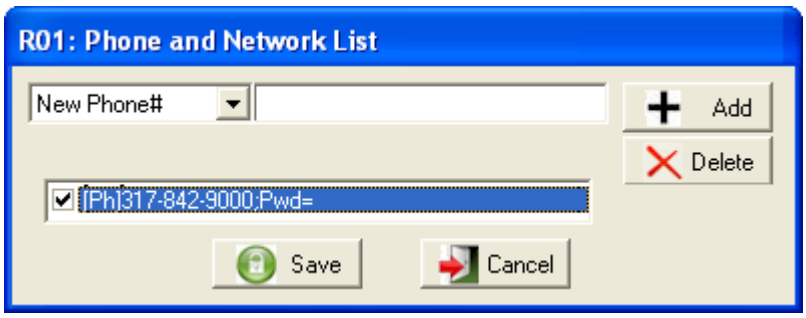


Figure 2-13 Phone and Network List – Enter New Phone Number

- New IP Addr:
  This selection is used when communication from *USIMaster*© to the selected DME system will be via Ethernet (LAN/WAN). Choose ***New IP Addr*** from the drop-down list (Figure 2-14) and enter the IP Address for the selected DME system

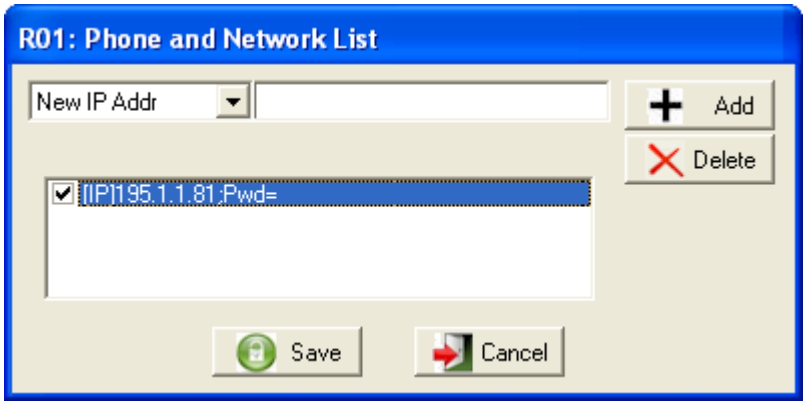


Figure 2-14 Phone and Network List – Enter IP Address

- New WinDFR Dir:
  This selection is used when the communication from *USIMaster©* to the selected DME System will be via mapped *WinDFR©* working directory. This method is typically used only for the *USIMaster©* application running as a local copy on the DME system itself. Choose ***New WinDFR Dir*** from the drop-down list (Figure 2-15) and enter the drive and directory location for the selected DME system, or use the Browse ***Browse*** button (which appears when this method is selected) to select it from the Browse for Folder window.

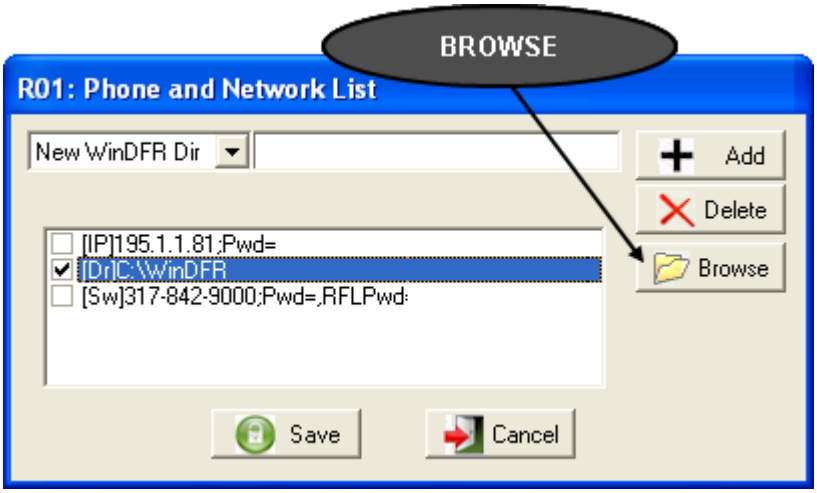


Figure 2-15 Phone and Network List – Enter New WinDFR Directory

- New RFL Dig Sw:
  This selection is used when communication from *USIMaster©* to the selected DME system will be via RFL 9660 Digital Switch. Choose ***New RFL Dig Sw*** from the drop-down list (Figure 2-15) and enter the dial-up phone number of the RFL 9660 Digital Switch for the selected DME system. Then enter the *WinDFR©* Password.

Next, the ***RFL 9660 Digital Switch Password*** window displays (see Figure 2-16). Enter the logon password for the RFL Digital Switch (see the Operators Manual for details to configure this password).

Next, the ***RFL 9660 Digital Switch Port#*** window displays (Figure 2-16). Enter the port number of the digital switch connected to the DME system.

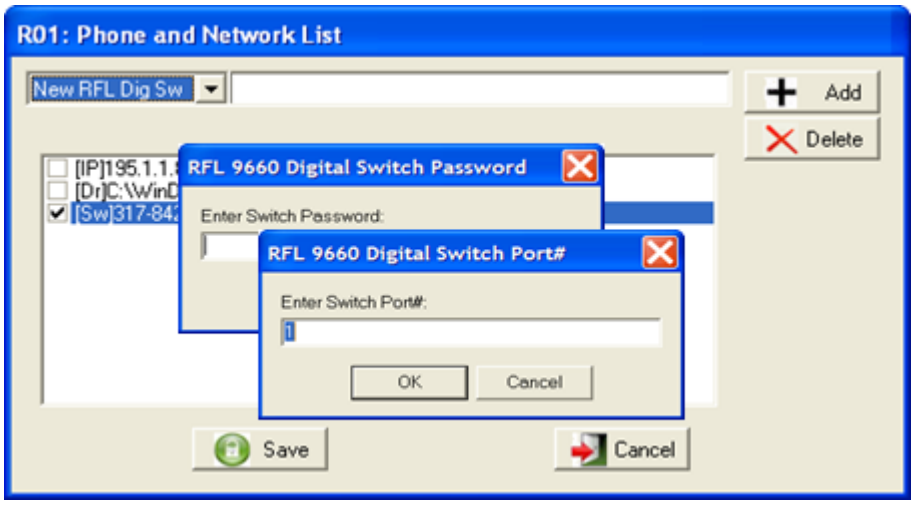


Figure 2-16 Phone and Network List – Enter WinDFR© Directory

- The Phone and Network List may have multiple communication entries for the selected DME system (e.g. you may have one dial-up connection configured for dialing from an inside phone line and another one for dialing from an outside phone line. The check-mark denotes the active communication medium and address (i.e. telephone number, IP address, etc.) used by *USIMaster*© (Figure 2-17).

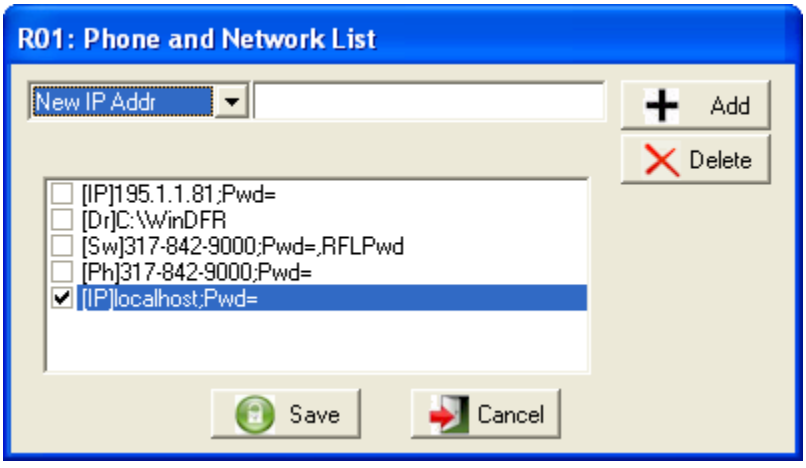


Figure 2-17 Phone and Network List

- Edit Phone and Network List:
  To edit an entry in the Phone and Network List, right-click an entry in the connection list to display a pop-up menu with the choice ***Edit***. Select ***Edit*** and the Edit window is displayed where the connection string may be modified. Right-click in the Edit window to display another pop-up menu with the choices ***Undo***, ***Cut***, ***Copy***, ***Paste***, ***Delete*** and ***Select All***.

- **Modem – Choose Modem**
  This selection displays the ***Choose Modem*** window (Figure 2-18). This window displays the list of modems installed on the USIMaster computer. Select a modem and click OK button [OK] to choose a modem.

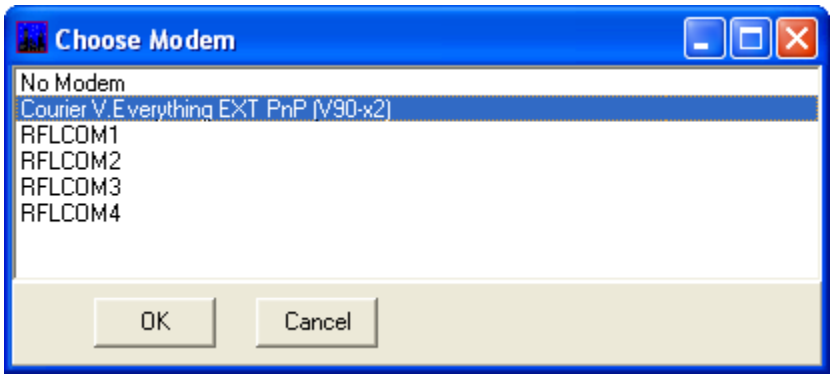


Figure 2-18 Modem List - Choose Modem

- **Modem – Configure Modem**
  Changes to the default modem configuration are rarely needed but can be made when necessary. For example, configuration changes may be necessary during an attempt to connect to the DME system via modem. Select **Configure Modem** to display preferences and to make changes to the default configuration.

Caution: Changes made to the modem configuration will be globally applied to all DME systems communicating via the chosen modem.

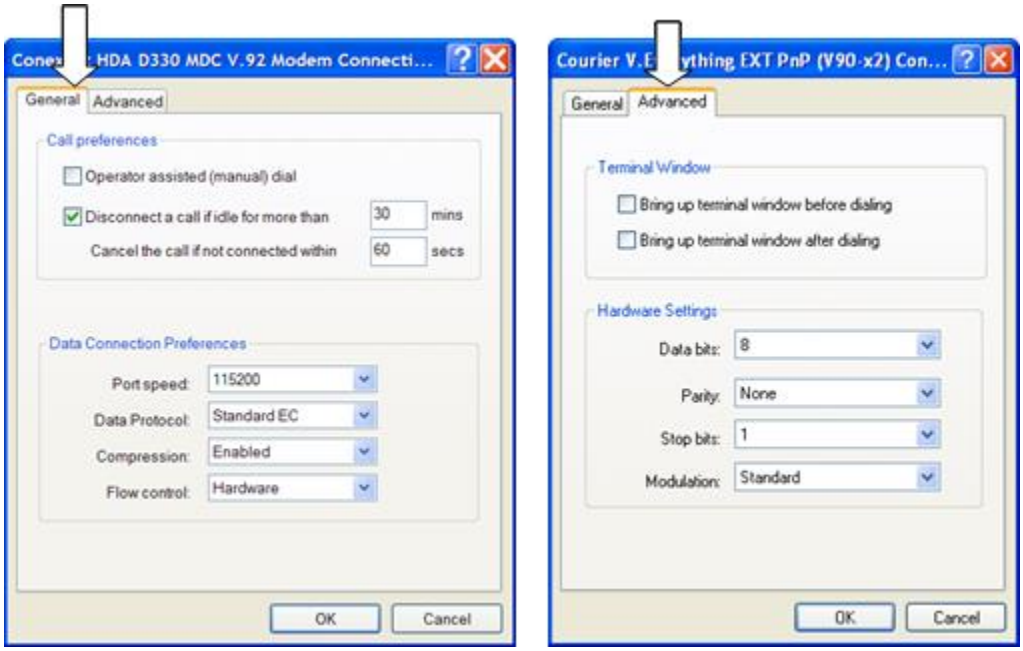


Figure 2-19 Configure Modem

- **Direct COM**
  Direct COM method of communication is used when *USIMaster*© is connected to the DME system via an RS-232 serial bus. This connection may be made via a null modem serial cable directly to a COM port on the DME system computer. This connection may also be made using a third-party device which creates a virtual serial connection over Ethernet.

  Select Direct COM from the Communication menu to display the following sub-menu choices.

  - Connect:
    Select this to establish communication with the selected DME system (Figure 2-11) via RS-232 serial bus. To establish communication via dial-up modem, Ethernet, or RFL 9660, see Call Remote below.

  - Choose COM:
    This selection displays the Choose COM window. This window lists the physical COM ports available on the Master Station computer. Select from this list the COM port to be used to connect to the DME system (Figure 2-20).

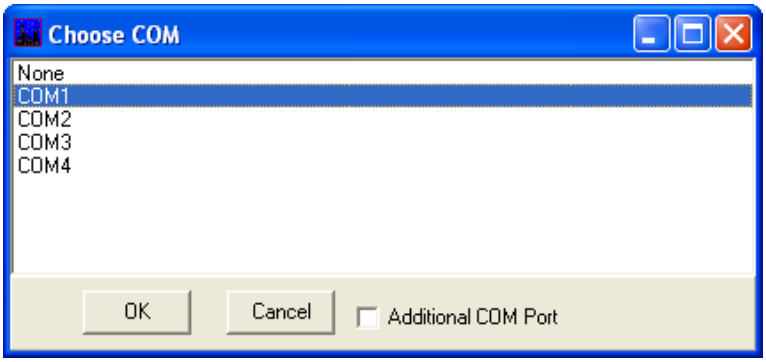


Figure 2-20 Choose COM Port

- If a virtual COM port is being used, select the ***Additional Comm Port*** check-box to display the ***Choose serial port #*** form and manually enter the virtual COM port number. COM9 is the highest port number that may be entered. Click Use ***Use*** or Discard ***Discard*** to add or remove virtual COM ports. Click OK ***OK*** to save the selection (Figure 2-21).

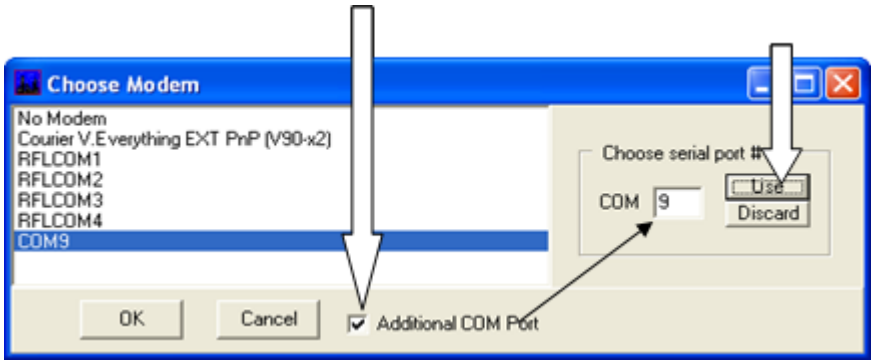


Figure 2-21 Choose Virtual COM Port

- Baud Rate:
  Set the communication rate by selecting one of the listed rates for the ***Direct COM*** connection (Figure 2-19). The baud rate setting for *USIMaster*© must match the DME system (see DME System Operators Manual) for communications to succeed. The factory default setting is 115,200.

- **Set Network Port # …**
  Select this to display the Set Network Port# window see (Figure 2-22). The default port number is set to 1024. Enter a new ***Network Port*** number if the 1024 port is blocked on your network. The port number entered will be a global setting applied to all DME systems in communication with *USIMaster*©. The port number in *USIMaster*© must match the port number setting in the DME system (see DME System Operators Manual).

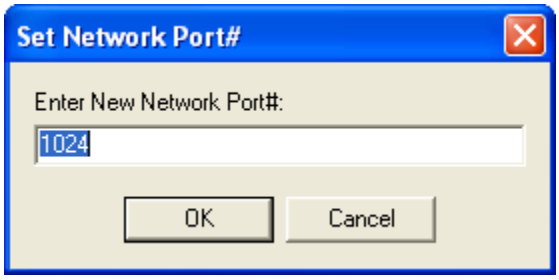


Figure 2-22 Set Network Port Number

- **Monitor Call**
  Selecting ***Monitor Call*** configures *USIMaster©* to listen for incoming calls. When ***Monitor Call*** is selected, a check mark displays beside it indicating that incoming call monitoring is enabled. When a check mark is not displayed, incoming call monitoring is disabled. Also a message indicating the incoming call monitoring status is displayed in the application status bar at the bottom of the screen (Figure 1-2).

- **Call Remote**
  This selection establishes a communication connection to the selected remote DME system (Figure 2-9) via dial-up modem, Ethernet, or RFL 9660. Once connected, operations such as retrieving or sending files can be performed. The connection will automatically disconnect after 10 minutes if there is no activity.

- **Stop File Transfer**
  Selecting this allows the user to stop a file transfer without disconnecting the *USIMaster©* from the DME system.

- **Hang Up**
  This selection terminates any communication connection with the selected DME system (Figure 2-9).

- **Retrieve Quick Summary File**
  Select this to download the ***Quick Summary*** file (Section 3.1) from the DME system. If *USIMaster©* is not already connected to the remote DME system, this will automatically establish a communication connection and download the file.

2.1.4 Services

The following selections are available on the ***Services*** menu (Figure 2-23) of the *USIMaster*© header screen (Figure 2-1):

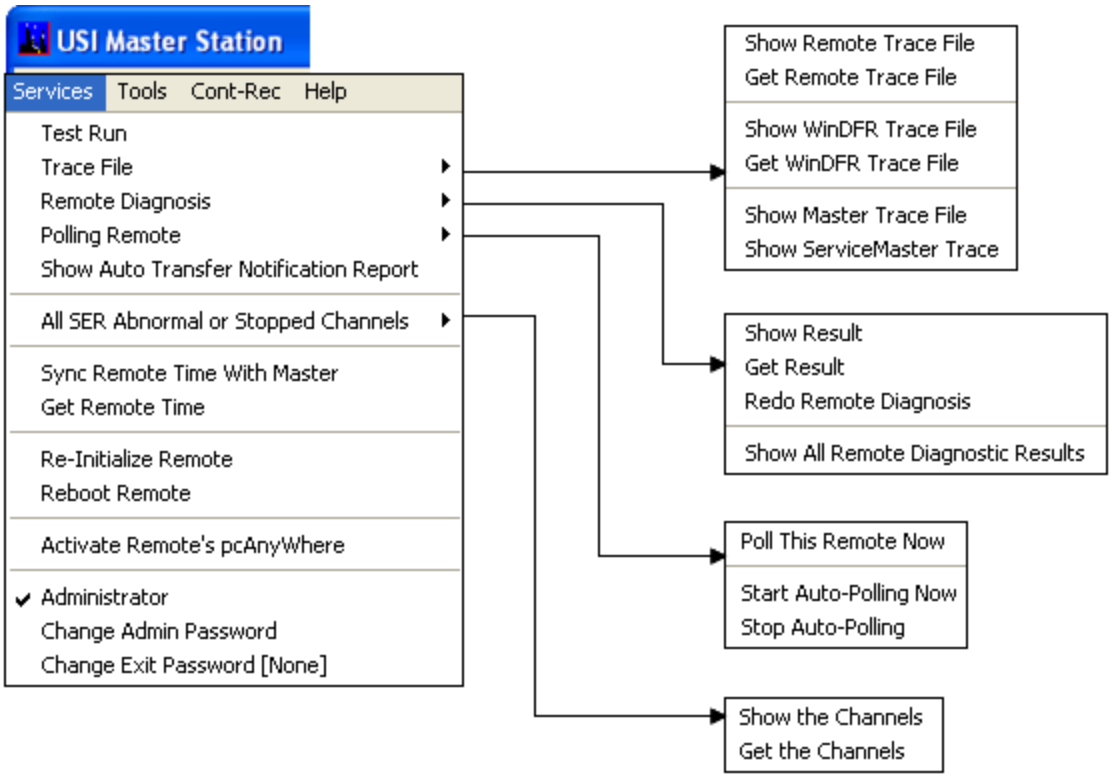


Figure 2-23 Services Menu

- **Test Run**
  This selection sends a command to the DME system to initiate a DFR Record. The letter ***Y*** displays on the ***Test*** column in the ***Quick Summary*** and ***History Data*** screens to indicate the fault was a Test Run (Sections 3.1 and 3.2).

- **Trace File**
  Trace files are log files containing internal operations, computer memory levels, and error messages of USI applications and are useful for troubleshooting. Applications which record trace files are *USIMaster*© at the master station, *WinDFR*© and *USIRemote*© at the DME system. These files are ASCII formatted and are displayed using Microsoft WordPad. Trace files are limited to 500kB in size. When a trace files reaches 500kB it is renamed changing the file extension to a sequential number (e.g. Trace01.001, Trace01.002, etc). These backup trace files may be downloaded using the File Transfer feature of *USIMaster*© (see Section 3.4).

The Master trace is located in the *USIMaster©* working directory and named *MTrace.wri*. *WinDFR©* and Remote trace files originate on the DME system and are located in the Setup folder as configured in the *WinDFR©* Configuration (Section 4.4). They are and named ***TraceXX.wri*** for *USIRemote©* and ***WTraceXX.wri*** for *WinDFR©*; where XX is the remote ID number. Once downloaded to *USIMaster©*, the trace files are saved in the *USIMaster©* Cal. Rec. Path as configured in the Master System Configuration (Section 4.1).

- **Show Remote Trace File**
  This selection displays the local copy of the Trace File for the *USIRemote©* application which was previously downloaded to the *USIMaster©*

  - Get Remote Trace File:
    This selection initiates a communication connection to the DME system, downloads the Trace File for the *USIRemote©* application, and displays it automatically.

  - Show *WinDFR©* Trace File:
    This selection displays the local copy of the Trace File for the *WinDFR©* application which was previously downloaded to the *USIMaster©*

  - Get *WinDFR©* Trace File:
    This selection initiates a communication connection to the DME system, downloads the Trace File for the *WinDFR©* application, and displays it automatically.

  - Show Master Trace File:
    This selection displays the Trace File for the *USIMaster©* application located in the working directory of the *USIMaster©* application.

- **Remote Diagnostic**
  A Remote diagnostic file is automatically updated at five minute intervals on the DME system. This file contains crucial system status information such as System Online/Offline status, clock synchronization and system time, disk drive free space, *USIRemote©* and *WinDFR©* application version numbers, and internal computer power supply voltages, temperatures, and cooling fan speeds.

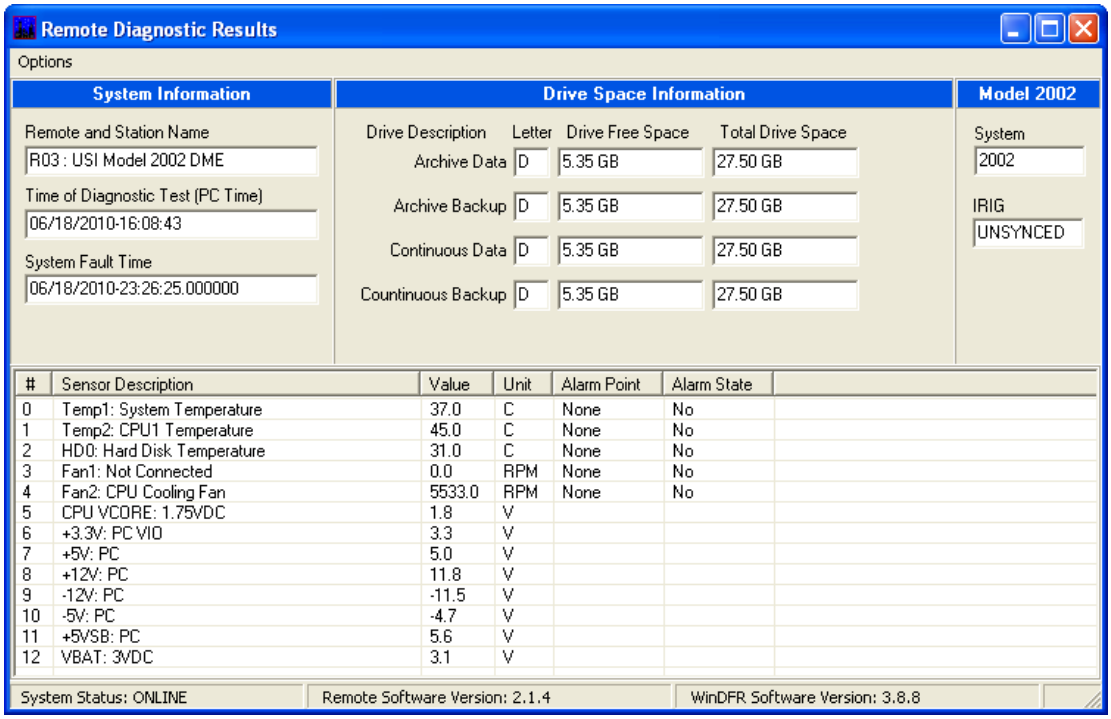


Figure 2-24 Remote Diagnostic Results

- Show Result:
  This selection opens the ***Remote Diagnostic Results*** window (Figure 2-24) and displays the local copy of the Remote Diagnostic file which was previously downloaded to *USIMaster©*

- Get Result:
  This selection initiates a communication connection to the DME system, downloads the Remote Diagnostic file, and opens the ***Remote Diagnostic Results*** window (Figure 2-24) displaying it automatically

- Redo Remote Diagnosis:
  This selection initiates a communication connection to the DME system, sends a command to redo the Remote Diagnostic file, downloads the Remote Diagnostic file, and opens the ***Remote Diagnostic Results*** window (Figure 2-24) displaying it automatically.

- Show All Remote Diagnostic Results:
  This selection opens the ***Remote Diagnostic Results*** window displaying the diagnostics summary of all DME systems that have been downloaded to the *USIMaster©*.

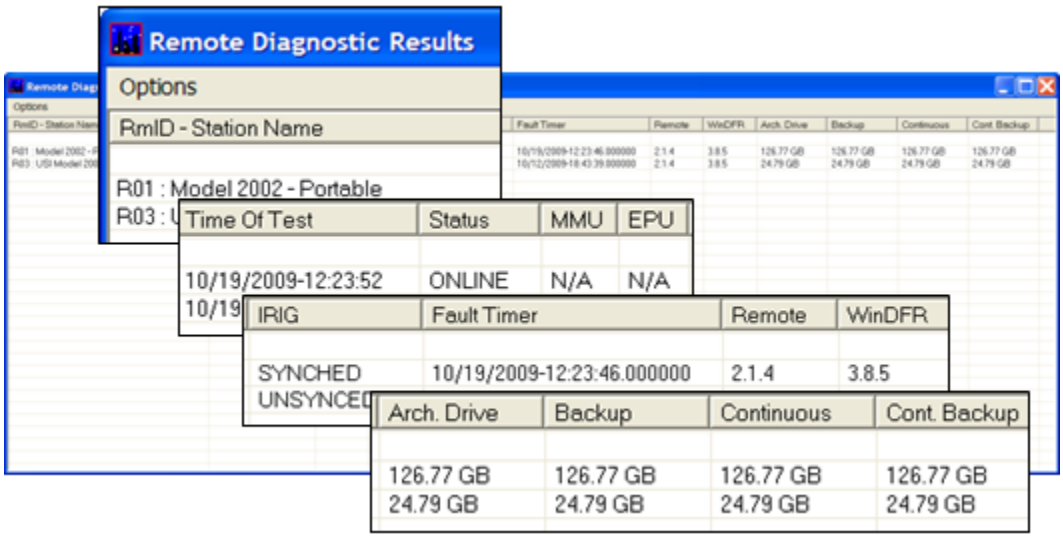


Figure 2-25 Show All Remote Diagnostics

- **Polling Remote**
  Polling is used to retrieve files from selected DME Systems specified in the ***Master Configuration***.

  - Poll This Remote Now:
    This selection will initiate the polling sequence for the selected DME system (Figure 2-25). The polling sequence initiates a communication connection and downloads both the Remote Diagnostic file and the Quick Summary file from the DME system.

  - Start Auto-Polling Now:
    Select to manually initiate Auto-Polling. Auto-Polling must have been enabled in the Master Configuration for this to succeed (Section 4.1.2).

  - Stop Auto-Polling:
    Select Stop Auto-Polling to terminate any Auto-Polling in progress.

- **Show Auto Transfer Notification Report**
  This selection displays the Show Auto Transfer Notification Report window.

  When automatic communication takes place between *USIMaster*© and a DME system the ***Auto Transfer Notification Report*** displays automatically (Figure 2-26). If the report has been closed, select this item on the Services menu to re-open it. See Section 4.1 for instructions to configure auto-polling, and Section 4.4 to configure auto-calling.

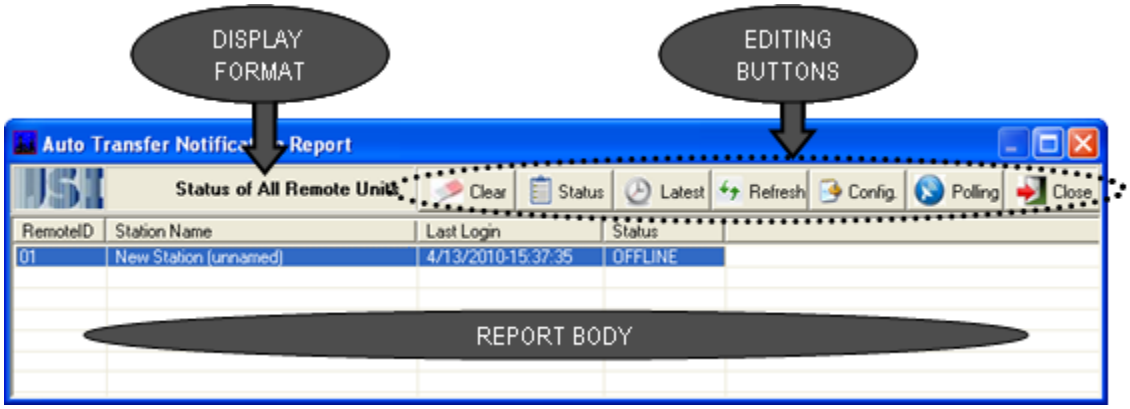


Figure 2-26 Auto Transfer Notification Report

This window displays a summary of automatic communications which have taken place. The Editing buttons across the top (Figure 2-27) are used to edit the report.

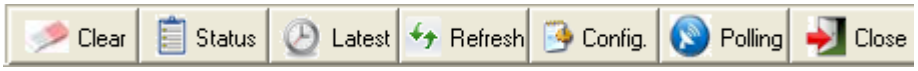
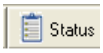


Figure 2-27 Editing Buttons - Auto Transfer Notification Report

The Editing buttons are used to initiate the following actions:

Use the ***Clear*** button to remove selected DME systems from the report. Each row in the report body displays data from a single reporting DME system. Selecting rows in the report body will activate the ***Clear*** button; clicking the ***Clear*** button will permanently remove the selected rows from the report. The removed DME systems will be re-inserted into the report the next time automatic communication occurs.



The ***Status*** button is used to report general health of all DME systems and the communication media to all DME systems that are configured to be polled in *USIMaster*© or to auto-call in the *WinDFR*© applications.

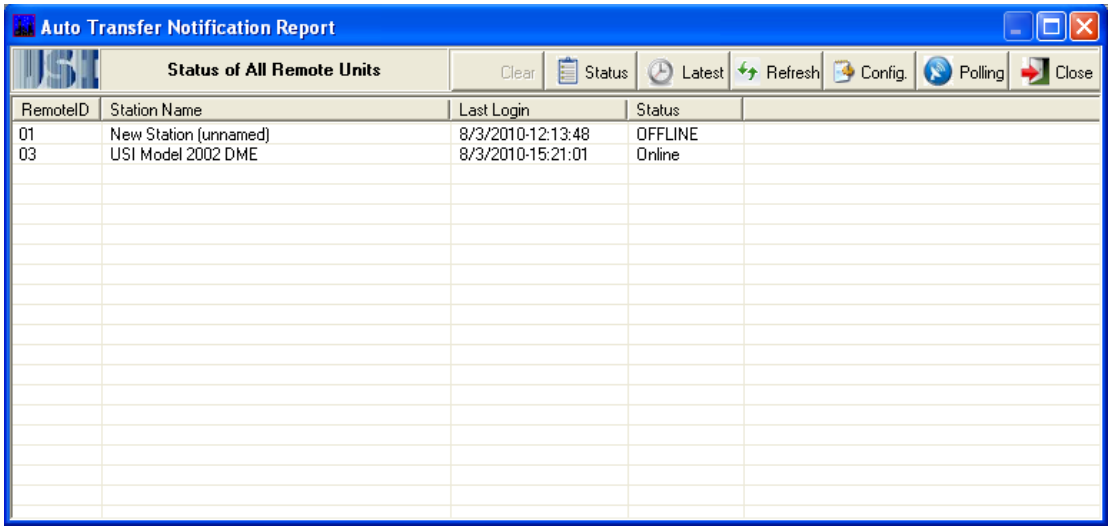


Figure 2-28 Auto Transfer Notification Report – Status Display

- Remote ID:
  The ***RemoteID*** column displays the unique ID number assigned to the DME system in the selected row.

- Station Name:
  The ***Station Name*** displays the name assigned to the DME system in the Calibration Record (Section 4.2).

- Last Login:
  The ***Last Login*** column displays the date that the selected DME system last logged into the *USIMaster©* application.

- Status:
  The ***Status*** column displays the condition of the DME system at the time of last login, either ***Online*** or ***OFFLINE.*** If *USIMaster©* was not able to log into the DME system, ***NO ANSWER*** is displayed.

The ***Latest*** button is used to filter the report to display only DME systems which have exercised automatic communication with *USIMaster©* and have downloaded a Quick Summary or COMTRADE data files within the configured time period. The ***Config*** button and dialogue box are used for defining the reporting period. Default time is the previous 24 hours (Figure 2-29). The data entries in this report indicate that the displayed DME system has triggered and that new data was transferred to *USIMaster©* within the reporting period.

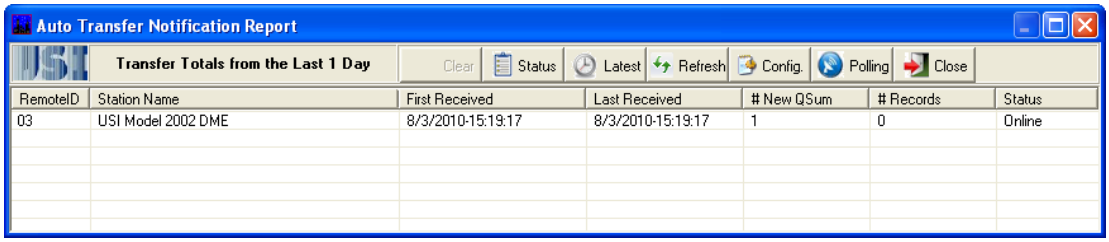
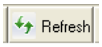


Figure 2-29 Auto Transfer Notification Report – Latest Display

- The RemoteID column displays the unique ID number assigned to the DME system in the selected row.
- The Station Name displays the name assigned to the DME system in the Calibration Record (see Section 4.2).
- The First Received column displays the date and time of the first transfer of a Quick Summary or COMTRADE data file.
- The Last Received column displays the date and time of the last transfer of a Quick Summary or COMTRADE data file.
- The # New QSum column displays the total number of Quick Summary files containing new listings that were downloaded to *USIMaster©* within the configured time period.
- The # Records column displays the total number of COMTRADE records that were downloaded to the *USIMaster©* within the configured time period.
- The ***Status*** column displays the condition of the DME system at the time of last login, either ***Online*** or ***OFFLINE.***



The ***Refresh*** button updates the ***Auto Transfer Notification Report.***

The ***Config*** button is used for defining the reporting period. Default time is the previous 24 hours (Figure 2-30).

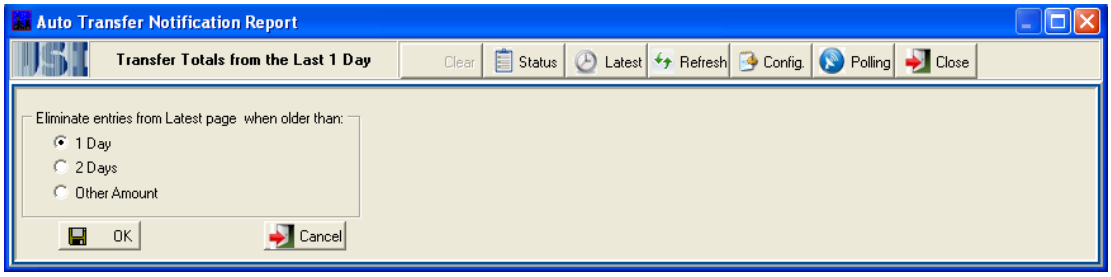


Figure 2-30 Auto Transfer Notification Report – Configuration Display

Polling The ***Polling*** button is used to initiate the Polling sequence. Auto-Polling must have been enabled in the Master Configuration for this to succeed (Section 4.2).

Close The ***Close*** button closes the ***Auto Transfer Notification Report*** window. To reopen the report, select ***Show Auto Transfer Notification Report*** on the Services menu.

- Right-click on DME system in the Auto Transfer Notification Report to display the right-click menu as shown in Figure 2-31. Select one of the following:

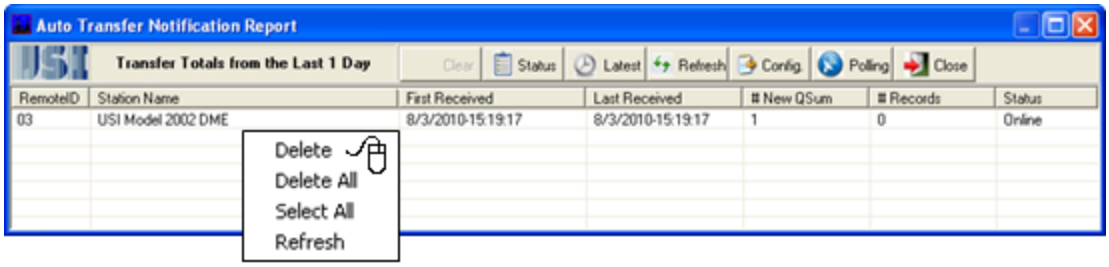


Figure 2-31 Auto Transfer Notification Report – Right-click menu

  - Delete:
    Deletes selected DME systems from the report; same as the ***Clear*** button.

  - Delete All:
    Deletes all DME systems displayed on the report.

  - Select All:
    Selects all DME systems displayed on the report.

  - Refresh:
    Refreshes (updates) the report; same as the ***Refresh*** button.

- **All SER Abnormal or Stopped Channels**
  An SER channel is defined as ***Abnormal*** when the state of the digital input contradicts the normal state setting in the Calibration Record (Section 4.2.1). An SER channel is defined as ***Stopped*** when it is set to ***Stop*** (Section 4.2.4, or has exceeded the SER Auto-Stop conditions set in the Calibration Record (Section 4.2.1).

  - Select ***Show the Channels*** to display the SER Abnormal or Stopped Channels previously uploaded to *USIMaster©* (Figure 2-32).

  - Select ***Get the Channels*** to initiate *USIMaster©* communications with the currently selected DME System, to download, and to display the SER Abnormal or Stopped Channels (Figure 2-32).

Figure 2-32 Show SER Abnormal or Stopped Channels

- **Sync Remote Time With Master**
  Select to send a command to synchronize the DME system PC clock and Fault Time Clock with the Master Station PC clock.

Caution: The ***Sync Remote Time With Master*** command could cause the DME System timing to become temporarily unstable if the DME system was previously synchronized to a GPS clock.

- **Get Remote Time**
  This selection retrieves the PC Time of the DME system. A question box displays (Figure 2-33).

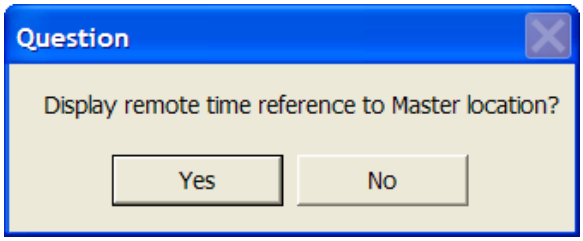


Figure 2-33 Display remote time reference to Master location?

Select ***No*** to display the DME system PC time directly. Select ***Yes*** to convert the time to the same time zone as the master station PC. For example, if the master station PC clock time zone is set to GMT-05:00 and reads ***2:00 PM*** and the DME System PC clock time zone is set to (GMT-06:00) and reads ***1:00 PM;*** clicking ***No*** would display the DME System PC time as ***1:00 PM*** and clicking ***Yes*** would display the DME System PC time as ***2:00 PM***. This feature enables users at the

master station to confirm the DME system time and the time zone setting of the DME system PC clock.

Note: When an IRIG-B signal is used to synchronize the DME System Fault Timer, the PC Clock time will not be in exact agreement with the data time stamp values as the IRIG-B synchronization method is more accurate than the PC clock.

- **Re-Initialize Remote**
  Select to send a re-initialize command to the *WinDFR*© and USIRemote© applications running on the DME system.

- **Reboot Remote**
  This selection sends a command that reboots the DME system.

- **Activate Remote's pcAnyWhere**
  Symantec pcAnywhere© (Host and Remote) is a third-party application supplied with each DME system to allow remote-control accessibility and file transfer capabilities from the master station PC. It may be used to install software updates remotely, to perform maintenance, and to run diagnostics via dial-up modem or Ethernet (LAN/WAN) communication media.

  This selection requires the installation of Symantec pcAnywhere© on the master station computer and a shortcut to pcAnywhere created in the *USIMaster*© working directory named ***shortcutpcAnywhere***. Then Remote Control shortcuts to each DME system may be configured within the pcAnywhere© application. Symantec pcAnywhere© is factory installed on each DME system and preconfigured for a ***Host*** session.

  Selecting ***Activate Remote's pcAnyWhere***© will initiate a communication session with the selected DME system and send a command to the *WinDFR*© application starting the pcAnywhere host session and disable *WinDFR*© from monitoring for incoming calls. Additionally, *USIMaster*© automatically runs the shortcut named shortcutpcanywhere to open the Symantec pcAnywhere© application on the master station.

  Users may then select the Remote Control shortcut within pcAnywhere© to initiate a remote control session. When the connection is successful the desktop of the DME system computer will display at the master station and users will have remote control of the DME system from the master station PC. For details of Symantec pcAnywhere© features, please review the third-party documentation or online help.

  When the remote-control session is terminated at the master station, the host session will also terminate on the DME system and *WinDFR*© will automatically resume monitoring for incoming calls.

- **Administrator**
  Administrator is a level of password protection that prevents setting changes from being made by unauthorized users. This feature prevents changes in *USIMaster©* or DME system setup and disables the ability to send certain commands to the DME systems. When ***Administrator*** is selected, the system prompts the user to enter the Administrator password. If the password is entered correctly: a check-mark displays beside this menu item; the administrator access icon color changes from red to green; and administrator level privileges are granted.

  Administrator privileges allow users to save *USIMaster©* and DME system setup files and upload them to the DME system. If ***Administrator*** is not checked, users will be prompted to enter the administrator password when a ***Save*** button is selected.

  Non-administrator users may open setup files and download Quick Summary, History Data, and SER Data and open these files as well, but may not save or upload changes to *USIMaster©* or the DME system.

- **Change Administrator Password**
  This selection allows Administrator users to set or modify an Administrator password. This window allows Administrator users to set or modify an Administrator password. Knowledge of the present administrator password is required to change the password.

- **Change Exit Password**
  This selection allows Administrator users to set or modify an Exit password for *USIMaster©*. When an Exit password has been created, *USIMaster©* will prompt users for the password before the application will close.

2.1.5 Tools

The following selections are available on the ***Tools*** menu (Figure 2-34) of the *USIMaster©* header screen (Figure 2-1):

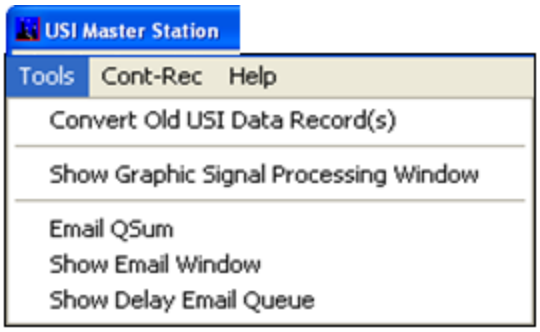


Figure 2-34 Tools Menu

- **Convert Old USI Data Records**
  This selection displays the ***Convert Old USI Data Record(s) to USI Comtrade File(s)*** window (Figure 2-35) used to convert data records from Model HT/LT2000A systems into COMTRADE format.

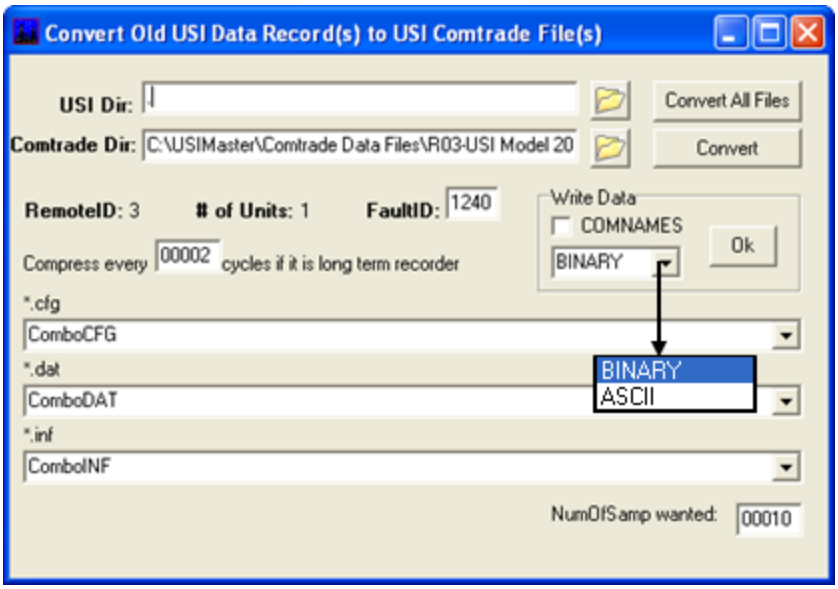


Figure 2-35 Convert Old Files Window

- Click in the field next to ***USI Dir:*** and type in the path where the HT/LT2000A data files are located or select the browse folder button to select the path from the Browse for Folder window.

- Click in the field next to ***Comtrade Dir:*** and type in the path where the COMTRADE data files are to be saved or select the browse folder button to select the path from the Browse for Folder window.

- Selecting the ***Convert All Files*** button will initiate a process to convert all HT/LT2000A formatted data files located in the USI Dir: path into COMTRADE format and to store them in the Comtrade Dir: path.

- The ***Convert*** button is used in conjunction with the ***FaultID:*** field to convert a specific HT/LT2000A formatted data file to COMTRADE format. This is done by entering the specific fault ID number into the ***Fault ID*** field and clicking the ***Convert*** button.

- ***COMNAMES*** can be selected in the ***Write Data*** box to enable the IEEE PC37.232 naming practice of the COMTRADE formatted files.

- ***BINARY*** or ***ASCII*** can be selected in the ***Write Data*** box to choose the format of the COMTRADE ***.dat*** file.

- The numerical field within the ***Compress Every 00002 cycles if it is long term recorder*** setting is used when converting Long Term data files from an LT2000A DFR. This setting is used to automatically create a Long Term RMS data file (i.e. COMTRADE file containing calculated RMS values from the Long Term oscillography data file). The number of cycles entered in this field provides both the window size for the RMS calculation and the calculation frequency for the Long Term RMS data file.

- To view converted files, click on the down arrow on the ****.cfg***, ****.dat*** or ****.inf*** boxes. The number of lines to be viewed is set in the ***NumOfSamp wanted:*** field.

- **Show Graphic Signal Processing Window**
  This selection displays the ***Graphic Signal Processing*** window. This window is used to analyze COMTRADE formatted data files (see Section 5 for details).

- **E-mail Qsum**
  This command sends an E-mail message containing the ***Quick Summary*** file (***Rxx.sum***) to all E-mail recipients as configured in the Master Configuration E-mail Settings (see Section 3.1 for details). The Master Station PC must have an internet connection and an SMTP/POP3 E-mail account in order to use E-mail features.

- **Show E-mail Window**
  This selection displays the Send E-mail window (Figure 2-36). From this window E-mail settings can be customized to define what information is to be sent and to whom. This window can also be used to send an E-mail message manually. The Master Station PC must have SMTP/POP3 E-mail account and connectivity in order to use the E-mail feature.

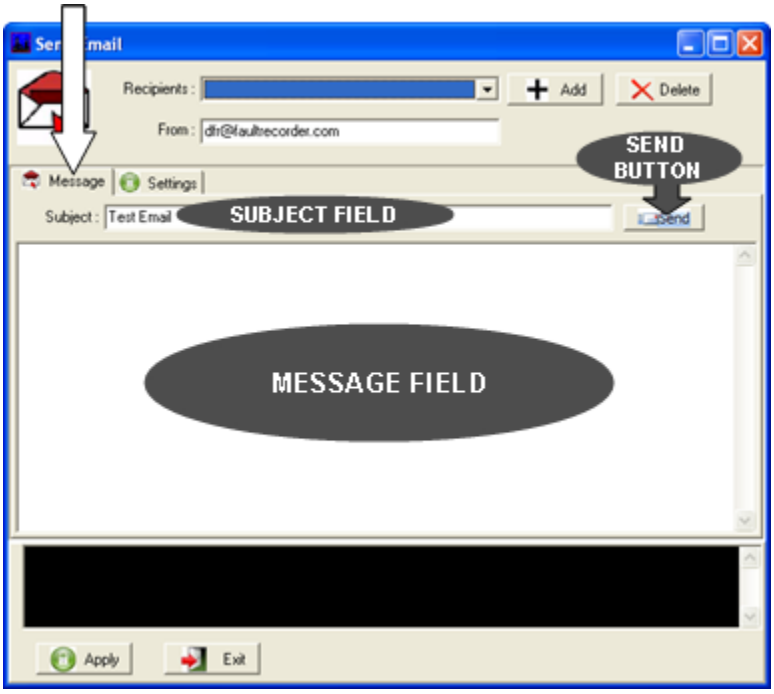


Figure 2-36 Send E-mail Window – Message Tab

- From the header section of this window, users can **Add** Add and **Delete** Delete E-mail addresses from the ***Recipients*** list and edit the ***From*** field to show the E-mail address of the master station.

- The ***Message*** screen tab (Figure 2-36) is an E-mail editor screen used to send an E-mail message manually to the E-mail addresses on the ***Recipients*** list. When the ***Recipients*** list, ***Subject*** field, and ***Message*** field have been completed, send the message by clicking the ***Send*** Send button.

    - Subject field:
      When manually preparing an E-mail, enter a message subject in this field.

Note: The subject field of E-mail messages sent automatically by *USIMaster*© is populated with the unique Remote ID number and Station Name of the recorder about which the message pertains.

    - Message field:
      When manually preparing an E-mail, enter the body of the message in this field.

Note: When automatic E-mail messages are sent by *USIMaster*© this field is populated with Quick Summary and Distance-to-Fault information for the DME record which initiated the E-mail message. If the Lightning Data Correlation option is enabled on *USIMaster*©, results of the automatic lightning correlation query will be included in the message body also.

- The ***Settings*** screen tab (Figure 2-37) allows users access to the ***Limitations*** and ***Email Server*** settings

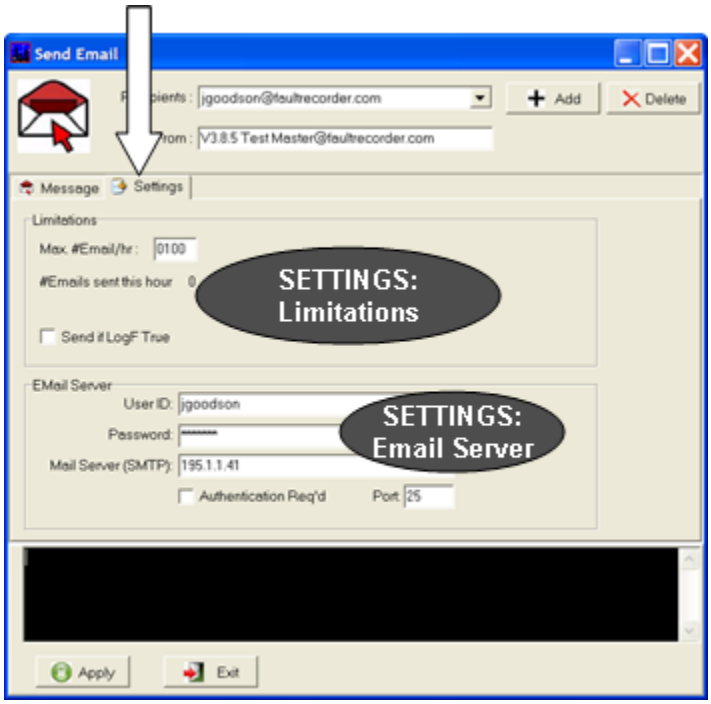


Figure 2-37 Send E-mail Window – Settings

- Limitations

  Max. #Email/hr:
  This setting limits the number of messages sent automatically by the *USIMaster*© application in a single 60 minute period.

  #Emails sent this hour
  This file displays the number of email messages which were sent this hour.

  Send if LogF True
  This check box enables the use of the Boolean Auto Call, Auto Email, and Auto Print decision logic to be applied to E-mail messages sent automatically by the *USIMaster*© application (Section 4.1.2). When this box is checked an automatic E-mail is

filtered by the Boolean decision logic, as entered in the WinDFR configuration, and sent on if the logic is true (Section 4.4).

- E-mail Server
  User ID:
  This field is used to enter the User ID for the E-mail account assigned to the master station.

  Password:
  This field displays allowing users to enter the User Password for the email account assigned to the master station. If no password is required by your mail server, this field may be left blank.

  Mail Server (SMTP):
  This field is used to enter the IP address of the SMTP Mail Server

  Authentication Req'd:
  this check box displays allowing users to enable authentication, if required by your mail server.

  Port:
  This field allows users to enter the port number of the IP address being used for E-mail message transport.

Note: The ***Outgoing Mail (SMTP)***, ***Port #***, *and* ***User ID*** fields must be entered. Contact your network administrator for this information.

- Apply The **Apply** button is used to save ***Settings*** entered within the Send E-mail window.
- Exit The **Exit** button is used to close the Send E-mail window.

- **Show Delay Email Queue**
  This selection displays the ***Email Delay Queue*** window (Figure 2-38). This feature is only enabled when the ***Lightning Data Correlation*** option is enabled in *USIMaster©*. This window is used to display E-mail messages that are temporarily stored in the E-mail queue while awaiting results from the automatic lightning data query. The length of time which E-mail messages are held in the queue is controlled by the ***Delay Time to Allow Lightning Data to Become Available*** setting in the ***Master System Configuration*** (Section 4.1 for details).

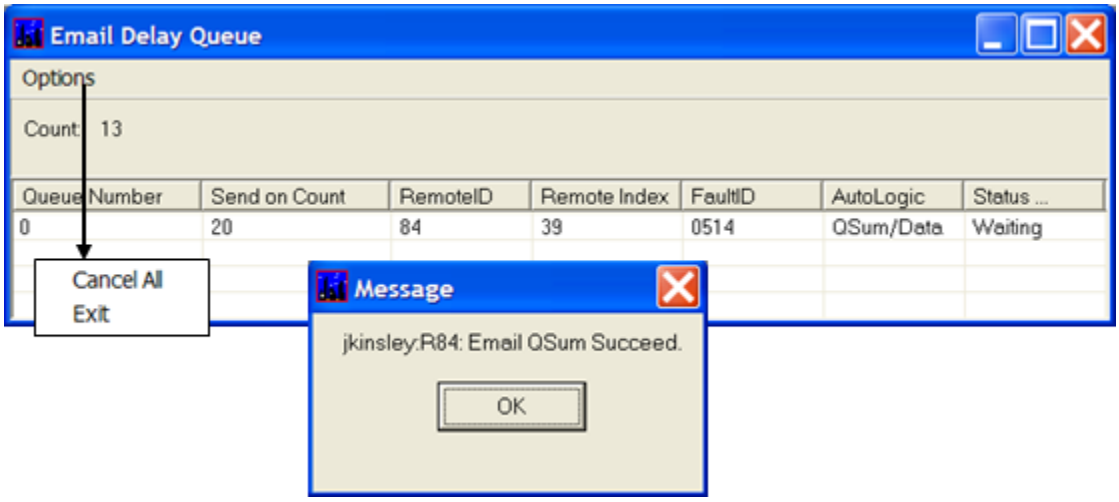


Figure 2-38 Send E-mail Delay Queue Options menu

- Options:
  Click on ***Options*** to drop down a menu with the following choices:
  - Cancel All
    This selection clears all messages from the E-mail delay queue.
  - Exit
    This selection closes this window without changing the queue.
- Count Field:
  This counter starts at zero (0) and increments by one (1) every six seconds.
- Queue Number:
  The Queue Number is the sequential number assigned to each message as it is entered into the E-mail queue FIFO.
- Send on Count:
  When the number in the Count field reaches this number, the E-mail message is sent and the item is deleted from the queue.
- RemoteID:
  This column displays the unique remote identification number of the DME System which initiated the E-mail message.
- Remote Index:
  This is a troubleshooting aid for use by USI service personnel only.
- FaultID:
  This column displays the unique identification number of the DME record summary in the queue.

- AutoLogic:
  This column displays what information will be sent to *USIMaster*© from each DME system during an auto-poll. This response is set on the ***WinDFR*© *Configuration*** screen (Section 4.4). One of the following is listed for each DME system:
  - Quick Summary
  - Quick Summary and Data
- Status … :
  This column displays the current status of each message in the queue.
  - Waiting
    Message is waiting to be sent.
  - In Process
    Message is in the process of being sent. Item will be cleared from the queue when sending is complete.

2.1.6 Cont-Rec

The following selections are available on the ***Cont-Rec*** menu (Figure 2-36) of the *USIMaster*© header screen (Figure 2-1). This menu provides access to the Continuous Recording (***Cont-Rec***)/ Disturbance data. ***Cont-Rec*** data is used in the analysis of wide-area disturbances to locate a disturbance source. ***Cont-Rec*** settings are located in the *WinDFR*© ***Configuration Record*** (Section 4.4.3). Continuous recordings of Frequency, RMS, and Phase values as well as recordings of Continuous Oscillography samples are derived from the ***Long Term Recording*** data.

Note: ***Long Term Recording*** must be enabled in order to enable the ***Cont-Rec*** features (Section 4.2.1).

The recording rate for Continuous Frequency, RMS, and Phase values is selected in the *WinDFR*© ***Configuration Record*** (Section 4.4.3). The sample rate for the Continuous Oscillography is the same as the ***Long Term*** sampling rate set in the Calibration Record (Section 4.2.1).

Cont-Rec data is stored on the DME system in daily files (midnight-to-midnight) for up to 90 days. After the specified number of ***Days to Record,*** the system begins to overwrite the oldest data.

The selections made in this menu (Figure 2-39) are used to request a desired time-slice of the Continuous Data from the bulk data files stored on the DME system. The retrieved data will be stored in a COMTRADE-formatted file in *USIMaster*© for later analysis.

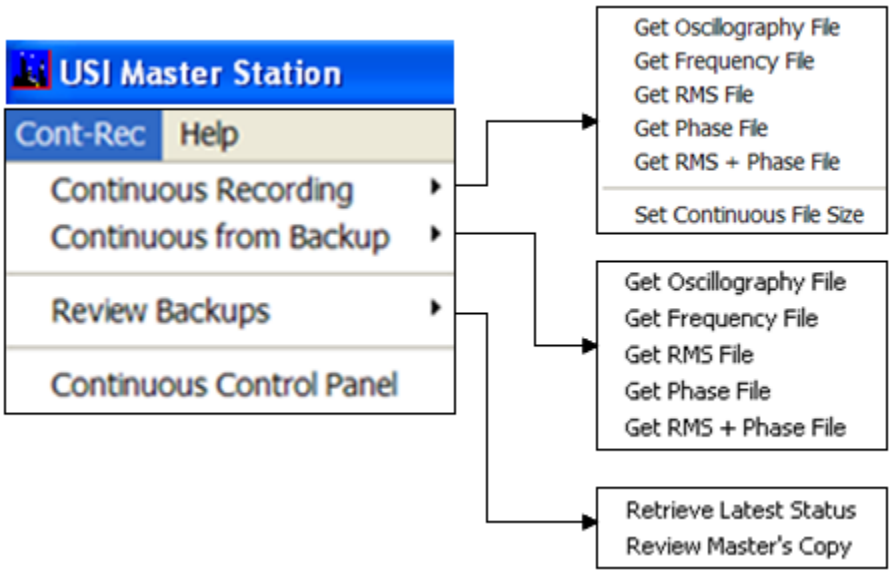


Figure 2-39 Continuous Recording Options Menu

- **Continuous Recording**

  - Get Frequency File:
    Select to initiate a communication connection with the Continuous Frequency data stored on the Continuous Archive path of the DME system. Continuous Frequency data is made up of calculated values recorded at the rate specified in the *WinDFR©* ***Configuration Record*** (Section 4.4.3).

  - Get RMS File:
    Select to initiate a communication connection with the Continuous RMS data stored on the Continuous Archive path of the DME system. Continuous RMS data is made up of calculated values recorded at the rate specified in the *WinDFR©* ***Configuration Record*** (Section 4.4.3).

  - Get Phase File:
    Select to initiate a communication connection with the Continuous Phase data stored on the Continuous Archive Path of the DME system. Continuous Phase data is made up of calculated values recorded at the rate specified in the *WinDFR©* ***Configuration Record*** (Section 4.4.3).

  - Get RMS + Phase File:
    Select to initiate a communication connection with the Continuous RMS + Phase data stored on the Continuous Archive Path of the DME system. Continuous RMS + Phase data can be used to calculate Continuous Apparent Power, Active Power, Reactive Power, Power Factor, or Impedance by utilizing the line group, three phase, or single phase

analysis format available in the Graphic Signal Processing window (Section 5).

- Get Oscillography File:
  Select to initiate a communication connection with the Continuous Oscillography data stored on the Continuous Archive Path of the DME system. Continuous Oscillography data is made up of sampled data recorded at the same sample rate selected for Long Term recording in the Calibration Record (Section 4.2.1).

- Set Continuous File Size:
  Select to modify the default Continuous Data file size of the selected DME system. When Continuous Data is selected, the data is saved into a COMTRADE IEEE C37.111-1999 formatted file for analysis. This format requires single ***.dat*** files to be limited to 1.44MB or smaller. When Continuous Data is recorded for several days the required file size is greater than 1.44MB and multiple 1.44MB data files would have to be created to store it. Rather than following this multiple COMTRADE file approach, USI limits Continuous Data to a single ***.dat*** file but gives the user the ability to set the file size limit.

Note: If the requested time-slice of Continuous Data results in data volumes greater than the Continuous File Size limit, the number of calculated data values will be reduced by a common denominator to fit within the entered file size.

Note: The ***Continuous File Size*** setting is NOT a global setting across all DME systems. It is a unique setting applied to the selected DME system.

- **Continuous From Backup**

  - Get ***Frequency*** File:
    Select to initiate a communication connection accessing the Continuous Frequency data stored on the Continuous Backup Path of the DME system.

  - Get ***RMS*** File:
    Select to initiate a communication connection accessing the Continuous RMS data stored on the Continuous Backup Path of the DME system.

  - Get ***Phase*** File:
    Select to initiate a communication connection accessing the Continuous Phase data stored on the Continuous Backup Path of the DME system.

  - Get ***RMS + Phase*** File:
    Select to initiate a communication connection accessing the Continuous

RMS + Phase data stored on the Continuous Backup Path of the DME system.

- Get ***Oscillography*** File:
  Select to initiate a communication connection accessing the Continuous Oscillography data stored on the Continuous Backup Path of the DME system.

Note: Selecting ***Get Oscillography File, Get Frequency File***, ***Get RMS File***, ***Get Phase File***, or ***Get RMS + Phase File*** from the ***Continuous Recording*** or ***Continuous from Backup*** menus initiates a communication connection with the DME system and displays the ***Create Comtrade Data File*** window shown in Figure 2-42. This window is used to access Continuous Data running any version of the WinDFR© software on the DME system. The ***Continuous Control Panel*** (Figure 2-43) also allows access to Continuous Recording data, but requires *WinDFR*© version V3.8.2 or newer software.

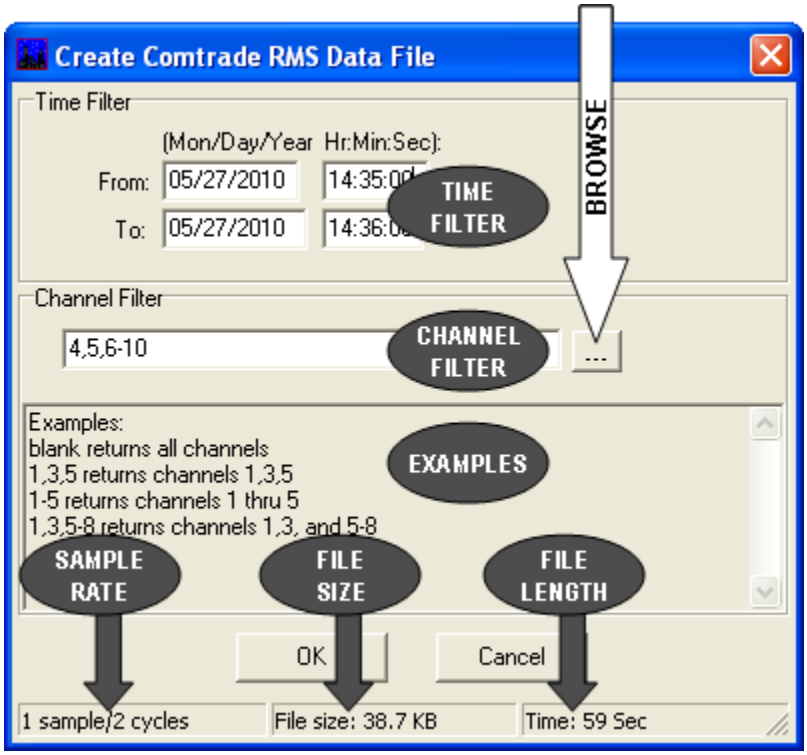


Figure 2-40 Continuous Recording - Create COMTRADE Data File Window

- Time Filter:
  The dates and times presented in the ***Time Filter*** fields display the range of time available for the selected Continuous Data. Edit these fields to select the desired range of data to be downloaded to *USIMaster*© for analysis and click the OK ***OK*** button.

- Channel Filter:
  The channel filter field is used to specify the DME system analog input channels from which the Continuous Data values are to be retrieved. Click the ***Browse*** button [---] to display the Select Continuous Channels window (Figure 2-41). From this window select the channels that contain the desired data.

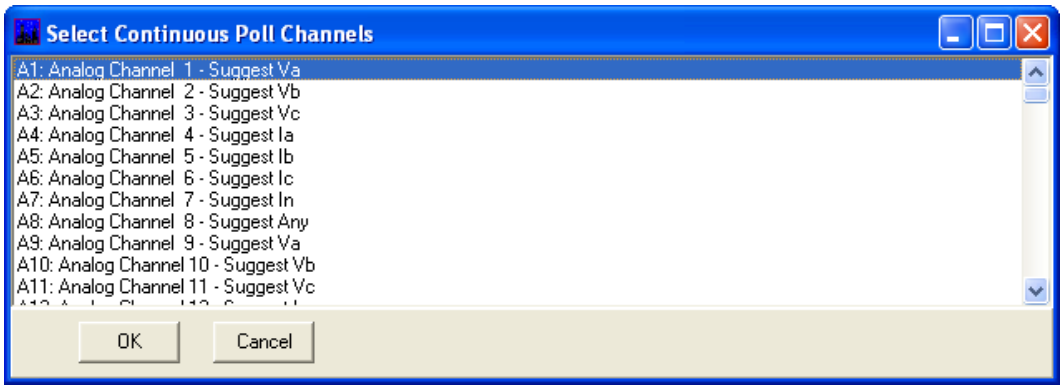


Figure 2-41 Continuous Recording - Select Continuous Channels Window

  - Use ***Ctrl+Left-click*** to select multiple channels and click the [OK] ***OK*** button to enter the respective input numbers into the ***Channel Filter*** field. If the analog input channel numbers are known, they may also be manually entered into the ***Channel Filter*** field as shown in the Examples section (Figure 2-40). Leaving the ***Channel Filter*** field empty selects every analog channel on the DME system.

- Status Information:
  Based on the time-slice of data selected in the ***Time Filter*** and the number of channels selected in the ***Channel Filter***, the status information on the bottom of the ***Create Comtrade Data File*** window displays the sample rate of the file, the size of the file, and the time length of the file (Figure 2-40).

- OK:
  Selecting the [OK] ***OK*** button of the ***Create Comtrade Data File window*** displays the ***Save Continuous Data File window*** (Figure 2-41). Select the path and enter the file name where the COMTRADE formatted Continuous Data file is to be saved using the ***Save in*** and ***File name*** fields. The default file name follows IEEE PC37.232, D4.5 recommended practice but it can be modified directly in the ***File name*** field necessary.

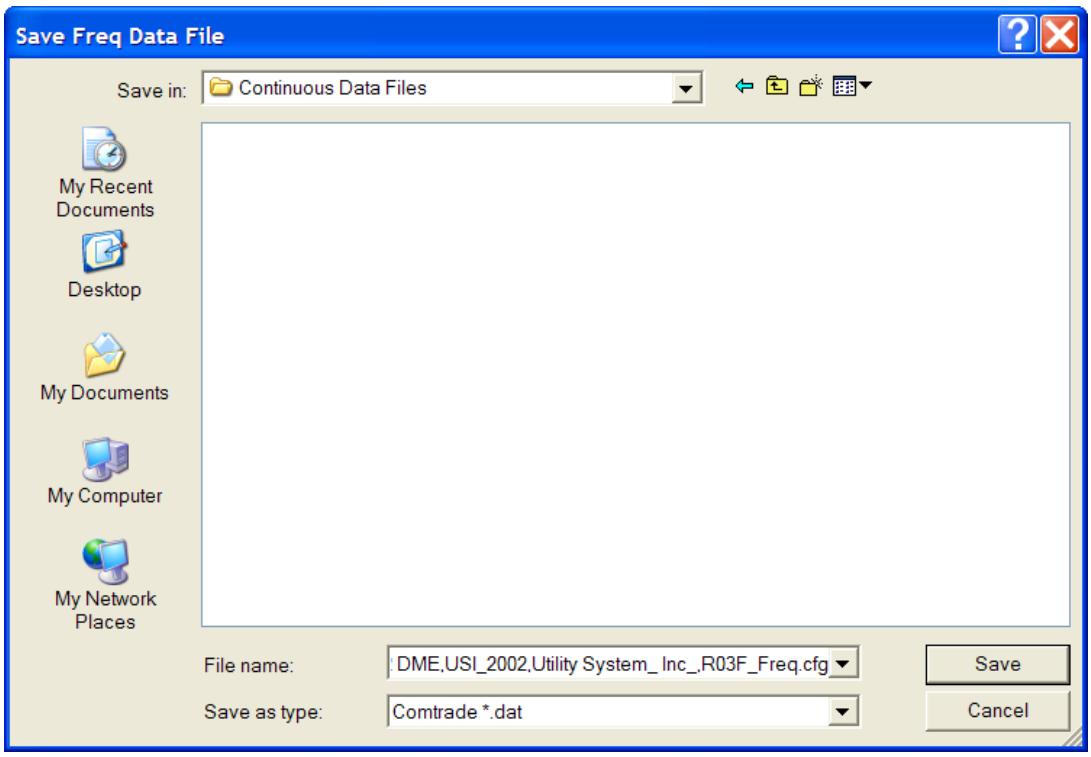


Figure 2-42 Continuous Recording – Save Continuous Data File Window

Click the Save ***Save*** button. A progress box displays indicating that the data is being packed on the DME system and that, following the packing, the file transfer will begin automatically. Progress of the transfer can be observed in the ***Communication Status*** window (Section 2.1.3).

When file transfer is complete, the ***Graphic Signal Processing*** window will open displaying the data for analysis. For details on ***Graphic Signal Processing,*** see Section 5. To re-open a Continuous Data file retrieved previously, see Section 5.

- **Review Backups**
  - Receive Latest Status:
    Select to download a ***Scheduled Backups Log*** from the selected DME system and open a window for review. Information displayed in this window includes scheduled backup time, scheduled number of days to be backed up, data source and destination paths, Continuous Data types to be backed up, and the progress of this backup operation (Figure 2-43).

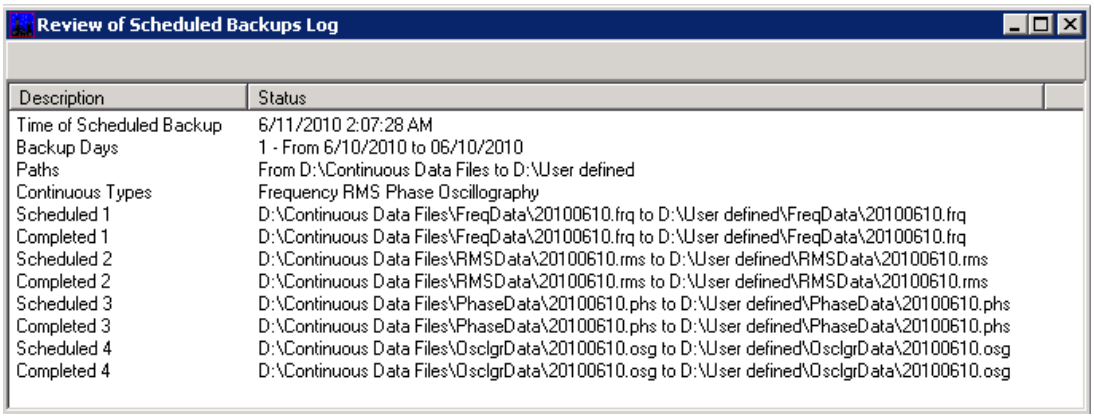


Figure 2-43 Continuous Recording - Scheduled Backups Log

- Review Master's Copy:
  Select to open the ***Review of Scheduled Backups Log*** (Figure 2-43). The local copy of the log displays. This is the version previously downloaded to *USIMaster©*.

- **Continuous Data Control Panel**
  The ***Continuous Data Control Panel*** allows flexible access to Cont-Rec data on DME systems running *WinDFR©* V3.x.x or later. Using the Retrieve Continuous Data screen tab of this panel provides access to Continuous Recorder data in the same location discussed above and additional file paths not available from the ***Continuous Recording*** and ***Continuous from Backup*** menus (Figure 2-44).

  Additionally the ***Continuous Data Control Panel*** provides the ability to schedule a backup of raw Continuous Recorded data from DME systems. This is used to schedule the backup of high priority Continuous Data to ensure that it is not overwritten. Backup scheduling is accomplished using the Schedule Continuous Backup screen tab of the ***Continuous Data Control Panel*** (Figure 2-45).

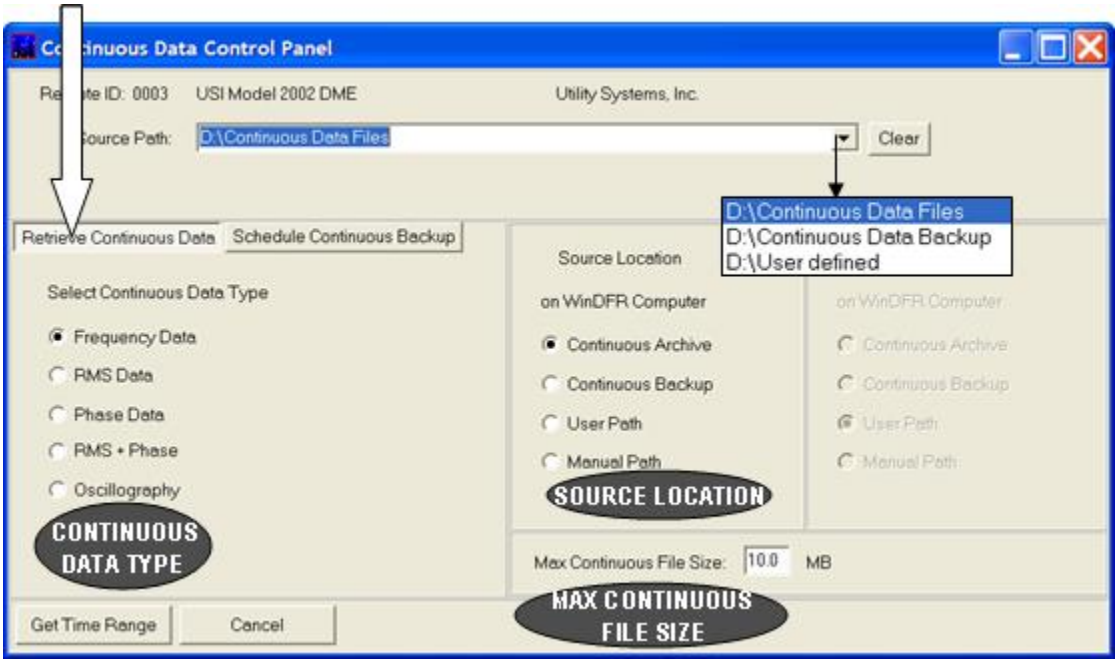


Figure 2-44 Continuous Data Control Panel – Retrieve Continuous Data

- Continuous Control Panel header:
  This section displays the ***Remote ID*** and ***Station Name*** of the selected DME system, and the ***Company Name*** as entered in the DME system ***WinDFR© Configuration*** file.

- Source Path/Source Location:
  This field displays the path from which the selected DME Continuous Data will be retrieved. The drop down list displays selection choices of Continuous Recording Archive Path, Continuous Recording Backup Path, and the Continuous Recording User Defined Path as entered in the ***WinDFR© Configuration*** file on the DME System (Section 4). These selections may also be made from the Source Location section of the Continuous Data Control Panel. If the Continuous Data is to be retrieved from a manually selected path, that path may be manually entered into this field.

- Select Continuous Data Type:
  This section allows selections of ***Frequency***, ***RMS***, ***Phase***, ***RMS + Phase***, and ***Oscillography*** Continuous Data types to be retrieved from the Source Path.

- Max Continuous File Size:
  This field displays the Max Continuous File Size configured for the selected DME system. This field can also be used to modify the Continuous Data file size of the selected DME system by entering a new value from 1.2MB to 100MB.

When ***Continuous Data*** is selected, the data is saved into COMTRADE format for analysis. This data format as specified in the COMTRADE standard requires single ***.dat*** files to be limited to 1.44MB or smaller. If the amount of data being saved is greater than 1.44MB, multiple data files are created, each limited to 1.44MB in size. As the DME system contains continuous data recorded for several days, Continuous COMTRADE data could easily result in the creation of numerous 1.44MB data files. Therefore, USI limits Continuous Data to a single ***.dat*** file but gives users the ability to alter the file size limit from 1.2MB to 100MB.

Note: If the requested time-slice of Continuous Data results in data volumes greater than the Continuous File Size limit, the calculated data values will be evenly reduced (divided by a common denominator) to fit within the entered file size.

Note: The ***Max Continuous File Size*** setting is not a global setting across all DME Systems. It is a unique setting applied to the selected DME system.

- Get Time Range Get Time Range:
  This button, shown in Figure 2-44, connects to the selected DME system and displays the ***Create Comtrade Data File*** window shown in Figure 2-40.

- Cancel Cancel:
  This button cancels the selections made on the ***Continuous Data Control Panel*** and closes the window.

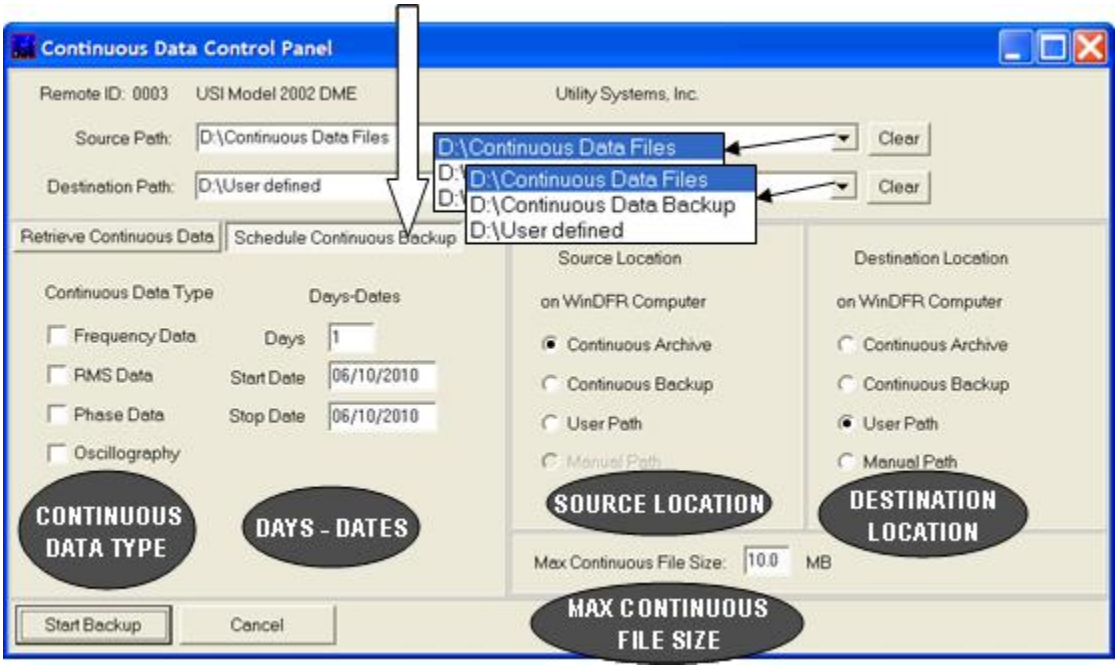


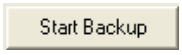
Figure 2-45 Continuous Data Control Panel – Schedule Continuous Backup

- Source Path/Source Location:
  This field (Figure 2-45) displays the path where the Continuous Data will be backed up on the selected DME system. The drop down list displays selection choices of Continuous Recording Archive Path, Continuous Recording Backup Path, and the Continuous Recording User Defined Path as entered in the ***WinDFR© Configuration*** file on the DME system (Section 4). These selections may also be made from the Source Location section of the ***Continuous Data Control Panel***. If the Continuous Data is to be retrieved from a manually selected path, that path may be manually entered into this field.

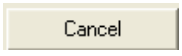
- Destination Path/Destination Location:
  This field displays the path where the Continuous Data will be backed up on the selected DME system. The drop down list displays selection choices of Continuous Recording Archive Path, Continuous Recording Backup Path, and the Continuous Recording User Defined Path as entered in the ***WinDFR Configuration*** file on the DME system (Section 4). These selections may also be made from the Source Location section of the ***Continuous Data Control Panel***. If the Continuous Data is to be backup copied to a manually selected path, that path may be manually entered into this field.

- Continuous Data Type:
  This section allows selections of ***Frequency***, ***RMS***, ***Phase***, and ***Oscillography*** continuous data types to be copied from the source path to the destination path.

- Days-Dates:
  This section allows selections of the number of days to be backup copied, the Start Date for the beginning day, and the Stop Date for the ending day to be backup copied from the source path to the destination path.

- 

  Start Backup:
  This button initiates the backup of continuous data.

- 

  Cancel:
  This button cancels the selections made on the ***Continuous Data Control Panel*** and closes the window.

2.1.7 Help

The following selections are available on the ***Help*** menu (Figure 2-46):

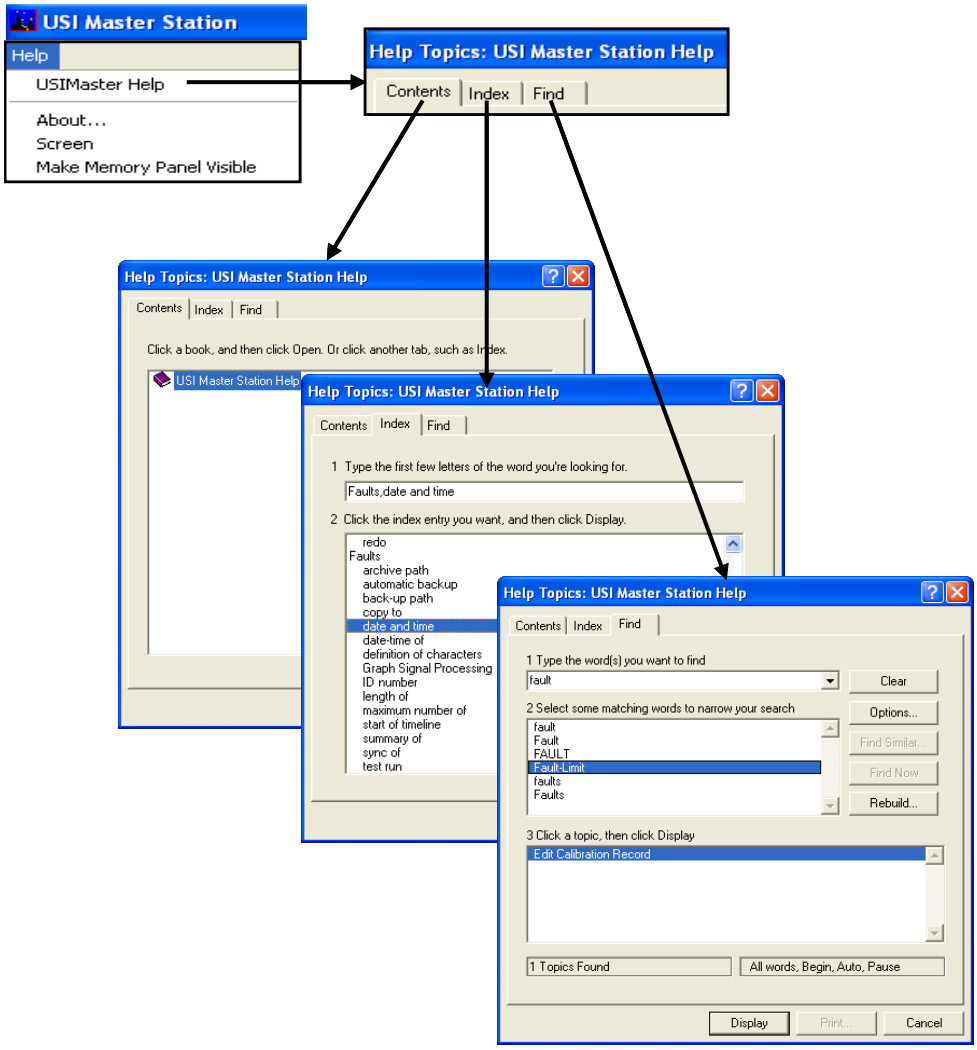


Figure 2-46 Help Menu

- ***USIMaster©* Help**
  - Contents:
    Displays the contents of the *USIMaster©* ***Help*** file.
  - Index:
    Displays the index to the *USIMaster©* ***Help*** file.
  - Find:
    Displays the screen used to search *USIMaster©* ***Help*** topics for a specific word.

- **About**
  This selection displays *USIMaster©* release version and copyright information, address, voice phone and fax numbers and Web addresses of Utility Systems, Inc. See a copy in Figure 1-1.

- **Screen**
  This selection displays the ***Screen Attributes*** window containing the Master Computer display resolution settings (Figure 2-47).

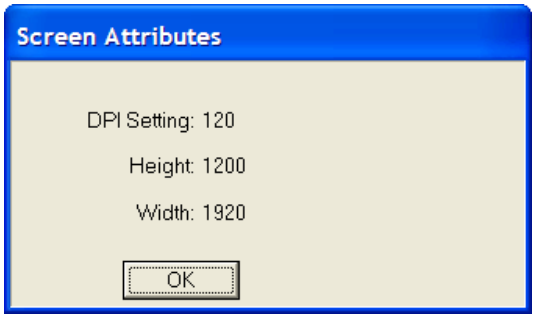


Figure 2-47 Screen Attributes

- **Make Memory Panel Visible**
  Select to open the panel shown in Figure 2-48. This panel displays, from left to right, unused (available) ***Paged***, ***Physical*** and ***Virtual*** memory percentages. This panel displays in the *USIMaster©* header screen to the left of the shortcut buttons (Figure 2-52).

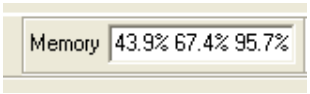


Figure 2-48 Memory Panel

2.2 USIMaster© Screens

From the *USIMaster©* header screen, select a screen from the drop-down menu (Figure 2-49).

2.2.1 DME System Selection List

Selecting the ***DME System Selection*** drop-down list displays the list of DME system station names from which a selection can be made. The name of the selected DME system is then displayed in the DME System Selection field (Figure 2-49). This drop-down list is populated with the station names of all DME systems configured with the *USIMaster©* from 1 to 9999 DME systems total.

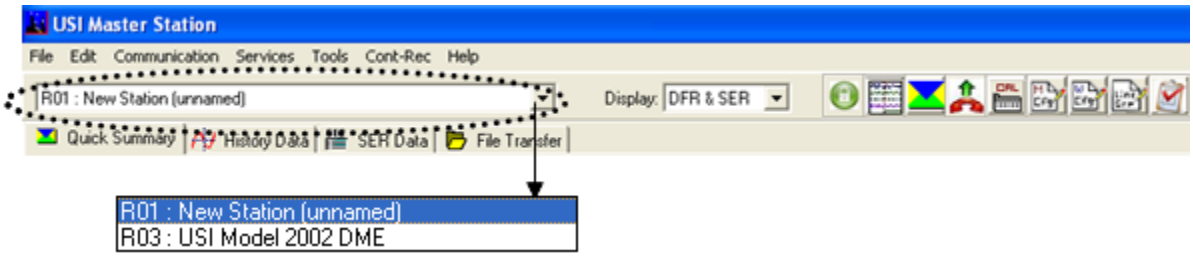


Figure 2-49 Select A Remote Station

- **DME System List – Right-click Menu**
  Right-click on the DME system selection field to display the menu shown in Figure 2-50 and Figure 2-51.

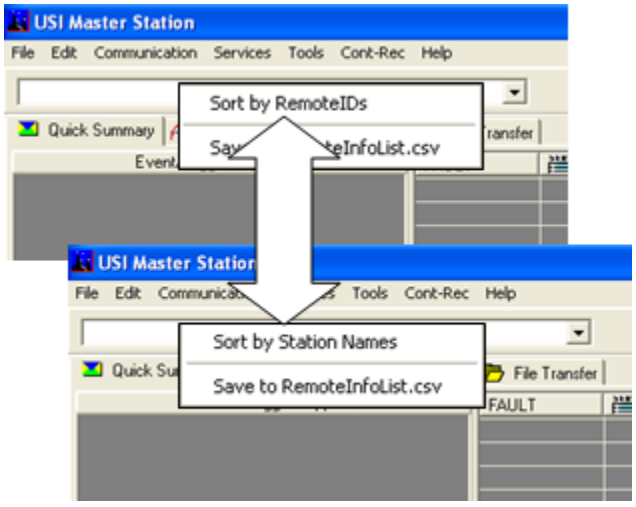


Figure 2-50 Sort Remote List

  - Sort by Station Names/Sort by Remote IDs:
    The first item on the drop-down list displays either ***Sort by Remote IDs*** or ***Sort by Station Names***. This selection toggles between these two sort choices (Figure 2-50)

Sort by RemoteIDs will sort the DME system drop-down list numerically by the ***Remote ID*** number assigned to the DME system.

Sort by Station Names will sort the DME system drop-down list alphabetically by the ***Station Name*** assigned to the DME system.

- Save to RemoteInfoList.csv:

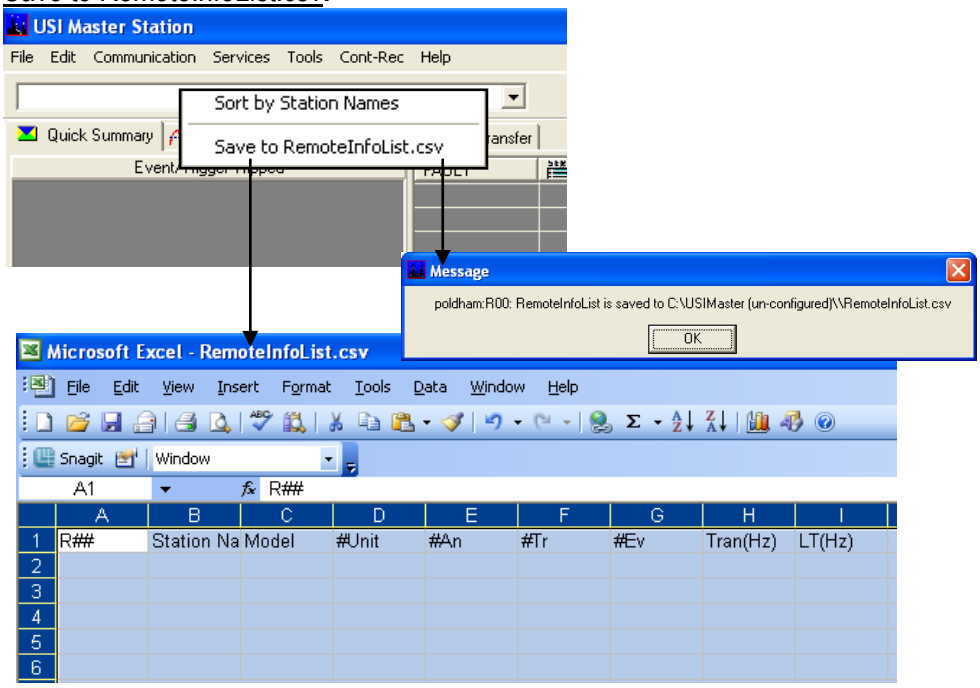


Figure 2-51 Remote List Information Spreadsheet

Select this item (Figure 2-51) to create a file with comma-separated values (***.csv***) containing general information for each DFR and SER in the station list. Information included is: remote ID number, station name, model number, total number of units, number of analog channels, number of analog triggers available, number of event channels, the transient sample rate and long-term sample rate. The ***.csv*** file (Figure 2-48 is saved in the working directory of the *USIMaster*© program. A message window also displays the specific location of the new file.

2.2.2 Shortcut Buttons

The shortcut buttons displayed on the USI Master Station screen (Figures 2-52 and 2-53) are explained in detail below:

Figure 2-52 Select A Shortcut Button

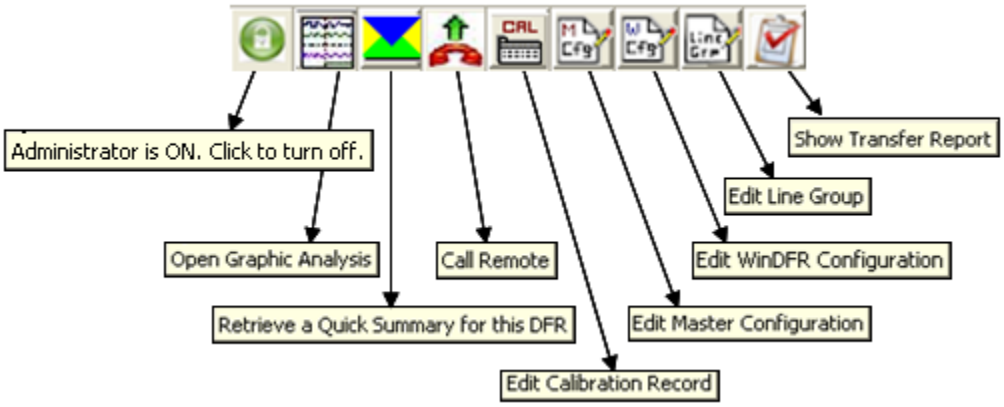


Figure 2-53 Shortcut Buttons – Detail

-  Administrator Off/On:
  Certain functions can be performed only by an operator who has ***Administrator*** credentials. This button is green and these functions are enabled only after these credentials have been established. If the operator has not established ***Administrator*** credentials the button remains red and the functions remain locked. See Section 2.1.4 – Administrator/Change Administrator Password for setup details.

-  Open Graphic Analysis:
  Select to open ***Graphic Signal Processing (GSP)*** screen. See Section 5 for complete details on ***GSP***.

-  Retrieve A Quick Summary for this DFR: retrieve
  Select to establish a communication connection and download the ***Quick Summary*** file for the selected DME system. See ***Quick Summary***, Section 3.1 for complete details.

-  Call/Hang-up Remote:
  Select the button with the up arrow to call the selected DME System (see Figure 2-53). Once *USIMaster©* is connected to the DME system the up arrow will change to a down arrow. Click the button with a down arrow to hang-up. See Section 2.1.3 for communication setup details.

-  Edit Calibration Record:
  Select this button to open the ***Edit* Calibration Record** window to view or edit the *USIMaster©* local copy of Calibration Record for the selected DME system. See Section 4.2 ***Edit Calibration Record*** for complete details.

-  Edit Master Configuration:
  Select this button to open the ***Master System Configuration*** window to view or edit this file. See Section 4.1 ***Master Configuration*** for complete details.

-  Edit *WinDFR©* Configuration:
  Select this button to open the ***WinDFR© System Configuration*** window and to view or edit the *USIMaster©* local ***WinDFR Configuration*** copy for the selected DME system. See Section 4.4 ***Edit WinDFR© Configuration*** for complete details.

-  Edit Line Group:
  Select this button to open the ***Edit Line-Group Record*** window to view or edit the *USIMaster©* local Line Group Record copy for the selected DME system. See Section 4.3 ***Edit Line-Group Record*** for complete details.

-  Show Transfer Report:
  Select this button to display the Auto Transfer Notification Report window (Figures 2-26 thru 2-31).

2.2.3 Application Status Bar

Program Status fields are displayed near the bottom of the screen in the Status Bar (Figure 2-54).

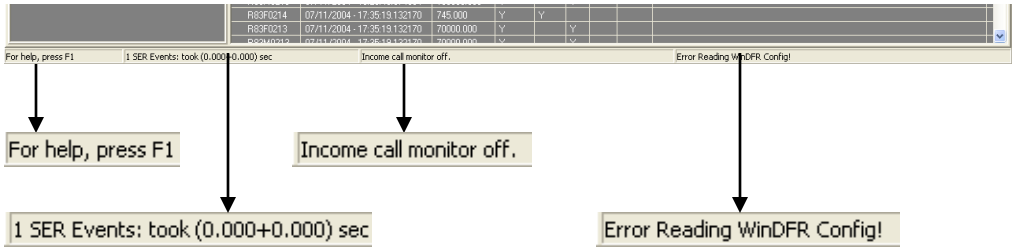


Figure 2-54 Application Status Bar

- For help, press F1:
  The F1 key displays help for the screen that is currently open. For more information, see Section 2.1.7.

- 1 SER Events: took (0.000+0.000) sec/Get WD90.tmp failed/succeeded:
  This information displays the total number of SER state changes recorded for the selected date

- Income call monitor Off/On:
  This information displays the communication connection status (e.g. Logged into remote, Monitoring incoming call, Incoming call monitor off). For more detailed information, see Section 2.1.3 – Communication menu.

- *WinDFR*© Configuration Read OK/Failed:
  This message indicates that there is a valid ***WinDFR*© *Configuration*** for the selected DME system on the master station and that it is read successfully by *USIMaster*©. For more detailed information, see Section 4.4.

2.2.4 Display Modes

The display mode shown in Figure 2-55 is automatically set based on the configuration of the Event inputs for the selected DME system. However, the user can manually select the display mode from the Display Mode drop-down list.

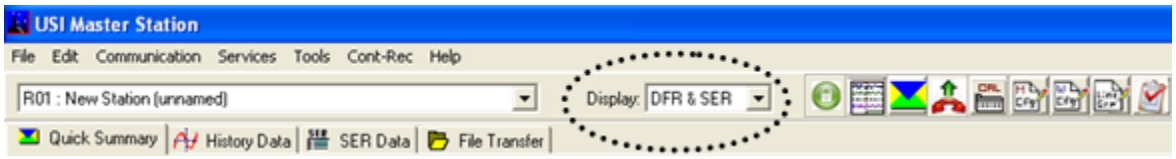


Figure 2-55 Select Display Mode

If the selected DME system has one or more digital inputs set as ***DFR*** and one or more set as ***SER*** or ***Both*** in the Calibration Record (Section 4.2.4), the display mode will be ***DFR & SER***. This mode will display ***Quick Summary***, ***History Data***, ***SER Data***, and ***File Transfer*** working screens (Figure 2-56).

If the selected DME system has all digital inputs set as ***DFR*** in the Calibration Record (Section 4.2.4), the display mode will be ***DFR only***. This mode will display ***Quick Summary***, ***History Data***, and ***File Transfer*** working screens (Figure 2-56).

If the selected DME system has all digital inputs set as ***SER*** in the Calibration Record (see Section 4.2.4), the display mode will be ***SER only***. This mode will display ***SER Data*** and ***File Transfer*** working screens (Figure 2-56), and the Tools and Cont-Rec application menus will be grayed out.

Complete details of the Working Screens are given in Section 3 and details of the application menu are given in Section 2.1.

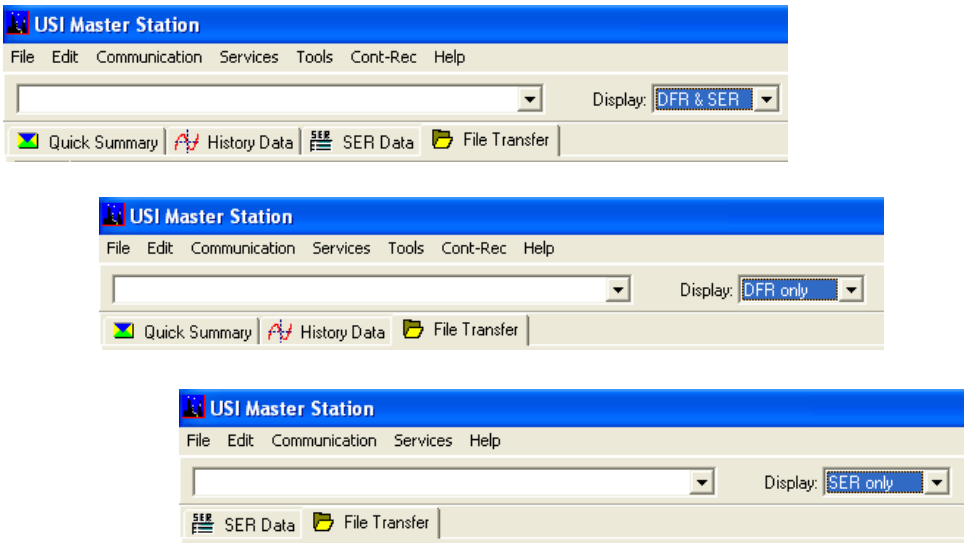


Figure 2-56 Display Mode Selection

Section 3: MASTER STATION – WORKING SCREENS

From the *USIMaster*© screen, click on a tab to select a Working Screen from the group shown in Figure 3-1.

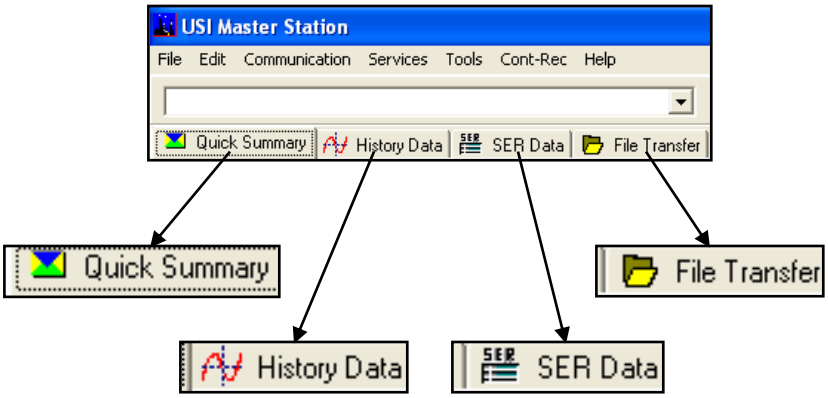


Figure 3-1 Working Screen Tabs

3.1 Quick Summary

The ***Quick Summary*** screen (Figure 3-2) displays a summary for the most recent records that have been recorded on the currently selected DME system. The number of summaries listed in the ***Quick Summary*** is configured in the ***WinDFR Configuration*** file (Section 4.4).

3.1.1 Quick Summary Screen Sections

The ***Quick Summary*** screen is divided into three sections; the ***Event/Trigger Tripped*** section, the ***Quick Summary Table,*** and the ***Fault Location Report*** (Figure 3-2).

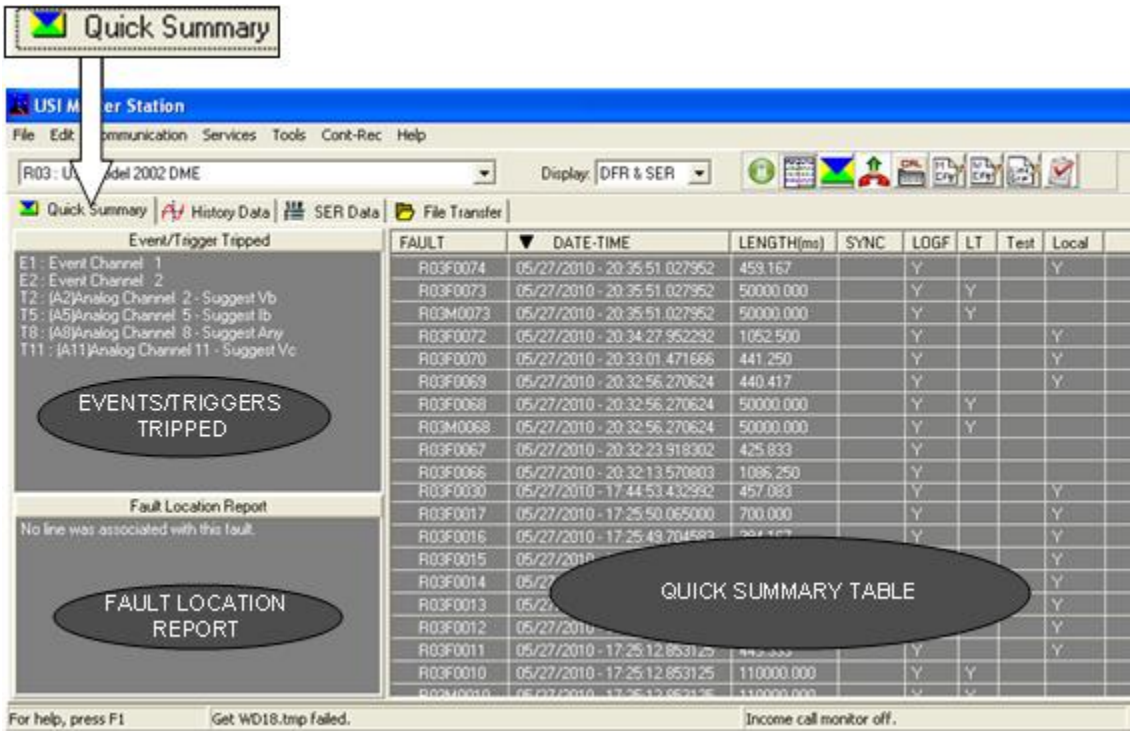


Figure 3-2 Quick Summary Screen

- ***Quick Summary Table***

  - FAULT:
    This column displays the fault identification number (or FID). The format of the FID is R03F0074 where the first character is always the letter R followed by a two- to four-digit number that identifies the selected DME system Remote ID number (e.g. R01 to R9999).

    The next character is either an upper-case ***F*** or an upper-case ***M. F*** indicates that this summary describes an oscillography data file (i.e. a Transient or Long Term record containing waveform data). ***M*** indicates that this summary describes a Long Term RMS data file (i.e. a data file containing RMS values calculated from the Long Term oscillography record; see Figure 3-2, R03M0073, for example).

    The last four digits make up the sequential four-digit ***Fault ID*** number assigned to this record.

    To sort the ***Quick Summary Table*** in ascending or descending order by ***Fault ID***, click on the ***Fault*** column header.

- DATE-TIME:
  This column displays the date and time of each fault. If the DME system is synchronized to IRIG-B (modulated) these times are accurate to better than 1 millisecond. When the DME system is synchronized to IRIG-B (de-modulated) these times are accurate to better than 1 microsecond. To sort the ***Quick Summary Table*** in ascending or descending order by date and time, click on the ***DATE-TIME*** column header.

- LENGTH (ms):
  Duration of the record (length of time in milliseconds).

- SYNC:
  A ***Y*** in this field indicates the fault time for the selected DME record was synchronized with the sync method assigned in the *USIRemote©* ***Configuration*** file on the DME system. If this field is blank, there was no synchronization for the fault.

- LOGF:
  A ***Y*** in this field indicates the Auto-email, Auto-call, Auto-print, Decision Logic in the *WinDFR©* ***Configuration*** was true for the selected DME record. If the logic is set up correctly, a ***Y*** indicates that the selected record was for a fault on one of the lines connected to this substation DME system. See Section 4.4.1 for more information on this logic filter.

- LT:
  A ***Y*** in this field indicates the selected record is a Long Term / Swing DME record. See Section 4.4.3 for more information about the setup of a Long Term recording.

- Test:
  A ***Y*** indicates the selected record was a Test Run initiated by selecting ***Test Run*** in the ***Services*** menu of *USIMaster©* or *WinDFR©*.

- Local:
  A ***Y*** indicates the COMTRADE data file for the selected DME record has been downloaded to *USIMaster©*. See Section 3.2 for more information about downloading DME records.

Note: To see the complete data for a fault, retrieve the ***History Data*** file either from the DFR or from a backup file, if it is not already in the ***History Data*** list. Once it is listed in the ***History Data*** screen the data can be viewed and analyzed.

- **Events/Triggers Tripped**
  The section of the ***Quick Summary*** window displays a list of digital event inputs and analog triggers which were abnormal for the selected DME record. The events and triggers are listed in the order that they occurred.

- **Fault Location Report**
  This section of the ***Quick Summary*** window displays the distance-to-fault calculation results. Fault location information displayed is as follows:

  - Line Name:
    This is the name of the affected line as assigned in the Line Group Record (Section 4.3 for details). The affected line is automatically determined by the distance-to-fault algorithm by applying the ***Line Decision Logic*** from the Line Group Record to the ***Event/Trigger Tripped*** information from the DME ***Record Summary***. The line name can also be selected manually by the user (Section 3.1.2).

  - Type:
    This is the type of fault determined automatically by the distance-to-fault algorithm. Fault Type display may be ***AG, BG, CG, ABG, BCG, CAG, AB, BC, CA, or ABC***. The Fault Type can also be selected manually by the user (Section 3.1.2).

  - Duration:
    This is the period of data selected by the distance-to-fault algorithm used to determine the fault location. The period of data used by the distance-to-fault algorithm can also be selected manually by the user (Section 5).

  - Distance:
    This is the calculated distance-to-fault from the selected DME system. Distance is displayed in miles and kilometers.

Note: If the distance-to-fault calculation is results in a distance longer than the Line Length parameter in the Line Group record, ***Hi-Z*** will be displayed next to the distance value in the ***Quick Summary*** and ***History*** tables.

- **Lightning Correlation Data**
  If the Lightning Data Correlation (LDC) add-on was purchased for *USIMaster*© the following data displays:

  - Lightning found XX milliseconds prior to this fault:
    This report indicates that lightning was detected within a 0 to 10 millisecond time window immediately preceding the fault trigger time.

  - No lightning found within 10 milliseconds of this event:
    This report indicates that the lightning database query did not return data that met the time and distance constraints assigned in the Master Configuration (Section 4.1.3).

  - Time correlation of the lightning strike was within limits however the location of the strike exceeded the distance tolerance. Please check

manually:
This report indicates that a lightning strike DID occur within the time tolerance of the fault record however it was NOT within the distance tolerance assigned in the Master Configuration (Section 4.1.3).

- View Lightning Correlation Data button:
  Selecting this button displays the Lightning Correlation window presenting details of the lightning strike and the transmission line structures which were within the distance tolerance assigned in the Master Configuration (Figure 3-3).

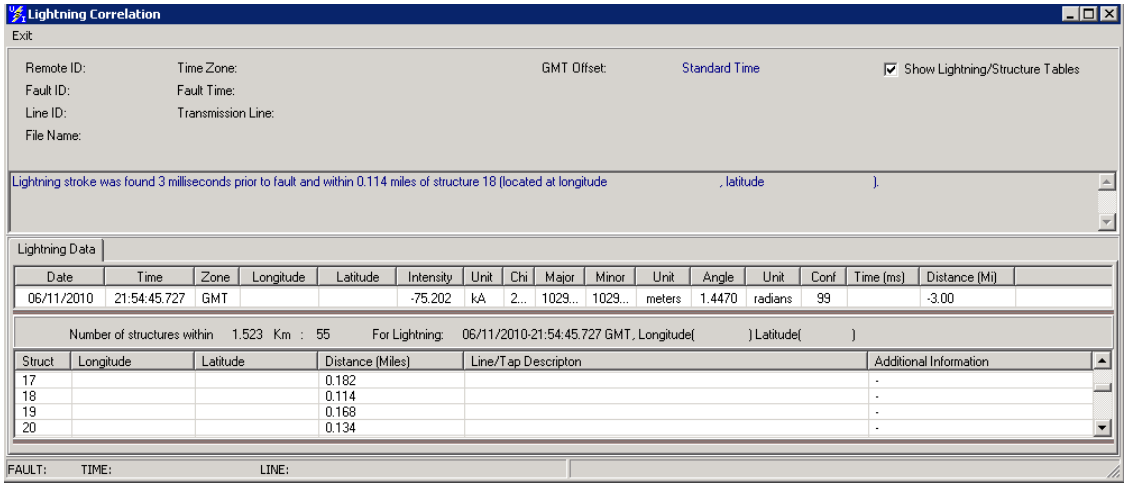


Figure 3-3 Lightning Data Correlation - Results

3.1.2 Quick Summary Menu

Right-click anywhere in the ***Quick Summary*** screen to display the menu shown in Figure 3-4.

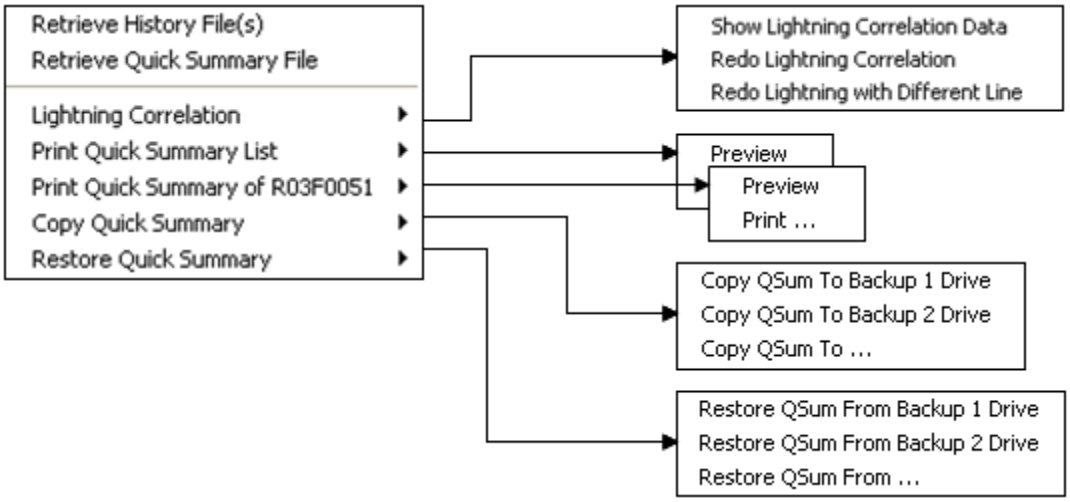


Figure 3-4 Quick Summary Menu

- **Retrieve History File (s)**
  Select ***Retrieve History File(s)*** to copy the complete COMTRADE files for selected records on the ***Quick Summary*** from the selected DME system to the *USIMaster©*. The downloaded data files are stored in the ***Archive Path*** on the *USIMaster©* as configured in the ***Master Configuration*** file, and displayed on the ***History Data*** screen (Section 3.2). Select multiple DME records by using ***Ctrl+Left-click*** or ***Shift+Left-click.***

Note: If the communication connection is interrupted or disconnected before the COMTRADE file is completely downloaded, the partial data that was successfully retrieved is still saved on *USIMaster©* and may be opened for analysis. If another attempt is made to retrieve the file, the program will pick up where it left off and download the remainder of the data file.

- **Retrieve Quick Summary File**
  This selection initiates a communication connection to the selected DME system and updates the ***Quick Summary*** screen with a list of the most recent record summaries.

- **Lightning Correlation**
  This menu is grayed out unless the Lightning Data Correlation (LDC) add-on was purchased for *USIMaster©*.

- Show Lightning Correlation Data:
  This selection displays the Lightning Correlation window which displays the detailed LDC results (Figure 3-3).

- Redo Lightning Correlation:
  This selection re-initiates the *USIMaster*© LDC feature to re-examine selected DME records for lightning correlation (Figure 3-5).

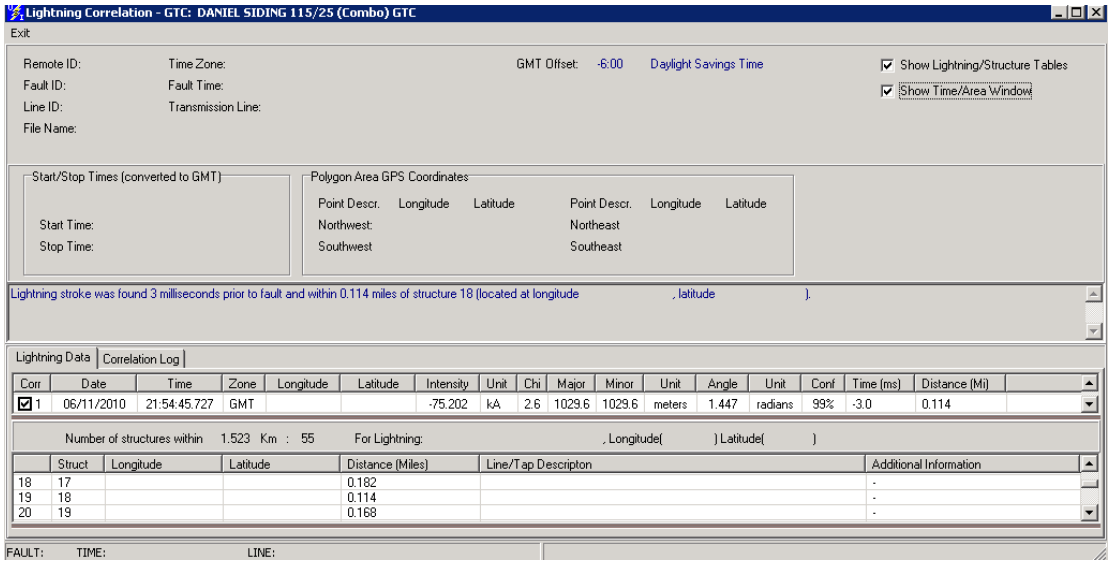


Figure 3-5 Redo Lightning Correlation

- Redo Lightning with Different Line:
  Select this function to perform lightning correlation on a manually selected transmission line (Figure 3-6).

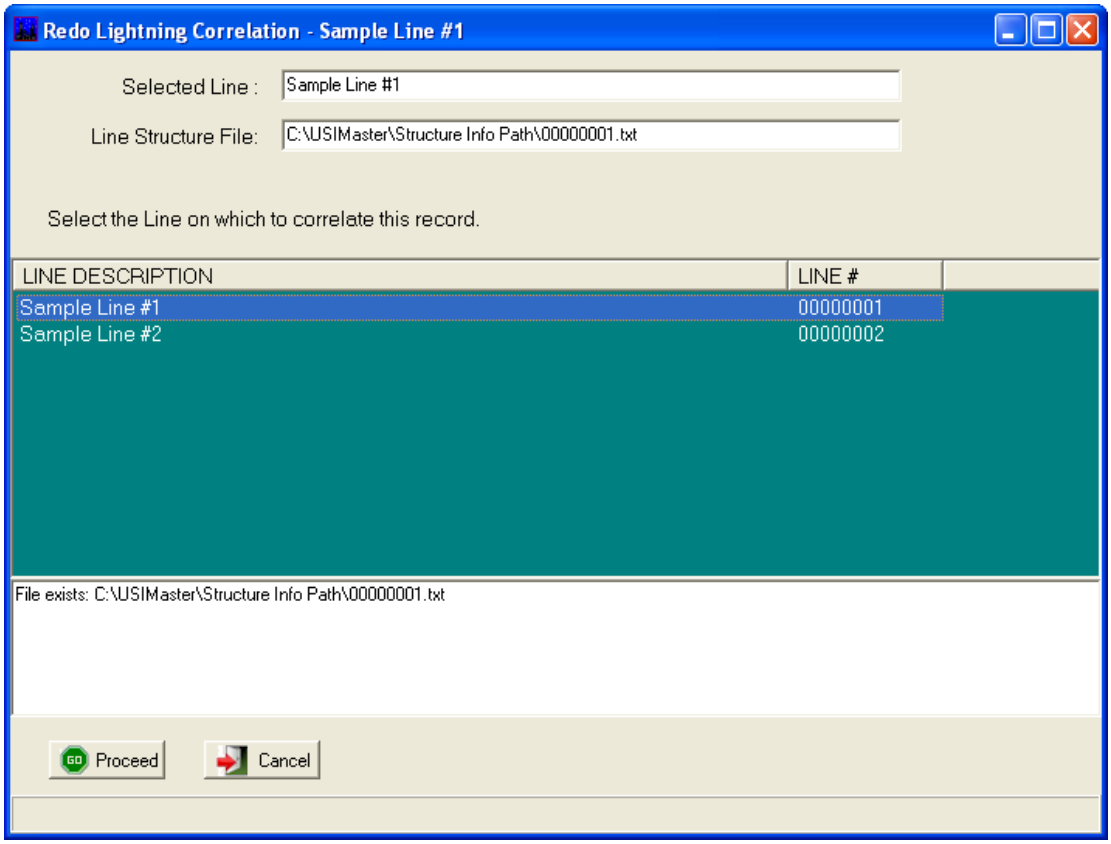


Figure 3-6 Lightning Data Correlation – Select A Different Line

- **Print Quick Summary List**
  Select to preview or print all the DME record summaries displayed in the ***Quick Summary*** table.

- **Print Quick Summary of RxxxxFyyyy**
  Select to preview or print a single DME record displayed in the ***Quick Summary*** table. The ***Quick Summary*** report contains fault, event, and trigger summaries.

  The Fault Summary displays Station Name, Fault Name, Fault Time, Clock Sync Status, Prefault/Postfault lengths, Sequence of Events, and Fault Location results if available.

  The Event Summary displays abnormal event channels and their Calibration Record settings. These events were abnormal at some point during the selected DME record (Section 4.2).

  The Trigger Summary displays trigger channels and their Calibration Record settings. These events were abnormal at some point during the selected DME record (Section 4.2.2).

- **Copy Quick Summary**
  Select to copy the ***Quick Summary*** file from the *USIMaster©* Archive Path to the ***Backup Path 1*** *or* ***Backup Path 2*** as assigned in the ***Master Configuration,*** or to a user selected path.

- **Restore Quick Summary**
  Select to retrieve a ***Quick Summary*** file for the currently selected DME System. The file is retrieved from the ***Back-Up Path*** specified in the ***Master Configuration***.

3.2 History Data

3.2.1 History Data Screen

The ***History Data Screen*** (Figure 3-7) displays the ***Summary***, ***Configuration***, and ***Header*** information for DME records that have been downloaded to *USIMaster©*.

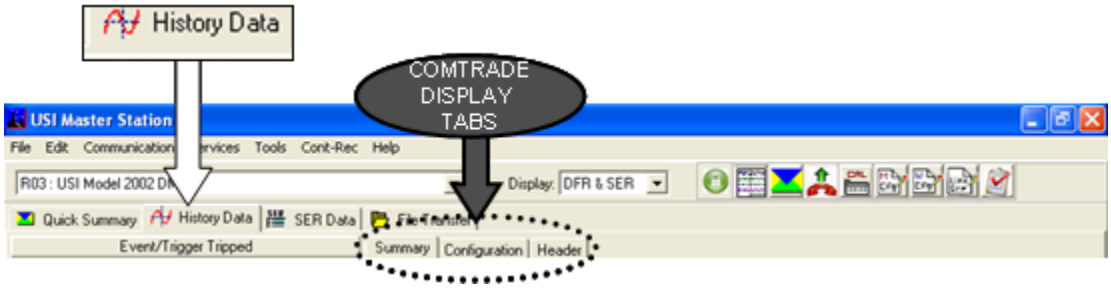


Figure 3-7 History Data Screen – Header Information

3.2.2 History Data Screen – Summary Table

Select the ***Summary*** tab to display the Summary table for COMTRADE data files that have been downloaded to *USIMaster©* (Figure 3-8).

Double-click on a DME record to open the COMTRADE file for the selected summary and display the ***Graphics Signal Processing*** window for viewing and analyzing the data (Section 5).

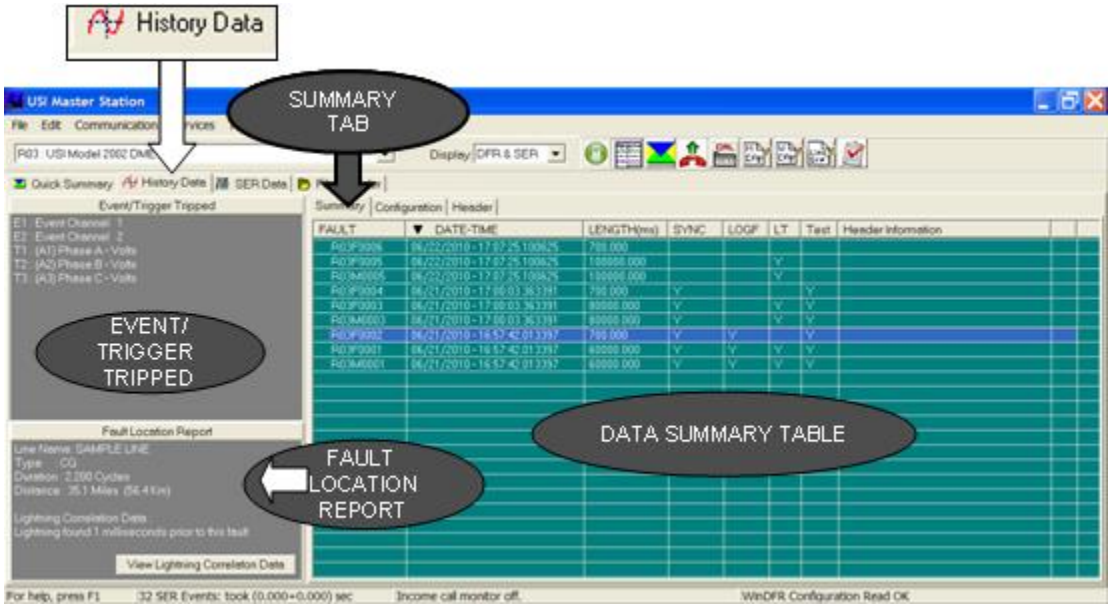


Figure 3-8 History Data Screen –Summary Table

- **History Data - Summary Table**

  - FAULT:
    This column displays the fault identification number (or FID). The format of the FID is R03F0074 where the first character is always the letter R followed by a two- to four-digit number that identifies the selected DME system Remote ID number (e.g. R01 to R9999).

    The next character is either an upper-case ***F*** or an upper-case ***M. F*** indicates that this summary describes an oscillography data file (i.e. a Transient or Long Term record containing waveform data). ***M*** indicates that this summary describes a Long Term RMS data file (i.e. a data file containing RMS values calculated from the long term oscillography record; see Figure 3-2, R03M0073, for example).

    The last four digits make up the sequential four-digit ***Fault ID*** number assigned to this record.

    To sort the ***History Data Summary Table*** in ascending or descending order by ***Fault ID***, click on the ***Fault*** column header.

  - DATE-TIME:
    This column displays the date and time of each fault. If the DME system is synchronized to IRIG-B (modulated) these times are accurate to better than 1 millisecond. When the DME system is synchronized to IRIG-B (de-modulated) these times are accurate to better than 1 microsecond. To sort the ***History Data Summary Table*** in ascending or descending order by date and time, click on the ***DATE-TIME*** column header.

  - LENGTH (ms):
    Duration of the record (length of time in milliseconds)

  - SYNC:
    A ***Y*** in this field indicates the fault time for the selected DME record was synchronized with the sync method assigned in the *USIRemote*© ***Configuration*** file on the DME system. If this field is blank, there was no synchronization for the fault.

  - LOGF:
    A ***Y*** in this field indicates the Auto-Email, Auto-call, Auto-print, Decision Logic in the *WinDFR*© ***Configuration*** was true for the selected DME record. If the logic is set up correctly, a ***Y*** indicates that the selected record was for a fault on one of the lines connected to this substation DME system. See Section 4.1.2 for more information on this logic filter.

- LT:
  A ***Y*** in this field indicates the selected record is a Long Term / Swing DME record. See Section 4.4.3 for more information about the setup of a Long Term recording.

- Test:
  A ***Y*** indicates the selected record was a Test Run initiated by selecting ***Test Run*** in the ***Services*** menu of *USIMaster©* or *WinDFR©*.

- Header Information:
  This column displays text entered into the header file. The amount of text displayed is determined by the width adjustment for this column. When more text is stored in the header file than can be displayed in this column, the initial text will be displayed with … at the end indicating that more text is available and that the text can be viewed in entirety by selecting the Header screen tab (Figure 3.2).

- **Events/Triggers Tripped**
  The section of the ***History Data Summary*** window displays a list of digital event inputs and analog triggers that were abnormal for the selected DME record. The events and triggers are listed in the order that they became abnormal.

- **Fault Location Report**
  This section of the ***History Data Summary*** window displays the distance-to-fault calculation and lightning correlation results. The following fault location information is displayed:

  - Line Name:
    Name of the affected line as assigned in the Line Group Record (see Section 4.1.3 for details)

  - Type:
    The type of fault (e.g. ***ABC, AB, BC, CA, ABG, BCG, CAG, AG, BG, or CG***

  - Duration:
    The period of data used to determine fault location

  - Distance:
    This is the calculated distance to the fault from the selected DME system. The distance is displayed in miles and kilometers.

- **Lightning Correlation Data**
  If the Lightning Data Correlation (LDC) add-on was purchased for *USIMaster©* the following data displays:

- Lightning found XX milliseconds prior to this fault:
  This report indicates that lightning was detected within the 0 to 10 millisecond window immediately preceding the fault trigger time.

- No lightning found within 10 milliseconds of this event:
  This report indicates that the lightning database query did not return data that met the time and distance constraints assigned in the Master Configuration (Section 4.1.3).

- Time correlation of the lightning strike was within limits however the location of the strike exceeded the distance tolerance. Please check manually:
  This report indicates that a lightning strike DID occur within the time tolerance of the fault record however it was NOT within the distance tolerance assigned in the Master Configuration (Section 4.1.3.

- View Lightning Correlation Data button:
  Selecting this button displays the Lightning Correlation window presenting details of the lightning strike and the transmission line structures which were within the distance tolerance assigned in the Master Configuration (Figure 3-3).

3.2.3 History Data Table Menu

Right-click on a fault record to display the menu shown in Figure 3-9. Select one of the following functions:

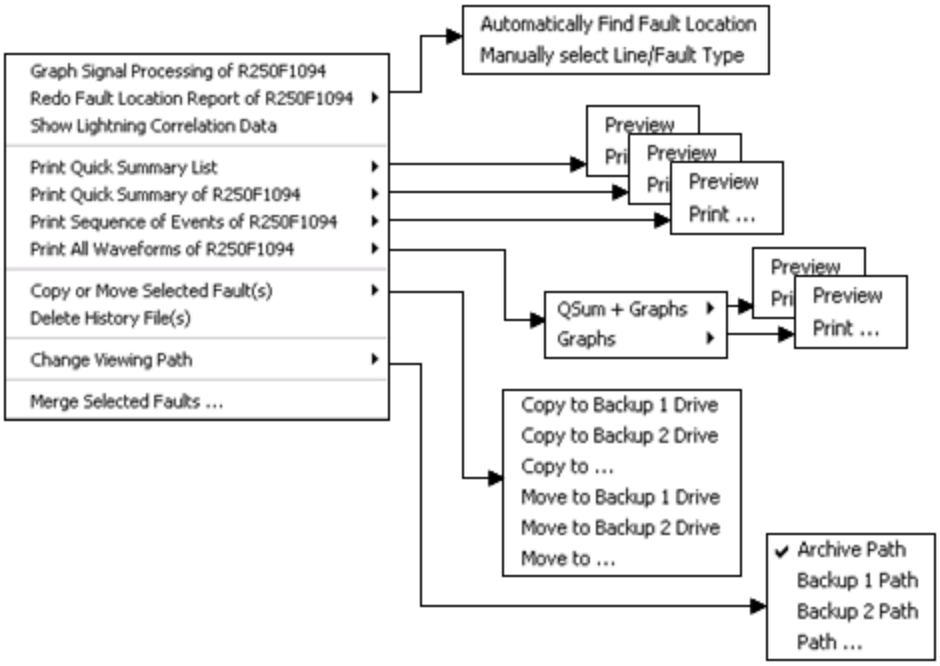


Figure 3-9 History Data Summary Table Menu

- **Graph Signal Processing of RxxxxFyyyy**
  This selection displays the ***Graph Signal Processing*** window to view and analyze COMTRADE data. See Section 5 for more information.

- **Redo Fault Location Report of RxxxxFyyyy**
  Select this menu item to redo the ***Fault Location Report*** of the selected ***Fault Record***.

Note: The necessary line parameters must be entered and the ***Auto Cal. Fault Loc.*** parameter set to ***Yes*** in the ***Line Group Record*** (Section 4.3, Figure 4-50) before distance calculations can be made. If the parameters are not correct or have not been entered, the message ***No calculable fault location*** will display.

The DME system can perform an automatic impedance based fault location but only when it has a valid ***Line Group*** configuration (Section 4.3). If the fault location calculation was performed in the DME system, the result is displayed in the ***Fault Location Report*** of the ***Quick Summary*** and ***History Data*** screens.

If a ***Line Group*** configuration was not present on the DME system or if the line parameters were incorrect, the ***Line Group*** may be created or edited in the

USIMaster© application (Section 4.3). After the Line Group has been created or edited, the fault location can be calculated or re-calculated by the *USIMaster©* application.

- Automatically Find Fault Location:
  This selection utilizes the logic built into *USIMaster©* to select the faulted line, the data window to be used, determine the fault type, and calculate the distance to the fault location from the selected DME System.

  Users will then be prompted to replace the existing Fault Location Report and be displayed in the ***Fault Location Report*** window at the bottom left of the screen and a detailed report of the fault location results will be displayed.

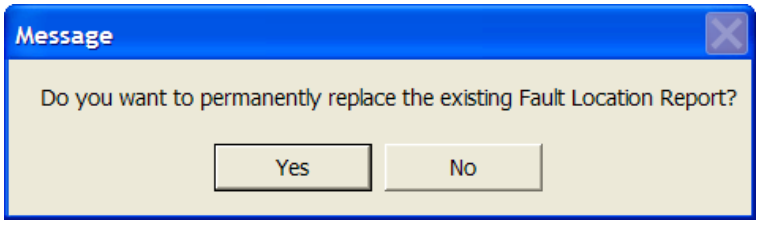


Figure 3-10 Replace Existing Fault Location Report message

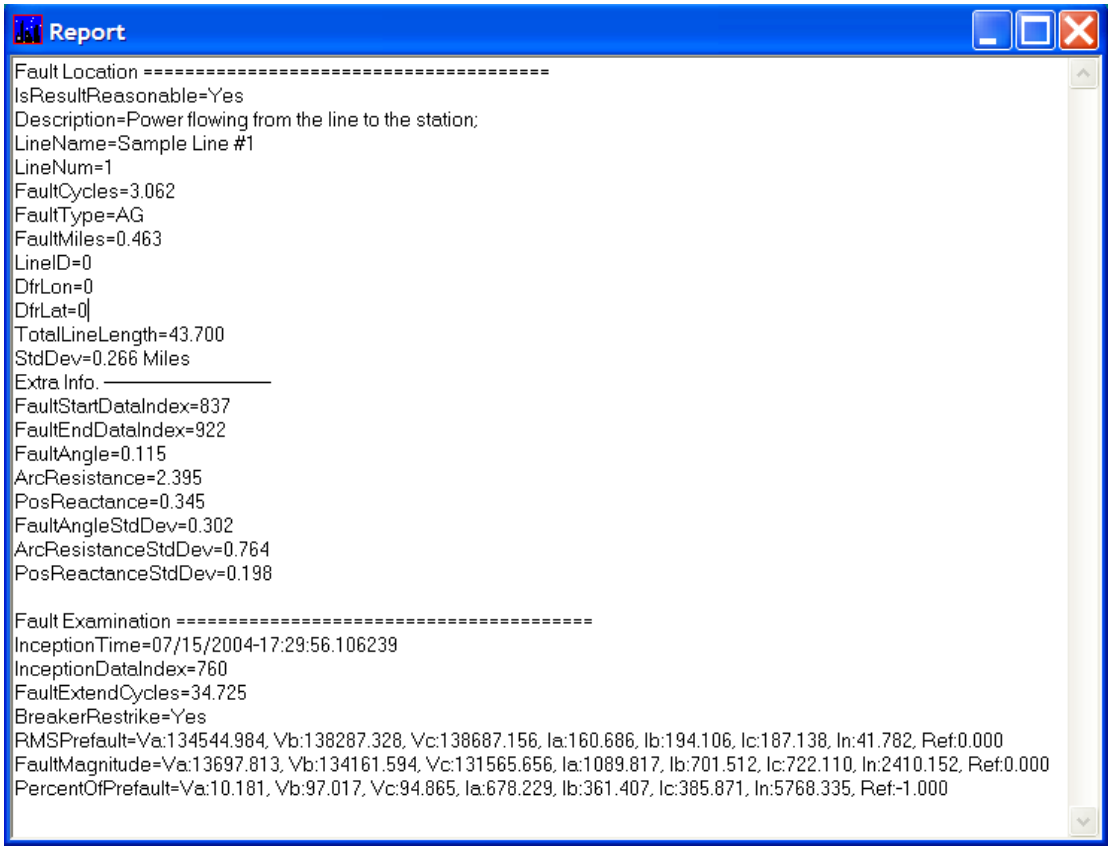


Figure 3-11 Detailed Fault Location Report

- Manually Select Line/Fault Type:
  Select this menu item to choose the Line Name, Fault Type, and Minimum # of Cycles to be used for the calculation. The software automatically selects the data window to be used for the calculation.

Note: Manual fault location can also be calculated within the ***Graphic Signal Processing*** window (Section 5) which allows users to select Line Name, Fault Type, and the Data window to be used for the calculation.

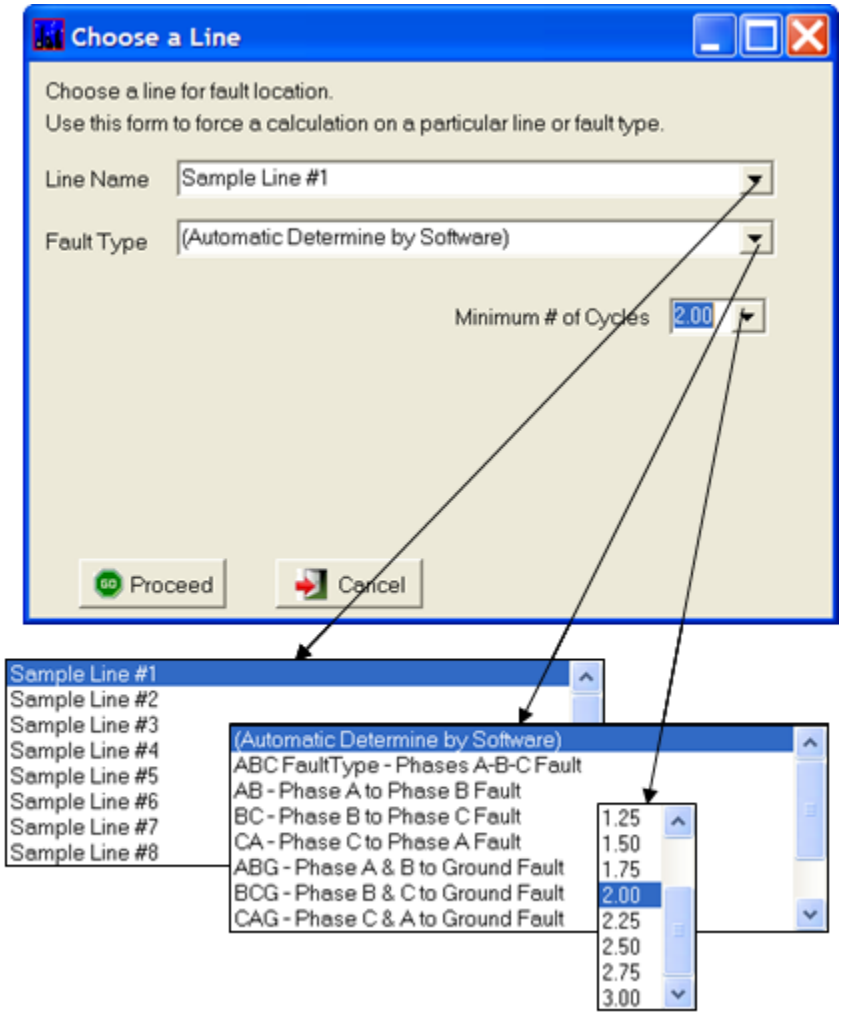


Figure 3-12 Manually Select Line/Fault Type

- **Show Lightning Correlation Data (Optional)**
  This selection displays the Lightning Correlation window which shows the detailed Lightning Data Correlation results (Figure 3-3). This menu item is grayed out if the ***Lightning Data Correlation***© add-on was not purchased (Section 4.1.3).

- **Print Quick Summary List**
  This selection is used to preview or print all the DME record summaries displayed in the ***History Data Summary*** table.

- **Print Quick Summary of RxxxxFyyyy**
  This selection is used to preview or print the summary of a selected DME Record in the ***History Data Summary*** table. The ***Quick Summary*** report contains Fault, Event, and Trigger summaries.

  The ***Fault Summary*** displays Station Name, Fault Name, Fault Time, Clock Sync Status, Prefault/Postfault lengths, Sequence of Events, and Fault Location results

if available.

The ***Event Summary*** displays abnormal Event channels and their Calibration Record settings. These events were abnormal at some point during the selected DME record (Section 4.2.2).

The ***Trigger Summary*** displays Trigger channels and their Calibration Record settings. These events were abnormal at some point during the selected DME record (Section 4.2.2).

- **Print Sequence of Events of RxxxxFyyyy**
  This selection is used to preview or print the ***Sequence of Events Report.*** This report contains the ***Fault Summary*** and the ***Sequence of Events (and Triggers)***.

  The ***Fault Summary*** displays Station Name, Fault Name, Fault Time, Clock Sync Status, Prefault/Postfault lengths, Sequence of Events, and Fault Location results if available.

  This ***Fault Summary*** reports all event and triggers that changed state during the course of the record. All events in the report are referenced to the trigger time T-zero (t_0) for the fault.

  The second section is a table, ***Sequence of Events***, containing the sequence information listed below:

  - Seconds:
    This column displays the time of the state change in milliseconds referenced to the initial trigger time (t_0) for the selected record.

  - Event/Trigger:
    This column displays the input number of the event or trigger that changed state.

  - Now:
    This column displays the present state of the event or trigger input. Event inputs display either ***Open*** or ***Closed***. Trigger inputs always display ***Disabled*** as this column is not applicable to triggers.

  - Normal:
    This column displays whether the present state is the normal (***Yes*** or ***No***) for the event or trigger input.

  - Description:
    This column displays the description of the event or trigger channel as entered in the Calibration Record. For an event or trigger returning back to the normal state, this column displays the duration of the abnormal state in milliseconds referenced to the start time (t_0).

- **Print All Waveforms of RxxxxFyyyy**
  This selection is used to preview and print the Quick Summary and waveforms, or the waveforms alone (Section 4.1.2).

  - Qsum + Graphs:
    This menu produces a preview or printout of the ***Quick Summary Report*** plus analog and digital data plots.

  - Graphs:
    This selection produces a preview or printout of only the analog and digital data plots.

    - Preview
      This selection displays the ***Format All Wave Printing*** window which contains the default print settings. These settings can be modified for the record being previewed.

    - Print
      This selection will display the ***Format All Wave Printing*** window displaying the default print preferences assigned in the Master Configuration. These settings may be modified and previewed prior to printing (Figure 3-13).

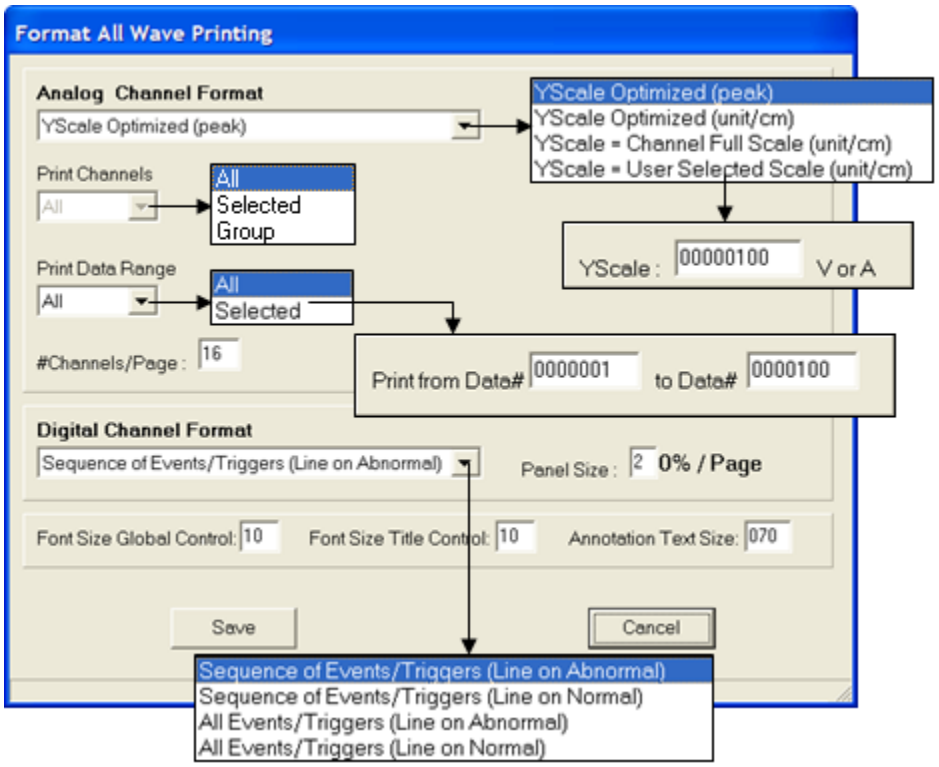


Figure 3-13 Print All Waveforms Preview

- **Copy or Move Selected Fault(s)**
  Use this selection to copy or move all associated files for the selected COMTRADE records from the Archive Path to Backup Path 1 *or* Backup Path 2 as assigned in the Master Configuration, or to a user selected path. Associated COMTRADE files included are files with the extensions ***.cfg***, ***.dat***, ***.inf*** and ***.hdr***.

  - Copy to Backup 1 Drive:
    This selection puts a copy of the selected COMTRADE records into the Backup 1 path. The original files are not removed from the Archive path.

  - Copy to Backup 2 Drive:
    This selection puts a copy of the selected COMTRADE records into the Backup 2 path. The original files are not removed from the Archive path.

  - Copy to …:
    This selection displays the Browse for Folder window (Figure 3-14) allowing the user to select a path to store a copy of the selected COMTRADE records. The original files are not removed from the Archive path.

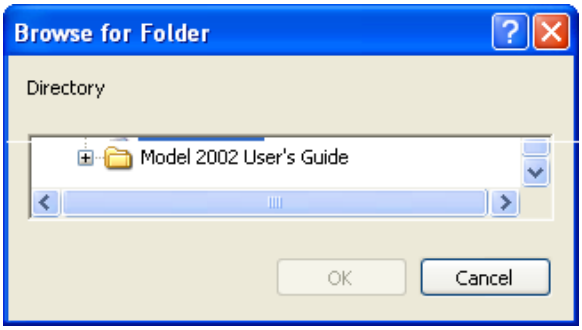


Figure 3-14 Browse for Folder - Directory

  - Move to Backup 1 Drive:
    This selection puts a copy of the selected COMTRADE records into the Backup 1 path and removes the original files from the Archive path.

  - Move to Backup 2 Drive:
    This selection puts a copy of the selected COMTRADE records into the Backup 2 path and removes the original files from the Archive path.

  - Move to …:
    This selection displays the Browse for Folder window (Figure 3-14) allowing the user to remove original COMTRADE files from the Archive path and transfer them to a selected destination path.

- **Delete History Files**
  This selection deletes all associated files for the selected COMTRADE records

from the Archive Path. Associated COMTRADE files included are files with the extensions ***.cfg***, ***.dat***, ***.inf*** and ***.hdr***. Once the files have been deleted, the only way to recover them is to retrieve them from the DME system (if they are still there) or to recover them from a backup (if one was made). They are not put into the Recycle Bin.

- **Change Viewing Path**
  This selection allows the user to change the source path for the files to be displayed in the ***History Data*** table. From the drop-down menu select one of four viewing paths:

  - Archive Path:
    This selection displays COMTRADE records located in the Archive Path as assigned in the Master Configuration (Section 4.1).

  - Backup 1 Path:
    This selection displays COMTRADE records located in the Backup 1 Path as assigned in the Master Configuration (Section 4.1).

  - Backup 2 Path:
    This selection displays COMTRADE records located in the Backup 2 Path as assigned in the Master Configuration (Section 4.1).

  - Path . . .:
    This selection displays the ***Browse for Folder*** window (Figure 3-14) allowing the user to select a path from which COMTRADE records can be displayed.

- **Merge Selected Faults . . .**
  Use this selection to merge two or more COMTRADE records end-to-end into a single COMTRADE record. From the ***History Data*** table, select the records to be merged together (***Ctrl +Left-click*** or ***Shift +Left-click***). Then ***Right-click*** on the selected records in the table to open ***Merge Selected Faults***.

  The ***Save Merged Data File As*** window displays (Figure 3-15). Browse to the folder location. Enter the name of the merged file to be saved and specify whether it is to be saved in ASCII or binary format.

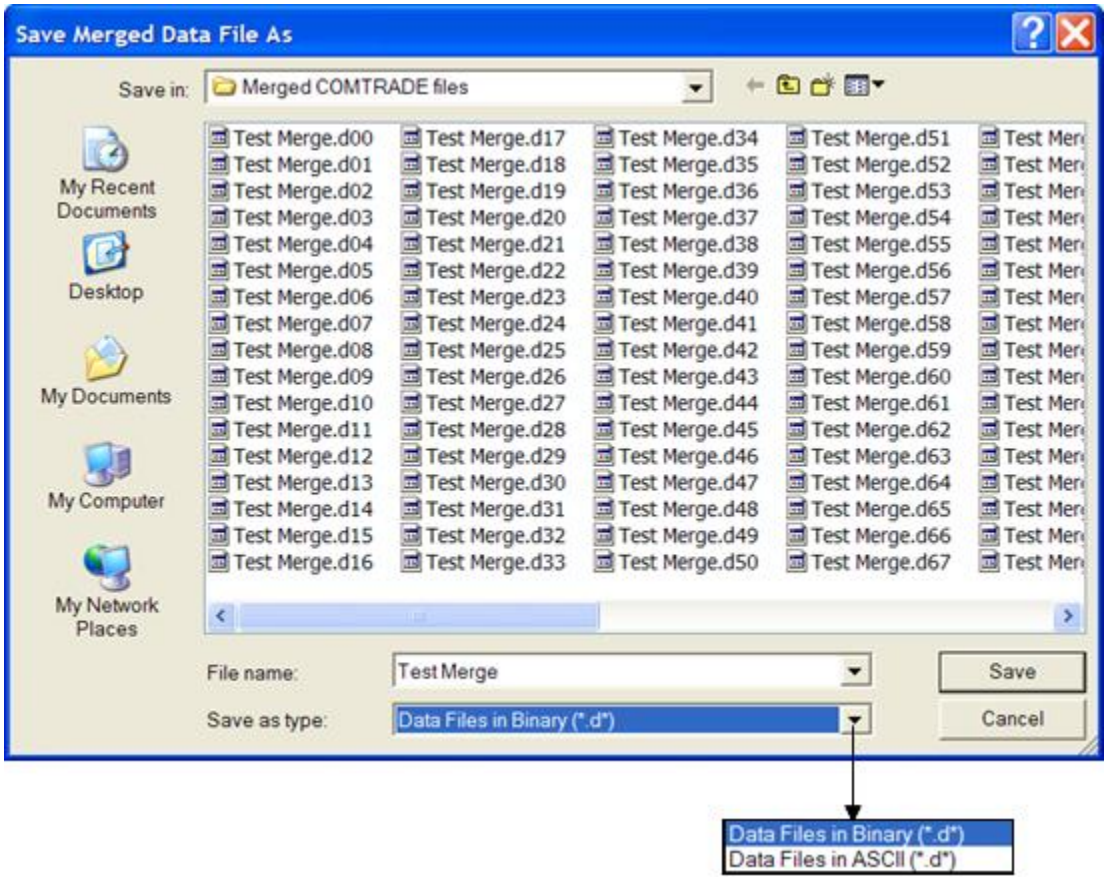


Figure 3-15 Merge Selected Faults

If the data records overlap in time, there will be a consistent stream of sampled data in the merged data file. If there are time gaps between the data files, null data will be inserted to fill the voids. Time length of the merged data file is equal to the total time span of the individual data files. When the merge completes, a message window displays (Figure 3-16). Click ***OK*** to acknowledge completion of the ***Merged COMTRADE Files***.

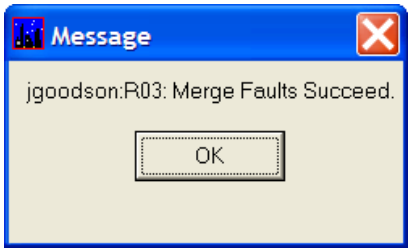


Figure 3-16 Merged File Message

Note: There are no restrictions on the length of data being merged together. When multiple data files are merged resulting in a combined record several minutes long, or if the records being merged together have long time lapses between them resulting in several seconds or even minutes of null data being inserted, the COMTRADE file will be very large. Consequently, both the merging process and the analysis in ***Graphic Signal Processing*** can be very slow.

3.2.4 Event/Trigger Tripped Menu

Right-click in the ***Event/Trigger Tripped*** window to display the menu shown in Figure 3-17.

Figure 3-17 Event/Trigger Tripped Menu

- **Quick View**
  This selection opens the ***Graphics Signal Processing*** window and displays several analog channels. These analog channels, selected automatically, are associated with the abnormal triggers shown in the ***Event/Trigger Tripped*** list. See Section 5 for more details.

- **Always Display Channels …**
  This selection displays the ***Always Display Channels*** window (Figure 3-18). Choose channels from this window to be displayed anytime ***Quick View*** is selected.

Note: A record must be selected in the ***History Data*** table to allow the ***Always Display Channels*** window to open.

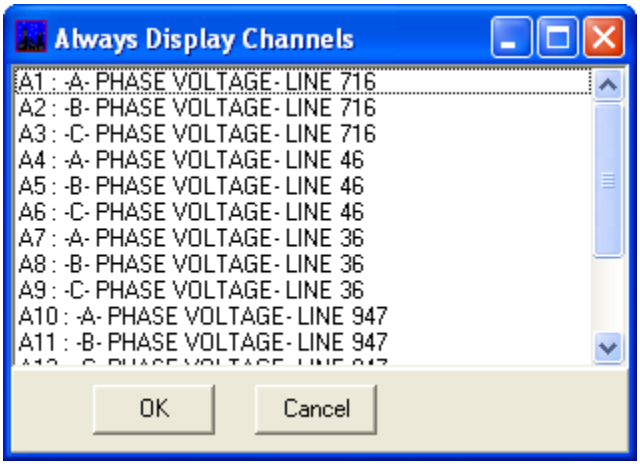


Figure 3-18 Always Display Channels

3.2.5 History Data – Configuration Table

This selection displays the ***Configuration*** screen tab showing the configuration of the DME System at the time the selected record was saved (Figure 3-19).

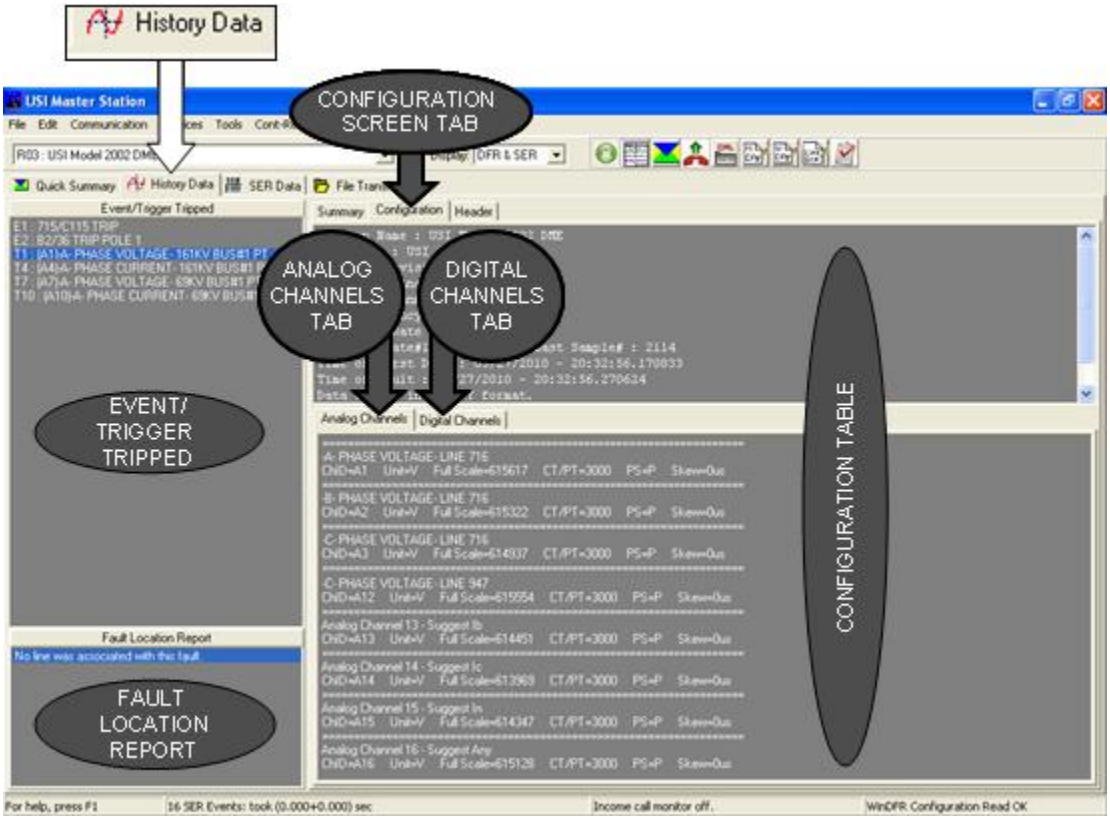


Figure 3-19 History Data Screen –Configuration Screen Tab

The system configuration portion displays settings for the selected DME Record including Station Name, Device ID, COMTRADE Revision Year, #Analog Channels, #Digital Channels, Line Frequency, #Sample Rates, Last Sample#, Time stamp of the first data sample, Time stamp of the record trigger, Data format (Binary or ASCII), Time Stamp Multiplication Factor, Prefault length, Postfault length (fault period + Postfault period combined).

The Analog Channels screen displays the settings of all the analog input channels including Channel description, ChID (Input number), Units being measured (Amp or Volts), , CT/PT Ratio, Primary/Secondary levels for the data values, time skew of samples from channel to channel.

The Digital Channels screen displays the setting of the digital channels (certain digital inputs and all analog triggers) including Channel description, ChID (Input number), and the Normal State of the input.

3.2.6 History Data – COMTRADE Header Display

This selection displays the ***Header*** screen used to enter, save, and display comments about a record (Figure 3-20).

Figure 3-20 History Data Screen –Header Tab

Enter text information into the body of this screen and click the ***Save*** button to save the text to a header file (****.hdr***) that is stored in the ***Archive*** directory as specified in the Master Configuration (see Section 3.2). The root file name will be the same as the other COMTRADE files associated with this record. A preview of the text entered on this screen is displayed in the Header Information column on the History Data screen (Figure 3-8).

3.3 Sequence of Events Recorder Data

Select the ***SER Data*** tab to display the Sequence of Event data files that have been downloaded to *USIMaster*© (Figure 3-21).

Note: The SER Data screen is accessible only if the ***Display*** type selected is ***DFR & SER*** or ***SER Only*** (Section 2.2.4). These display types are selected automatically based on the Event Channel DFR/SER setting assigned in the Calibration Record (Section 4.2).

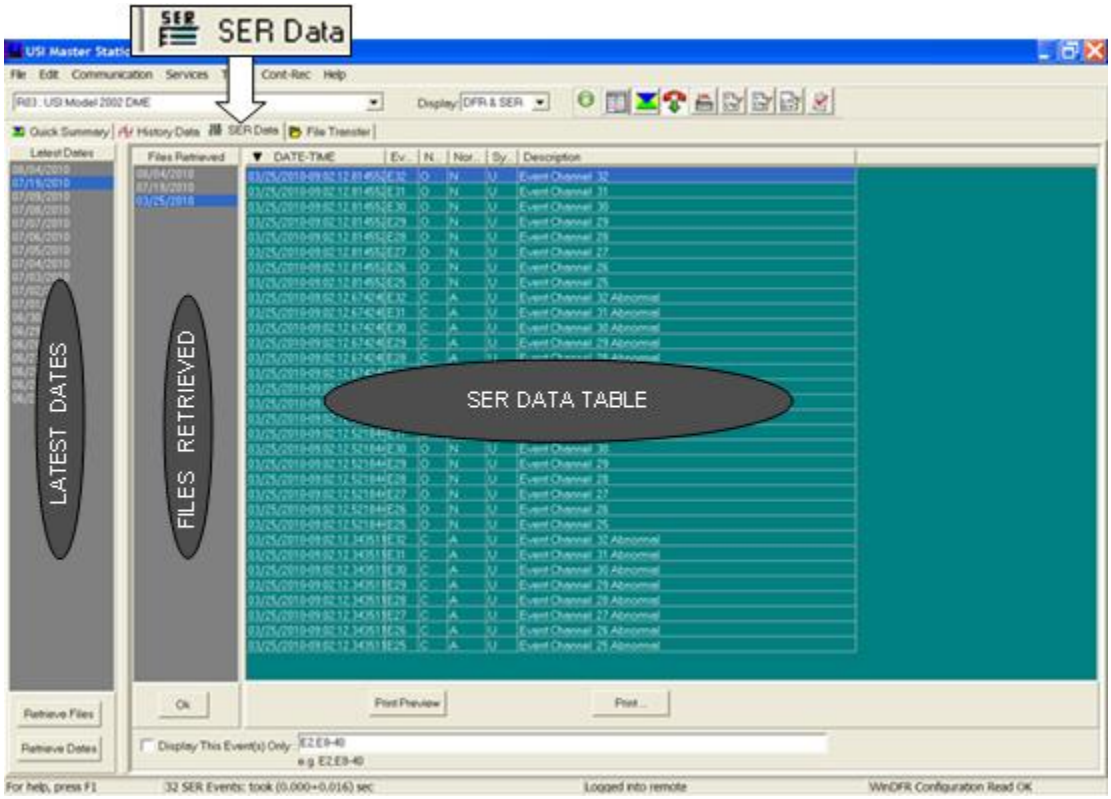


Figure 3-21 SER Data Screen

3.3.1 SER Data Screen Sections

The ***SER Data*** screen is divided into three sections: ***Latest Dates***, ***Files Retrieved*** and ***SER Data Table*** (Figure 3-21).

- **Latest Dates**
  The ***Latest Dates*** column displays a list of dates that the selected DME system has recorded Sequence of Event data. This column is updated by clicking the Retrieve Dates ***Retrieve Dates*** button to list dates.

  Double-click on a specific date to download the SER data for that day from the

DME System. SER data files for multiple dates will be downloaded to the *USIMaster©* by selecting the desired dates and clicking the Retrieve Files ***Retrieve Files*** button.

- **Files Retrieved**
  Once SER data files have been downloaded to *USIMaster©*, the dates of that data are displayed in the ***Files Retrieved*** column.

  To display the SER data file on the SER Data Table, double-click on a date or select multiple dates and click the Ok ***OK*** button.

- **SER Data Table**
  The following columns are displayed on the SER Data Table:

  - DATE-TIME:
    This column displays the date and time that the event input changed state. The SER data displayed on the table can be sorted in ascending or descending order by date and time by clicking on this column header.

  - Event:
    The event input number on the DME system

  - Now:
    State of the event input (C=closed, O=open) after the state change

  - Normal:
    Whether the current state for this event input (shown in the *Now* column) is Normal (N) or Abnormal (A). The normal state is defined by the Normal State setting in the Calibration Record (Section 4.2).

  - Sync:
    Tells whether the DME System clock is synced (S) or un-synced (U) with an IRIG-B satellite clock.

  - Description:
    The event channel description of the event input is displayed in this column. When the state of the event input is Normal, the ***Normal Descriptor*** as entered in the Calibration Record (Section 4.2) is displayed.

    When the state of the event input is Abnormal, the ***Alt. Descriptor*** as entered in the Calibration Record (Section 4.2) is displayed.

    - (END)
      This is inserted at the beginning of the event channel description for event inputs that are abnormal when the DME system closes an SER data file at the end of the day.

- (A.Stop)
  This is inserted at the beginning of the Event Channel Description for event inputs that have been automatically stopped by the DME system. This automatic stop is defined by the ***#Events happened in #Minutes*** setting configured in the Calibration Record on the ***DSP Boards Config*** screen (Section 4.2).

- (A.Start)
  This is inserted at the beginning of the Event Channel Description for event inputs that were restarted automatically by the DME system. This automatic restart is defined by the ***Then Auto Restore after #Minutes*** setting assigned in the Calibration Record on the ***DSP Boards Config*** screen (Section 4.2).

- (M.Stop)
  This is inserted at the beginning of the event channel description for event inputs that were manually stopped by the Event Channels SER Run/Stop setting in the Calibration Record.

- **☑ Display This Event(s) Only**
  This query entry field and checkbox allows the user to display specific event input numbers. Queries can be entered for specific event input numbers separated by commas (e.g. E1, E4, E12), or a range of event input numbers separated by a hyphen (e.g. E1-8), or a combination of these (e.g. E1, E4, E8-12). To display only the events defined in the query field, check the ☑***Display This Event(s) Only*** box (a check mark indicates when it is active) and click the ***OK*** button Restore the SER data table to redisplay all SER input data, un-checking the ***Display This Event(s) Only*** box and then clicking the ***OK*** button.

- **Print Preview**
  This selection displays a Print Preview of the Sequence of Events Recorder Report. The report contains the events displayed in the SER Data table.

- **Print …**
  This selection displays the ***Print*** window which allows the user to select the Printer, Print range, and Copies for the Sequence of Events Recorder Report. Click the ***OK*** button to send the report to the printer.

3.3.2 SER Data Menu

Right-click anywhere on the Files Retrieved column or the SER Data table to display the menu shown in Figure 3-22.

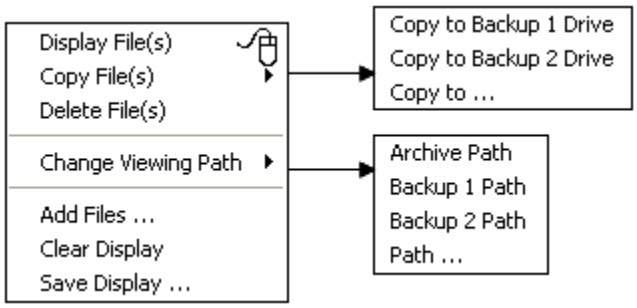


Figure 3-22 SER Data Menu

- **Display Files**
  This selection will display selected SER Data files from the Files Retrieved column. Select the files to be displayed and, from the right-click menu, select Display Files.

  SER data files can also be displayed by double-clicking on selected dates, or selecting the SER dates and clicking the ***OK*** button.

- **Copy Files**
  Use this selection to copy the selected SER Data files from the Archive Path to Backup Path 1 or Backup Path 2 (as assigned in the Master Configuration), or to a user selected path.

  - Copy to Backup 1 Drive:
    This selection puts a copy of the selected SER Data files into the Backup 1 path. The original files are not removed from the Archive path.

  - Copy to Backup 2 Drive:
    This selection puts a copy of the selected SER Data files into the Backup 2 path. The original files are not removed from the Archive path.

  - Copy to … :
    This selection displays the ***Browse for Folder*** window (Figure 3-23) allowing the user to select a path to store a copy of the selected SER Data files. The original files are not removed from the Archive path.

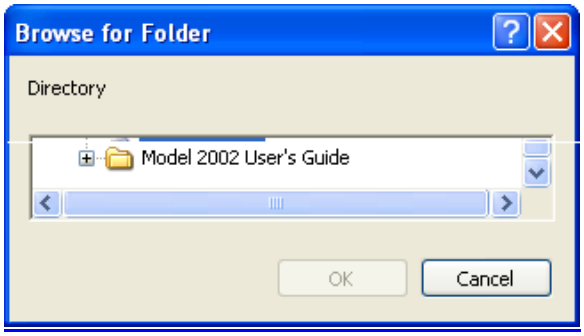


Figure 3-23 Browse for Folder - Directory

- **Delete Files**
  This selection is used to delete selected SER Data files from the Archive Path. Once the files have been deleted, the only way to recover them is to retrieve them from the DME system (if they are still there) or to recover them from a backup (if one was made). They are not put into the Recycle Bin.

- **Change Viewing Path**
  This selection allows the user to change the source path for the files to be displayed in the ***SER Data*** table. From the drop-down menu select one of four viewing paths:

  - Archive Path:
    This selection displays ***SER Data*** records located in the Archive Path as assigned in the Master Configuration (Section 4.2).

  - Backup 1 Path:
    This selection displays ***SER Data*** records located in the Backup 1 Path as assigned in the Master Configuration (Section 4.2).

  - Backup 2 Path:
    This selection displays ***SER Data*** records located in the Backup 2 Path as assigned in the Master Configuration (Section 4.2).

  - Path . . . :
    This selection displays the ***Browse for Folder*** window (Figure 3-14) allowing the user to select a path from which ***SER Data*** records can be displayed.

- **Add Files**
  This selection opens the ***Add SER File(s)*** window. This window is used to import ***SER Data*** from other directory paths (Figure 3-24).

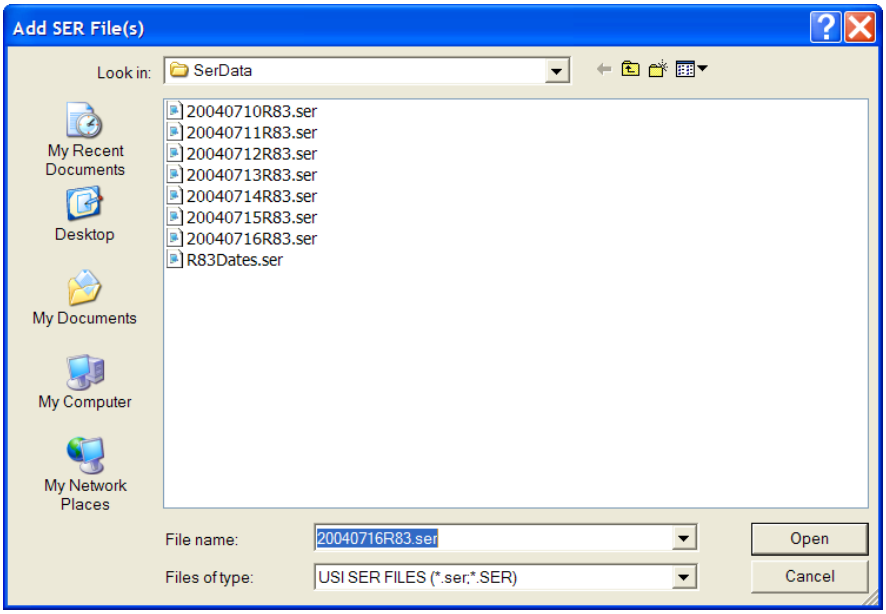


Figure 3-24 Add SER Files

- **Clear Display**
  This selection clears the SER Data displayed in the table except for the top row of the table. This does not delete the SER data from the data file, only from the SER Data table displayed.

- **Save Display**
  This selection displays the Save SER Display window. This window is used to save the displayed SER Data to a new SER Data file. The name and path of the new file is selected from the Save SER Display window (Figure 3-25).

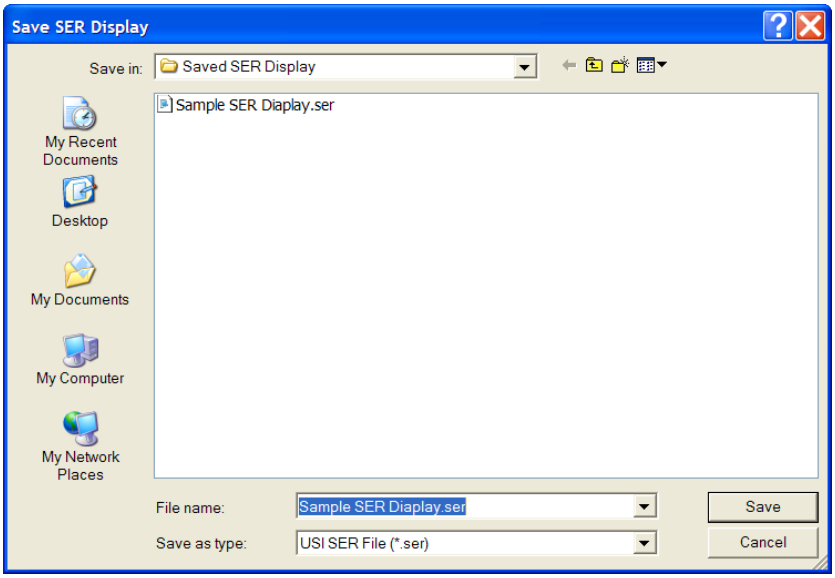


Figure 3-25 Save SER Display window

3.4 File Transfer

Select the ***File Transfer*** tab to display the ***File Transfer Screen*** (Figure 3-26).

3.4.1 File Transfer Screen Sections

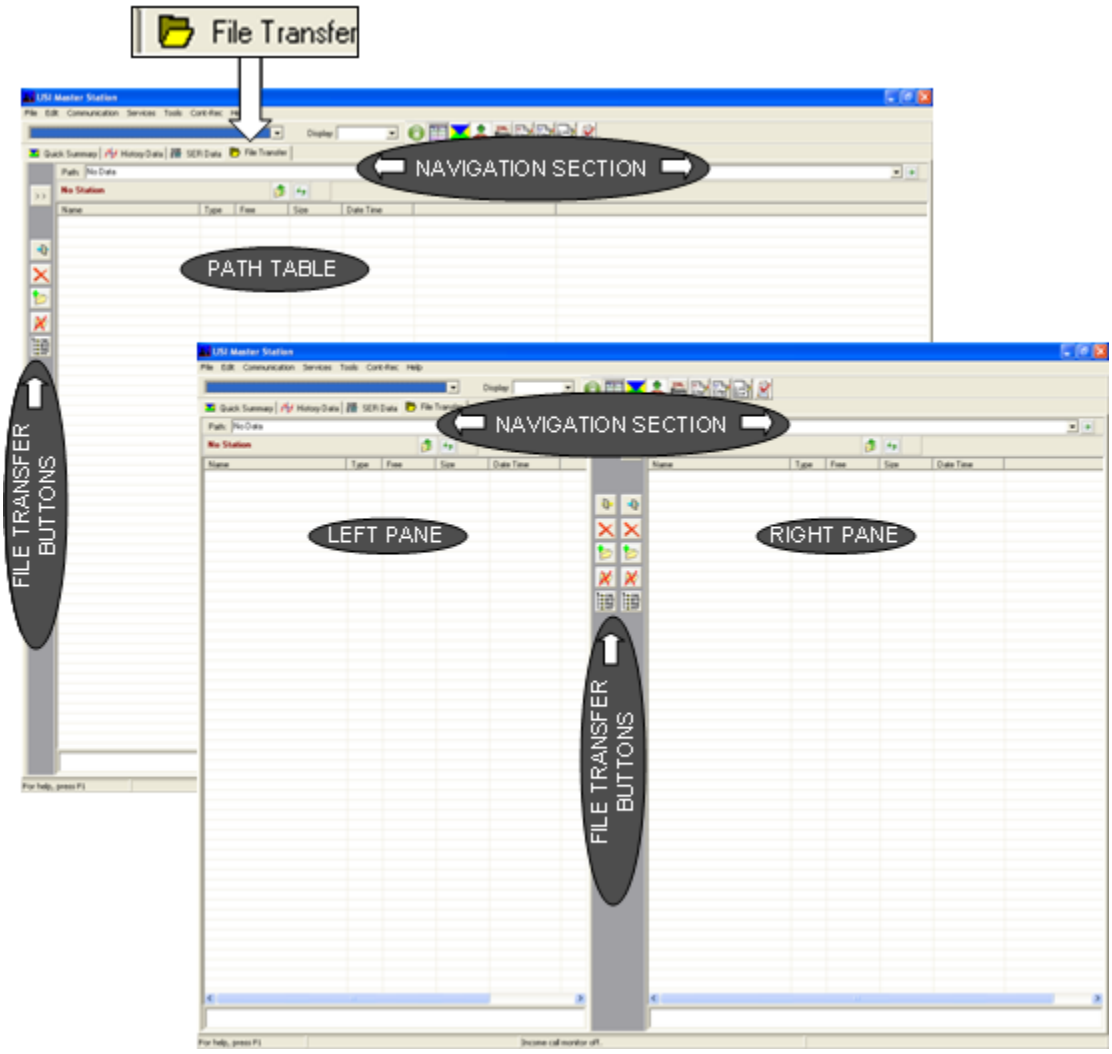


Figure 3-26 File Transfer Screen

- **Path Navigation Tools**
  Tools located in the Path Navigation section are used to navigate folder paths on the selected DME system. These paths are displayed in the Path table.

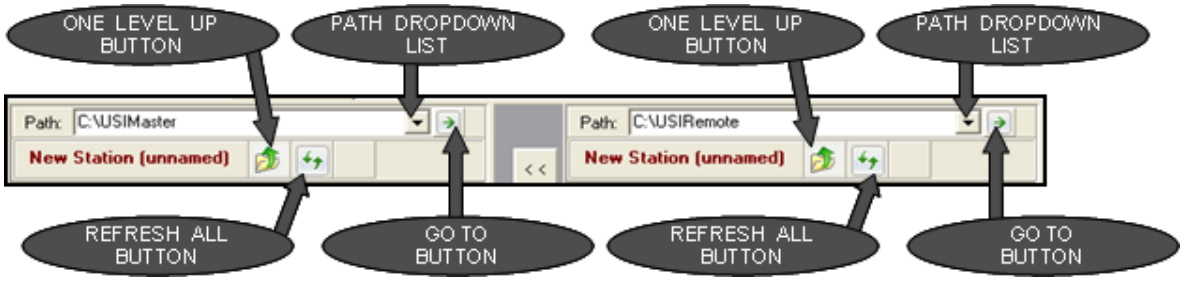


Figure 3-27 Navigation Section - Path Navigation Tools

- Path:
  The ***Path*** dropdown list displays application default and previously browsed storage paths on the DME system (Figure 3-28). Click to select a storage path. A path may also be manually typed into the ***Path*** field.

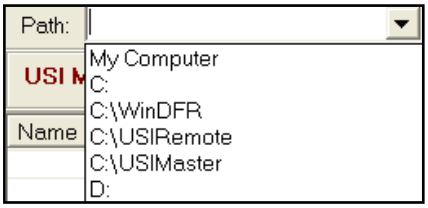


Figure 3-28 Path Dropdown List

- ***Goto*** button:
  After making a selection from the ***Path*** dropdown list, click the ***Goto*** button to display the files and folders stored on this DME system path. It is not necessary to click the ***Goto*** button after a specific location has been typed into the ***Path*** field. Simply press the ***Enter*** key to go to the selected location.

- ***One Level Up*** button:
  Click this button to display a list of files and folders located in the parent folder of the currently displayed folder.

- ***Refresh All*** button:
  Click this button to reload contents of the currently displayed folder. Use this action to view any content changes.

- **Path Table**

  - Name:
    The Name column displays file or folder names located in the selected path on the DME system

- Type:
  The Type column defines each row in the Path table as either a folder or a file.

- Size:
  The Size column displays the size (in bytes) for files displayed in the Path table. The size column displays a hyphen for rows displaying a folder.

- Date-Time:
  The Date-Time column displays the modified date and time records for the files and folders in each row of the Path table.

- **Path Table - File and Folder Tool Buttons**
  These buttons are used to transfer and delete files and folders within the selected DME system.

  -  ***Show Extra Pane*** button:
    Click this button to reveal the left File Transfer pane. This pane is used for copying files within the remote computer. (Note: this file transfer screen is primarily used for transferring files from one location to another within the computer in the field. It will also copy files to and from the master, but this action is done on the right-click menu.)

  -  ***Hide Extra Pane*** button:
    Click this button to hide the left File Transfer pane.

  -  ***Copy File to the Right*** button:
    Clicking this button will copy all selected files from the left File Transfer pane to the right pane. The File Transfer screen will automatically update the right pane to show that the copy action has taken place.

  -  ***Delete Selected File*** button:
    Click this button to delete selected files from a pane. If the left pane is open, it will have a ***Delete*** button. The File Transfer screen will automatically update to show that the files have been deleted.

  -  ***Create New Folder*** button:
    Click this button to create a single folder in a pane. If the left pane is open, it will have a ***Create Folder*** button. The File Transfer screen automatically updates to show that the new folder has been created.

-  ***Delete an Empty Folder*** button:
  Click this button to delete a single folder from a pane. If the left pane is open, it will have a ***Delete an Empty Folder*** button. This operation will work only when the current folder is displayed and it is empty. For example: to delete folder C:\temp, C:\temp should be the currently displayed folder and the indicated contents of the folder must be a single dot and a double dot ("**.**" and "**..**"). After the folder is deleted, the display will move up one folder to the parent folder of the deleted folder. The File Transfer screen automatically updates to show that the deleted folder is gone.

-  ***Create Continuous Tree*** button:
  Click this button to create a directory tree for storing continuous data. In USI software, continuous data is stored in subfolders under the continuous path that has been programmed into the configuration.

  For example: If the configuration has the path ***E:\Continuous Data*** as a continuous archive path, the actual continuous data files are stored in subfolders underneath this path.

  The continuous data will be stored in the folders listed in the following example:

RMS data:	**`E:\Continuous Data\RMSData`**
Frequency Data:	**`E:\Continuous Data\FreqData`**
Phase Data:	**`E:\Continuous Data\PhaseData`**
Oscillography Data:	**`E:\Continuous Data\OsclgrData`**

  Clicking this button accomplishes two things: it creates a new folder which must be named by the user; and it automatically creates the subfolders for continuous data storage.

- **Path Table - Right Click Menu**
  Right-click anywhere on the Path Table to display the menu shown in Figure 3-29.

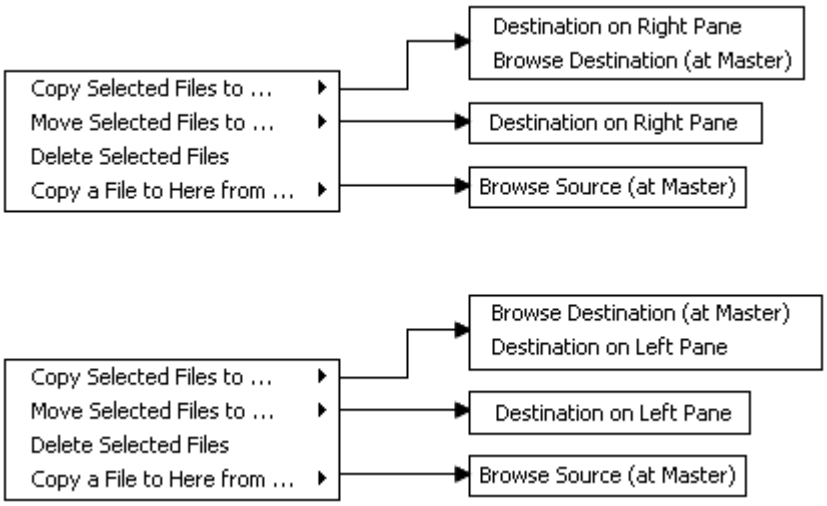


Figure 3-29 Path Table – Right Click Menu – Right and Left Pane Destinations

- **Copy Selected Files to …**
  - Destination on Right/Left Pane:
    This selection is used to copy selected files from one pane to the destination displayed in the opposite pane.
  - Browse Destination (at Master):
    This selection displays the ***Select Directory*** window and is used to copy selected files from the left or right pane to the destination at the *USIMaster*© selected in this window (Figure 3-30).

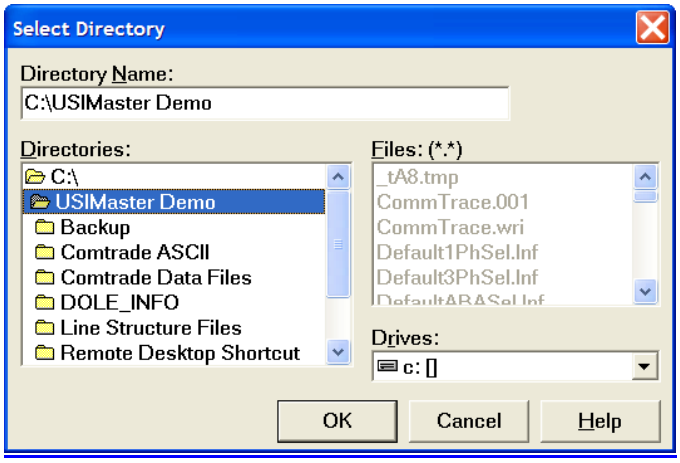


Figure 3-30 Path Table Right-click Menu – Browse Destination (at Master)

- **Move Selected Files to …**

    - Destination on Right/Left Pane:
      This selection is used to move selected files from one pane to the destination displayed in the opposite pane.

- **Delete Selected Files**
  This selection is used to delete selected files from the destination displayed in the left or right pane.

- **Copy a File to Here from …**

    - Browse Source (at Master):
      This selection displays the ***File to Copy From Master*** window (Figure 3-31) and is used to copy files to the DME system from a selected source location at the *USIMaster©*.

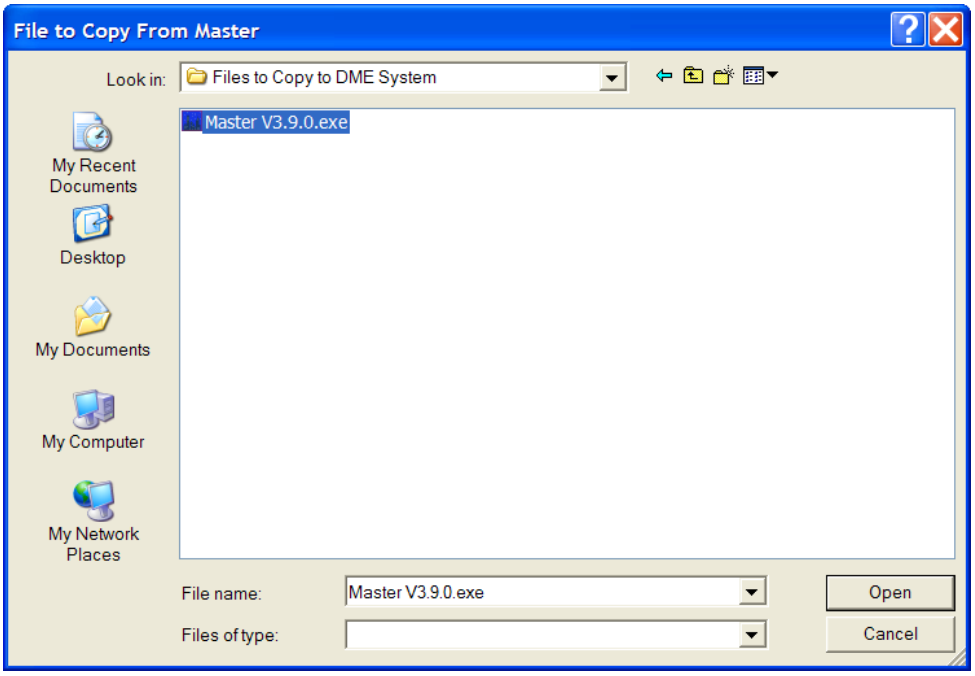


Figure 3-31 Path Table Right-click Menu – Browse Source (at Master)

Section 4: USIMASTER© AND DME SYSTEM SETUP

The following is a list of the fundamental configuration files for *USIMaster*© and the DME system:

- **Master Configuration** (Section 4.1)
- **Calibration Record** (Section 4.2)
- **Line Group Record** (Section 4.3)
- ***WinDFR*© Configuration** (Section 4.4)

Each of these records can be accessed from the ***Edit*** menu (Figure 2-3).

4.1 Master Configuration

The Master System Configuration window can be opened for editing or for review by selecting it from the Edit menu (Section 2.1.2). The Master System Configuration window consists of three different screen tabs used to configure General, Automation, and Lightning settings (Figure 4-1).

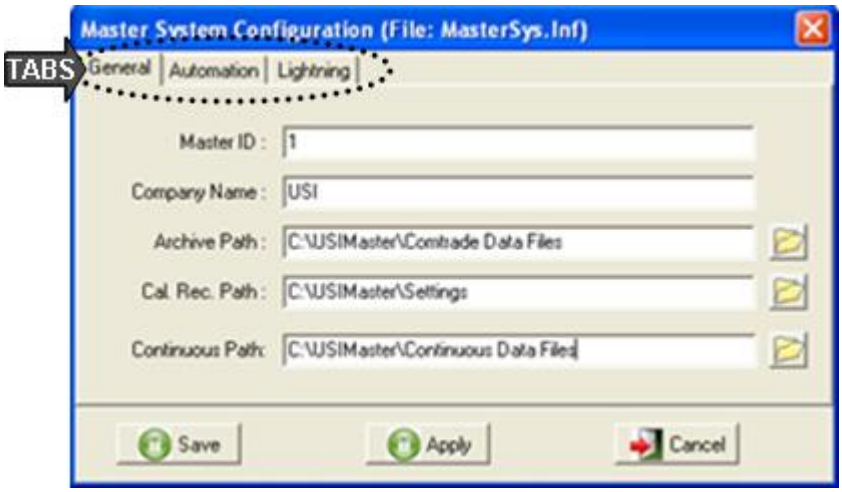


Figure 4-1 Master System Configuration – Screen Tabs

- Save ***Save:***
  This selection is used to save all setting changes made on any screen tab, close the Master System Configuration, and Reinitialize/Exit the *USIMaster*© application.

Note: The configuration settings assigned in the Master System Configuration window are stored into the file named ***mastersys.inf*** located in the *USIMaster*© application working directory.

Note: If the ***Save*** and ***Apply*** buttons display a red ***Locked*** symbol, the applications global Administrator privileges are disabled (Section 2.1.4). Clicking a locked ***Save*** or ***Apply*** button will open the Administrator Password window (Figure 4-2) allowing users to enter a valid Administrator password and click ***OK*** for a one-time ***Save*** or ***Apply***.

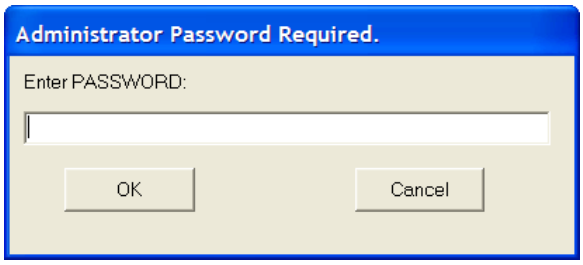


Figure 4-2 Administrator Password Window

- ***Apply:***
  This selection is used to perform an interim Save without triggering the Close, Reinitialize, and Exit functions. Used primarily to apply setting changes to *ServiceMaster©*.

- ***Cancel:***
  This selection is used to cancel all setting changes made on any screen tab and to close the Master System Configuration.

4.1.1 Master System Configuration – General Tab

The General screen tab is used to assign the following settings (Figure 4-3).

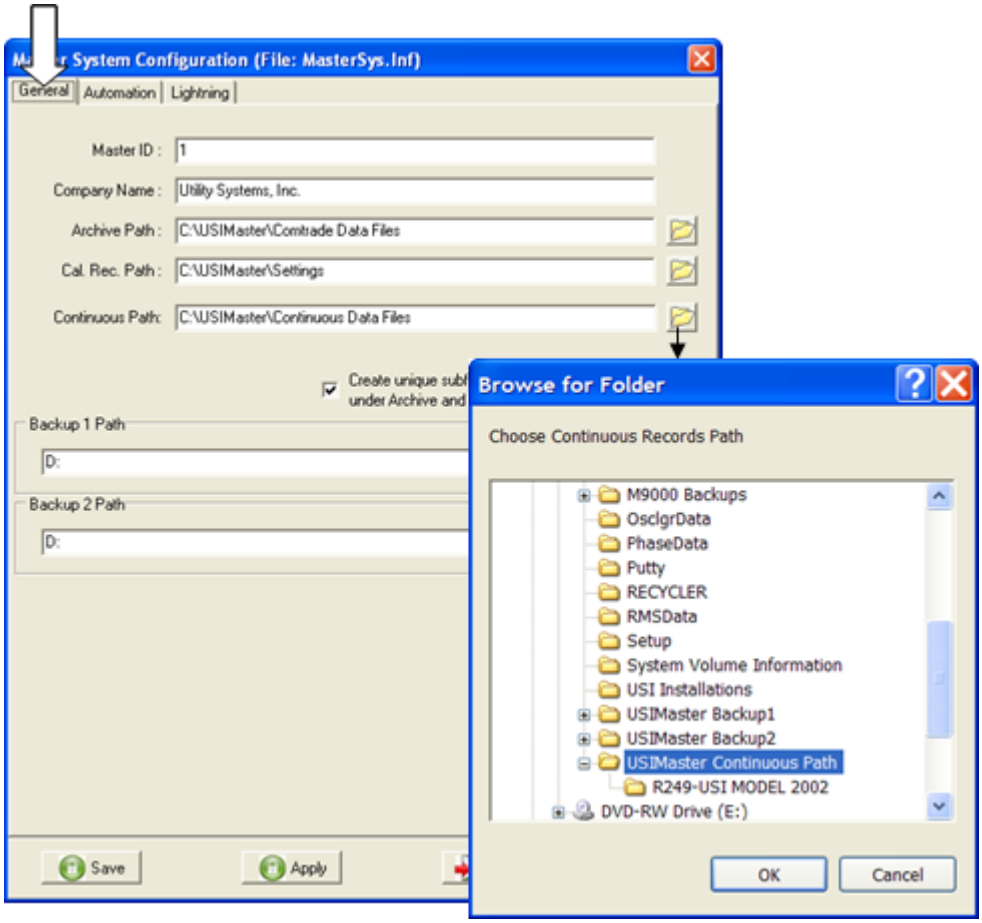


Figure 4-3 Master Configuration Screen – General Tab – Browse

- **Master ID**
  Enter Master ID in this text box. The Master ID uniquely identifies this master station. Master ID is used to receive incoming calls from a USI DME system that has Master ID in its Master Phone List (Figure 4-1). This is not a required field.

- **Company Name**
  Enter the company name of the user here. This is not a required field.

- **Archive Path**
  This parameter specifies the drive and folder where ***Transient, Long Term, and SER Data Files*** are stored after being retrieved.

Note: File paths can be assigned by either typing the path directly into the text box or by clicking the  ***Browse for Folder*** button to choose a path listed in the ***Browse for Folder*** window.

- **Cal. Rec. Path**
  This parameter specifies the drive and folder where Calibration Record files for all DME systems are stored (Section 4.2).

- **Continuous Path**
  This parameter specifies the drive and folder where ***Continuous Files*** will be stored when transferred via auto-poll or auto-call from a DME system.

Note: See Master System Configuration – Automation Tab to configure Auto-polling and the inclusion of Continuous Data files. See *WinDFR*© System Configuration – General Tab to configure Auto-call Master, to include Continuous Data files, to select the Continuous Data values, and to select the input channels to be transferred.

- **☑Create Unique Subfolder**
  Select this checkbox to enable *USIMaster*© to automatically create a unique subfolder within the ***Archive, Backup1*** and ***Backup2*** paths.

  The subfolder name contains the remote ID number and station name assigned in the Calibration Record and displayed in the DME system drop-down list.

- **Backup 1 Path**
  This parameter specifies the drive and folder for the Backup 1 path. This path can be used to copy or to move manually or automatically to Quick Summary, COMTRADE, and SER data files as well as DME system configuration files.

- **Backup 2 Path**
  This parameter specifies the drive and folder for the Backup 2 path. This path can be used to copy or move manually or automatically to Quick Summary, COMTRADE, and SER data files as well as DME system configuration files.

4.1.2 Master System Configuration – Automation Tab

The Automation screen tab is used to assign settings for Auto-Polling, Automatic Backup/Printing/Email, and ServiceMaster parameters (Figure 4-4).

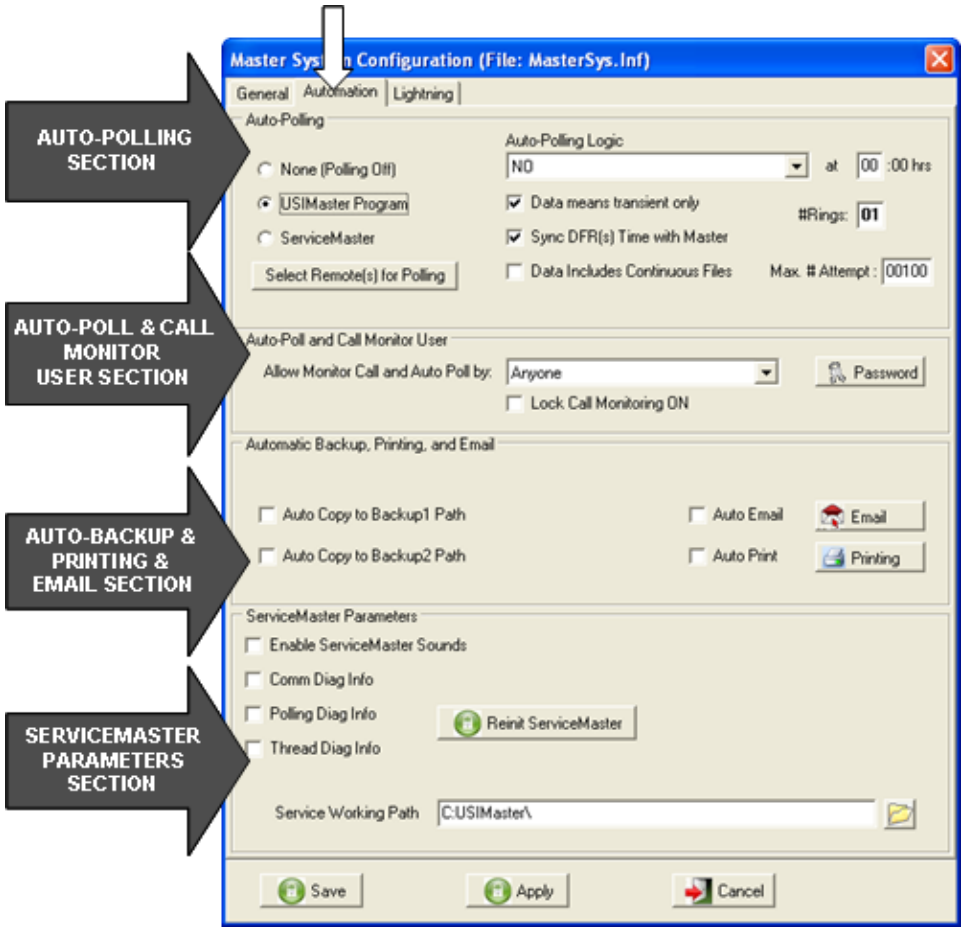


Figure 4-4 Master Configuration Screen – Automation Tab

- **Auto-Polling section**
  The Auto-Polling section of the Automation screen tab is used to assign the following settings (Figure 4-5).

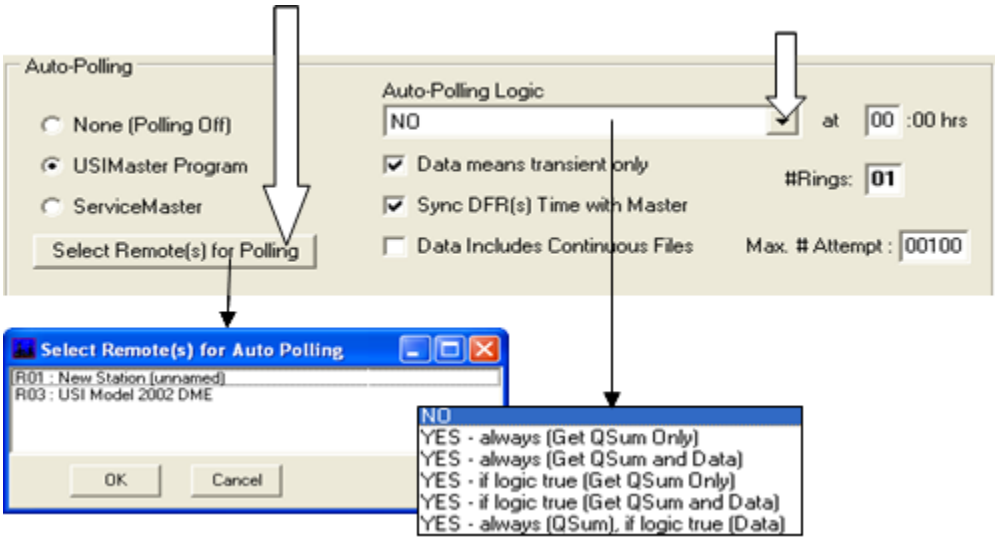


Figure 4-5 Master System Configuration Screen – Automation Tab – Select Auto-Polling

- **None (Polling Off)**
  This selection disables Auto-Polling.

- **USIMaster Program**
  This selection enables the *USIMaster©* application to handle the Auto-Polling functions.

- **ServiceMaster**
  This selection enables the USI *ServiceMaster©* which runs as a service on the *USIMaster©* computer to handle the Auto-Polling functions.

- **Select Remote(s) for Polling**
  This selection opens the Select Remote(s) for Auto Polling window (Figure 4-6). From this list select the DME systems to be polled using ***Ctrl +Left-click*** or ***Shift +Left-click***.

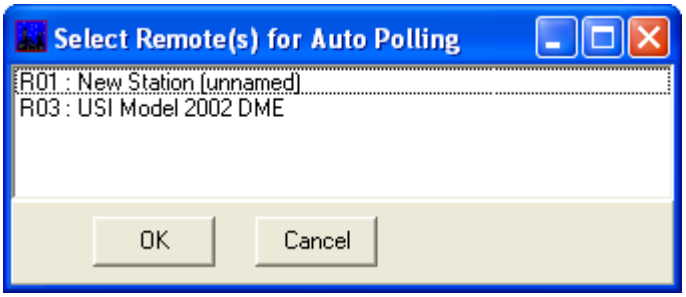


Figure 4-6 Select Remotes for Auto-Polling

- **Auto-Polling Logic**
  This drop-down menu is used to enable Auto-Polling and to determine what data is to be downloaded to *USIMaster*© during an Auto-Polling session (Figure 4-7).

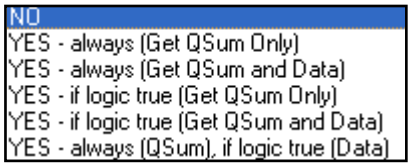


Figure 4-7 Auto Polling Drop-Down Menu

  - NO:
    This selection disables Auto-Polling.

  - YES – always (Get QSum Only):
    This selection enables Auto-Polling to always download the Quick Summary file.

  - YES – always (Get QSum and Data):
    This selection enables Auto-Polling to always download both Quick Summary and new COMTRADE files.

  - YES – if logic true (Get QSum only):
    This selection enables Auto-Polling to selectively download the Quick Summary file based on the ***Auto Email, Auto Call Master*** and ***Auto Print Decision Logic*** in the *WinDFR*© configuration (Section 4.4).

  - YES – if logic true (Get QSum and Data):
    This selection enables Auto-Polling to selectively download the Quick Summary file and new COMTRADE files based on the ***Auto Email, Auto Call Master and Auto Print Decision Logic*** Boolean equation in the *WinDFR*© configuration (Section 4.4).

  - YES – always (QSum), if logic true (Data):
    This selection enables Auto-Polling to always download the Quick Summary file but selectively download new COMTRADE files based on

the ***Auto Email, Auto Call Master and Auto Print Decision Logic*** Boolean equation in the *WinDFR©* configuration (Section 4.4).

- ☑ **Data means transient only**
  This checkbox controls the type of data to be downloaded to *USIMaster©* from the DME systems. If the box is checked, only COMTRADE files for transient DME records will be downloaded. If the box is unchecked, COMTRADE files for both transient and long term DME records will be downloaded.

- ☑ **Sync DFR Time with Master**
  This checkbox enables the *USIMaster©* to synchronize the DME system clock with the Master Station clock. This is a global setting which is applied to all DME systems selected for polling.

Caution: The **Sync DFR Time with Master** selection is intended to be used only on DME systems that do not have time synced from an IRIG-B satellite-sourced GPS clock. Applying this option otherwise could cause instability in the DME system fault timers.

- ☑ **Data Includes Continuous Files**
  This checkbox enables Auto-Polling to download selected continuous data to *USIMaster©* as configured in the *WinDFR©* Configuration (Section 4.4).

- **at ##:00 hrs**
  This field is used to set the time, in 24 hour format (00:00 through 23:00), that Auto-Polling is to begin.

- **#Rings (Number of Rings)**
  This setting configures the number of rings the *USIMaster©* modem will wait before it answers an incoming call.

- **Max # Attempt (Maximum Number of Attempts)**
  This setting configures the maximum number of times *USIMaster©* will attempt to poll a DME system during a single polling session. If the polling of a DME system does not succeed within this number of attempts, Auto-Polling will not make any further attempts until the next scheduled session.

- **Auto-Poll and Call Monitor User**
  The following settings are used to apply ***Auto-Poll and Call Monitor*** security

conditions:

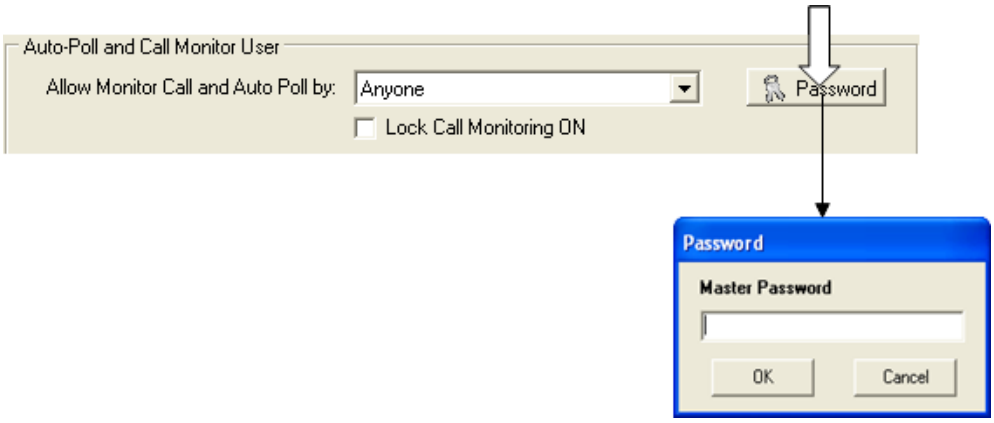


Figure 4-8 Auto-Poll and Call Monitor User

- Allow Monitor Call and Auto Poll by:
  This drop-down menu displays a list of users logged on the PC where *USIMaster©* is running. This selection is used to assign the master level user who will answer incoming calls and initiate Auto-Polling sessions (Figure 4-8).

  When *USIMaster©* is installed on a PC where multiple simultaneous users may be logged in, each running a separate copy of *USIMaster©*, Auto-polling or Auto-call conflicts can occur. This feature prevents Auto-Polling or Auto-call conflict between the multiple *USIMaster©* sessions.

- Password: Password
  This button displays the Master Password window (Figure 4-8). This window is used to enter a password to allow remote login to *USIMaster©*. This password is used to prevent logins from unauthorized callers.

  If this field is left blank, no password is assigned and any caller can attempt to login. If a password is entered, *USIMaster©* will require this password from the caller to allow a log in attempt.

  If the DME systems are configured to Auto-call, the Master Password is required to be in the *WinDFR©* program ***Master Phone List***. If it is not, the DME system cannot login to *USIMaster©* (Section 4.4).

- ☑ Lock Call Monitoring ON:
  This checkbox is used to lock the ***Monitor Call*** setting ON. If this box is un-checked, the call monitor control is handled by the ***Monitor Call*** setting in the Communication menu (Section 2.1.3). Checking this box ensures that only an administrator (Section 2.1.4) can disable Monitor Call.

- **Automatic Backup, Printing, and Email**
  The following settings are used to store, distribute and print automatic copies of Fault Records:

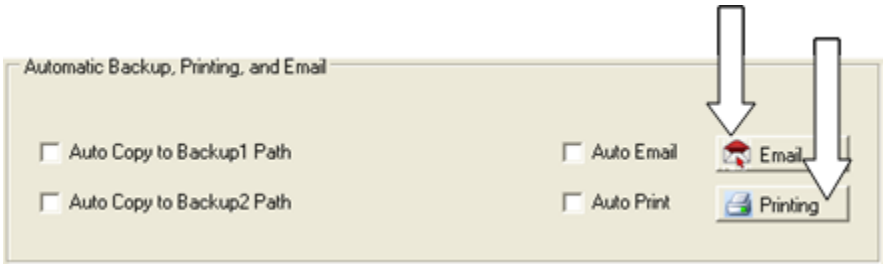


Figure 4-9 Automatic Backup, Printing, and E-mail

  - ☑ Auto Copy to Backup1 Path:
    Check this box to enable the *USIMaster©* to put a copy of Quick Summary, COMTRADE, and SER data files to the Backup 1 path automatically. The Backup 1 path was configured in the General tab of the Master System Configuration (Section 4.1.1). This action takes place upon completion of an Auto Polling or Auto Calling session with selected DME systems.

  - ☑ Auto Copy to Backup2 Path:
    Check this box to enable the *USIMaster©* to put a copy of Quick Summary, COMTRADE, and SER data files to the Backup 2 path automatically. The Backup 1 path was configured in the General tab of the Master System Configuration (Section 4.1.1). This action takes place upon completion of an Auto Polling or Auto Calling session with selected DME systems.

  - ☑ Auto E-mail:
    Check this box to enable the *USIMaster©* to send an automatic E-mail to all addresses saved in the Recipients field of the E-mail settings screen. The message contains fault summary information of DME records received during Auto-call and Auto-Polling sessions.

  - 

E-mail:
    This button is used to display the ***Send E-mail*** window (Figure 4-10). From this window E-mail settings can be customized to define what information is to be sent automatically and to whom. This window can also be used to send an E-mail message manually. The *USIMaster©* must have an SMTP/POP3 E-mail account and connectivity in order to use the E-mail feature.

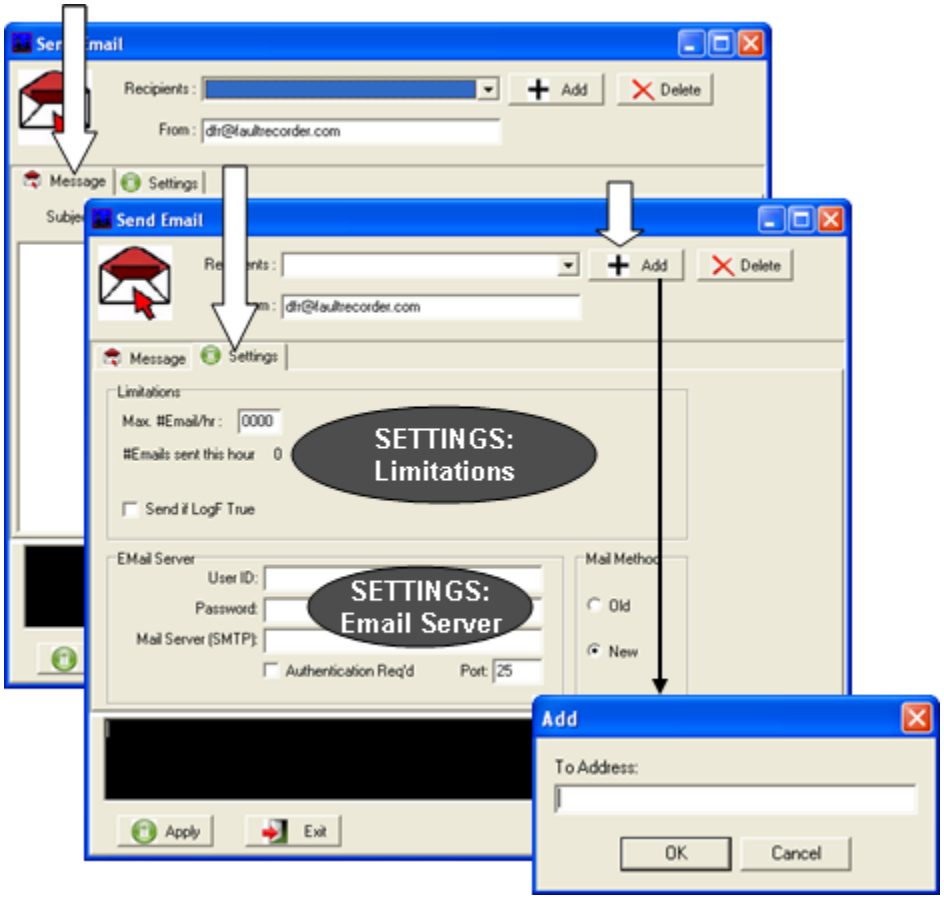


Figure 4-10 Send E-mail

-  **Add:**
  This button is used to display the ***Add*** window. Use this window to add an E-mail address to the ***Recipients*** drop-down list. Click the  **OK** button to complete.

-  **Delete:**
  To delete an E-mail address, select one from the ***Recipients*** drop-down list and click the **Delete** button.

- **From**:
  This field is used to enter or revise the E-mail address of the master station.

- The ***Settings*** screen tab (Figure 4-10) allows user access to the ***Limitations*** settings and ***Email Server*** settings listed below:

  - Limitations
    Max. #Email/hr:

This setting limits the number of messages that can be sent automatically in a single 60 minute period.

#Emails sent this hour
This field displays the number of E-mail messages sent in the current hour.

☑ Send if LogF True
This checkbox is used to apply the Auto Call, Auto Email, and Auto Print decision logic to E-mail messages (Section 4.4.1). E-mail messages shall be sent only if this logic is true.

- E-mail Server
  User ID:
  This field is used to enter the User ID for the master station E-mail account.

  Password:
  This field is used to enter the User Password for the master station E-mail account. If no password is required by the mail server, this field may be left blank.

  Mail Server (SMTP):
  This field is used to enter the IP address of the SMTP Mail Server.

  ☑ Authentication Req'd:
  This checkbox is used to enable authentication, if required by the SMTP Mail Server.

  Port:
  This field allows users to enter the port number of the IP address being used for E-mail message transport.

- The ***Message*** screen tab (Figure 4-10) is used to send a test E-mail message to the addresses in the ***Recipients*** list.

  - Subject:
    The Subject field is used to enter a subject for the E-mail message being created manually.

Note: The subject field of E-mail messages automatically sent by *USIMaster*© are populated with the Remote ID number and Station Name of the DME system.

- Message field:
  This field is used to enter the body of an E-mail message being sent manually.

Note: The body of an E-mail message initiated by a new DME record will be populated automatically with Quick Summary and Distance-to-Fault information. Lightning Data Correlation results are also included if this option was purchased.

-  **Send**:
  When the ***Recipients*** list, ***Subject*** field, and ***Message*** field have been completed, send the message by clicking the ***Send*** button.

-  The **Apply** button is used to save ***Settings*** entered within the Send E-mail window.
-  The **Exit** button is used to close the Send E-mail window.

- ☑ Auto Print:
  This checkbox is used to enable *USIMaster*© to print any new DME records received during an Auto-call or Auto-Polling session. This printout is sent to the default printer. The content of the printout is determined by what is downloaded to *USIMaster*© as configured by the Auto-Polling Logic (Figure 4-5).

Note: The default printer was selected in the Printer Setup window of the File menu (Section 2.1.1). The format for waveform printing is determined by the default settings assigned in the Format All Wave Printing window (Figure 4-11).

-  Printing Format:
  This button displays the Format All Wave Printing window (Figure 4-11) and is used to configure the *USIMaster*© default printing format.

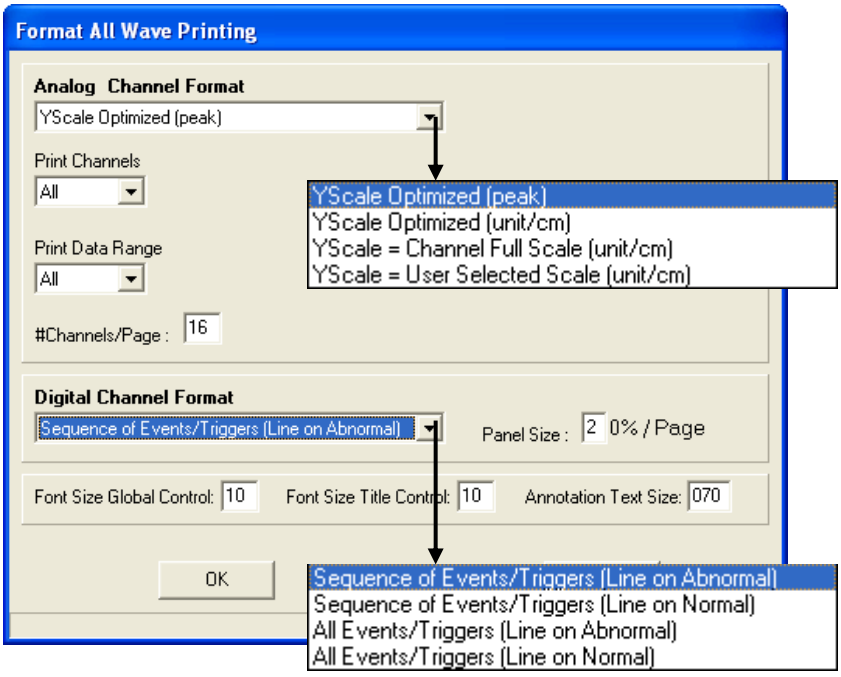


Figure 4-11 Format All Wave Printing

- Analog Channel Format
  This drop-down list is used to select the default Y-scale settings for analog waveforms being printed.

  - YScale Optimized (peak)
    This selection optimizes the height of each waveform to its allocated printable area. The height allocated on the page for each waveform is determined by the #Channels/Page setting. This makes very small waveforms more visible.

    The Y-scale reference is the peak magnitude value for each printed waveform (Figure 4-12).

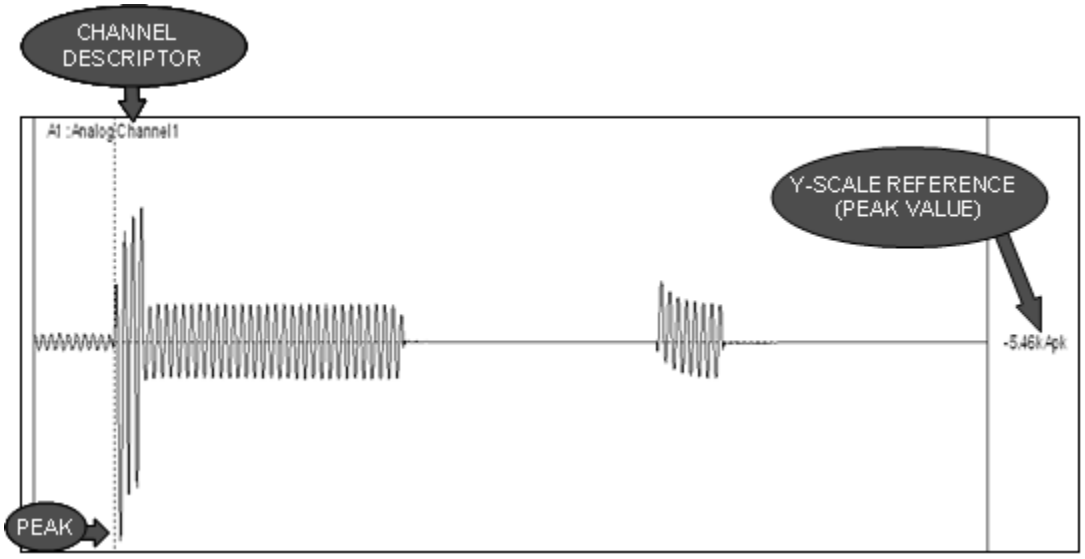


Figure 4-12 Y-Scale – Optimized – Peak – Sample Printout

- YScale Optimized (unit/cm)
  This selection optimizes the height of each waveform to its allocated printable area. The height allocated on the page for each waveform is determined by the #Channels/Page setting. This makes very small waveforms more visible.

  The appearance of the waveforms is the same as YScale Optimized (peak). However, the Y-scale reference is set to unit/cm rather than peak (Figure 4-13). The signal value can be determined by measuring the waveform height on the printout and multiplying the measurement by the Y-scale reference.

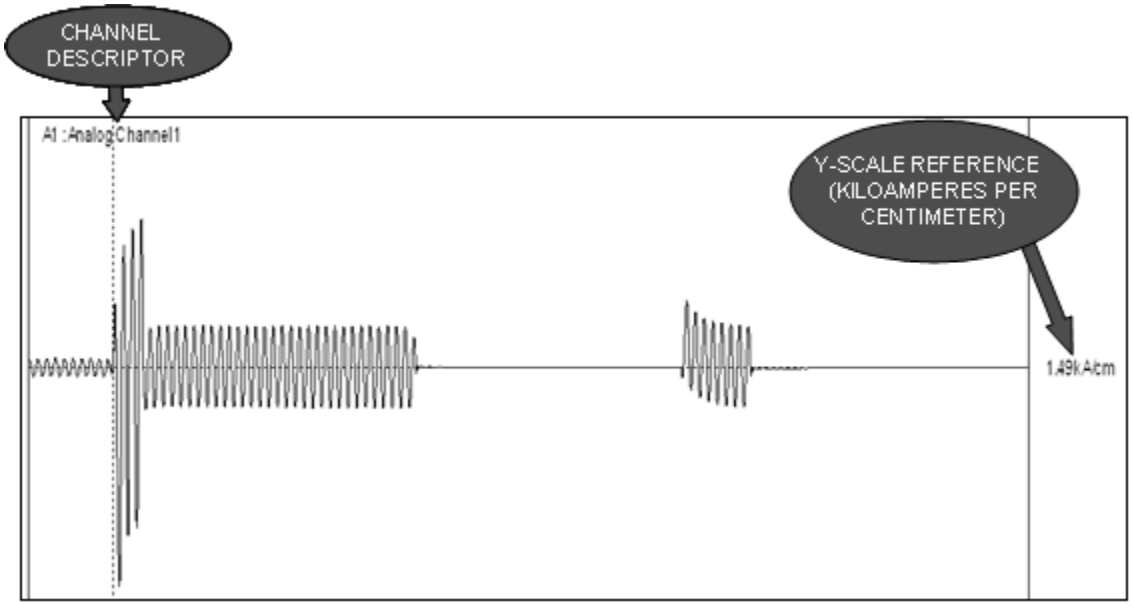


Figure 4-13 Y-Scale – Optimized – Unit/Centimeter – Sample Printout

- YScale = Channel Full Scale (unit/cm)
  This selection sets the Y-scale height to the Analog Channel Full Scale value entered in the Calibration Record (Section 4.2).

  The Y-scale reference is set to unit/cm. The signal value can be determined by measuring the waveform height on the printout and multiplying the measurement by the Y-scale reference (Figure 4-14).

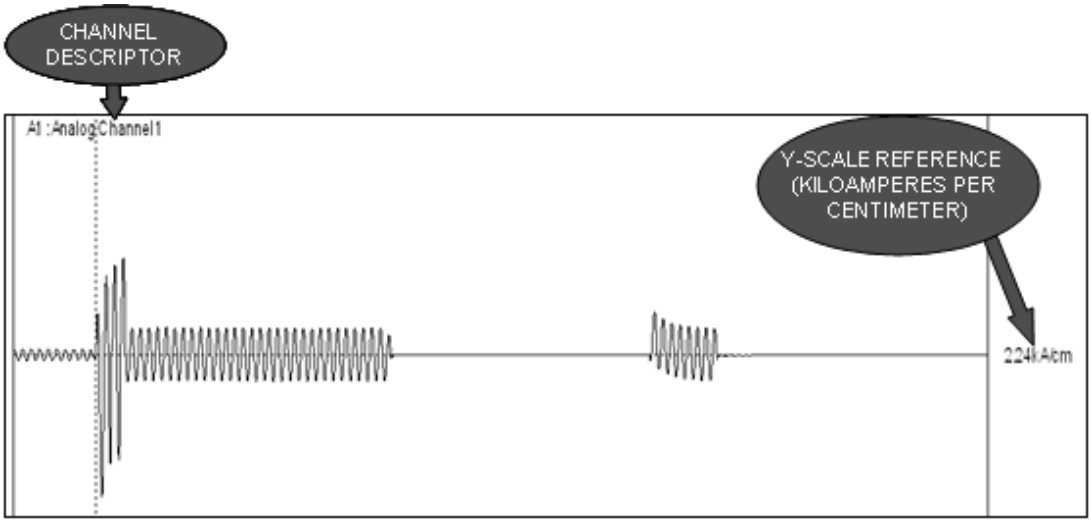


Figure 4-14 Y-Scale – Channel Full-Scale – Unit/Centimeter – Sample Printout

- YScale = User Selected Scale (unit/cm)
  This selection sets the Y-scale height for each waveform to the value entered in the ***YScale V or A*** field (Figure 4-15).

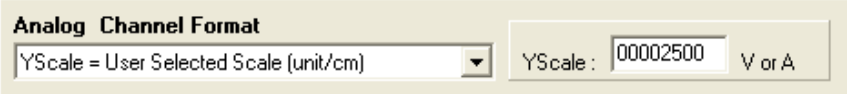


Figure 4-15 User Selected Y-Scale

The Y-scale reference is set to unit/cm. The signal value can be determined by measuring the waveform height on the printout and multiplying the measurement by the Y-scale reference (Figure 4-16).

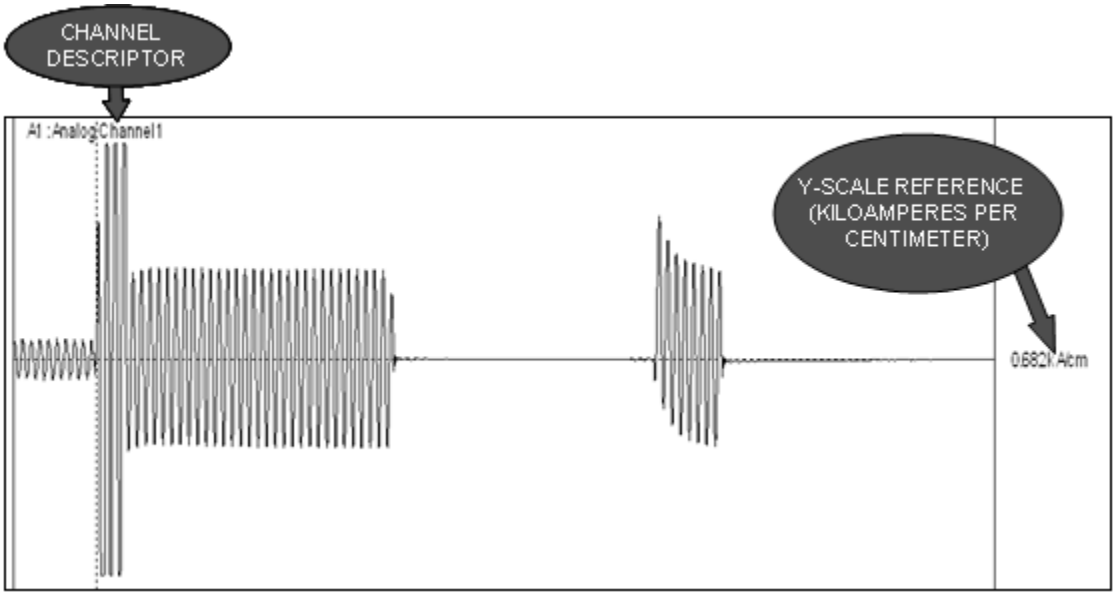


Figure 4-16 Y-Scale - User Selected – Unit/Centimeter – Sample Printout

- Print Channels
  This drop-down list is used to select the default settings for analog waveforms being printed (Figure 4-11). The default settings define user printout preferences. These preferences are applied to automatic and manual printouts, and are the starting point for print previews.

  The default can only be set to ***All*** channels which prints all

waveforms for the DME record being printed. This setting can only be changed during a print preview (Figure 2-2).

- Print Data Range
  This drop-down list (Figure 4-11) displays selections to choose from ***All*** or ***Selected*** data range to be printed. The default setting is ***All*** and this setting may be changed only during a print preview of waveforms.

- #Channels/Page
  This field is used to select the number of analog channel waveforms to be printed on each page. Valid channels-per-page settings range from 1 to 99.

- Digital Channel Format
  The following drop-down list (Figure 4-11) is used to select the default format setting for the digital traces being printed:

  - Sequence of Events/Triggers (Line on Abnormal)
    This selection prints only the digital events and analog triggers which were abnormal during the DME record to be printed. A solid line will be printed to display the ***Abnormal*** period for each event or trigger. Absence of the solid line along the same x-axis indicates the ***Normal*** period for the event or trigger. The lines will be printed from top to bottom in the sequence they became abnormal. The color of the solid line will match the color of the descriptor for the event or trigger. See example printout in Figure 4-17.

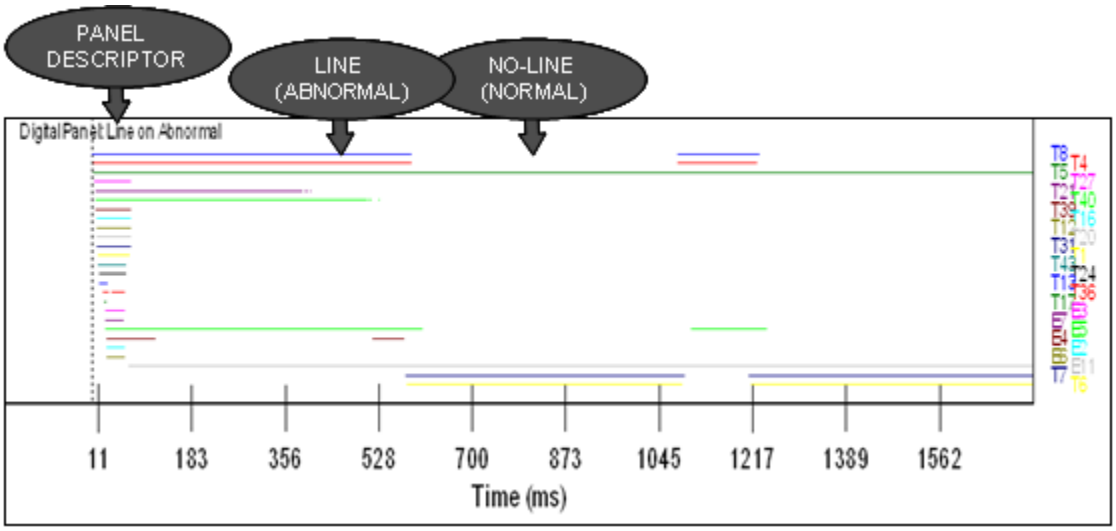


Figure 4-17 Sequence of Events/Triggers – Line on Abnormal – Sample Printout

- Sequence of Events/Triggers (Line on Normal)
  This selection prints only the digital events and analog triggers which were abnormal during the DME record to be printed. A solid line will be printed to display the ***Normal*** period for each event or trigger. Absence of the solid line along the same x-axis indicates the ***Abnormal*** period for the event or trigger. The lines will be printed from top to bottom in the sequence they became abnormal. The color of the solid line will match the color of the descriptor for the event or trigger. See example printout in Figure 4-18.

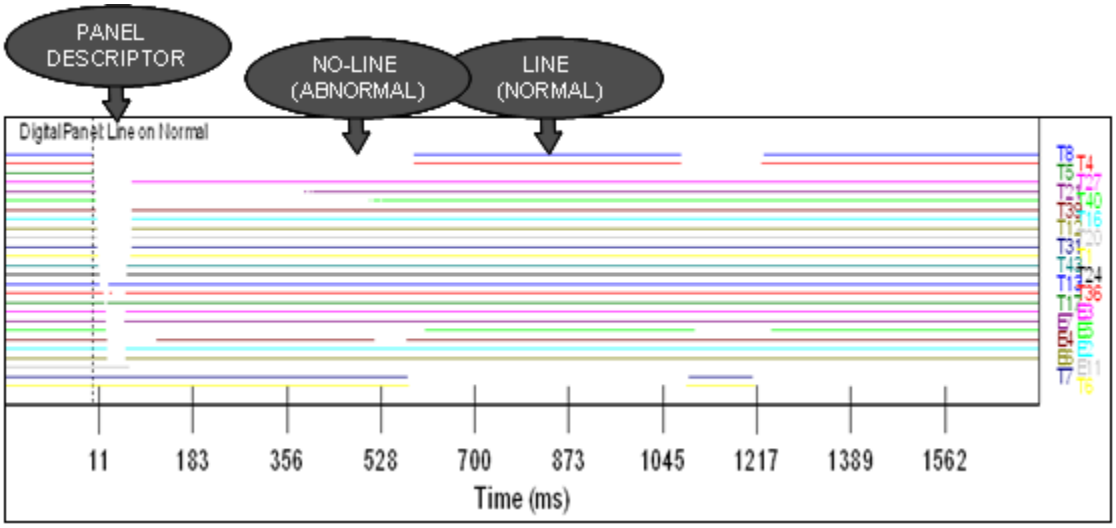


Figure 4-18 Sequence of Events/Triggers – Line on Normal – Sample Printout

- All Events/Triggers (Line on Abnormal)
  This selection will print ***All*** digital events and analog triggers, allocating space for 32 digital events and 8 analog triggers on each page. A solid line will be printed to display the ***Abnormal*** period for of each digital event or analog trigger. Absence of the solid line along the same x-axis indicates the ***Normal*** period for each digital event or analog trigger. The color of the solid line will match the color of the descriptor for the event or trigger. See example printout in Figure 4-19.

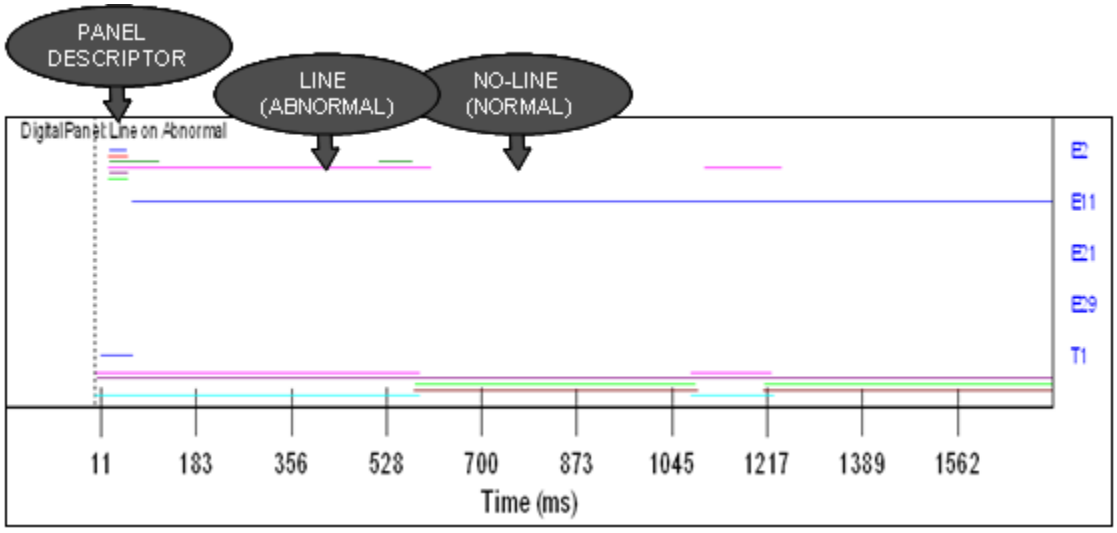


Figure 4-19 All Events/Triggers – Line on Abnormal – Sample Printout

- All Events/Triggers (Line on Normal)
  This selection will print ***All*** digital events and analog triggers, allocating space for 32 digital events and 8 analog triggers on each page. A solid line will be printed to display the ***Normal*** period for of each digital event or analog trigger. Absence of the solid line along the same x-axis indicates the ***Abnormal*** period for each digital event or analog trigger. The color of the solid line will match the color of the descriptor for the event or trigger. See example printout in Figure 4-20.

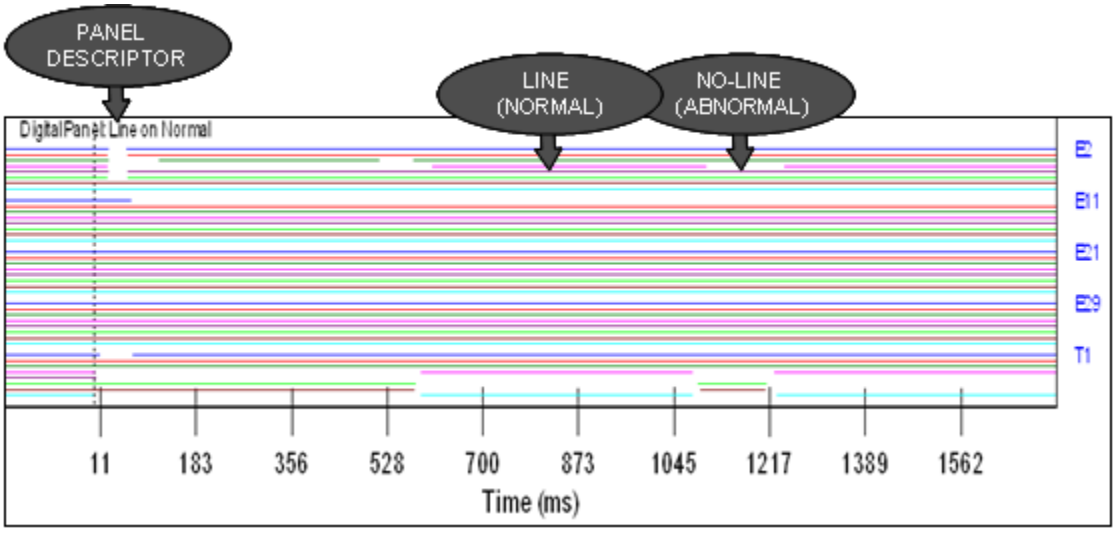


Figure 4-20 All Events/Triggers – Line on Normal – Sample Printout

- Panel Size
  This field is used to define the default panel height (in percent of printout page height) for the digital events and analog triggers panel. The values are adjustable in steps of 10% from 10% to 90%.

- Font Size Controls

  - Font Size Global Control
    This field is used to assign the default font size which will be applied globally to text characters on the printout.

  - Font Size Title Control
    This field is used to assign the default font size which will be applied specifically to title characters on the printout.

  - Annotation Text Size
    This field is used to assign the default font size which will be applied specifically to annotation characters on the printout.

- 

OK button
Click this button to save these settings and close the Format All Wave Printing window.

- 

Cancel button
Click this button to cancel all setting changes and close the Format All Wave Printing window.

- **ServiceMaster Parameters**
  The following settings are used to configure the *ServiceMaster©* service application (Figure 4-21). *ServiceMaster©* is separate from the *USIMaster©* desktop application and is used to handle Auto-calls, Auto-polling, Automatic E-mail, Auto-backups, and Lightning Data Correlation. The advantage of *ServiceMaster©* is that being a service application it will handle these functions without the need for a specific user to be logged onto the master station computer.


Note: *ServiceMaster©* has a separate installation package from *USIMaster©*. If this feature is not installed on the master PC the *ServiceMaster©* sections will not display. Contact Utility Systems, Inc. for assistance in downloading and installing this feature.

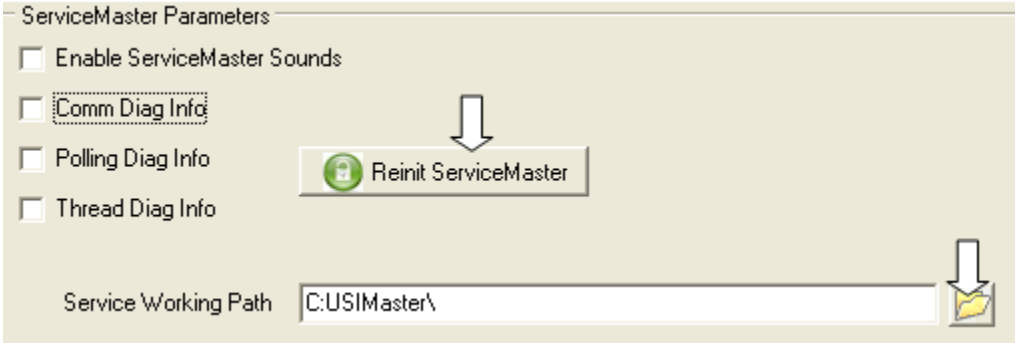


Figure 4-21 ServiceMaster

- ☑ Enable ServiceMaster Sounds:
  This checkbox is used to enable sounds to be generated by *ServiceMaster©* at the computer running the service. These sounds provide useful cues to the operator as to what the service is doing. Distinctive sounds are generated when a DME system logs in and logs out with *ServiceMaster©*. A repeating beep is generated to cue the operator that the service is running.

  If *ServiceMaster©* Sounds is not enabled, operation can be verified in the Windows ™ Task Manager on the Processes tab.

- ☑ Comm Diag Info:
  This checkbox is used to store communications-related diagnostic information in the Trace File. This information is useful only for communications troubleshooting. This box should be unchecked during normal operation.

- ☑ Polling Diag Info:
  This checkbox is used to store polling-related diagnostic information in the Trace File. This box should be unchecked during normal operation.

- ☑ Thread Diag Info:
  This checkbox is used to store thread-related diagnostic information in the Trace File. This box should be unchecked during normal operation.

- Reinit ServiceMaster Reinit ServiceMaster:
  This button is used to re-initialize *ServiceMaster©* to update the configuration. When a Configuration file has been updated, click this button to run the updated configuration file, reload its updated list of remotes, and incorporate polling parameter changes.

- Service Working Path:
  This is the directory where *ServiceMaster*© looks to get the Configuration file.

4.1.3 Master Configuration Screen - Lightning Tab

The Lightning screen tab is used to assign settings for the ***Lightning Data Correlation***© (***LDC***) option (Figure 4-22).

The ***Lightning Data Correlation***© (***LDC***) feature is an add-on option to *USIMaster*©. This add-on feature enables *USIMaster*© to check for correlation between DME system records and lightning strikes near the fault time and area of the faulted transmission line. This option also requires a subscription to real-time lightning sensor data from Vaisala, Inc. Contact Utility Systems, Inc. for ordering information.

Note: ***Lightning Data Correlation***© ***(LDC)*** is an option which must be purchased. If this option has not been purchased and installed, this screen tab will NOT display.

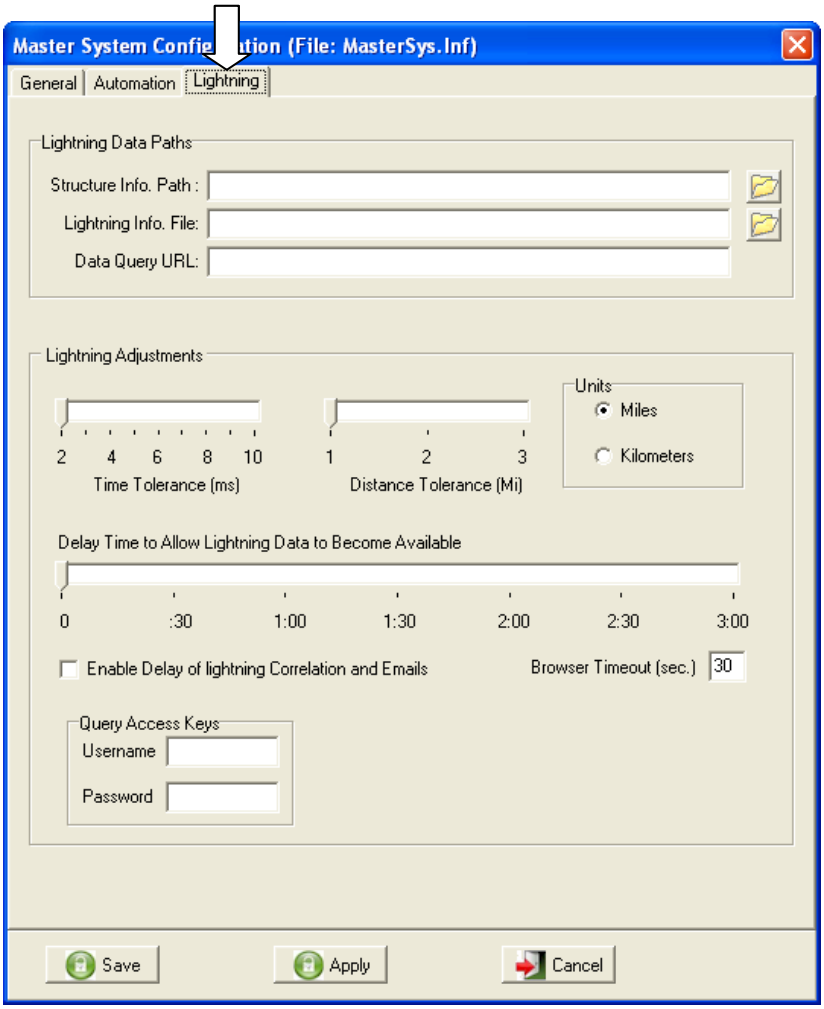


Figure 4-22 Master Configuration Screen – Lightning Tab

- **Lightning Data Paths**
  The Lightning Data Paths section is used to assign the following settings (Figure 4-22):

  - Structure Info. Path:
    This directory path specifies the location where transmission line structure files are stored. These files contain the GPS coordinates of each tower.

  - Lightning Info. File:
    All lightning strike Database Query Responses returned from Vaisala are stored in this archive file. They are in text file (***.txt***) format and can be read with Notepad or any text editor.

  - Data Query URL:
    This field is used to enter the URL address *USIMaster©* uses to send a Lightning Data Query to the Vaisala, Inc. lightning database.

- **Lightning Adjustments**
  The Lightning Adjustments section is used to assign the following settings (Figure 4-22):

  - Time Tolerance (ms):
    This slide bar specifies the time proximity, from 2 to 10 milliseconds, between the lightning strike timestamp and DME record trigger time (t_0) to be used for correlation purposes. The lightning strike is assumed to have caused the disturbance if the strike occurred at t_0 ***+4 / -10*** milliseconds.

  - Distance Tolerance:
    This slide bar specifies the distance proximity, from 1 to 5 kilometers or 1 to 3 miles, between the lightning strike GPS coordinates and the GPS coordinates of each transmission line structure to be used for correlation purposes.

  - Units:
    This is used to select distance units of ***Miles*** or ***Kilometers*** to be used for the ***Distance Tolerance*** setting.

  - Delay Time to Allow Lightning Data to Become Available:
    This slide bar is used to set a delay period between the time *USIMaster©* receives notification from a DME system of a new fault and when the lightning data query is sent to Vaisala. This delay period is to allow time for the lightning data to be entered into the database and be made available to the *USIMaster©* query.

  - ☑ Enable Delay of Lightning Correlation and E-mails:
    This checkbox is used to enable *USIMaster©* to apply the ***Delay Time to Allow Lightning Data to Become Available*** setting to the lightning data correlation queries and to the automatic E-mail reports being sent. Utilizing this delay helps reduce false negative results caused by *USIMaster©* sending a query before the lightning strike data is available.

  - Browser Timeout (sec.):
    This is the amount of time the system gives the browser to return a response to a query. Upon timeout, the system flags a timeout and immediately sends another query.

- **Query Access Keys**
  The Query Access Keys section is used to assign the following settings (Figure 4-22):

  - Username:
    This field is used to enter the Username assigned by Vaisala and used by *USIMaster©* to connect to their lightning strike database.

- Password:
  This field is used to enter the password assigned by Vaisala and used by *USIMaster*© to connect to their lightning strike database.

4.2 Calibration Record

The ***Edit Calibration Record*** window can be opened for editing or review by clicking on the Edit menu and selecting it from the Calibration Record menu (Section 2.1.2). This window consists of Calibration Record header, Station header, and Screen Select tabs (Figure 4-23).

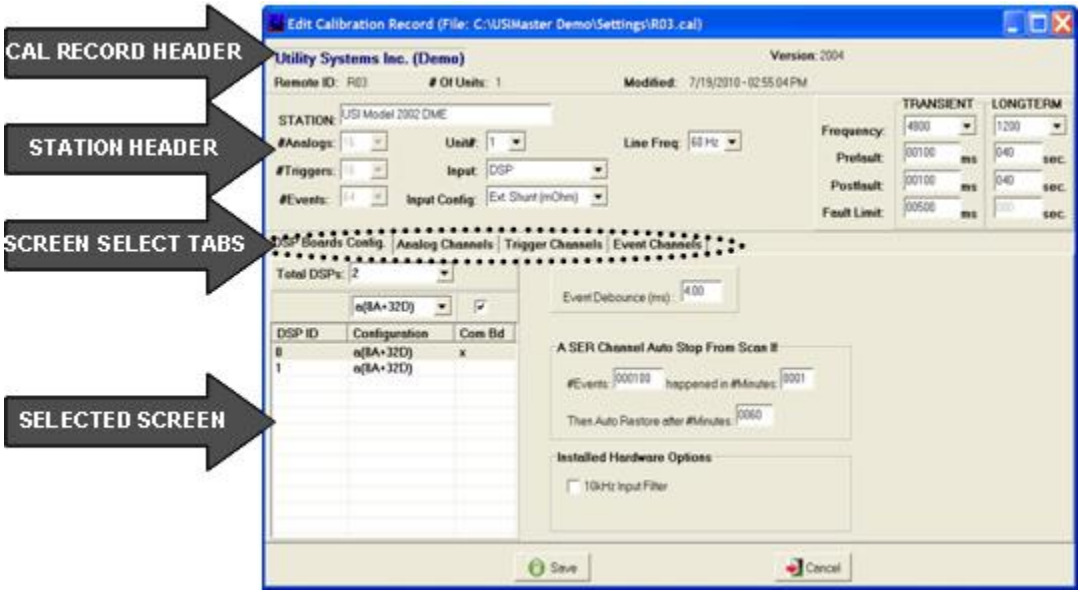


Figure 4-23 Calibration Record Screen

Note: The Calibration Record settings are stored at the Cal. Rec. Path (Section 4.2) in a file named ***rxxxx.cal*** where the ***xxxx*** is the unique 4-digit DME system identification number.

Note: For newly purchased DME systems, a USI applications engineer will request channel assignment settings from the customer. Prior to shipment, the engineer will enter these settings into the Calibration Record. USI will provide the customer with the completed Calibration Record file (***rxxxx.cal)***. If no customer channel assignments are available at the time of shipment, USI will supply a generic file that includes only default settings.

4.2.1 Calibration Record Header

The Calibration Record header contains setup information for the DME system. The settings and variables for the Cal Record header are shown below (Figure 4-24).

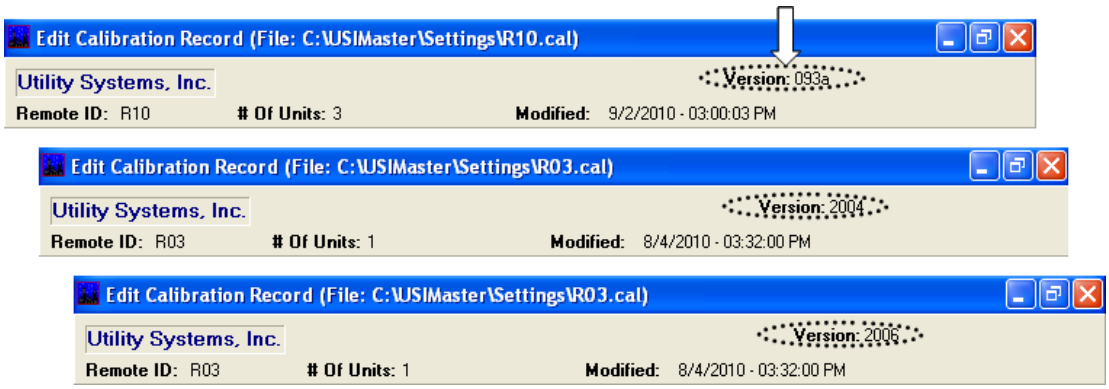


Figure 4-24 Calibration Record Header Versions

- **Company Name**
  This field displays the Company Name as configured in the Master System Configuration file (see Section 4.1).

- **Version**
  This field displays the version of Calibration Record as 093a, 2004, or 2006 (Figure 4-24). Calibration Records can be converted between V2004 and V2006 by right-clicking anywhere in the Cal Record Header and selecting Convert to 2004/2006. V093a can not be converted to other format versions.

  - Calibration Record – Version 093a
    This format version of the Calibration Record is used for the Model HT/LT2000W Digital Fault Recorder only (Figure 4-27).

  - Calibration Record – Version 2004:
    This format version of the Calibration Record is used for any Model 2002 DME system running any version of *USIRemote*© software (Figure 4-28).

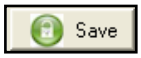
  - Calibration Record – Version 2006:
    This format version of the Calibration Record is used for any Model 2002 DME system running *USIRemote*© V2.1.0 software or later (Figure 4-31).

- **Remote ID**
  This field displays the unique identification number for the selected DME system.

- **# Of Units (Number of Units)**
  This field displays the number of units (1 to 4) that makes up the selected DME system. If this number is greater than one (1), multiple discreet HT/LT2000W units have been cascaded together to assemble the overall DFR system. This is done

when either the total number of inputs needed exceeds the maximum available on a single-unit system or when the location requires distributing units in different locations within a substation or power plant.

- **Modified**
  This field displays the date and time of the master PC when Modified Date-Time was last updated. Users are prompted to update the Modified Date-Time when saving the Calibration Record (Figure 4-25).

- 

Save
  This selection is used to save all setting changes made on any screen tab and to close the Edit Calibration Record window.

  When the ***Save*** button is selected, the Modified Date-Time window displays. Selecting ***Yes*** will update the Modified field in the Calibration Record header to the master station PC time. This feature is useful in tracking when changes were made previously. Selecting ***No*** will leave the Modified field unchanged.

  After a selection is made on the Modified Date-Time window the ***Cal. Record is Saved*** message displays. Click ***OK*** to acknowledge.

  After acknowledging that the Cal. Record is saved the Send Cal. Record to Remote message window displays. Selecting ***Yes*** initiates a communication connection with the recorder, uploads the Calibration Record, and re-initializes the system putting the new settings into effect. Selecting ***No*** will close the Send Cal. Record to Remote window without sending the saved file to the recorder.

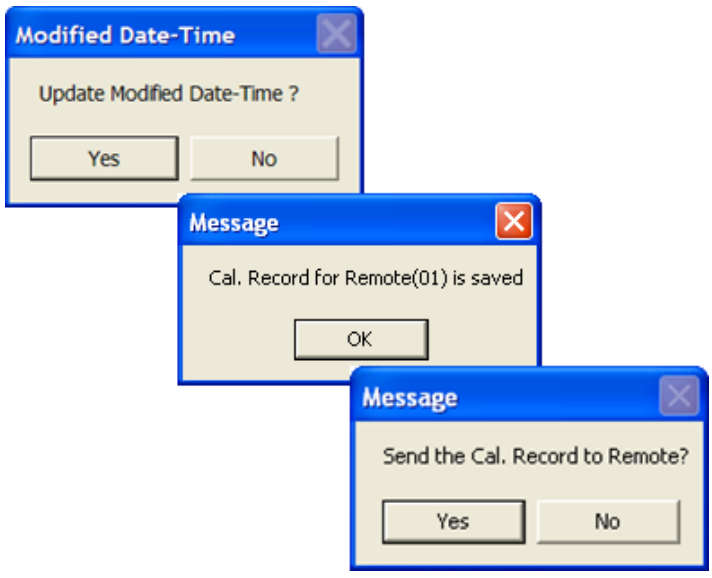


Figure 4-25 Save Calibration Record

-  **Cancel**
  This selection is used to cancel all setting changes made on any screen tab and to close the Edit Calibration Record window.

4.2.2 Edit Calibration Record – Analog, Trigger, and Event Channels

- **Editing Analog Channels – Edit Bar**
  The Analog Channels Edit Bar is used to modify the analog input settings. Select an analog input by left-clicking on a row in the analog channels table. Use the fields in the Edit Bar to modify the settings as desired.

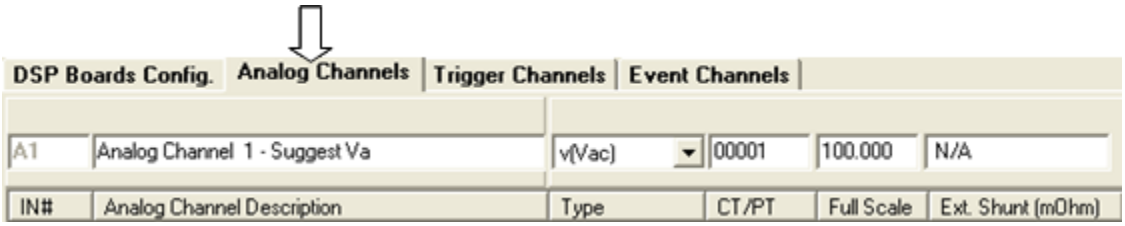


Figure 4-26 Analog Channels Edit Bar

Multiple analog channels may also be edited simultaneously by using Ctrl + Left-click or Shift + Left-click to select them. Any change made in the Edit Bar will then be applied to each of the selected channels.

- Analog Channels Edit Bar – Right-click menu
  Right-click anywhere on the Analog Channels Edit Bar to display the right-click menu (Figure 4-27). This menu displays standard editing tools. These edit tools can also be accessed through standard keystrokes (e.g. Ctrl + Z = Undo, Ctrl + X = Cut, etc.).

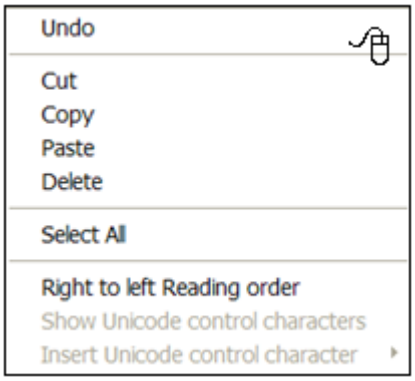


Figure 4-27 Analog Channels Edit Bar –Right-click Menu

- Analog Channels Table – Right-click menu
  Right-click anywhere on the Analog Channels table to display this menu (Figure 4-28).

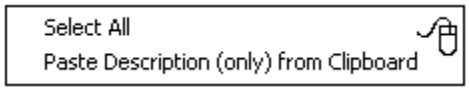


Figure 4-28 Calibration Record Analog Channels –Right-click Menu

- Select All
  This selection will highlight all the rows in the Analog Channel table.

- Paste Description (only) from Clipboard
  This selection will paste descriptions from the Windows™ clipboard into the description fields for the selected analog channels.

Note: Analog Channel descriptions can be copied in bulk from an MS Excel worksheet. Highlight and copy the descriptions on the spreadsheet to place them on the Windows™ clipboard. Click ***Select All*** from the Analog Channels right-click menu and then click ***Paste Description (only) from Clipboard***.

- **Editing Trigger Channels – Edit Bar**
  The Trigger Channels Edit Bar (Figure 4-29) is used to modify the analog trigger settings. Select a trigger by left-clicking on a row in the Trigger Channels table. Use the fields in the Edit Bar to modify the settings as desired.

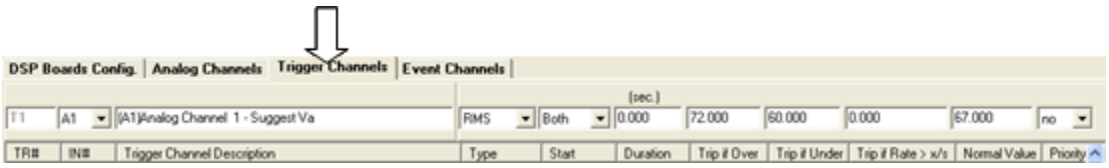


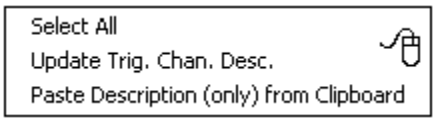
Figure 4-29 Trigger Channels Edit Bar

Multiple analog channels may also be edited simultaneously by using ***Ctrl + Left-click*** or ***Shift + Left-click*** to select them. Any change made in the Edit Bar will then be applied to each of the selected channels.

- Trigger Channels Edit Bar – Right-click menu
  Right-click anywhere on the Trigger Channels Edit Bar to display the right-click menu (Figure 4-30). This menu displays standard editing tools. These edit tools can also be accessed through standard keystrokes (e.g. ***Ctrl + Z*** = Undo, ***Ctrl + X*** = Cut, etc.).

Figure 4-30 Trigger Channels Edit Bar –Right-click Menu

- Trigger Channels Table – Right-click menu
  Right-click anywhere on the Trigger Channels table to display this menu (Figure 4-31).



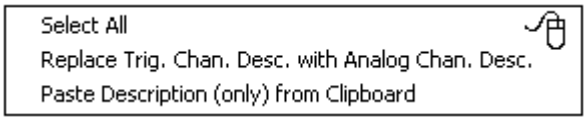


Figure 4-31 Calibration Record Trigger Channels – Right-click Menu

- Select All
  This selection will highlight all the rows in the Trigger Channel table.

- Update Trig. Chan. Desc.
  This function displays only for version 093a. This selection replaces the trigger channel description with the analog channel description.

- Replace Trig. Chan. Desc. With Analog Chan. Desc.
  This function displays only for versions 2004 & 2006. This selection replaces the trigger channel description with the analog channel description.

- Paste Description (only) from Clipboard
  This selection will paste descriptions from the Windows™ clipboard into the description fields for the selected trigger channels.

Note: Trigger Channel descriptions can be copied in bulk from an MS Excel™ worksheet. Highlight and copy the descriptions on the spreadsheet to place them

on the Windows™ clipboard. Click ***Select All*** from the Trigger Channels right-click menu and then click ***Paste Description (only) from Clipboard***.

- **Editing Event Channels – Edit Bar**
  The Event Channels Edit Bar is used to modify the event settings. Select an event by left-clicking on a row in the event channels table. Use the fields in the Edit Bar to modify the settings as desired.

Figure 4-32 Event Channels Edit Bar

Multiple event channels may also be edited simultaneously by using ***Ctrl + Left-click*** or ***Shift + Left-click*** to select them. Any change made in the Edit Bar will then be applied to each of the selected channels.

- Event Channels Edit Bar – Right-click menu
  Right-click anywhere on the Event Channels Edit Bar to display the right-click menu (Figure 4-33). This menu displays standard editing tools. These edit tools can also be accessed through standard keystrokes (e.g. ***Ctrl + Z*** = Undo, ***Ctrl + X*** = Cut, etc.).

Figure 4-33 Event Channels Edit Bar –Right-click Menu

- Event Channels Table – Right-click menu
  Right-click anywhere on the Event Channels table to display this menu (Figure 4-34).

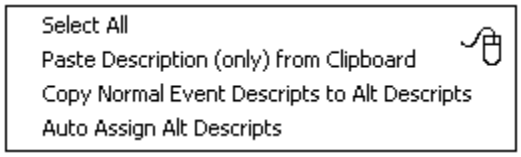


Figure 4-34 Calibration Record Event Channels – Right-click Menu

- Select All
  This selection will highlight all the rows in the Event Channel table.

- Paste Description (only) from Clipboard
  This selection will paste descriptions from the Windows™ clipboard into the description fields for the selected trigger channels.

- Copy Normal Event Descripts to Alt Descripts
  This selection replaces the alternate event descriptions with the normal event channel descriptions.

- Auto Assign Alt Descripts
  This selection appends the suffix ***Abnormal*** to the event alternate event channel descriptions.

Note: Event Channel descriptions can be copied in bulk from an MS Excel worksheet. Highlight and copy the descriptions on the spreadsheet to place them on the Windows™ clipboard. Click ***Select All*** from the Event Channels right-click menu and then click ***Paste Description (only) from Clipboard***.

4.2.3 Edit Calibration Record Version 093a

The format version 093a Calibration Record applies to the Model HT/LT2000W Digital Fault Recorder only.

- **Station Header**
  The Station Header section is used to assign the following settings (Figure 4-35).

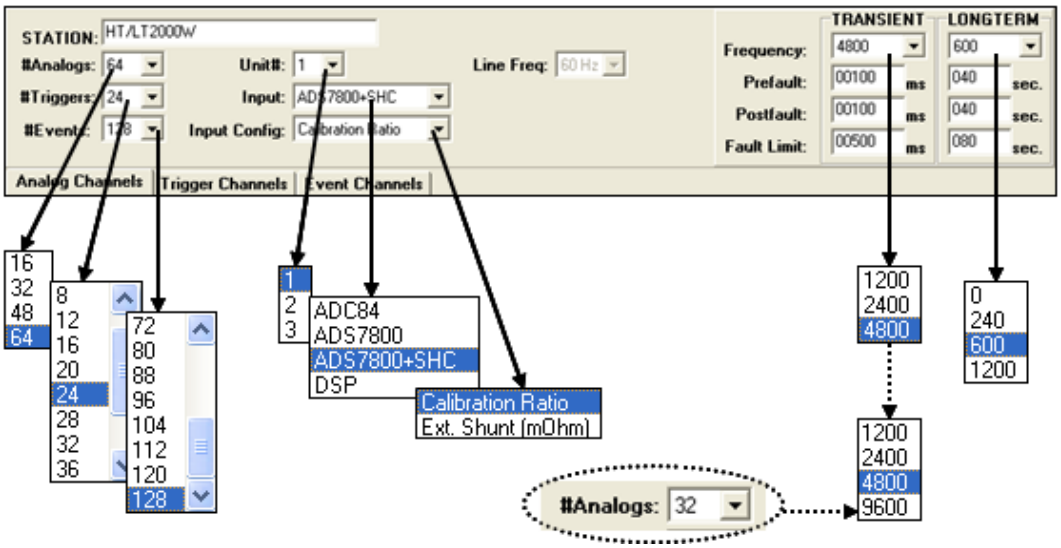


Figure 4-35 Calibration Record Station Header –Version 093a

- Station:
  This field is used to enter the alpha-numeric station name. The name is limited to 32 characters.

- #Analogs:
  This drop-down menu is used to select the number of analog input channels available for the selected ***Unit*** of the DFR system. Analog channels on the Model HT/LT2000W system are selectable in multiples of 16 from 16 to 64.

- #Triggers:
  This drop-down menu is used to select the number of analog triggers available for the selected ***Unit*** of the DFR system. Analog triggers on the Model HT/LT2000W system are selectable in multiples of four from 4 to 48.

- #Events:
  This drop-down menu is used to select the number of digital event inputs available for the selected ***Unit*** of the DFR system. Event inputs on the Model HT/LT2000W system are selectable in multiples of eight from 8 to 128.

- Unit #:
  This drop-down menu is used to select the specific ***Unit*** number of the DFR system to be displayed. The number of units can range from 1 to 4 depending on the selection made when the Calibration Record was initially added (Figure 2-5).

- Input:
  This drop-down menu is used to select the type of analog-to-digital converter used on the input cards for Model HT/LT2000W systems, or to select DSP for Model 2002 systems (Sections 4.2.3 and 4.2.4). This setting informs the DFR or DME system which routine to use when reading the analog data.

  - ADC84:
    This selection specifies that the analog-to-digital converter used on the analog input boards is the ADC84 family.

  - ADS7800:
    This selection specifies that the analog-to-digital converter used on the analog input boards is the ADS7800 family without sample-and-hold capability.

  - ADS7800 + SHC:
    This selection specifies that the analog-to-digital converter used

on the analog input boards is the ADS7800 family with sample-and-hold capability.

Note: The Model HT/LT2000W system utilizes a single Analog-to-Digital converter chip per 16 analog channels. All sixteen channels are multiplexed through the same converter. Sample-and-Hold technology is used to eliminate time skew between channels.

- DSP:
  This selection specifies that the system is a Model 2002 DME system and converts the Calibration Record to version 2004 or 2006 (Sections 4.2.3 and 4.2.4)

- Input Config:
  This drop-down menu is used to select the analog input configuration. This selection changes the last column title on the Analog Channels screen to the selected Input Config.

  - Calibration Ratio:
    This selection enables a multiplier to be applied to analog channel sampled values. This multiplier setting is entered in the Calibration Ratio column on the Analog Channels screen. The default multiplier setting is one (1).

  - Ext. Shunt (mOhm):
    This selection is used to indicate that the current-measuring analog inputs are receiving signals from an external shunt or auxiliary CT device as opposed to the system internal shunt. The actual value of the external shunt or the equivalent shunt value of the auxiliary CT device may be entered in mOhms (milliohms) into the Ext. Shunt (mOhm) column on the Analog Channels screen tab.

- Line Freq:
  In Calibration Record version 093a this field displays 60 Hz only. The Model HT/LT2000W system is compatible only with 60 Hz power systems. In Calibration Record versions 2004 and 2006 this field drop-down menu displays 50 Hz and 60 Hz.

- Frequency:
  These drop-down menus are used to select the TRANSIENT and LONG TERM sampling frequencies (samples per second) at which the DFR Analog-to-Digital converters operate.

  - TRANSIENT: For systems having 16 or 32 analog input channels available sample rate selections are 1200Hz, 2400Hz, 4800Hz, or

9600Hz. Systems having 48 or 64 analog input channels are limited to sample rate selections of 1200Hz, 2400Hz, or 4800Hz. This sampling frequency is applied to the analog inputs only. The sampling frequency of the analog triggers and the digital inputs is fixed at 1000Hz.

- LONGTERM: Sample rate selections available from this drop-down menu are 0Hz (Disables Long Term recording), 240Hz, 600Hz, or 1200Hz.

- Pre-Fault:
  This setting determines the period of prefault data that the DFR will record prior to the actual trigger event. This value is set for both the Transient and Long Term recorders. Transient record Pre-Fault can be set to a maximum of 10 seconds. Long term Pre-Fault can be set to a maximum of 990 seconds.

- Post-Fault:
  This setting determines the period of Post-Fault data that the DFR will record after the triggers and events clear, or the Fault Limit period has elapsed. This value is set for both the Transient and Long Term recorders. Transient Post-Fault can be set to a maximum of 10 seconds. Long Term Post-Fault can be set to a maximum of 990 seconds.

- Fault Limit:
  This setting determines the time limit of any record. This value is set for both Transient and Long-Term recorders. Transient Fault-Limit may be set for a maximum of 10 seconds. Long term Fault-Limit is not applicable.

Note: The total length of a fault record is equal to (*Pre-Fault period*) + (*Fault period*) + *Post-Fault period*). If an analog or digital trigger should re-occur during the *Post-Fault* period, the fault record will be extended to contain the entire event in a single COMTRADE data file. The maximum length of a ***Fault Record*** in a re-trigger situation is 40 seconds.

- **Analog Channels (Version 093a)**
  The Analog Channels section is used to assign the following settings (Figure 4-36).

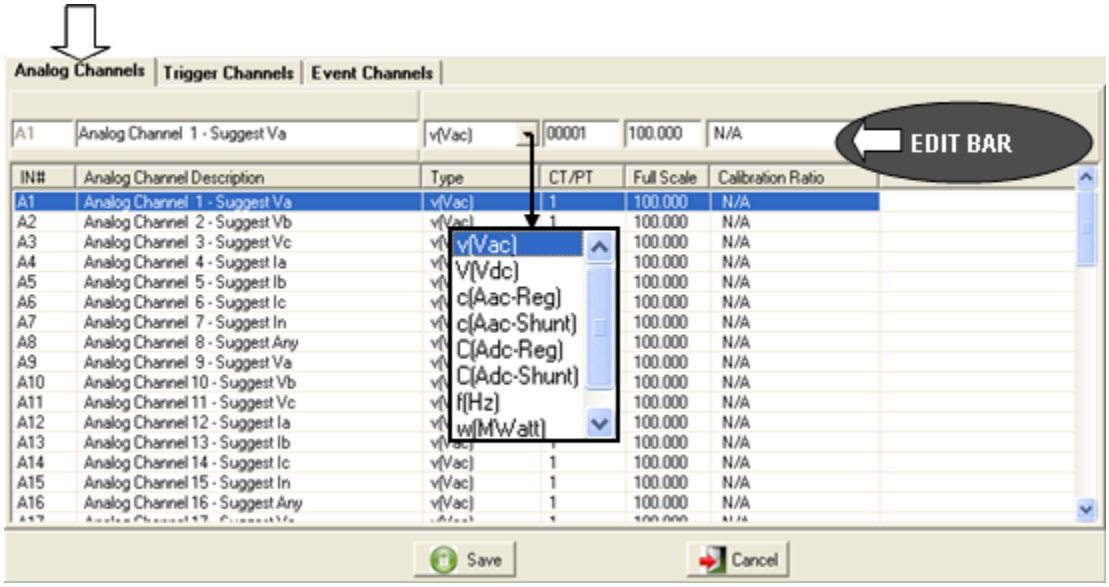


Figure 4-36 Calibration Record Analog Channels –Version 093a

- IN#:
  This column displays the analog channel number for each physical input.

- Analog Channel Description:
  This column displays the alpha-numeric description entered for each analog input. The analog channel description is limited to 80 characters.

- Type:
  This column displays the channel type selected for each analog input:

  - v(Vac):
    This selection indicates that the analog input is monitoring an AC voltage signal.

  - V(Vdc):
    This selection indicates that the analog input is monitoring a DC voltage signal.

  - c(Aac-Reg):
    This selection indicates that the analog input is monitoring an AC current signal measured by an internal current shunt. This input type connects to the HT/LT2000W system between the **I** and **C** terminals.

  - c(Aac-Shunt):
    This selection indicates that the analog input is monitoring an AC current signal by measuring the voltage output of an external current shunt or an auxiliary current transformer device.

- C(Adc-Reg):
  This selection indicates that the analog input is monitoring a DC current signal measured by an internal current shunt. This input type connects to the HT/LT2000W system between the **I** and **C** terminals.

- C(Adc-Shunt):
  This selection indicates that the analog input is monitoring a DC current signal by measuring the voltage output of a current shunt or an external current transformer device.

- f(Hz):
  This selection indicates that the analog input is monitoring frequency by measuring the DC voltage output of a transducer external to the system.

- w(MWatt):
  This selection indicates that the analog input is monitoring megawatts by measuring the DC voltage output of a transducer external to the system.

- q(MVar):
  This selection indicates that the analog input is monitoring Mega VARs by measuring the DC voltage output of a transducer external to the system.

Note: This note applies to all inputs measuring AC or DC voltage signals directly from potential transformers, voltage outputs from external shunts or auxiliary CT devices, and voltage output from transducers.

If the full scale voltage range being measured is less than or equal to 40V(rms), this input type connects to the HT/LT2000W system between the **V2** and **C** terminals.

If the full scale voltage range being measured is greater than 40V(rms), this input type connects to the HT/LT2000W system between the **V1** and **C** terminals.

- CT/PT:
  This column displays the Current Transformer or Potential Transformer ratio for each analog input. This setting is the ratio of primary to secondary transformer turns (e.g. an entry of 240 indicates a ratio of 240:1).

- Full Scale:
  This column displays the worst-case input level expected to be applied to the HT/LT2000W system at the input terminals.

Note: Care should be taken when selecting full scale levels. Setting this value too low will result in clipping if the input signal exceeds this level; conversely, setting this value too high will result in reduced accuracy of low level readings.

Note: After changing full scale levels on a Model HT/LT2000W system, re-calibration of the modified channels is required.

- Calibration Ratio / Ext. Shunt (mOhm):
  This column title is defined by the selection made on the Calibration Record station header from the Input Config drop-down list.

  - Calibration Ratio
    This column displays any additional multiplier to be applied to the measured data during analysis. Primary values for analog channels are calculated as follows: [measured input value] x [CAL Ratio] x [CT/PT Ratio]. The default setting for this column is one (***1***).

  - Ext. Shunt (mOhm)
    This column displays the value, in milliohms, of the external shunt resistor or the equivalent shunt value of an auxiliary current transformer device. The system uses these stored resistance values to convert sensed voltages to their equivalent line currents (R = E÷I).

- **Trigger Channels (Version 093a)**
  The Trigger Channels section is used to assign the following settings (Figure 4-37).

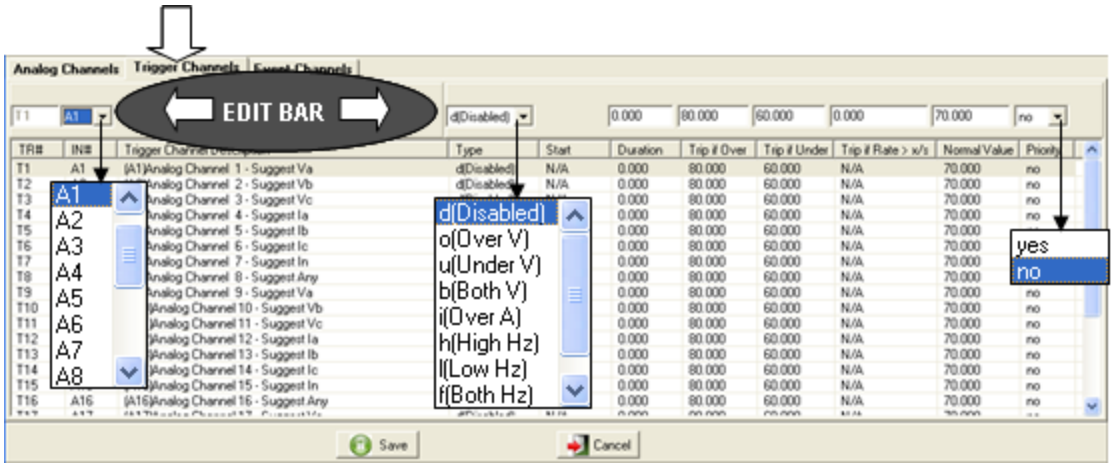


Figure 4-37 Calibration Record Trigger Channels –Version 093a

- TR#:
  This column displays the analog trigger numbers available to be assigned to an analog channel.

- IN#:
  This column displays the analog channel number assigned to an analog trigger.

- Trigger Channel Description:
  This column displays the alpha-numeric description entered for each trigger channel. The trigger channel description is limited to 80 characters. This descriptor will display in the Events/Triggers Tripped column of the Quick Summary and History Data screens. This descriptor can be exactly the same as the Analog Channel description or it can be tailored to identify the analog trigger more specifically (e.g. adding harmonic, frequency, etc. to identify specifically the unit that this trigger is monitoring).

- Type:
  This column displays the trigger type that is applied to each analog input.

  - d(Disabled)
    This selection prevents the trigger from initiating a recording.

  - o(Over V)
    This selection enables the analog trigger to initiate a recording if the RMS voltage level of the analog input is equal to or greater than the value assigned in the Trip if Over column.

  - u(Under V)
    This selection enables the analog trigger to initiate a recording if the RMS voltage level of the analog input is less than the value assigned in the Trip if Under column.

  - b(Both V)
    This selection enables the analog trigger to initiate a recording if the RMS voltage level of the analog input is either less than the value assigned in the Trip if Under column or equal to or greater than the value assigned in the Trip if Over column.

  - i(Over A)
    This selection enables the selected analog trigger to initiate a recording if the RMS current level of the analog input is equal to or greater than the value assigned in the Trip if Over column.

  - h(High Hz)
    This selection enables the selected analog trigger to initiate a

recording if the frequency of the analog input is equal to or greater than the value assigned in the Trip if Over column.

- l(Low Hz)
  This selection enables the selected analog trigger to initiate a recording if the frequency of the analog input is less than the value assigned in the Trip if Under column.

- f(Both Hz)
  This selection enables the selected analog trigger to initiate a recording if the frequency of the analog input is less than the value assigned in the Trip if Under column or equal to or greater than the value assigned in the Trip if Over column.

- z(Zero Seq.)
  This selection enables the selected analog trigger to initiate a recording if the zero sequence level of the analog input is equal to or greater than the value assigned in the Trip if Over column.

- Start:
  This column is not applicable to the Model HT/LT2000W system. This column applies only to the Model 2002 DME system and is activated only in Calibration Record versions 2004 and 2006.

- Duration:
  This column is not applicable to the Model HT/LT2000W system. This column applies only to the Model 2002 DME system and is activated only in Calibration Record versions 2004 and 2006.

- Trip if Over:
  This column displays the level at which an over voltage, over current, over frequency, or over zero sequence trigger will initiate a recording.

- Trip if Under:
  This column displays the level at which an under voltage, under current, or under frequency trigger will initiate a recording.

- Trip if Rate > x/s:
  This column is not applicable to the Model HT/LT2000W system. This column applies only to the Model 2002 DME system and is activated only in Calibration Record versions 2004 and 2006.

- Normal Value:
  This column displays the level designated to be the normal or expected signal level. The values in this column are not used by the analog triggers and are for reference only. Entries into this column are not required.

- Priority:
  This column displays the priority trigger setting.

  - no
    Analog triggers with Priority set to ***no*** will be limited to a recording assigned by the Fault Limit setting.

  - yes
    Analog triggers with Priority set to ***yes*** will not limit recordings to the Fault Limit setting and will allow recording to continue as long as that trigger is in an abnormal condition or until the system memory fills up.

Caution: Do NOT enable Priority on under-voltage or under-frequency analog triggers. If the circuit being monitored is taken out of service, the persistent under-voltage and under-frequency conditions will create excessively long data records. These records could fill the memory and cause the system to malfunction.

- **Event Channels (Version 093a)**
  The Event Channels section is used to assign the following settings (Figure 4-38):

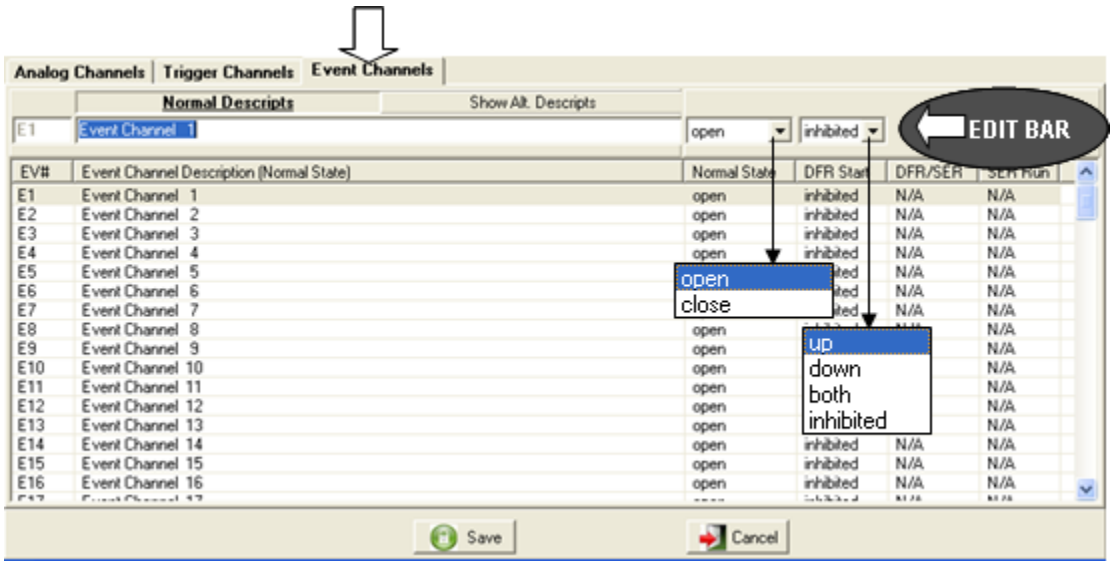


Figure 4-38 Calibration Record Event Channels –Version 093a

- Normal Descripts:
  This screen tab is used to enter the Event Channel settings for the Model HT/LT2000W system.

- EV#:
  This column displays the event channel number for each physical input.

- Event Channel Description (Normal State):
  This column displays the alpha-numeric description entered for each digital event input. The event channel description is limited to 80 characters.

- Normal State:
  This column displays the contact status defined as the normal condition:

  - open
    This selection defines the normal state of the selected event channel as when the contact is open and the event channel detects a logic zero (***0***).

  - close
    This selection defines the normal state of the selected event channel as when the contact is closed and the event channel detects a logic one (***1***).

- DFR Start:
  This column displays the conditions under which an event channel initiates a recording:

  - up
    This selection indicates that the selected event channel initiates a recording on the rising edge of a state change (transition from logic zero (**0)** to logic one (**1**).

  - down
    This selection indicates that the selected event channel initiates a recording on the falling edge of a state change (transition from logic one (**1)** to logic zero (**0**).

  - both
    This selection indicates that the selected event channel initiates a recording on either the rising edge or falling edge of a state change (transition from logic **0** to logic **1** or transition from logic **1** to logic **0**).

  - inhibited
    This selection indicates that the selected event channel is disabled from initiating a recording. The status of these event channels will be recorded when a recording is

initiated by another event channel or analog trigger channel, but the selected event channel can not initiate a recording itself.

Note: On the Model HT/LT2000W system, the DFR Start column does not directly control the trigger function of the event channels. The eight-channel Event Board contains two eight-position DIP switches which actually control the trigger functions. See the *HT/LT2000W Users Guide* for details about these settings.

- DFR/SER:
  This column is not applicable to the Model HT/LT2000W system. This column applies only to the Model 2002 DME system and is activated only in Calibration Record versions 2004 and 2006.

- SER Run:
  This column is not applicable to the Model HT/LT2000W system. This column applies only to the Model 2002 DME system and is activated only in Calibration Record versions 2004 and 2006.

- Show Alt. Descripts:
  This screen tab is not applicable to the Model HT/LT2000W system. Settings on this screen apply only to the Model 2002 DME system and are activated only in Calibration Record versions 2004 and 2006.

4.2.4 Calibration Record Version 2004

The format version 2004 Calibration Record applies to the Model 2002 DME system running any version of *USIRemote*© software.

- **Station Header (Version 2004)**
  The Station Header section is used to assign the following settings (Figure 4-39).

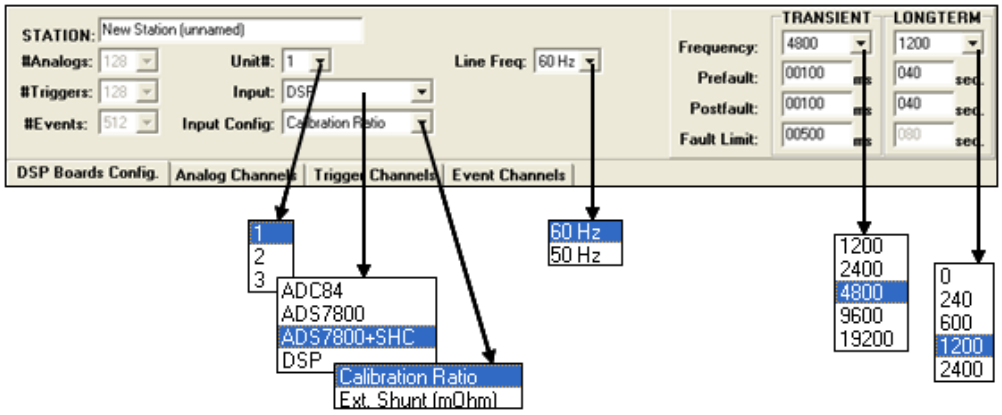


Figure 4-39 Calibration Record Station Header – Version 2004

- #Analogs:
  This field displays the total number of physical analog input channels for the selected ***Unit*** of the DME system. Analog inputs are available in multiples of eight. The value in this field is populated automatically based on the number of DSP boards and the configuration of these boards (see DSP Boards Config. section).

- #Triggers:
  This field displays the total number of analog triggers available for the selected ***Unit*** of the DME system. In Calibration Record Version 2004, the quantity of analog triggers is the same as the number of analog channels.

- #Events:
  This field displays the total number of digital/event inputs for the selected ***Unit*** of the DME system. Digital/Event inputs are available in multiples of thirty-two. The value in this field is populated automatically based on the number of DSP boards and the configuration of these boards (see DSP Boards Config, Section 4.2)

- Unit#:
  This drop-down menu is used to select the specific ***Unit*** number of the DFR system to be displayed. The number of units can range from 1 to 4 depending on the selection made when the Calibration Record was initially created (Figure 2-5).

- Input:
  This drop-down menu is used to select the type of analog-to-digital converter used on the input cards for Model HT/LT2000W systems, or to select DSP for Model 2002 systems (Section 4.2.4). This setting informs the DFR or DME system which routine to use when reading the analog data.

  - ADC84:
    This selection is used for Model HT/LT2000W systems only and specifies that the analog-to-digital converter used on the analog input boards is the ADC84.

  - ADS7800:
    This selection is used for Model HT/LT2000W systems only and specifies that the analog-to-digital converter used on the analog input boards is the ADS7800 without sample-and-hold capability.

  - ADS7800 + SHC:
    This selection is used for Model HT/LT2000W systems only and specifies that the analog-to-digital converter used on the analog input boards is the ADS7800 with sample-and-hold capability.

Note: The Model HT/LT2000W system utilizes a single analog-to-digital converter chip per 16 analog channels. All sixteen channels are multiplexed through the same converter. Sample-and-hold technology is used to eliminate time skew between channels.

- DSP:
  This selection is used for Model 2002 DME systems only and converts the Calibration Record to version 2004 or 2006 (Section 4.2.4).

- Input Config:
  This drop-down menu is used to select the analog input configuration. This selection changes the last column title on the Analog Channels screen to the selected Input Config.

  - Calibration Ratio:
    This selection enables a multiplier to be applied to analog channel sampled values. This multiplier setting is entered in the Calibration Ratio column on the Analog Channels screen. The default multiplier setting is one (1).

  - Ext. Shunt (mOhm):
    This selection is used to indicate that the current-measuring analog inputs are receiving signals from an external shunt or auxiliary CT device as apposed to the system internal shunt. The actual value of the external shunt or the equivalent shunt value of the auxiliary CT device may be entered in mOhms (milliohms) into the Ext. Shunt (mOhm) column on the Analog Channels screen tab.

- Line Freq:
  This drop-down menu is used to select the power system frequency being monitored. This setting is used to define the cycle period and number of data samples used by the trigger algorithms.

- Frequency:
  These drop-down menus are used to select the TRANSIENT and LONGTERM sampling frequencies (samples per second) at which the DFR analog-to-digital converters operate.

  - TRANSIENT: Sample rate selections available from this drop-down menu are shown in Figures 4-39. These sampling frequencies are valid for all Model 2002 systems and are not dependent on the number of analog inputs. All the analog and digital inputs are sampled at the selected rate.

- LONGTERM: Sample rate selections available from this drop-down menu are shown in Figures 4-39. These sampling frequencies are valid for all Model 2002 systems and are not dependent on the number of analog inputs.

Note: Sample rate selection of 0Hz disables Long Term recording.

- Pre-Fault:
  This setting determines the period of prefault data that the DFR will record prior to the actual trigger event. This value is set for both the Transient and Long Term recorders. Transient record Pre-Fault can be set to a maximum of 10 seconds. Long term Pre-Fault can be set to a maximum of 990 seconds.

- Post-Fault:
  This setting determines the period of Post-Fault data that the DFR will record after the triggers and events clear, or after the Fault Limit period has expired. This value is set for both the Transient and Long Term recorders. Transient Post-Fault can be set to a maximum of 10 seconds. Long Term Post-Fault can be set to a maximum of 990 seconds.

- Fault Limit:
  This setting determines the time limit of any record. This value is set for both Transient and Long-Term recorders. Transient Fault Limit may be set for a maximum of 10 seconds. Long term Fault Limit is not applicable.

Note: The total length of a fault record is equal to (*Pre-Fault period*) + (*Fault period*) + *Post-Fault period*). If an analog or digital trigger should re-occur during the *Post-Fault* period, the fault record will be extended to contain the entire event in a single COMTRADE data file. The maximum length of a ***Fault Record*** in a re-trigger situation is 40 seconds.

- **DSP Boards Config (Version 2004)**
  The ***DSP Boards Config*** screen tab is used to assign the following settings (Figure 4-40):

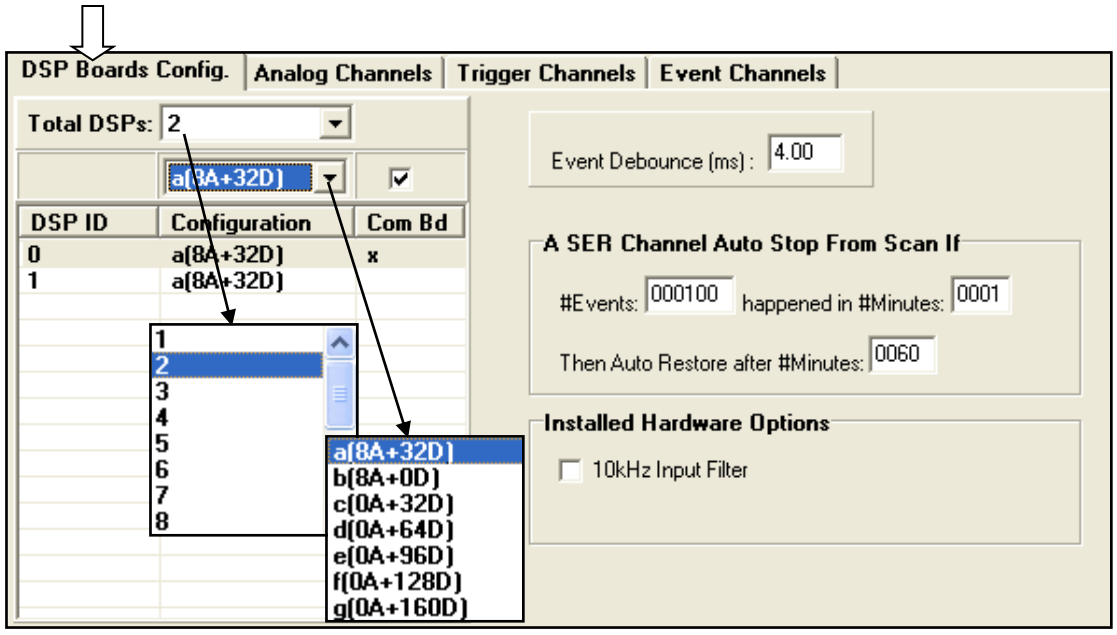


Figure 4-40 DSP Boards Configuration Screen Tab – Version 2004

Caution: Do not change the factory settings for ***#DSP*** or ***DSP Configuration*** except as directed by USI personnel. These settings must match the physical configuration of the chassis for the system to function correctly.

- **Total DSPs**
  This drop-down menu is used to select the number of DSP boards present in the selected unit. The possible number of boards per unit ranges from one to 16. A row is added to the DSP Configuration table for each DSP board. Each board is assigned an identification address (DSP ID) sequentially from ID0 to ID15. This DSP ID number is also assigned on the DSP board by shorting jumpers.

- **DSP Configuration**
  This drop-down list is used to select the configuration of each DSP board in the selected unit. To modify the configuration of a DSP board, select the corresponding row in the table and choose a new configuration from the drop-down list. Possible selections are as follows:

  - a(8A+32D)
    This selection configures the selected DSP board to process eight analog channels and 32 digital inputs.

  - b(8A+0D)
    This selection configures the selected DSP board to process eight analog channels and zero digital inputs.

- c(0A+32D)
  This selection configures the selected DSP board to process zero analog channels and 32 digital inputs.

- d(0A+64D)
  This selection configures the selected DSP board to process zero analog channels and 64 digital inputs.

- e(0A+96D)
  This selection configures the selected DSP board to process zero analog channels and 96 digital inputs.

- f(0A+128D)
  This selection configures the selected DSP board to process zero analog channels and 128 digital inputs.

- g(0A+160D)
  This selection configures the selected DSP board to process zero analog channels and 160 digital inputs.

Note: DSP configuration g(0A-160D) requires a custom 6U chassis to accommodate this number of digital inputs in a single chassis.

- **Com Bd**
  This column identifies which DSP boards have had a Common board installed. This extra board, a type of daughterboard, provides system timing signals. At least one DSP board in each system must have a Common board attached. Multiple Common boards are used in distributed systems where portions of a single unit are located greater than 150 feet apart. The presence of a Common board on a DSP is indicated by an ***x*** in the DSP ID row.

  To indicate the presence of a Common board on a DSP, select the row in the DSP configuration table and select the checkbox above the ***Com Bd*** column.

- **Event Debounce (ms)**
  This field is used to enter the period of time that the system provides digital filtering to digital inputs. The default setting is 4 milliseconds. This filter is applied to help prevent the recording of contact bounces. This filter is applied to the trigger function of digital inputs. It is also applied to digital inputs designated as SER inputs and as DFR inputs configured to trigger the DME system.

  Once a state change is detected on a digital input, the timestamp of the initial state change is recorded and the trigger function is halted for the Event Debounce period. A comparison is then made between the initial state change and the state of the input after this period. If the states are the same, the Event Trigger is validated and recording is initiated.

The ***Event Debounce*** time does not delay the start of fault recording. A ***Fault Record*** start time will still reflect the first detection of a change of state provided the debounced event remains steady state for the debounce time.

Note: Use caution when setting the Event Debounce period. Too long a period can result in missed event triggers and too short a period can result in contact bounces being recorded in the SER data.

- **A SER Channel Auto Stop From Scan If**
  These settings define when a digital input (event) is temporarily inhibited from triggering an SER recording. There are two fields that define the inhibit start time and one field that defines the inhibit stop time.
  - #Events
    This field indicates the number of state changes (#Events) that must occur within the specified time period before an Auto Stop occurs.
  - happened in #Minutes
    This field indicates the time period within which the specified number of events (#Events) must occur to cause an Auto Stop.
  - Then Auto Restore after #Minutes
    This field indicates the period of time (#Minutes) the trigger function of the offending digital input will be disabled. At the end of this period the triggering is automatically re-enabled.

- **Installed Hardware Options**
  This checkbox indicates that the analog input channels have a 10kHz Low Pass Input Filter. This setting is only relevant when the PMU option is enabled on the DME system.

- **Analog Channels (Version 2004)**
  The Analog Channels section is used to assign the following settings (Figure 4-41).

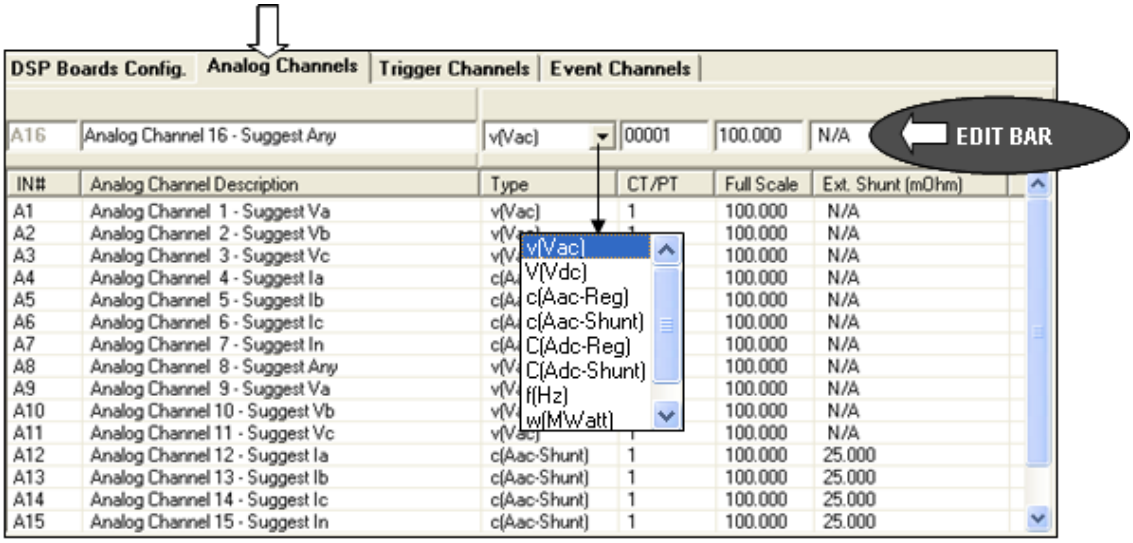


Figure 4-41 Analog Channels Tab – Version 2004

- IN#:
  This column displays the analog channel number for each physical input.

- Analog Channel Description:
  This column displays the alpha-numeric description entered for each analog input. The analog channel description is limited to 80 characters.

- Type:
  This column displays the channel type selected for each analog input:

  - v(Vac)
    This selection indicates that the analog input is monitoring an AC voltage signal.

  - v(Vac)
    This selection indicates that the analog input is monitoring an AC voltage signal.

  - V(Vdc)
    This selection indicates that the analog input is monitoring a DC voltage signal.

  - c(Aac-Reg)
    This selection indicates that the analog input is monitoring an AC current signal measured by an internal current shunt. This input type connects to the HT/LT2000W system between the **I** and **C** terminals.

  - c(Aac-Shunt)
    This selection indicates that the analog input is monitoring an AC

current signal by measuring the voltage output of an external current shunt or an auxiliary current transformer device.

- C(Adc-Reg)
  This selection indicates that the analog input is monitoring a DC current signal measured by an internal current shunt. This input type connects to the HT/LT2000W system between the **I** and **C** terminals.

- C(Adc-Shunt)
  This selection indicates that the analog input is monitoring a DC current signal by measuring the voltage output of a current shunt or an external current transformer device.

- f(Hz)
  This selection indicates that the analog input is monitoring frequency by measuring the DC voltage output of a transducer external to the system.

- w(MWatt)
  This selection indicates that the analog input is monitoring megawatts by measuring the DC voltage output of a transducer external to the system.

- q(MVar)
  This selection indicates that the analog input is monitoring megaVARs by measuring the DC voltage output of a transducer external to the system.

Caution: If +/-/0 sequence triggers, single-phase W/VAR/PF triggers, or three-phase W/VAR/PF triggers are planned to be used, see Figure 4-42 for channel assignment restrictions.

TR#	IN#	Trigger Channel Description
T1	A1	(A1)Analog Channel 1 - Suggest Va
T2	A2	(A2)Analog Channel 2 - Suggest Vb
T3	A3	(A3)Analog Channel 3 - Suggest Vc
T4	A4	(A4)Analog Channel 4 - Suggest Ia
T5	A5	(A5)Analog Channel 5 - Suggest Ib
T6	A6	(A6)Analog Channel 6 - Suggest Ic
T7	A7	(A7)Analog Channel 7 - Suggest In
T8	A8	(A8)Analog Channel 8 - Suggest Any

Figure 4-42 Three-Phase Trigger Restrictions

Note: This note applies to all inputs measuring AC or DC voltage signals directly from potential transformers, voltage outputs from external shunts or auxiliary CT devices, and voltage output from transducers.

If the full scale voltage range being measured is less than or equal to 40V(rms), this input type connects to the HT/LT2000W system between the V2 and C terminals.

If the full scale voltage range being measured is greater than 40V(rms), this input type connects to the HT/LT2000W system between the V1 and C terminals.

- CT/PT:
  This column displays the current transformer or potential transformer ratio for each analog input. This setting is the ratio of primary to secondary transformer turns (e.g. an entry of 240 indicates a ratio of 240:1).

- Full Scale:
  This column displays the worst-case input level expected to be applied to the Model 2002 system at the input terminals. The value is displayed as entered; however the system has defined ranges (Table 4-43) that are automatically selected.

DFR Input Ranges

Range (RMS):	Input:
400V	V1
200V	V1
100V	V1
40V	V2
24V	V2
12V	V2
4V	V2
2V	V2
1.5V	V2
200A	I
100A	I
75A	I

Table 4-43 Trigger Channels Tab

Note: Care should be taken when selecting full scale levels. Setting this value too low will result in clipping if the input signal exceeds this level; conversely; setting this value too high will result in reduced accuracy of low level readings.

Note: For analog channels measuring voltage from external shunts or auxiliary CT devices (e.g. c(Aac-Shunt) or C(Adc-Shunt) the full scale value entered must be as seen at the external current sensing device. The software will automatically calculate the proper full scale voltage range based on the current full scale and the external shunt values. This is calculated as: E(range) = I(full scale) * R(ext. shunt).

Note: After changing full scale ranges on a Model 2002 system, run the Internal Calibration to ensure accuracy within 0.25% of reading.

- Calibration Ratio / Ext. Shunt (mOhm):
  This column title is defined by the selection made on the Calibration Record station header from the Input Config drop-down list.
  - Calibration Ratio
    This column displays any additional multiplier to be applied to the measured data during analysis. Primary values for analog channels are calculated as follows: [measured input value] x [CAL Ratio] x [CT/PT Ratio]. The default setting for this column is one (***1***).
  - Ext. Shunt (mOhm)
    This column displays the value, in milliohms, of the external shunt resistor or the equivalent shunt value of an auxiliary current transformer device. The system uses these stored resistance values to convert sensed voltages to their equivalent line currents (R = E÷I).

- **Trigger Channels (Version 2004)**
  The Trigger Channels section is used to assign the following settings (Figure 4-44).

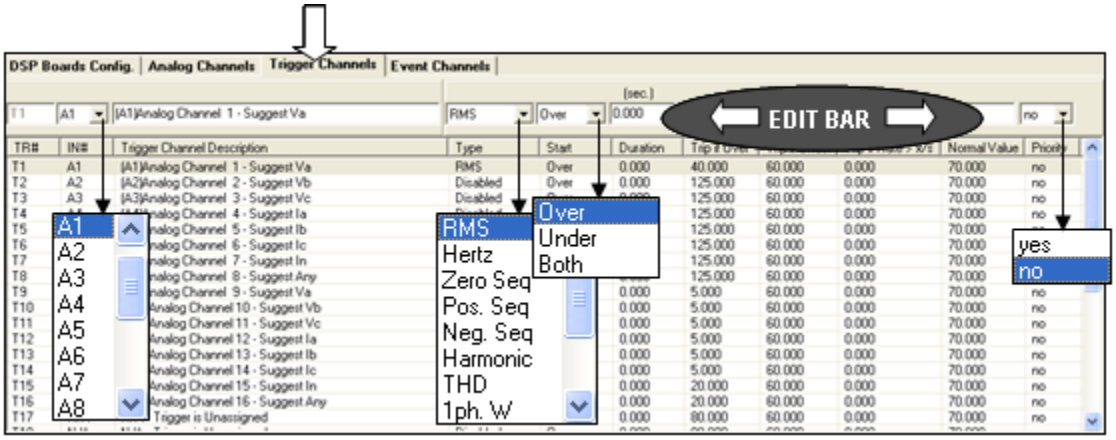


Figure 4-44 Trigger Channels Tab

- TR#:
  This column displays the analog trigger numbers available to be assigned to an analog channel.

- IN#:
  This column displays the analog channel number assigned to an analog trigger. In calibration record V2004 only 8 triggers can be assigned to each group of 8 analog channels (e.g. 1-8, 9-16, 17-24, etc.).

- Trigger Channels Description:
  This column displays the alpha-numeric description entered for each trigger channel. The trigger channel description is limited to 80 characters. This descriptor will display in the Events/Triggers Tripped column of the Quick Summary and History Data screens. This descriptor can be exactly the same as the Analog Channel description or it can be tailored to identify the analog trigger more specifically (e.g. adding harmonic, frequency, etc. to identify specifically the unit that this trigger is monitoring).

Note: The trigger channel descriptor displays in the ***Quick Summary*** tab and ***History Data*** tab. Therefore, it may be convenient to add the trigger type to the trigger name.

- Type:
  This column displays the trigger type that is applied to each analog input.

  - Disable
    This selection prevents the selected trigger from initiating a recording.

- RMS
  This selection enables an analog channel to initiate a recording based on the RMS level of the analog signal.

- Hertz
  This selection enables an analog channel to initiate a recording based on the frequency of the analog signal.

- Zero Seq
  This selection enables a group of three-phase analog channels to initiate a recording based on the zero sequence value.

- Pos Seq
  This selection enables a group of three-phase analog channels to initiate a recording based on the positive sequence value.

- Neg Seq
  This selection enables a group of three-phase analog channels to initiate a recording based on the negative sequence value.

Note: Sequence trigger types must be assigned to the analog channel monitoring Phase-A of the three-phase group. The system assumes that the following two analog channels are Phase-B and Phase-C. All three-phase inputs must be in the same group of eight analog channels and must be the same analog channel type.

- Harmonic
  This selection enables an analog channel to initiate a recording based on the harmonic level of the analog signal.

  This trigger type calculates the first through the eighth harmonic and triggers the system if any single harmonic exceeds the ***Trip if Over*** setting.

- THD
  This selection enables an analog channel to initiate a recording based on the harmonic level of the analog signal.

  This trigger type calculates the first through the eighth harmonic and triggers the system if the sum of the first eight harmonics exceeds the ***Trip if Over*** setting.

- 1 ph. W
  This selection enables a single-phase group of analog channels to initiate a recording based on the real power level.

- 1 ph. Vr
  This selection enables a single-phase group of analog channels to initiate a recording based on the reactive power level (VAR).

- 1 ph. PF
  This selection enables a single-phase group of analog channels to initiate a recording based on the power factor level.

Note: Single-phase trigger types are calculated from analog channels measuring one voltage phase and one current phase. The system assumes that the following third analog channel is the current phase. The single-phase trigger must be assigned to the analog channel monitoring the voltage phase. Both phase inputs must be in the same group of eight (8) analog channels.

- 3 ph. W
  This selection enables a three-phase group of analog channels to initiate a recording based on the real power level.

- 3 ph. Vr
  This selection enables a three-phase group of analog channels to initiate a recording based on the reactive power level (VAR).

- 3 ph. PF
  This selection enables a three-phase group of analog channels to initiate a recording based on the power factor level.

Note: Three-Phase trigger types are calculated from analog channels measuring three voltage phases and three current phases. The system assumes that the analog inputs are connected in the order shown in Table 4-45, below. The Three-Phase trigger must be assigned to the analog channel monitoring the A-phase voltage input. All six phase inputs must be in the same group of eight analog channels; therefore, three-phase trigger types can only be assigned to the first or second input in each group of eight channels.

TR#	IN#	Trigger Channel Description
T1	A1	(A1)Analog Channel 1 - Suggest Va
T2	A2	(A2)Analog Channel 2 - Suggest Vb
T3	A3	(A3)Analog Channel 3 - Suggest Vc
T4	A4	(A4)Analog Channel 4 - Suggest Ia
T5	A5	(A5)Analog Channel 5 - Suggest Ib
T6	A6	(A6)Analog Channel 6 - Suggest Ic
T7	A7	(A7)Analog Channel 7 - Suggest In
T8	A8	(A8)Analog Channel 8 - Suggest Any

Table 4-45 Three-Phase Trigger Restrictions

- Start:
  This drop-down list is used to choose a start condition. ***Start*** choices are shown below:

  - o(Over)
    The selected trigger will start if an overvoltage limit is exceeded.

  - u(Under)
    The selected trigger will start if an undervoltage limit is exceeded.

  - b(Both)
    The selected trigger will start if either an overvoltage limit or an undervoltage limit is exceeded.

- Duration:
  This field displays the time period which a trigger must remain continuously abnormal before it will initiate a recording. The default setting is 0.000 seconds which initiates a recording instantly. This setting is applicable to all trigger types but is most often used in conjunction with a rate-of-change setting for disturbance type triggers.

- Trip if Over:
  This field displays the level at which an over trigger will initiate a recording.

- Trip if Under:
  This field displays the level at which an under trigger will initiate a recording.

- Trip if Rate > x/s:
  This field is used to enable a rate-of-change trigger. The trigger starts the fault recording process when the measured value exceeds this set limit. The default value is ***0*** (zero) which disables rate-of-change triggering.

  Example:
  Analog channel type is ***Vac***
  The trigger type is ***RMS***
  The *Trip if Rate >?/s* is ***1.000***
  Recording will begin if the RMS voltage rate-of-change exceeds one Volt per second.

Note: The rate-of-change trigger does not have to exceed the limit for an entire second. The Duration setting defines the time period in milliseconds over which the rate of change must occur before a recording is triggered. This period can be as short as one millisecond.

- Normal Value:
  This field displays the level designated to be the normal or expected signal level. The values in this column are not used by the analog triggers and are for reference only. Entries into this column are optional.

- Priority:
  This column displays the priority trigger setting.

  - no
    Analog triggers with Priority set to ***no*** will be limited to a recording assigned by the Fault Limit setting.

  - yes
    Analog triggers with Priority set to ***yes*** will not limit recordings to the Fault Limit setting and will allow recording to continue as long as that trigger is in an abnormal condition or until the system memory fills up.

- **Event Channels (Version 2004)**
  The Event Channels section is used to assign the following settings (Figures 4-46 and 4-47).

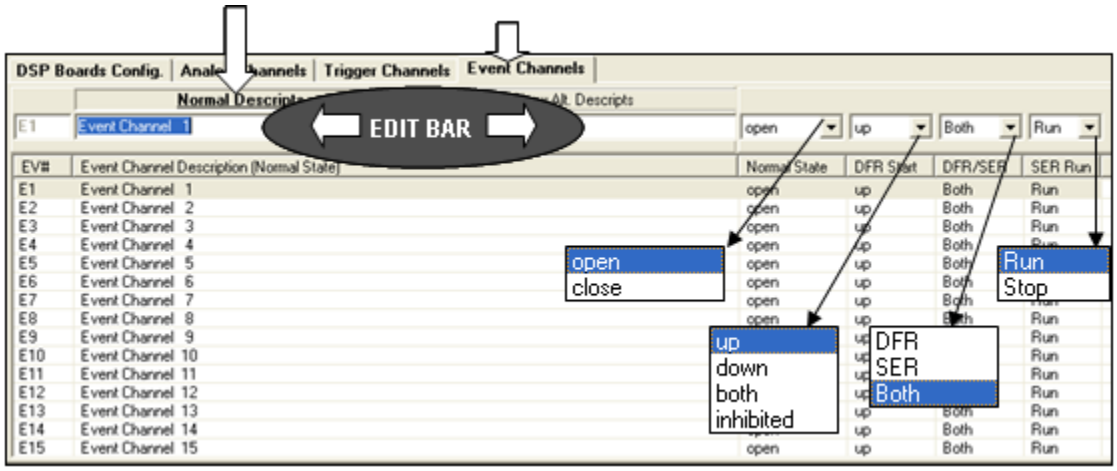


Figure 4-46 Event Channels Tab – *Normal Descripts* Selected

- EV# (Event Number):
  This column displays the event channel number for each physical input.

- Event Channel Description (Normal State – Select *Normal Descripts* tab):
  This column displays the alpha-numeric description entered for each event input. The event channel description is limited to 80 characters. This is the description recorded in DFR waveform recordings. This description is also recorded by the SER Data records when the event input returns to the ***Normal State***.

- Normal State:
  This setting defines the normal state of an event input.

  - open
    This selection indicates that a logic zero (***0***) detected by the recorder is to be considered the normal state and a logic one (***1***) detected by the recorder is to be considered the abnormal state.

  - close
    This selection indicates that a logic zero (***0***) detected by the recorder is to be considered the abnormal state and a logic one (***1***) detected by the recorder is to be considered the normal state.

- DFR Start:
  This setting determines whether an event input will trigger the recording process producing a COMTRADE data file.

  - up
    This selection enables the selected event input to trigger a DFR waveform recording on a transition from a logic zero (***0***) to a logic one (***1***) condition (e.g. the closing of the monitored event input contact).

  - down
    This selection enables the selected event input to trigger a DFR waveform recording on a transition from a logic one (***1***) to a logic zero (***0***) condition (e.g. the opening of the monitored event input contact).

  - both
    This selection enables the selected event input to trigger a DFR waveform recording on either the transition from a logic zero (***0***) to a logic One (***1***) condition (e.g. the closing of the monitored event input contact) or the transition from a logic one (***1***) to a logic zero (***0***) condition (e.g. the opening of the monitored event input contact).

  - Inhibit
    This selection prevents the selected event input from triggering a DFR waveform recording. The status of the event input is still monitored and recorded when the DME system is triggered by an analog trigger or another event input but an inhibited input alone cannot trigger a DFR waveform recording.

- DFR/SER:
  This setting determines how the selected event input is to be recorded.

- DFR
  This selection indicates that the input is to be treated as a DFR input only. The Sequence of Events function of the selected event input is disabled. The status of this event input will be recorded in the DFR waveform recordings only.

- SER
  This selection indicates that the input is to be treated as an SER input only. The DFR Start column for the selected event input is disabled. The status of this event input will be recorded in the SER Data records only.

- Both
  This selection indicates that the input is to be treated as both a DFR input and an SER input. The status of this event input will be recorded in both the DFR waveform recordings and the SER Data records.

- SER Run:
  This setting indicates the condition of the SER recording for the selected event input.

  - Run
    This selection enables the SER recording of the input. This is the default setting for events configured as SER inputs or Both (DFR and SER).

  - Stop
    This selection disables the SER recording of the input.

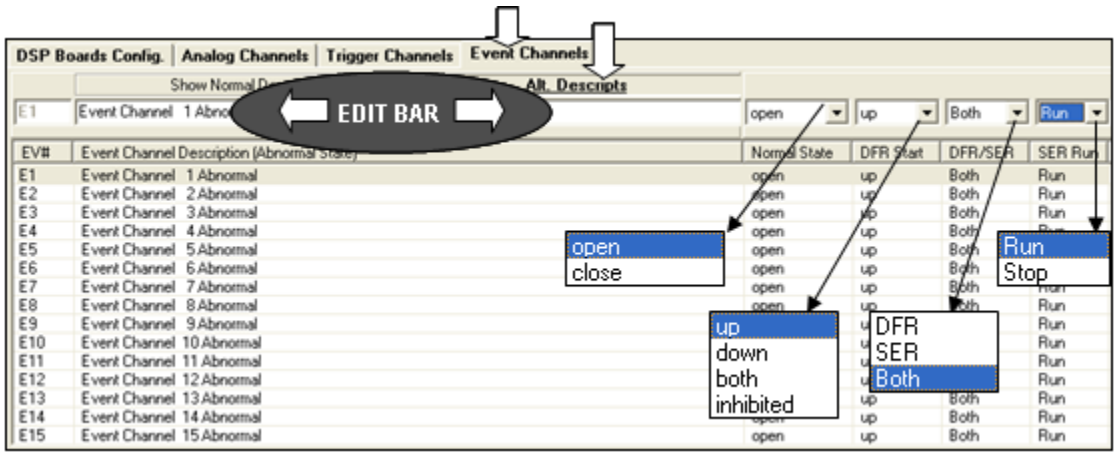


Figure 4-47 Event Channels Tab – *Show Alt. Descripts* Selected

- Event Channel Description (Abnormal State):
  This column displays the alpha-numeric description for the ***abnormal***

state of each event input (Figure 4-47). The event channel description is limited to 80 characters. This description is not recorded in DFR waveform recordings. This description is recorded in the SER Data records only when the event input transitions to the ***Abnormal State***.

4.2.5 Edit Calibration Record – Convert to Version 2004/2006

Version 2006 Calibration Record format was developed to increase the number of available Transient and Long Term sampling frequencies and to increase the number of available analog triggers to be equal to twice the number of analog channels.

Version 2004 Calibration Records may be converted to Version 2006 Calibration Records or vice versa. This conversion is done by right-clicking anywhere in the area of the station header and selecting the Convert Cal Record to 2004/2006 Format pop-up (Figure 4-48).

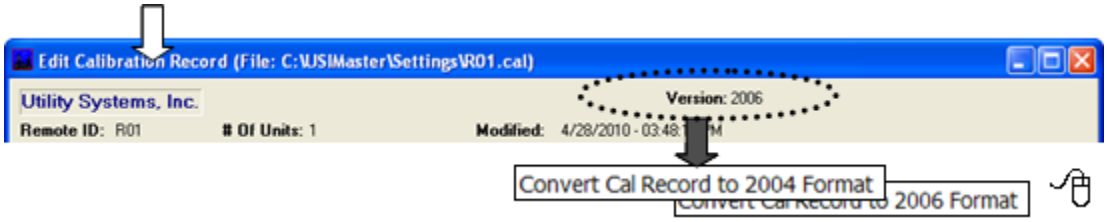


Figure 4-48 Calibration Record – Convert Format Version

Note: When a V2004 Calibration Record is converted to V2006 format, the expansion trigger channels are assigned new trigger numbers in sequence after the original trigger channel numbers. When V2006 Calibration Records are converted to V2004 format, all the expansion trigger channels and their settings are deleted. The V2004 format trigger channels are not changed.

4.2.6 Edit Calibration Record Version 2006

This format version of the Calibration Record is compatible with any Model 2002 DME system running *USIRemote*© V2.1.0 software or higher.

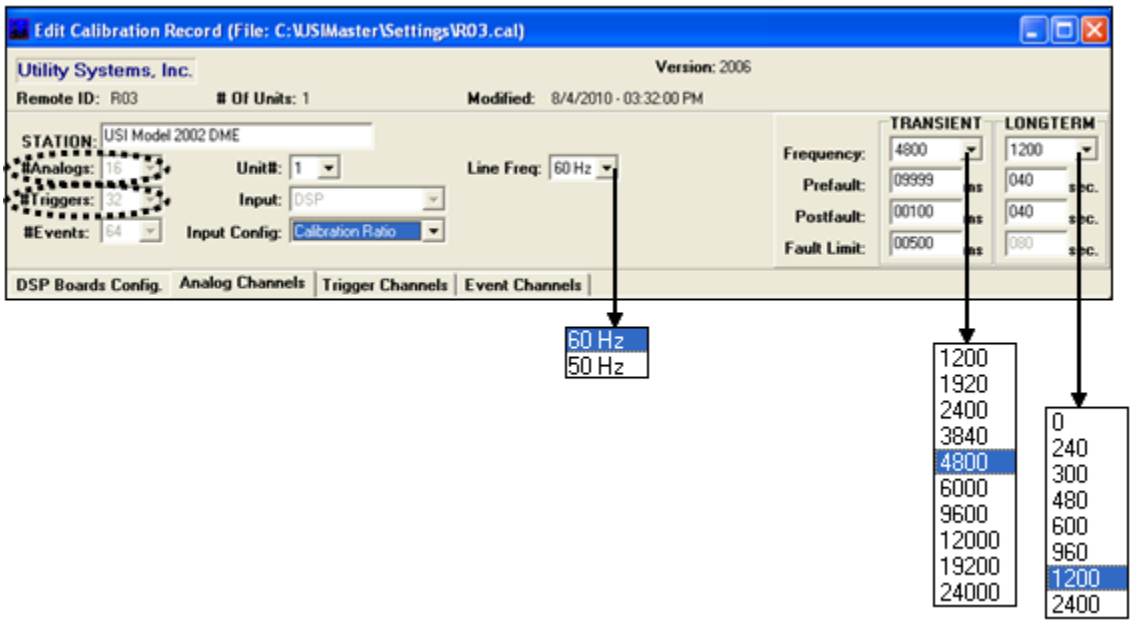


Figure 4-49 Calibration Record Station Header – Version 2006 (60 Hz Line Frequencies)

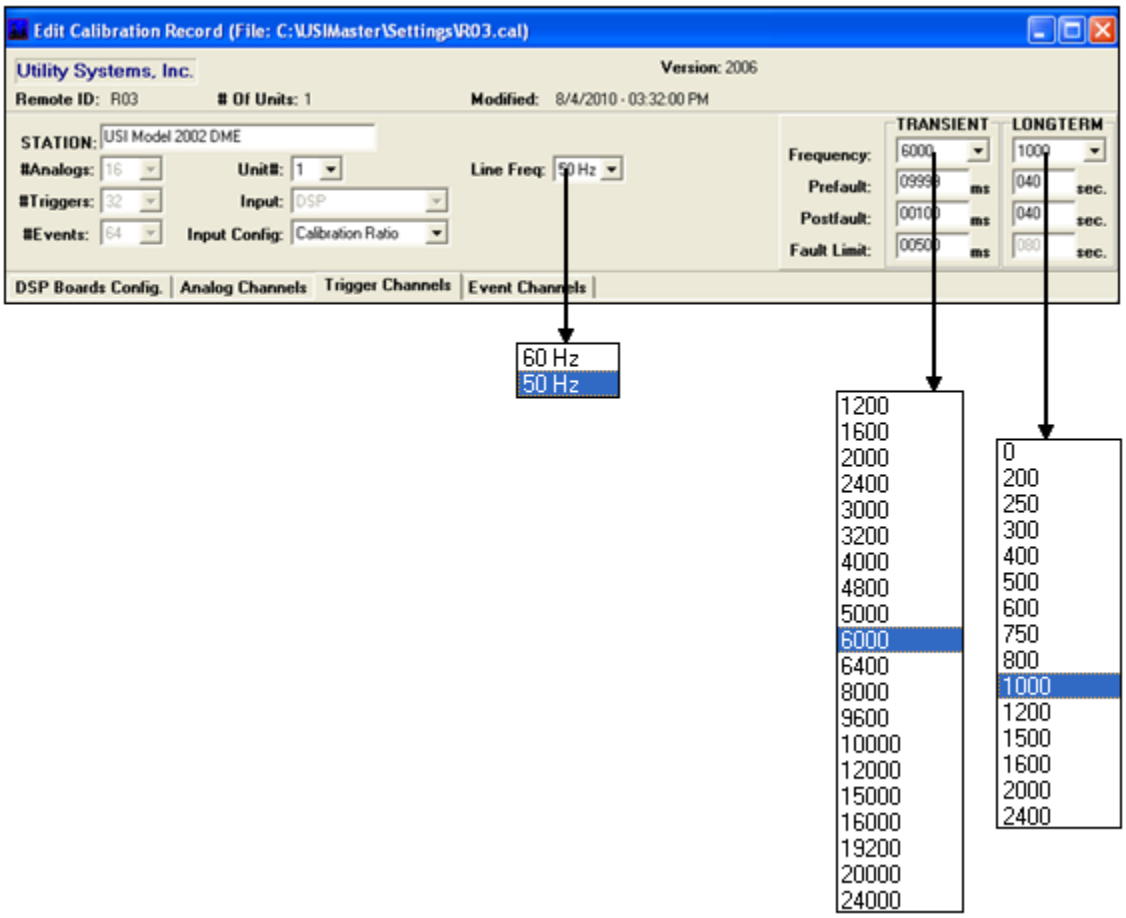


Figure 4-50 Calibration Record Station Header - Version 2006 (50 Hz Line Frequencies)

- **Station Header (Version 2006)**
  The Station Header section is used to assign the following settings (Figure 4-50). All settings in the V2006 station header are the same as the V2004 station header except for the following:

  - #Triggers:
    This field displays the total number of available analog triggers for the selected ***Unit*** of the DME system. In Calibration Record Version 2006, the number of available analog triggers is equal to twice the number of available analog channels.

  - Frequency:
    These drop-down menus are used to select the TRANSIENT and LONGTERM sampling frequencies (samples per second) at which the DME system analog-to-digital converters operate.

- TRANSIENT
  Sample rate selections available from this drop-down menu are dependent on the Line Freq: setting (Figures 4-49 and 4-50). These sampling frequencies are valid for all Model 2002 systems running *USIRemote© V2.1.0* or later and are not dependent on the number of analog inputs. All the analog and digital inputs are sampled at the selected rate.

- LONGTERM
  Sample rate selections available from this drop-down menu are dependant on the Line Freq: setting (Figures 4-49 and 4-50). These sampling frequencies are valid for all Model 2002 systems running *USIRemote© V2.1.0* or later and are not dependent on the number of analog inputs.

Note: The LONGTERM sampling frequencies displayed will vary depending on the selected TRANSIENT sampling frequency. The LONGTERM frequencies displayed are only those that have a common denominator with the TRANSIENT frequency and that are evenly divisible by the line frequency (e.g. 60 Hz or 50 Hz).

- **Trigger Channels (Version 2006)**
  The Trigger Channels section is used to assign the following settings (Figure 4-51). All settings in the V2006 trigger channels are the same as the V2004 format except for the following:

  - TR#:
    This column displays the analog trigger numbers available to be assigned to an analog channel. In a V2006 format Calibration Record, the number of available analog triggers is twice the number of available analog channels.

Note: No more than 16 analog triggers can be assigned to each group of eight analog channels.

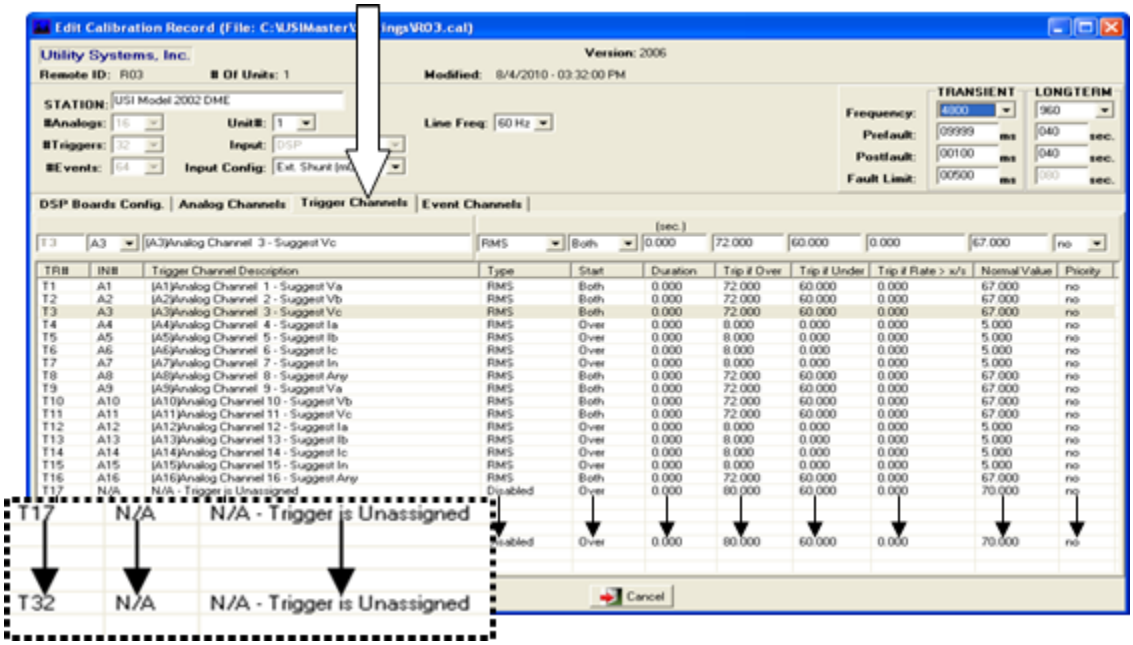


Figure 4-51 Calibration Record Trigger Channels Tab – Version 2006

4.3 Edit Line-Group Record

The ***Edit Line-Group Record*** window can be opened for editing or review by clicking on the Edit menu and selecting it from the Line Group Record menu (Figure 4-52).

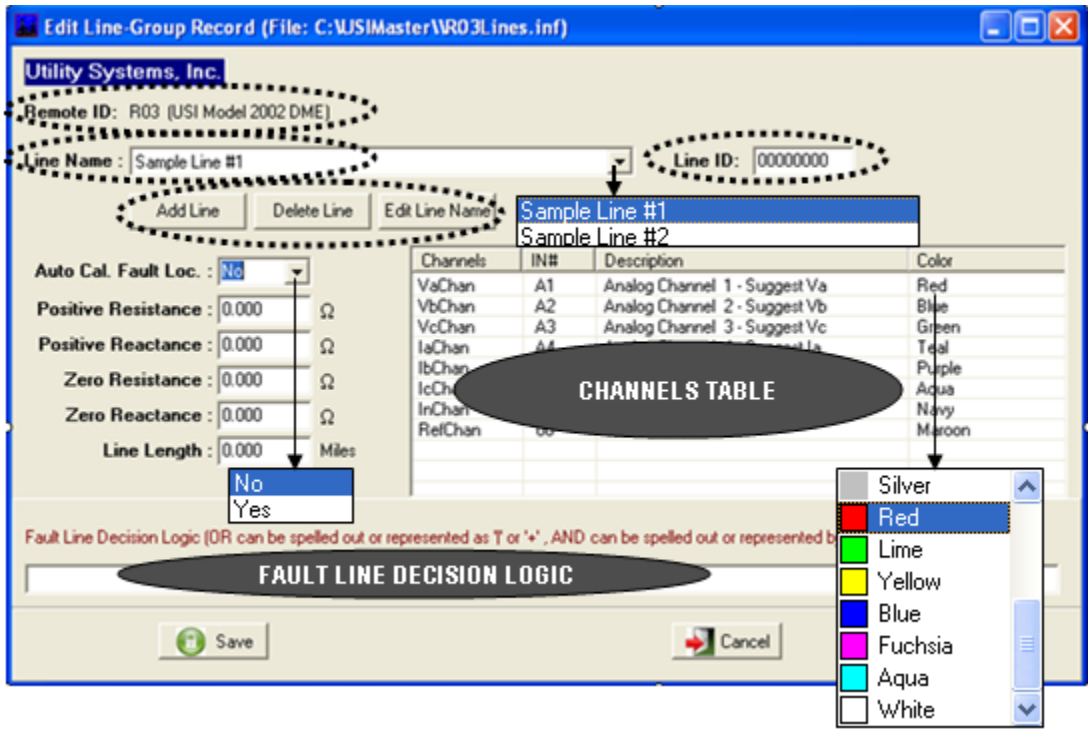


Figure 4-52 Edit Line Group Record Window

This record contains information about a group of channels associated with a three-phase transmission line or generator output. The line group information is used in distance-to-fault calculations and group analysis. This record is not required. The system will run without a Line Group Record. This record may be created and edited at the DME system using *WinDFR©* application or at the master station using *USIMaster©*. The filename for the Line Group Record is ***rxxxxLines.inf*** where *xxxx* is the remote ID number for the selected DME system. Parameters contained in the Line Group Record are as follows:

- **Remote ID:**
  This field displays the remote ID number and station name for the selected DME system.

- **Line Name**
  This drop-down list displays the existing line groups. Select a group from this list to edit or review.

- **Line ID**
  This field is used only by the Lightning Data Correlation option of the *USIMaster©*. This is a numeric entry that identifies the selected line name.

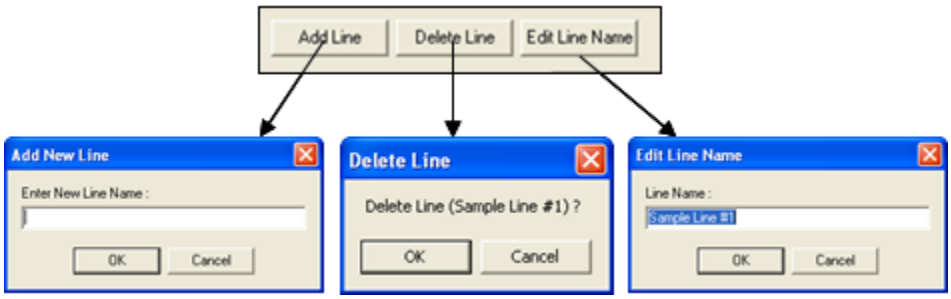


Figure 4-53 Line Group Buttons

- **Add Line**
  This selection is used to add a line to the Line Group Record. Clicking the Add Line ***Add Line*** button displays the ***Add New Line*** window (Figure 4-53). Enter the name of the line being added and click OK ***OK*** or click Cancel ***Cancel*** to return to the Edit Line Group Record window.

- **Delete Line**
  This selection is used to delete a line from the line group record. Clicking the Delete Line ***Delete Line*** button displays the Delete Line message window (Figure 4-53). Click OK ***OK*** to delete the selected line or click Cancel ***Cancel*** to return to the Edit Line Group Record window.

- **Edit Line Name**
  This selection is used to edit a line name in the line group record. Clicking the Edit Line Name ***Edit Line Name*** button displays the ***Edit Line Name*** window (Figure 4-53). Edit the line name and click OK ***OK*** to save the edited name or click Cancel ***Cancel*** to return to the Edit Line Group Record window.

- **Auto Cal. Fault Loc.**
  This drop-down list (Figure 4-52) is used to enable (***Yes***) or disable (***No***) the automatic fault location feature for the selected line. The distance-to-fault feature applies an impedance based algorithm using the transmission line parameters and the data measured from each of the transmission line elements to estimate the location of a fault on this transmission line. The calculated distance-to-fault results will be displayed in the Fault Location Report on the ***Quick Summary*** and ***History Data*** screens and can also be automatically delivered via E-mail. The following fields are required for the calculation:

    - Positive Resistance:
      This field is used to enter the positive sequence resistance value (in ohms) for the selected line.

- Positive Reactance:
  This field is used to enter the positive sequence reactance value (in ohms) for the selected line.

- Zero Resistance:
  This field is used to enter the zero sequence resistance value (in ohms) for the selected line.

- Zero Reactance:
  This field is used to enter the zero sequence reactance value (in ohms) for the selected line.

- Line Length:
  This field is used to enter the line length value (in miles) for the selected line.

- **Channels Table**
  The Channels Table is used to assign analog inputs to the Line Group. The Channels Table must be populated to perform distance-to-fault calculations or to utilize the ***Group*** format in Graphic Signal Processing (Section 5.9.3). The Channels Table consists of the following:

  - Channels column:
    This column displays the unit and phase of the input to be selected for each row in the Channels Table. The rows in the Channels Table are identified as follows:

    - VaChan
      This row displays the analog input assigned to be the A-phase voltage channel of the selected Line Group.

    - VbChan
      This row displays the analog input assigned to be the B-phase voltage channel of the selected Line Group.

    - VcChan
      This row displays the analog input assigned to be the C-phase voltage channel of the selected Line Group.

    - IaChan
      This row displays the analog input assigned to be the A-phase current channel of the selected Line Group.

    - IbChan
      This row displays the analog input assigned to be the B-phase current channel of the selected Line Group.

- IcChan
  This row displays the analog input assigned to be the C-phase current channel of the selected Line Group.

- InChan
  This row displays the analog input assigned to be the Neutral current channel of the selected Line Group.

- RefChan
  This row displays the analog input assigned to be used as reference for the selected Line Group. Configuring this row is optional and this channel is only displayed in the Graphic Signal Processing window when Format is set to ***Group*** and Graph Type is set to (***Ia,b,c***)(***neu***)(***Va,b,c***)(***ref***) (Section 5.9).

- IN#:
  This column displays the input number of the analog channel assigned to each row.

- Description:
  This column displays the descriptor for the analog channel selected for each row. The description is displayed exactly as it was entered into the Analog Channels screen of the Calibration Record.

- Color:
  This column displays the color to be used when this waveform is plotted in **Group** format of the Graphic Signal Processing window. Clicking on a color drops down a menu for choosing a different color (Figure 4-54).

Figure 4-54 Color Menu

- Channels Table Right-click menu:
  Right-clicking on any row in the Channels Table will display the following menu (Figure 4-55):

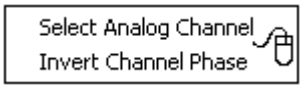


Figure 4-55 Channels Table - Right-click Menu

- Select Analog Channel
  This selection displays the ***Select Analog Channel for XxChan*** window. This window displays the list of analog channels by input number and description to choose for the selected row (e.g. ***Va***, ***Vb***, ***Vc***, ***Ia***, ***Ib***, ***Ic***, ***In***, ***Ref***). Click the OK ***OK*** button to enter the selected input into the Channels Table or click the Cancel ***Cancel*** button to return to the Edit Line Group Record window. Repeat this step for each of the rows in the Channels Table.

  If the DME system does not have all of the voltage or current phase inputs, select ***00: Virtual Channel*** from the ***Select Analog Channel*** window (Figure 4-56). The selection of ***00: Virtual Channel*** causes the software to calculate the missing waveform data by extracting information from the other waveforms in the group. The calculated waveform data is then used by the distance-to-fault algorithm to estimate the location of a fault on this transmission line.

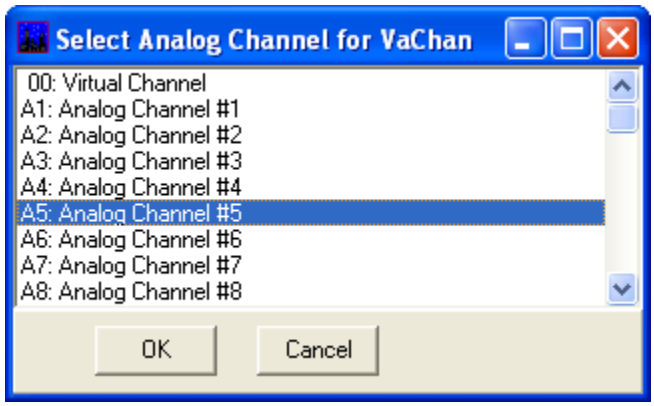


Figure 4-56 Select Analog Channel Window

The calculated data for a virtual channel will also be displayed in ***Graphic Signal Processing*** when in Group format. A virtual channel is always labeled as such.

Note: The Channels Table interface will allow the selection of multiple virtual channels; however, selections should be limited to no more than one virtual channel per line group.

- Invert Channel Phase
  This selection is used to instruct the distance-to-fault algorithm to invert this waveform before running the calculation. The algorithm assumes that neutral current data is supplied. This inversion tool is useful when ***3I0*** is being measured rather than the neutral

current (***In***). The ***3I0*** waveform is in phase with fault current. The fault location algorithm requires neutral current which is the inverse of ***3I0.***

- **Fault Line Decision Logic**
  This logic This logic (see Table 4-57 and following examples) is a Boolean equation of analog triggers and digital events and determines whether a fault calculation should be carried out, based on which triggers and events were abnormal during each DFR record. This field is used by the distance-to-fault algorithm to determine which line from the Line Group Record tripped due to a fault.

  If field is left empty, the distance-to-fault will run only on the first line group it checks because a blank Fault Line Decision Logic is interpreted as True.

  Line group logic statements are limited to 200 characters. Spaces are legal characters and are ignored, but they count towards the 200 character limit.

Note: The distance-to-fault algorithm calculated fault location only on a single line group for each fault record.

Boolean Operators	Logic Description
& , *, AND	AND function
|, +, *OR*	OR function
t1, t2, t3, etc	Triggers
e1, e2, e3, etc	Events
0 (zero)	False, will never pass logic filter
1	True, will always pass logic filter
Nothing (blank)	True, will always pass logic filter
Parentheses ( )	Groups logic
Spaces	Spaces are ignored by the logic

Table 4-57 Fault Line Decision Logic

Examples:
Below are three different syntax samples for the same equation.

(T1|T2|T3|T4|T8|T5|T6|T7) & ((E4 | E5) & E11)

(T1+T2+T3+T4+T8+T5+T6+T7) * ((E4 + E5) * E11)

(T1 OR T2 OR T3 OR T4 OR T8 OR T5 OR T6 OR T7) AND ((E4 OR E5) AND E11)

- Save **Save**
  This selection is used to save all setting changes made and to close the ***Edit Line-Group Record*** window.

After this selection is made the ***Line-Group Record is Saved*** message displays (Figure 4-58). Click ***OK*** to acknowledge.

After acknowledging that the Line-Group Record is saved the ***Send Line-Group Record to Remote*** message window displays (Figure 4-58). Selecting ***Yes*** initiates a communication connection with the recorder, uploads the Line-Group Record, and re-initializes the system putting the new settings into effect. Selecting ***No*** will close the ***Send Line-Group Record to Remote*** window without sending the saved file to the recorder.

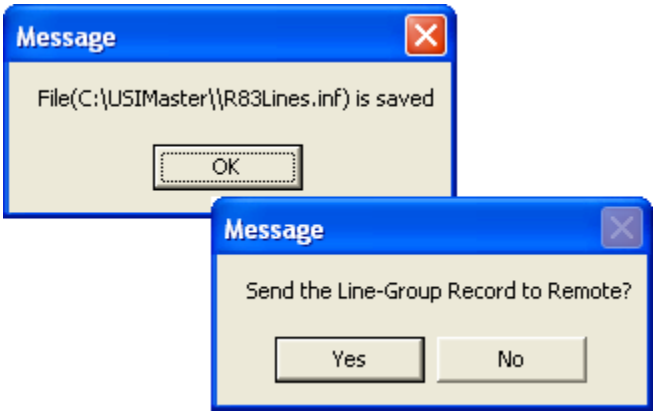


Figure 4-58 Save Line-Group Record

Note: If the ***Save*** button displays a red ***Locked*** symbol, the applications global Administrator privileges are disabled (Section 2.1.4). Clicking a locked Save ***Save*** button will open the Administrator Password window (Figure 4-59) allowing users to enter a valid Administrator password and click OK ***OK*** for a one-time ***Save***.

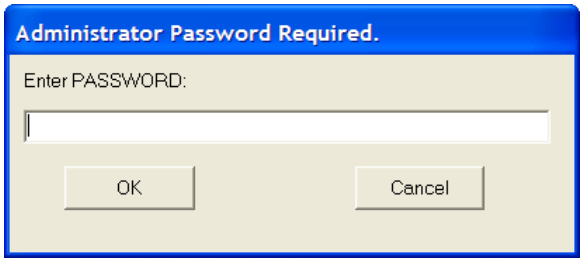


Figure 4-59 Administrator Password Window

- Cancel **Cancel**

  This selection is used to cancel all setting changes made and to close the ***Edit Line-Group Record*** window.

4.4 Edit WinDFR© Configuration

The ***WinDFR© Configuration*** window can be opened for editing or for review by selecting it from the Edit menu (Section 2.1.2). The ***WinDFR© Configuration*** window consists of four different screen tabs used to configure General, File Paths/Time Zone, Continuous Recording, and Memory Options settings (Figure 4-60).

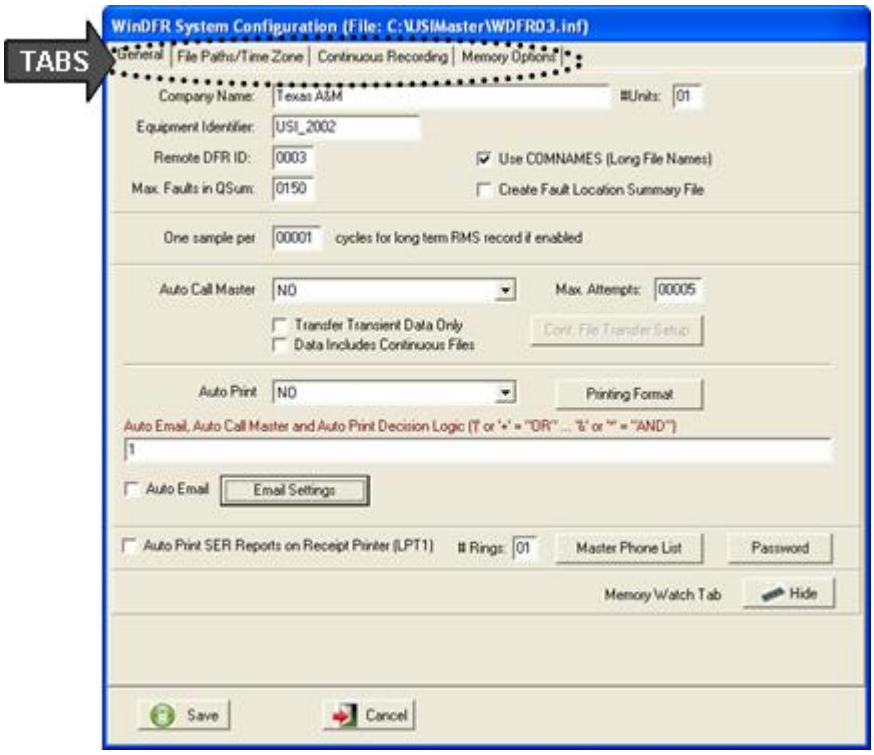


Figure 4-60 WinDFR System Configuration – Screen Tabs

- Save ***Save:***
  This selection is used to save all setting changes made on any screen tab and close the ***WinDFR© System Configuration*** window.

  The ***Send WinDFR© Config. to Remote*** message window displays (Figure 4-61). Selecting ***Yes*** initiates a communication connection with the recorder, uploads the Line-Group Record, and re-initializes the system putting the new settings into effect. Selecting ***No*** will close the ***Send Line-Group Record to Remote*** window without sending the saved file to the recorder.

Figure 4-61 Send WinDFR© Configuration

Note: Configuration settings assigned in the ***WinDFR© System Configuration*** are stored in a file in the *USIMaster©* working directory. The file is located in a file named ***WDFR##.inf*** where ## is the related DME system ID number.

Note: If the ***Save*** button displays a red ***Locked*** symbol, the global Administrator privileges are disabled (Section 2.1.4). Clicking a locked ***Save*** button will open the ***Administrator Password Window*** (Figure 4-62) allowing users to enter a valid Administrator password and click ***OK*** for a one-time ***Save***.

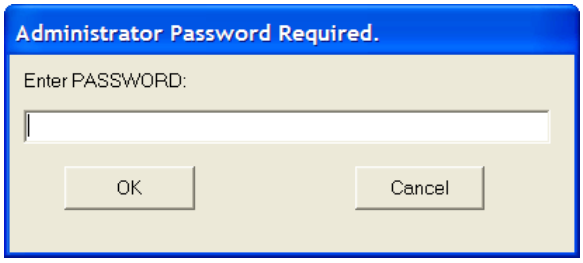


Figure 4-62 Administrator Password Window

- ***Cancel:***
  This selection is used to cancel all setting changes made on any screen tab and to close the ***WinDFR© System Configuration*** window.

4.4.1 WinDFR© Configuration Screen – General Tab

The General screen tab is used to assign the following settings (Figure 4-63).

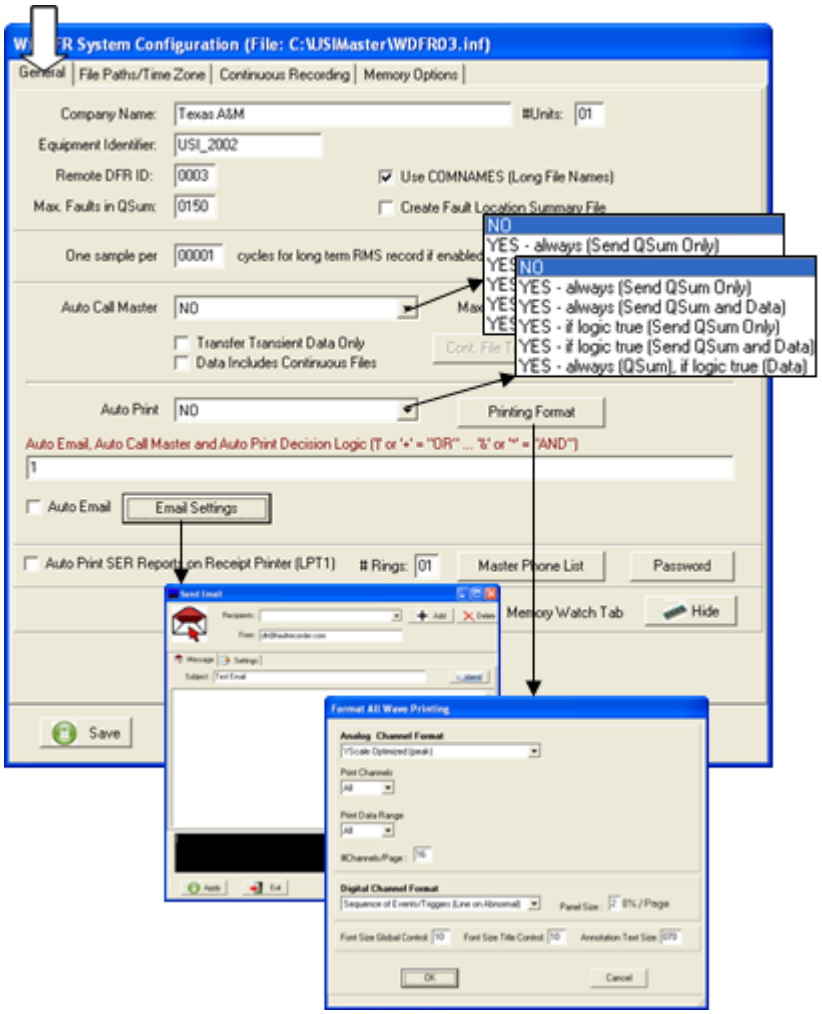


Figure 4-63 WinDFR© Configuration Screen – General Tab

- **Company Name**
  Enter the company name of the user here. This is not a required field.

- **# Units**
  Number of Units is typically ***1***. Number of Units refers to the number of computers running the *USIRemote*© application on the DME. The number entered in this field must match the number of units entered when the Calibration Record was initially created (Figure 2-5).

- **Equipment Identifier**
  This field is used to assign the text which will be inserted into the ***Device Identifier*** field of the file name for COMTRADE data files when the ***Use COMNAMES (Long File Names)*** box is checked (see below in this section). The default entry

automatically assigned to this field is either ***USI_2002*** or ***HT2000W*** depending on the model of the system. This is a variable length field containing alpha-numeric characters and some punctuation marks. Characters disallowed are comma, question mark, quotation mark, forward slash, backward slash, less than, greater than, asterisk, pipe, and colon.

- **Remote DFR ID**
  This field contains the unique Remote ID number assigned to the selected DME system (Figure 2-4). This entry is restricted to a number from one to four digits in length.

- **☑Use COMNAMES (Long File Names)**
  This checkbox enables the ***COMNAMES*** feature. When this box is selected, the *WinDFR*© program will automatically name the data files in accordance with the IEEE C37.232 standard.

- **Max # Faults in Qsum**
  This field contains the maximum number of fault summary lines that can be inserted into the ***Quick Summary*** file. The default number is 50; the maximum number is 9999.

- **☑Create Fault Location Summary File**
  This checkbox enables the creation of an information file in the working directory of the *WinDFR*© application. This file contains summary information about the DME records which had a successful fault location calculation.

- **One sample per xxxxx cycles for long term RMS record if enabled**
  Long Term RMS is a separate data file derived from the Long Term oscillography data file (***RxxxxMyyyy,*** see Section 3.1.1). This data file is automatically created by the DME system and contains calculated RMS values. These RMS values are calculated using a window of Long Term oscillography data. This setting defines window size for the data used in the calculation. The window slide increment is equal to the window size; therefore, there is no overlapped or skipped data between successive calculations.

  Example: On a 60 Hz power system, a setting of **One sample per 0001 cycles** results in 60 calculations per second, **One sample per 0002 cycles** results in 30 calculations per second, etc.

- **Auto Call Master**
  This drop-down menu is used to enable the Auto-Call feature and to determine what data is to be downloaded to *USIMaster*© during an Auto-Call session (Figure 4-64).

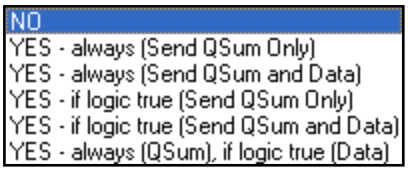


Figure 4-64 Auto Polling Drop-Down Menu

- NO:
  This selection disables Auto-Call.

- YES – always (Send QSum Only):
  This selection enables Auto-Call to always download the Quick Summary file.

- YES – always (Send QSum and Data):
  This selection enables Auto-Call to always download the Quick Summary and new COMTRADE files.

- YES – if logic true (Send QSum only):
  This selection enables Auto-Call to selectively download the Quick Summary file based on the ***Auto Email, Auto Call Master and Auto Print Decision Logic*** (see below in this section).

- YES – if logic true (Send QSum and Data):
  This selection enables Auto-Call to selectively download the Quick Summary file and new COMTRADE files based on the ***Auto Email, Auto Call Master and Auto Print Decision Logic*** (see below in this section).

- YES – always (QSum), if logic true (Data):
  This selection enables Auto-Call to always download the Quick Summary file but selectively download new COMTRADE files based on the ***Auto Email, Auto Call Master and Auto Print Decision Logic*** (see below in this section).

- **Max. Attempts**
  This field is used to determines how many attempts the DME system will make to call *USIMaster©* when ***Auto Call*** is set to ***Yes***.

- **☑Transfer Transient Data Only**
  This checkbox is used to control the type of data that is sent to *USIMaster©* by the DME system. If the box is checked, only transient data files will be sent and Long-Term data files will not. Checked ☑ is the default setting.

- **☑Data Includes Continuous Files**
  This checkbox is used to configure the transfer of continuous recording data files during an Auto-Call or Auto-Polling session. Checking this box activates the ***Cont.***

File Transfer Setup button [Cont. File Transfer Setup]. When this checkbox is selected, continuous recording data will be transferred to *USIMaster*© during a DME system Auto-Call session as configured in the ***Cont. File Transfer Setup***.

If continuous recording data is to be transferred to *USIMaster*© only during an Auto-Polling session, un-check this box after selecting the continuous data types and the analog channels from which data is to be transferred (see ***Data Includes Continuous Files*** in Section 4.1.2).

If the ***Data Includes Continuous Files*** checkboxes are selected in both the WinDFR© Configuration and the Master System Configuration, continuous recording data will be transferred to *USIMaster*© during both a DME system Auto-Call session and a *USIMaster*© Auto-Polling session.

- **Cont. File Transfer Setup**
  Click this button to display the ***Continuous File Auto Transfer Setup*** window (Figure 4-65). This window is used to select which continuous data type is to be transferred and which analog channel data is to be sent.

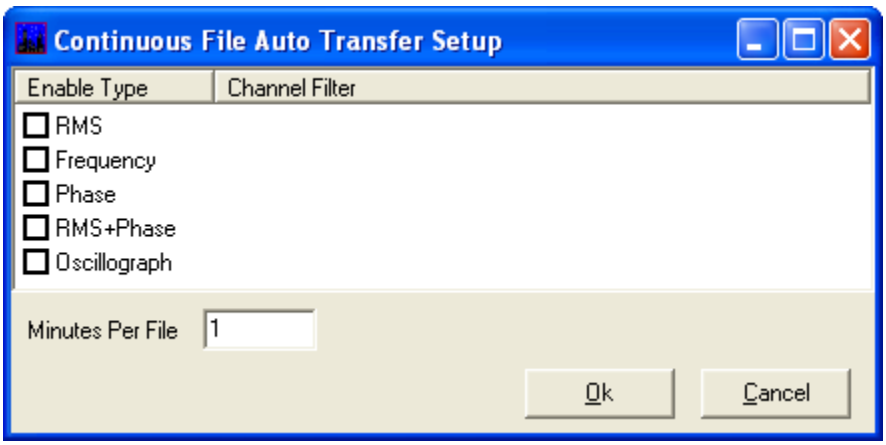


Figure 4-65 Continuous File Auto Transfer Setup window

Double-click each Continuous Type row in the Channel Filter column to display the Select Continuous Channels window. This window is used to select the analog channels for which continuous data values will be transferred.

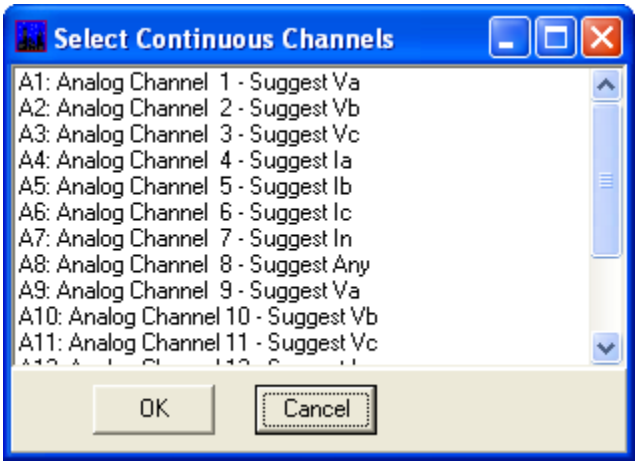


Figure 4-66 Select Continuous Channels Window

- **Auto Print**
  This drop-down list (Figure 4-67) is used to enable *WinDFR©* to print and control what is to be printed when a new DME record is created. This drop-down list is also used to control what is to be printed by *USIMaster©* when new DME records are received during an Auto-call or Auto-Polling session. This printout is sent to the default printer.

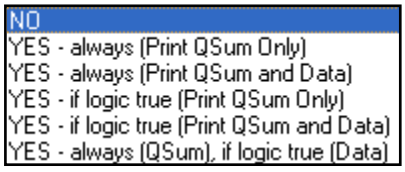


Figure 4-67 Auto Print Drop Down List

  - NO:
    This selection disables Auto-Print.

  - YES – always (Print QSum Only):
    This selection enables Auto-Print to always print the Quick Summary file.

  - YES – always (Print QSum and Data):
    This selection enables Auto-Print to always print the Quick Summary and new COMTRADE files.

  - YES – if logic true (Print QSum only):
    This selection enables Auto-Print to selectively print the Quick Summary

file based on the ***Auto Email, Auto Call Master and Auto Print Decision Logic*** in the *WinDFR*© configuration (see below in this section).

- YES – if logic true (Print QSum and Data):
  This selection enables Auto-Print to selectively print the Quick Summary file and new COMTRADE files based on the ***Auto Email, Auto Call Master and Auto Print Decision Logic*** Boolean equation in the *WinDFR*© configuration (see below in this section).

- YES – always (QSum), if logic true (Data):
  This selection enables Auto-Print to always print the Quick Summary file but selectively print new COMTRADE files based on the ***Auto Email, Auto Call Master and Auto Print Decision Logic*** Boolean equation in the *WinDFR*© configuration (see below in this section).

- Printing Format **Printing Format**
  This button displays the Format All Wave Printing window (Figure 4-68) and is used to configure the *WinDFR*© default printing format.

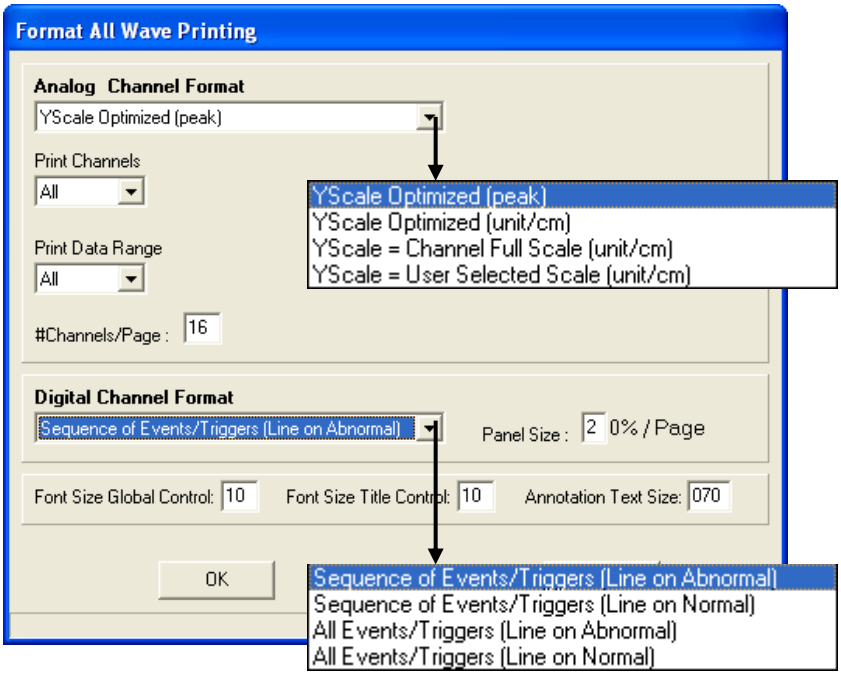


Figure 4-68 Format All Wave Printing

- Analog Channel Format
  This drop-down list is used to select the default Y-scale settings for analog waveforms being printed.

  - YScale Optimized (peak)
    This selection optimizes the height of each waveform to fill its allocated printable area. The height allocated on the

page for each waveform is determined by the ***#Channels/Page*** setting. This makes very small waveforms more visible.

The Y-scale reference is the peak magnitude value for each printed waveform (Figure 4-69).

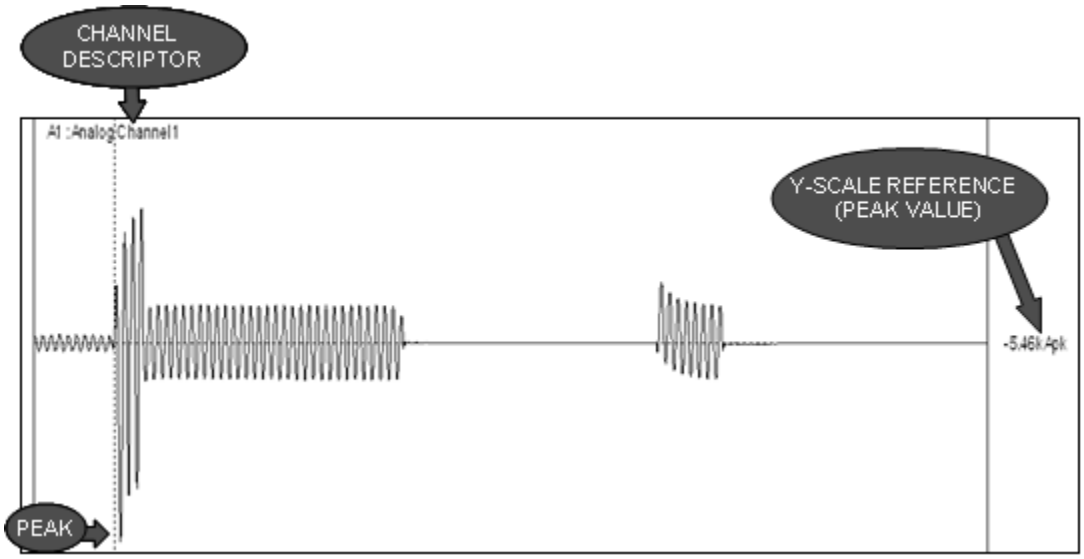


Figure 4-69 Y-Scale – Optimized – Peak – Sample Printout

- YScale Optimized (unit/cm)
  This selection optimizes the height of each waveform to its allocated printable area. The height allocated on the page for each waveform is determined by the ***#Channels/Page*** setting. This makes very small waveforms more visible.

  The appearance of the waveforms is the same as YScale Optimized (peak). However, the Y-scale reference is set to unit/cm rather than peak (Figure 4-70). The signal value can be determined by measuring the waveform height on the printout and multiplying the measurement by the Y-scale reference.

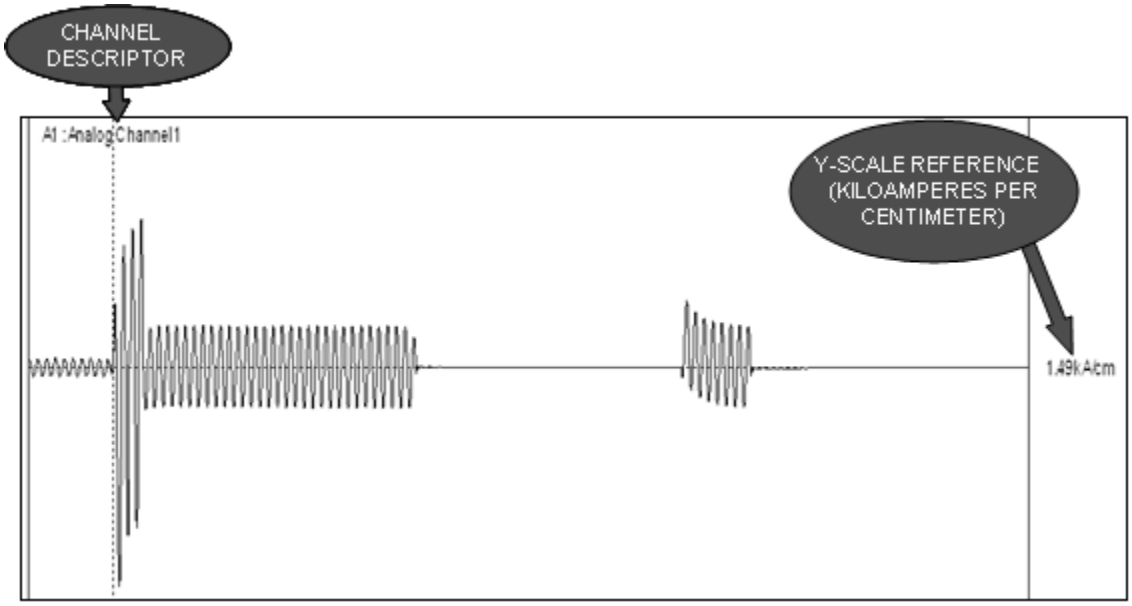


Figure 4-70 Y-Scale – Optimized – Unit/Centimeter – Sample Printout

- YScale = Channel Full Scale (unit/cm)
  This selection sets the Y-scale to the Analog Channel Full Scale value entered in the Calibration Record (Section 4.2).

  The Y-scale reference is set to unit/cm. The signal value can be determined by measuring the waveform height on the printout and multiplying the measurement by the Y-scale reference (Figure 4-71).

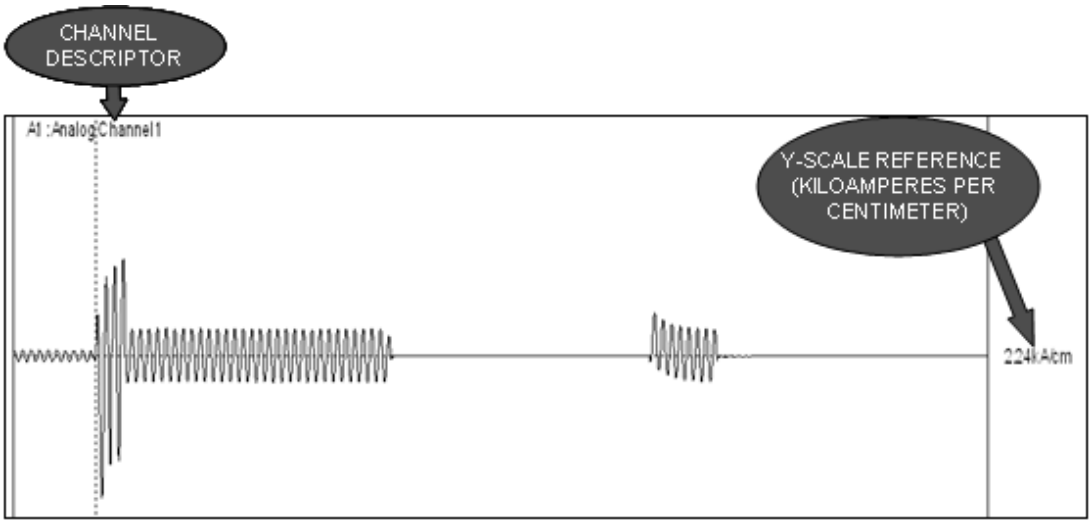


Figure 4-71 Y-Scale – Channel Full-Scale – Unit/Centimeter – Sample Printout

- YScale = User Selected Scale (unit/cm)
  This selection sets the Y-scale height for each waveform to the value entered in the ***YScale V or A*** field (Figure 4-72).

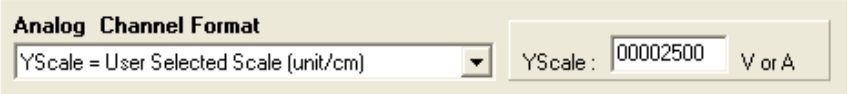


Figure 4-72 User Selected Y-Scale

The Y-scale reference is set to unit/cm. The signal value can be determined by measuring the waveform height on the printout and multiplying the measurement by the Y-scale reference (Figure 4-73).

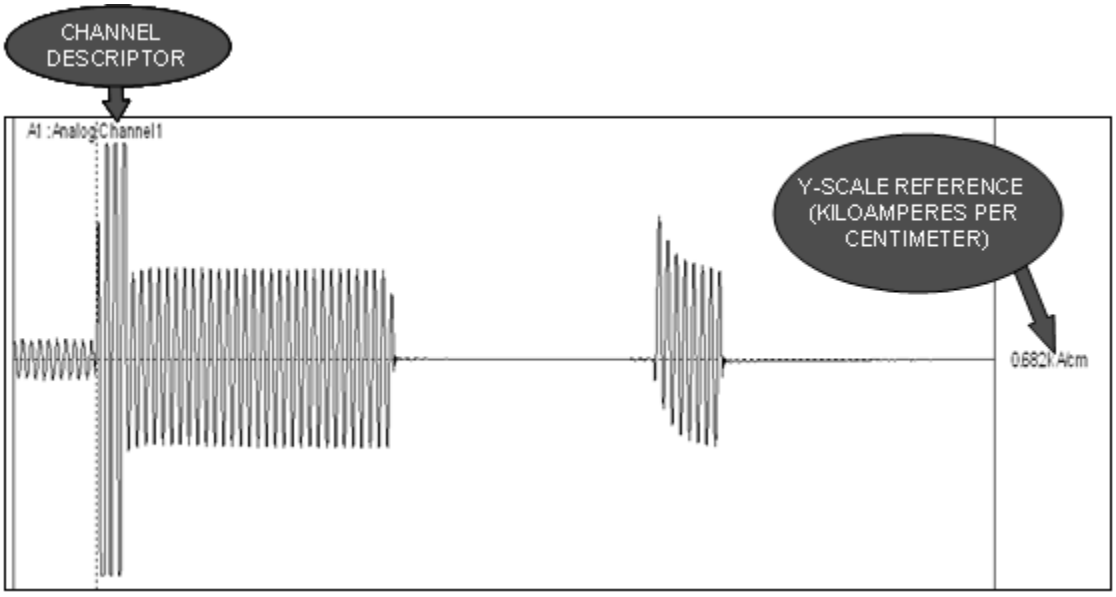


Figure 4-73 Y-Scale - User Selected – Unit/Centimeter – Sample Printout

- Print Channels
  This drop-down list is used to select the default settings for analog waveforms being printed (Figure 4-68). The default settings define user printout preferences. These preferences are applied to automatic and manual printouts, and are the starting point for print previews.

  The default can only be set to ***All*** channels which prints all

waveforms for the DME record being printed. This setting can only be changed during a print preview (Figure 2-2).

- Print Data Range
  This drop-down list (Figure 4-68) displays selections to choose from ***All*** or ***Selected*** data range to be printed. The default setting is ***All*** and this setting may be changed only during a print preview of waveforms.

- #Channels/Page
  This field is used to select the number of analog channel waveforms to be printed on each page. Valid channels-per-page settings range from 1 to 99.

- Digital Channel Format
  The following drop-down list (Figure 4-68) is used to select the default format setting for the digital traces being printed:

  - Sequence of Events/Triggers (Line on Abnormal)
    This selection prints only the digital events and analog triggers which were abnormal during the DME record to be printed. A solid line will be printed to display the ***Abnormal*** period for each event or trigger. Absence of the solid line along the same x-axis indicates the ***Normal*** period for the event or trigger. The lines will be printed from top to bottom in the sequence they became abnormal. The color of the solid line will match the color of the descriptor for the event or trigger. See example printout in Figure 4-74.

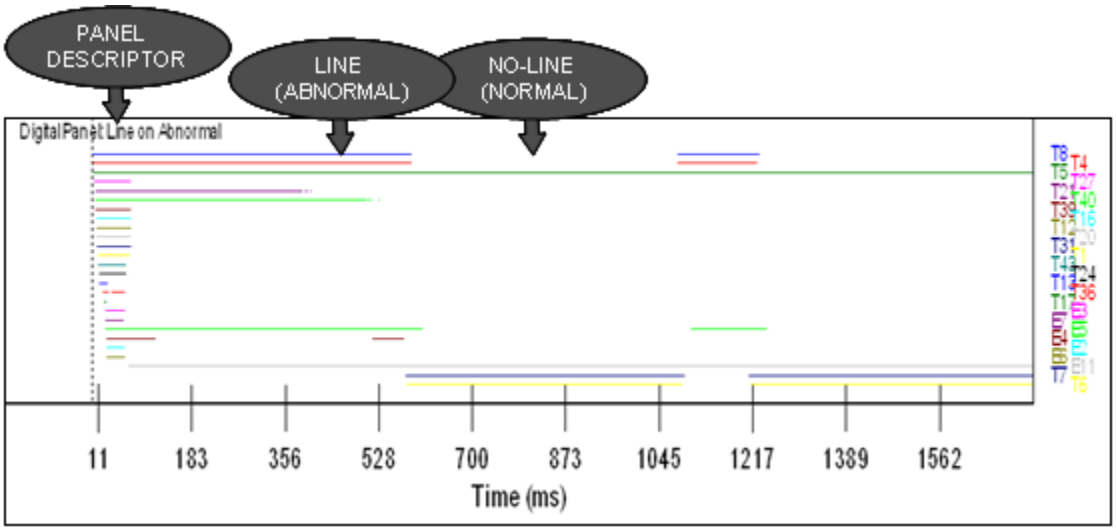


Figure 4-74 Sequence of Events/Triggers – Line on Abnormal – Sample Printout

- Sequence of Events/Triggers (Line on Normal)
  This selection prints only the digital events and analog triggers which were abnormal during the DME record to be printed. A solid line will be printed to display the ***Normal*** period for each event or trigger. Absence of the solid line along the same x-axis indicates the ***Abnormal*** period for the event or trigger. The lines will be printed from top to bottom in the sequence they became abnormal. The color of the solid line will match the color of the descriptor for the event or trigger. See example printout in Figure 4-75.

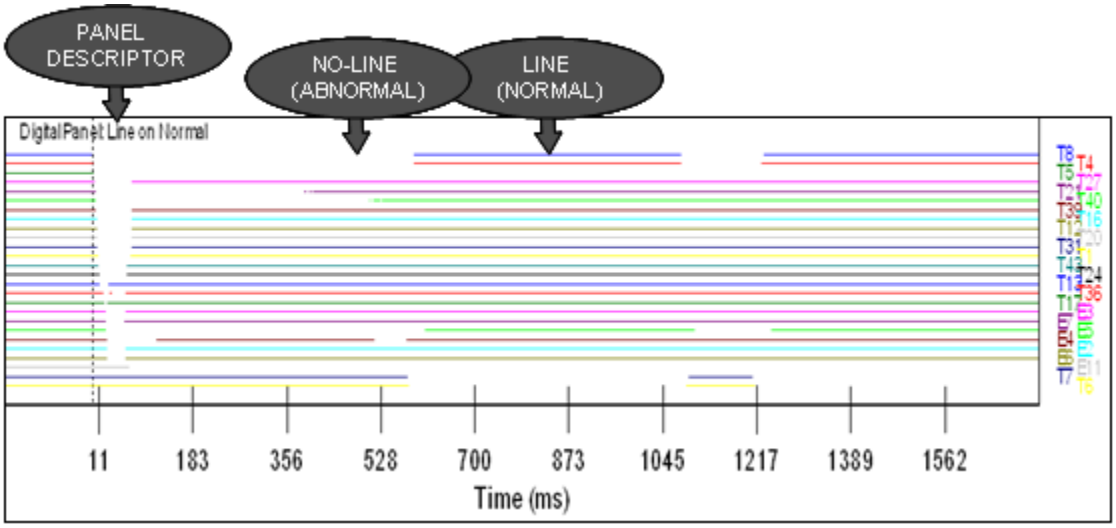


Figure 4-75 Sequence of Events/Triggers – Line on Normal – Sample Printout

- All Events/Triggers (Line on Abnormal)
  This selection will print ***All*** digital events and analog triggers, allocating space for 32 digital events and 8 analog triggers on each page. A solid line will be printed to display the ***Abnormal*** period for of each digital event or analog trigger. Absence of the solid line along the same x-axis indicates the ***Normal*** period for each digital event or analog trigger. The color of the solid line will match the color of the descriptor for the event or trigger. See example printout in Figure 4-76.

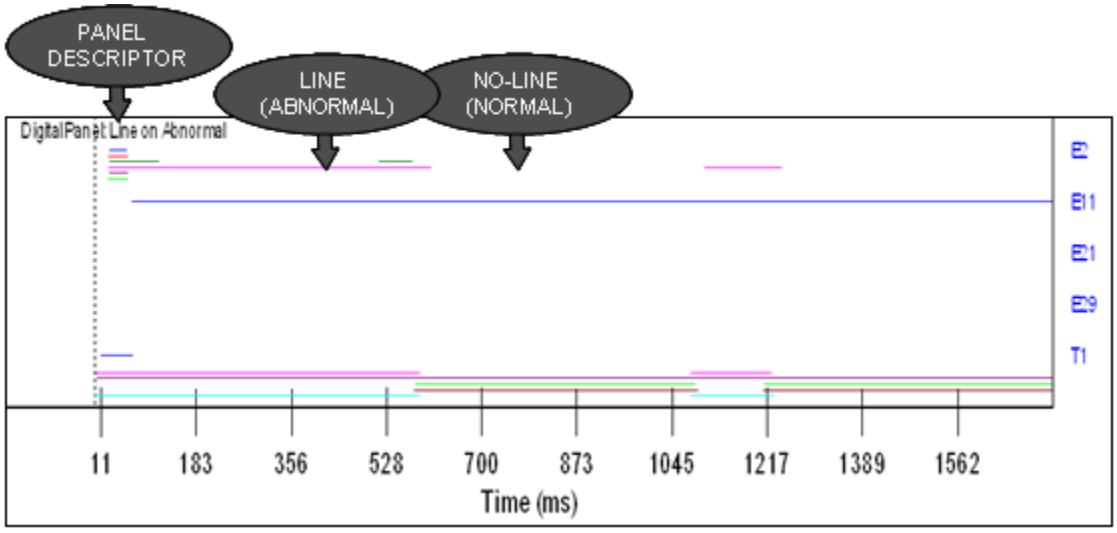


Figure 4-76 All Events/Triggers – Line on Abnormal – Sample Printout

- All Events/Triggers (Line on Normal)
  This selection will print ***All*** digital events and analog triggers, allocating space for 32 digital events and 8 analog triggers on each page. A solid line will be printed to display the ***Normal*** period for of each digital event or analog trigger. Absence of the solid line along the same x-axis indicates the ***Abnormal*** period for each digital event or analog trigger. The color of the solid line will match the color of the descriptor for the event or trigger. See example printout in Figure 4-77.

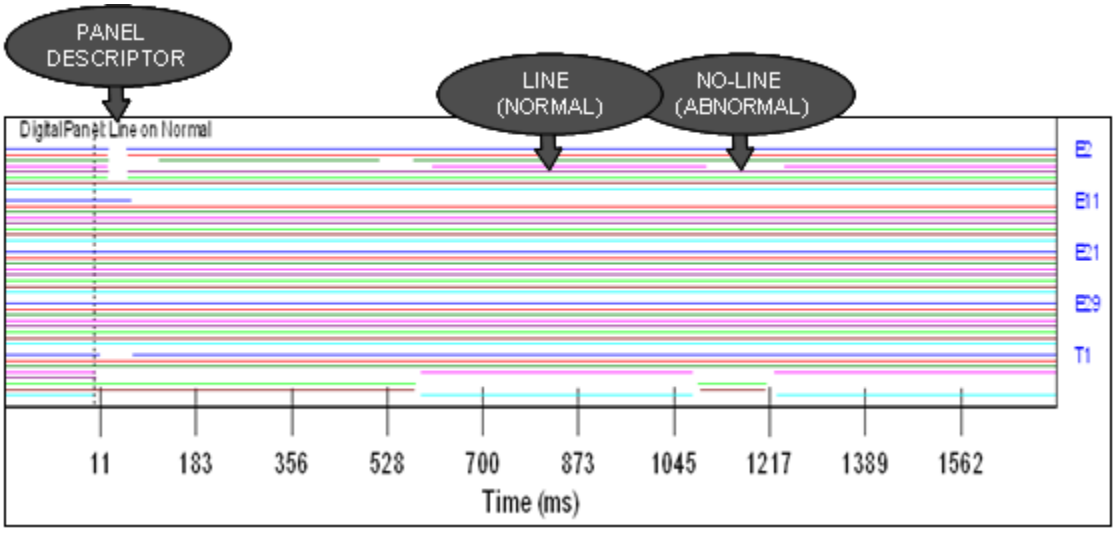


Figure 4-77 All Events/Triggers – Line on Normal – Sample Printout

- Panel Size
  This field is used to define the default panel height (in percent of printout page height) for the digital events and analog triggers panel. The values are adjustable in steps of 10% from 10% to 90%.

- Font Size Controls

  - Font Size Global Control
    This field is used to assign the default font size which will be applied globally to text characters on the printout.

  - Font Size Title Control
    This field is used to assign the default font size which will be applied specifically to title characters on the printout.

  - Annotation Text Size
    This field is used to assign the default font size which will be applied specifically to annotation characters on the printout.

- **Auto Email, Auto Call Master and Auto Print Decision Logic**
  This logic (see Table 4-78 and following examples) is a Boolean equation of analog triggers and digital events and determines whether an Auto-Email, Auto-Call, or Auto-Print action should be carried out, based on which triggers and events were abnormal during each record. This field is used by the DME system to select priority DME records to be processed by the Auto E-mail, Call or Print functions.

  If this field is left empty the decision logic is interpreted as ***True*** and the Auto E-mail, Call and Print functions will be performed on every DME record.

  Line group logic statements are limited to 200 characters. Spaces are legal characters and are ignored, but they count towards the 200 character limit.

Boolean Operators	**Logic Description**
& , *, AND	AND function
|, +, *OR*	OR function
t1, t2, t3, etc	Triggers
e1, e2, e3, etc	Events
0 (zero)	False, will never pass logic filter
1	True, will always pass logic filter
Nothing (blank)	True, will always pass logic filter
Parentheses ( )	Groups logic
Spaces	Spaces are ignored by the logic

Table 4-78 Fault Line Decision Logic

Examples:
Below are three different syntax samples for the same equation.

(T1|T2|T3|T4|T8|T5|T6|T7) & ((E4 | E5) & E11)

(T1+T2+T3+T4+T8+T5+T6+T7) * ((E4 + E5) * E11)

(T1 OR T2 OR T3 OR T4 OR T8 OR T5 OR T6 OR T7) AND ((E4 OR E5) AND E11)

- This parameter allows a user to setup a Boolean logic equation that determines if ***Auto Call*** and ***Auto Print*** should be carried out, based on which triggers or events are activated. If nothing is entered in this box, the ***Auto Call Master*** *and* ***Auto Print*** parameters determine whether a call or printout is made. If an equation (Table 4-79) is entered in this box and the ***Auto Call Master*** or ***Auto Print*** parameter is ***No***, no calling or printing is done.

Symbol or Entry	Logic Description
*&, *, AND*	AND function
| , +, OR	OR function
t1, t2, t3, etc	Triggers
e1, e2, e3, etc	Events
0 (zero)	False, will never pass logic filter
1	True, will always pass logic filter
Nothing (blank)	True, will always pass logic filter

Table 4-79 Auto Call and Auto Print Decision Logic

- **☑Auto Email**
  Check this box to enable the DME system to send an automatic E-mail to all addresses saved in the Recipients field of the E-mail settings screen. The message contains fault summary information of DME records received during Auto-call and Auto-Polling sessions.

Note: An Ethernet connection is required in order for the DME system to send an E-mail.

  - **E-mail Settings**
    This selection displays the ***Send E-mail*** window (Figure 4-80). From this window E-mail settings can be customized to define what information is to be sent automatically and to whom. This window can also be used to send an E-mail message manually. The DME system must have an SMTP/POP3 E-mail account and connectivity in order to use the E-mail feature.

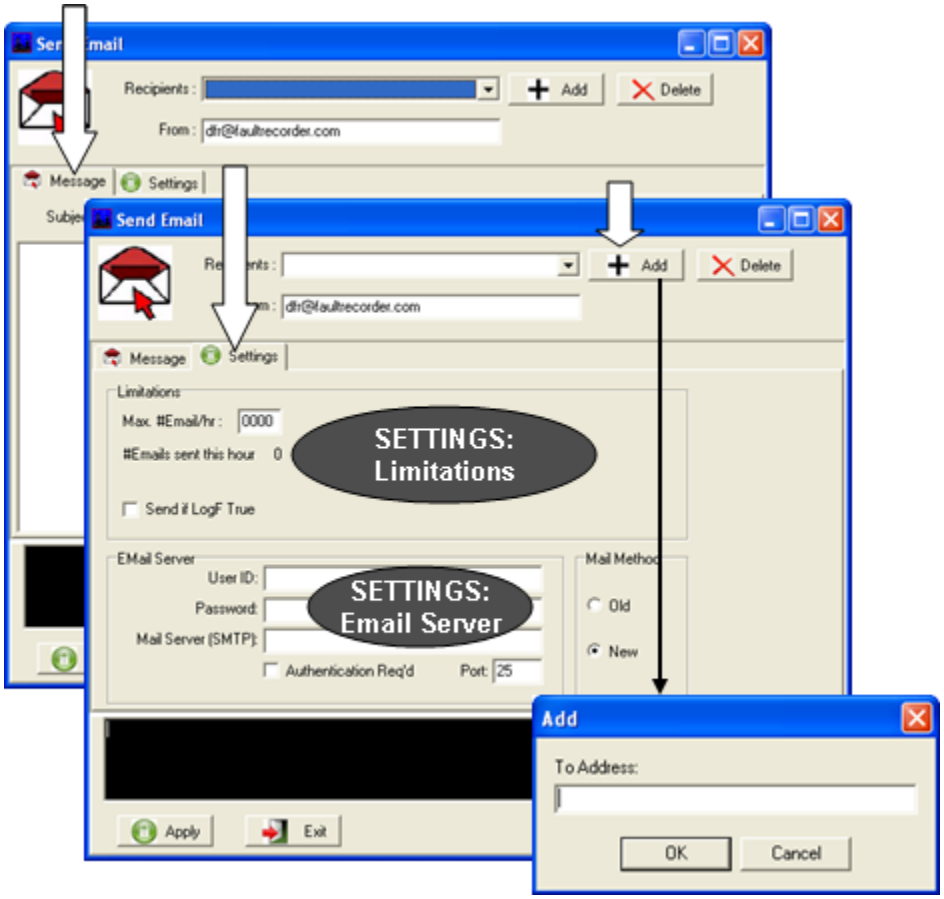


Figure 4-80 Send E-mail

- Add **Add**:
  Click the **Add** button to display the ***Add*** window. Use this window to add an E-mail address to the ***Recipients*** drop-down list.

- Delete **Delete:**
  To delete an E-mail address, select one from the ***Recipients*** drop-down list and click the **Delete** button.

- **From**:
  This field is used to enter or revise the E-mail address of the master station.

- The ***Settings*** screen tab (Figure 4-80) allows user access to the ***Limitations*** settings and ***Email Server*** settings listed below:

  - Limitations
    Max. #Email/hr:
    This setting limits the number of messages that can be sent automatically in a single 60 minute period.

#Emails sent this hour
This field displays the number of E-mail messages sent in the current hour.

☑Send if LogF True
Check this box to apply the Auto Call, Auto Email, and Auto Print decision logic to E-mail messages. E-mail messages will only be sent if this logic is true.

- E-mail Server
  User ID:
  This field is used to enter the User ID for the master station E-mail account.

  Password:
  This field is used to enter the User Password for the master station E-mail account. If no password is required by the mail server, this field may be left blank.

  Mail Server (SMTP):
  This field is used to enter the IP address of the SMTP Mail Server.

  ☑Authentication Req'd:
  This check box allow users to enable authentication, if required by the SMTP Mail Server.

  Port:
  This field allows users to enter the port number of the IP address being used for E-mail message transport.

- The ***Message*** screen tab (Figure 4-80) is used to send a test E-mail message to the addresses in the ***Recipients*** list.

  - Subject:
    The Subject field is used to enter a subject for the E-mail message being created manually.

Note: The subject field of E-mail messages automatically sent by the DME system is populated with the Remote ID number and Station Name.

  - Message field:
    This field is used to enter the body of an E-mail message being sent manually.

Note: The body of an E-mail message initiated by a new DME record will be populated automatically with Quick Summary and Distance-to-Fault information. Lightning Data Correlation results are also included if this option was purchased.

- ☐ Send **Send**:
  When the ***Recipients*** list, ***Subject*** field, and ***Message*** field have been completed, send the message by clicking the ***Send*** button.

- Apply The **Apply** button is used to save ***Settings*** entered within the Send E-mail window.

- Exit The **Exit** button is used to close the Send E-mail window.

- **☑Auto Print SER Reports on Receipt Printer (LPT1)**
  This checkbox is used to route the Sequence of Events Report to an receipt printer. Each time an SER point changes state a new line is added to the SER Report. The information printed on the SER Report is also displayed on the SER Data screen (Section 3.3).

- **# Rings**
  This field sets the number of telephone rings to wait before the modem answers an incoming call.

- Master Phone List **Master Phone list**
  Selecting this button displays the Master Phone List window. This window is used to configure the communication medium and enter the phone number, IP address, or Master ID (Figure 4-81) for the selected DME system to call *USIMaster©*.

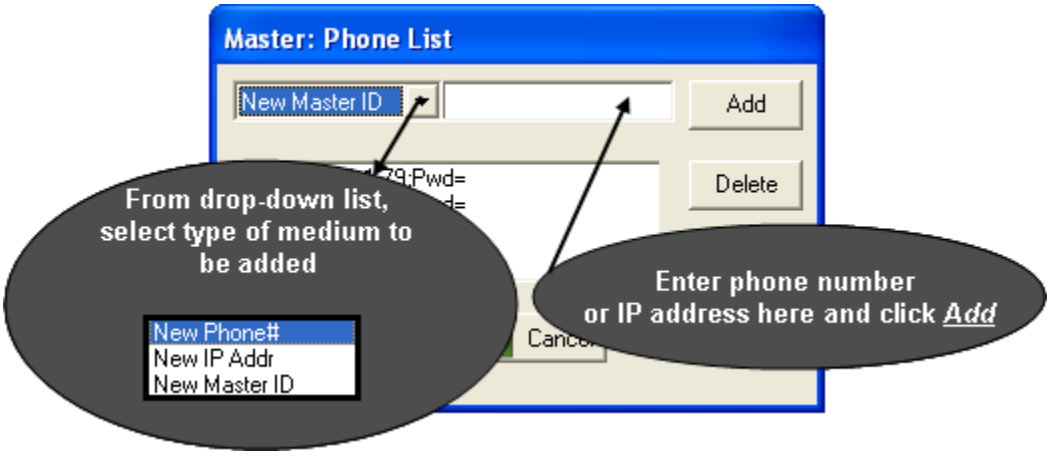


Figure 4-81 Phone and Network – Select Communication Medium

- For communication via dial-up modem, Ethernet (LAN/WAN), or Master ID, enter the phone number, IP Address, or Master ID into the text box directly to the right of the drop-down list (Figure 4-81), then click the Add ***Add*** button.

- After adding the phone number, IP Address, or Master ID the ***Master Password*** window opens requesting the logon password of the *USIMaster©*. Enter the password exactly as assigned in the Master Configuration set in the Master System Configuration (see Section 4.1.2) or leave blank if no password has been assigned. The factory default is No Password Assigned to the *USIMaster©*. Click OK ***OK*** then click Save ***Save*** (Figure 4-82).

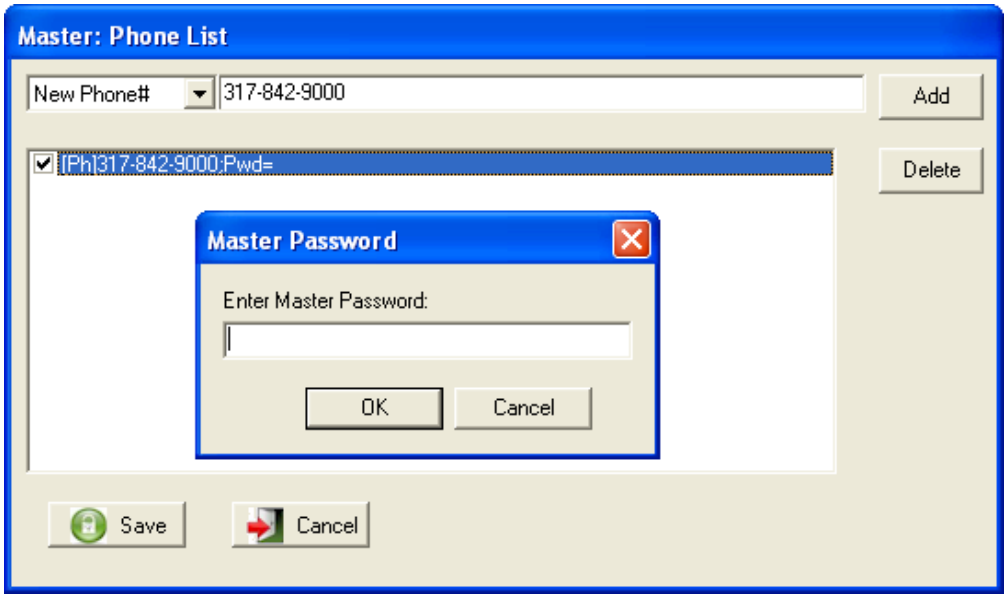


Figure 4-82 Master Phone List - Enter Password

- New Phone#:
  This selection is used when communication from the DME system to *USIMaster©* will be via modem. Choose ***New Phone#*** from the drop-down list (Figure 4-83) and enter the dial-up phone number of the *USIMaster©*.

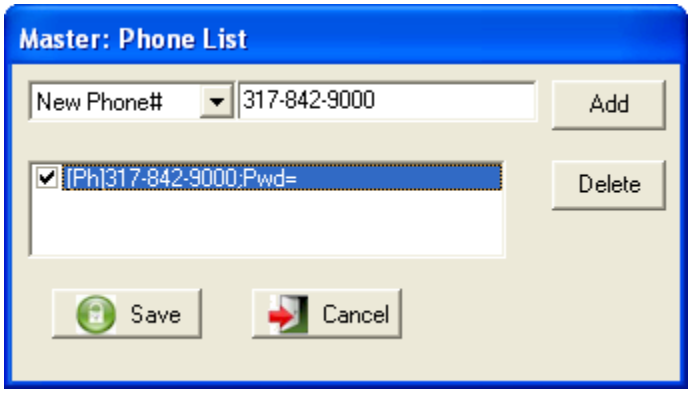


Figure 4-83 Master Phone List – Enter New Phone Number

- New IP Addr:
  This selection is used when communication from the DME system to *USIMaster©* will be via Ethernet (LAN/WAN). Choose ***New IP Addr*** from the drop-down list (Figure 4-84) and enter the IP Address of the *USIMaster©*.

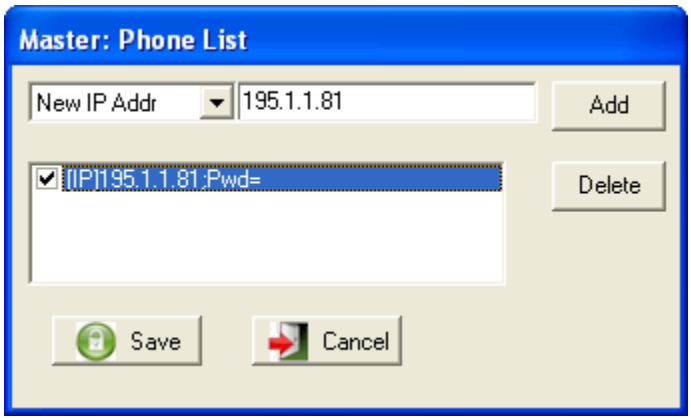


Figure 4-84 Master Phone List – Enter New IP Address

- New Master ID:
  This selection is used when communication from the DME system to *USIMaster©* will be via Master ID. Choose ***New Master ID*** from the drop-down list (Figure 4-85) and enter the Master ID of the *USIMaster©* as it is entered in the Master Configuration (Figure 4-3).

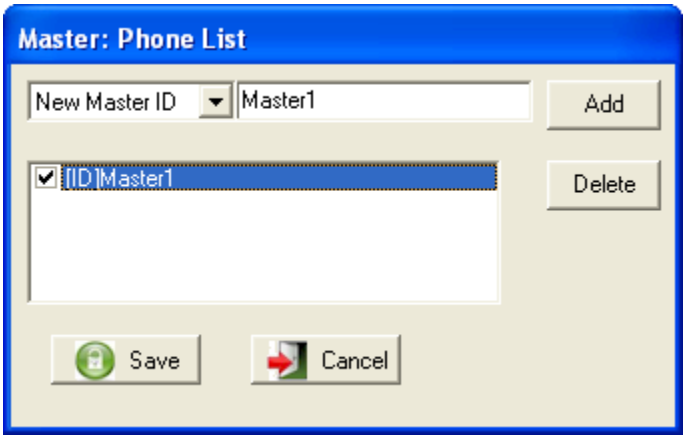


Figure 4-85 Master Phone List – Enter New Master ID

- Password **Password**
  This button is used to assign a communication password to the DME system. Clicking this button displays the *WinDFR*© Password window (Figure 4-86) used to enter the password for the selected DME system.

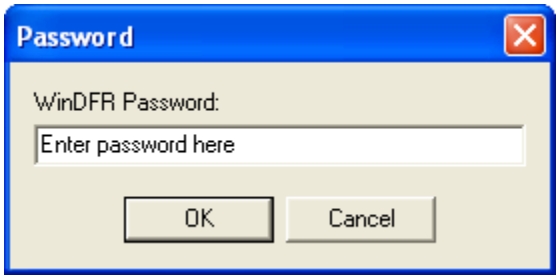


Figure 4-86 WinDFR Configuration – WinDFR Password Window

- **☑Use RFL Switch**
  This checkbox enables the feature to configure communications via an RFL 9660 digital switch on the DME. When this box is checked, the RFL selections are displayed in the *WinDFR*© Communication menu. When this box is not checked, these selections are not displayed in the *WinDFR*© Communication menu.

- **Memory Watch Tab (Show/Hide)**
  This button is used to show or hide the Memory Options tab on the *WinDFR*© configuration screen. This screen is hidden by default. When this tab is displayed, the ***Program Memory Level Options*** can be modified (Figure 4-94).

4.4.2 WinDFR© Configuration Screen – File Paths/Time Zone

The File Paths/Time Zone screen tab is used to assign the following settings (Figure 4-87).

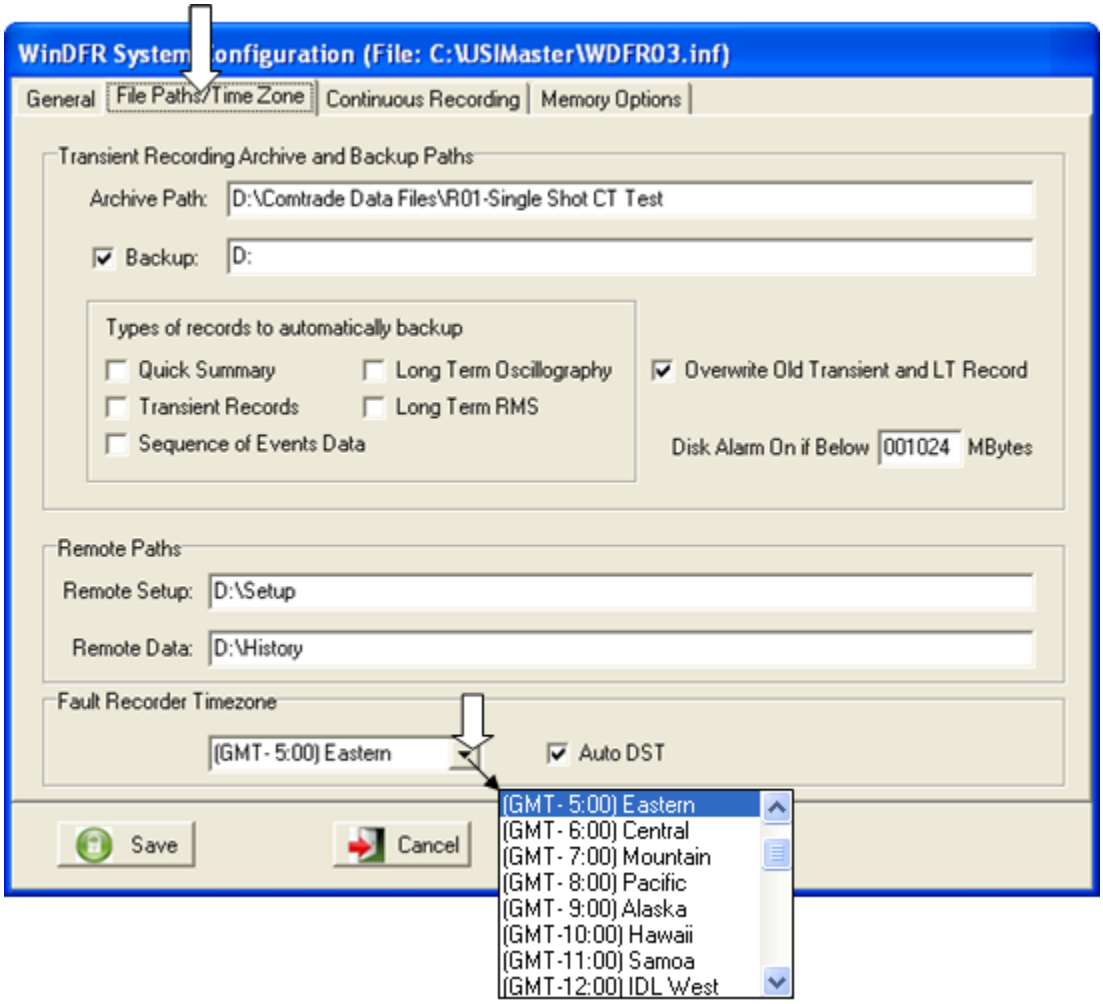


Figure 4-87 WinDFR© Configuration Screen – File Paths/Time Zone Tab

- **Archive Path**
  This path displays the location where the Transient and Long Term fault records and the Sequence of Events data files are stored on the DME system (Figure 4-87). The Transient and Long Term records are stored in COMTRADE format. The default path is ***D:\Comtrade Data Files***.

Caution: Modifying the Archive path could cause the DME system to malfunction or go offline. If this path is to be changed, take care to ensure that the new path actually exists on the selected DME system.

- **☑Back-Up**
  This checkbox is used to enable the automatic data backup function on the DME system. When this box is checked the ***Types of records to automatically backup*** fields are activated.

- **Back-Up Path**
  This path displays the location where data selected in the ***Types of records to automatically backup*** fields will be copied.

- **Types of records to backup automatically**
  Click on one or more of the following checkboxes to select types for automatic backup:

  - ☑Quick Summary:
    Checking this box will cause the DME system to store a copy of the Quick Summary into the Backup Path each time this file is updated.

  - ☑Long Term Oscillography:
    Checking this box will cause the DME system to store a copy of each Long Term Oscillography file into the Backup Path.

  - ☑Transient Records:
    Checking this box will cause the DME system to store a copy of each Transient (DFR) record into the Backup Path.

  - ☑Long Term RMS:
    Checking this box will cause the DME system to store a copy of each Long Term RMS file into the Backup Path.

  - ☑Sequence of Events Data:
    Checking this box will cause the DME system to store a copy of each SER data file into the Backup Path.

- **☑Overwrite Old Transient and LT Record checkbox**
  This check box is used to enable the DME system to overwrite the oldest Transient and Long Term fault records from the ***Archive path***. The files are deleted in a first in, first out (FIFO) basis when the Archive disk free space is at 100MB above the ***Disk Alarm On*** setting.

Caution: Data files which have been overwritten are permanently deleted and can not be recovered.

- **Disk Alarm On if Below xxxxxx Mbytes**
  This setting is used to assign both the activation point for the ***Disk Full Alarm***, and the start level to begin overwriting the oldest Transient and Long Term fault data. The field is a numeric entry in megabytes. When the free space on the archive drive is less than this value, the ***DISK*** alarm output relay will be picked up and the ***DISK FULL*** LED on the DME system front panel will be illuminated. The default setting is 1024 MB (the equivalent of one gigabyte).

- **Remote Setup Path**
  This field displays the location where the Calibration Record is stored. This path is also where to store trace files and command files. The Remote program monitors the ***Setup*** folder for commands it should execute or records it should update.

- **Remote Data Path**
  This field displays the location where *WinDFR*© polls for new Transient and Long Term fault records and Sequence of Events data. *WinDFR*© takes these files and executes post-process actions such as adding fault summary information, calculating Distance-to-Fault, executing the Decision Logic.

Note: After completing these post-processes, the finalized DME record is stored in the Archive path and the original files from the Remote Data path are deleted.

Caution: Modifying the Remote Setup or Remote Data paths could cause the DME system to malfunction or go offline. If this path is to be changed, take care to ensure that the new path actually exists on the selected DME system.

- **Fault Recorder Timezone**
  This drop-down list (Figure 4-88) is used to select the time zone for the DME system location.

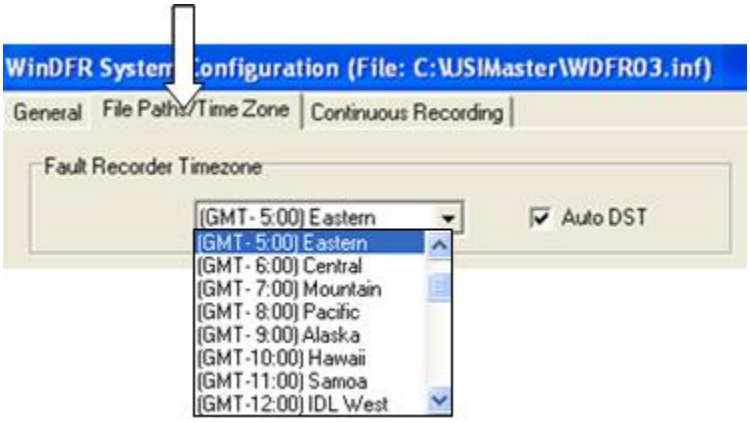


Figure 4-88 Fault Recorder Time Zone Menu

- **☑Auto DST checkbox**
  This checkbox (Figure 4-88) is used to indicate whether or not the DME system clock recognizes automatic Daylight Saving Time (DST) changeovers.

Note: This setting is used by *USIMaster*© when the Lightning Data Correlation software option is being used. The timestamps for lightning strike data are stored in GMT.

This setting is used by the Lightning Data Correlation feature to convert the DME record trigger time back to GMT.

4.4.3 WinDFR© Configuration Screen – Continuous Recording

The Continuous Recording screen tab is used to assign the following settings (Figure 4-89).

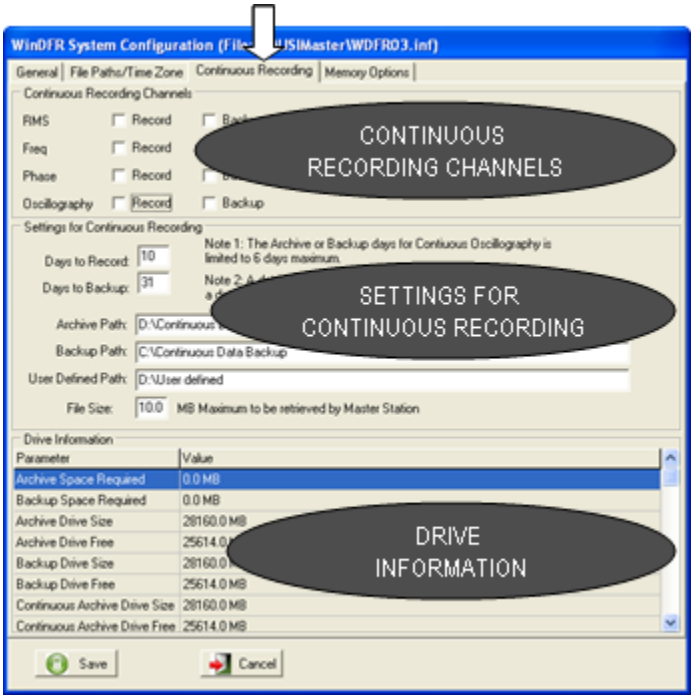


Figure 4-89 WinDFR© Configuration Screen – Continuous Recording Tab

- **Continuous Recording Channels**
  This section (Figure 4-90) is used to enable Continuous Recording and Backup functions and to set the recording rate of calculated ***RMS***, ***Frequency***, and ***Phase*** values.

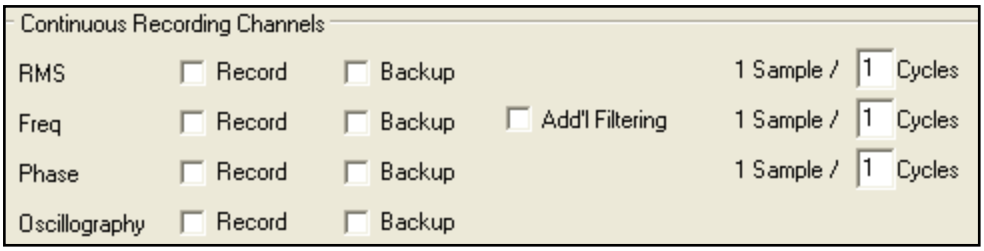


Figure 4-90 Continuous Recording - Channels

- RMS:
  These settings control the continuous recording of RMS values.

  - ☑Record
    This checkbox enables the recording of continuous RMS recording values on all analog input channels.

  - ☑Backup
    This checkbox enables the automatic backup of continuous RMS recording values on all analog input channels.

  - 1Sample / XX cycles
    This field selects the recording rate of continuous RMS recording values on all analog channels. This field also controls the window size and step size used for the RMS calculation.

Note: RMS values are calculated by the DME system using a sliding window of ***Long Term*** data samples. The window size is determined by the number of cycles entered in the RMS ***1 Sample / XX cycles*** field. This number of cycles entered is also equal to the number of cycles of old data which will slide out and new data which will slide in for each calculation.

- Freq:
  These settings control the continuous recording of Frequency values.

  - ☑Record
    This checkbox enables the recording of continuous Frequency recording values on all analog input channels.

  - ☑Backup
    This checkbox enables the automatic backup of continuous Frequency recording values on all analog input channels.

  - ☑Add'l Filtering

  - 1Sample / XX cycles
    This field selects the recording rate of continuous Frequency recording values on all analog channels.

Note: Frequency values are calculated by the DME system.

- Phase:
  These settings control the continuous recording of Phase angle values.

- ☑ Record
  This checkbox enables the recording of continuous Phase angle recording values on all analog input channels.

- ☑ Backup
  This checkbox enables the automatic backup of continuous Phase angle recording values on all analog input channels.

- 1Sample / XX cycles
  This field selects the recording rate of continuous Phase angle recording values on all analog channels.

Note: Phase values are calculated by the DME system.

- Oscillography:
  These settings control the continuous recording of Oscillography samples.

  - ☑ Record
    This checkbox enables the recording of continuous Oscillography samples on all analog input channels.

  - ☑ Backup
    This checkbox enables the automatic backup of continuous Oscillography samples on all analog input channels.

Note: The continuous oscillography samples are recorded at the same rate as the Long Term recording sample frequency. These data samples are used to calculate the RMS, Frequency, and Phase values.

- **Settings for Continuous Recording**
  This section (Figure 4-91) is used to configure the continuous recording storage period, to configure the location on the DME system where the continuous data is to be stored, and to set the file size limit when the data is stored into COMTRADE.

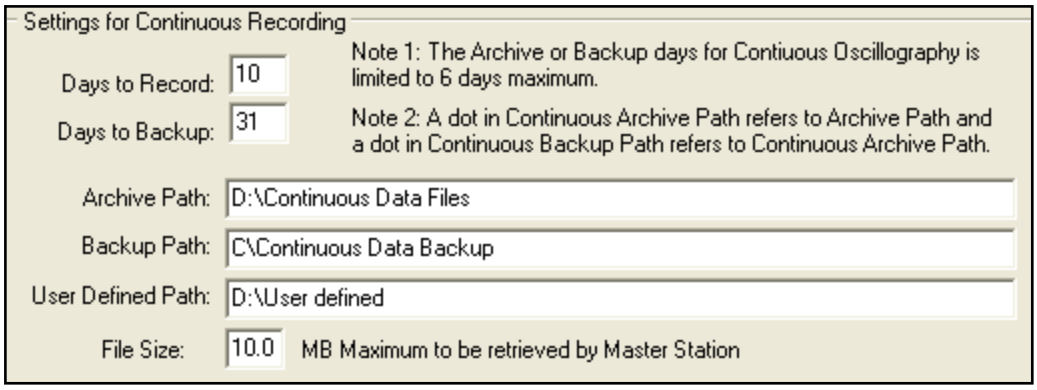


Figure 4-91 Continuous Recording – Settings

- Days to Record:
  This field is used to enter the number of days continuous data is to be stored in the continuous ***Archive Path***. A maximum of 91 days is allowed for RMS, Frequency and Phase.

- Days to Backup:
  This field is used to enter the number of days continuous data is to be stored in the continuous ***Backup Path***. A maximum of 91 days is allowed for RMS, Frequency and Phase.

Note: Recording and backup of continuous Oscillography is limited to 6 days maximum.

- Archive Path:
  This directory path specifies the location where ***Continuous Recording*** values will be stored on the DME system.

- Backup Path:
  This directory path specifies the location where ***Continuous Recording*** values will be copied to on the DME system when the backup checkbox (Figure 4-90) is selected.

Note: The continuous ***Backup Path*** must be set to a different drive from the ***Archive Path*** to enable the Backup checkboxes. When a Backup checkbox is selected, the total amount of available continuous data will be equal to the sum of the ***Days to Record*** and ***Days to Backup*** settings.

- User Defined Path:
  This directory path specifies a location where ***Continuous Recording*** values can be copied when the ***Schedule Continuous Backup*** feature is used (Figure 2-45).

- File Size XX Maximum to be retrieved by Master Station:
  This field is used to set the maximum continuous COMTRADE data file size. This value can be adjusted from 1.2MB to 100MB.

  When ***Continuous Data*** is selected, the data is saved in a single COMTRADE formatted data file with the exception that the data file size is extended to the number entered here.

  COMTRADE format as specified in the standard limits the size of a data file to 1.2MB. Without this feature, if the amount of data being saved is greater than 1.2MB, multiple data files must be created, each limited to 1.2MB in size. Since the DME system contains several days of continuous data, retaining the COMTRADE standard could easily create numerous 1.2MB data files.

- **Drive Information**
  This section (Figure 4-92) displays calculated disk storage requirements based on the selections made in the ***Continuous Recording Channels*** and ***Settings for Continuous Recording*** sections.

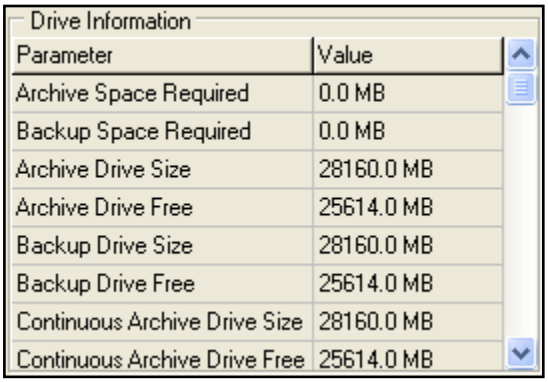


Figure 4-92 Continuous Recording – Drive Information

- Archive Space Required:
  This value displays the calculated disk space required based on the recording selections made in the Continuous Recording Channels section (Figure 4-90).

- Backup Space Required:
  This value displays the calculated disk space required based on the Backup selections made in the Continuous Recording Channels section (Figure 4-90).

- Archive Drive Size:
  This value displays the size of the continuous recording archive drive.

- Archive Drive Free:
  This value displays the available free space on the continuous recording archive drive.

- Backup Drive Size:
  This value displays the size of the continuous recording backup drive.

- Backup Drive Free:
  This value displays the available free space on the continuous recording backup drive.

- Continuous Archive Drive Size:
  This value displays the size of the continuous recording archive drive.

- Continuous Archive Drive Free:
  This value displays the available free space on the continuous recording archive drive.

4.4.4 WinDFR© Configuration Screen – Memory Options

The contents of the ***WinDFR© Configuration – Memory Options Tab*** screen (Figure 4-93) are outlined below:

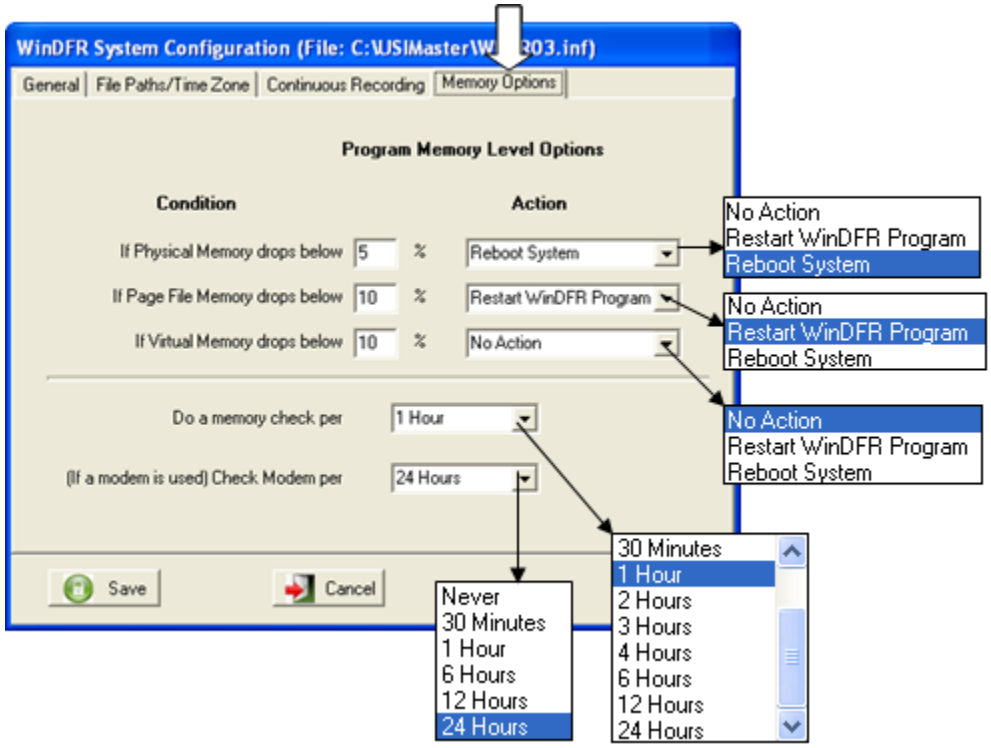


Figure 4-93 WinDFR© Configuration Screen – Memory Options Tab

Note: This screen is visible only after the **Memory Watch Tab *Show*** button (Figure 4-63) has been selected. When selected, this button toggles between Show ***Show*** and Hide ***Hide***. This screen is hidden by default.

Caution: Modifying these settings could cause the DME system to become unstable or even malfunction.

- **Program Memory Level Options**
  WinDFR© has a memory watch-dog which monitors the DME system memory usage. It initiates the selected action if the available memory level drops below the specified limit to free up committed memory.

  - If Physical Memory drops below xx%
    This field is used to enter the minimum level in percentage for available Physical Memory before the selected action (Figure 4-93) will be taken. The default action is ***Reboot System***.

  - If Page File Memory drops below xx%
    This field is used to enter the minimum level in percentage for available Page File Memory before the selected action (Figure 4-93) will be taken. The default action is ***Restart WinDFR Program***.

  - If Virtual Memory drops below xx%
    This field is used to enter the minimum level in percentage for available Virtual Memory before the selected action (Figure 4-93) will be taken. The default action is ***No Action***.

  - Action:
    The following actions may be selected for each of the above conditions.

    - No Action
      This selection will cause ***No Action*** to be taken when the limit condition is reached.

    - Restart *WinDFR*© Program
      This selection will restart *WinDFR*© when the limit condition is reached.

    - Reboot System
      This selection will reboot the DME system when the limit condition is reached.

  - Do a memory check per:
    This drop-down list (Figure 4-93) is used to select the memory check time

interval. A message is recorded into the *WinDFR*© trace file to log the available levels of Physical Memory, Page File Memory, and Virtual Memory when this time limit is reached. The default check interval is one (**01**) hour.

- (If a modem is used) Check Modem per:
  This drop-down list (Figure 4-93) is used to select the time interval for *WinDFR*© to verify that the dial-up modem device is responding. Default check interval is 24 hours.

Section 5: GRAPHIC SIGNAL PROCESSING

The ***Graphic Signal Processing (GSP)*** window provides tools to view and analyze ***COMTRADE*** formatted Transient, Long-Term (Swing), and Continuous (Disturbance) data files from any origin. The **GSP** window can be used to perform Single-Ended or Double-Ended data analysis. This window consists of the GSP Header, Channel Description column, Analog Graph panel, Digital Graph panel, and Measurements column (Figure 5-1). The ***GSP*** window may be opened for Single-Ended analysis in one of four ways:

- From the ***History Data*** screen, double-click on a data record listed in the table. The ***GSP*** window opens and displays the data for the selected fault.
- From the ***History Data*** screen, right-click on a data record listed in the table. In the pop-up menu, select ***Graph Signal Processing of RxxxxFyyyy***,(Figure 3-9). The ***GSP*** window opens and displays the data for the selected fault.
- Click on the  ***Open Graphic Analysis*** button (Figure 2-52). The ***GSP*** window opens and displays the data for the selected fault.
- From the ***Tools*** menu, select ***Show Graphic Signal Processing Window*** (Figure 2-34). The ***GSP*** window opens with no fault data displayed. COMTRADE data files may be opened by selecting ***Open Data*** from the ***File*** menu (Section 5.2.1).

Note: If using computer with multiple displays, the GSP window can be dragged to the second display, resulting in the *USIMaster*© screen displayed on one display and the GSP window on the other.

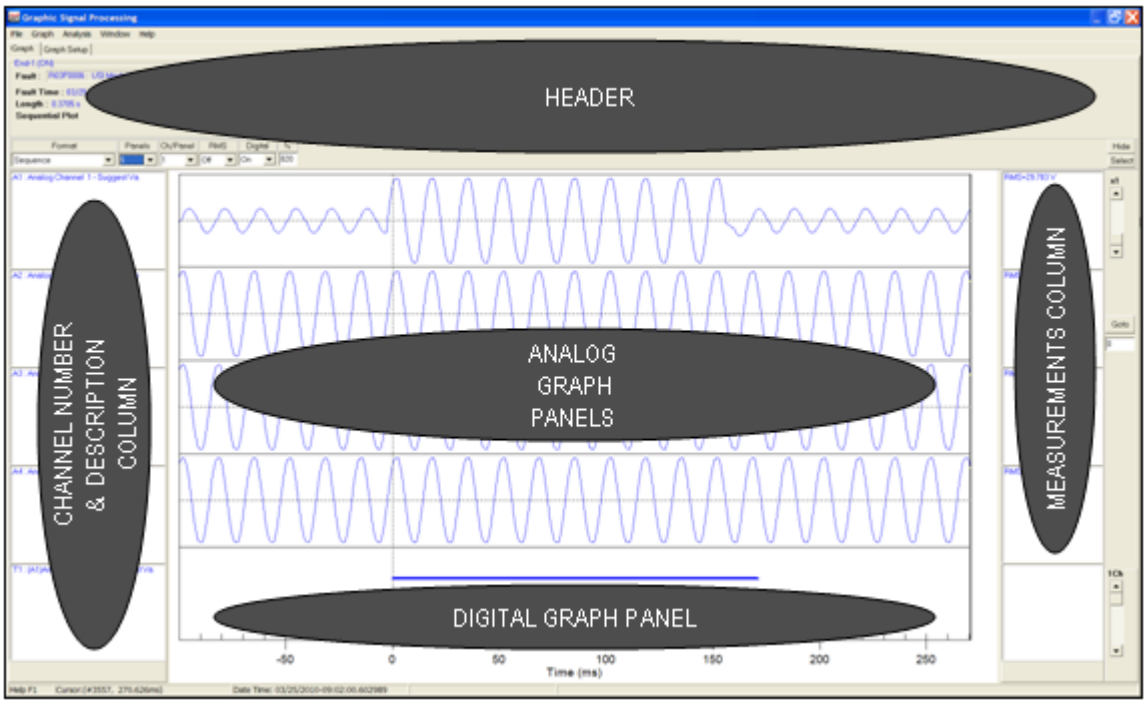


Figure 5-1 Graphic Signal Processing (GSP) Window

5.1 GSP Window – Menus and Screen Tabs

The GSP Menu bar contains the File, Graph, Analysis, Window, and Help menus (Figure 5-2).

Figure 5-2 GSP Menus

5.1.1 File Menu

The following selections are available on the ***File*** menu (Figure 5-3) of the Graphic Signal Processing (GSP) Window header (Figure 5-2):

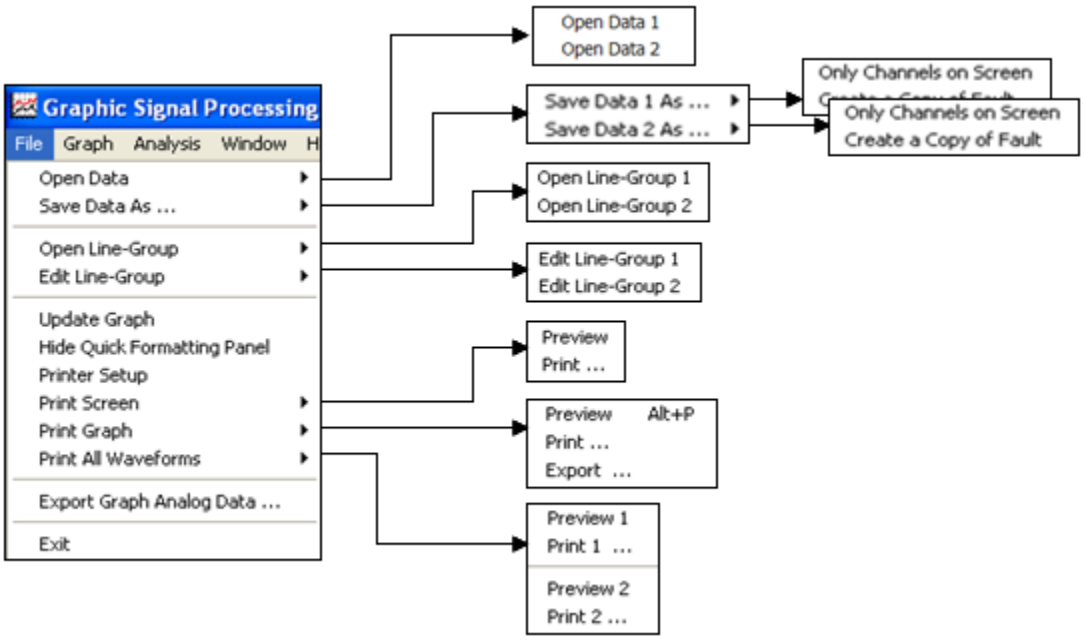


Figure 5-3 File Menu

- **Open Data**
  This selection is used to open COMTRADE data files of any origin for analysis.

  - Open Data 1:
    This selection displays the Open End-1 Data File window (Figure 5-4). This window is used to browse to the COMTRADE data file to be opened for analysis.

  - Open Data 2:
    This selection displays the Open End-2 Data File window (Figure 5-4). This window is used to browse to the COMTRADE data file to be opened for Double-Ended analysis (Section 5-9).

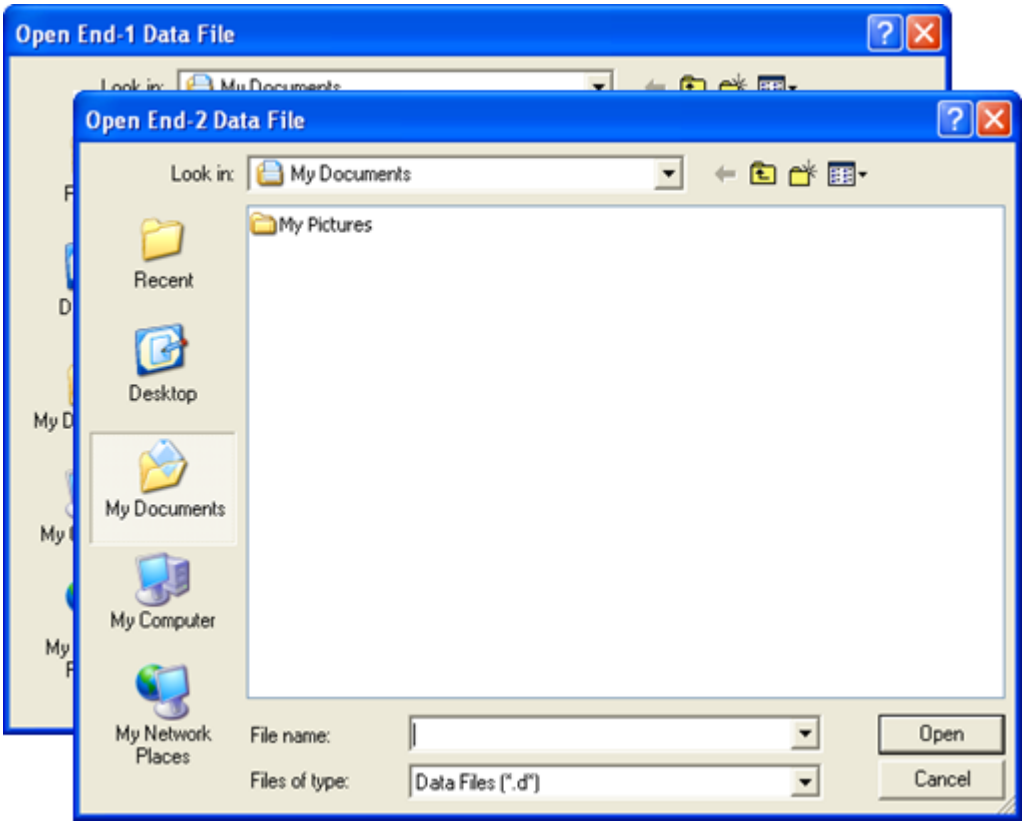


Figure 5-4 Open Data File Window

- Merge to existing graph?
  If a COMTRADE file is already displayed by the Graphic Signal Processing window when another file is selected to be opened, this dialog box will display (Figure 5-5).

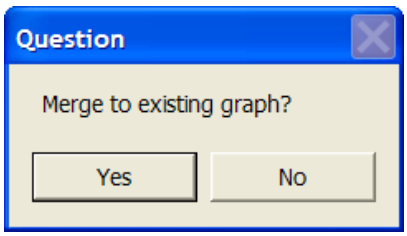


Figure 5-5 Merge to existing graph?

Selecting ***No*** closes the displayed data file and then opens and displays the new data.

Selecting ***Yes*** appends the displayed data file end-to-end to the data file being opened. The merged data is then displayed.

Note: If the data records overlap in time, there will be a consistent stream of sampled data displayed. If there is a time gap between the data files, null data will be

inserted to fill the void. Time length of the merged data is equal to the total time span of the individual data files.

Note: There are no restrictions on the length of data being merged together. When records being merged together have long time lapses between them resulting in several seconds or even minutes of null data being inserted, the displayed waveform data will be very large. Consequently, both the merging process and the analysis in ***Graphic Signal Processing*** can be very slow.

- **Save Data As**
  This selection is used to save the displayed waveforms as a COMTRADE data file. This selection displays the Save End-1/End-2 Data File As window. This window is used to browse to the location for the file to be stored, and to select binary or ASCII format.

  - Save Data 1 As – Only Channels on Screen:
    This selection creates a COMTRADE data file containing only the End-1 waveforms that are displayed on the Graphic Signal Processing window.

  - Save Data 1 As – Create a Copy of Fault:
    This selection creates a copy of the entire End-1 COMTRADE data file opened by the Graphic Signal Processing window. This selection also allows the data file to be converted from binary to ASCII format, or vice versa.

  - Save Data 2 As – Only Channels on Screen:
    This selection creates a COMTRADE data file containing only the End-2 waveforms that are displayed on the Graphic Signal Processing window.

  - Save Data 2 As – Create a Copy of Fault:
    This selection creates a copy of the entire End-2 COMTRADE data file opened by the Graphic Signal Processing window. This selection also allows the data file to be converted from binary to ASCII format, or vice versa.

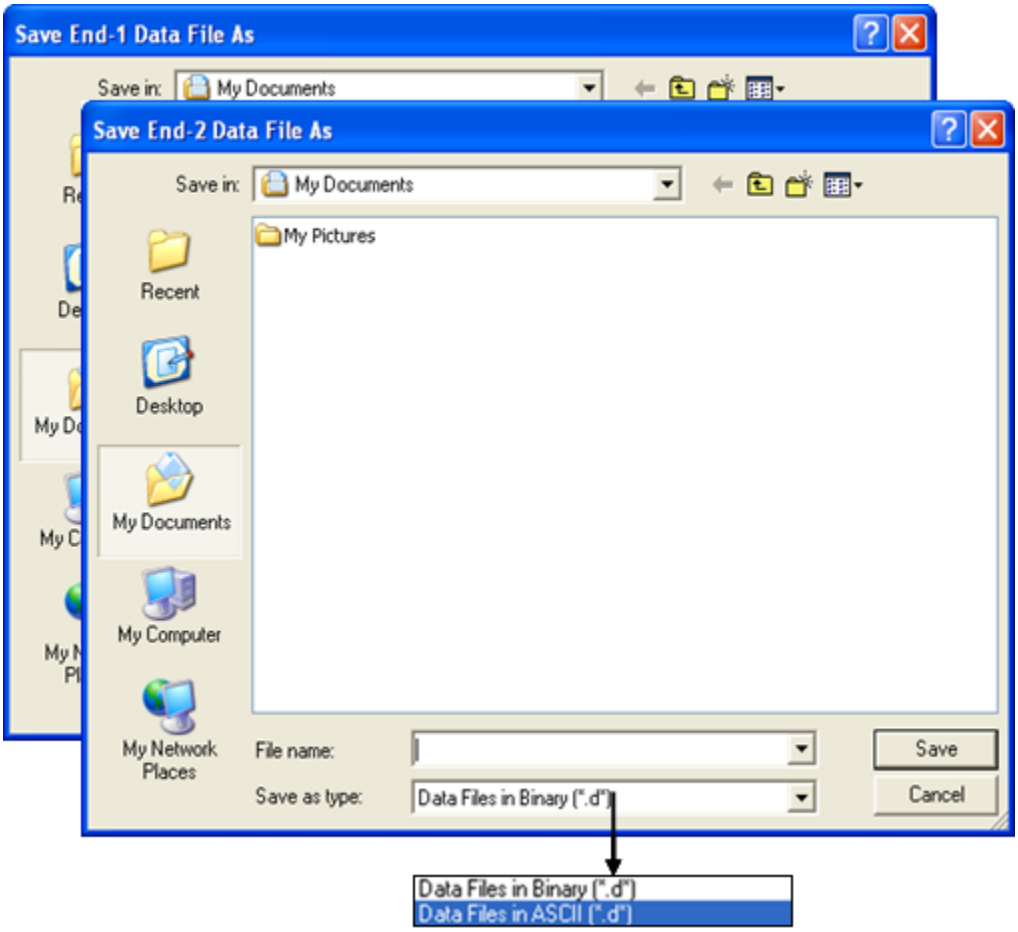


Figure 5-6 Save Data File As Window

- **Open Line Group**
  This selection (Figure 5-7) is used to associate a Line Group record with a COMTRADE data file that was opened using ***Open Data*** from the ***File*** menu.

  When data files are opened directly from the History Data screen, the Line Group record for the selected DME is automatically associated with the data file. When a data file is opened from within the Graphic Signal Processing window, a Line-Group file can not be automatically associated.

Note: Establishing a Line-Group association is not required unless Graphic Signal Processing is being used to perform group analysis or to calculate fault location.

  - Open Line-Group 1:
    This selection displays the Open End-1 Line-Group Record window. This window is used to browse to the location of the file to be associated with the End-1 COMTRADE file.

- Open Line-Group 2:
  This selection displays the Open End-2 Line-Group Record window. This window is used to browse to the location of the file to be associated with the End-2 COMTRADE file.

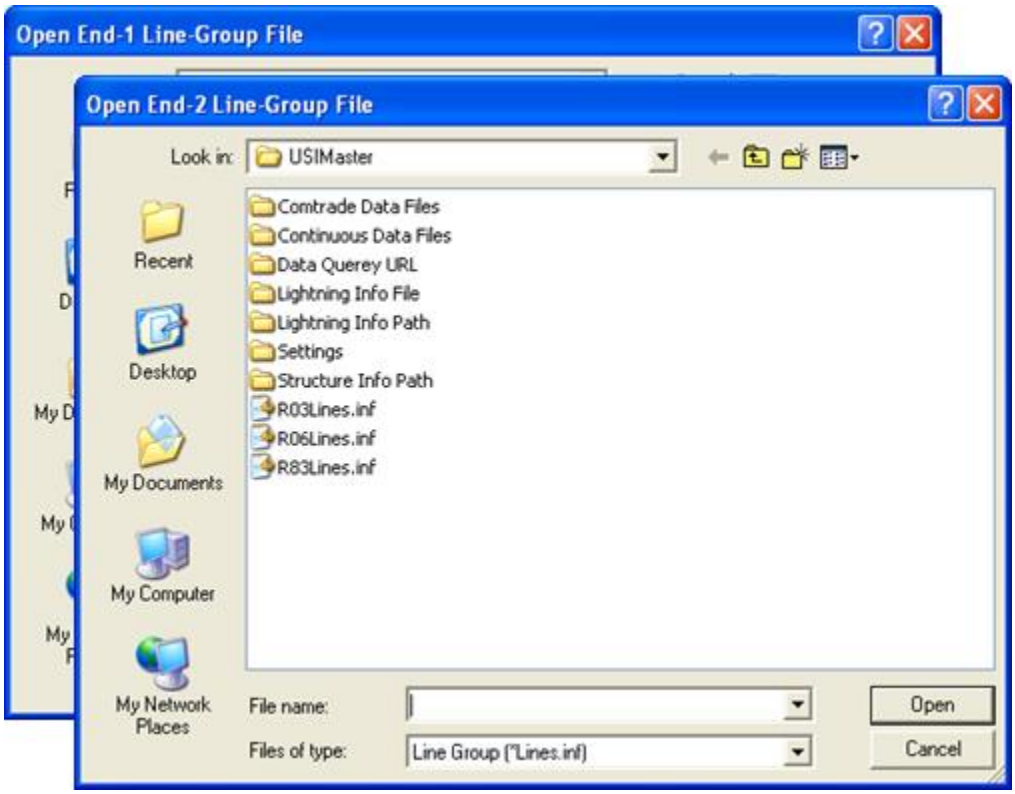


Figure 5-7 Open Line-Group File

- **Edit Line-Group**
  This selection displays the Edit Line-Group Record window (Figure 5-8). This window can be used to view or edit the Line-Group file associated with the End-1 or End-2 COMTRADE file. See Section 4.3 for complete details.

  This window is the same as described in Section 4-3 except a ***Save As*** button is displayed. The ***Save As*** button is useful when editing a Line-Group record for a COMTRADE record from a piece of equipment other than a USI DME system. This allows the Line-Group record to be stored and named in a selected path.

  - Edit Line Group 1:
    This selection displays Edit Line-Group Record window for the End-1 data file.

  - Edit Line Group 2:
    This selection displays Edit Line-Group Record window for the End-2 data file.

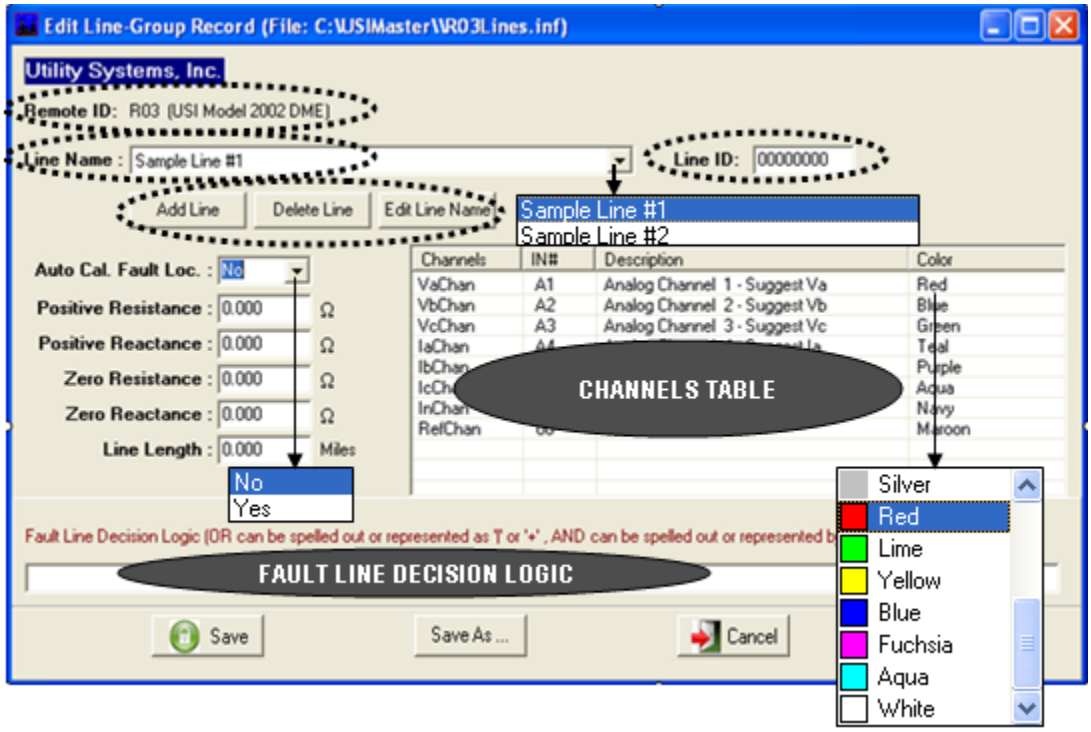


Figure 5-8 Edit Line-Group Record

- **Update Graph**
  This selection refreshes the Graphic Signal Processing window.

- **Hide Quick Formatting Panel**
  This selection hides the GSP Quick Formatting Panel portion of the header (Figure 5-1). When this panel is hidden, Graphic Signal Processing display modifications must be made from the Graph Setup screen tab.

  If ***Hide Quick Formatting Panel*** is selected, this menu item changes to ***Show Quick Formatting Panel***. This selection restores the Quick Formatting Panel to the display. For complete details about this panel see Section 5.7.

- **Printer Setup**
  This selection displays the standard Windows™ ***Print Setup*** window. This window is used to select the *USIMaster©* default printer.

- **Print Screen**
  This selection is used to preview or print the current screen.

- **Print Graph**
  This selection is used to preview, print, or export the graphs currently displayed on the screen. When ***Export*** is selected, the Exporting window displays (Figure 5-9).

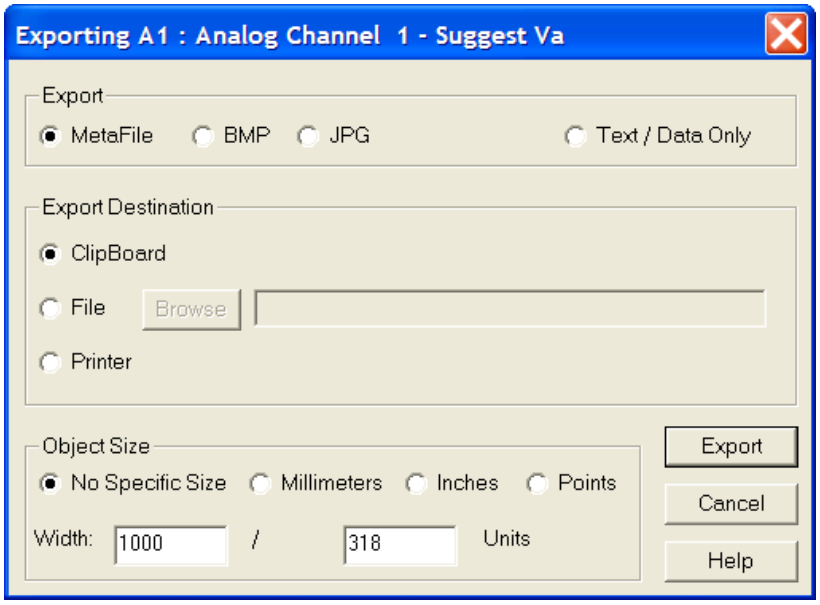


Figure 5-9 Graphic File - Exporting Window

- Export:
  This section is used to select the format of the exported information.
  - Metafile
    This format can be sent to the clipboard, or to a file with a ***.wmf*** extension, or to a printer.
  - BMP
    This format is a bitmap that can be sent to the clipboard, or to a file with a ***.bmp*** extension.
  - Text/Data Only
    This format is an ASCII text that can be sent to the clipboard, or a file with a ***.txt*** or ***.dat*** extension. It can be viewed or printed by using a word processor.
- Export Destination:
  - Clipboard
    Copies the graph to the Windows Clipboard®.
  - File
    Saves the graph to a file in the format selected in the ***Export*** section. Click on ***Browse*** to open the ***Save As*** window. Then select the file destination folder, type in the filename, and then click the ***Save*** button to return to the ***Export*** window. Click on ***Export*** to save the file.

- Printer
  This selection is used to send the graph to a printer. When this selection is made, the ***Export*** button changes to a ***Print…*** button.

- Object Size:
  Select the desired parameters for the object size.

- **Print All Waveforms**
  This selection is used to preview and print all the waveforms contained in the displayed COMTRADE data file.

  - Preview 1:
    This selection displays the ***Format All Wave Printing*** window (Figure 5-10) which contains the default print settings. These settings can be modified for the End-1 record being previewed. For complete details about this window see Section 4.1.2.

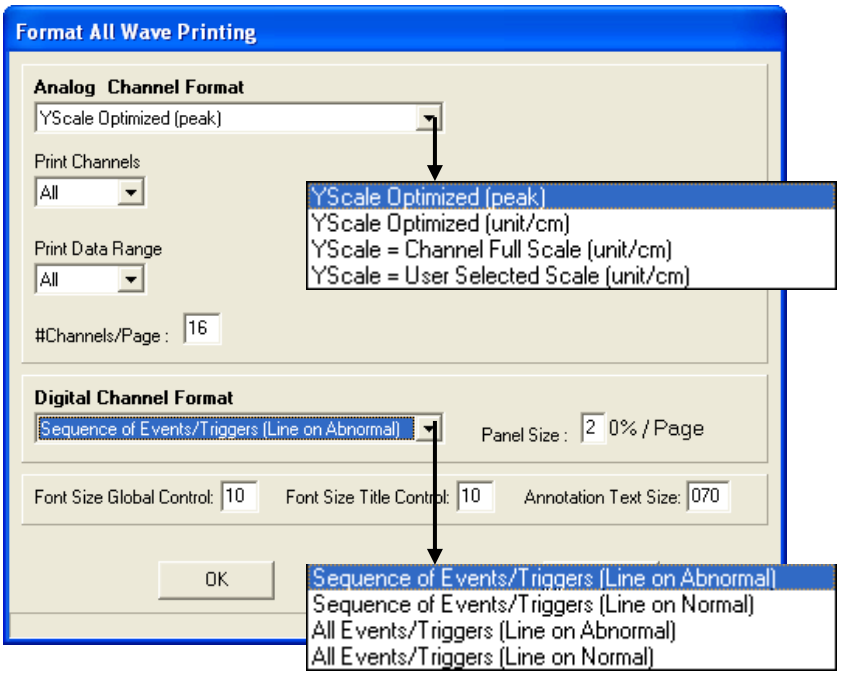


Figure 5-10 Format All Wave Printing

  - Print 1…:
    This selection is used to ***Print*** all the End-1 waveforms of the Analog, Trigger, and Digital channels. The ***Format All Wave Printing*** window displays the default print preferences assigned in the Master Configuration. These settings may be modified and previewed prior to printing (Figure 3-13).

  - Preview 2:
    This selection displays the ***Format All Wave Printing*** window (Figure 5-

10) which contains the default print settings. These settings can be modified for the End-2 record being previewed. For complete details about this window see Section 4.1.2.

- Print 2:
  This selection is used to ***Print*** all the End-2 waveforms of the Analog, Trigger, and Digital channels. The ***Format All Wave Printing*** window displays the default print preferences assigned in the Master Configuration. These settings may be modified and previewed prior to printing (Figure 3-13).

- **Export Graph Analog Data**
  This selection displays the Export Analog Data window (Figure 5-11) which is used to export the analog waveform data to a comma-delimited spreadsheet file (***filename.csv***).

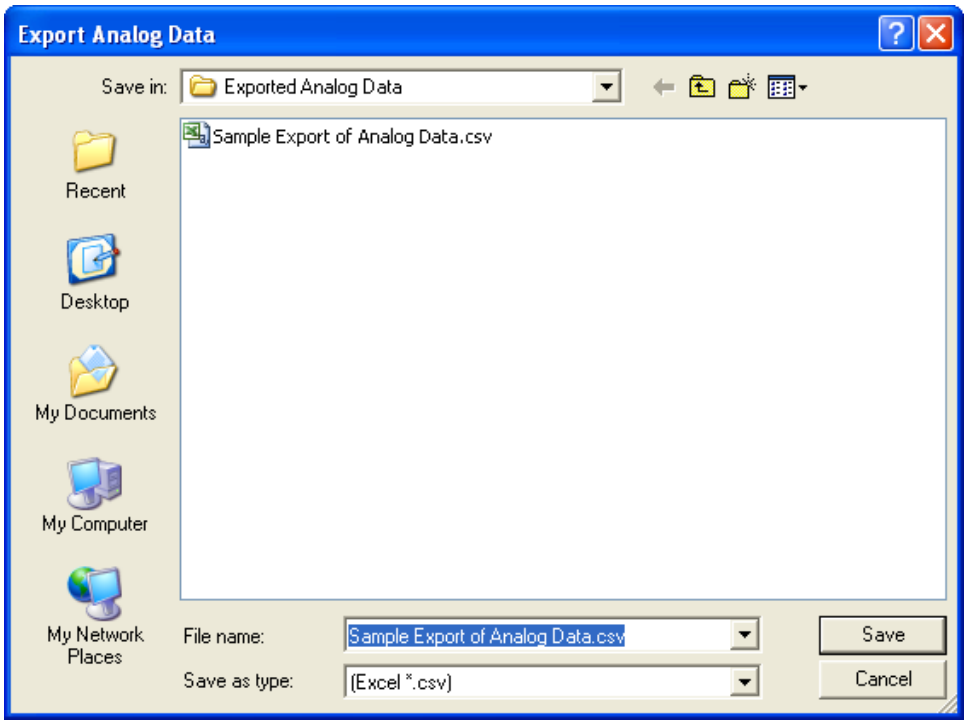


Figure 5-11 Export Analog Data Window

- **Exit**
  Closes the *Graphic Signal Processing* window.

5.1.2 Graph Menu

This selection from the menus listed on the GSP window (Figure 5-2) drops down the ***Graph*** menu (Figure 5-12). Tasks may be selected from this menu.

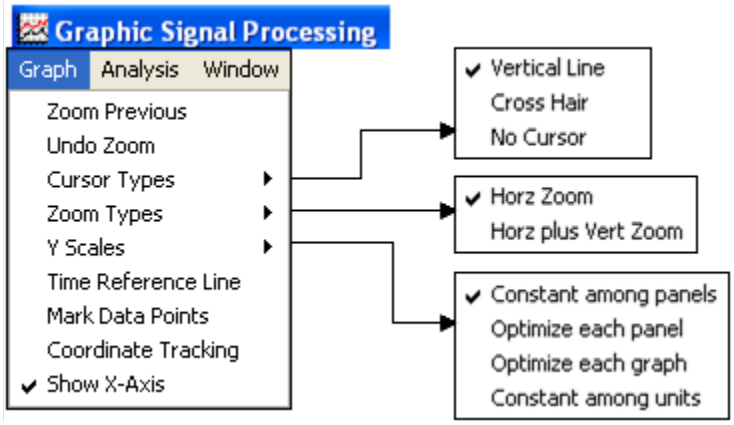


Figure 5-12 Graphic Signal Processing – Graph Menu

- **Zoom Previous**
  This selection is used to undo the most recent zoom on the graph.

- **Undo Zoom**
  This selection is used to undo all zooms reverting to the original graph display scale.

- **Cursor Types**
  Three types of cursors are available:

  - Vertical Line:
    This selection makes the cursor a vertical line through all waveforms.

  - Cross Hair:
    This selection makes the cursor with both vertical and horizontal lines. The horizontal line is active only in the currently selected waveform. Select a waveform by clicking on its description in the ***Channel Number and Description*** column (Figure 5-1).

  - No Cursor:
    This selection turns off the cursor. This feature is useful when a printout without cursor lines is desired.

- **Zoom Types**
  Waveforms can be zoomed by holding the left mouse button down and dragging a box around the area to be enlarged. There are two zoom types:

  - Horz Zoom:
    This selection is used to zoom the area horizontally by holding the left mouse button and dragging a box horizontally around the area to be expanded.

- Horz plus Vert Zoom:
  This selection is used to zoom the area, both horizontally and vertically, by holding the left mouse button and dragging a box diagonally around the area to be expanded.

- **Y Scales**
  Visibility of the waveforms can be enhanced by choosing one of the following:

  - Constant among panels:
    This selection expands panel with the largest waveform to full deflection and then expands all other panels to the same scale.

  - Optimize each panel:
    This selection expands the largest waveform of each panel to full deflection and then expands all other waveforms within each panel to the same scale.

Caution: When this feature is selected each panel has a different Y-scale. Similar looking waveforms may have very different magnitudes.

  - Optimize each graph:
    This selection expands each waveform to full deflection.

Caution: When this feature is selected each waveform has a different Y-scale. Similar looking waveforms may have very different magnitudes.

  - Constant among units:
    This selection expands the larges waveform of each measurement unit (e.g. Volts, Amperes, etc.) to full deflection and then expands the other waveforms of the same measurement unit to the same scale.

- **Time Reference Line**
  This selection places a red vertical reference line at the current cursor position (Figure 5-13). The time reference line can be moved to other positions on the graphic display by placing the cursor on the desired location and double-clicking. A ***Dt*** status field is also displayed at the bottom of the Graphic Signal Processing window showing the delta time between the time reference line and the cursor line. The delta time is presented both in milliseconds and in power line cycles. This feature is useful for determining operating times of various protection equipment. Clicking again on this menu selection will remove the time reference line and the ***Dt*** status field from the graph screen.

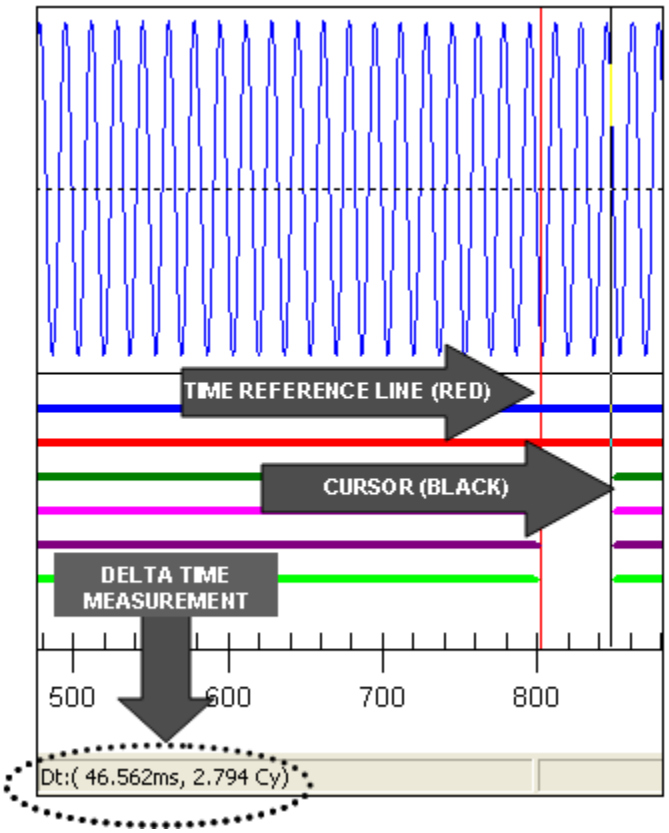


Figure 5-13 Time Reference Line

- **Mark Data Points**
  This selection places bullets on the waveforms showing the points where the A-to-D converter sampled (Figure 5-14). Clicking again on this menu selection will remove the data point marks.

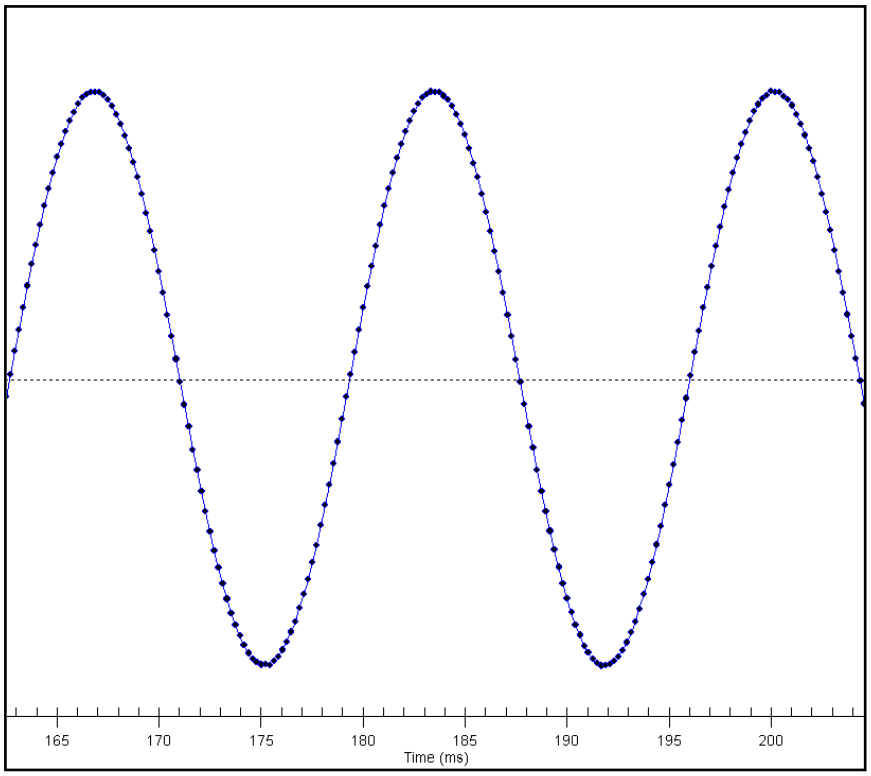


Figure 5-14 Mark Data Points

- **Coordinate Tracking**
  This selection displays an X=, Y= status field at the bottom of the Graphic Signal Processing window (Figure 5-15). This field displays the precise position of the mouse pointer where the X-coordinate is time and the Y-coordinate is magnitude. The coordinates follow the mouse pointer. The cursor line still snaps from sample to sample. This feature allows a user to interpolate a time and magnitude between sampled points.

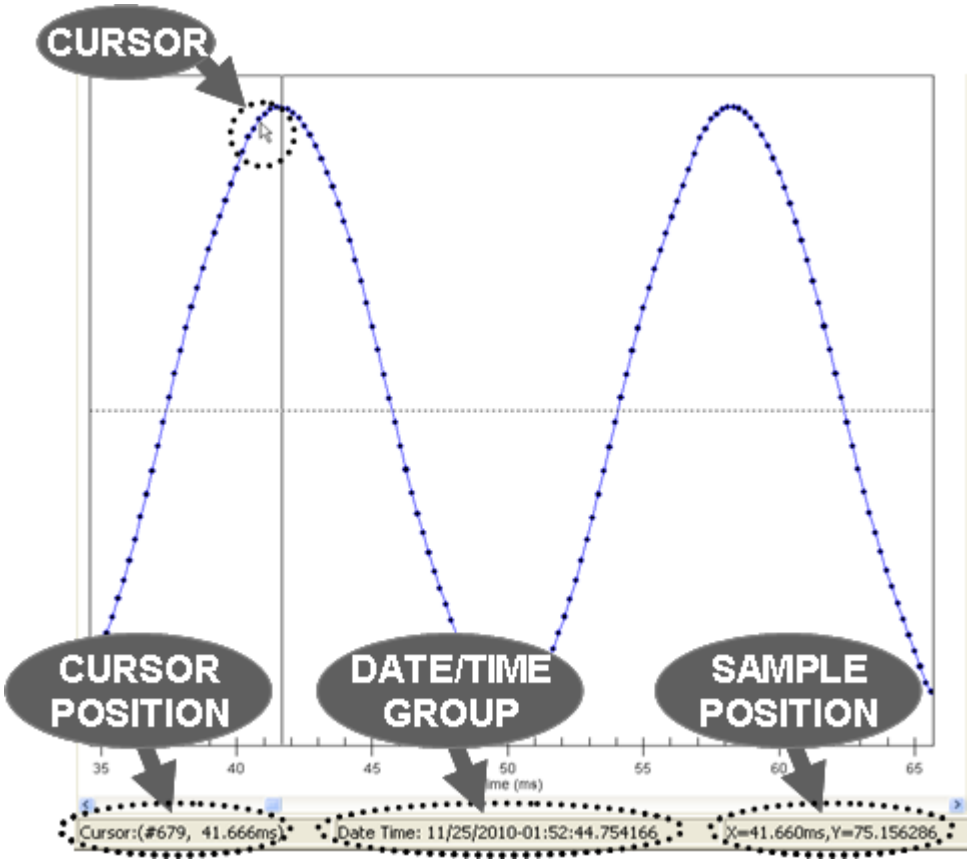


Figure 5-15 Coordinate Tracking

- **Show X-Axis**
  This selection displays a time reference line at the bottom of the Graphic Signal Processing screen. The scale on this time line is referenced to time t_0 (Figure 5-16).

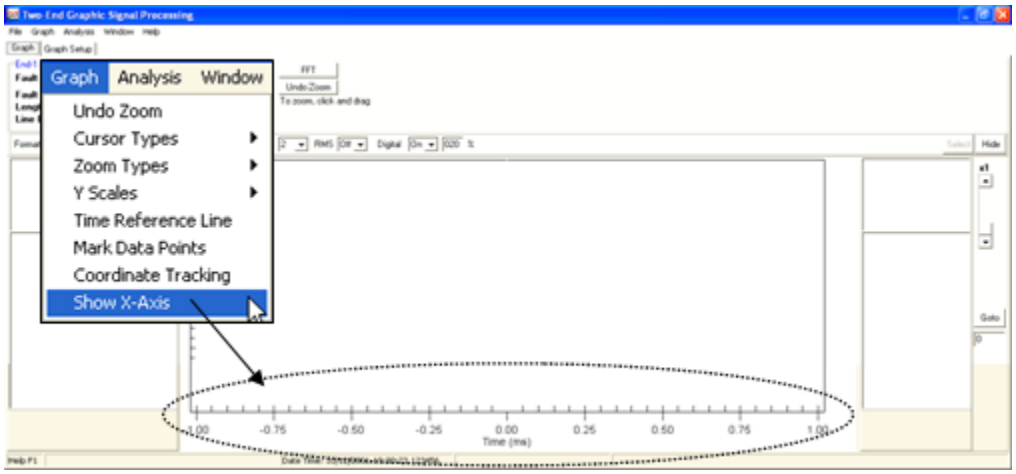


Figure 5-16 Graph Menu - Show X-Axis

5.1.3 Analysis Menu

Select ***Analysis*** from the menu list in the GSP window (Figure 5-1) to display the ***Analysis*** menu (Figure 5-17). Tasks may be selected from this menu.

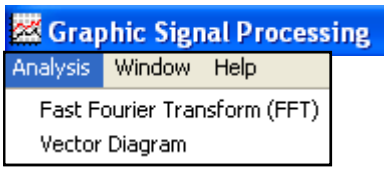


Figure 5-17 Graphic Signal Processing – Analysis Menu

- **Fast Fourier Transform (FFT)**
  This selection displays the Fast Fourier Transform (FFT) Analysis window (Figure 5-18). This window can also be displayed by clicking on the ***FFT*** button on the GSP screen header.

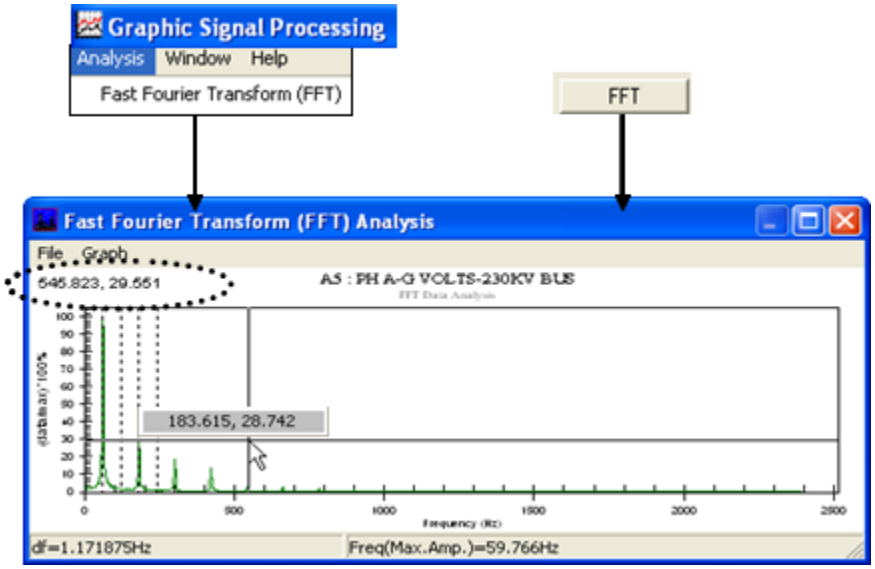


Figure 5-18 Data Analysis FFT Screen

This window displays the FFT plot for the selected channel. A channel is selected by left-clicking on the channel description in the ***Channel Number and Description*** column. Clicking on a different channel causes the FFT screen to update automatically to the FFT plot of the newly selected channel.

Zooming in or out on the selected waveform in the GSP increases or decreases the number of data samples used for the FFT calculation. The number of data samples used for the FFT calculation determines accuracy. Zooming on the selected waveform causes the FFT screen to update automatically to the FFT plot from the newly selected data.

The Y-axis of this window is scaled such that 100% equals the peak magnitude of the fundamental frequency. The X-axis of this window is scaled to half the frequency of the sample rate of the sample data used to calculate these values.

This X-Y coordinate field displays the precise position of the mouse pointer where the X-coordinate is frequency and the Y-coordinate is magnitude. The coordinates follow the mouse pointer. A double-click on any point of the graph will also display the x,y readings of that point.

- FFT Window – File menu:
  The following selections are available on the ***File*** menu (Figure 5-19) of the Fast Fourier Transform (FFT) Analysis Window (Figure 5-18).

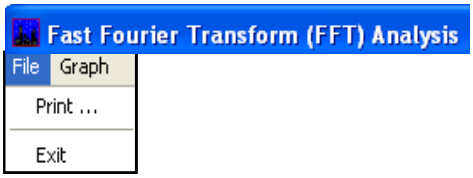


Figure 5-19 FFT File Menu

  - Print …
    This selection displays the ***Exporting*** window (Figure 5-20).

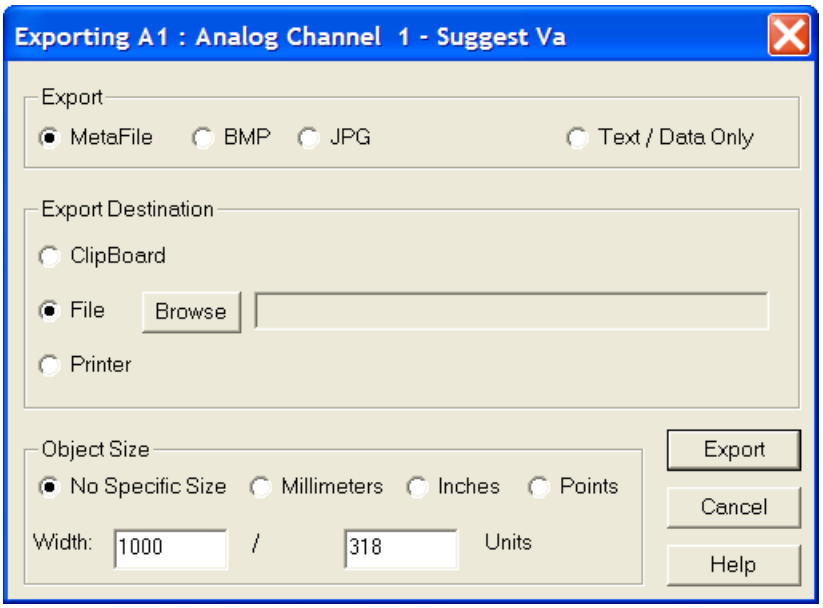


Figure 5-20 FFT – Exporting window

- Export:
  This section is used to select the format of the exported information.

- Metafile
  This format can be sent to the clipboard, or to a file with a ***.wmf*** extension, or to a printer.
- BMP
  This format is a bitmap that can be sent to the clipboard, or to a file with a ***.bmp*** extension.
- JPG
  This format is a JPEG that can be sent to a file with a ***.jpg*** extension.
- Text/Data Only
  This format is an ASCII text that can be sent to the clipboard, or to a file with a ***.txt*** or ***.dat*** extension. It can be viewed or printed by using a word processor.

- Export Destination:

  - Clipboard
    Copies the graph to the Windows Clipboard®.
  - File
    Saves the graph to a file in the format selected in the ***Export*** section. Click on ***Browse*** to open the ***Save As*** window. Then select the file destination folder, type in the filename, and then click the ***Save*** button to return to the ***Export*** window. Click on ***Export*** to save the file.
  - Printer
    This selection is used to send the graph to a printer. When this selection is made, the ***Export*** button changes to a ***Print…*** button.

- Object Size:
  Select the desired parameters for the object size.

- Select ***Exit*** from the File menu to close the ***Fast Fourier Transform (FFT)*** window. The ***Exporting*** window can also be closed by clicking the ***Close*** icon in the top-right corner.

- FFT Window – Graph menu:
  The following selections are available on the ***Graph*** menu (Figure 5-21) of the Fast Fourier Transform (FFT) Analysis Window (Figure 5-18).

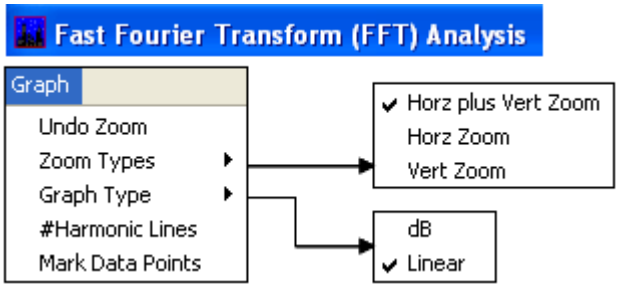


Figure 5-21 FFT Window – Graph menu

- Undo Zoom
  This selection is used to undo all zooms reverting to the original graph display scale.

- Zoom Types
  Waveforms can be zoomed by holding the left mouse button down and dragging a box around the area to be enlarged. There are three zoom types:

  - Horz plus Vert Zoom:
    This selection is used to zoom the area, both horizontally and vertically, by holding the left mouse button and dragging a box diagonally around the area to be expanded.

  - Horz Zoom:
    This selection is used to zoom the area horizontally by holding the left mouse button and dragging a box horizontally around the area to be expanded.

  - Vert Zoom:
    This selection is used to zoom the area vertically by holding the left mouse button and dragging a box vertically around the area to be expanded.

- Graph Type
  Two graph types are available:

  - dB:
    This selection displays the FFT plot with full scale of the fundamental set to 0dB.

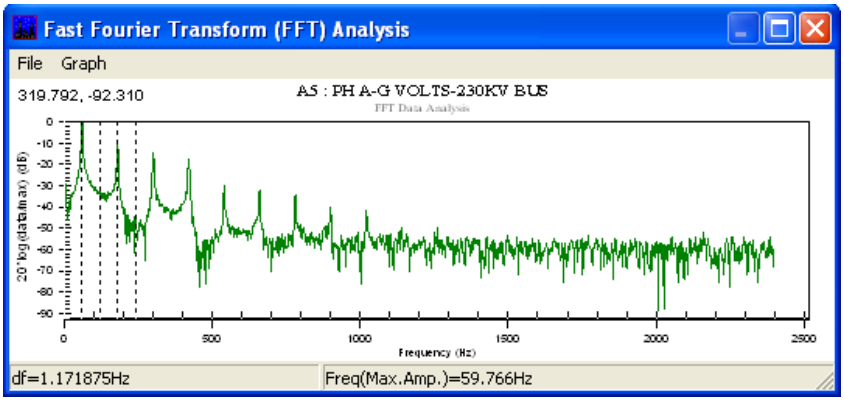


Figure 5-22 FFT Window – Y-Scale dB Graph

- Linear:
  This selection displays the FFT plot with peak value of the fundamental set to 100%.

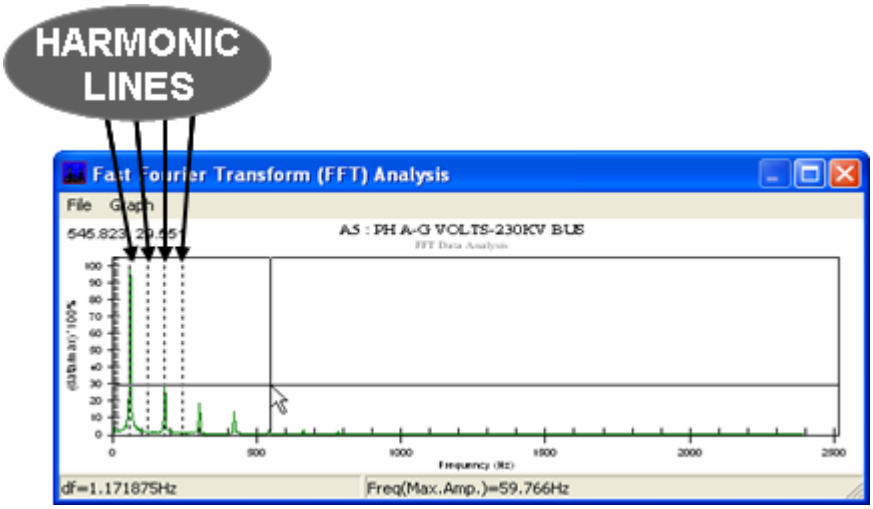


Figure 5-23 FFT Window – Y-Scale Linear Graph

- #Harmonic Lines
  This selection displays the ***Enter Number of Harmonic Lines*** window (Figure 5-24). This window is used to enter a number for the quantity of harmonic reference lines to be placed vertically at frequency multiples of the fundamental power line frequency.

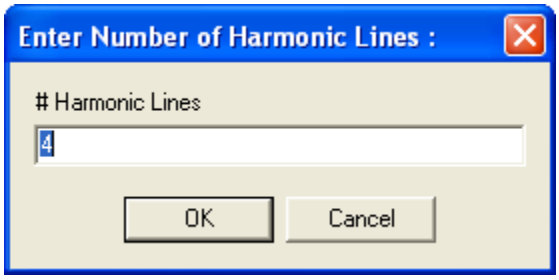


Figure 5-24 FFT Window –Enter Number of Harmonic Lines

- Mark Data Points
  This selection places bullets on the waveform showing the points where there are calculated values (Figure 5-14). Clicking again on this selection will remove the data point marks.

- FFT window – Right-click menu:
  Right-clicking on the FFT window displays the following menu.

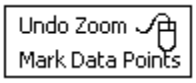


Figure 5-25 FFT Window – Right-click menu

The following selections are available on the FFT window right-click menu (Figure 5-25).

- Undo Zoom
  This selection is used to undo all zooms reverting to the original graph display scale.

- Mark Data Points
  This selection places a bullet on the waveforms showing the point on the wave where the A-to-D converter sampled (Figure 5-14). Clicking on this selection on the menu again will remove the data point marks.

- FFT Window – Footer:
  The following information displays on the FFT window footer (Figure 5-26) of the Fast Fourier Transform (FFT) Analysis Window (Figure 5-18).

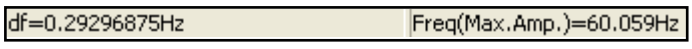


Figure 5-26 FFT Window – Footer

- df
  This field displays the frequency difference (delta frequency) between calculated FFT values on the X-axis. This value varies

based on the number of data samples used to calculate the FFT plot. The number of samples used to calculate the FFT plot is determined by the number of samples displayed on the GSP window.

- Freq(Max.Amp)
  This field displays the frequency which has the largest amplitude value.

- **Vector Diagram**
  This selection displays the Vector Analysis window (Figure 5-27).

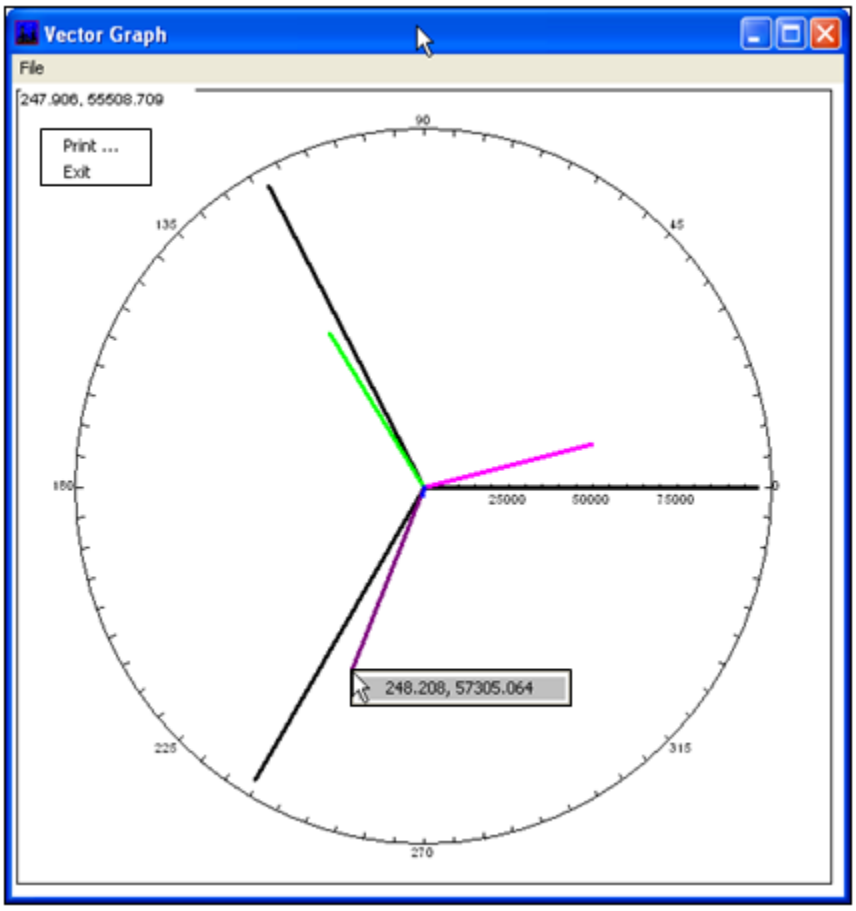


Figure 5-27 Vector Graph

This window displays calculated phasors in a polar plot. The phasors displayed in this window are derived from the sampled analog data in the currently selected ***Analog Graph Panel***. Each displayed phasor is color coded to match the descriptor of the analog channel and waveform used to derive the calculated phasor values.

To display additional phasors in the vector analysis window, additional analog channels must be inserted into the selected ***Analog Graph Panel***.

Note: See Section 5.2.2 for instructions on how to insert analog channels to an ***Analog Graph Panel***.

The reference vector (zero phase angle) is determined by the selected descriptor in the ***Channel Number and Description Column***.

The scale of the vector analysis plot is automatically optimized to the magnitude of the largest waveform at the cursor position of the selected ***Analog Graph Panel***. To magnify a vector, click on its analog channel descriptor and slide the Y-scale scroll bar (Section 5.5). To magnify multiple vectors, use Ctrl + Left-click or Shift + Left-click to select additional channel descriptors and slide the Y-scale scroll bar.

Note: See Section 5.5 for details on use of the Y-scale scroll bar.

- **Vector Graph – File Menu**

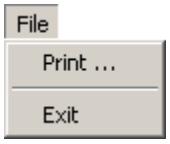


Figure 5-28 Vector Graph File Menu

  - Print:
    This selection displays the ***Exporting*** window (Figure 5-29).

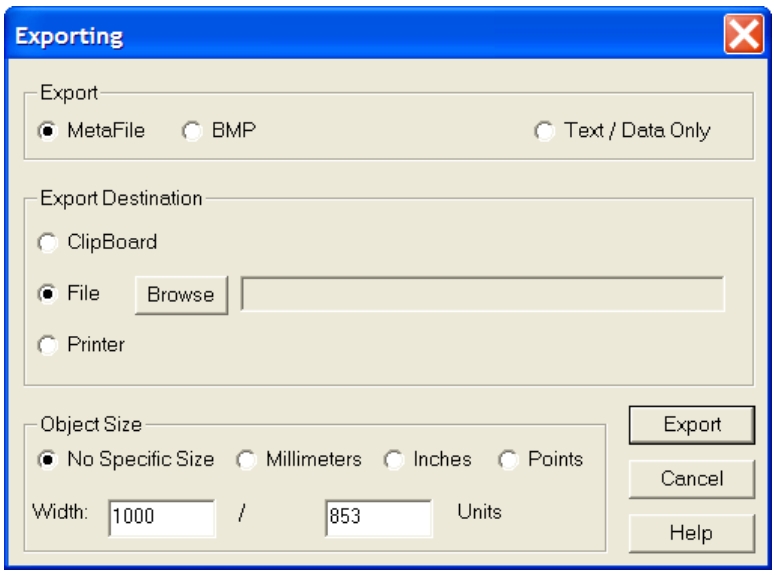


Figure 5-29 Exporting Window

- Export
  This section is used to select the format of the exported information.
  - Metafile:
    This format can be sent to the clipboard, or to a file with a ***.wmf*** extension, or to a printer (Figure 5-29).
  - BMP:
    This format is a bitmap that can be sent to the clipboard, or to a file with a ***.bmp*** extension.
  - Text/Data Only:
    This format is an ASCII text that can be sent to the clipboard, or to a file with a ***.txt*** or ***.dat*** extension. It can be viewed or printed by using a word processor.
- Export Destination
  - Clipboard:
    Copies the graph to the Windows Clipboard®.
  - File:
    Saves the graph to a file in the format selected in the ***Export*** section. Click on ***Browse*** to open the ***Save As*** window. Then select the file destination folder, type in the filename, and then click the

Save button to return to the ***Export*** window. Click on ***Export*** to save the file.

- Printer:
  This selection is used to send the graph to a printer. When this selection is made, the ***Export*** button changes to a ***Print…*** button.

- Object Size
  Select the desired parameters for the object size.

- Export
  Export button. See Figure 5-29.

- Cancel
  Cancel button.

- Help
  Help button.

- Exit:
  This selection is used to close the ***Vector Graph*** window. Also clicking the ***Close*** icon in the top-right corner will close this window.

5.1.4 Window Menu

This selection from the menus listed on the GSP window (Figure 5-2) drops down the ***Window*** menu (Figure 5-30). Tasks may be selected from this menu.

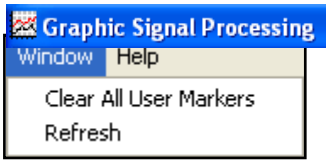


Figure 5-30 Graphic Signal Processing – Window Menu

- **Clear All User Markers**
  This selection is used to clear ALL previously inserted ***User Text*** and ***Meter Value*** markers.

Note: See Section 5.2.3 for details on adding user markers.

- **Refresh**
  This selection is used to refresh the screen.

5.1.5 Help Menu

This selection from the menus listed on the GSP window (Figure 5-2) drops down the ***Help*** menu (Figure 5-31). Tasks may be selected from this menu.

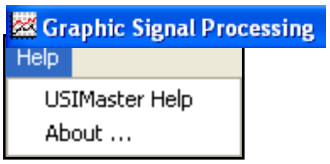


Figure 5-31 Graphic Signal Processing – Help Menu

- ***USIMaster*© Help**
  This selection displays the USIMaster Station Help window (Figure 5-32). The following selections are available:

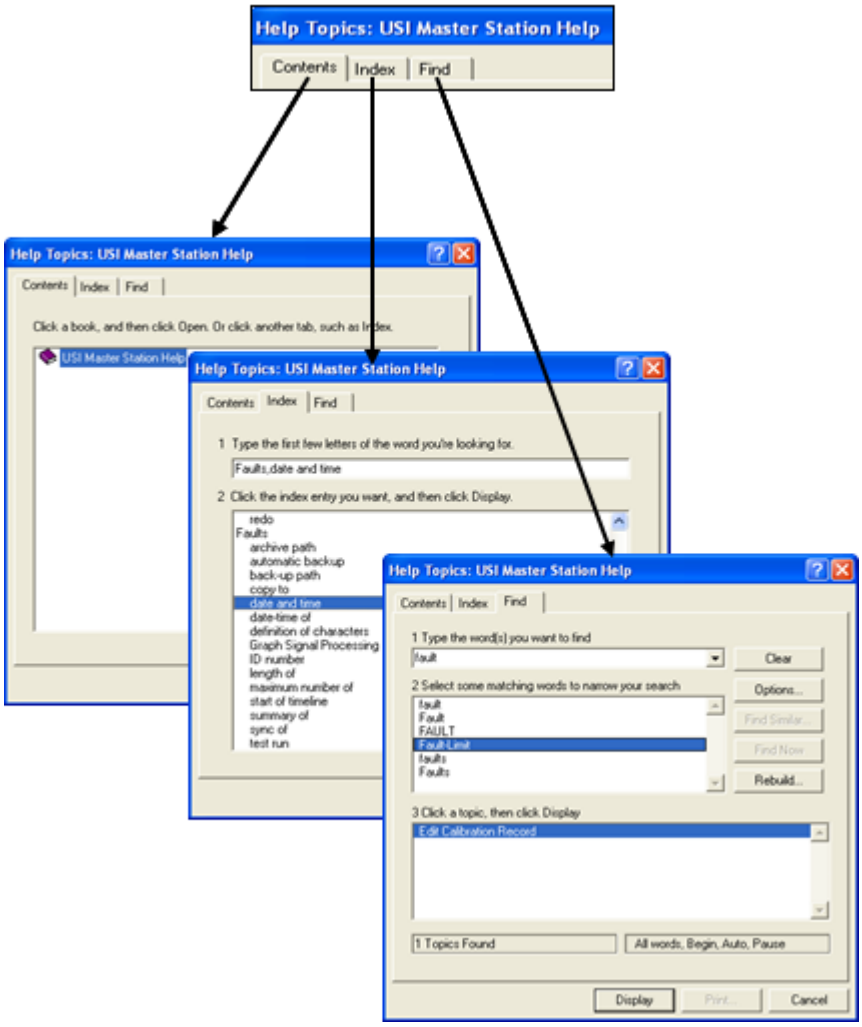


Figure 5-32 Help Topics Window

- Contents:
  Displays the contents of the *USIMaster©* ***Help*** file.

- Index:
  Displays the index to the *USIMaster©* ***Help*** file.

- Find:
  Displays the screen used to search *USIMaster©* ***Help*** topics for a specific word.

- **About**
  This selection displays *USIMaster©* release version and copyright information, address, voice phone and fax numbers and Web addresses of Utility Systems, Inc.

5.1.6 GSP – Working Screen Tabs

From the ***Graphic Signal Processing*** window, click on a tab to select a Working Screen from the group shown in Figure 5-33.

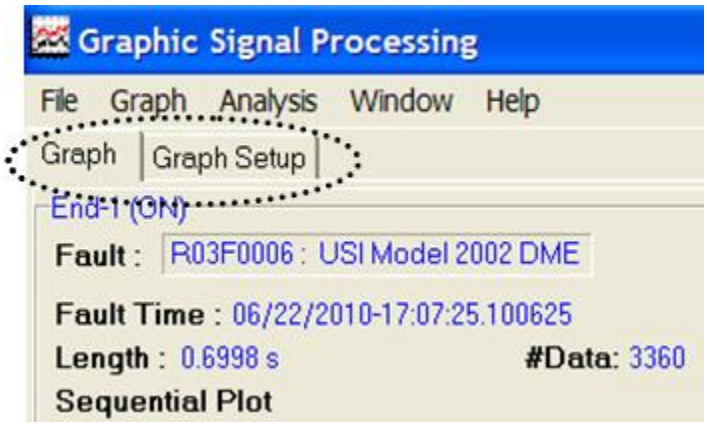


Figure 5-33 GSP Header – Working Screen Tabs

- **Graph**
  Clicking this tab displays the waveform analysis screen. This screen is used to display COMTRADE formatted data files (Figure 5-1).

- **Graph Setup**
  Clicking this tab displays the graph setup screen used to customize the view of the Graphic Signal Processing screen. The setting choices on this screen are also available using the ***Quick Formatting Panel*** (Section 5-7).

5.2 GSP – Graph Screen Tab

The Graph screen displays the Graphic Signal Processing Header, Channel Number & Description Column, Analog Graph Panels, Measurement Column, and the Digital Graph Panel (Figure 5-1).

Analog data, digital data, and trigger data for the fault is displayed in three separate panels across the graph screen. The left column lists the input numbers and channel descriptions. The center panels show the waveform graphs for the inputs. The right column can be set to show ***RMS***, ***Magnitude***, ***Peak***, ***DC amplitude*** or ***Phase*** and ***RMS values***.

The graph panels initially show the entire length of the data file. A scroll bar displays (Figure 5-47) beneath the graphs to allow scrolling back and forth when the zoom feature is used (Section 5.1.2). The vertical line between the ***Channel Number and Description Column*** and the ***Graph panels*** can be dragged left or right to adjust the size of the description column and the graph panels. To adjust the size left-click on this symbol .

5.2.1 GSP - Header

The GSP header contains the End-1 fault information, Zoom Controls, FFT analysis buttons, and the Quick Formatting Panel (Figure 5-2).

- **End-1 Data Box**
  The End-1 data box displays information needed for single-ended fault analysis (Figure 5-34).

Note: See Section 5.9 for details on double-ended analysis.

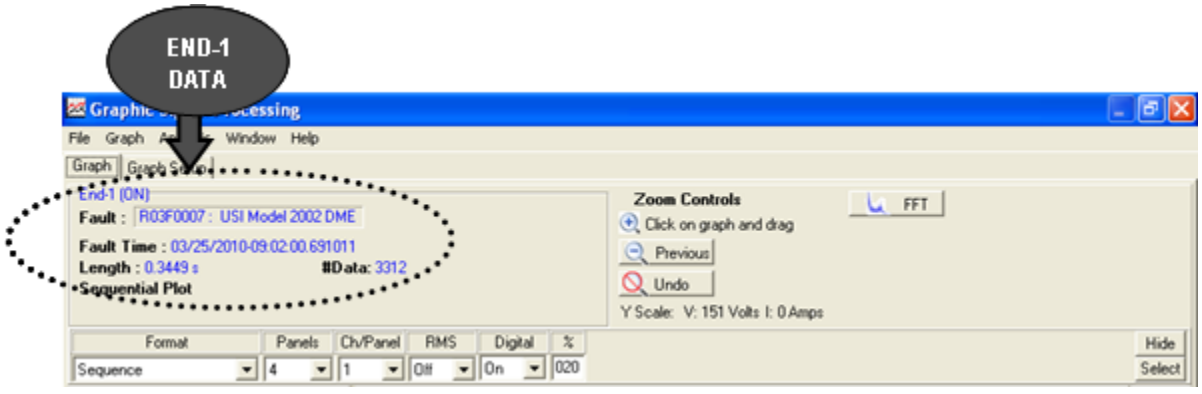


Figure 5-34 End-1 Data Box

- Fault:
  This field displays (Remote ID number) (Fault ID number): (Station name).

- Fault Time:
  This field displays the time when this fault record was triggered.

- Length:
  This field displays the fault record length in time.

- #Data:
  This field displays the fault record length in number of A-to-D data samples.

- Plot:
  This field displays the selected graph format (Section 5.7 or Section 5.8).

- **Zoom Controls**
  The zoom controls are used to zoom and restore zoomed waveforms to their original scale (Figure 5-35). See Section 5.1.2 – Zoom Types for more details on zooming into waveforms.

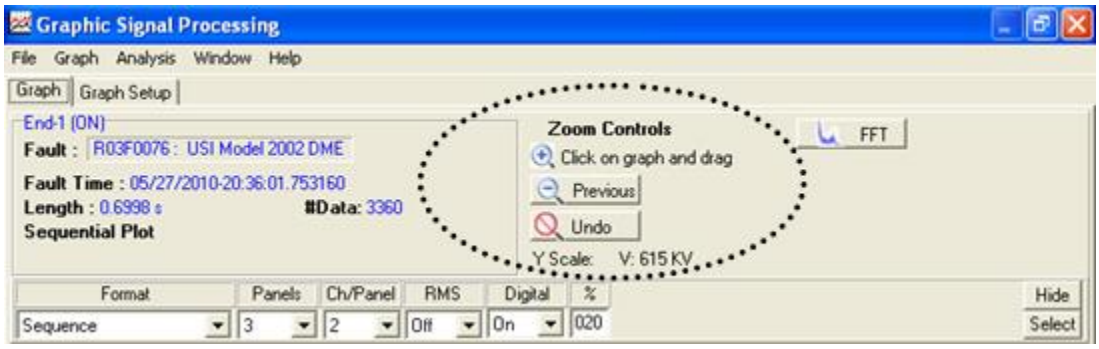


Figure 5-35 Zoom Controls

- Previous:
  This selection is used to remove the latest zoom and return to the previously zoomed scale (Section 5.2.3).

- Undo:
  This selection is used to remove all zooms (Section 5.2.3) and return to the original scale.

- FFT **FFT Button**
  This selection displays the ***Fast Fourier Transform (FFT) Analysis*** window (Figure 5-36).

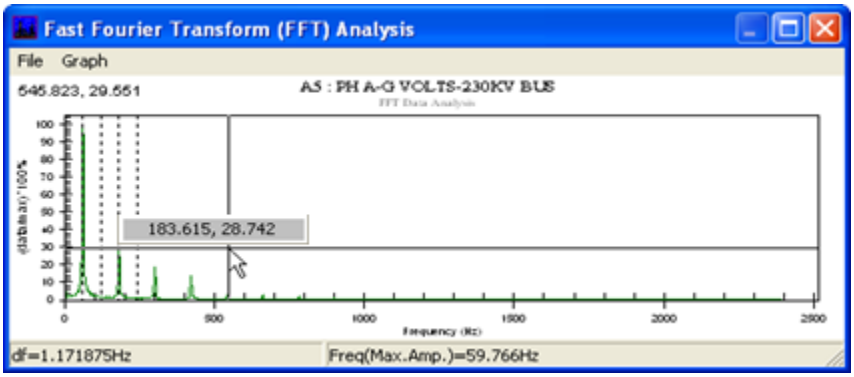


Figure 5-36 FFT Analysis Window

- This window displays the FFT plot for the selected channel. See Section 5.1.3 for details on the use of this window. It is used for harmonic analysis.

- **Quick Formatting Panel**

  The ***Quick Formatting Panel*** (Figure 5-37) is located below the header and is used to customize the view of the analog graph and digital graph panels (Figure 5-1).

  The ***Quick Formatting Panel*** can be removed from the GSP window by clicking the Hide ***Hide*** button. When hidden, the Quick Formatting Panel can be restored by clicking ***Show Quick Formatting Panel*** on the ***File*** menu.

  The ***Format*** drop-down menu displays the following selections (Figure 5-37). The selection made determines which supporting drop-down menus are displayed.

  The Quick Formatting Panel is covered in detail in Section 5.7.

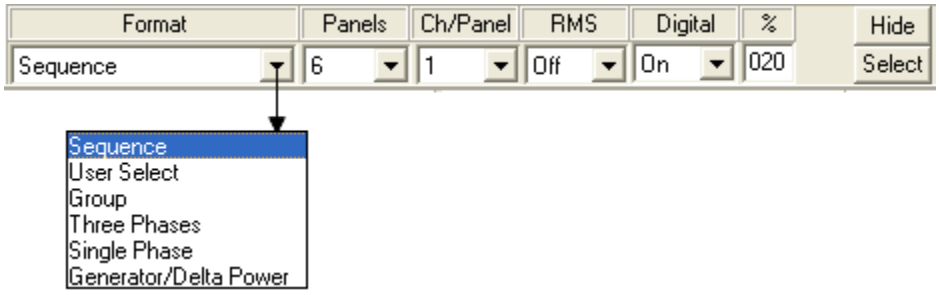


Figure 5-37 Format Drop-Down Menu

5.2.2 GSP – Channel Description Column

This column (Figure 5-1) displays the Analog Description and Digital Description cells. This panel also has a right-click menu (Figure 5-38) for both the analog and digital channel description cells.

- **Analog Description Cells**
  These cells identify the analog input numbers and descriptions for the waveforms displayed in the analog graph panels (Figure 5-1). Each channel description is color-coordinated to match the corresponding information in the ***Graph Panels*** and in the ***Measurement*** column.

- **Analog Channel Description Column – Right-Click Menu**
  Right-clicking anywhere on the analog channel description cells will display the menu shown in Figure 5-38. The following choices are available:

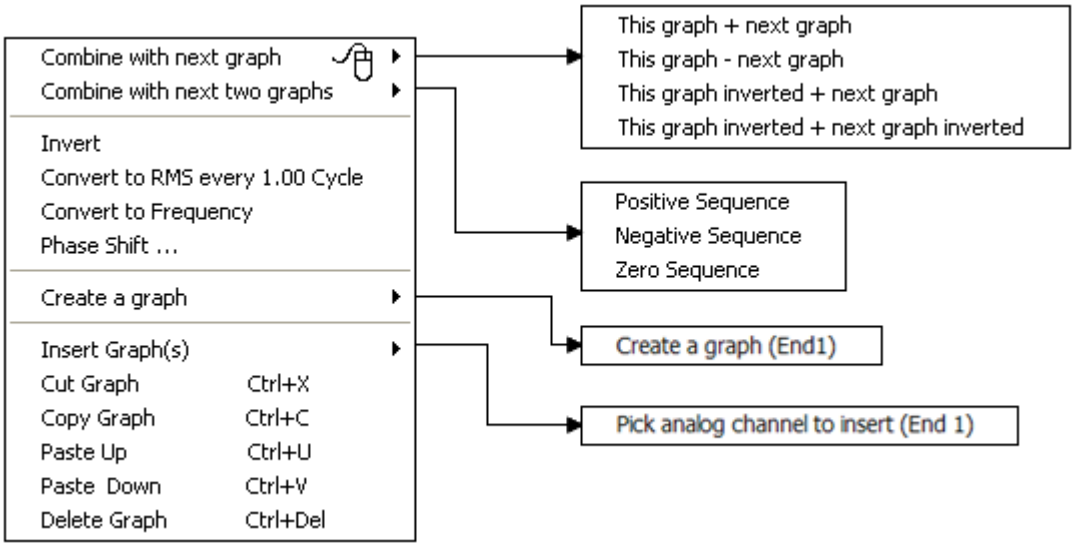


Figure 5-38 Analog Description Right-Click Menu

  - Combine with next graph:
    The following selections are used to combine two waveforms mathematically by adding or subtracting the values of their A-to-D samples point-by-point. The first graph is selected by left-clicking on its description. By selecting one of the following options, the resulting calculated values are plotted in the ***Analog Graph Panel*** replacing the original waveforms.

Note: The two graphs to be combined must have the same units and must be displayed in the same graph waveform panel.

    - This Graph Plus Next Graph
      This selection takes the A-to-D sample values of the selected waveform and adds to them the A-to-D sample values of the next waveform. The formula for this selection is:

$$A(sum) = A1 + A2$$

- This Graph Minus Next Graph
  This selection takes the A-to-D sample values of the selected waveform and subtracts from them the A-to-D sample values of the next waveform. The formula for this selection is:

$$A(sum) = A1 - A2$$

- This Graph Inverted Plus Next Graph
  This selection inverts the A-to-D sample values of the selected waveform and adds to them the A-to-D sample values of the next waveform. The formula for this selection is:

$$A(sum) = -A1 + A2$$

- This Graph Inverted Plus Next Graph Inverted
  This selection inverts the A-to-D sample values of the selected waveform and adds to them the inverted A-to-D sample values of the next waveform. The formula for this selection is:

$$A(sum) = -A1 - A2$$

- Combine with next two graphs:
  The following selections are used to combine three waveforms together mathematically point by point as shown in the formulas below. The first graph is selected by left-clicking on its description. By selecting one of the following options, the resulting calculated waveform is plotted in the ***Analog Graph Panel*** and replaces the original waveforms.

Note: The three graphs to be combined must have the same units, must be displayed in the same graph waveform panel, and must be displayed in phase A-B-C sequence from top to bottom.

- Positive Sequence
  This selection shifts the B-phase by 120 degrees and the C-phase by 240 degrees, sums the waveform magnitudes for a point in time, and divides the sum by three. In a balanced system, the result is equal to the magnitude of A-phase. The formula for this summation (using voltages for the example) is:

$$V_1 = \frac{1}{3}(V_a + aV_b + a^2V_c)$$

Note: In the Fortescue analysis method, the a operator shifts a vector by an angle of 120 degrees counterclockwise and the a^2 operator shifts a vector 240 degrees counterclockwise.

- Negative Sequence
  This selection shifts the B-phase by 240 degrees and the C-phase by 120 degrees, sums the waveform magnitudes for a point in time, and divides the sum by three. In a balanced system, the result is zero. The formula for this summation (using voltages for the example) is:

$$V_2=⅓\ (V_a+a^2V_b+aV_c)$$

- Zero Sequence
  This selection simply sums the waveform magnitudes for any point in time, and divides the sum by three. In a balanced system, the result is zero. The formula for this summation (using voltages for the example) is:

$$V_0=⅓(V_a+V_b+V_c)$$

- Invert**:**
  This selection inverts the A-to-D sample values of the selected waveform and plots the inverted graph. When this feature has been selected, a negative sign will display in the channel description indicating the data is inverted.

- Convert to RMS every x.yy cycle:
  This selection is used to graph a linear plot of RMS values calculated from the A-to-D samples for the selected channel. The number of cycles displayed in this menu item determines the number of samples used to calculate the RMS value. The number of cycles is selectable using the ***Measurement Panel*** right-click menu (Figure 5-56).

- Convert to Frequency:
  This selection is used to graph a linear plot of frequency values calculated from the A-to-D samples for the selected channel.

- Phase Shift:
  This selection displays the ***Phase Shift of Graph*** window (Figure 5-39). This window is used to displace the waveform by the entered number of degrees. When this feature has been selected, the channel description displays the word ***Shift*** followed by the number of degrees of the shift.

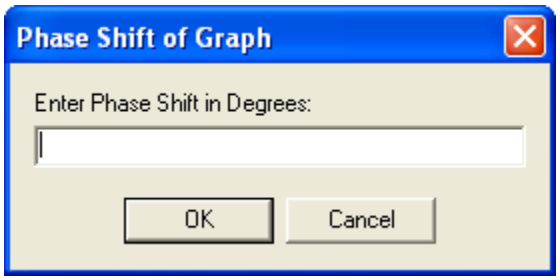


Figure 5-39 – Phase Shift of Graph

- Create a Graph:
  This feature is used to graph a waveform of calculated values. These values are calculated by applying a user-entered formula to A-to-D samples from the displayed data file.

  - Create a graph (End1)
    This selection is used to graph a waveform of a calculated values created by applying a user-entered formula to A-to-D samples from the (End1) data file.

  - Create a graph (End2)
    This selection is used to graph a waveform of a calculated values created by applying a user-entered formula to A-to-D samples from the (End2) data file.

  These selections display the ***Create a Graph*** window (Figure 5-40). This window is used to select waveforms and enter mathematical operators to create new graphs for display and analysis.

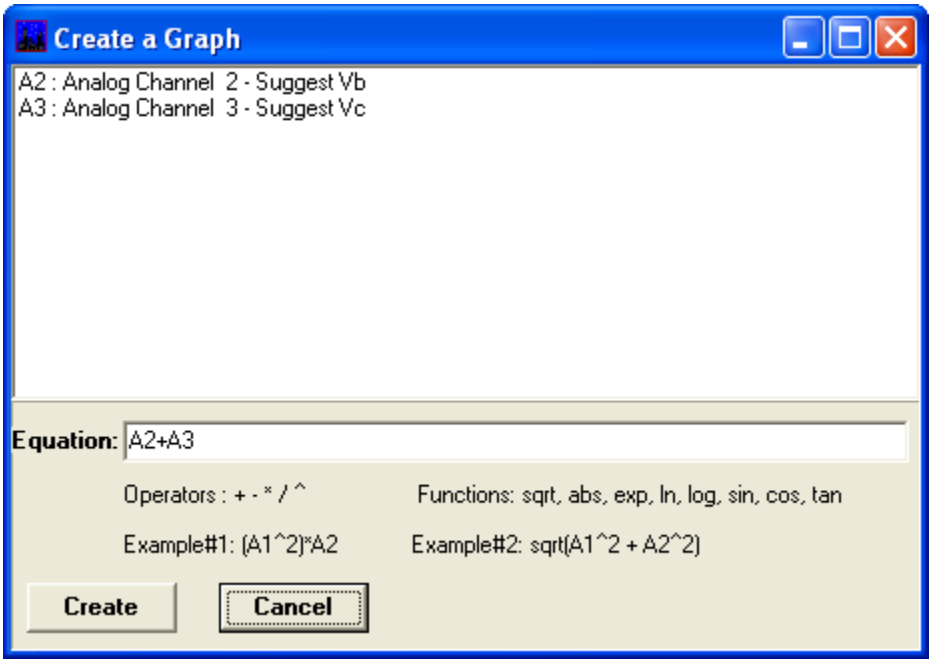


Figure 5-40 Create a Graph – Setup

- Operands (available graphs) listed in the ***Create a Graph*** window are the channels displayed in the present view of the Graph Analysis Panels.

- Equation
  This field displays the entered formula.

- Operators available are:

  + (Addition)
  - (Subtraction)
  * (Multiplication)
  / (Division)
  ^ (Exponential)

- Functions available are:

  sqrt (Square Root)
  abs (Absolute Value)
  exp (Exponential)
  ln [Logarithm (natural or Napierian – base e)]
  log [Logarithm (decimal - base 10)]
  sin (Sine)
  cos (Cosine)
  tan (Tangent)

- Create
  This button executes the formula entered in the Equation field and plots the calculated graph values (Figure 5-41).

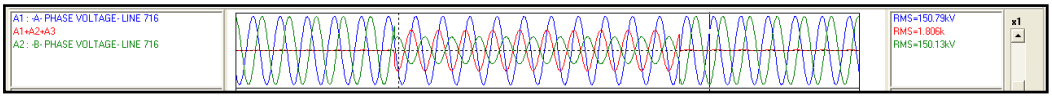


Figure 5-41 Create a Graph - Result

- Cancel
  This button closes the ***Create a Graph*** window.

- Insert Graph(s):
  These selections are used to insert additional analog channels into selected Graph Waveform Panels.

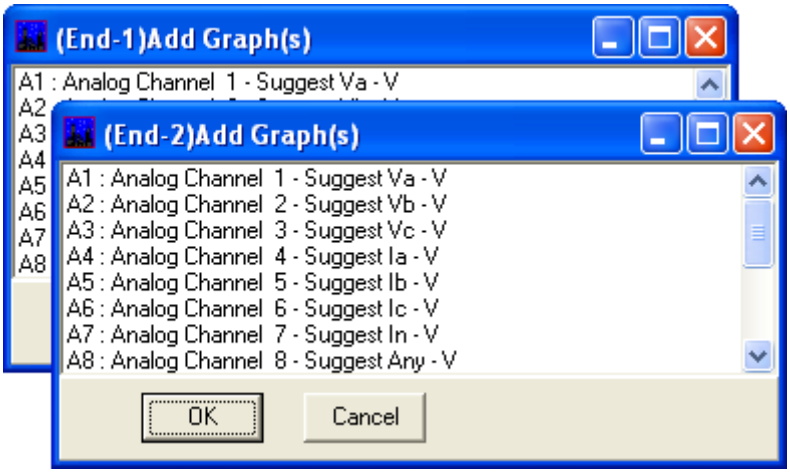


Figure 5-42 Add Graph(s) Window

- Pick Analog Channel to Insert (End 1)
  This selection displays the ***(End-1)Add Graph(s)*** window (Figure 5-42). This window is used to select the analog channels from the End-1 data file. Select channels by using Ctrl+Left-click to select individual channels or using Shift+Left-click to select a group of channels. The selected analog channels are inserted into the selected Waveform Graph Panel (Figure 5-1).

- Pick Analog Channel to Insert (End 2)
  This selection displays the ***(End-2)Add Graph(s)*** window (Figure 5-42). This window is used to select the analog channels from the End-2 data file. Select channels by using Ctrl+Left-click to select individual channels or using Shift+Left-click to select a group of channels. The selected analog channels are inserted into the selected Graph Panel (Figure 5-1).

- Cut Graph:
  This selection removes the highlighted channel descriptions and graphs from the current view. Select channels by using Ctrl+Left-click to select individual channels or using Shift+Left-click to select a group of channels The selected channels can then be pasted into another panel or back into the same Graph Panel.

- Copy Graph:
  This selection copies but does not remove the selected channel descriptions and graphs. Select channels by using Ctrl+Left-click to select individual channels or using Shift+Left-click to select a group of channels The selected channels can then be pasted into another panel or back into the same Graph Panel.

Note: The ***Cut*** and ***Copy*** operations do not copy the displayed waveforms to the Windows Clipboard®.

- Paste Up:
  This selection will paste ***Cut*** or ***Copied*** channel descriptions and graphs into the selected Graph Panel and position them above the selected channel. Select a waveform by left-clicking on the waveform description.

- Paste Down:
  This selection will paste ***Cut*** or ***Copied*** channel descriptions and graphs into the selected Graph Panel and position them below the selected channel. Select a waveform by left-clicking on the waveform description.

- Delete Graph:
  This selection removes the selected channel descriptions and graphs from the current panel. A single remaining channel description and graph cannot be deleted from a panel.

- **Digital Description Cell**
  This cell identifies the input numbers and descriptions for the event input and analog triggers for the waveforms displayed in the digital graph panel. The color of each input number and description matches the color of the waveform plot and measurement values.

- **Digital Channel Description Cell – Right-Click Menu**
  Right-clicking anywhere on the digital channel description cell will display the menu shown in Figure 5-43. The following choices are available:

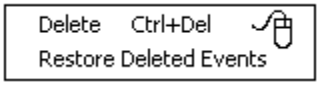


Figure 5-43 GSP – Digital Channel Description Right-Click Menu

- Delete:
  This selection is used to remove the selected digital descriptions and graphs from the display. Nothing is deleted from the data file.

- Restore Deleted Events:
  This selection is used to restore digital descriptions and graphs which were removed using the Delete feature.

5.2.3 GSP - Waveform Graph Panels

These panels (Figure 5-1) display graphs of the analog inputs, digital inputs, and analog triggers. They also have a right-click menu (Figure 5-45).

When a data file is opened, the entire length of the fault file is displayed in the graph panels. The data can be zoomed by left-clicking and dragging to select an area. A horizontal scroll bar (Figure 5-44) is displayed beneath the graphs following a zoom.

The graph panels can be horizontally sized by clicking on the left border and dragging to the left or right to make the panels larger or smaller.

- **Analog Graph Panels**
  These panels display the analog waveform graphs. Up to 14 graphs can be displayed in each panel. Each graph is color-coordinated to match the corresponding information in the ***Channel Number/Description*** and ***Measurement*** columns.

- **Digital Graph Panel**
  This panel displays the analog trigger and event input graphs (Figure 5-1). All events and analog triggers that were abnormal during the displayed fault are shown here. They are displayed and plotted in the sequence in which they became abnormal. Each graph is color-coordinated to match the corresponding information in the ***Channel Number/Description*** column.

  This panel can be removed or restored by clicking on the ***Digital*** drop-down of the ***Quick Format Panel*** (Section 5.7) or the ***Digital Data*** drop-down on the ***Graph Setup*** screen (Section 5.8). When digital graph panel is turned off, this panel is used to display an additional analog graph.

- **T-zero Time Line (First Trigger After Start of Fault)**
  The vertical dashed line on the graphs (Figure 5-44) indicates the point of the fault where the first trigger occurred. The data to the left of this line is the prefault and the data to the right of this line is the fault and postfault.

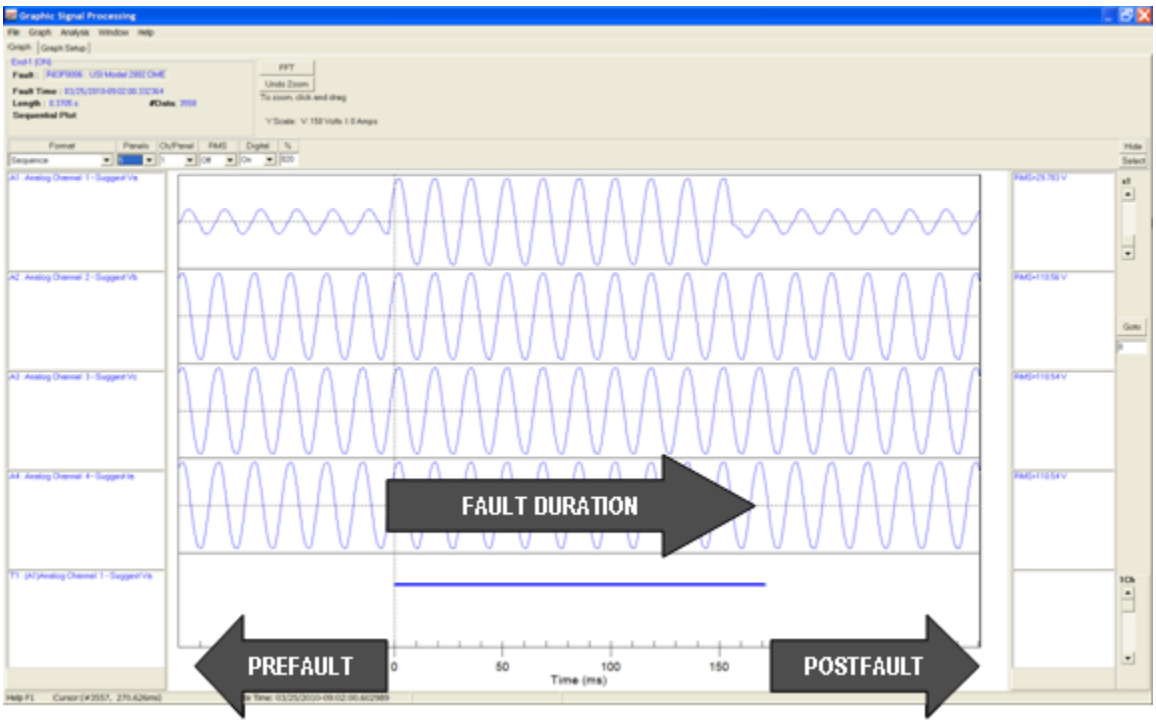


Figure 5-44 Start Of Fault Timeline (T-zero)

- **Analog Graph Panels – Right-Click Menu**
  Right-click anywhere on the graph panels to display the menu shown in Figure 5-45. The following selections are available:

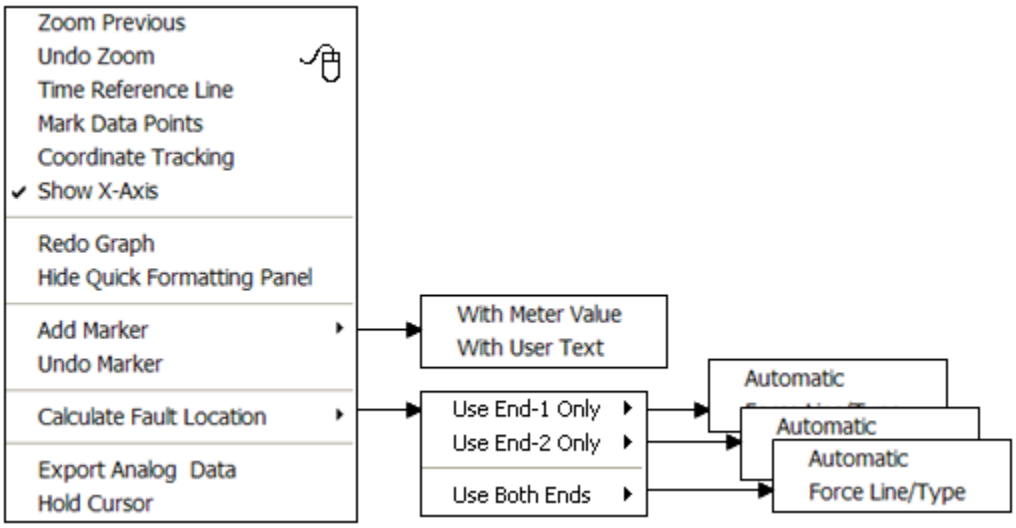


Figure 5-45 Waveform Graph Panels – Right-click Menu

  - Zoom Previous:
    This selection is used to undo the most recent zoom (Section 5.2.3) on the graph.

- Undo Zoom:
  This selection is used to undo all zooms (Section 5.2.3) reverting to the original graph display scale.

- Time Reference Line:
  This selection places a red vertical reference line at the current cursor position (Figure 5-46). The time reference line can be moved to other positions on the graphic display by placing the cursor on the desired location and double-clicking. A ***Dt*** status field is also displayed at the bottom of the Graphic Signal Processing window showing the delta time between the time reference line and the cursor line. The delta time is presented both in milliseconds and in power line cycles. This feature is useful for determining operating times of various protection equipment. Clicking again on this menu selection will remove the time reference line and the ***Dt*** status field from the graph screen.

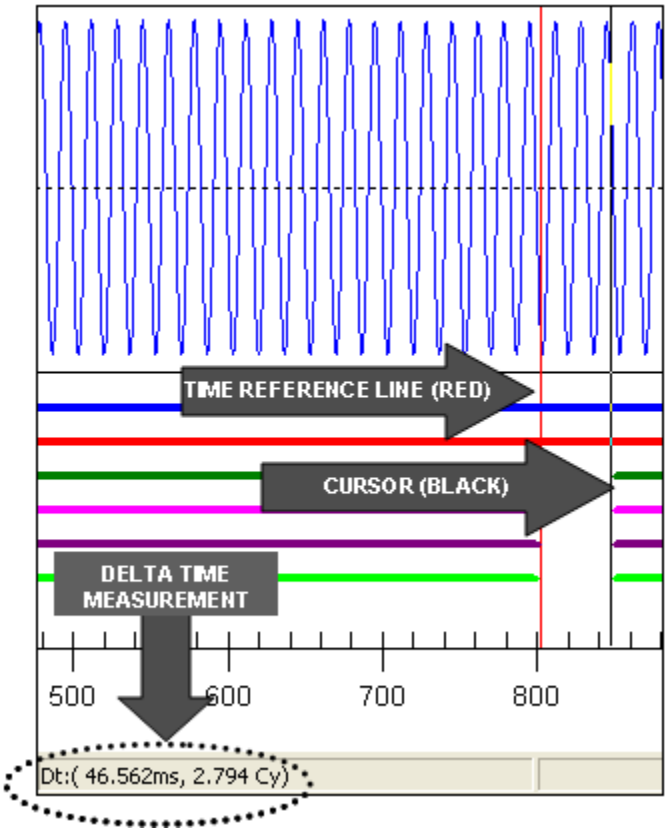


Figure 5-46 Time Reference Line

- Mark Data Points:
  This selection places bullets on the waveforms showing the points where the A-to-D converter sampled (Figure 5-47). Clicking again on this menu selection will remove the data point marks.

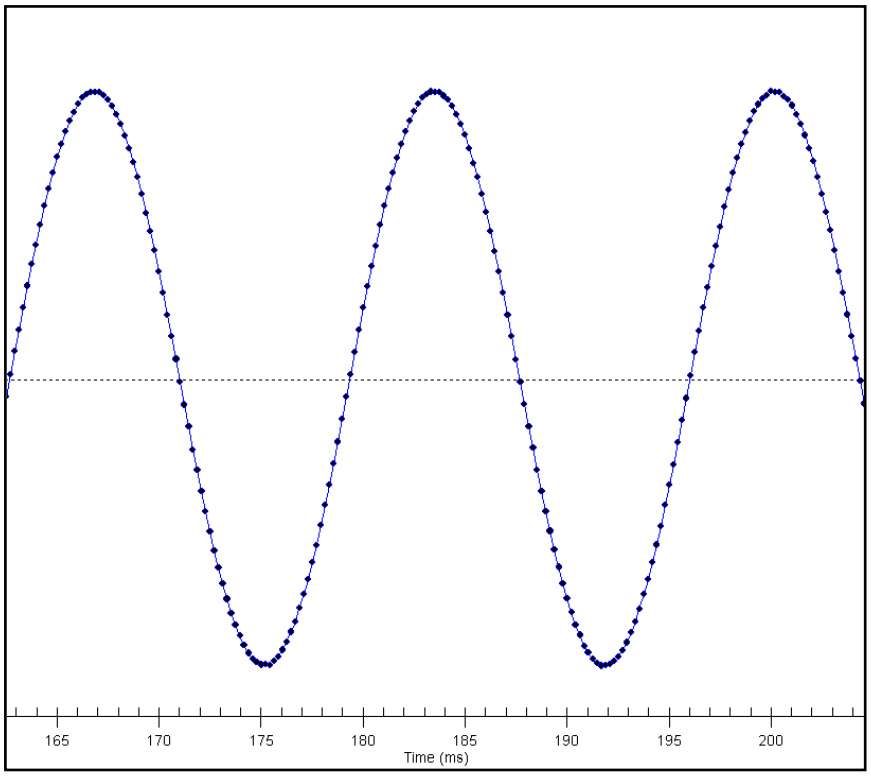


Figure 5-47 Mark Data Points

- Coordinate Tracking:
  This selection displays an X=, Y= status field at the bottom of the Graphic Signal Processing window (Figure 5-48). This field displays the precise position of the mouse pointer where the X-coordinate is time and the Y-coordinate is magnitude. The coordinates follow the mouse pointer. The cursor line still snaps from sample to sample. This feature allows a user to interpolate a time and magnitude between sampled points.

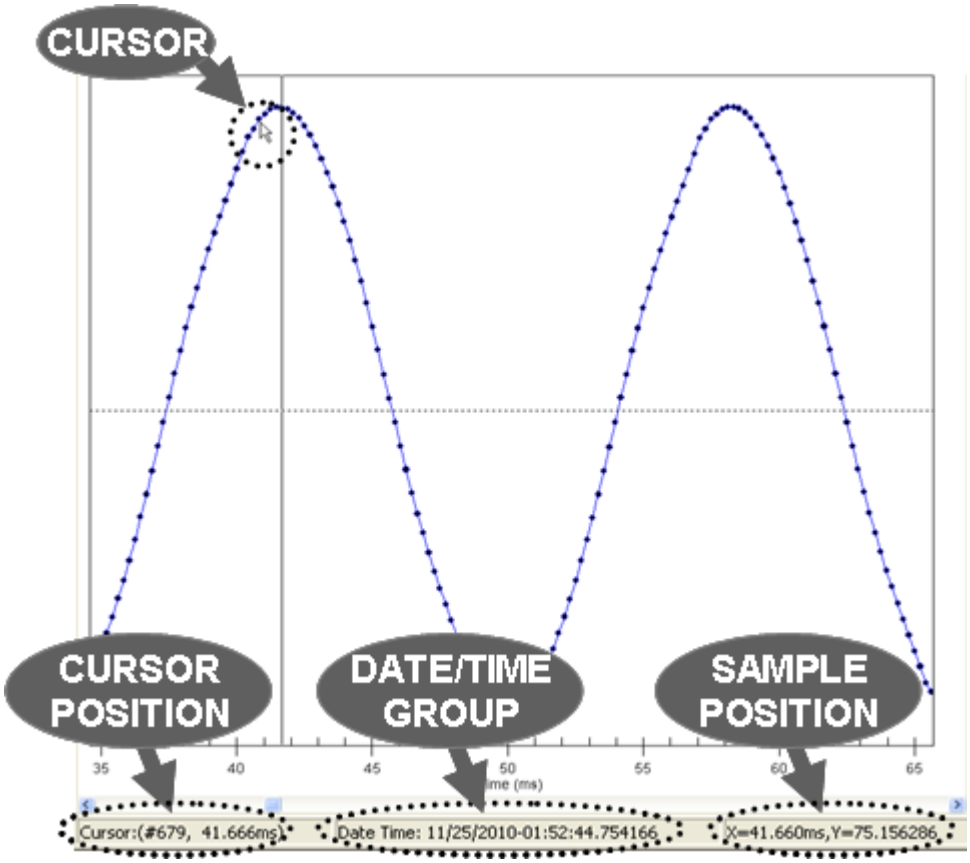


Figure 5-48 Coordinate Tracking

- Show X-Axis:
  This selection displays a time reference line at the bottom of the Graphic Signal Processing screen. The scale on this time line is referenced to time t_0 (Figure 5-49).

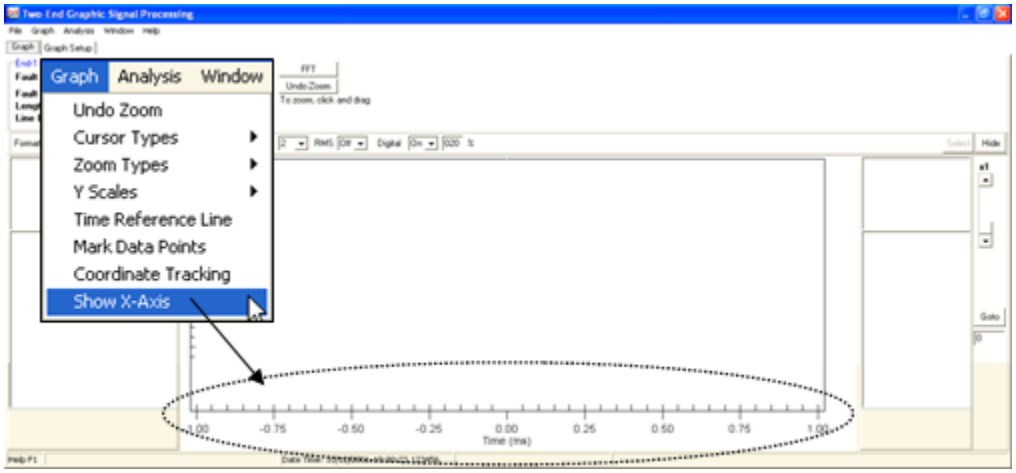


Figure 5-49 Graph Menu - Show X-Axis

- Redo Graph:
  This selection refreshes the Graphic Signal Processing window.

- Hide/Show Quick Formatting Panel:
  This selection hides the GSP Quick Formatting Panel (Figure 5-1). When this panel is hidden, Graphic Signal Processing display modifications must be made from the Graph Setup screen tab.

  If ***Hide Quick Formatting Panel*** is selected, this menu item changes to ***Show Quick Formatting Panel***. This selection restores the Quick Formatting Panel to the display. For complete details about this panel see (Section 5.7).

- Add Marker**:**
  Markers can be added to the graphs to provide comments or measurement values.

  - With User Text
    This selection is used to enter comments to the graph panels being viewed (Figure 5-50).

  - With Meter Value
    This selection is used to enter measurement values to the graph panels being viewed (Figure 5-50).

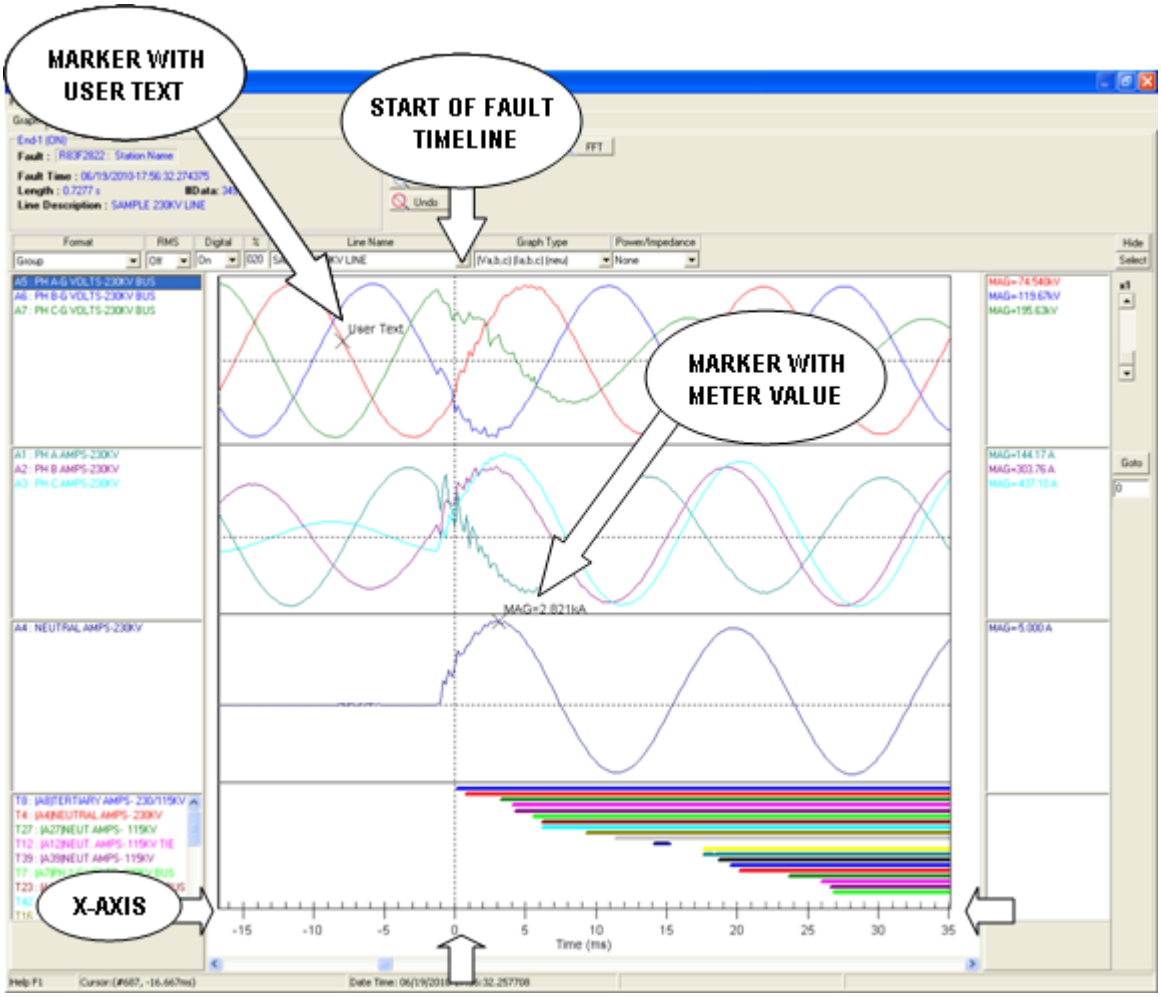


Figure 5-50 Start of Fault (t_0), X-Axis, and Text Markers

- Undo Marker:
  This selection is used to clear the most recently added marker.

- Calculate Fault Location:
  This selection is enabled only when Group format (Section 5.7.3) is chosen. It is used to calculate the distance to a fault on a transmission line.

Note: The DME system is also capable of calculating fault location automatically after creating a record. This feature is provided as a means of manual verification.

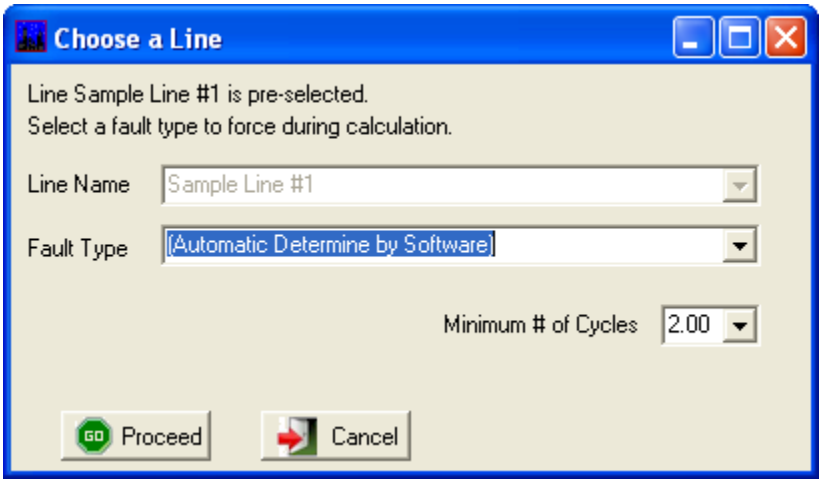


Figure 5-51 Calculate Fault Location

- Use End-1 Only
  These selections are used to calculate distance-to-fault using the ***End-1*** data file and ***Line Group Record***.

  - Automatic
    This selection allows the application to automatically determine the fault type used for the calculation. The fault location algorithms are then applied to the ***Line Name*** selected in the ***Quick Format Panel*** (Section 5.7) or the ***Graph Setup Screen*** and the data displayed on the analog graph panels.

Note: Zooming in to a point of interest on the display permits selection of data to be used in the calculation.

  - Force Line/Type
    This selection displays the ***Choose a Line*** window (Figure 5-52).

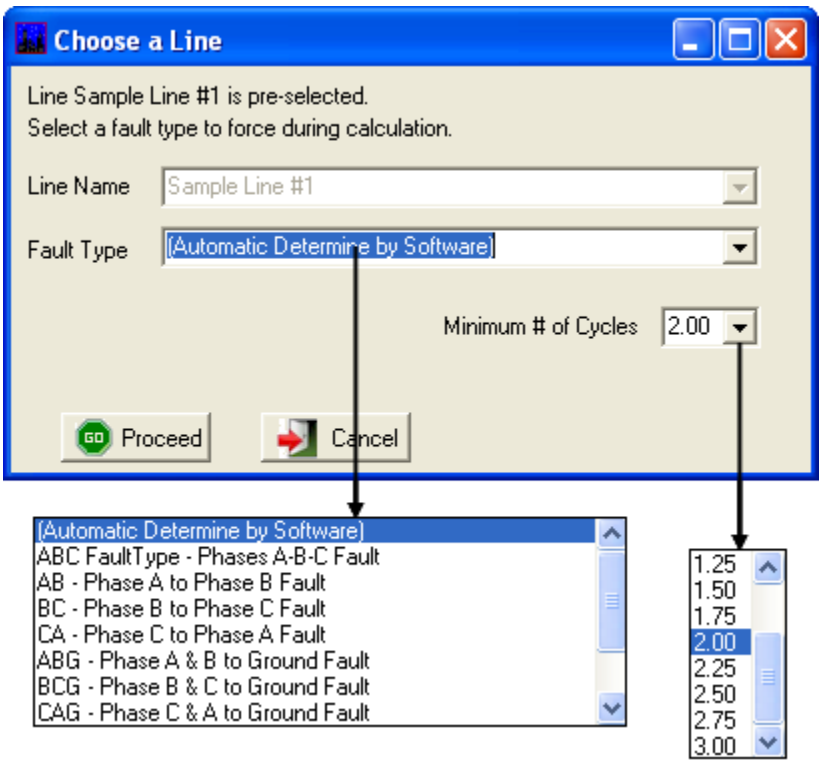


Figure 5-52 Choose A Line Window

This window is used to manually select the fault type and the minimum number of fault cycles to be used by the fault location routine.

When the fault location algorithm detects a fault that persists longer than the selected number of cycles, the following messages and report are displayed (Figure 5-53).

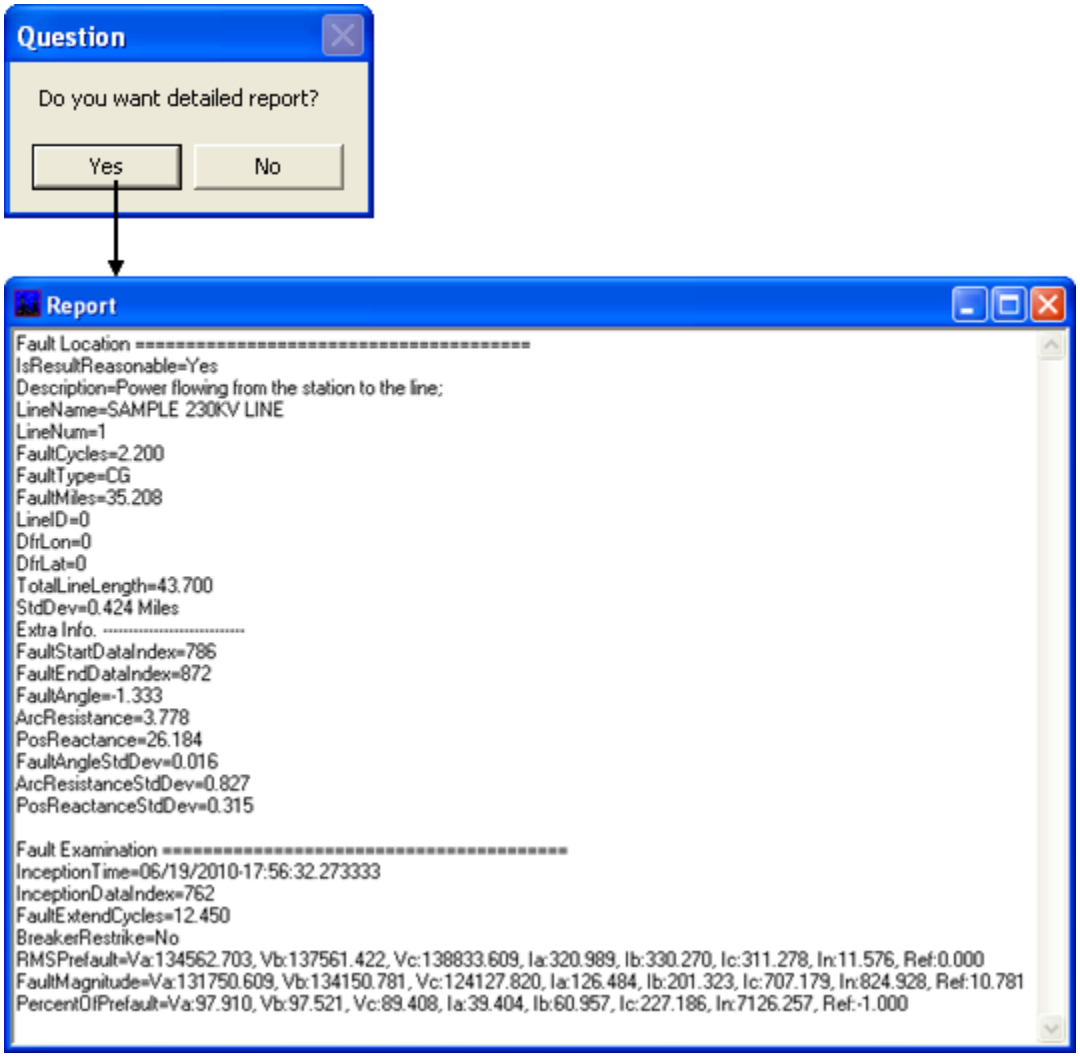


Figure 5-53 Successful Fault Location Report

The distance-to-fault results are also displayed in the header of the GSP screen (Figure 5-54).

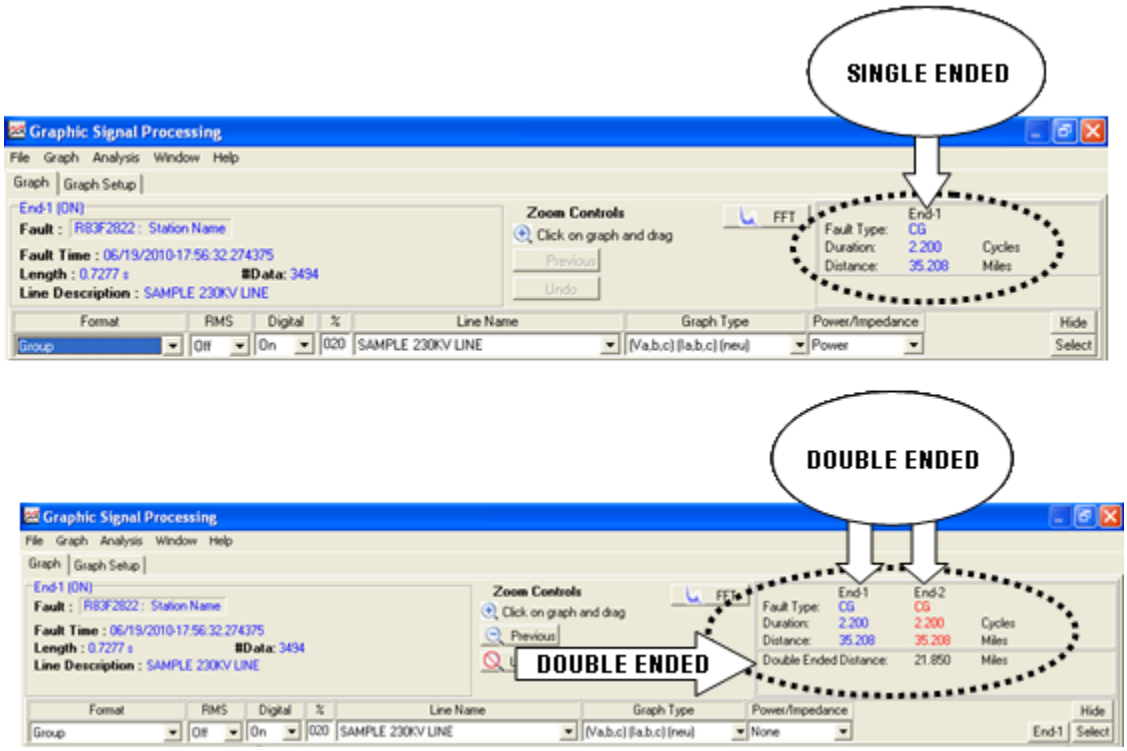


Figure 5-54 Successful Fault Location Report

When the fault location algorithm is not successful at detecting a fault greater than the minimum number of cycles the following messages and report are displayed (Figure 5-55).

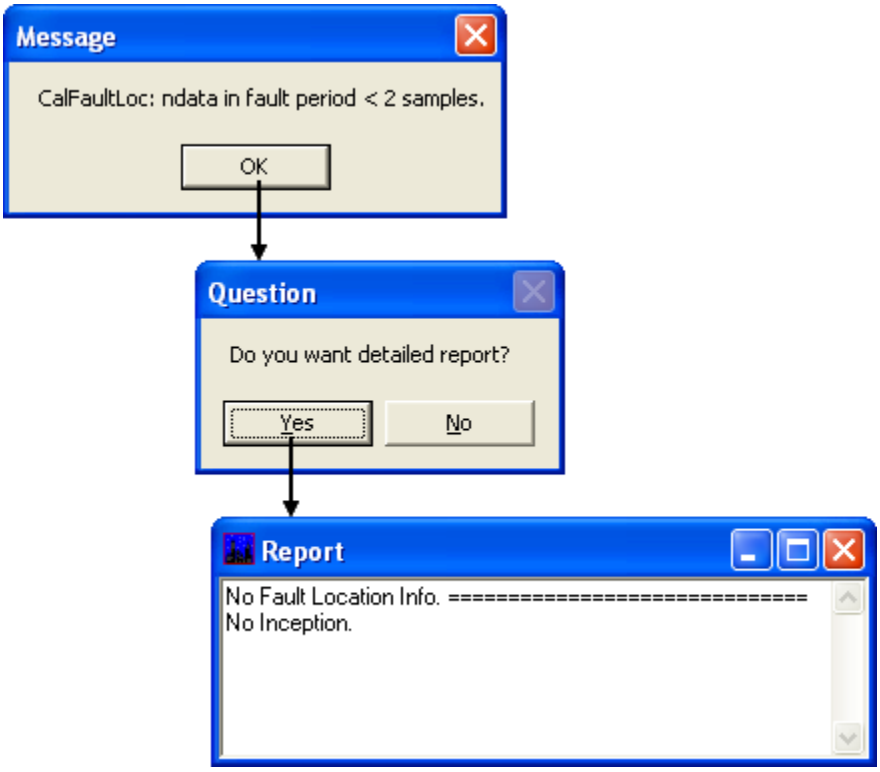


Figure 5-55 Unsuccessful Fault Location Report

- Use End-2 Only
- Use Both Ends

Note: Two data files must be open for the ***Use End-2 Only*** and ***Use Both Ends*** selections to be enabled. For addition information on opening two data files and double-ended analysis, see Section 5.9.

- **Export Analog Data**
  This selection displays the ***Export Analog Data*** window (Figure 5-11). From this window, data can be exported to a comma delimited file (****.csv***). This type of file can be opened in other applications.

- **Hold Cursor**
  This selection freezes the cursor at the current mouse position and detaches it from the mouse pointer. This feature is useful when grabbing a screen-shot for documentation.

5.4 GSP - WAVEFORM MEASUREMENT PANELS

This column (Figure 5-1) displays the analog waveform measurement values. Each measurement value is color-coordinated to match the corresponding information in the ***Channel Number/Description*** column and the ***Graph Panels***.

The default values displayed are RMS. To change the values displayed, right-click anywhere on the waveform measurement column to display the menu shown in Figure 5-56. The following selections are available:

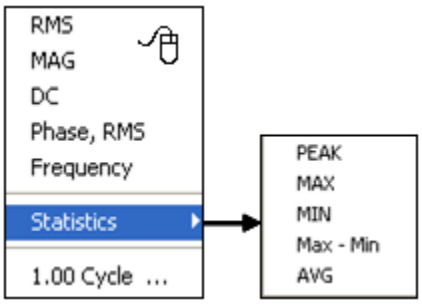


Figure 5-56 Measurement Panel Right-Click Menu

- **RMS**
  This selection displays ***RMS*** values of each analog waveform. This value is calculated from the data samples for one power line cycle to the left of the cursor.

- **MAG**
  This displays the instantaneous magnitude of the data point at the cursor.

- **DC**
  This selection displays the instantaneous direct current value of the data point at the cursor.

- **Phase, RMS**
  This selection displays the phase angles and the RMS values of each analog waveform.

  The default reference channel for phase angle values is the first channel description listed at the top of the GSP screen. Phase angle measurements of all other analog channels are referenced to the reference channel. The reference channel can be changed by left-clicking on the description of the preferred reference channel.

- **Frequency**
  This selection displays the frequency values of each analog waveform using a one cycle DFT algorithm.

- **Statistics**
  These selections are used to provided statistical information (Figure 5-56) about the waveforms. These selections are useful when analyzing linear plots of calculated values such as ***Continuous Frequency, RMS, and Phase Data*** and ***Long Term RMS*** files.

  - Peak:
    This selection finds the location and displays the numerical value of the point on the plotted graph having the highest positive or lowest negative value**.**

  - MAX:
    This selection finds the location and displays the numerical value of the point on the plotted graph having the highest measured value**.** This value can be positive or negative.

  - MIN:
    This selection finds the location and displays the numerical value of the point on the plotted graph having the lowest measured value**.** This value can be positive or negative.

Note: Data value numbers are displayed in the GSP footer (Section 5.6). The value numbers displayed by Peak, Max, and Min selections can be located by using the cursor and observing the number displayed on the GSP footer. These values may also be located by using the ***Goto*** feature of the ***Navigation Controls*** (Section 5.5).

  - Max-Min:
    This selection calculates the difference between the Max value and the Min value of the plotted graph. When this selection is applied to a sinusoidal waveform, the resulting value would be the peak-to-peak value.

  - Average:
    This selection calculates the average of all the plotted values.

- **# Cycles …** (**Number of Cycles)**
  This selection is used to set the window size used by the measurement reading algorithms and also by the ***Convert to RMS*** feature (Figure 5-38). The default setting is ***1*** (one cycle).

Note: This window size is converted to a number of A-to-D samples based on the sample frequency and the fundamental line frequency (e.g. if the sample frequency = 6000 Hz and the line frequency = 60 Hz, then the window size used by the measurement column will be 100 samples).

5.5 GSP – NAVIGATION CONTROLS

The following navigation controls (Figure 5-57) are used to maneuver around within the displayed data file.

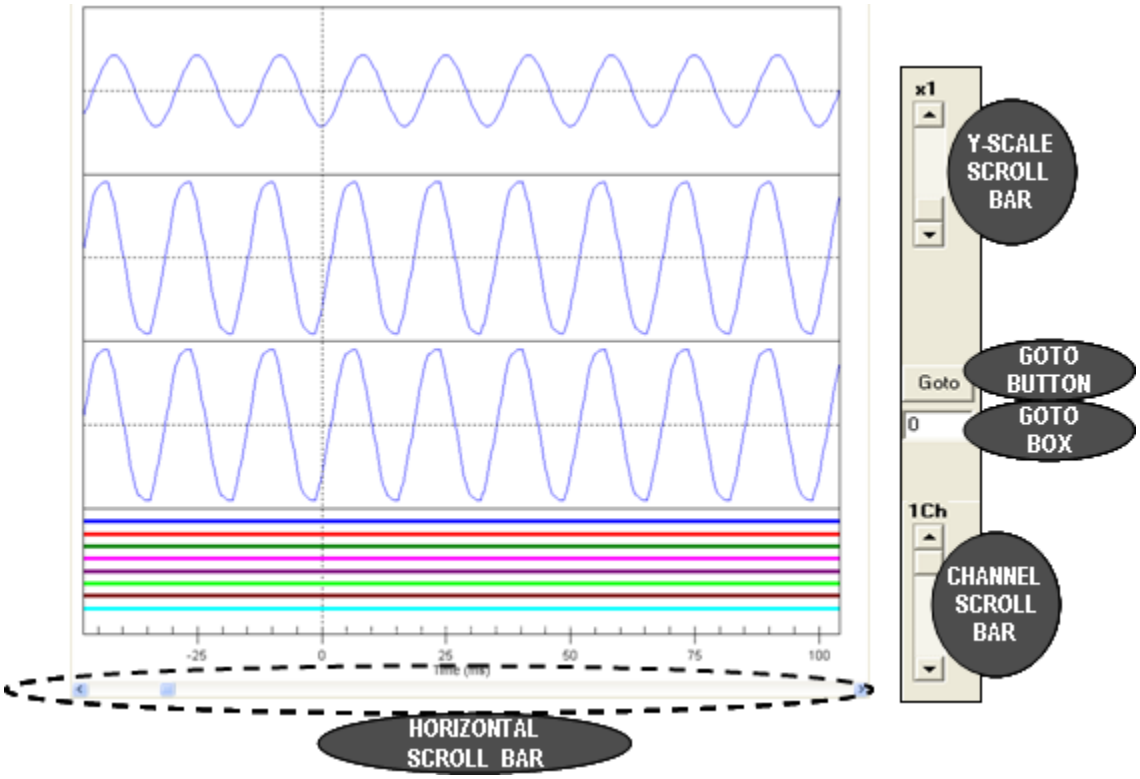


Figure 5-57 GSP – Navigation Controls

- **Y-Scale Scroll bar**
  This scroll bar is a multiplier setting used to magnify the Y-scale of the displayed waveforms in the analog graph panels. To magnify a waveform, select the graph by left-clicking on its description. Multiple graphs can be selected by using Ctrl+Left-click or Shift+Left-click. Changing the Y-scale multiplier does not change the values displayed in the measurement column.

Note: Only graphs plotted in the same analog graph panel can be selected to be magnified. Graphs in adjacent panels must be selected and magnified separately.

Note: This feature is not active when ***Optimize each graph*** has been selected in the graph Y-scale settings.

- **Goto**
  This button and field are used to place the cursor at a specific data point in the graph. The data points displayed are numbered from left to right from zero to the total number of points in the file. Entering the number of the desired data point in the ***Goto*** field and clicking the ***Goto*** button will place the cursor at that point.

- **Ch Scroll Bar (Channel Scroll Bar)**
  This scroll bar is used to scroll vertically through the graphs. This feature is active only when in ***Sequence Format*** (Section 5.7.1).

- **Horizontal Scroll Bar**
  This scroll bar is used to scroll horizontally through the graphs. This feature is active only when the data has been zoomed (Section 5.2.3).

5.6 GSP – FOOTER

The following information is displayed in the GSP footer (Figure 5-58):

Figure 5-58 Graphic Signal Processing – Footer Screen

- **Help F1**
  This field is an indicator that by pressing the F1 key, help for the current screen will be displayed (Figure 5-58).

- **Cursor**
  This field indicates the cursor position on the displayed graphs. The position is indicated by sample number followed by a time reference to the Start of Fault Timeline (t_0) (Figure 5-50). If the cursor is positioned to the left of the t_0 line, this number will be negative.

- **Date Time**
  This field indicates the absolute time of the cursor position on the displayed graphs.

5.7 GSP – Quick Formatting Panel

This panel is used to customize the ***Graphic Signal Processing*** screen for analysis.

5.7.1 Sequence Format

When this format is selected, the Graphic Signal Processing window displays the analog channels in sequential order from top to bottom. The following supporting drop-down menus are available on the Quick Formatting Panel (Figure 5-59).

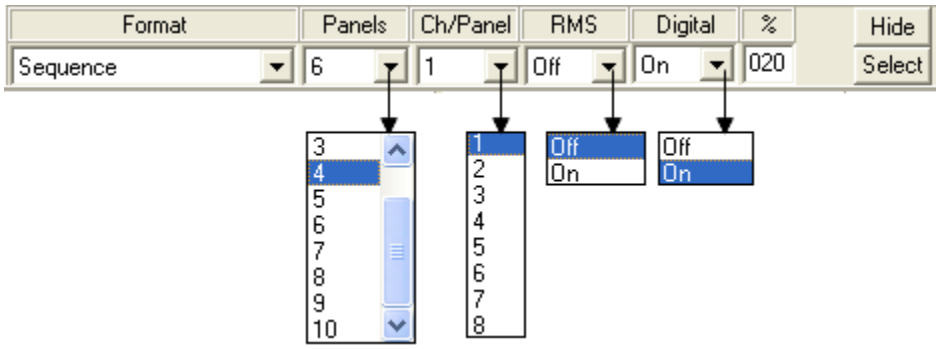


Figure 5-59 Sequence Format Drop-Down Menus

- **Panels**
  Waveform panels are the horizontal rows used to display the analog and digital data. This drop-down menu allows selections of one to ten (1 to 10) display panels.

- **Ch/Panel**
  Each of the waveform display panels can display a single waveform or multiple waveforms. This drop-down menu allows selections of one to eight (1 to 8) waveforms to be displayed in each panel.

- **RMS**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- **Digital**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

  Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order which it became abnormal.

  When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- **% (Percent)**
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the

Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- Hide **Hide**
  This button (Figure 5-59) is used to remove the Quick Formatting Panel from the GSP window. When hidden, the Quick Formatting Panel can be restored by clicking ***Show Quick Formatting Panel*** on the ***File*** menu.

- Select **Select**
  This button displays the Sequence Plot Graph Parameters window (Figure 5-60).

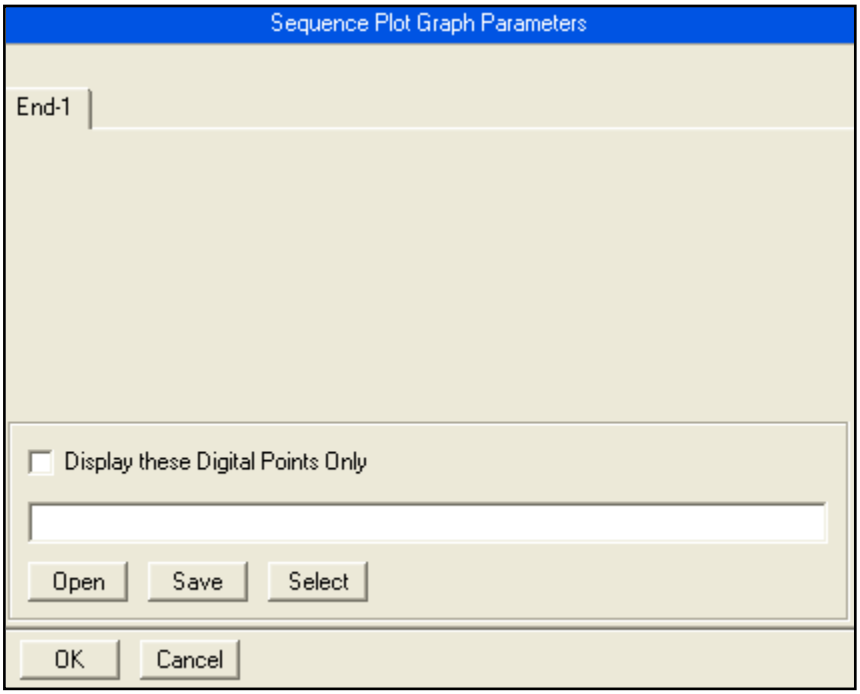


Figure 5-60 Sequence Plot Graph Parameters

This window is used to select the digital event or analog trigger inputs to be displayed.

- ☑ Display these Digital Points Only:
  This checkbox enables the GSP to display on the digital points displayed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Open Open
    This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-61). This window is used to select a previously saved selected digital channels information file.

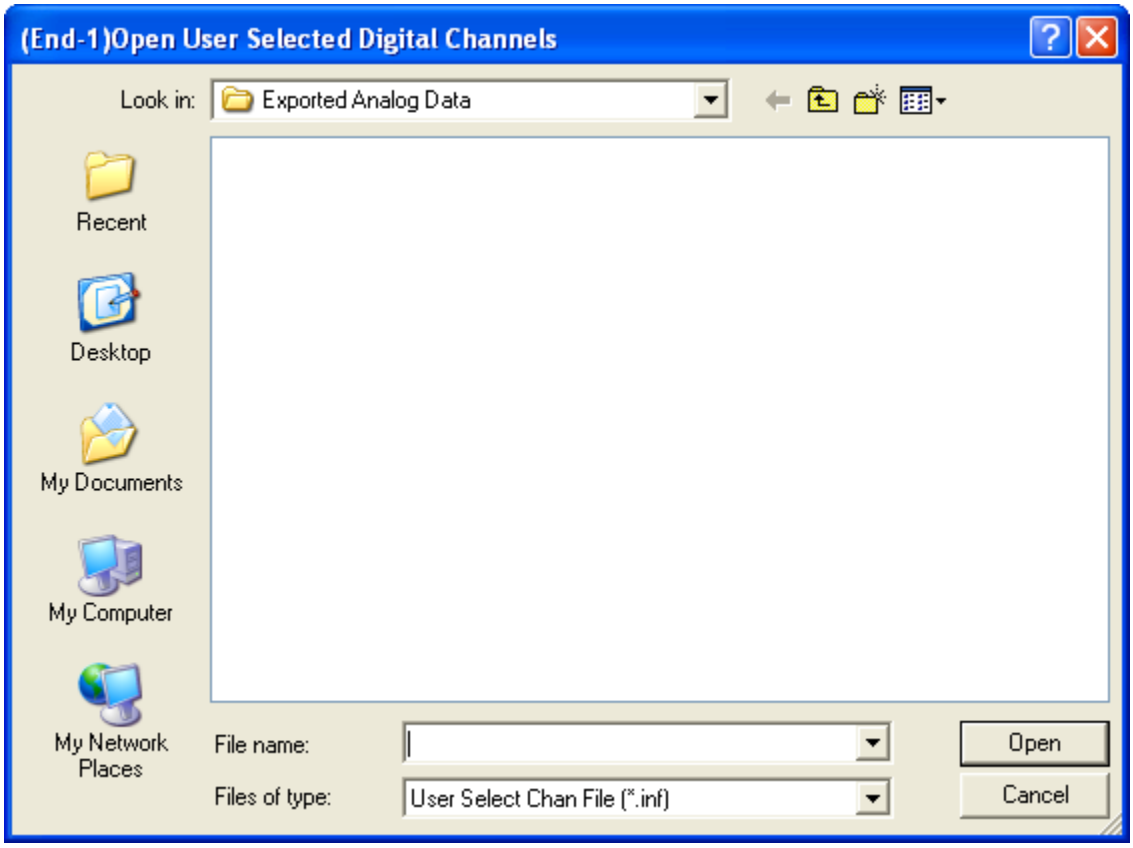


Figure 5-61 Open User Selected Digital Channels Window

- Save Save
  This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-62). This window is used to save the selected digital channels to an information file for future viewing.

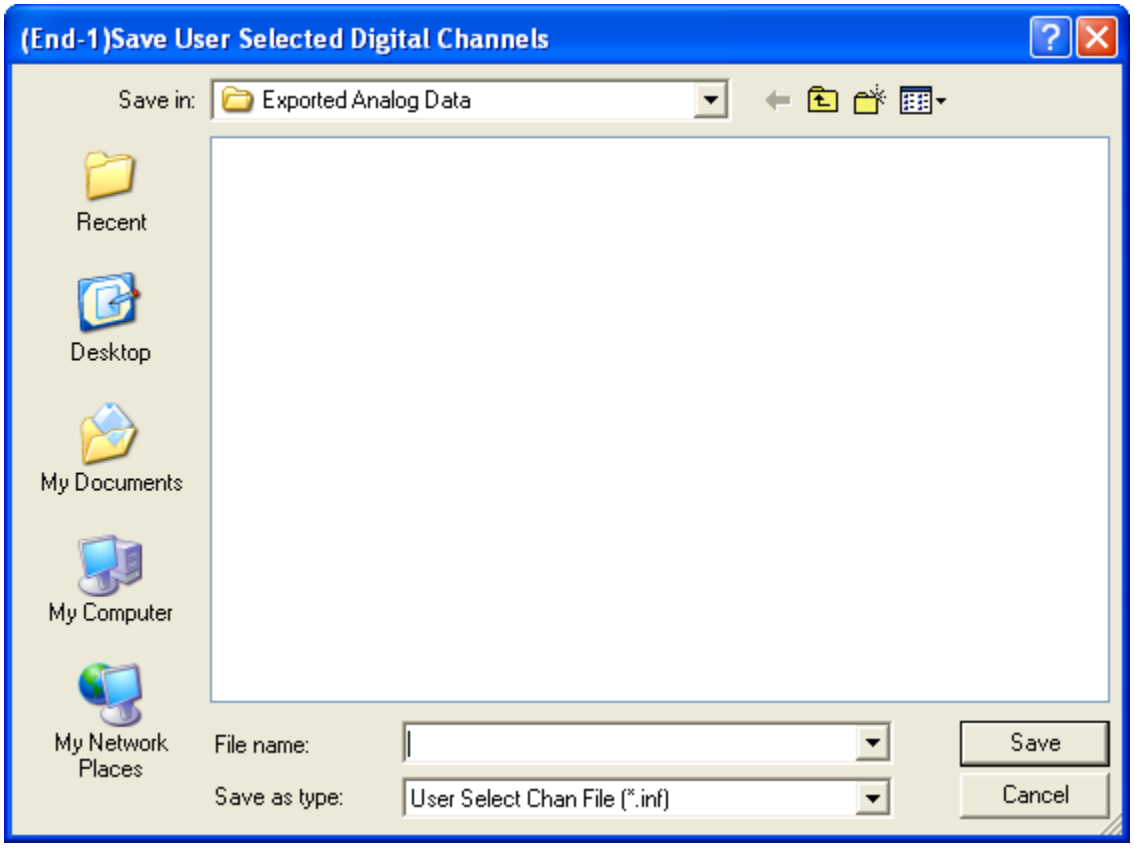


Figure 5-62 Open User Selected Digital Channels Window

- Select Select
  This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-63). This window is used to select the digital event or analog trigger inputs to be displayed.

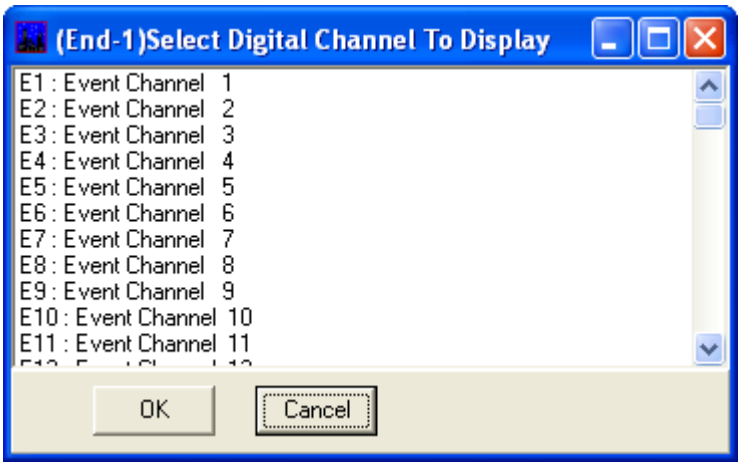


Figure 5-63 Select Digital Channel To Display Window

5.7.2 User Select Format

When this format is selected, the ***User Channel Select*** window displays (Figure 5-64). This window is used to create a user-defined display format.

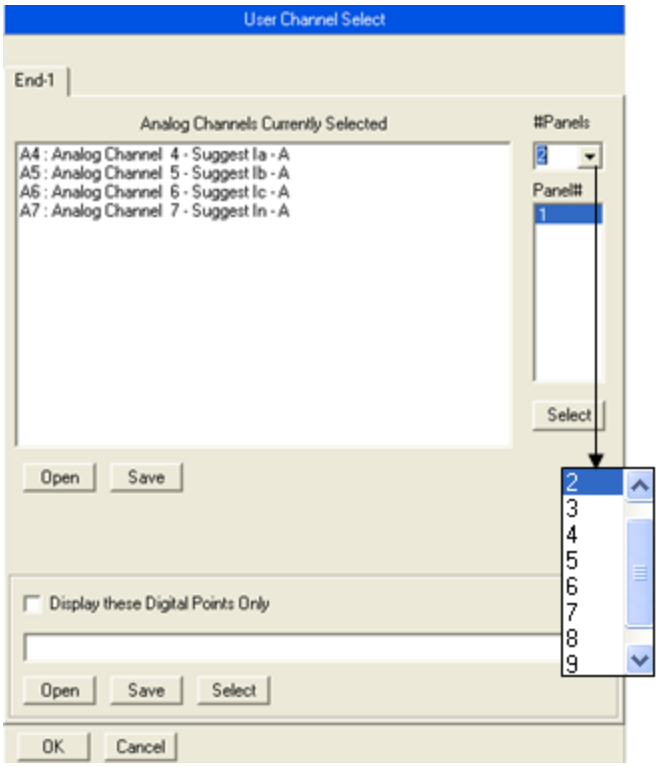


Figure 5-64 User Channel Select Window

- **#Panels (Number of Panels Selection)**
  Waveform panels are the horizontal rows used to display the analog and digital data. This drop-down menu allows selection of one to ten display panels.

  - Analog Channels Currently Selected:
    This window displays the analog input number and the channel description selected for the highlighted panel number.

  - Panel# (Panel Number):
    This window lists the analog waveform panel numbers.

  - Select Select:
    This button displays the Select Analog Channel(s) for Panel N window (Figure 5-65). This window is used to choose which channels will be displayed in each waveform panel. To display this window, click on the panel number to be configured and then click this button.

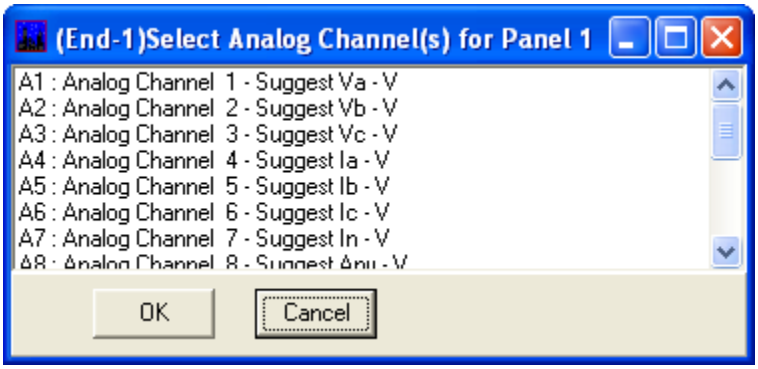


Figure 5-65 Select Analog Channel(s) for Panel N Window

- Open: This button displays the ***(End-1)Open User Selected Analog Channels*** window (Figure 5-66). This window is used to select a previously saved selected analog channel information file.

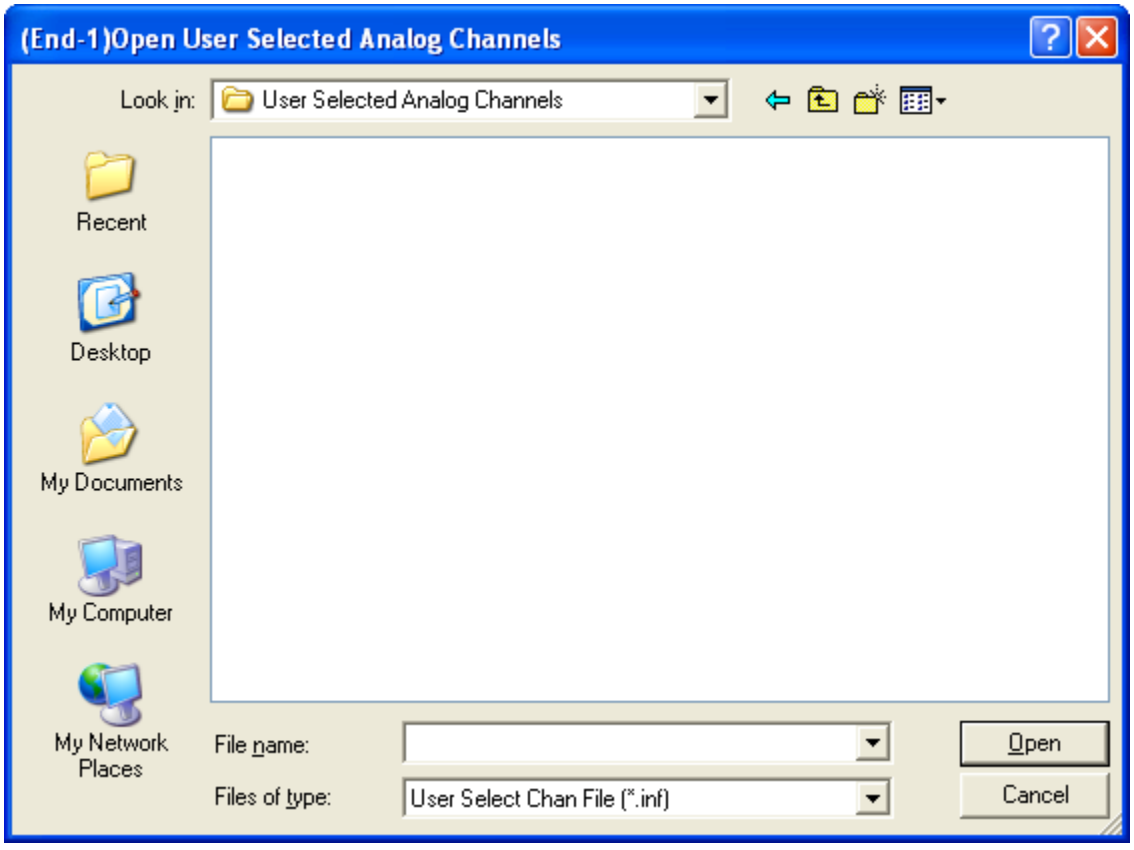


Figure 5-66 Open User Selected Analog Channels

- Save: This button displays the ***(End-1)Save User Selected Analog Channels***

window (Figure 5-67). This window is used to save the selected analog channels to an information file for future viewing.

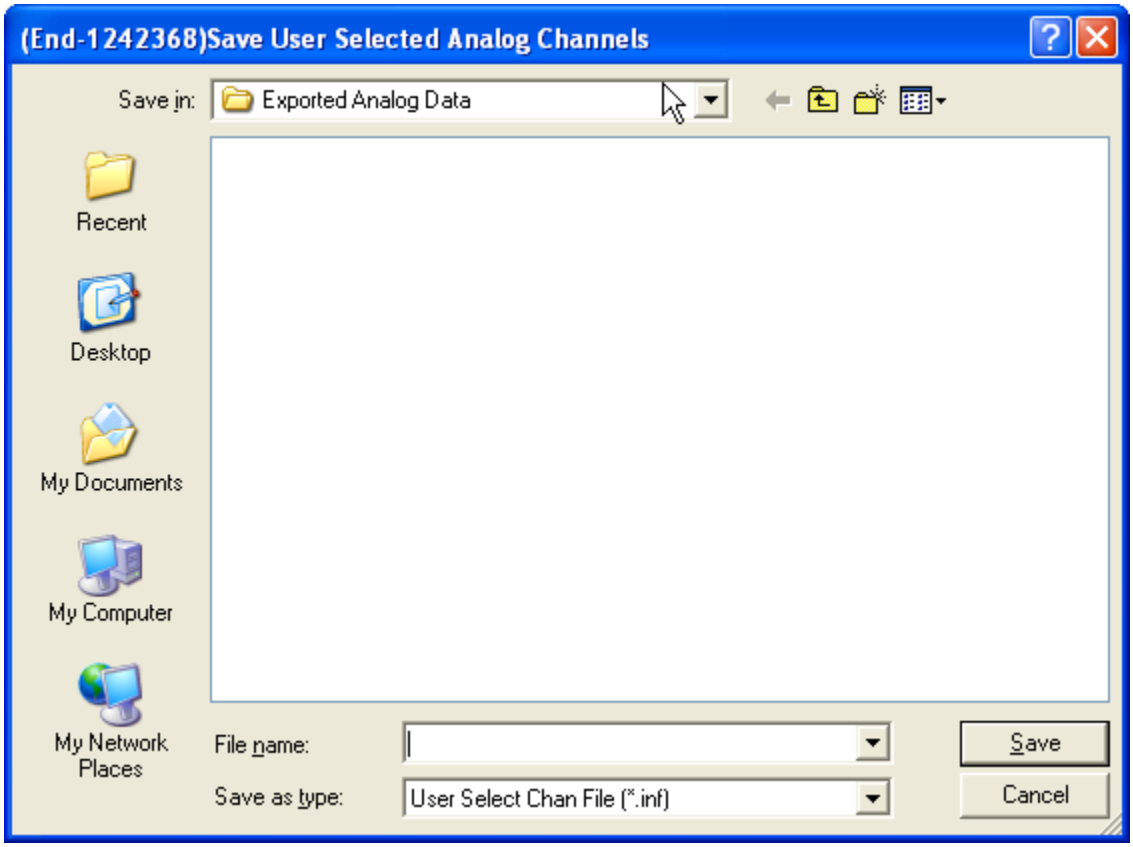


Figure 5-67 Save User Selected Analog Channels

- **☑ Display these Digital Points Only**
  This checkbox enables the GSP to display the digital points listed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Open: Open:
    This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-68). This window is used to select a previously saved selected digital channels information file.

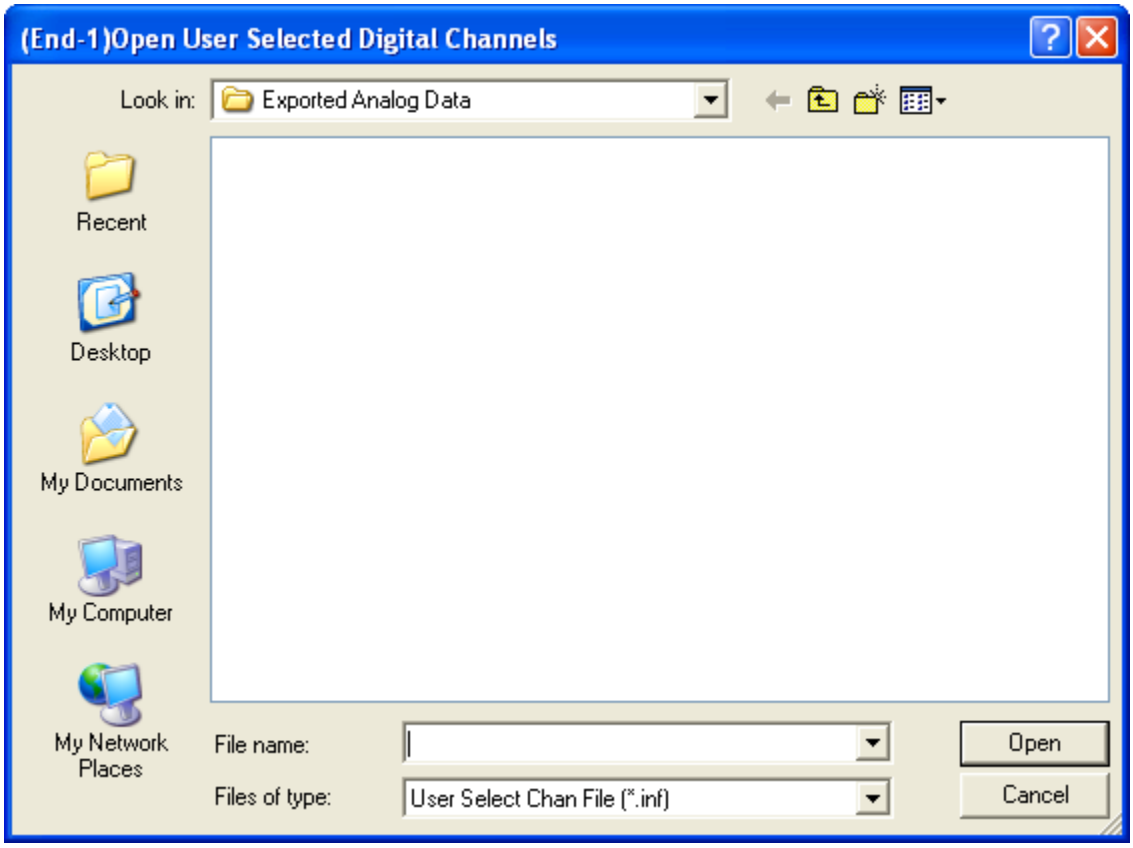


Figure 5-68 Open User Selected Digital Channels Window

- Save: This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-69). This window is used to save the selected digital channels to an information file for future viewing.

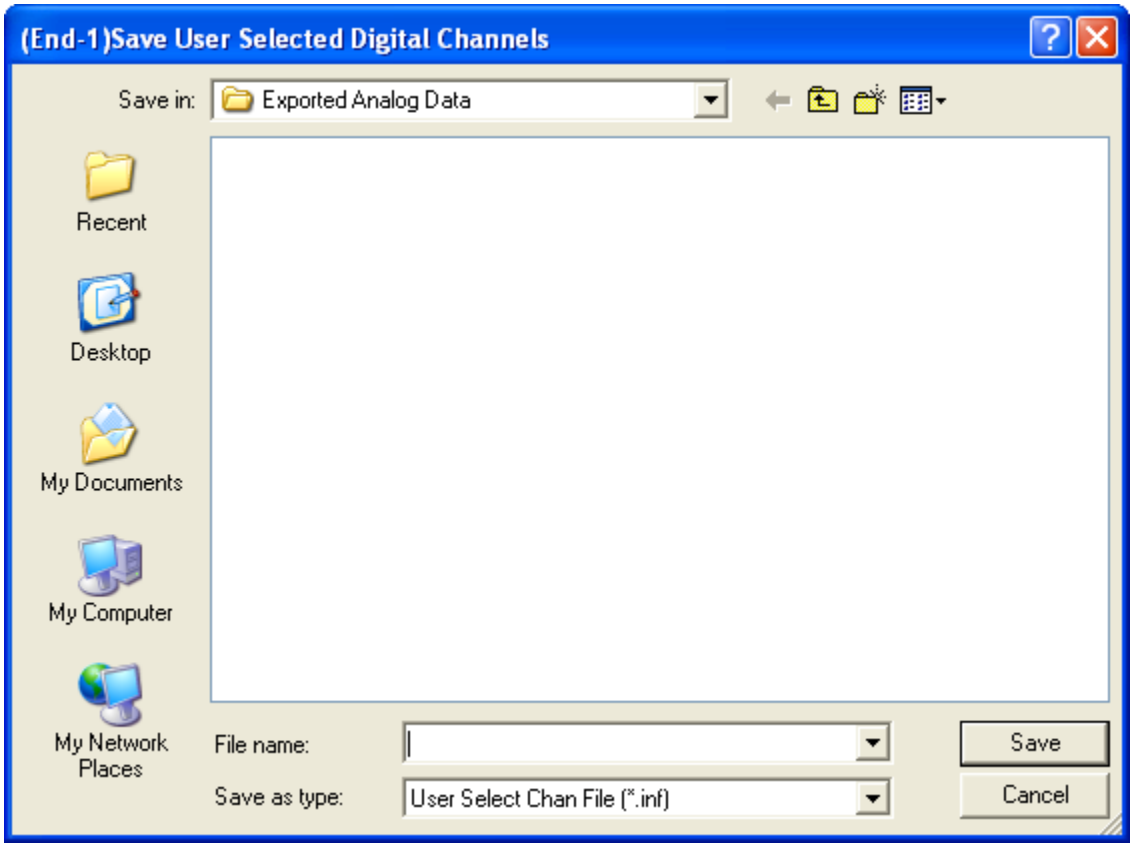


Figure 5-69 Save User Selected Digital Channels Window

- Select: Select
  This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-70). This window is used to select the digital event or analog trigger inputs to be displayed.

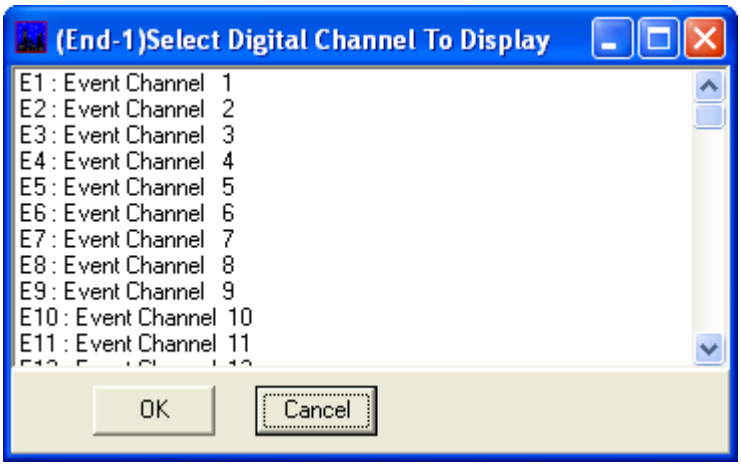


Figure 5-70 Select Digital Channel To Display Window

- OK **OK**
  This button acknowledges the selections made on the ***User Channel Select*** window and displays these selected channels.

- Cancel **Cancel**
  This button cancels the selections made on the ***User Channel Select*** window and returns to the previous display.

The following supporting drop-down menus are available on the Quick Formatting Panel for the User Select format (Figure 5-71).

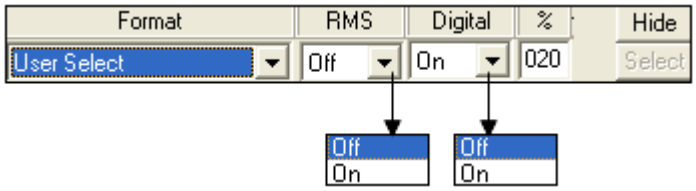


Figure 5-71 Quick Formatting Panel – User Select

- **RMS**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- **Digital**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

  Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order in which it became abnormal.

  When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- **% (Percent)**
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- Hide **Hide**
  This button (Figure 5-71) is used to remove the Quick Formatting Panel from the GSP window. When hidden, the Quick Formatting Panel can be restored by clicking ***Show Quick Formatting Panel*** on the ***File*** menu.

- Select **Select**
  This button is used to display the ***User Channel Select*** window (Figure 5-70).

5.7.3 Group Format

This selection is used to perform analysis of pre-assigned Line Group Records (Section 4.3). When this format is selected, the following supporting drop-down menus are displayed on the Quick Formatting Panel (Figure 5-72).

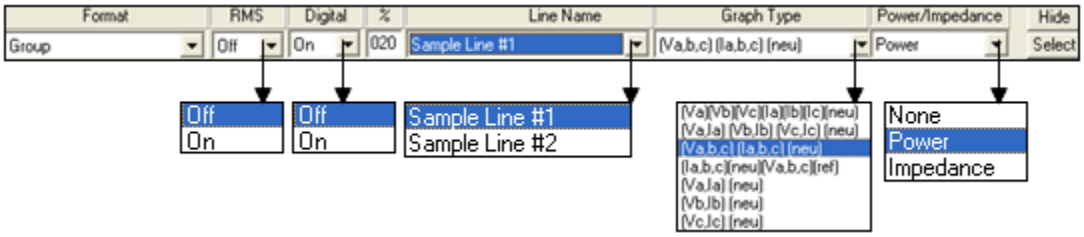


Figure 5-72 Quick Formatting Panel – Group

- **RMS**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- **Digital**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

  Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order in which it became abnormal.

  When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- **% (Percent)**
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the Digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- **Line Name**
  This drop-down displays the list of line groups entered into the Line Group Record (Section 4.3 and Section 5.1.1)

- **Graph Type**
  This drop-down displays the list of panel channel assignments. This list displays

different arrangements of the three-phase inputs. The inputs grouped within parenthesis are displayed in separate waveform panels. The waveform panels are displayed from top to bottom in the order they are shown in the list.

- (Va)(Vb)(Vc)(Ia)(Ib)(Ic)(neu):
  This selection displays A-phase voltage in the first panel, B-phase voltage in the second panel, C-phase voltage in the third panel, A-phase current in the fourth panel, B-phase current in the fifth panel, C-phase current in the sixth panel, and the neutral current in the seventh panel.

- (Va,Ia)(Vb,Ib)(Vc,Ic)(neu):
  This selection displays the voltage and current inputs for A-phase in the first panel, the voltage and current inputs for B-phase in the second panel, the voltage and current inputs for C-phase in the third panel, and the neutral current input in the fourth panel.

- (Va,b,c)(Ia,b,c)(neu):
  This selection displays the three-phase voltage inputs in the first panel, the three-phase current inputs in the second panel, and the neutral current input in the third panel.

- (Ia,b,c)(neu)(Va,b,c)(ref):
  This selection displays the three-phase current inputs in the first panel, the neutral current input in the second panel, the three-phase voltage inputs in the third panel, and the reference channel input in the fourth panel.

- (Va,Ia)(neu):
  This selection displays the voltage and current inputs for the A-phase in the first panel and the neutral current input in the second panel.

- (Vb,Ib)(neu):
  This selection displays the voltage and current inputs for the B-phase in the first panel and the neutral current input in the second panel.

- (Vc,Ic)(neu):
  This selection displays the voltage and current inputs for the C-phase in the first panel and the neutral current input in the second panel.

- **Power/Impedance**
  This drop-down menu displays None, Power, or Impedance.

  - None:
    When this is selected, the Power/Impedance waveform panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

  - Power:
    When this is selected, the Power/Impedance waveform panel is displayed.

This panel displays Apparent Power, Active Power, Reactive Power, and Power Factor values that are calculated from the analog data from the selected ***Line Name***.

- Impedance:
  When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Phase A, Phase B, and Phase C impedance values that are calculated from the analog data from the selected ***Line Name***.

- Hide **Hide**
  This button (Figure 5-72) is used to remove the Quick Formatting Panel from the GSP window. When hidden, the Quick Formatting Panel can be restored by clicking ***Show Quick Formatting Panel*** on the ***File*** menu.

- Select **Select**
  This button displays the ***Sequence Plot Graph Parameters*** window (Figure 5-73).

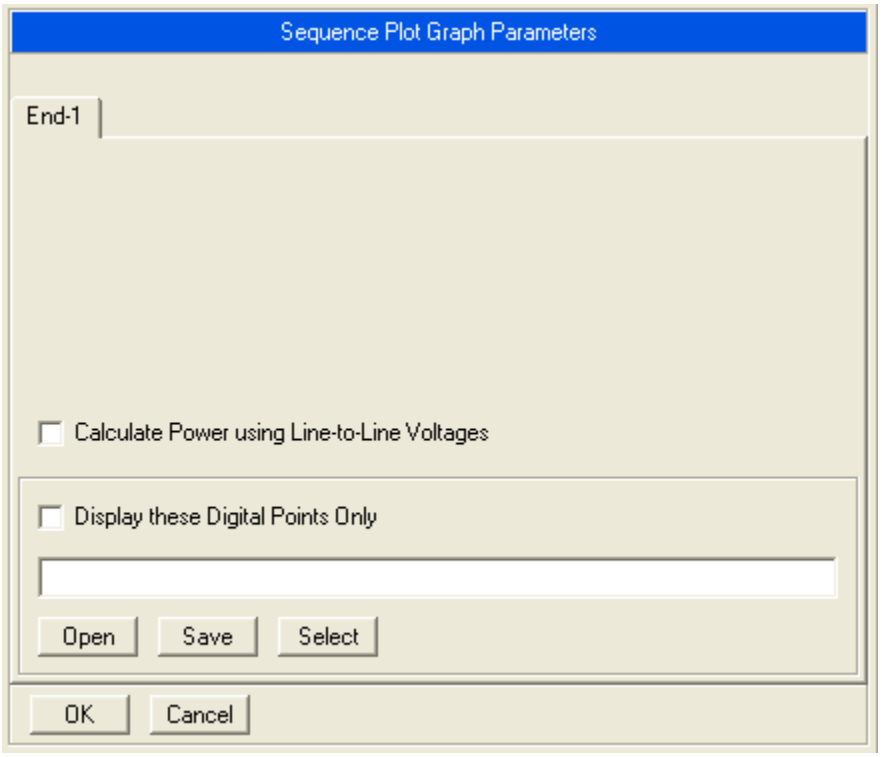


Figure 5-73 Sequence Plot Graph Parameters

This window is used to select the digital event or analog trigger inputs to be displayed.

- ☑ Calculate Power using Line-to-Line Voltages:
  This checkbox enables the GSP to calculate the power and impedance values using voltage inputs from a delta-connected transformer.

- ☑ Display these Digital Points Only:
  This checkbox enables the GSP to display the digital points listed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Open Open
    This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-74). This window is used to select a previously saved selected digital channel information file.

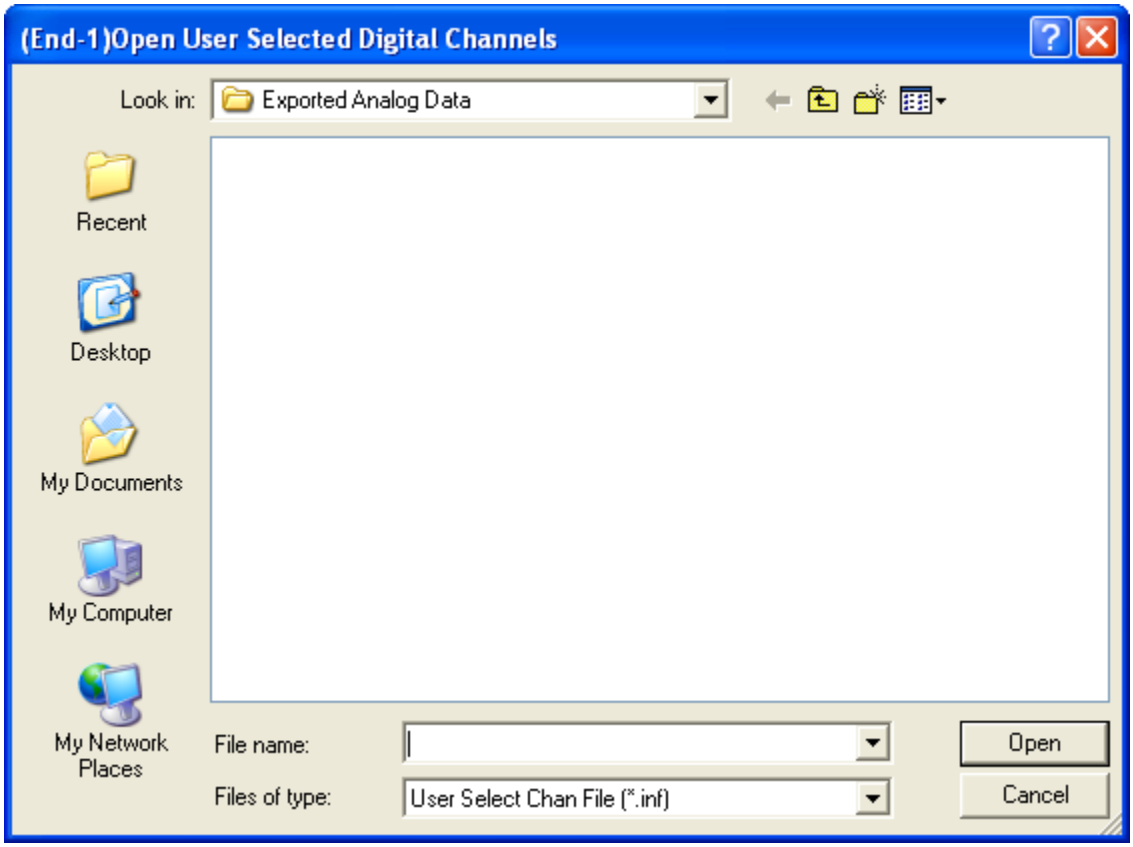


Figure 5-74 Open User Selected Digital Channels Window

  - Save Save
    This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-75). This window is used to save the selected digital channels to an information file for future viewing.

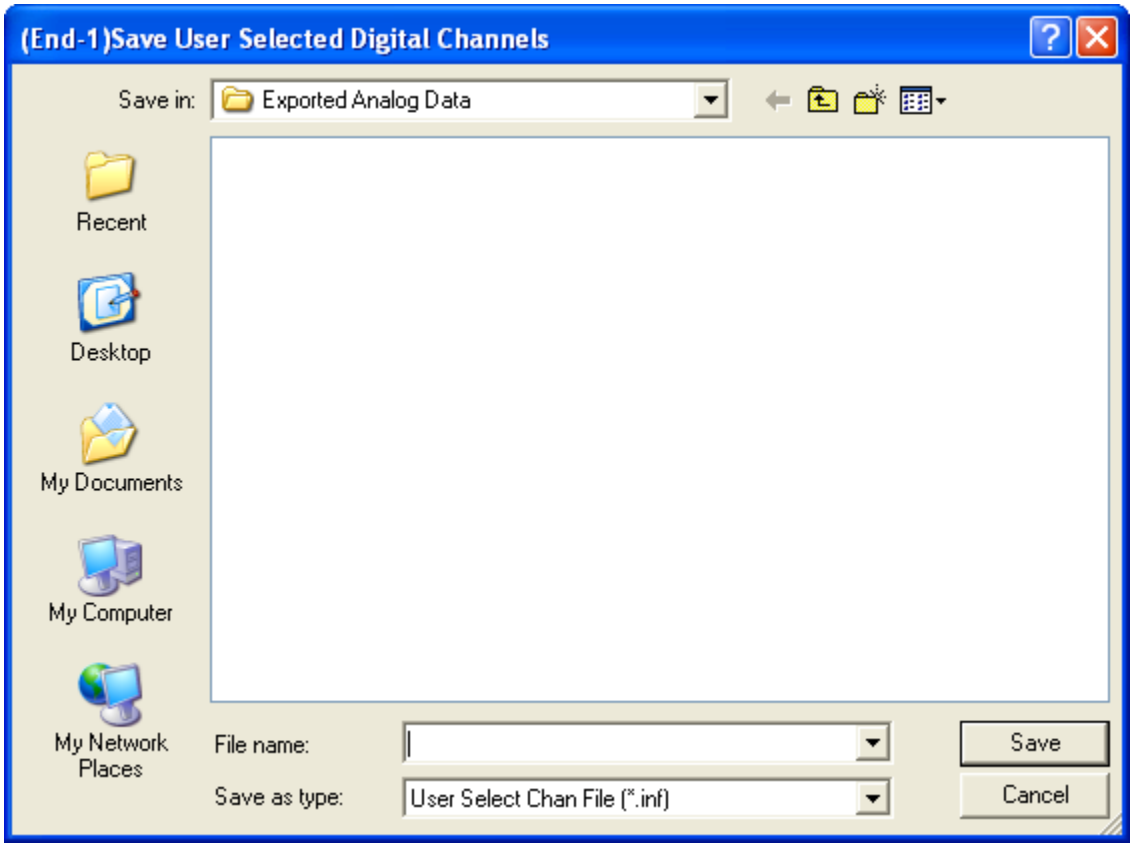


Figure 5-75 Open User Selected Digital Channels Window

- Select Select
  This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-76). This window is used to select the digital event or analog trigger inputs to be displayed.

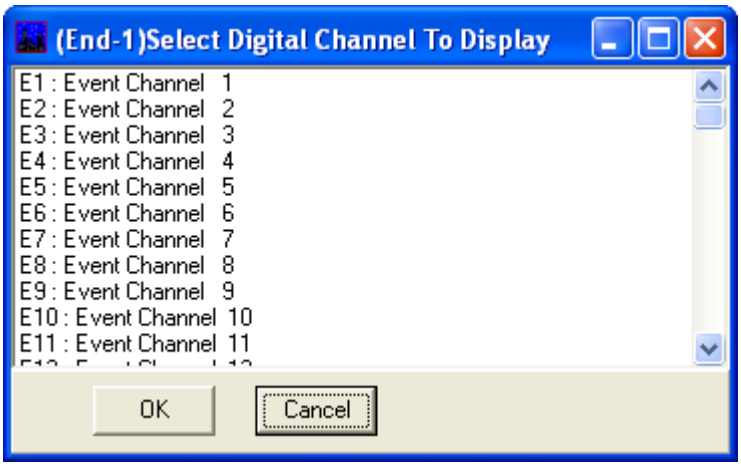


Figure 5-76 Select Digital Channel To Display Window

- OK: OK:
  This button acknowledges the selections made on the ***User Channel Select*** window and displays these selected channels.

- Cancel: Cancel:
  This button cancels the selections made on the ***User Channel Select*** window and returns to the previous display.

5.7.4 Three Phases Format

When this format is selected, the ***Three Phases Channel Select*** window displays (Figure 5-77).

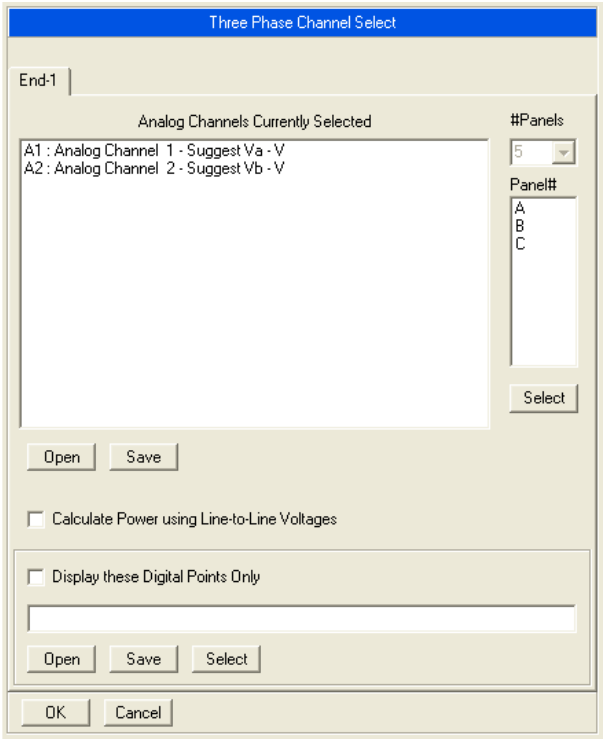


Figure 5-77 Three Phase Channel Select Window

- **#Panels (Number of Panels Selection)**
  Waveform panels correspond to the horizontal rows used to display the analog and digital data. This drop-down menu is disabled in three-phase format.

  - Analog Channels Currently Selected:
    This window displays the analog input number and the channel description selected for the highlighted panel number.

  - Panel# (Panel Number):
    This window lists the analog waveform panel by power line phase.

- Select Select:
  This button displays the ***Select Analog Channel(s) for Panel N*** window (Figure 5-78). These windows are used to select the voltage and current input channels for the selected A-phase, B-phase, or C-phase panels. To display this window, click on the panel to be configured and then click this button.

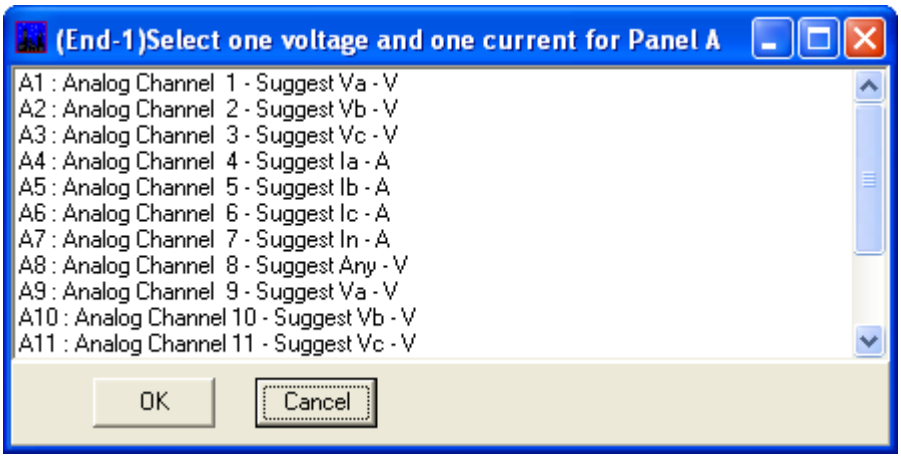


Figure 5-78 Select Analog Channel(s) for Panel N Window

- Open Open:
  This button displays the ***(End-1)Open User Selected Analog Channels*** window (Figure 5-79). This window is used to select a previously saved selected analog channels information file.

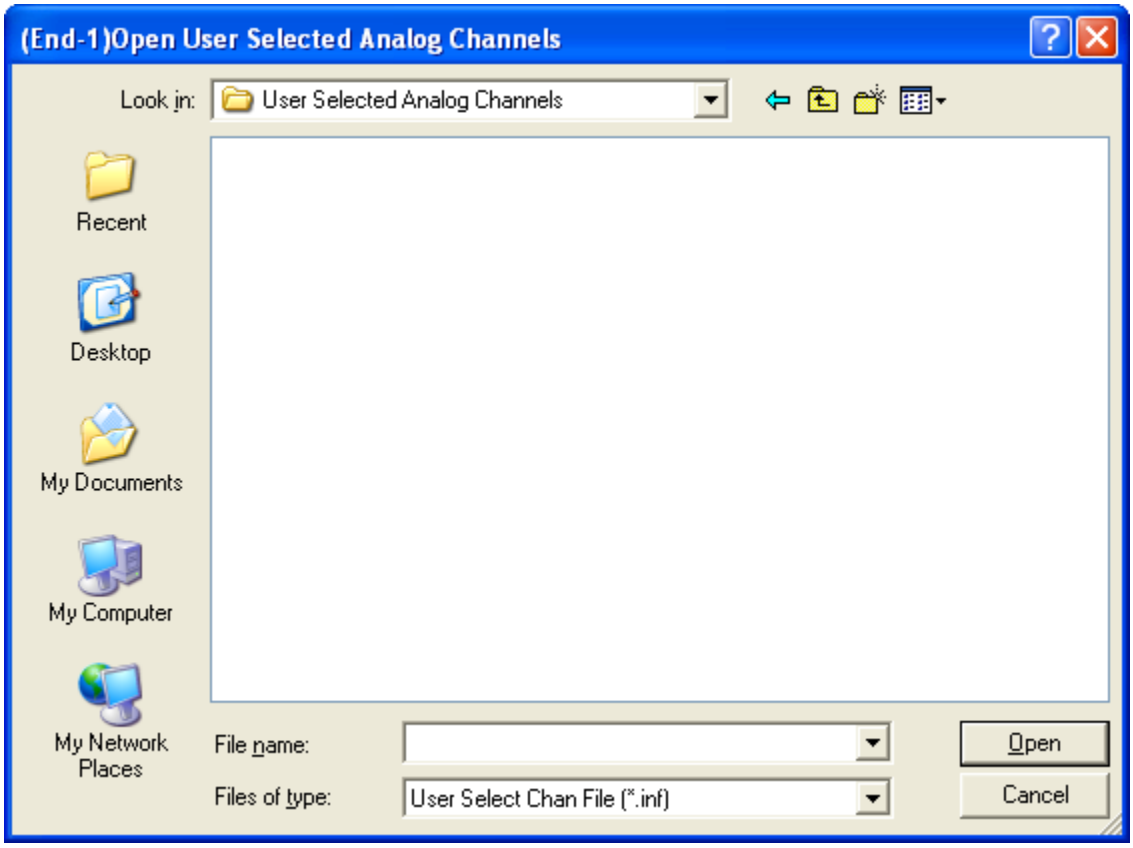


Figure 5-79 Open User Selected Analog Channels

- Save: Save:
  This button displays the ***(End-1)Save User Selected Analog Channels*** window (Figure 5-80). This window is used to save the selected analog channels to an information file for future viewing.

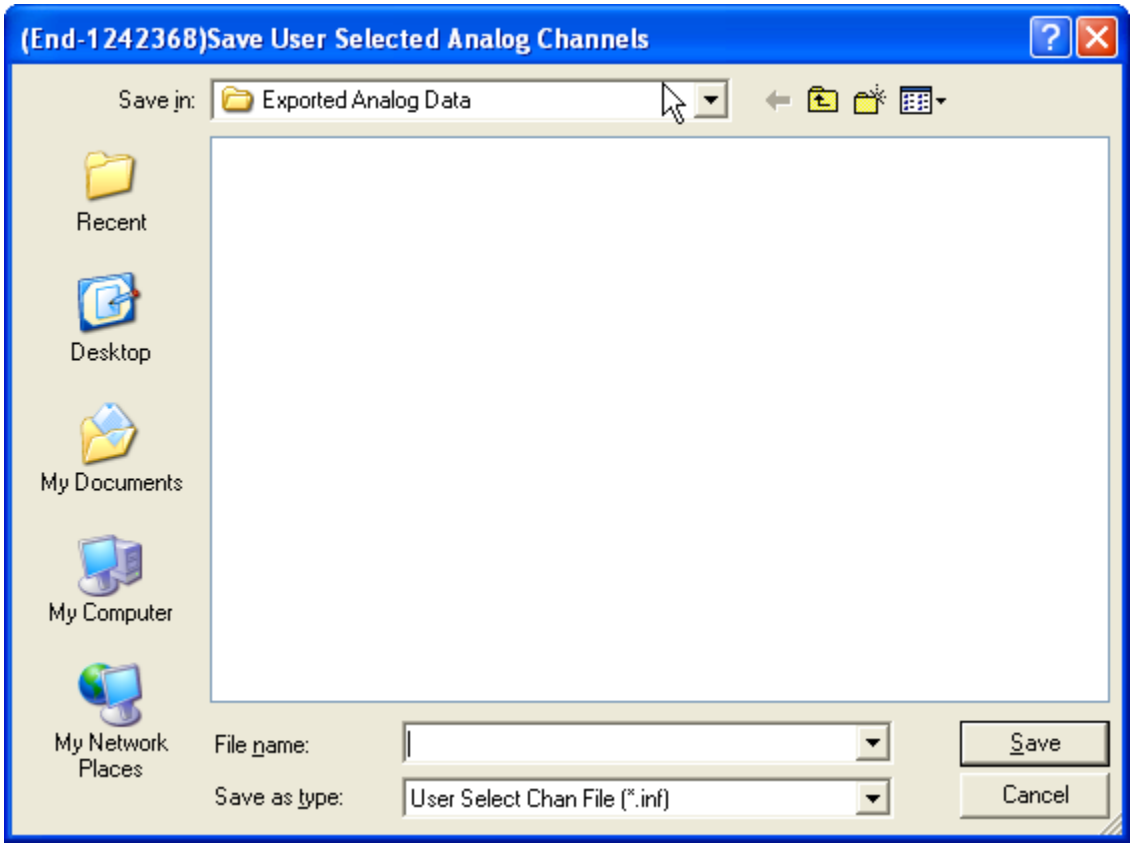


Figure 5-80 Save User Selected Analog Channels

- ☑ Calculate Power using Line-to-Line Voltages:
  This checkbox enables the GSP to calculate the power and impedance values using voltage inputs from a delta-connected transformer.

- **☑ Display these Digital Points Only**
  This checkbox enables the GSP to display the digital points listed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Open: Open:
    This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-81). This window is used to select a previously saved selected digital channel information file.

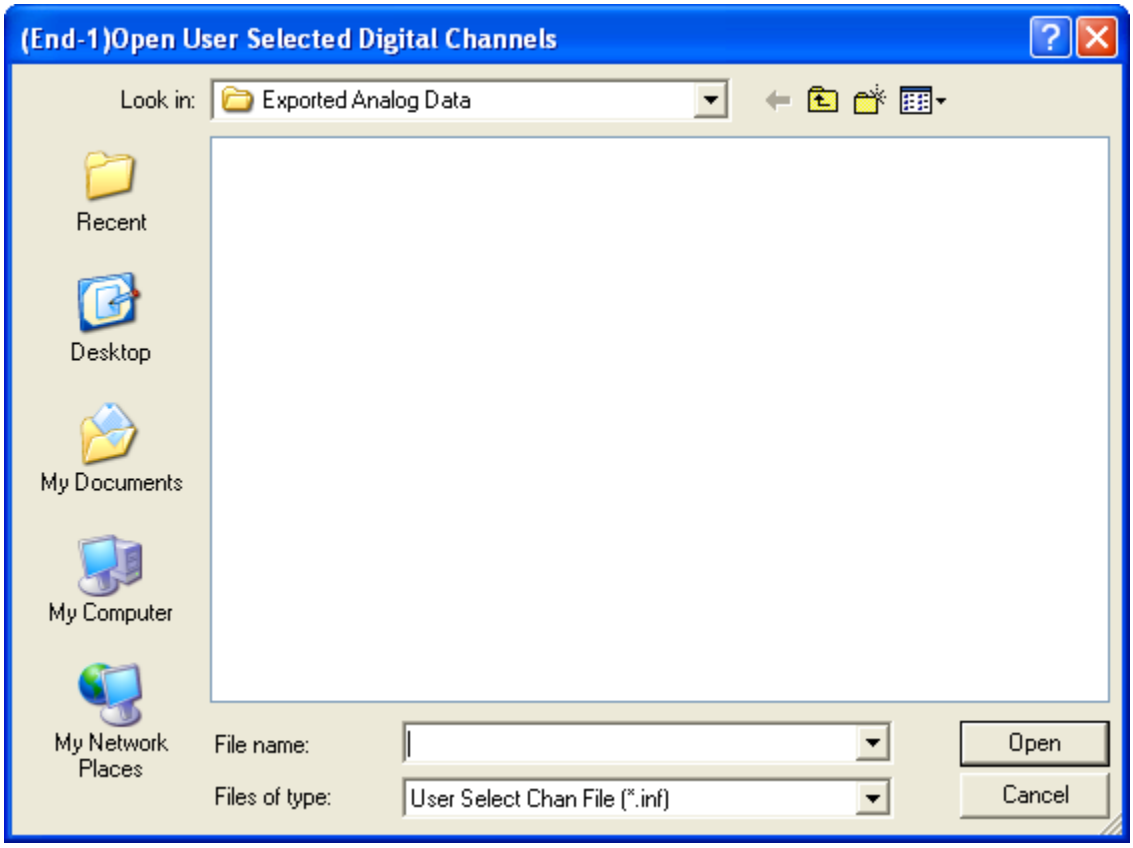


Figure 5-81 Open User Selected Digital Channels Window

- Save: This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-82). This window is used to save the selected digital channels to an information file for future viewing.

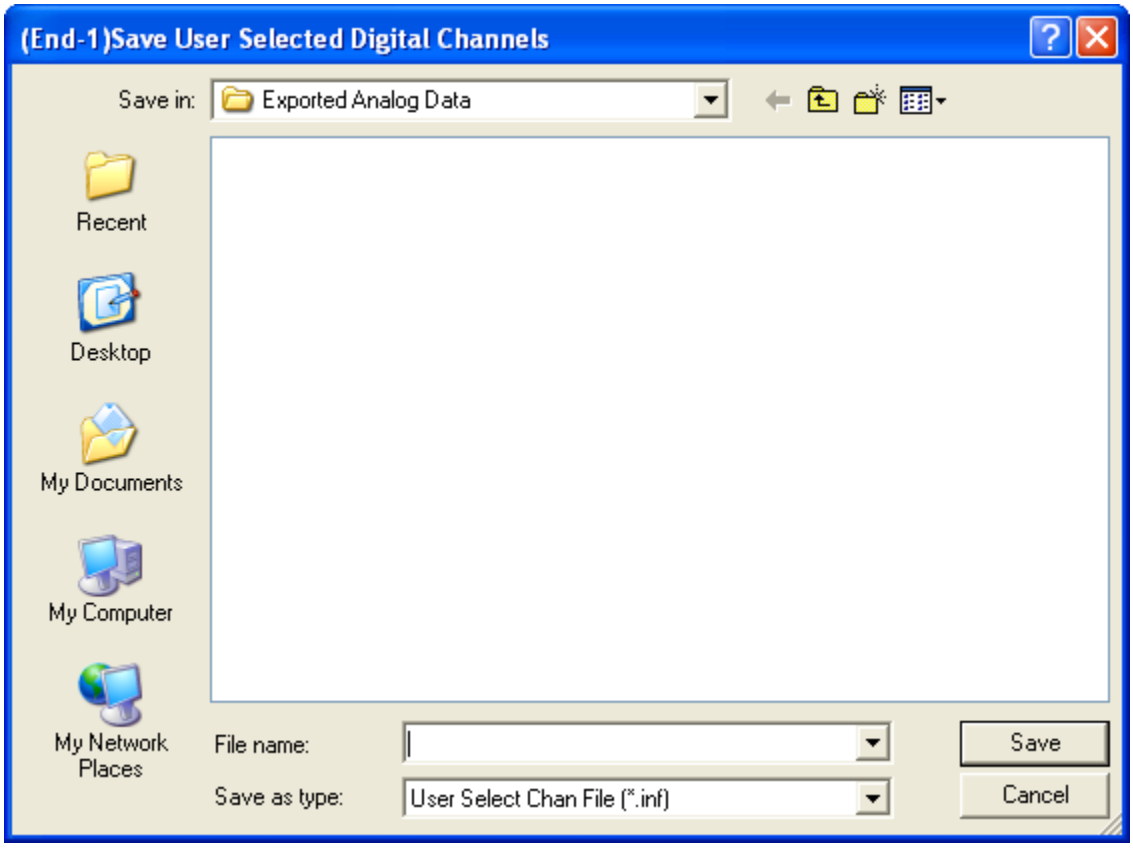


Figure 5-82 Open User Selected Digital Channels Window

- Select: Select
  This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-83). This window is used to select the digital event or analog trigger inputs to be displayed.

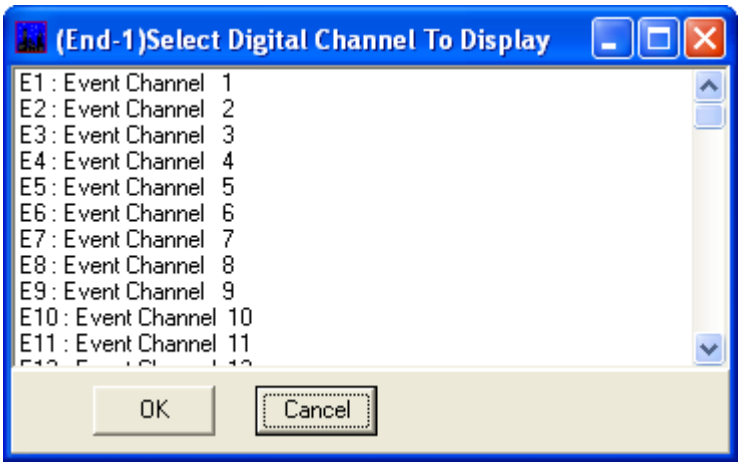


Figure 5-83 Select Digital Channel To Display Window

- **OK**
  This button acknowledges the selections made on the ***User Channel Select*** window and displays these selected channels.

- **Cancel**
  This button cancels the selections made on the ***User Channel Select*** window and returns to the previous display.

The following supporting drop-down menus are available on the Quick Formatting Panel for the Three Phases format (Figure 5-84).

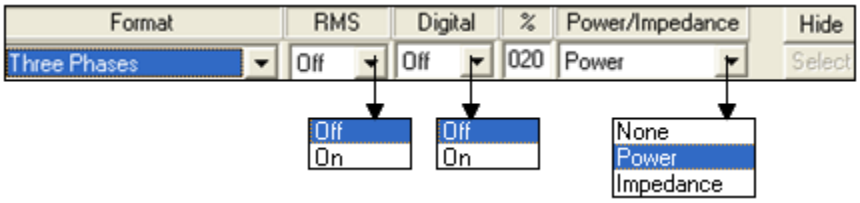


Figure 5-84 Quick Formatting Panel – Three Phases

- **RMS**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- **Digital**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

  Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order in which it became abnormal.

  When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- **% (Percent)**
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- **Power/Impedance**
  This drop-down menu displays None, Power, or Impedance.

- None:
  When this is selected, the Power/Impedance waveform panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- Power:
  When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Apparent Power, Active Power, Reactive Power, and Power Factor values that are calculated using analog data from the selected ***Line Name***.

- Impedance:
  When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Phase ***A***, Phase ***B***, and Phase ***C*** impedance values that are calculated using analog data from the selected ***Line Name***.

- Hide **Hide**
  This button (Figure 5-84) is used to remove the Quick Formatting Panel from the GSP window. When hidden, the Quick Formatting Panel can be restored by clicking ***Show Quick Formatting Panel*** on the ***File*** menu.

- Select **Select**
  This button displays the ***Three Phases Channel Select*** window (Figure 5-77).

5.7.5 Single Phase Format

When this format is selected, the ***Single Phase Channel Select*** window displays (Figure 5-85).

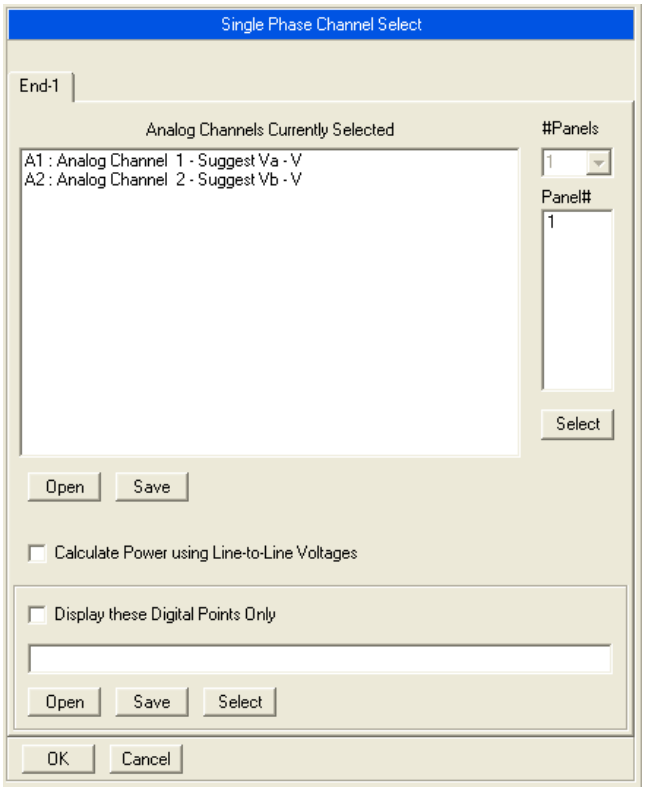


Figure 5-85 Single Phase Channel Select Window

- **#Panels (Number of Panels Selection)**
  Waveform panels correspond to the horizontal rows used to display the analog and digital data. This drop-down menu is disabled in single-phase format.

  - Analog Channels Currently Selected:
    This window displays the analog input number and the channel description selected for the highlighted panel number.

  - Panel# (Panel Number):
    This window lists the analog waveform panel by power line phase.

  - Select Select:
    This button displays the ***Select Analog Channel(s) for Panel N*** window (Figure 5-86). This window is used to select the voltage and current input channels for the selected phase panel. To display this window, click on the panel to be configured and then click this button.

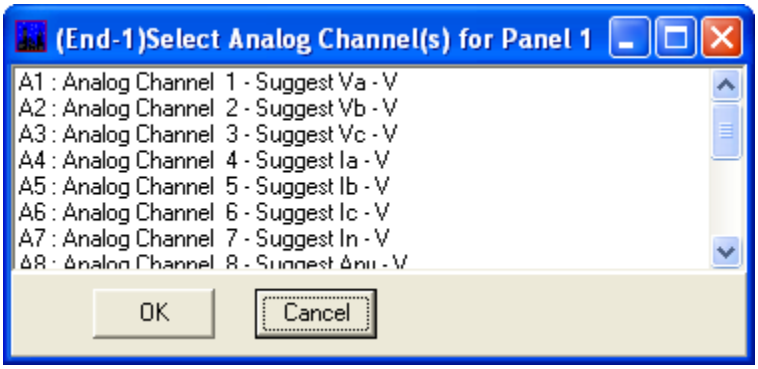


Figure 5-86 Select Analog Channel(s) for Panel N Window

- Open: This button displays the ***(End-1)Open User Selected Analog Channels*** window (Figure 5-87). This window is used to select a previously saved selected analog channel information file.

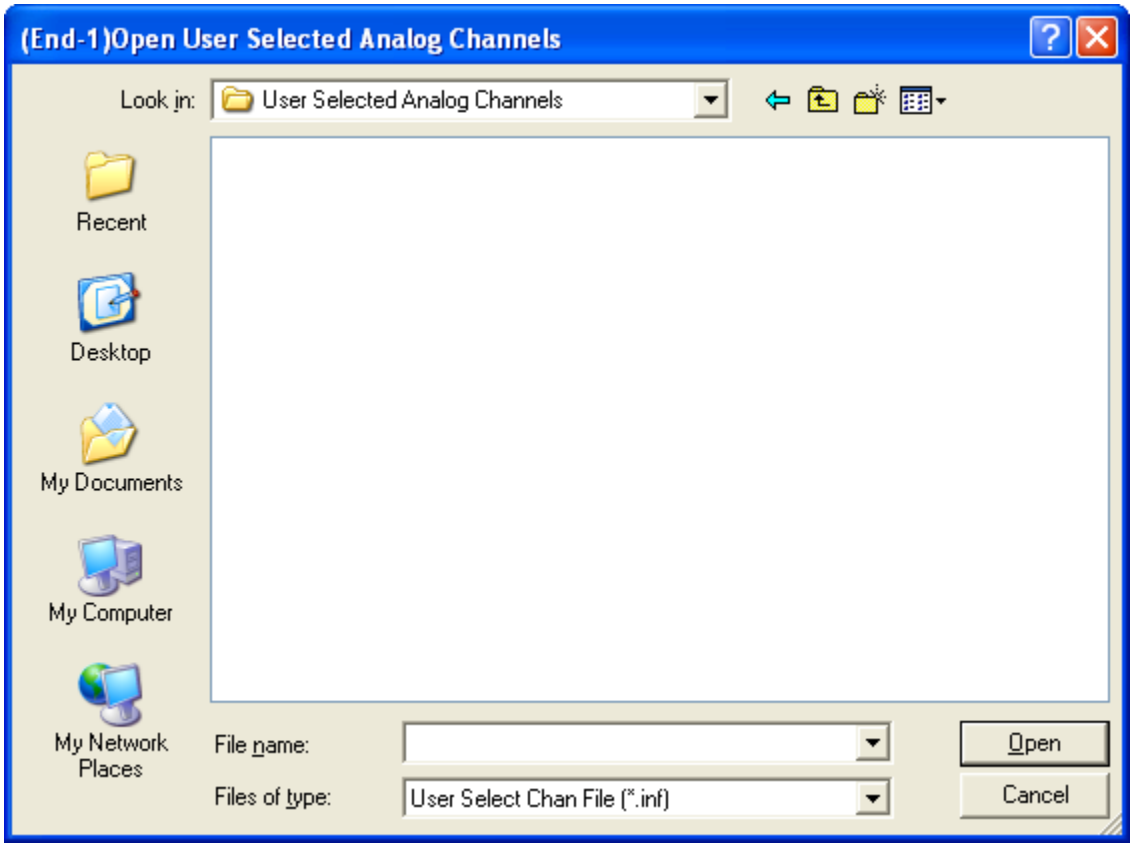


Figure 5-87 Open User Selected Analog Channels

- This button displays the ***(End-1)Save User Selected Analog Channels*** window (Figure 5-88). This window is used to save the selected analog channels to an information file for future viewing.

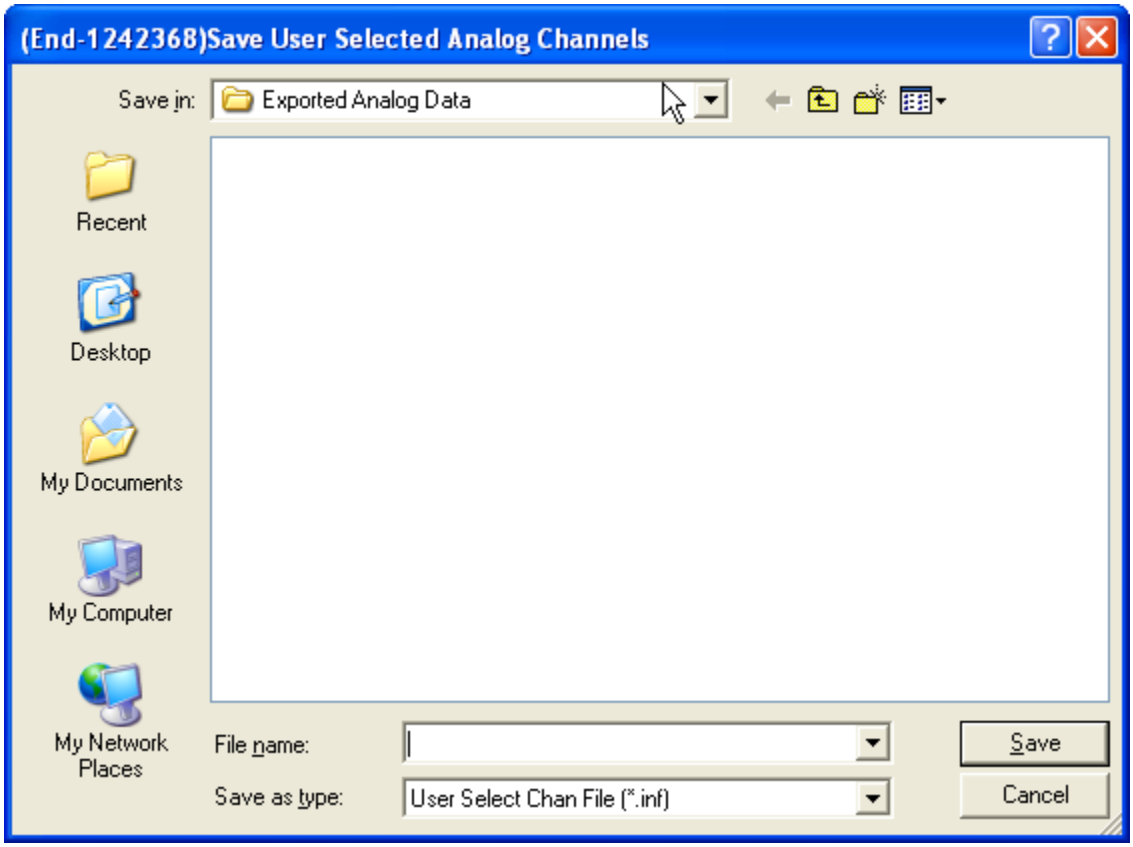


Figure 5-88 Save User Selected Analog Channels

- ☑ Calculate Power using Line-to-Line Voltages:
  This checkbox enables the GSP to calculate the power and impedance values using voltage inputs from a delta-connected transformer.

- **☑ Display these Digital Points Only**
  This checkbox enables the GSP to display the digital points listed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Open: Open:
    This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-89). This window is used to select a previously saved selected digital channel information file.

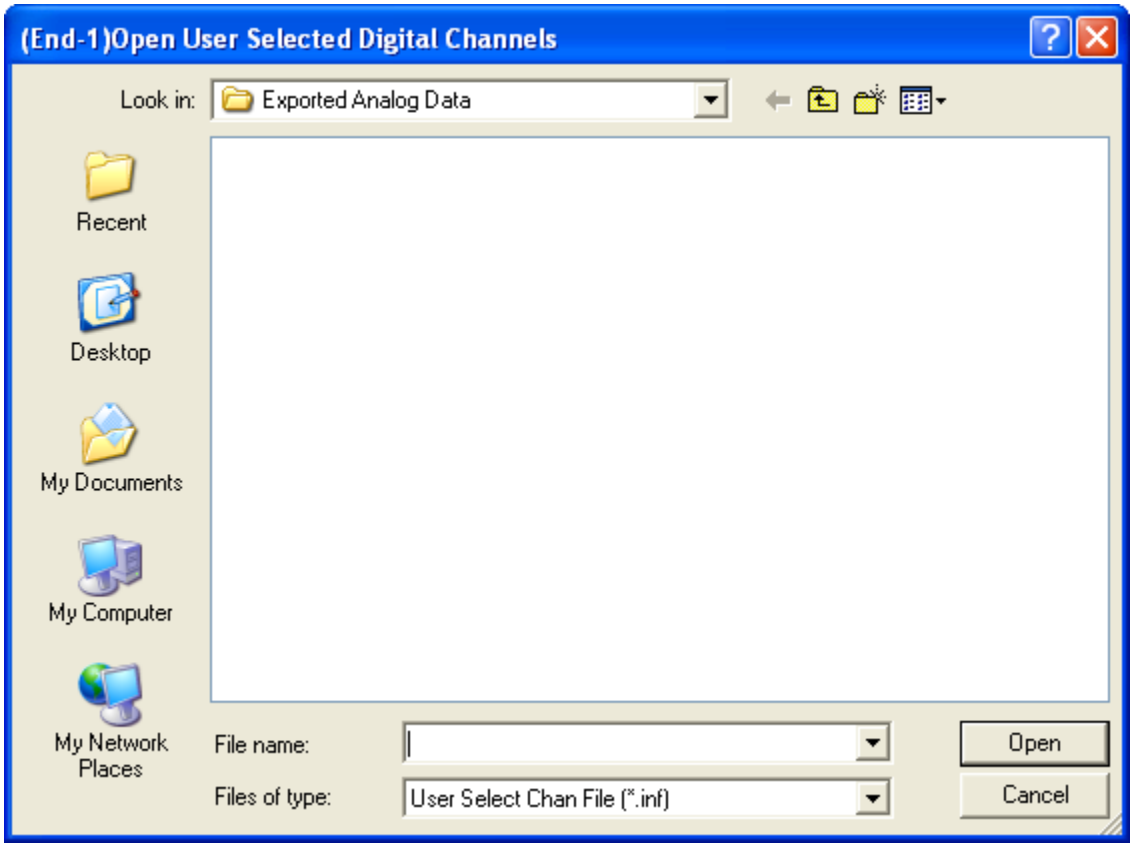


Figure 5-89 Open User Selected Digital Channels Window

- Save: This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-90). This window is used to save the selected digital channels to an information file for future viewing.

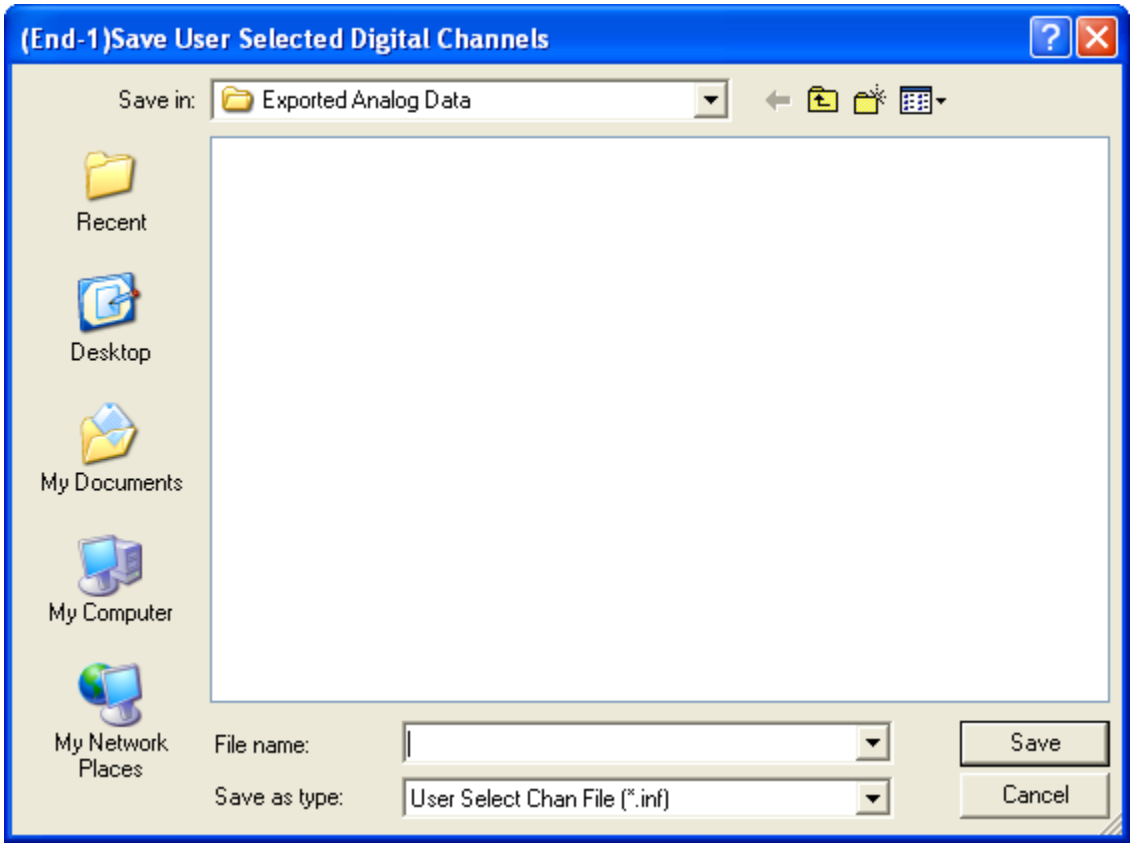


Figure 5-90 Open User Selected Digital Channels Window

- Select: Select
  This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-91). This window is used to select the digital event or analog trigger inputs to be displayed.

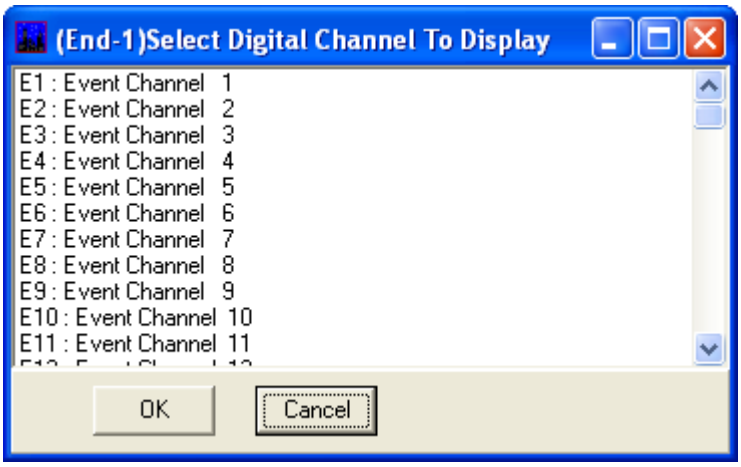


Figure 5-91 Select Digital Channel To Display Window

- OK **OK**
  This button acknowledges the selections made on the ***User Channel Select*** window and displays the selected channels.

- Cancel **Cancel**
  This button cancels the selections made on the ***User Channel Select*** window and returns to the previous display.

The following supporting drop-down menus are available on the Quick Formatting Panel for the ***Single Phase*** format (Figure 5-92).

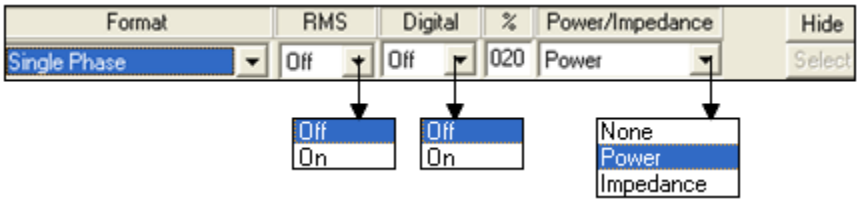


Figure 5-92 Quick Formatting Panel – Single Phase

- **RMS**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- **Digital**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

  Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order in which it became abnormal.

  When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- **% (Percent)**
  This field is used to enter the percentage (5% through 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- **Power/Impedance**
  This drop-down menu displays None, Power, or Impedance.

- None:
  When this is selected, the Power/Impedance waveform panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- Power:
  When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Apparent Power, Active Power, Reactive Power, and Power Factor values that are calculated from the analog data from the selected ***Line Name***.

- Impedance:
  When this is selected, the Power/Impedance waveform panel is displayed. This panel displays the impedance value that is calculated using the analog data from the selected phase.

- Hide **Hide**
  This button (Figure 5-93) is used to remove the Quick Formatting Panel from the GSP window. When hidden, the Quick Formatting Panel can be restored by clicking ***Show Quick Formatting Panel*** on the ***File*** menu.

- Select **Select**
  This button displays the ***Single Phase Channel Select*** window (Figure 5-91).

5.7.6 Generator/Delta Power Format

This selection is used to perform analysis of pre-assigned Line Group Records (Section 4.3) that are generator or wye-delta inputs to the DME system. The following supporting drop-down menus are available on the Quick Formatting Panel for the ***Generator/Delta Power*** format (Figure 5-93).

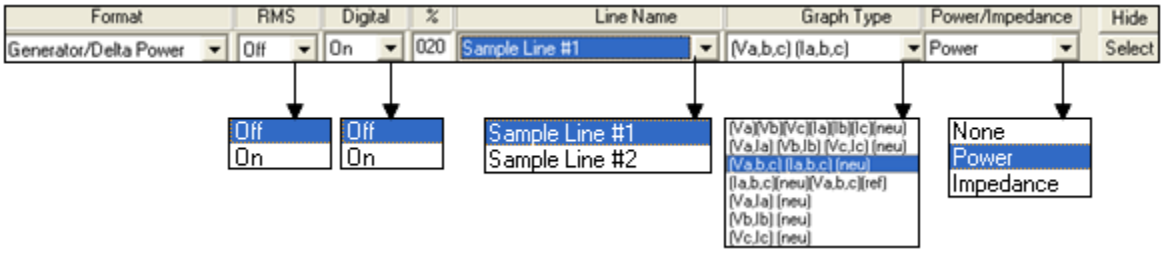


Figure 5-93 Quick Formatting Panel – Generator/Delta Power

- **RMS**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- **Digital**
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether

digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order in which it became abnormal.

When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- **% (Percent)**
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- **Power/Impedance**
  This drop-down menu displays None, Power, or Impedance.

  - None:
    When this is selected, the Power/Impedance waveform panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

  - Power:
    When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Apparent Power, Active Power, Reactive Power, and Power Factor values that are calculated from the analog data from the selected ***Line Name***.

  - Impedance:
    When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Phase ***A***, Phase ***B***, and Phase ***C*** impedance values that are calculated from the analog data from the selected ***Line Name***.

- **Line Name**
  This drop-down displays the list of line groups entered into the Line Group Record (Section 4.3 and Section 5.1.1)

- **Graph Type**
  This drop-down displays the list of panel channel assignments. This list displays different arrangements of the three-phase inputs. The inputs grouped within parenthesis are displayed in separate waveform panels. The waveform panels are displayed from top to bottom in the order they are shown in the list.

  - (Va)(Vb)(Vc)(Ia)(Ib)(Ic):
    This selection displays A-phase voltage in the first panel, B-phase voltage in the second panel, C-phase voltage in the third panel, A-phase current in

the fourth panel, B-phase current in the fifth panel, and the C-phase current in the sixth panel.

- (Va,Ia)(Vb,Ib)(Vc,Ic):
  This selection displays the voltage and current inputs for A-phase in the first panel, the voltage and current inputs for B-phase in the second panel, and the voltage and current inputs for C-phase in the third panel.

- (Va,b,c)(Ia,b,c):
  This selection displays the three-phase voltage inputs in the first panel and the three-phase current inputs in the second panel.

- Hide **Hide**
  This button (Figure 5-93) is used to remove the Quick Formatting Panel from the GSP window. When hidden, the Quick Formatting Panel can be restored by clicking ***Show Quick Formatting Panel*** on the ***File*** menu.

- Select **Select**
  This button displays the ***Sequence Plot Graph Parameters*** window (Figure 5-94).

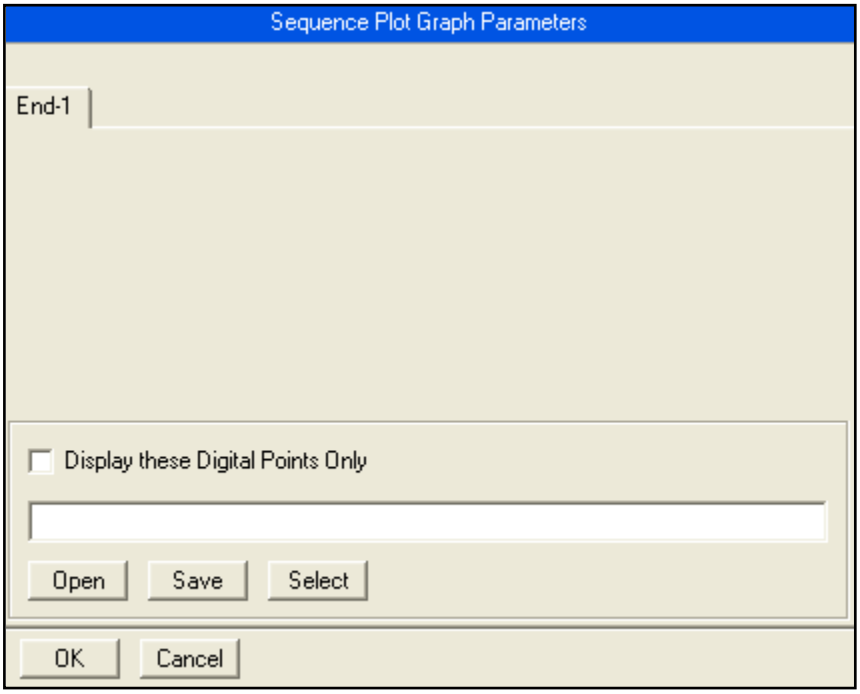


Figure 5-94 Sequence Plot Graph Parameters

This window is used to select the digital event or analog trigger inputs to be displayed.

- ☑ Display these Digital Points Only:
  This checkbox enables the GSP to display the digital points listed in the

Display these Digital Points Only field. Digital points can be typed into this field or inserted by using the ***Select*** button.

- Open Open
  This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-95). This window is used to select a previously saved selected digital channel information file.

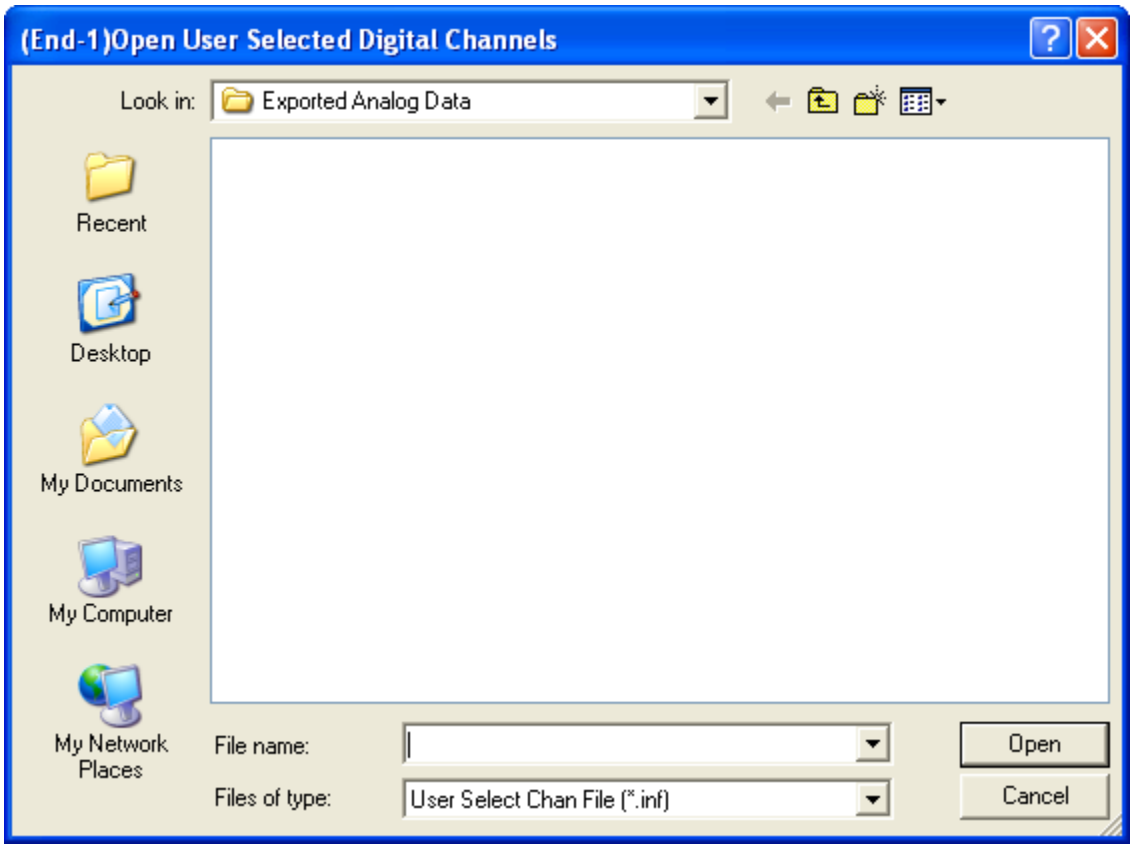


Figure 5-95 Open User Selected Digital Channels Window

- Save Save
  This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-96). This window is used to save the selected digital channels to an information file for future viewing.

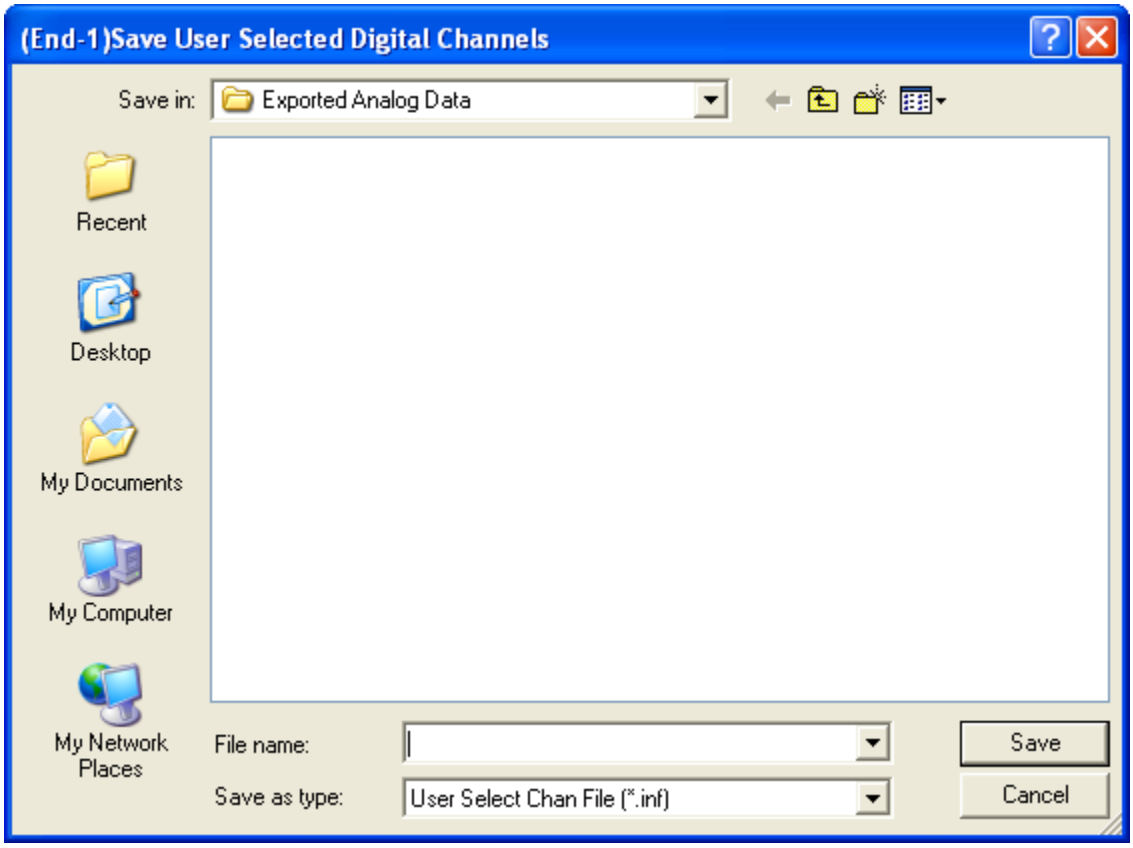


Figure 5-96 Open User Selected Digital Channels Window

- Select Select
  This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-97). This window is used to select the digital event or analog trigger inputs to be displayed.

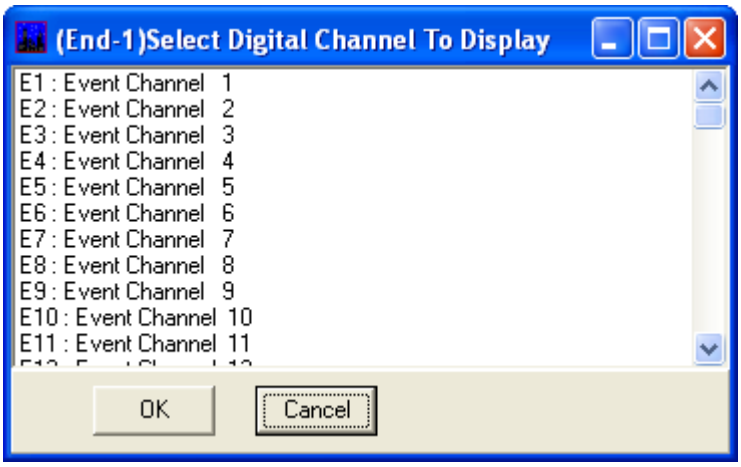


Figure 5-97 Select Digital Channel To Display Window

- OK: OK
  This button acknowledges the selections made on the ***User Channel Select*** window and displays these selected channels.

- Cancel: Cancel
  This button cancels the selections made on the ***User Channel Select*** window and returns to the previous display.

5.8 GSP - GRAPH SETUP SCREEN

This screen is accessed by selecting the ***Graph Setup*** tab on the Graphic Signal Processing window (Figure 5-98). This screen is used to customize the format of the ***Graphic Signal Processing*** screen for analysis. There are six different formats to choose from.

Note: The settings available on this screen are also available on the ***Quick Formatting Panel***.

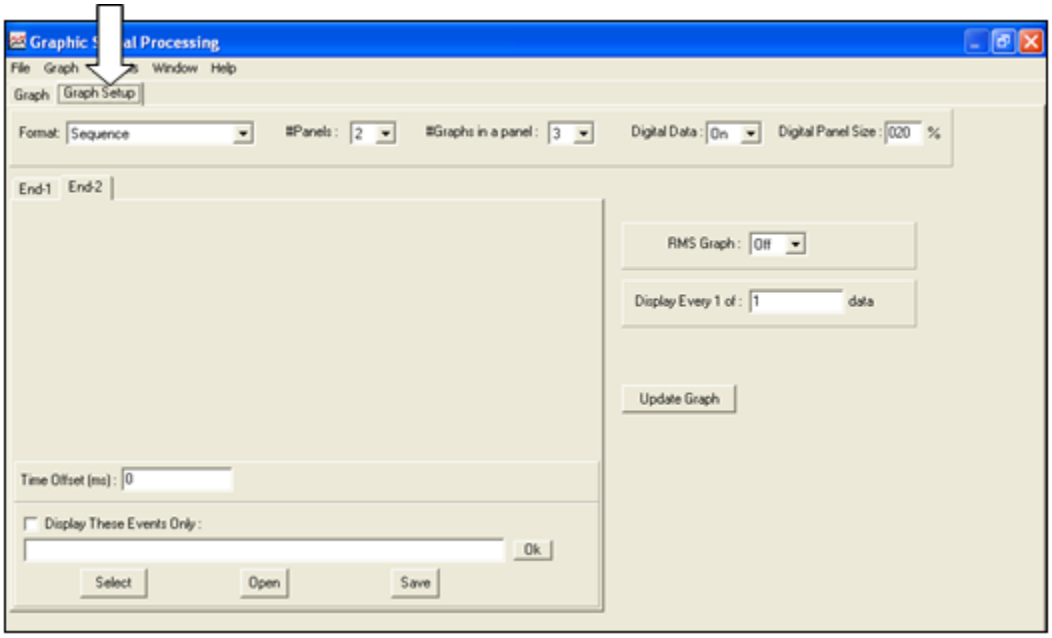


Figure 5-98 Graph Setup Screen

5.8.1 Sequence Format Setup Screen

When this format is selected, the Graphic Signal Processing window displays the analog channels in sequential order from top to bottom. The following drop-down menus are available (Figure 5-99).

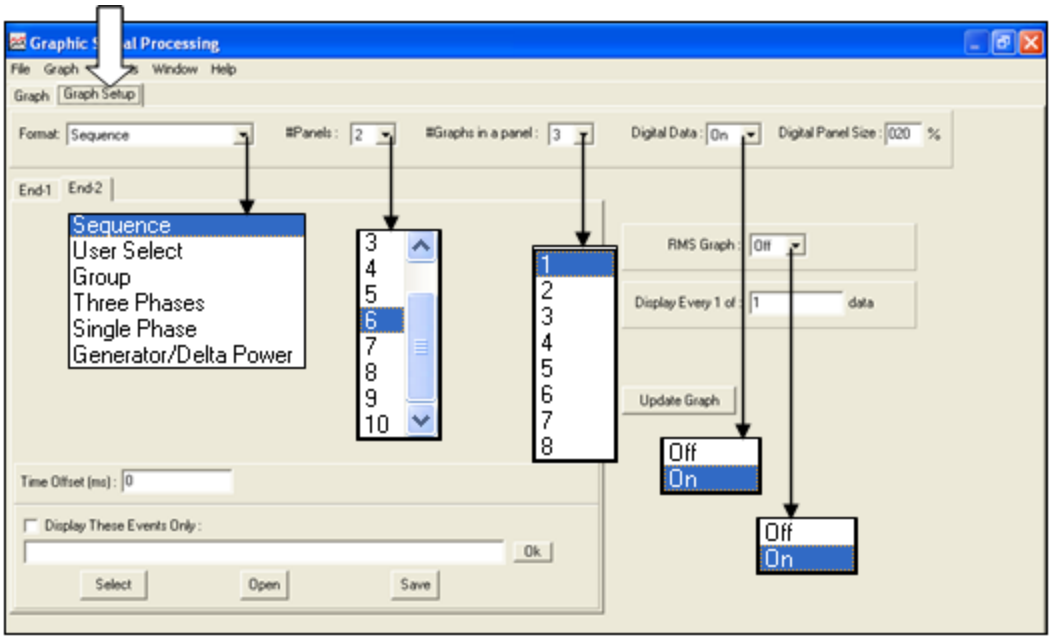


Figure 5-99 Sequence Format

- **End1 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-1 data file.

- **End2 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-2 data file. This tab is displayed only when two data files are open.

    - #Panels (Number of Panels Selection):
      Waveform panels are the horizontal rows used to display the analog and digital data. This drop-down menu allows selection of one to ten display panels.

    - #Graphs in a panel:
      Each of the waveform display panels can display a single waveform or multiple waveforms. This drop-down menu allows selections of one to eight waveforms to be displayed in each panel.

    - Digital Data:
      This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel***

is displayed.

Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order which it became abnormal.

When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- Digital Panel Size *N*%:
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- Time Offset (ms)**:**
  This field only displays when two data files are opened for double-ended analysis. This feature is used to compensate manually for time skew of the End-2 data.

- ☑ Display these Digital Points Only:
  This checkbox enables the GSP to display the digital points listed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Select Select
    This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-100). This window is used to select the digital event or analog trigger inputs to be displayed.

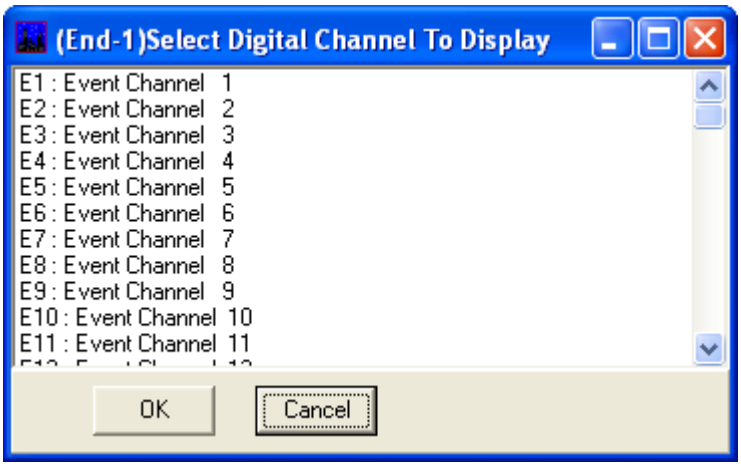


Figure 5-100 Select Digital Channel To Display Window

- Open Open
  This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-101). This window is used to select a previously saved selected digital channels information file.

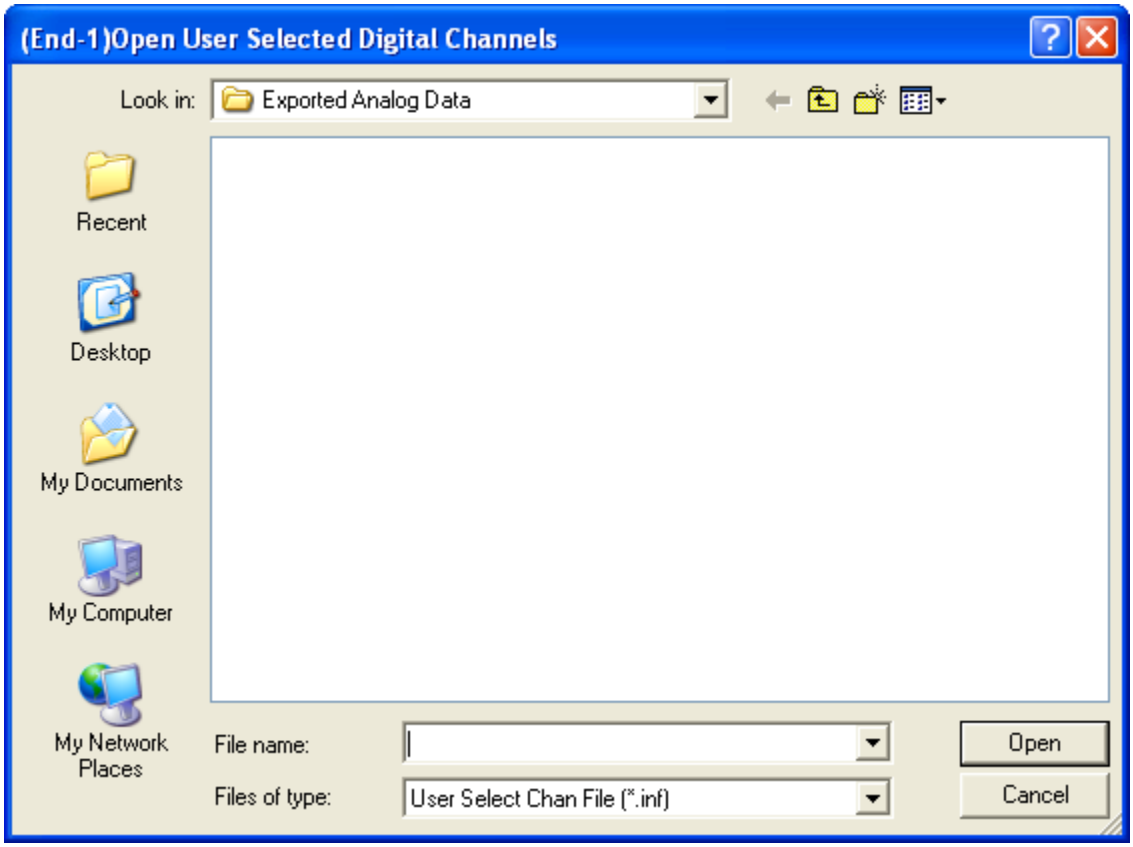


Figure 5-101 Open User Selected Digital Channels Window

- Save Save
  This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-102). This window is used to save the selected digital channels to an information file for future viewing.

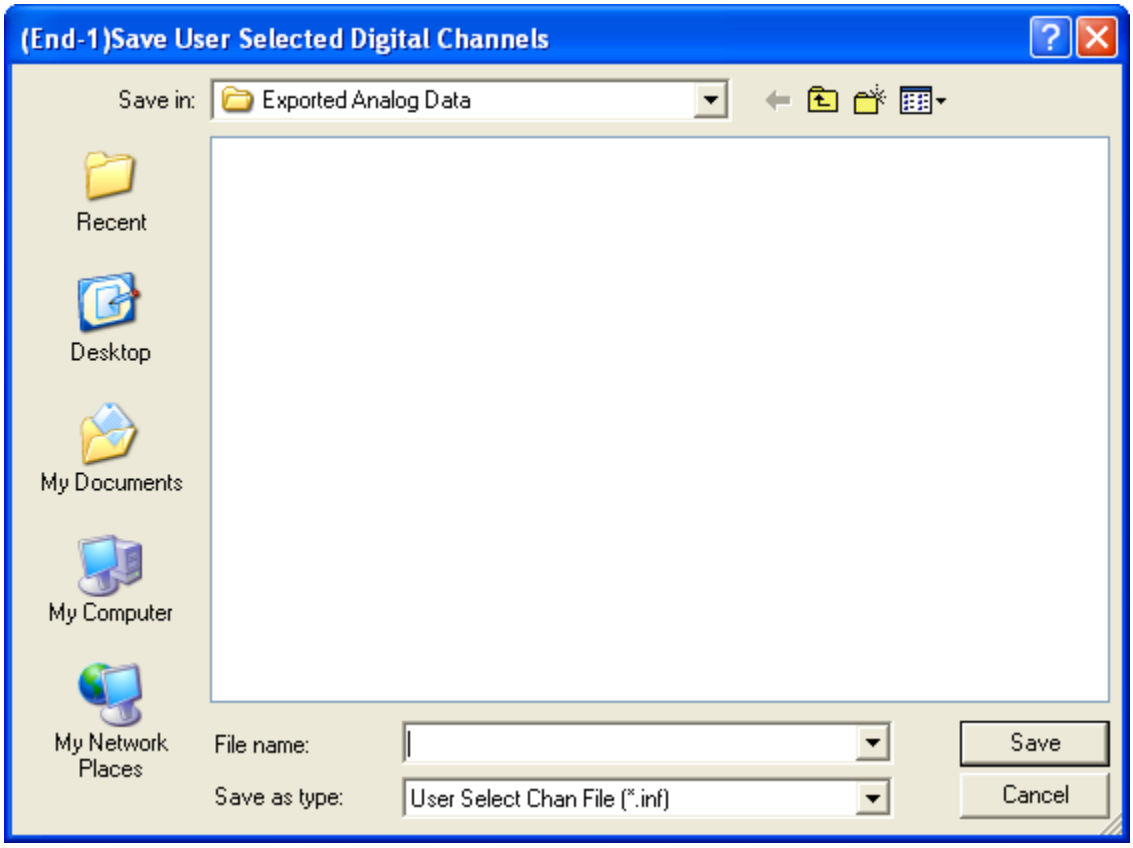


Figure 5-102 Open User Selected Digital Channels Window

- OK Ok
  This button applies the entries in the ***Display This Event(s) Only*** field and returns to the GSP graph screen.

- RMS Graph:
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- Display Every 1 of *N* data:
  This field is used to reduce the resolution of the displayed data. The default setting for this field is ***1*** which displays all data samples. This is only used if opening very large data files on a master station PC with limited resources. Increasing the value in this field will reduce the number of data samples displayed and decrease the amount of time taken to display the data file.

- Update Graph Update Graph:
  This button applies all the selections of the Graph Setup screen and returns to the GSP graph screen.

5.8.2 User Select Format Setup Screen

This window is used to create a user-defined display format. When this format is selected, the following drop-down menus are available (Figure 5-103).

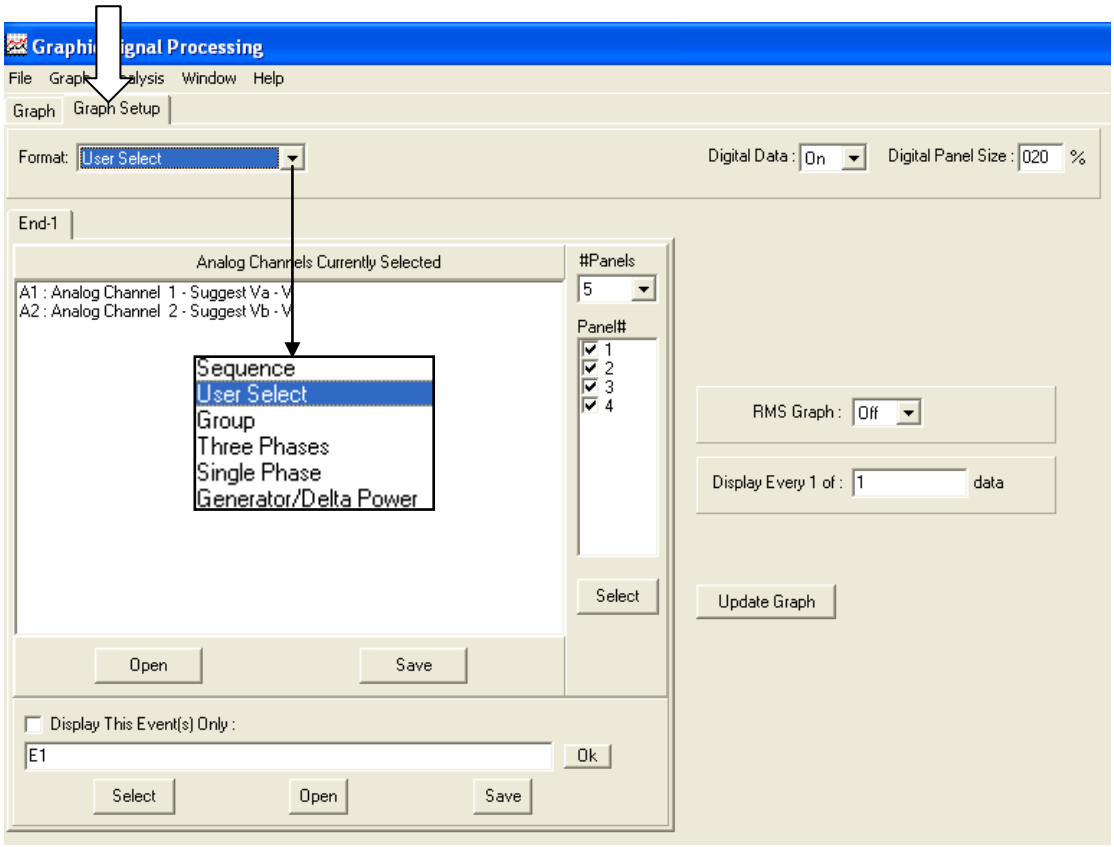


Figure 5-103 User Select Format

- **End1 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-1 data file.

- **End2 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-2 data file. This tab is only displayed when two data files are open simultaneously.

    - Digital Data:
      This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

      Digital Graph Panel displays the status of all abnormal analog triggers

and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order which it became abnormal.

When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- Digital Panel Size *N*%:
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- #Panels (Number of Panels Selection):
  Waveform panels are the horizontal rows used to display the analog and digital data. This drop-down menu allows selection of one to ten display panels.

  - Analog Channels Currently Selected
    This window displays the analog input number and the channel description selected for the highlighted panel number.

  - Panel# (Panel Number)
    This window lists the analog waveform panel numbers.

  - Select Select
    This button displays the Select Analog Channel(s) for Panel N window (Figure 5-104). This window is used to choose which channels will be displayed in each waveform panel. To display this window, click on the panel number to be configured and then click this button.

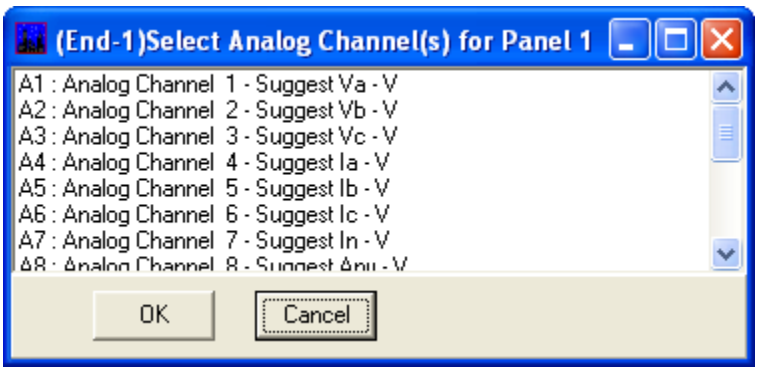


Figure 5-104 Select Analog Channel(s) for Panel N Window

  - Open Open
    This button displays the ***(End-1)Open User Selected Analog***

Channels window (Figure 5-105). This window is used to select a previously saved selected analog channels information file.

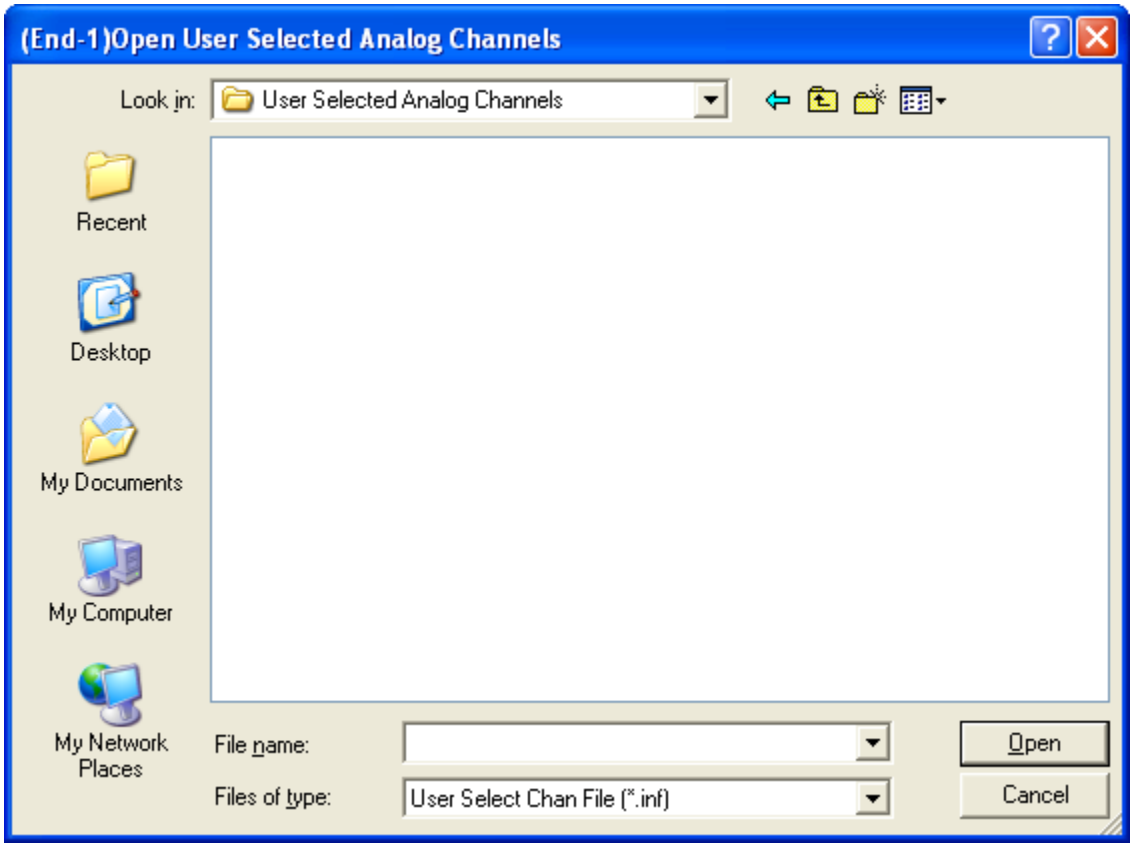


Figure 5-105 Open User Selected Analog Channels

- Save
  This button displays the ***(End-1)Save User Selected Analog Channels*** window (Figure 5-106). This window is used to save the selected analog channels to an information file for future viewing.

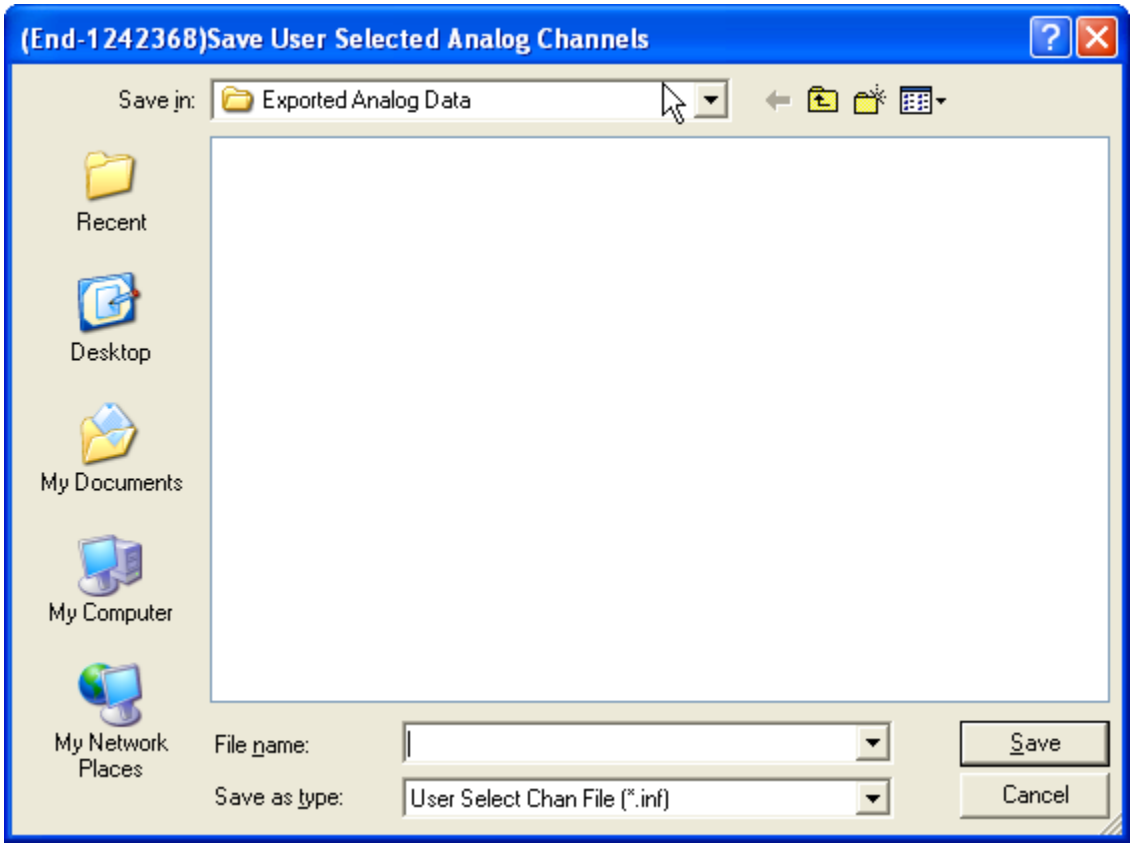


Figure 5-106 Save User Selected Analog Channels

- Time Offset (ms)
  This field only displays when two data files are opened for double-ended analysis. This feature is used to compensate manually for time skew of the End-2 data.

- ☑ Display these Digital Points Only:
  This checkbox enables the GSP to display on the digital points displayed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Select Select
    This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-107). This window is used to select the digital event or analog trigger inputs to be displayed.

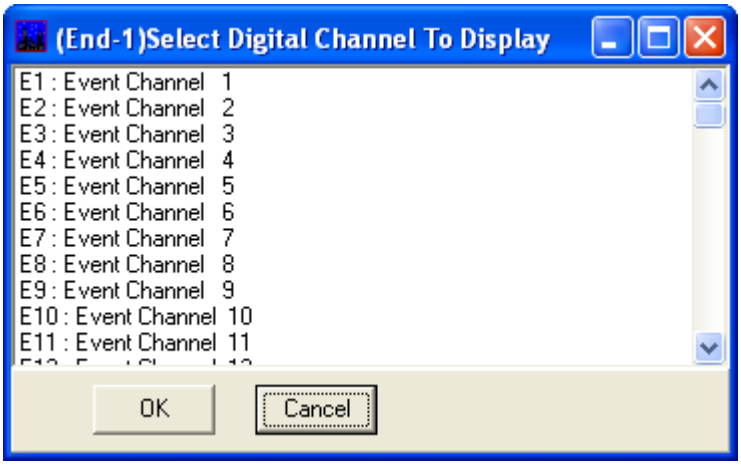


Figure 5-107 Select Digital Channel To Display Window

- Open
  This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-108). This window is used to select a previously saved selected digital channel information file.

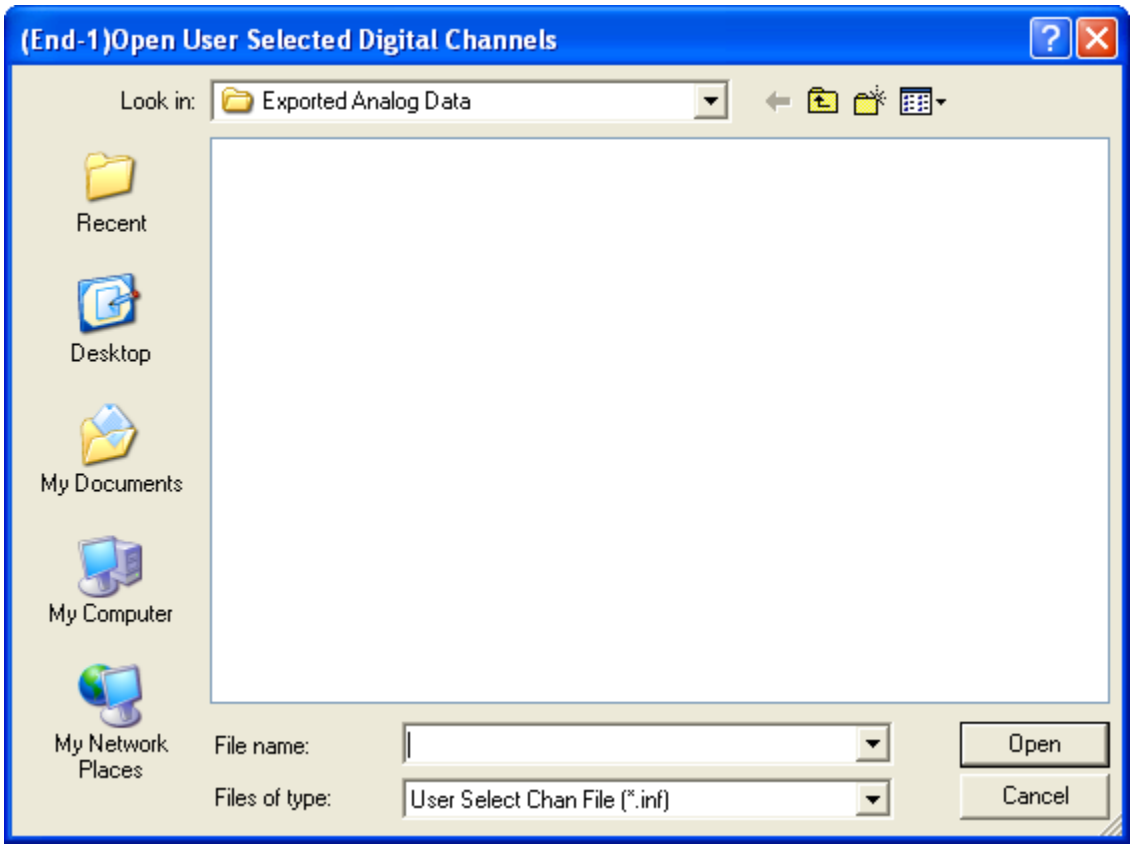


Figure 5-108 Open User Selected Digital Channels Window

- Save Save
  This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-109). This window is used to save the selected digital channels to an information file for future viewing.

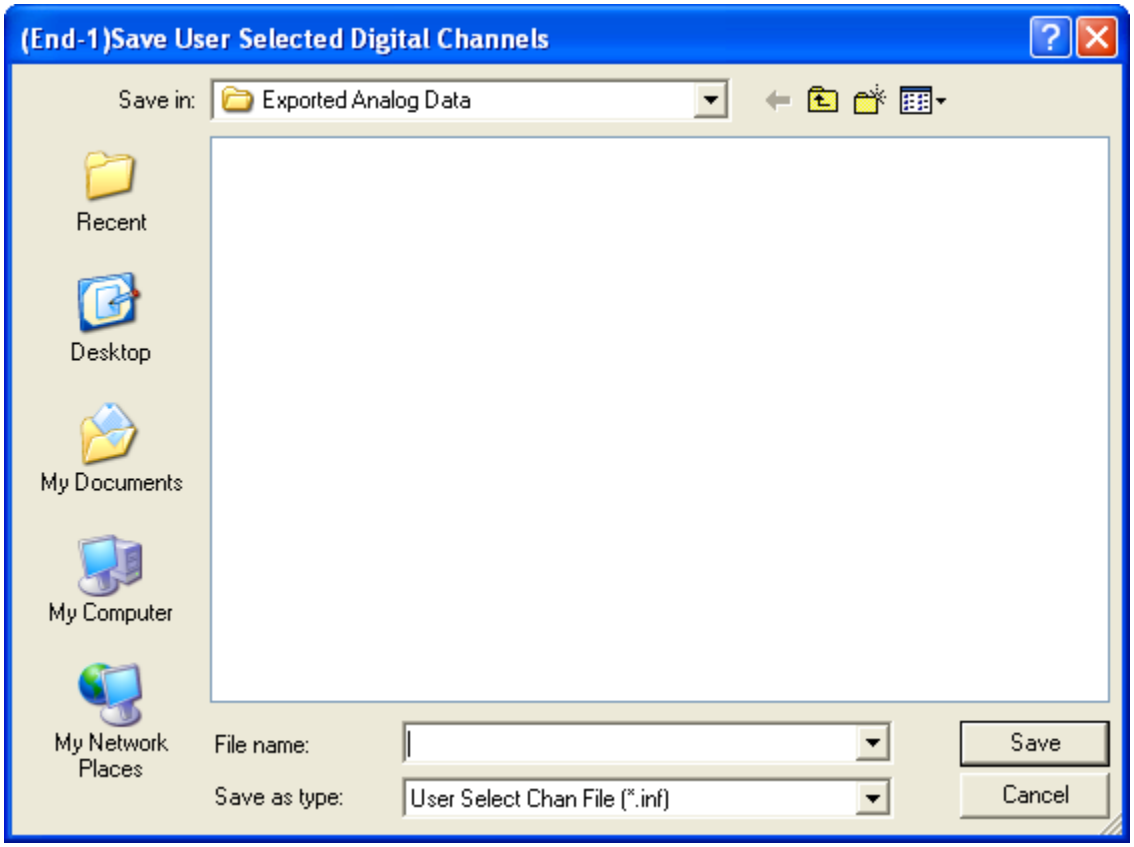


Figure 5-109 Save User Selected Digital Channels Window

- OK Ok
  This button applies the entries in the ***Display This Event(s) Only*** field and returns to the GSP graph screen.

- RMS Graph:
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- Display Every 1 of *N* data:
  This field is used to reduce the resolution of the displayed data. The default setting for this field is ***1*** which displays all data samples. This is only used if opening very large data files on a master station PC with limited resources. Increasing the value in this field will reduce the number

of data samples displayed and decrease the amount of time taken to display the data file.

- Update Graph Update Graph:
  This button applies all the selections on the Graph Setup screen and returns to the GSP graph screen.

5.8.3 Group Format Setup Screen

This selection is used to perform analysis of pre-assigned Line Group Records (Section 4.3). When this format is selected, the following drop-down menus are available (Figure 5-110).

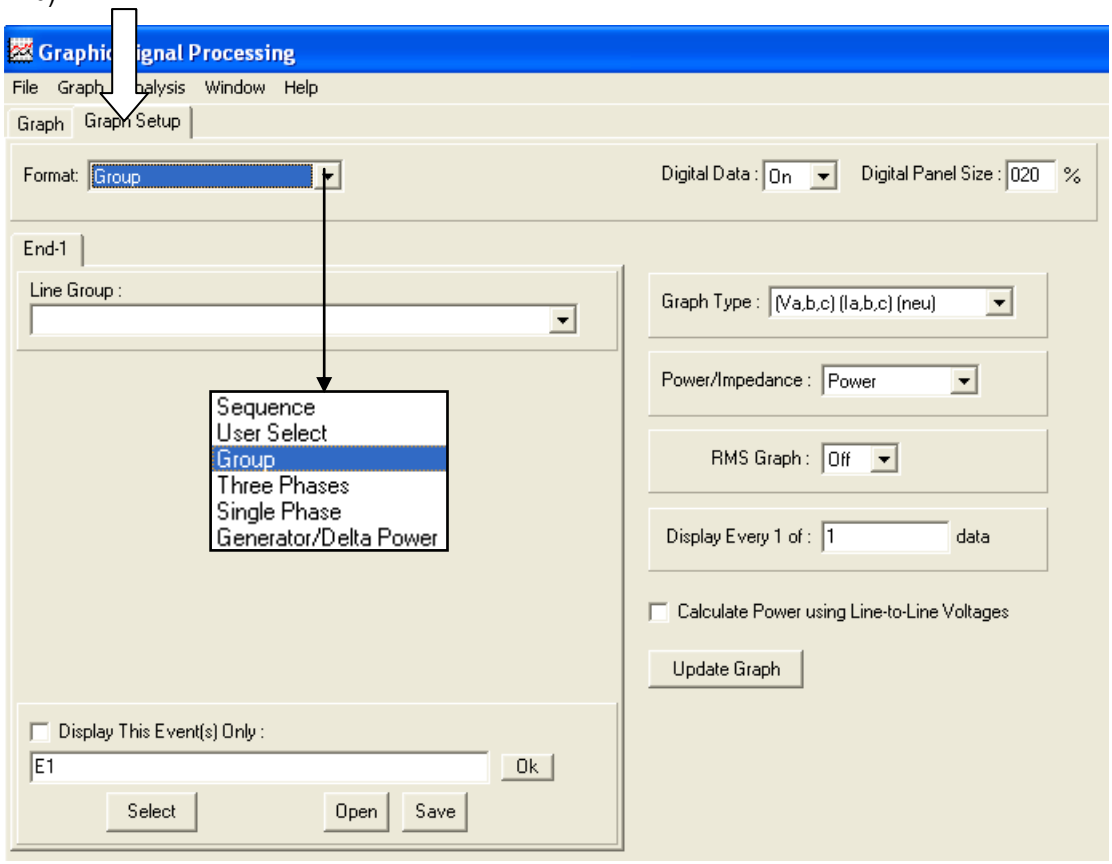


Figure 5-110 Group Format

- **End1 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-1 data file.

- **End2 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-2 data file. This tab is only displayed when two data files are open simultaneously.

- Digital Data:
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

  Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order which it became abnormal.

  When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- Digital Panel Size *N*%:
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- Line Group:
  This drop-down displays the list of line groups entered into the Line Group Record (Section 4.3 and Section 5.1.1).

- Time Offset (ms)**:**
  This field only displays when two data files are opened for double-ended analysis. This feature is used to manually compensate for possible time skew of the End-2 data.

- ☑ Display these Digital Points Only:
  This checkbox enables the GSP to display on the digital points displayed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Select Select
    This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-111). This window is used to select the digital event or analog trigger inputs to be displayed.

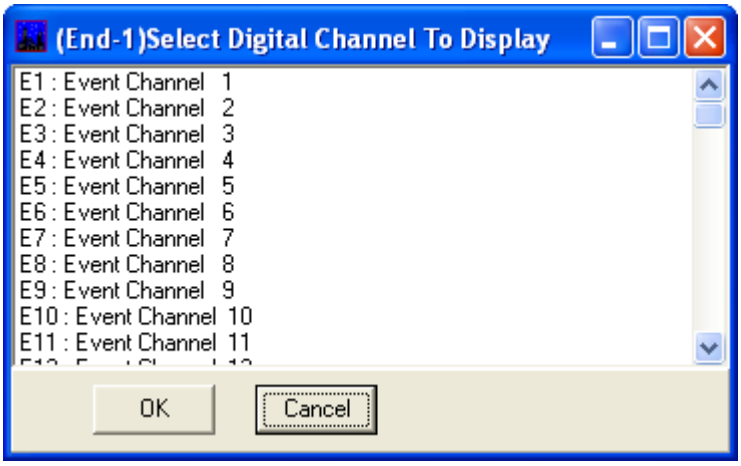


Figure 5-111 Select Digital Channel To Display Window

- Open Open
  This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-112). This window is used to select a previously saved selected digital channels information file.

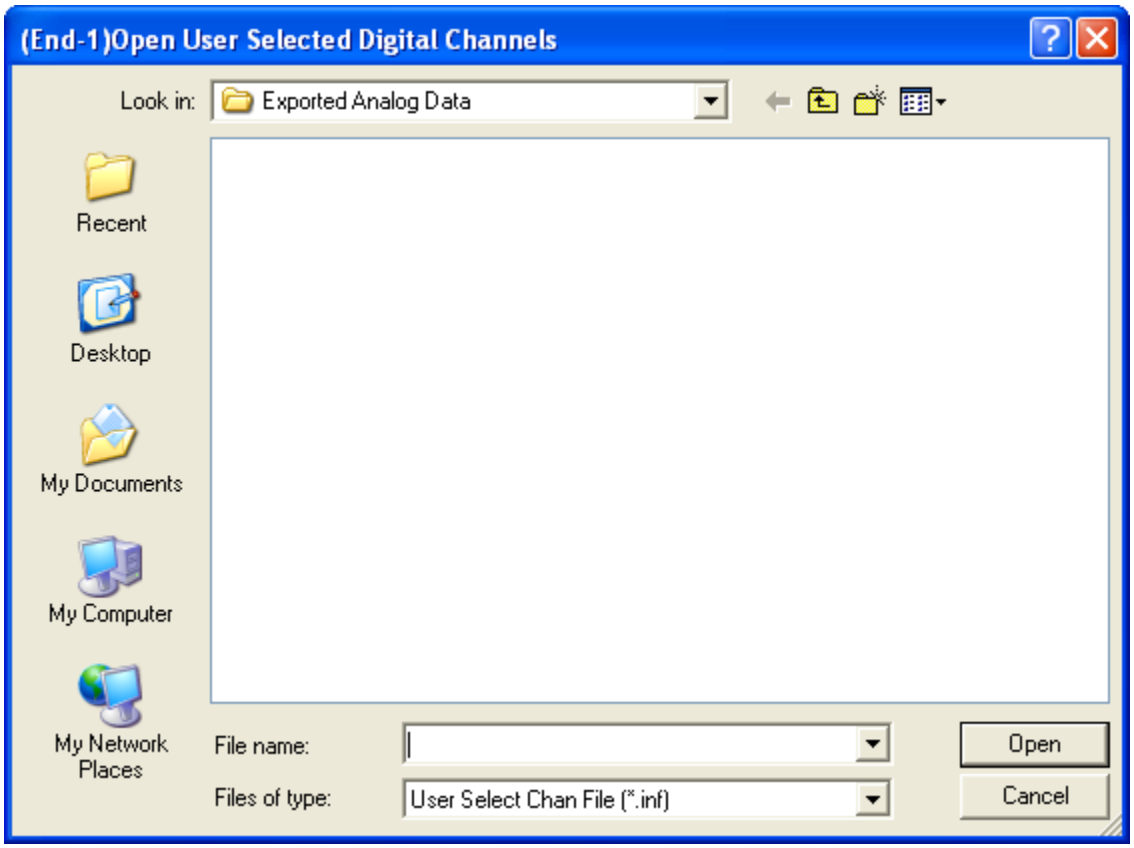


Figure 5-112 Open User Selected Digital Channels Window

- Save Save
  This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-113). This window is used to save he selected digital channels to an information file for future viewing.

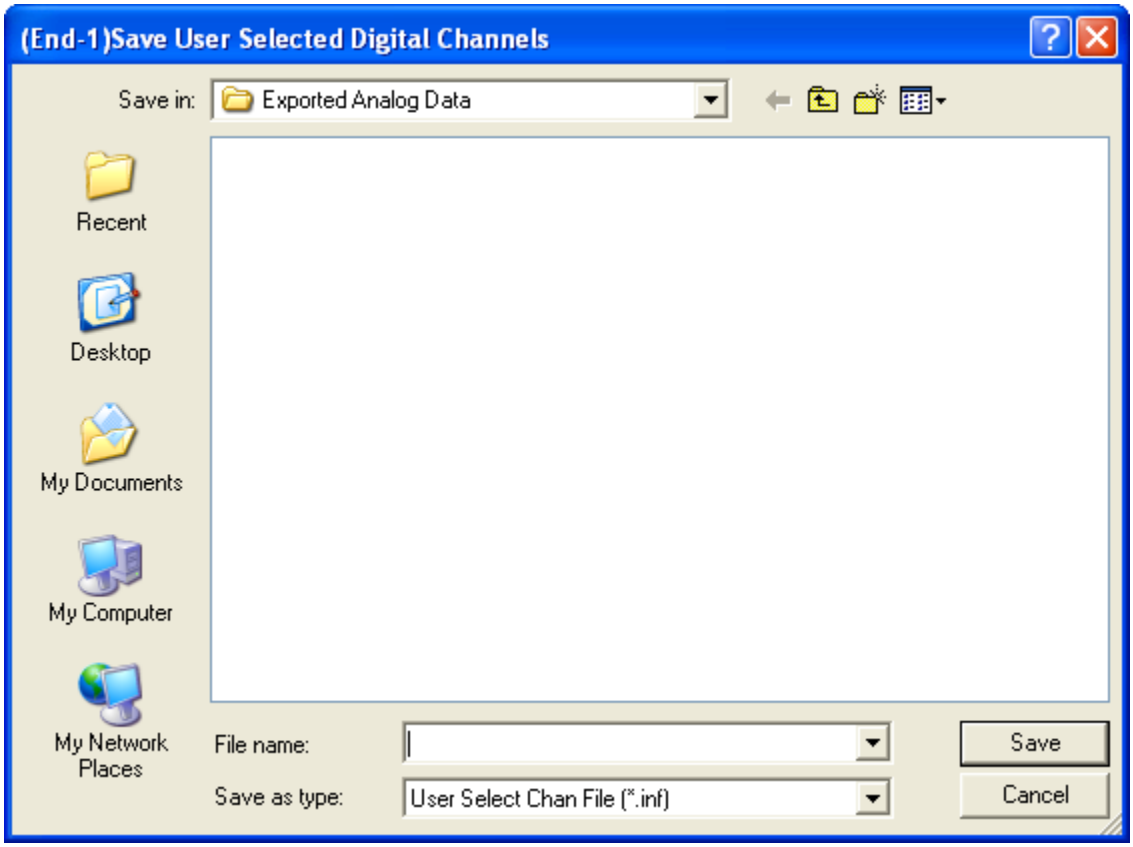


Figure 5-113 Save User Selected Digital Channels Window

- OK Ok
  This button applies the entries in the ***Display This Event(s) Only*** field and returns to the GSP graph screen.

- Graph Type:
  This drop-down displays the list of panel channel assignments. This list displays different arrangements of the three-phase inputs. The inputs grouped within parenthesis are displayed in separate waveform panels. The waveform panels are displayed from top to bottom in the order they are shown in the list.

  - (Va)(Vb)(Vc)(Ia)(Ib)(Ic)(neu)
    This selection displays A-phase voltage in the first panel, B-phase voltage in the second panel, C-phase voltage in the third panel, A-phase current in the fourth panel, B-phase current in the fifth

panel, C-phase current in the sixth panel, and the neutral current in the seventh panel.

- (Va,Ia)(Vb,Ib)(Vc,Ic)(neu)
  This selection displays the voltage and current inputs for A-phase in the first panel, the voltage and current inputs for B-phase in the second panel, the voltage and current inputs for C-phase in the third panel, and the neutral current input in the fourth panel.

- (Va,b,c)(Ia,b,c)(neu)
  This selection displays the three-phase voltage inputs in the first panel, the three-phase current inputs in the second panel, and the neutral current input in the third panel.

- (Ia,b,c)(neu)(Va,b,c)(ref)
  This selection displays the three-phase current inputs in the first panel, the neutral current input in the second panel, the three-phase voltage inputs in the third panel, and the reference channel input in the fourth panel.

- (Va,Ia)(neu)
  This selection displays the voltage and current inputs for the A-phase in the first panel and the neutral current input in the second panel.

- (Vb,Ib)(neu)
  This selection displays the voltage and current inputs for the B-phase in the first panel and the neutral current input in the second panel.

- (Vc,Ic)(neu)
  This selection displays the voltage and current inputs for the C-phase in the first panel and the neutral current input in the second panel.

- Power/Impedance:
  This drop-down menu displays None, Power, or Impedance.

  - None
    When this is selected, the Power/Impedance waveform panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

  - Power
    When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Apparent Power, Active Power,

Reactive Power, and Power Factor values that are calculated from the analog data from the selected ***Line Name***.

- Impedance
  When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Phase ***A***, Phase ***B***, and Phase ***C*** impedance values that are calculated from the analog data from the selected ***Line Name***.

- RMS Graph:
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- Display Every 1 of *N* data:
  This field is used to reduce the resolution of the displayed data. The default setting for this field is ***1*** which displays all data samples. This is only used if opening very large data files on a master station PC with limited resources. Increasing the value in this field will reduce the number of data samples displayed and decrease the amount of time taken to display the data file.

- ☑ Calculate Power using Line-to-Line Voltages:
  This checkbox enables the GSP to calculate the power and impedance values using voltage inputs from a Delta-connected transformer.

- 

Update Graph:
  This button applies all the selections on the Graph Setup screen and returns to the GSP graph screen.

5.8.4 Three Phases Format Setup Screen

This format is used to perform three-phase analysis. When this format is selected, the following drop-down menus are available (Figure 5-114).

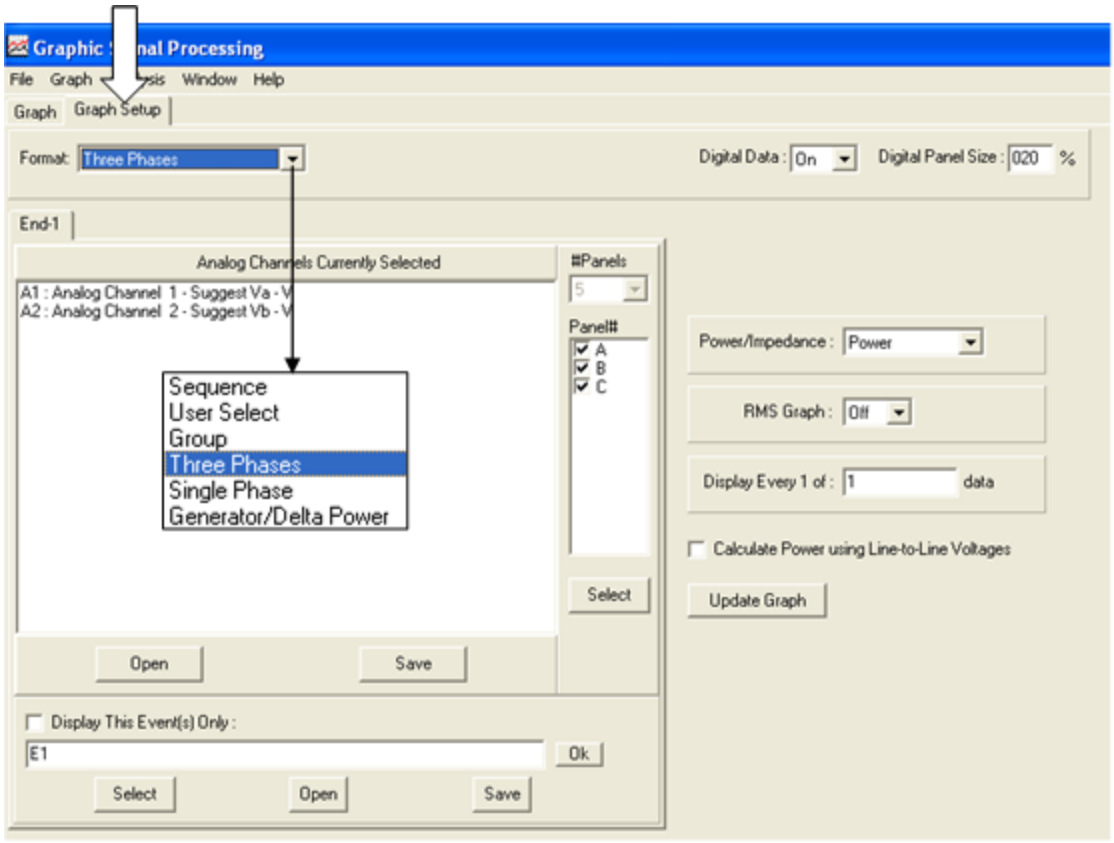


Figure 5-114 Three Phases Screen

- **End1 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-1 data file.

- **End2 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-2 data file. This tab is only displayed when two data files are open simultaneously.

    - Digital Data:
      This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

      Digital Graph Panel displays the status of all abnormal analog triggers

and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order which it became abnormal.

When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- Digital Panel Size *N*%:
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- #Panels (Number of Panels Selection):
  Waveform panels correspond to the horizontal rows used to display the analog and digital data. This drop-down menu is disabled in three-phase format.

  - Analog Channels Currently Selected
    This window displays the analog input number and the channel description selected for the highlighted panel number.

  - Panel# (Panel Number)
    This window lists the analog waveform panel by power line phase.

  - Select Select
    This button displays the ***Select Analog Channel(s) for Panel N*** window (Figure 5-115). These windows are used to select the voltage and current input channels for the selected A-phase, B-phase, or C-phase panels. To display this window, click on the panel to be configured and then click this button.

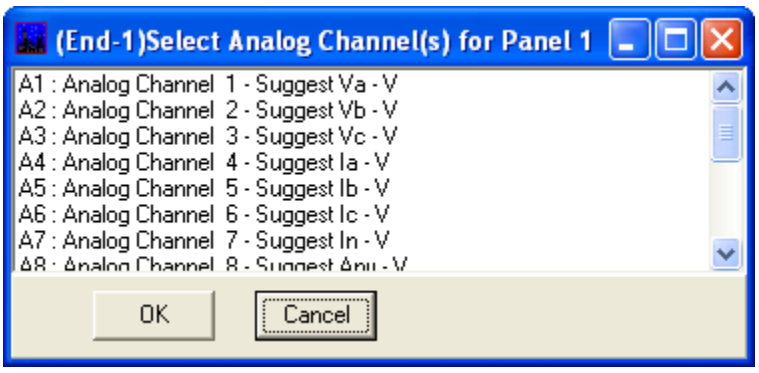


Figure 5-115 Select Analog Channel(s) for Panel N Window

  - Open Open
    This button displays the ***(End-1)Open User Selected Analog***

Channels window (Figure 5-116). This window is used to select a previously saved selected analog channel information file.

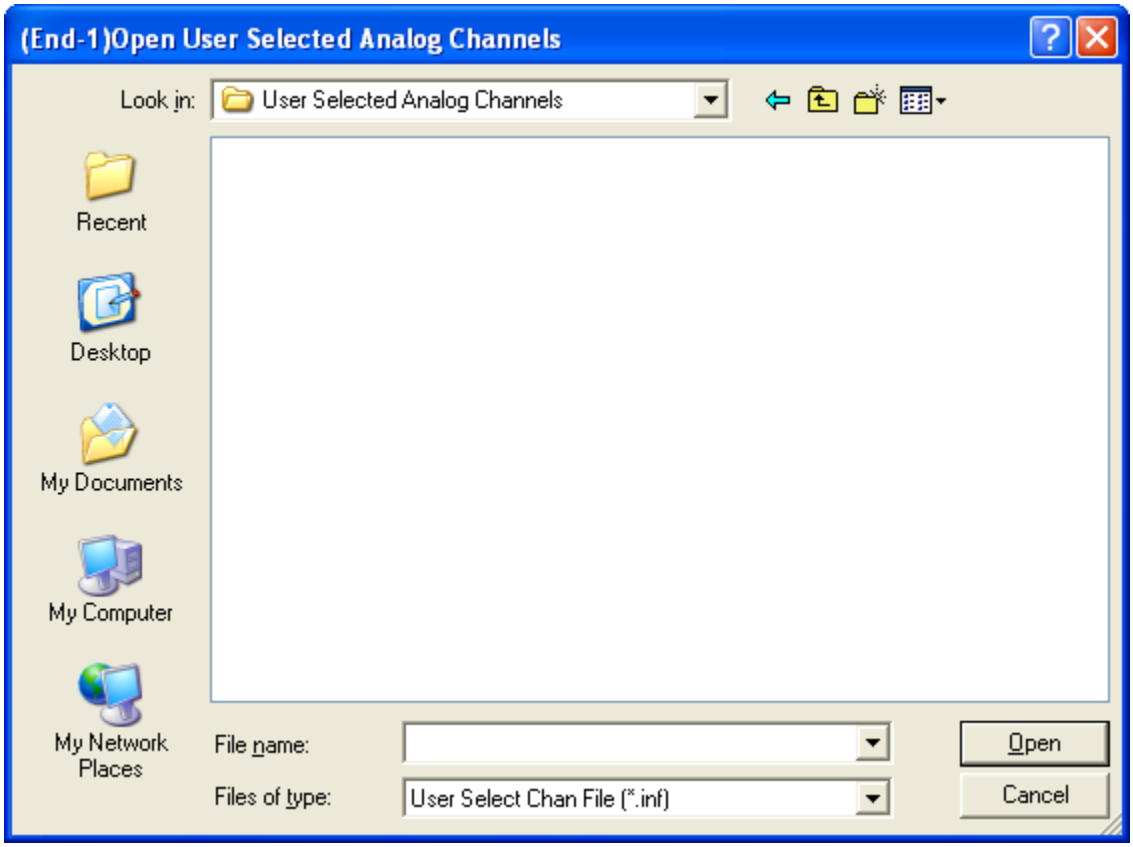


Figure 5-116 Open User Selected Analog Channels

- Save
  This button displays the ***(End-1)Save User Selected Analog Channels*** window (Figure 5-117). This window is used to save the selected analog channels to an information file for future viewing.

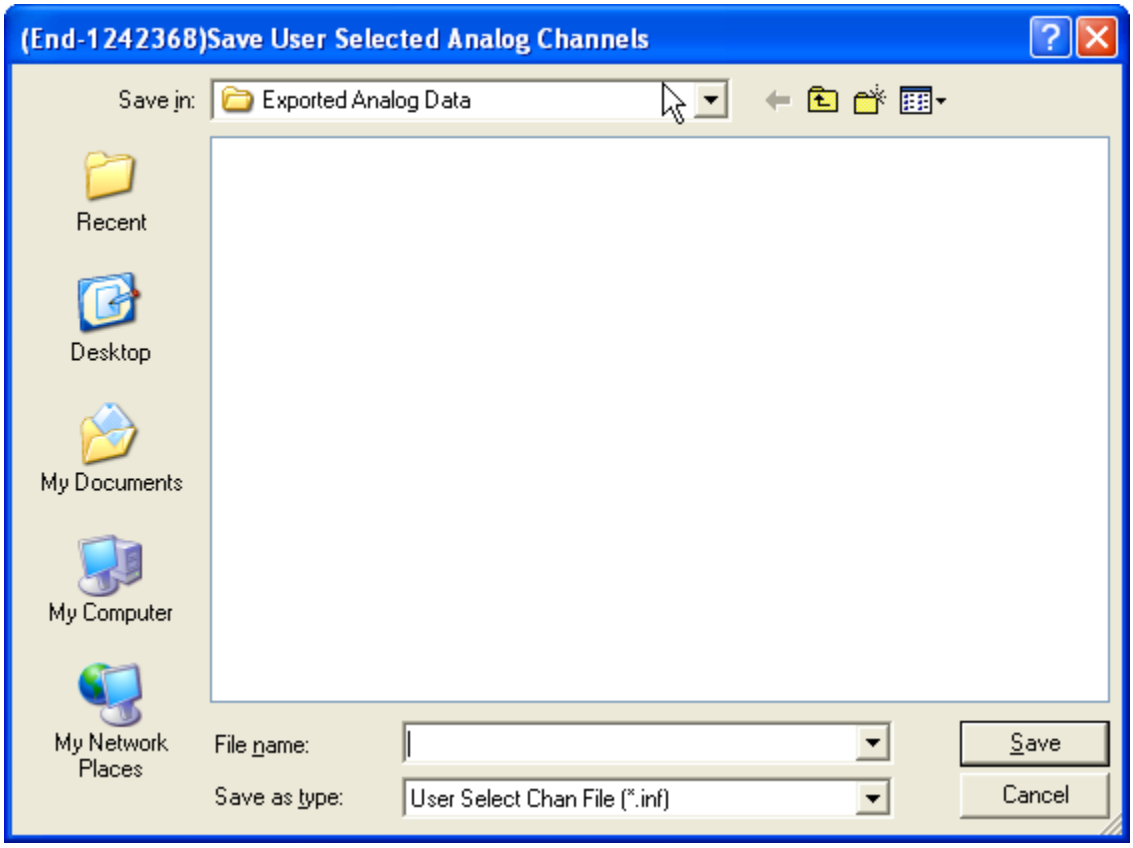


Figure 5-117 Save User Selected Analog Channels

- Time Offset (ms)
  This field only displays when two data files are opened for double-ended analysis. This feature is used to manually compensate for possible time skew of the End-2 data.

- ☑ Display these Digital Points Only:
  This checkbox enables the GSP to display the digital points displayed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Select Select
    This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-118). This window is used to select the digital event or analog trigger inputs to be displayed.

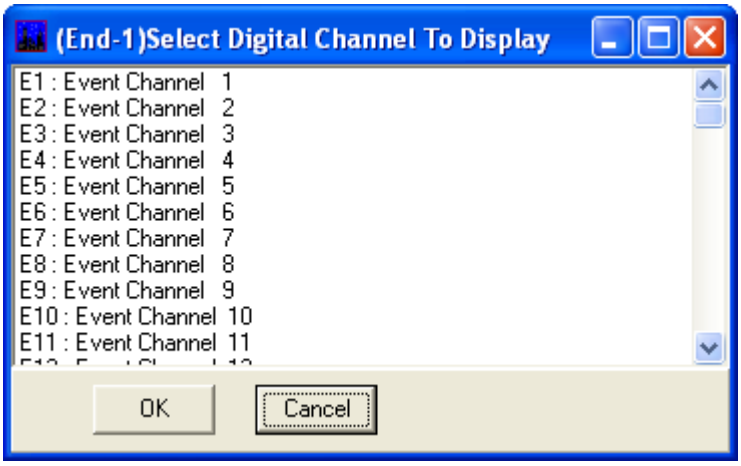


Figure 5-118 Select Digital Channel To Display Window

- Open Open
  This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-119). This window is used to select a previously saved selected digital channels information file.

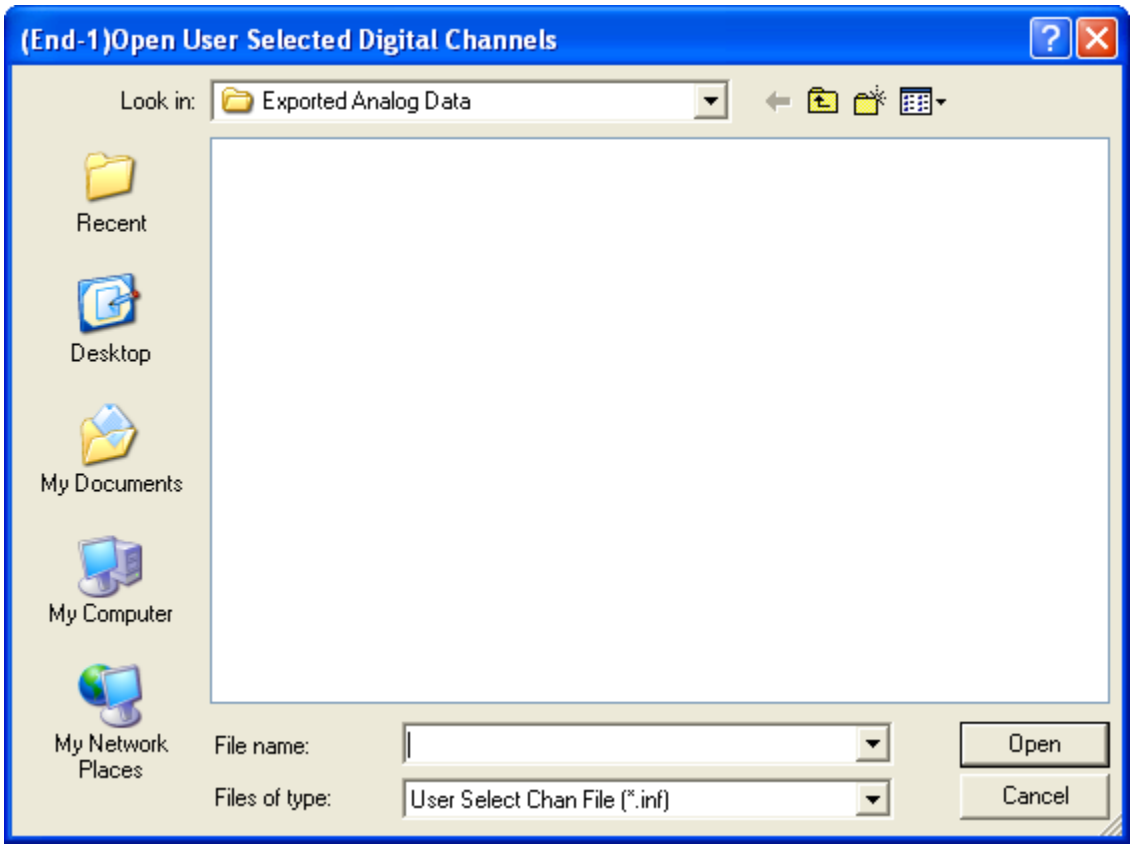


Figure 5-119 Open User Selected Digital Channels Window

- Save Save
  This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-120). This window is used to save the selected digital channels to an information file for future viewing.

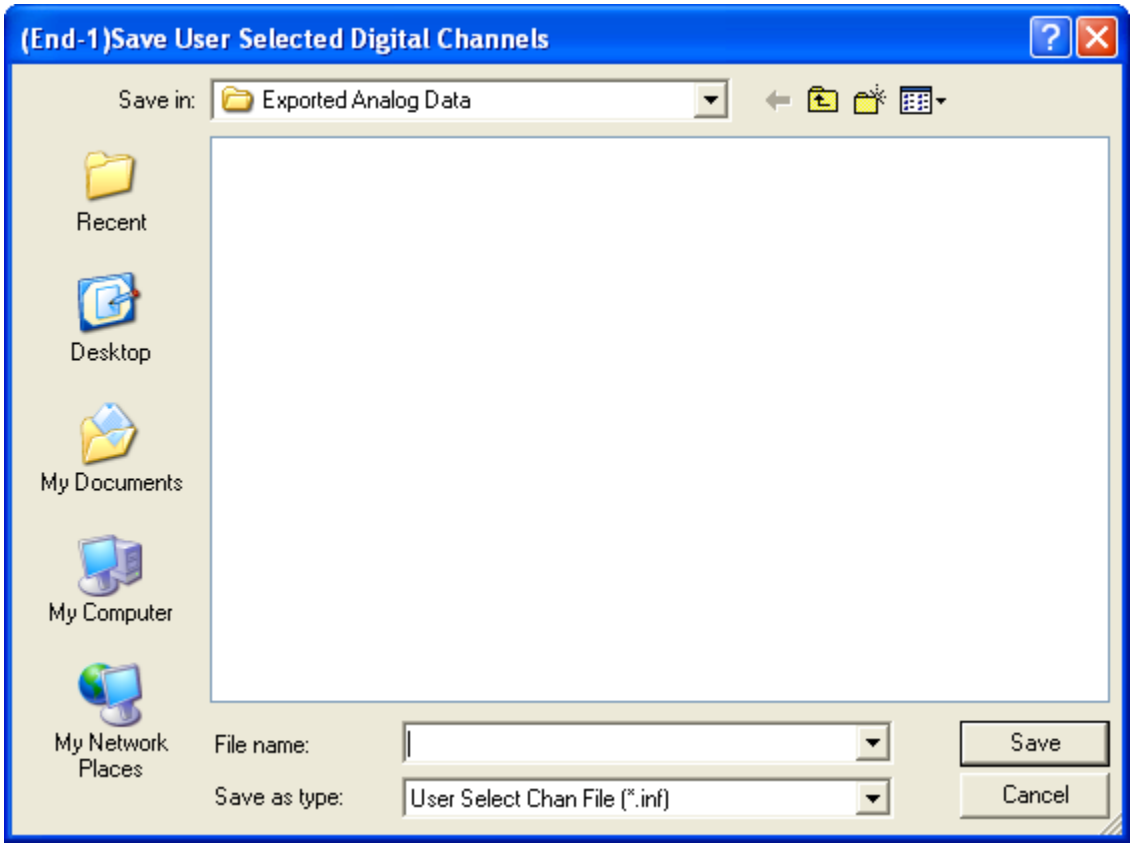


Figure 5-120 Open User Selected Digital Channels Window

- OK Ok
  This button applies the entries in the ***Display This Event(s) Only*** field and returns to the GSP graph screen.

- Power/Impedance:
  This drop-down menu displays None, Power, or Impedance.

  - None
    When this is selected, the Power/Impedance waveform panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

  - Power
    When this is selected, the Power/Impedance waveform panel is

displayed. This panel displays Apparent Power, Active Power, Reactive Power, and Power Factor values that are calculated from the analog data from the selected ***Line Name***.

- Impedance
  When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Phase ***A,*** Phase ***B***, and Phase ***C*** impedance values that are calculated from the analog data from the selected ***Line Name***.

- RMS Graph:
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- Display Every 1 of *N* data:
  This field is used to reduce the resolution of the displayed data. The default setting for this field it 1 which displays all data samples. This is only used if opening very large data files on a master station PC with limited resources. Increasing the value in this field will reduce the number of data samples displayed and decrease the amount of time taken to display the data file.

- ☑ Calculate Power using Line-to-Line Voltages:
  This checkbox enables the GSP to calculate the power and impedance values using voltage inputs from a Delta-connected transformer.

- Update Graph Update Graph:
  This button applies all the selections on the Graph Setup screen and returns to the GSP graph screen.

5.8.5 Single Phase Format Setup Screen

This format is used to perform single-phase analysis. When this format is selected, the following drop-down menus are available (Figure 5-121).

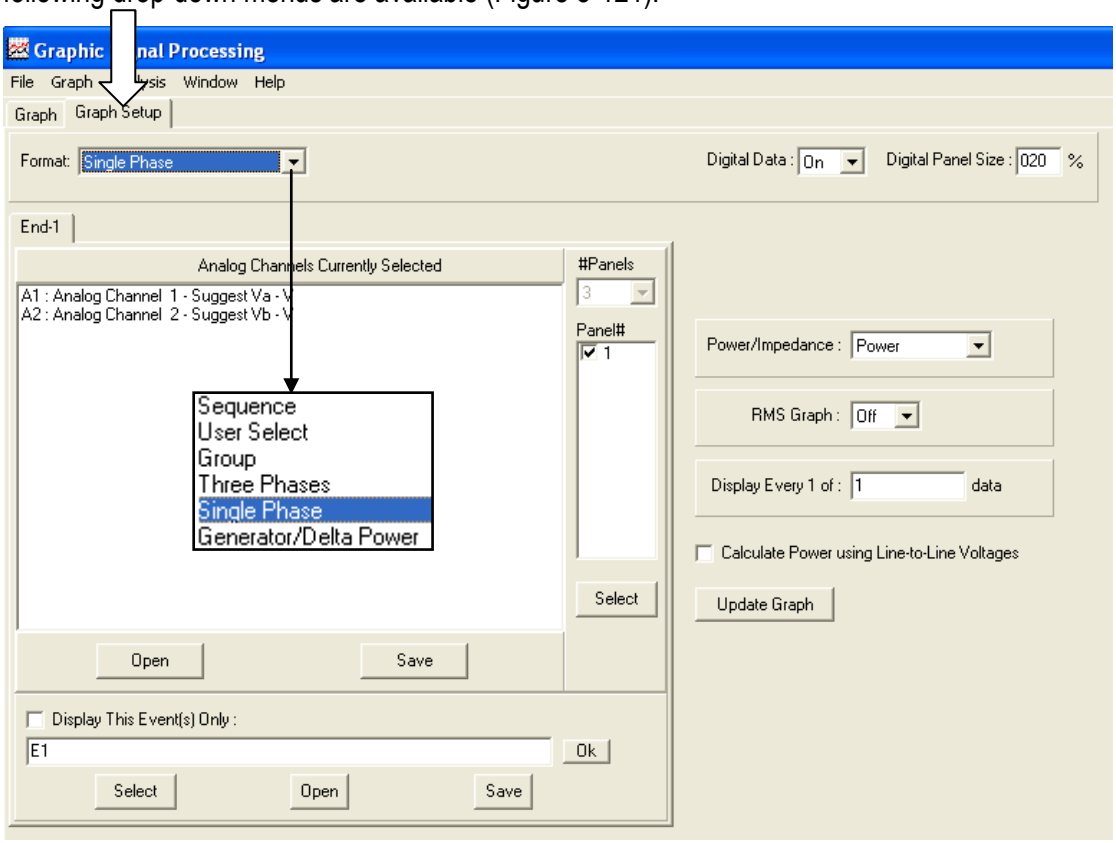


Figure 5-121 Single Phase Format

- **End1 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-1 data file.

- **End2 Screen Tab**
  This screen displays the available drop-down menus and setting to customize the End-2 data file. This tab is only displayed when two data files are open simultaneously.

    - Digital Data:
      This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

      Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is

displayed sequentially from top to bottom in the order which it became abnormal.

When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- Digital Panel Size *N*%:
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- #Panels (Number of Panels Selection):
  Waveform panels correspond to the horizontal rows used to display the analog and digital data. This drop-down menu is disabled in single-phase format.

  - Analog Channels Currently Selected
    This window displays the analog input number and the channel description selected for the highlighted panel number.

  - Panel# (Panel Number)
    This window lists the analog waveform panel by power line phase.

  - Select Select
    This button displays the ***Select Analog Channel(s) for Panel N*** window (Figure 5-122). These windows are used to select the voltage and current input channels for the selected phase panel. To display this window, click on the panel to be configured and then click this button.

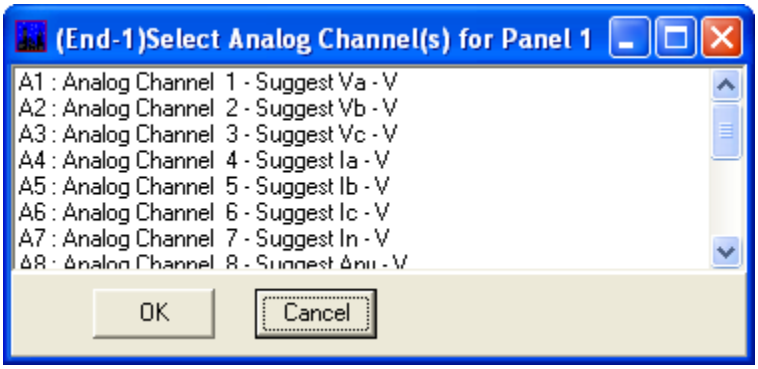


Figure 5-122 Select Analog Channel(s) for Panel N Window

  - Open Open
    This button displays the ***(End-1)Open User Selected Analog***

Channels window (Figure 5-123). This window is used to select a previously saved selected analog channels information file.

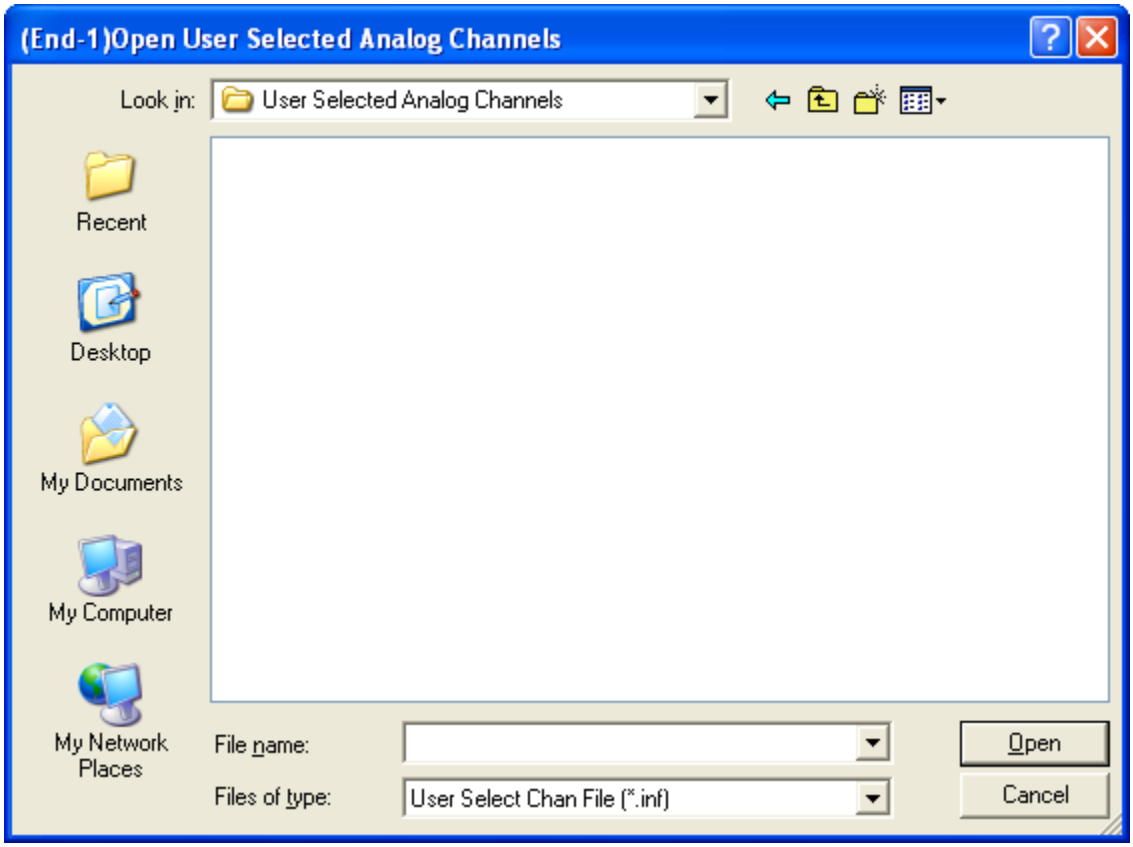


Figure 5-123 Open User Selected Analog Channels

- Save
  This button displays the ***(End-1)Save User Selected Analog Channels*** window (Figure 5-124). This window is used to save the selected analog channels to an information file for future viewing.

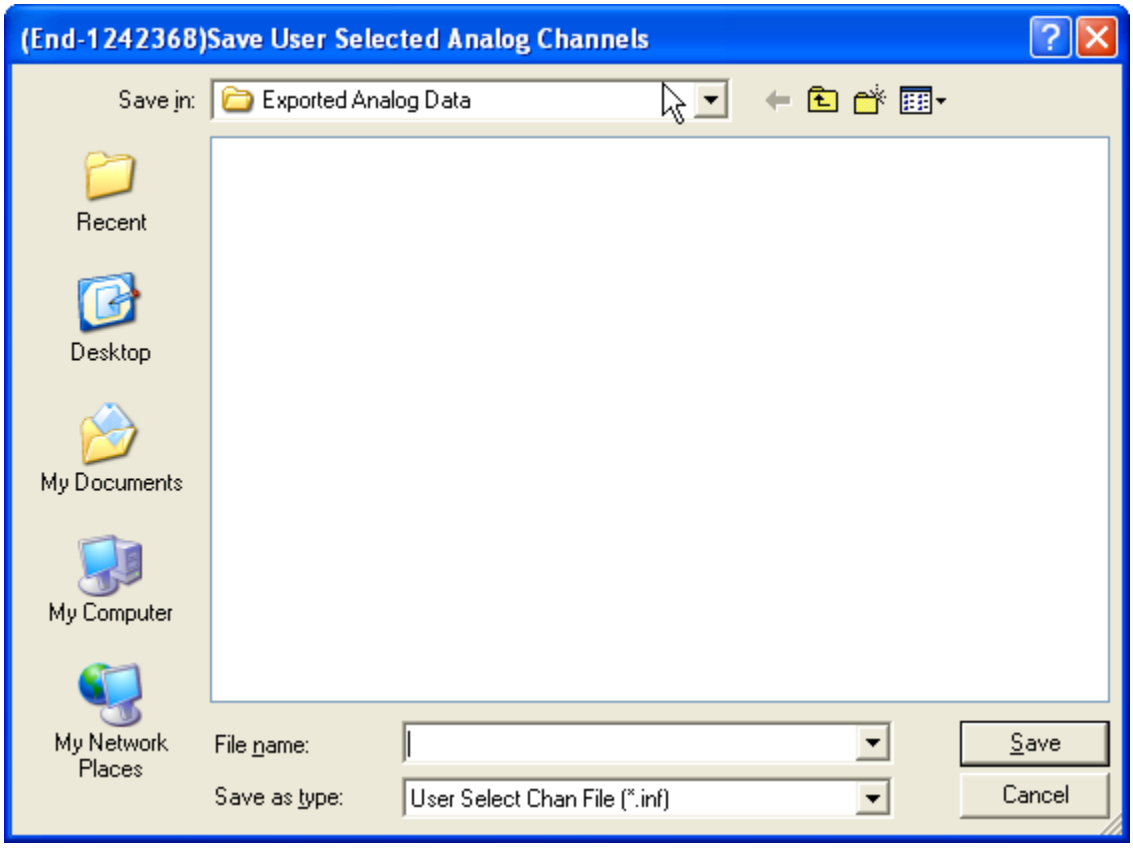


Figure 5-124 Save User Selected Analog Channels

- Time Offset (ms)
  This field only displays when two data files are opened for double-ended analysis. This feature is used to manually compensate for possible time skew of the End-2 data.

- ☑ Display these Digital Points Only:
  This checkbox enables the GSP to display on the digital points displayed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Select Select
    This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-125). This window is used to select the digital event or analog trigger inputs to be displayed.

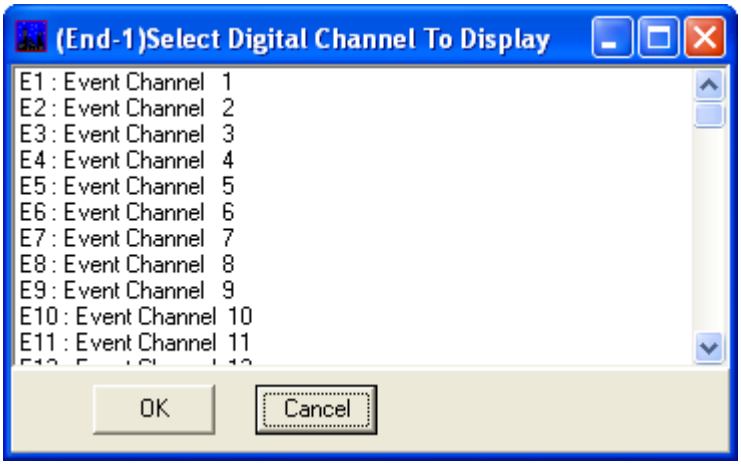


Figure 5-125 Select Digital Channel To Display Window

- Open Open
  This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-126). This window is used to select a previously saved selected digital channels information file.

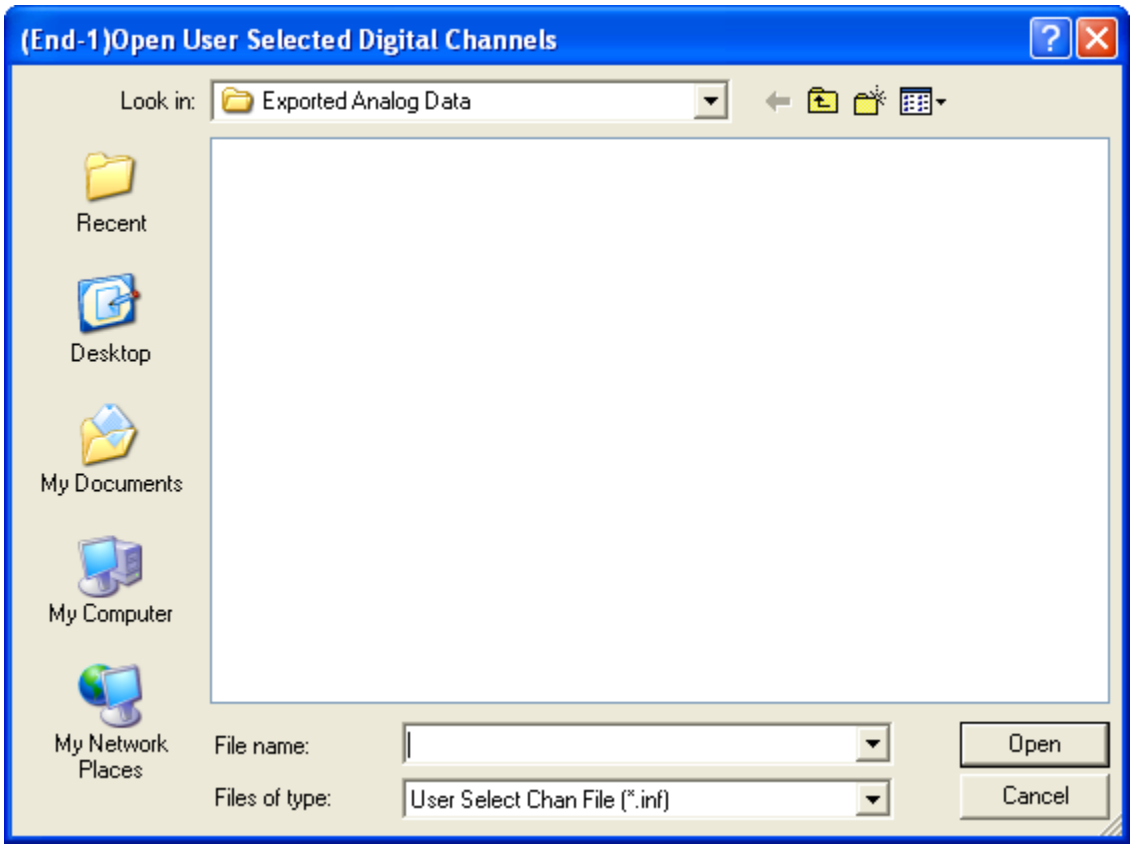


Figure 5-126 Open User Selected Digital Channels Window

- Save Save
  This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-127). This window is used to save the selected digital channels to an information file for future viewing.

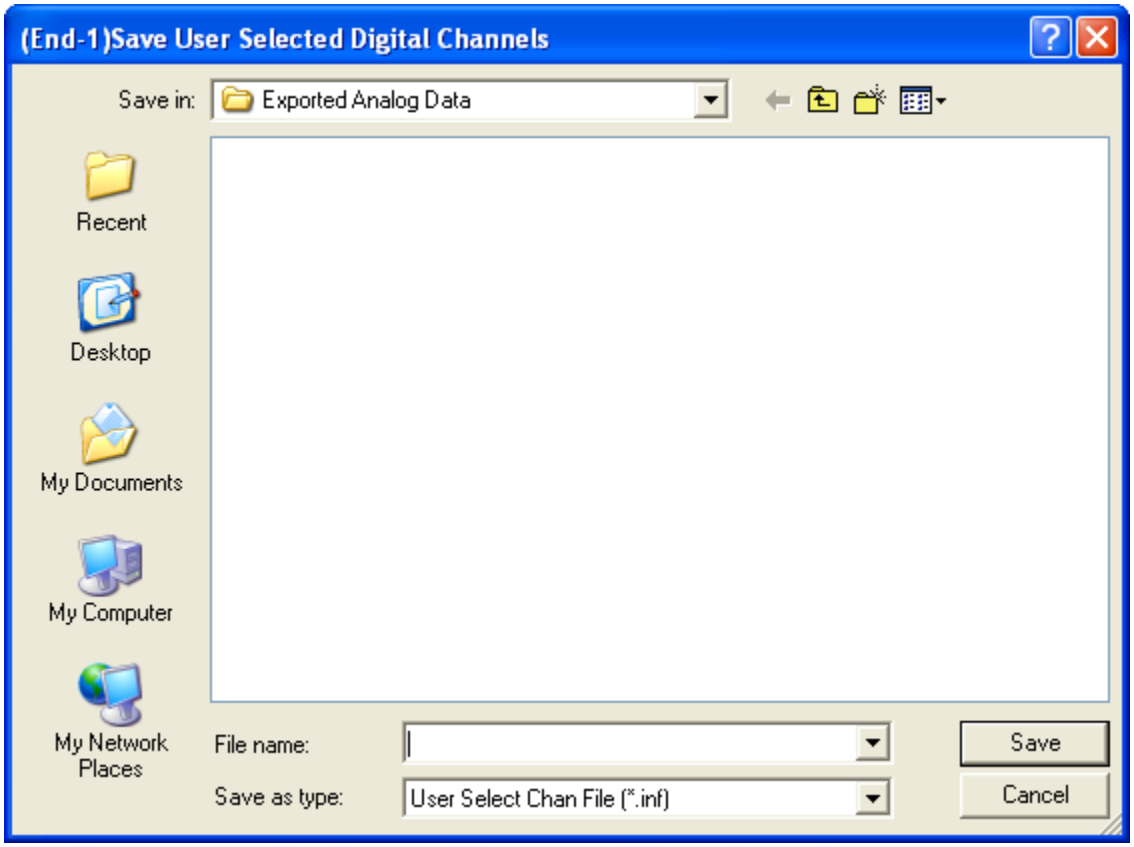


Figure 5-127 Save User Selected Digital Channels Window

- OK Ok
  This button applies the entries in the ***Display This Event(s) Only*** field and returns to the GSP graph screen.

- Power/Impedance:
  This drop-down menu displays None, Power, or Impedance.

  - None
    When this is selected, the Power/Impedance waveform panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

  - Power
    When this is selected, the Power/Impedance waveform panel is

displayed. This panel displays Apparent Power, Active Power, Reactive Power, and Power Factor values that are calculated from the analog data from the selected ***Line Name***.

- Impedance
  When this is selected, the Power/Impedance waveform panel is displayed. This panel displays the impedance value that is calculated from the analog data from the selected phase.

- RMS Graph:
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- Display Every 1 of *N* data:
  This field is used to reduce the resolution of the displayed data. The default setting for this field it 1 which displays all data samples. This is only used if opening very large data files on a master station PC with limited resources. Increasing the value in this field will reduce the number of data samples displayed and decrease the amount of time taken to display the data file.

- ☑ Calculate Power using Line-to-Line Voltages:
  This checkbox enables the GSP to calculate the power and impedance values using voltage inputs from a delta-connected transformer.

- 

Update Graph:
  This button applies all the selections on the Graph Setup screen and returns to the GSP graph screen.

5.8.6 Generator/Delta Power Format Setup Screen

This selection is used to perform analysis of pre-assigned Line Group Records (Section 4.3) that are generator or wye-delta inputs to the DME system. When this format is selected, the following drop-down menus are available (Figure 5-128).

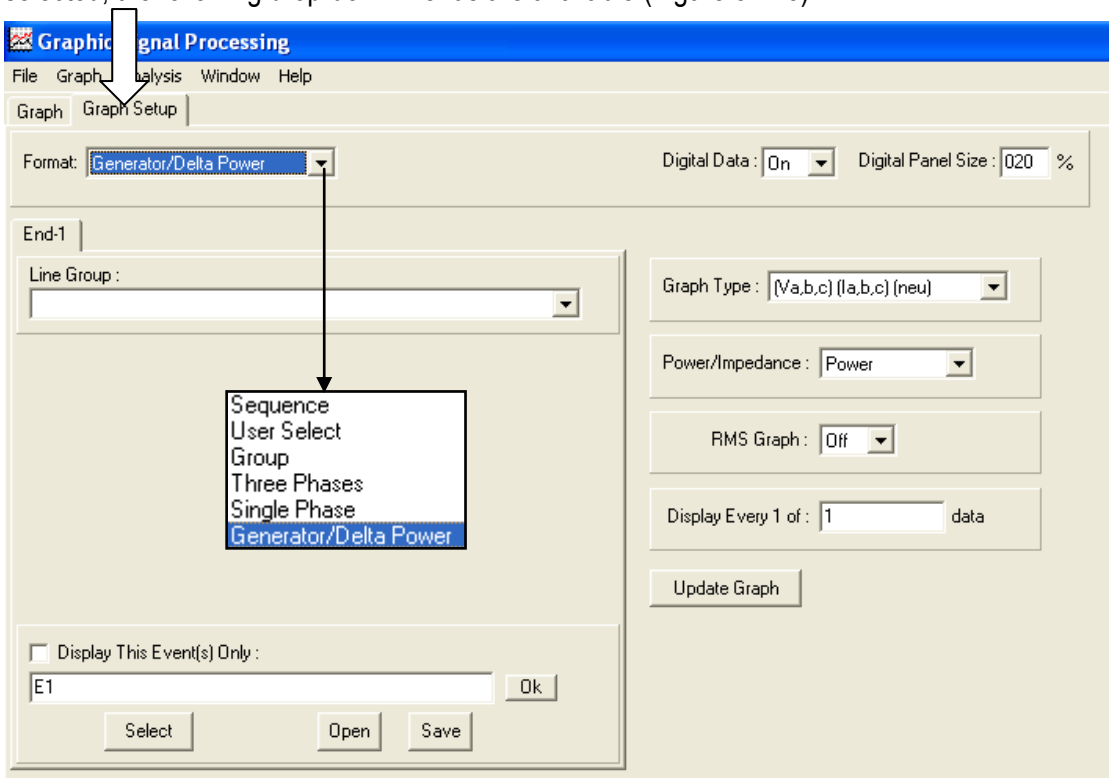


Figure 5-128 Generator/Delta Power Screen

- **End1 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-1 data file.

- **End2 Screen Tab**
  This screen displays the available drop-down menus and settings to customize the End-2 data file. This tab is only displayed when two data files are open simultaneously.

    - Digital Data:
      This drop-down menu displays ***Off*** or ***On***. This selection determines whether digital data is plotted in the bottom waveform panel of the Graphic Signal Processing window. When ***On*** is selected, the ***Digital Graph Panel*** is displayed.

      Digital Graph Panel displays the status of all abnormal analog triggers and event inputs during the fault. The data plotted in the digital panel is displayed sequentially from top to bottom in the order which it became

abnormal.

When ***Off*** is selected, the digital panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

- Digital Panel Size *N*%:
  This field is used to enter the percentage (5% thru 95% in increments of 1%) of the Graphic Signal Processing (GSP) window the digital display panel will occupy. The remaining percentage of the GSP window will be used to display the analog panels.

- Line Group:
  This drop-down displays the list of line groups entered into the Line Group Record (Section 4.3 and Section 5.1.1).

- Time Offset (ms):
  This field only displays when two data files are opened for double-ended analysis. This feature is used to manually compensate for possible time skew of the End-2 data.

- ☑ Display these Digital Points Only:
  This checkbox enables the GSP to display on the digital points displayed in the ***Display these Digital Points Only*** field. Digital points can be typed into this field or inserted by using the ***Select*** button.

  - Select Select
    This button displays the ***(End-1)Select Digital Channel To Display*** window (Figure 5-129). This window is used to select the digital event or analog trigger inputs to be displayed.

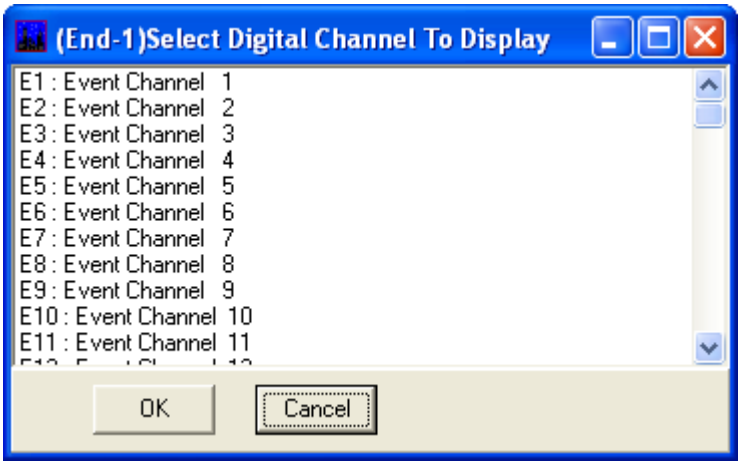


Figure 5-129 Select Digital Channel To Display Window

- Open Open
  This button displays the ***(End-1)Open User Selected Digital Channels*** window (Figure 5-130). This window is used to select a previously saved selected digital channels information file.

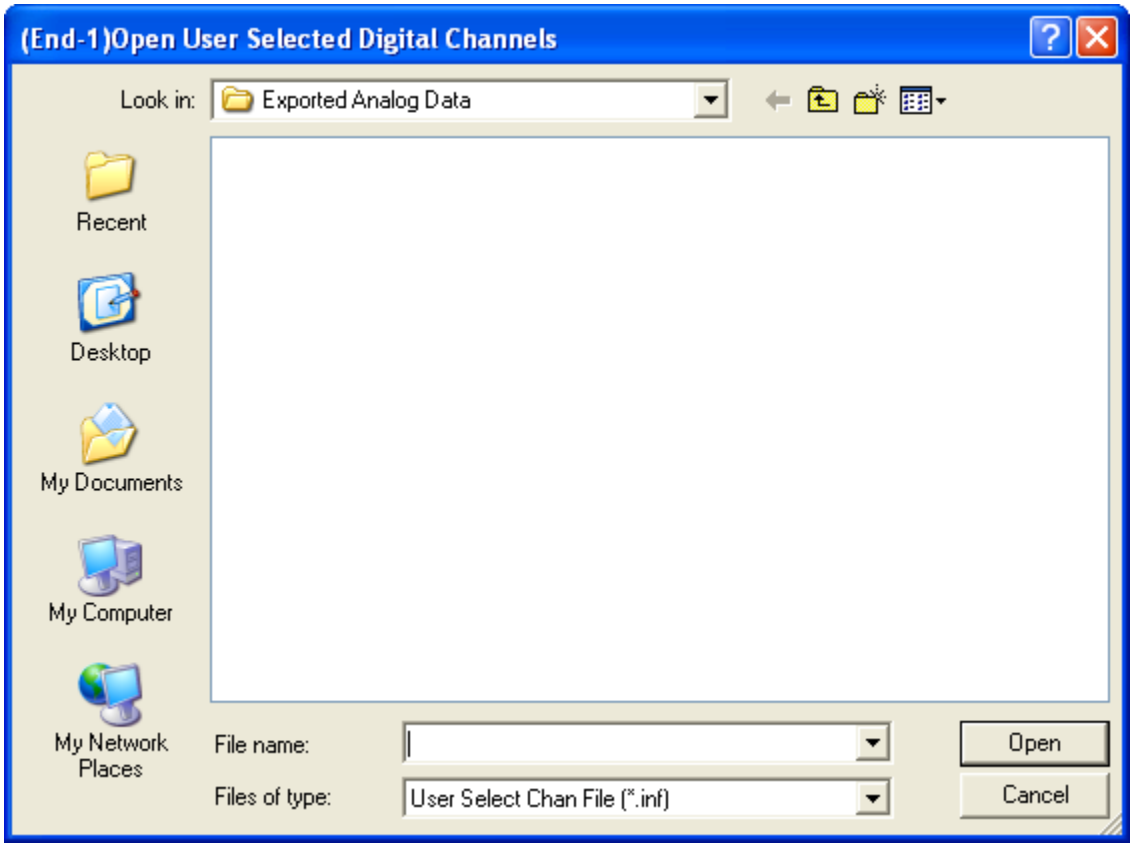


Figure 5-130 Open User Selected Digital Channels Window

- Save Save
  This button displays the ***(End-1)Save User Selected Digital Channels*** window (Figure 5-131). This window is used to save he selected digital channels to an information file for future viewing.

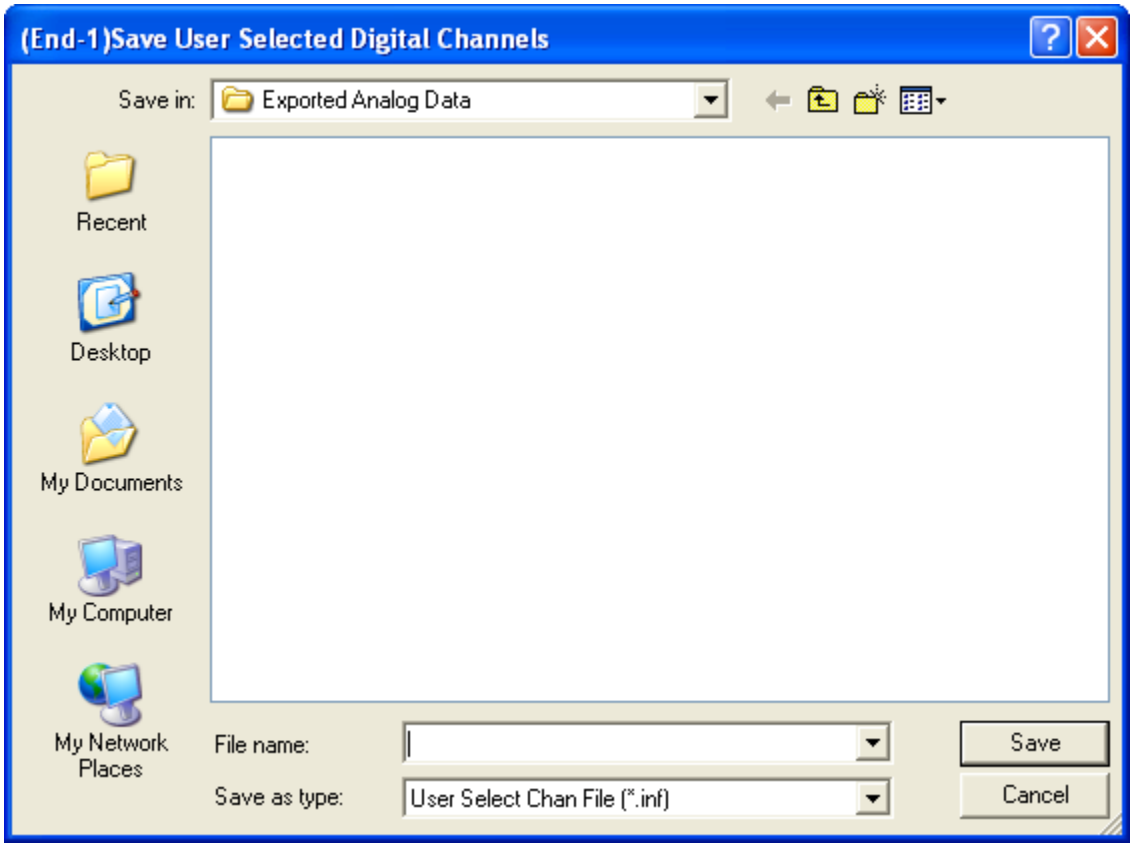


Figure 5-131 Save User Selected Digital Channels Window

- OK Ok
  This button applies the entries in the ***Display This Event(s) Only*** field and returns to the GSP graph screen.

- Graph Type:
  This drop-down displays the list of panel channel assignments. This list displays different arrangements of the three-phase inputs. The inputs grouped within parenthesis are displayed in separate waveform panels. The waveform panels are displayed from top to bottom in the order they are shown in the list.

  - (Va)(Vb)(Vc)(Ia)(Ib)(Ic)(neu)
    This selection displays A-phase voltage in the first panel, B-phase voltage in the second panel, C-phase voltage in the third panel, A-phase current in the fourth panel, B-phase current in the fifth panel, C-phase current in the sixth panel, and the neutral current in the seventh panel.

  - (Va,Ia)(Vb,Ib)(Vc,Ic)(neu)
    This selection displays the voltage and current inputs for A-phase in the first panel, the voltage and current inputs for B-phase in the

second panel, the voltage and current inputs for C-phase in the third panel, and the neutral current input in the fourth panel.

- (Va,b,c)(Ia,b,c)(neu)
  This selection displays the three-phase voltage inputs in the first panel, the three-phase current inputs in the second panel, and the neutral current input in the third panel.

- (Ia,b,c)(neu)(Va,b,c)(ref)
  This selection displays the three-phase current inputs in the first panel, the neutral current input in the second panel, the three-phase voltage inputs in the third panel, and the reference channel input in the fourth panel.

- (Va,Ia)(neu)
  This selection displays the voltage and current inputs for the A-phase in the first panel and the neutral current input in the second panel.

- (Vb,Ib)(neu)
  This selection displays the voltage and current inputs for the B-phase in the first panel and the neutral current input in the second panel.

- (Vc,Ic)(neu)
  This selection displays the voltage and current inputs for the C-phase in the first panel and the neutral current input in the second panel.

- Power/Impedance:
  This drop-down menu displays None, Power, or Impedance.

  - None
    When this is selected, the Power/Impedance waveform panel is removed and the ***Analog Graph Panels*** display expands to fill the window.

  - Power
    When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Apparent Power, Active Power, Reactive Power, and Power Factor values that are calculated from the analog data from the selected ***Line Name***.

  - Impedance
    When this is selected, the Power/Impedance waveform panel is displayed. This panel displays Phase ***A***, Phase ***B***, and Phase ***C***

impedance values that are calculated from the analog data from the selected ***Line Name***.

- RMS Graph:
  This drop-down menu displays ***Off*** or ***On***. This selection determines whether the sampled data is plotted to display the original waveforms ***(Off)***, or is used to calculate and plot a linear graph of RMS values ***(On)***.

- Display Every 1 of *N* data:
  This field is used to reduce the resolution of the displayed data. The default setting for this field is ***1*** which displays all data samples. This is only used if opening very large data files on a master station PC with limited resources. Increasing the value in this field will reduce the number of data samples displayed and decrease the amount of time taken to display the data file.

- ☑ Calculate Power using Line-to-Line Voltages:
  This checkbox enables the GSP to calculate the power and impedance values using voltage inputs from a delta-connected transformer.

- Update Graph:
  This button applies all the selections on the Graph Setup screen and returns to the GSP graph screen.

5.9 GSP – Two-Ended Analysis

The Graphic Signal Processing window can also be used to analyze a fault having data files from recording devices at both ends of the faulted transmission line. The data files can come from any USI or non-USI devices which produce a data file in COMTRADE format (e.g. DFR, DME, Protective Relay, Meter, etc.).

Two-Ended analysis can be performed when records from two different devices are opened in the same ***GSP*** window. There are three techniques to enter double-ended analysis mode. These are listed below.

5.9.1 Opening Two USI Data Files

This technique describes how to open two data files, both originating from a Utility Systems, Inc. DFR or DME.

- To open the End-1 data file, select the End-1 station from the ***DME System Selection*** drop-down list (Section 2.2.1).
- From the ***History Data*** screen tab, double-click on the End-1 fault record to open the GSP window and display this data file.
- Click the Restore-Down button to minimize the ***GSP*** screen.

Note: If using computer with multiple displays, the GSP window can be dragged to the second display, resulting in the *USIMaster©* screen displayed on one display and the GSP window on the other.

- To open the End-2 data file, select the End-2 station from the ***DME System Selection*** drop-down list.
- From the ***History Data*** screen tab, double-click on the End-2 fault record to display this data file overlaying the End-1 data file in the same GSP window. If the two records do not overlap in time due to loss of clock synchronization, the message window shown in Figure 5-132 is displayed. Click OK ***OK*** to align the trigger-zero (t_0) times and display the two records.

Figure 5-132 Double Graph Message Box

Note: Two data files having different sample rates and different record lengths can be used.

5.9.2 Opening One USI Data File and One Non-USI Data File

This technique describes how to open two COMTRADE data files, one originating from a Utility Systems, Inc. DFR or DME and the other from a non-USI device.

- To open the End-1 data file, select the End-1 station from the ***DME System Selection*** drop-down list (Section 2.2.1).
- From the ***History Data*** screen tab, double-click on the End-1 fault record to open the GSP window and display this data file.
- To open the End-2 data file, from the ***File*** menu select ***Open Data*** and then select ***Open Data 2.*** This displays the ***Open End-2 Data File*** window.
- Then use this window to select the End-2 data file. If the two records do not overlap in time due to loss of clock synchronization, the message window shown in Figure 5-132 is displayed. Click OK ***OK*** to align the trigger-zero (t_0) times and display the two records.

5.9.3 Opening Two Non-USI Data Files

This technique describes how to open two COMTRADE data files, both originating from non-USI devices.

- Open the GSP window by clicking the ***Tools*** menu and selecting ***Show Graphic Signal Processing Window***.
- To open the End-1 data file, from the ***File*** menu select ***Open Data*** and then select ***Open Data 1.*** This displays the ***Open End-1 Data File*** window.
- Then use this window to select the End-1 data file.
- To open the End-2 data file, from the ***File*** menu select ***Open Data*** and then select ***Open Data 2.*** This displays the ***Open End-2 Data File*** window.
- Then use this window to select the End-2 data file. If the two records do not overlap in time due to loss of clock synchronization, the message window shown in Figure 5-132 is displayed. Click OK ***OK*** to align the trigger-zero (t_0) times and display the two records.

5.9.4 Two-Ended Analysis

When two data files are open in the GSP window, ***End-2*** information is displayed in the right side of the GSP Header and ***End-1*** information is displayed in the left side of the GSP Header (Figure 5-133).

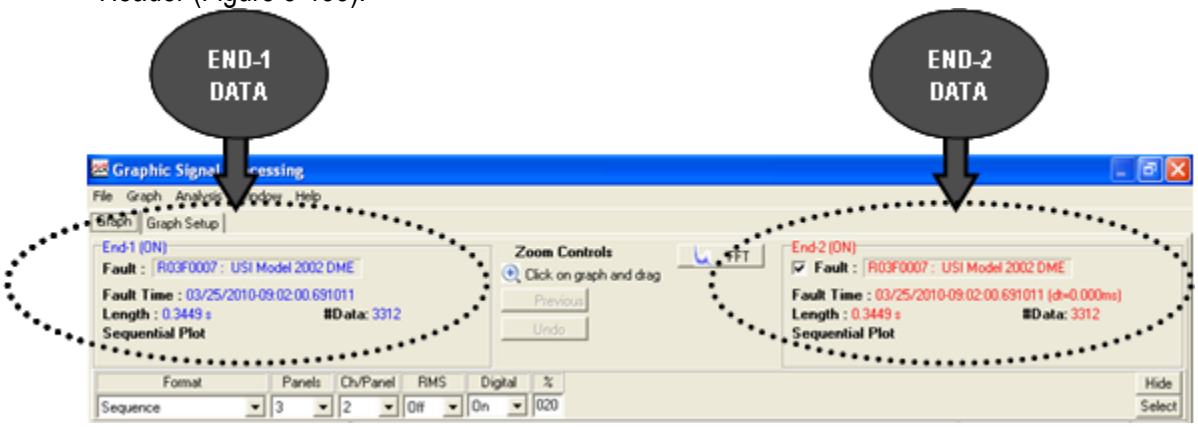


Figure 5-133 Graphic Signal Processing – Two-Ended Data

- **End-2 Data Box**
  The End-2 data box displays information for the second fault record when using double-ended analysis (Figure 5-133).

Note: See Section 5.9 for details on double-ended analysis.

- ☑ End-2 On/Off Check-box:
  This check-box toggles ***ON*** or ***OFF*** the display of the second data files waveforms.

- Fault:
  This field displays End-2 data file information as follows: (Remote ID number) (Fault ID number): (Station name).

- Fault Time:
  This field displays the time when the End-2 fault record was triggered.

- Length:
  This field displays the End-2 fault record length in time.

- #Data:
  This field displays the End-2 fault record length in number of A-to-D data samples.

- Plot:
  This field displays the selected graph format (Section 5.7 or Section 5.8).

- **Two-Ended GSP Window**
  When two data files are open in the GSP window, both the ***End-2*** and ***End-1*** waveforms are displayed in the Analog Graph Panels (Figure 5-134), and the calculated values are displayed in the Measurement column.

  The input numbers and descriptions are displayed in the Channel Number and Description column.

Note: The analog input numbers and descriptions will display a prefix of ***1*** or ***2*** to indicate End-1 or End-2 (e.g. 1A1 = End-1 Analog Channel 1 and 2A1 = End-2 Analog Channel 1). Likewise, the digital event and analog trigger inputs also display a prefix of ***1*** or ***2*** to indicate End-1 or End-2.

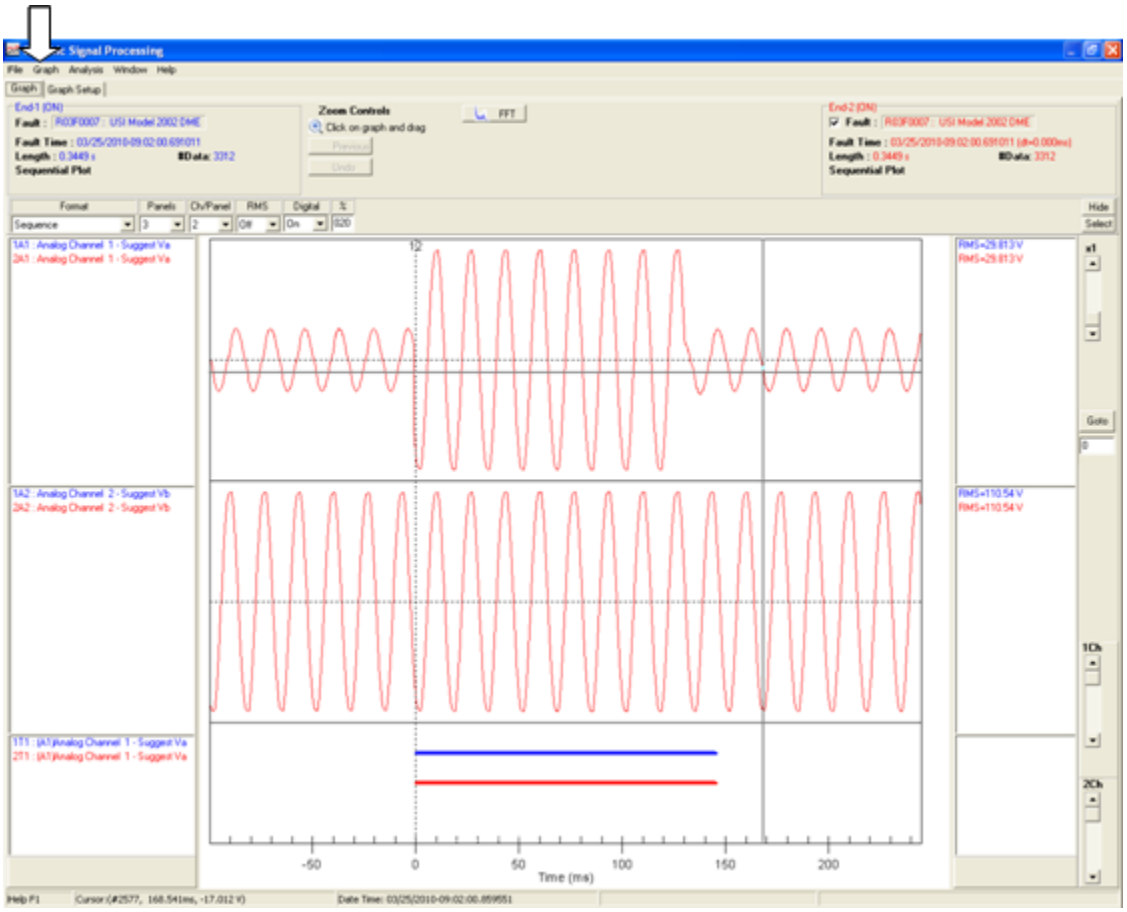


Figure 5-134 Two-Ended GSP Window

- **Two-Ended Quick Formatting Panel and Graph Setup Screen**
  When two data files are opened in the same ***GSP*** screen, the same customizations can be done for both data files by using the End-1 ***End-1*** or End-2 ***End-2*** buttons on the ***Quick Formatting Panel*** (Section 5.7) or by using the ***End-1*** or ***End-2*** screen tabs on the ***Graph Setup*** screen (Section 5.8) of each format.

- Graph Setup Screen – End1 Screen Tab:
  This screen displays the available drop-down menus and settings to customize the End-1 data file.

- Graph Setup Screen – End2 Screen Tab:
  This screen displays the available drop-down menus and settings to customize the End-2 data file. This tab is displayed only when two data files are open simultaneously.

  - Time Offset (ms)
    This field displays only on the End-2 Graph Setup screen when two data files are opened for double-ended analysis.

    When the GPS times of the two data files overlap, they are plotted synchronously with their GPS times. Small time offsets are automatically corrected and the computed offset value is displayed in this field.

    When the GPS times of the two data files do not overlap due to a loss of clock synch at the DME, they are plotted synchronously at their trigger-zero t_0 points. This field is used to compensate manually for the time difference. The value entered here is used to align the End-2 data file to the End-1 data file.

- Sequence Format:
  When this format is selected, the Graphic Signal Processing window displays the End-1 and the End-2 analog channels in sequential order from top to bottom.

  When two data files are displayed in this format, the Quick Formatting Panel (Section 5.7.1) and Graph Setup screen (Section 5.8.1) can be used to customize the graphs using the End-1 and End-2 screen tabs.

  - Sequence Format – Quick formatting Panel
    Clicking the Select Select button displays the ***Sequence Plot Graph Parameters*** window (Figure 5-135). When two data files are displayed, the End-2 tab can be used to customize the End-2 graphs in the same manner as in single-ended analysis (Section 5.7.1).

Figure 5-135 End-2 Sequence Format – Graph Parameters

- Sequence Format – Graph Setup Screen
  Click the Graph Setup tab to display the Graph Setup screen (Figure 5-136). When two data files are displayed, the End-2 tab can be used to customize the End-2 graphs in the same manner as in single-ended analysis (Section 5.8.1).

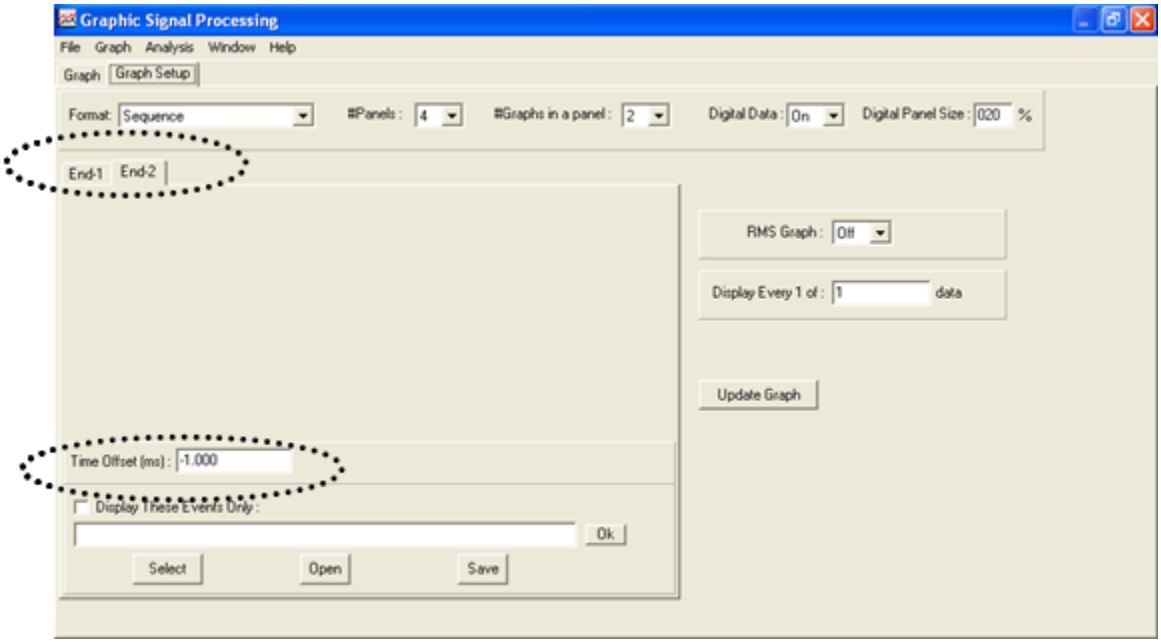


Figure 5-136 End-2 Sequence Format – Graph Setup Screen

The same navigation controls used to maneuver around within the two-ended analysis are the same used to maneuver around within the single-ended analysis (Section 5.5). There is an additional channel scroll bar for the End-2 data file (Figure 5-137).

- Ch Scroll Bar (Channel Scroll Bar)
  The ***1Ch*** scroll bar is used to scroll vertically through the End-1 graphs. The ***2Ch*** scroll bar is used to scroll vertically through the End-2 graphs.

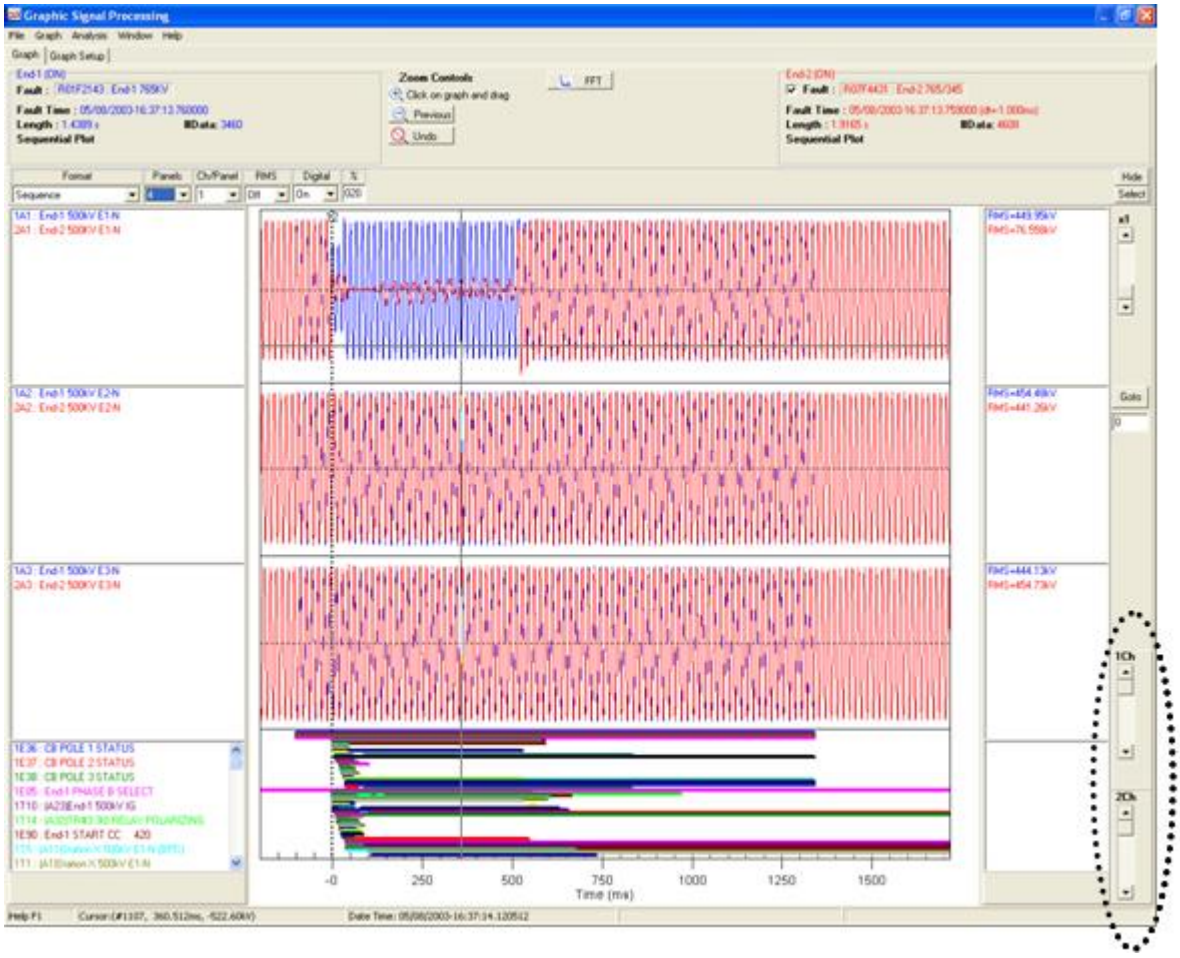


Figure 5-137 Two-Ended – Sequence Format

- User Select Format:
  When two data files are displayed in this format, the Quick Formatting Panel (Section 5.7.2) and Graph Setup screen (Section 5.8.2) can be used to customize the graphs using the End-1 and End-2 screen tabs.

  - User Select – Quick formatting Panel
    Choosing User Select from the Quick Formatting Panel displays the ***User Channel Select*** window (Figure 5-138). When two data files are displayed, the End-2 tab can be used to customize the End-2 graphs in the same manner as in single-ended analysis (Section 5.7.2).

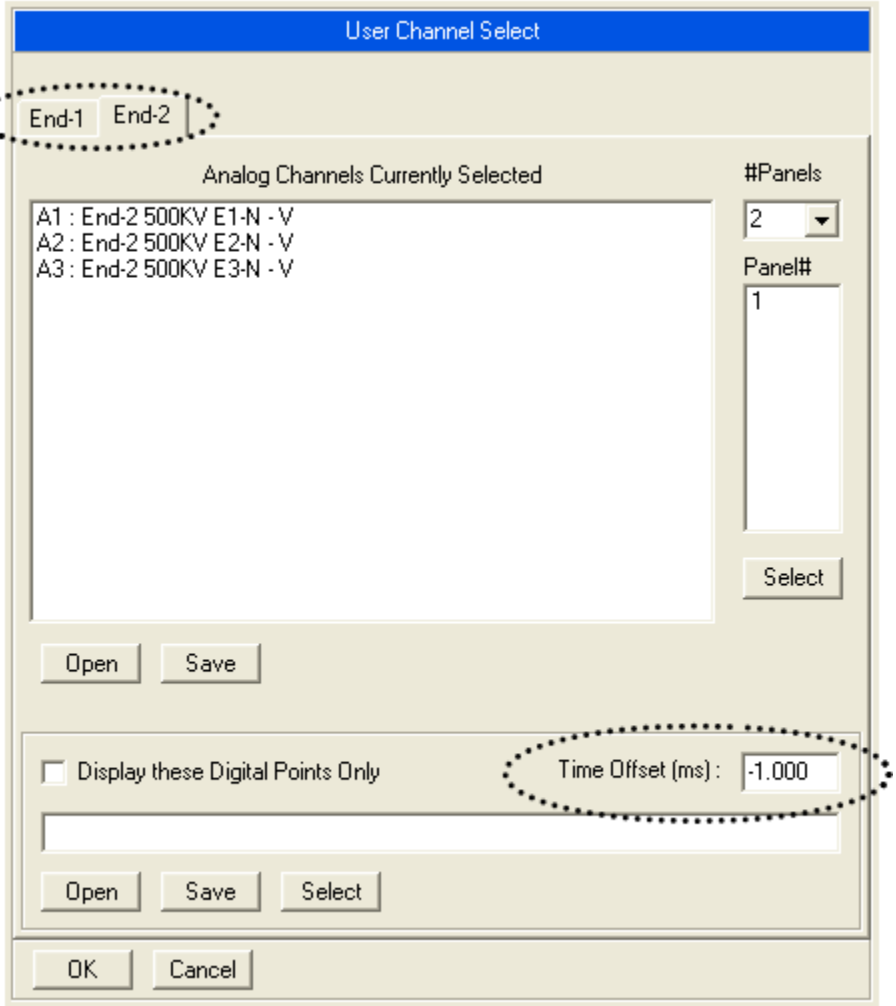


Figure 5-138 Two-Ended – User Select Format Channel Select Window

- User Select – Graph Setup Screen
  Choosing ***User Select*** from the Graph Setup window displays the Two-Ended User Select Format Graph Setup Window (Figure 5-139). When two data files are displayed, the End-2 tab can be used to customize the End-2 graphs in the same manner as in single-ended analysis (Section 5.8.2).

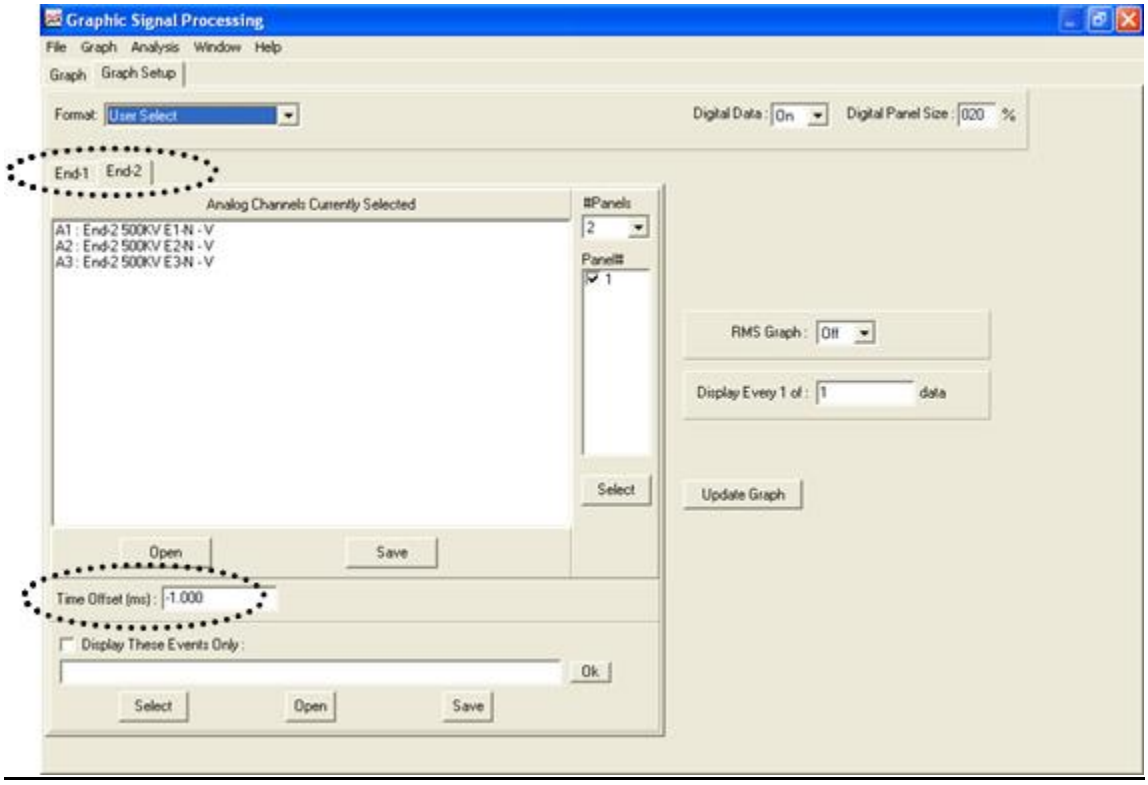


Figure 5-139 Two-Ended – User Select Format Graph Setup Window

- Group Format:
  When two data files are displayed in this format, the Quick Formatting Panel (Section 5.7.3) and Graph Setup screen (Section 5.8.3) can be used to customize the graphs.

  - Group Format – Quick formatting Panel
    When using the Quick Formatting Panel an End-1 End-1/ End-2 End-2 button is displayed (Figure 5-140). This button is used to display the End-1 Line Groups or the End-2 Line Groups in the***Line Name*** drop-down list.

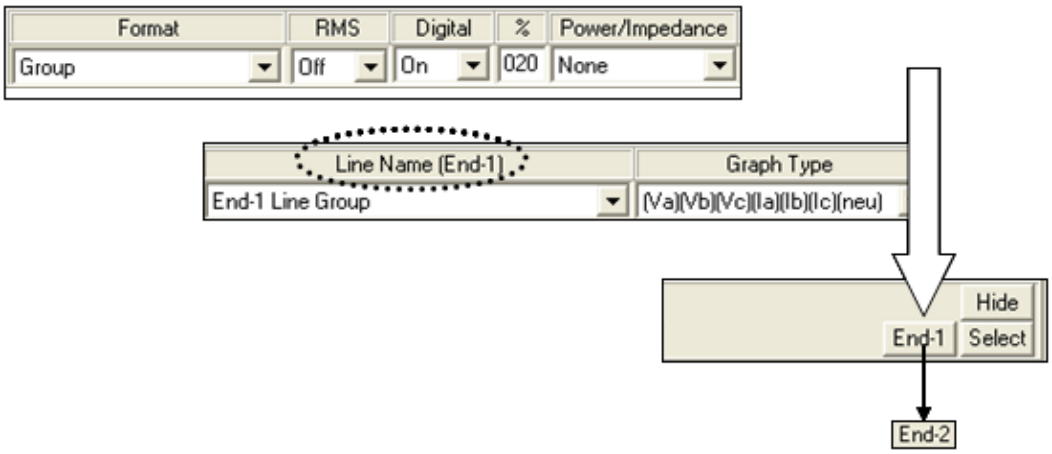


Figure 5-140 Two-Ended – Group Format Quick Formatting Panel

- Group Format – Graph Setup Screen
  Choosing ***Group*** from the Graph Setup window displays (Figure 5-141). When two data files are displayed, the End-1 and End-2 tabs are used to display the End-1 Line Groups or the End-2 Line Groups in the ***Line Name*** drop-down list (Section 5.8.3).

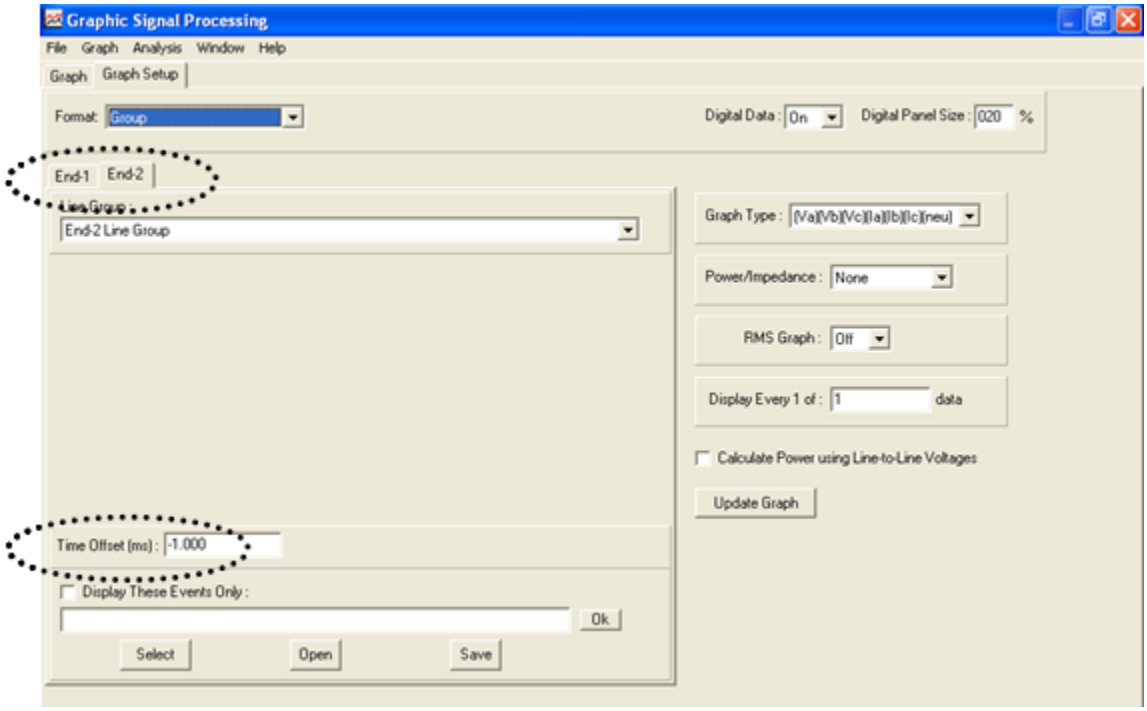


Figure 5-141 Two-Ended – Group Format Graph Setup Screen

- Three Phases Format:
  When two data files are displayed in this format, the Quick Formatting

Panel (Section 5.7.4) and Graph Setup screen (Section 5.8.4) can be used to customize the graphs.

- Three Phases Format – Quick formatting Panel
  Choosing ***Three Phases*** from the Quick Formatting Panel displays the ***Three Phase Channel Select*** window (Figure 5-142). When two data files are displayed, the End-2 tab can be used to customize the End-2 graphs in the same manner as in single-ended analysis Section 5.7.4).

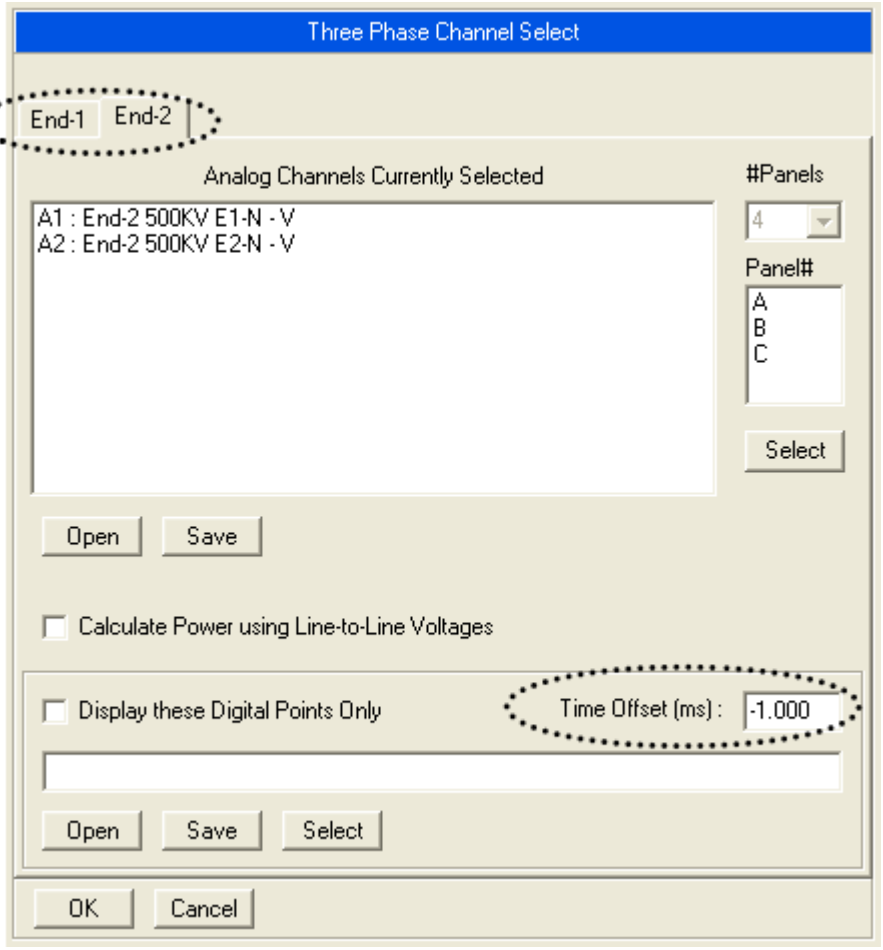


Figure 5-142 Two-Ended – Three Phases Format Channel Select Window

- Three Phases – Graph Setup Screen
  Choosing ***Three Phases*** from the Graph Setup window displays the Two-Ended – Three Phases Graph Setup Screen (Figure 5-143). When two data files are displayed, the End-2 tab can be used to customize the End-2 graphs in the same manner as in single-ended analysis (Section 5.8.4).

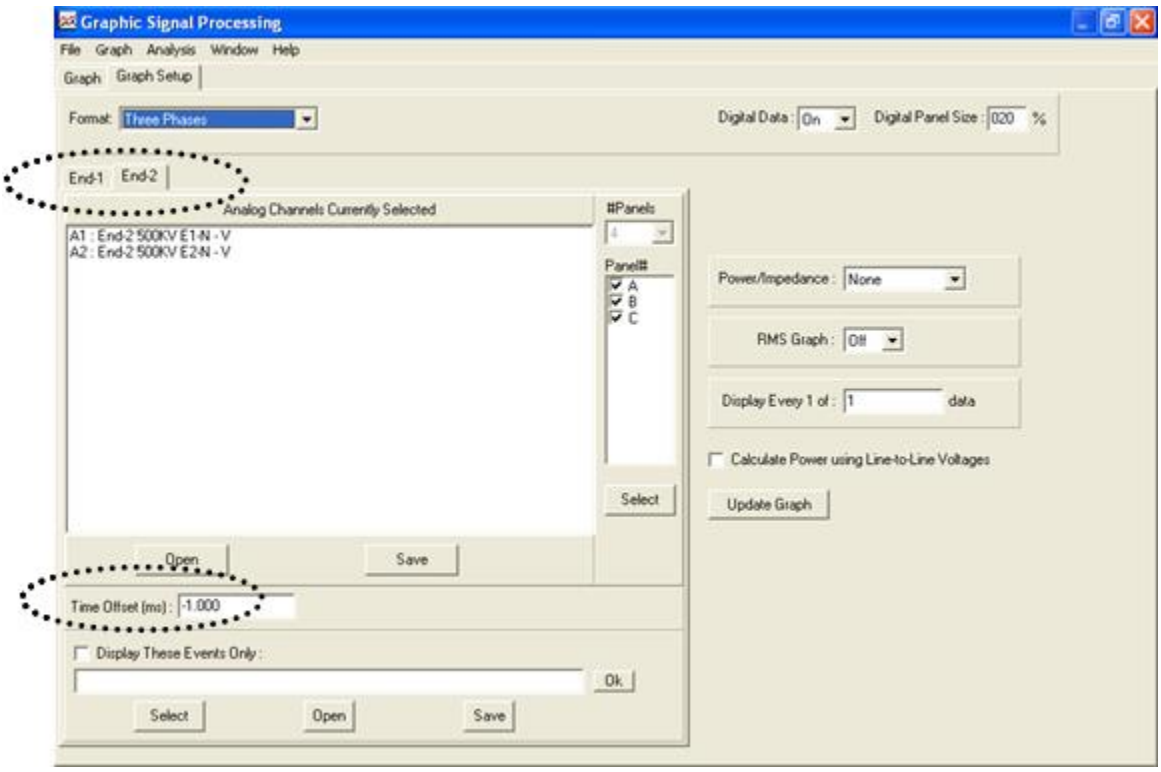


Figure 5-143 Two-Ended – Three Phases Format Graph Setup Screen

- Single Phase Format:
  When two data files are displayed in this format, the Quick Formatting Panel (Section 5.7.5) and Graph Setup screen (Section 5.8.5) can be used to customize the graphs.

  - Single Phase Format – Quick formatting Panel
    Choosing ***Single Phase*** from the Quick Formatting Panel displays the ***Single Phase Channel Select*** window (Figure 5-144). When two data files are displayed, the End-2 tab can be used to customize the End-2 graphs in the same manner as in single-ended analysis (Section 5.7.5).

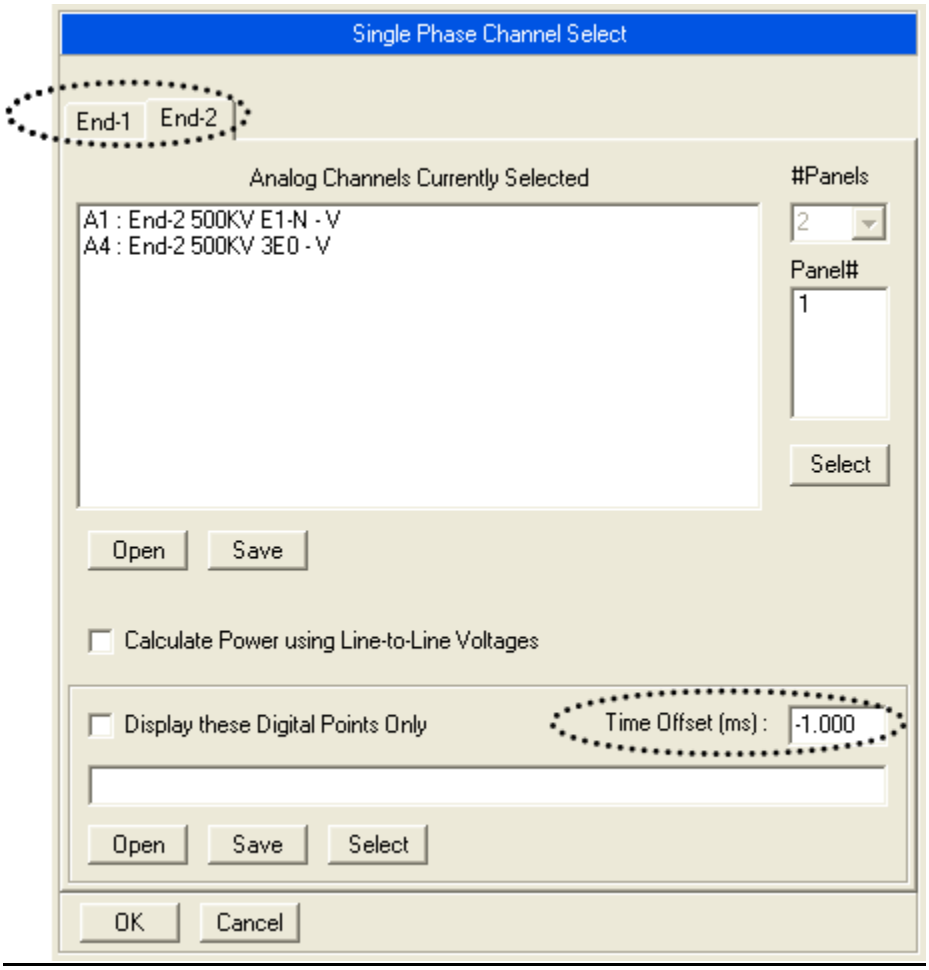


Figure 5-144 Two-Ended – Single Phase Format Channel Select Window

- Single Phase – Graph Setup Screen
  Choosing ***Single Phase*** from the Graph Setup window displays the ***Single Phase Channel Select*** window (Figure 5-144). When two data files are displayed, the End-2 tab can be used to customize the End-2 graphs in the same manner as in single-ended analysis (Section 5.8.5).

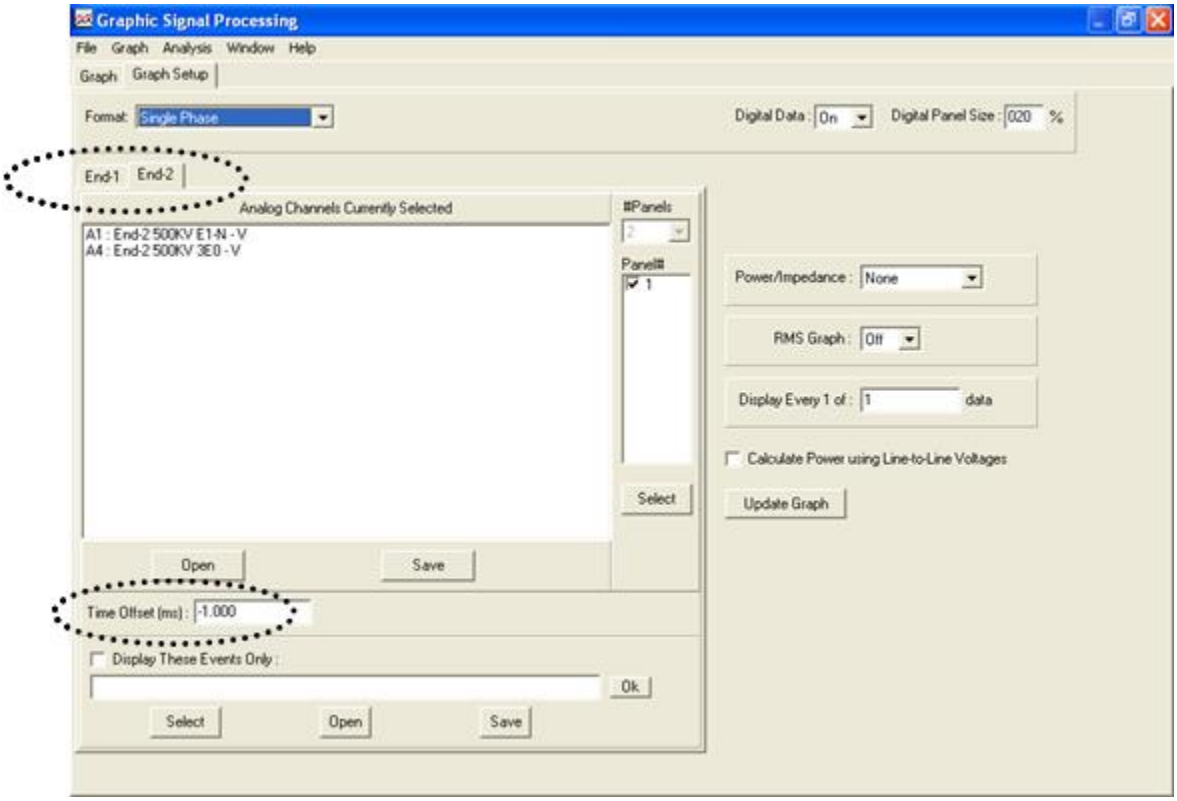


Figure 5-145 Two-Ended – Single Phase Format Graph Setup Screen

- Generator/Delta Power Format:
  When two data files are displayed in this format, the Quick Formatting Panel (Section 5.7.6) and Graph Setup screen (Section 5.8.6) can be used to customize the graphs.

  - Generator/Delta Power Format – Quick formatting Panel
    When using the Quick Formatting Panel an End-1 End-1/ End-2 End-2 button is displayed (Figure 5-146). This button is used to display the End-1 Line Groups or the End-2 Line Groups in the ***Line Name*** drop-down list.

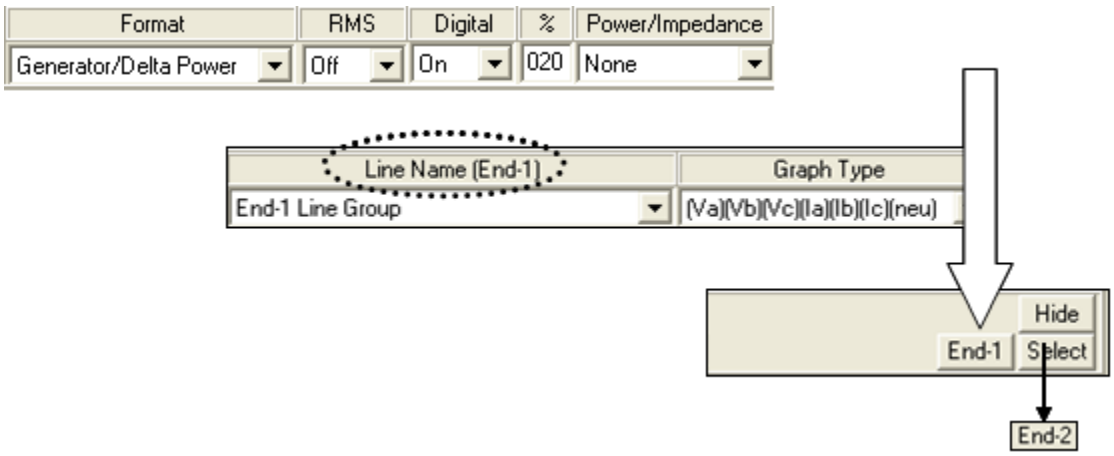


Figure 5-146 Two-Ended – Generator/Delta Power Format Quick Formatting Panel

- Generator/Delta Power Format – Graph Setup Screen
  Choosing ***Generator/Delta Power*** from the Graph Setup window displays (Figure 5-147). When two data files are displayed, the End-1 and End-2 tabs are used to display the End-1 Line Groups or the End-2 Line Groups in the ***Line Name*** drop-down list (Section 5.8.6).

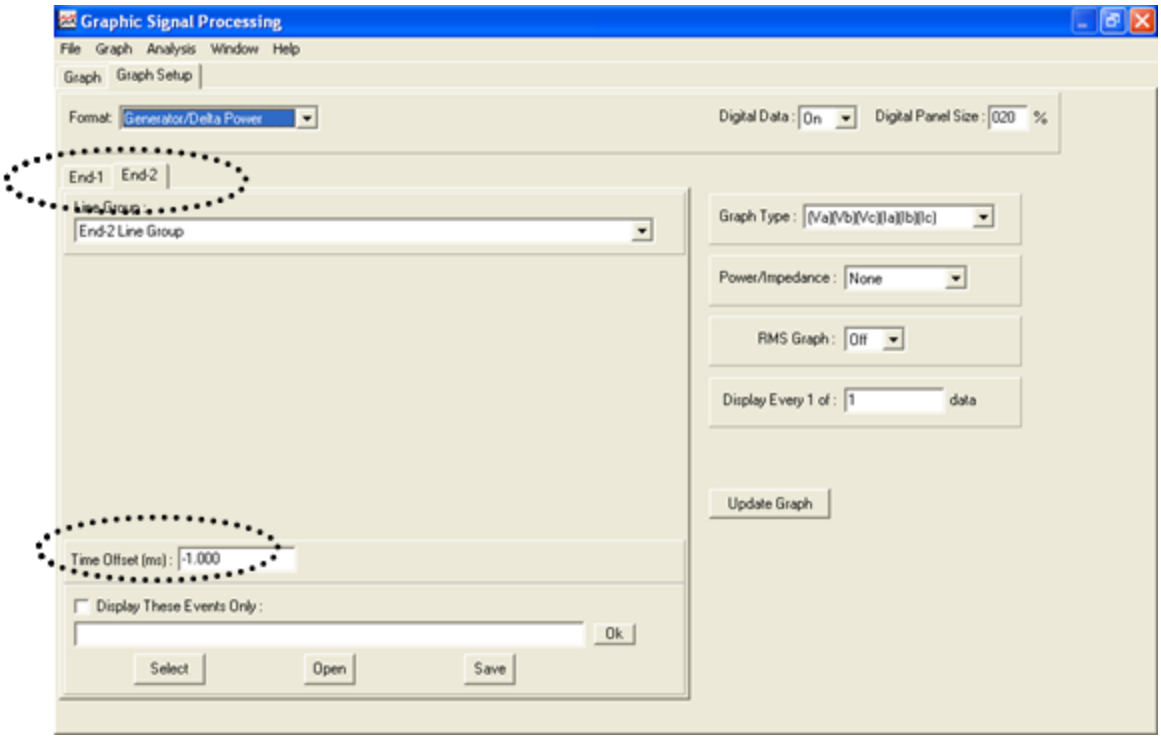


Figure 5-147 Two-Ended – Generator/Delta Power Graph Setup Screen

5.9.5 Two-Ended Fault Location

Another feature of the GSP – Two-Ended analysis is Two-Ended Fault Location. To utilize this feature, two COMTRADE data files must be opened and displayed in the Group Format. This feature is accessed from the Waveform Graph Panel – Right-Click Menu (Figure 5-148). The two data files displayed must each have a Line Group setup file (Section 4.3).

- **Two USI Data Files**
  When using two USI data files, the Line Group files previously created are automatically opened when the data files are opened (Section 5.9.1). Therefore, the GSP is now ready to do two-ended fault location.

- **One USI Data File and One Non-USI Data File**
  When using one USI data file and one non-USI data file, the Line Group file previously created for the USI data file is automatically opened when that data file is opened. However, when the non-USI data file is opened (Section 5.9.2) there is no USI Line Group file associated with this file, therefore one must be manually opened. For two-ended fault location the data files being used must have data for the same transmission line, the Line Group file for the USI data file can be opened for use with the non-USI data file. This Line Group file can then be edited to assign the correct analog channels to the non-USI Line Group file.

  - To open the line group file for the non-USI data file, use the GSP – File menu (Section 5.1.1) and select Open Line-Group.

  - To edit the line group file for the non-USI data file, use the GSP – File menu and select Edit Line-Group (Section 4.3).

- **Two Non-USI Data Files**
  When using two non-USI data files, neither data file has a USI Line Group file associated to it. In this case, a Line Group file must be created for both End-1 and End-2 data files. This can be done by using the Edit Line-Group selection from the GSP – File menu (Section 5.1.1) or from the *USIMaster*© Edit Menu (Section 4.3).

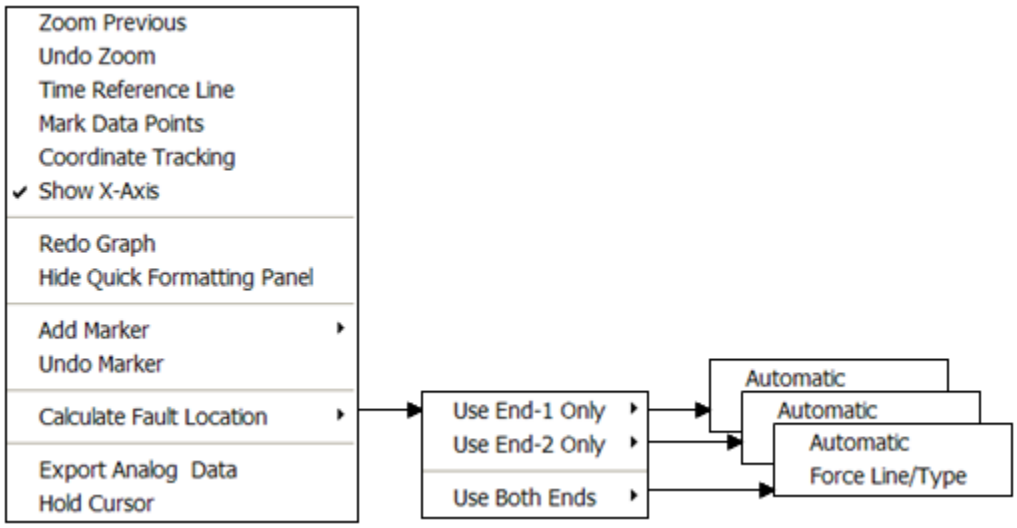


Figure 5-148 Double-ended Analysis Fault Location

- **Time Offset (ms):**
  The time offset of end-2 can be shifted by clicking on **Graph Setup, End-2** and then entering a ***time offset*** value. The units on the numbers entered are milliseconds. If the times of the two graphs overlap, they are placed in the same panel with the t_0 lines appropriately placed.

Glossary

1

1-Ended

Or single-ended (q.v.). A type of distance-to-fault calculation. See Section 5

1 ph. PF

Abbreviation for Single-Phase Power Factor

1 ph. Vr

Abbreviation for Single-Phase Reactive Power (Vr is an abbreviation for VAR)

1 ph. W

Abbreviation for Single-Phase Real Power

2

2-ended

Or double-ended (q.v.). A type of distance-to-fault calculation. If two fault recorders at opposite ends of a transmission line pick up the same fault, then a distance-to-fault computation can be made from both ends. This is known as a 2-ended or double-ended computation. See Section 5.9.

3

3I0

Three-I-Zero. Abbreviation for a vector representing zero sequence current.

3 ph. PF

Abbreviation for Three-Phase Power Factor

3 ph. Vr

Abbreviation for Three-Phase Reactive Power (Vr is an abbreviation for VAR)

3 ph. W

Abbreviation for Three-Phase Real Power

4

4 Point

Area Query method for LDC system (Section 4.1.3). See Polygon method.

A

ANSI

American National Standards Institute, a publisher of standards

ASCII

American Standard Code for Information Interchange, an eight-bit character-based code

Auto

Abbreviation for Automatic

B

Baud (rate)

The signaling rate of a communications circuit which is equal to the number of transitions (voltage or frequency changes) that are made per second. Often used erroneously as equivalent to bits per second. Baud and bits per second are equivalent only at rates of 300/second and lower. A V.22bis modem generates 1200 bps at 600 baud. Baud was named after French engineer Jean Maurice Emile Baudot (1845-1903).

Binary

The binary number system, or base-2 number system represents numeric values using two symbols, **0** and **1**.

BMP

A graphics file in bitmap (bump) format; these files have a ***.bmp*** extension and can be sent to the Windows Clipboard

C

Cal

Or Cal. Abbreviation for Calibration

Cal Rec

Or Cal. Rec. Abbreviation for Calibration Record

Calibration Record

The Calibration Record (Cal Rec) contains the channel assignments for the DME system. This record also includes the sample rate, fault length parameters, analog and digital input channel parameters, and analog trigger parameters. This record may be created and edited at the remote units or at the master stations. See Section 4.

CD-ROM

Compact Disc – Read-Only Memory. This is a type of portable storage medium used to transport software and data. It is similar in appearance to a common audio CD.

Ch

Abbreviation for Channel

COM

Abbreviation for Communication as in COM Port

Com Bd

Abbreviation for Common Board. The Common board is mounted on a DSP board and is used in local distributed systems. See Section 4.2.3.

Comm

Or Comm. Abbreviation for Communication

COMTRADE

Acronym for Common Format for Transient Data Exchange. Source: IEEE Std C37.111-1999, *IEEE Standard Common Format for Transient Data Exchange (COMTRADE) for Power Systems*.

COMNAMES

Standardized file naming convention, part of IEEE Std PC37.111-1999, IEEE Standard Common Format for Transient Data Exchange (COMTRADE) for Power Systems.

Config

Or Config. Abbreviation for Configuration

Cont-Rec

Abbreviation for Continuous Recording. See Section 2.1.6.

CPU

Abbreviation for Central Processing Unit (or processor), the primary functional element of a computer.

CT

Current Transformer

CT Ratio

CT refers to Current Transformer, a type of instrument transformer used to measure a current in an electrical power system by sensing a voltage across a transformer winding. The value entered in this field is the ratio of input current to output current (turns ratio) of the transformer (e.g. 240:1). See PT Ratio.

D

DAS

Data Analysis Software. This is the Model 2002 Digital Fault Recorder Master Station Data Analysis Software supplied by Utility Systems, Inc. *USIMaster*©

dB

Decibel, the unit of power-level comparison; technically, the base-10 logarithm of a ratio of two power levels

Descripts

Abbreviation for Descriptions

df

Delta Frequency. Frequency increment between adjacent data points on the FFT graph. Displayed on the lower left corner of the FFT screen. See Section 5.3.

DFR

Digital Fault Recorder. A subsystem of the DME.

DFR/SER

Digital Fault Recorder/Sequence of Events Recorder. Subsystems of the DME.

DFT

Discreet Fourier Transform. See FFT.

Diag

Abbreviation for Diagnostic

Dial-up

A method whereby the various stations of the DME system communicate with each other via a telephone system

DIP

Dual In-line Package. A standardized component package for use on circuit boards

Disturbance

An unplanned event that produces an abnormal system condition

Disturbance, Electromagnetic

Any electromagnetic phenomena which may degrade the performance of a device, equipment or system, or adversely affect living or inert matter.

DME

Disturbance Monitoring Equipment (i.e. Digital Fault Recorder, Sequence of Event Recorder, and Disturbance Monitoring System)

DNP3

Distributed Network Protocol 3: A set of communications protocols and functions. The DNP3 protocol is detailed in IEEE 1815 and IEC 62351-3.

Double Ended

A type of distance-to-fault calculation. If two fault recorders at opposite ends of a transmission line pick up the same fault, then a distance-to-fault computation can be made from both ends. This is known as a 2-ended or double-ended computation. See Section 5.10.

DSP

Digital Signal Processor. This is a type of integrated circuit used in the Model 2002 Disturbance Monitoring Equipment (DME).

DST

Abbreviation for Daylight Saving Time. See Section 4.4.2.

E

E-mail

Electronic mail routed over the Internet. See SMTP/POP3.

ESD

Electrostatic Discharge: the sudden transfer of charge between bodies of differing electrostatic potentials.

Ethernet

Ethernet is a family of computer networking technologies for Local Area Networks (LANs). It has been standardized as IEEE 802.3 and has been in use since the early 1980s. It has largely replaced the competing technologies: token ring, FDDI, and ARCNET.

EV#

Abbreviation for ***Event Number***

Ext

Abbreviation for **External**

F

Fault Table

Located at center-right of the ***Edit Line-Group Record*** screen. See Section 4, Figure 4-43.

Fax

Abbreviation for facsimile. Facsimile (fax) machines interchange text and graphics in a low-resolution half-tone page raster format over telephone systems.

FFT

Fast Fourier Transform. This mathematical technique is used to transform data bi-directionally between the time domain and the frequency domain. See Section 5.2.3.

FID

Fault Identification (ID) number

FIFO

Acronym for First In First Out, a method of data storage and retrieval

FIPS

Federal Information Processing Standards (FIPS), a series of federal (U.S.A.) standards. These documents are available from National Technical Information Services (NTIS).

Fortescue

Charles Legeyt Fortescue (1876-1936), a Canadian electrical engineer, developed a methodology for representing three-phase systems using three sets of independent symmetrical components. These are: Positive Sequence, Negative Sequence, and Zero Sequence for both voltage and current.

Freq

Abbreviation for Frequency. In this document, Frequency is used as:
1.the power system line frequency (nominally 50 Hz or 60Hz), or
2. the update rate of the Continuous Frequency, RMS, and Phase calculation rates (calculations per second), or
3. the update rate of the Long Term RMS calculation rate (calculations per second), or
4. the sampling rate of the analog-to-digital converters in the DME units (samples per second).

G

GMT

Greenwich Mean Time

Goto

Literally "Go To." The Goto box on the GSP screen provides a shortcut to a selected data point on a displayed waveform. See Section 5.4.

GPS

Global Positioning System. GPS can be used to time synchronize the Disturbance Monitoring Equipment (DME) (see Synch DFR Time) and also provides location coordinates for power line structures used by the LDC option (see Section 4.1.3).

GSP

Graphic Signal Processing. See Section 5.

H

Horz

Abbreviation for Horizontal

I

ID

Abbreviation for Identification, Identifier, Identify, or Ident

IEEE

The Institute of Electrical and Electronics Engineers, a publisher of standards

IN#

Abbreviation for Input (Channel) Number

Info

Also Info. Abbreviation for Information

IP address

An Internet Protocol (IP) address is a numerical label assigned to devices participating in a computer network that uses Internet Protocol (IP) for communication between its nodes.

IRIG-B

IRIG-B refers to a serial time code format. It is a timing signal transmitted at a 100 bps rate. IRIG-B sends Day of Year, Hour, Minute and Second data on a 1 kHz carrier. It has a one-second update rate. IRIG is an abbreviation for **I**nter **R**ange **I**nstrumentation **G**roup.

J

JPEG

Joint Photographic Expert Group – a commonly used standard for digitizing photographic images

JPG

A graphics file in compressed JPEG (q.v.) format that can be output only as a file with a ***.jpg*** extension

K

Kilometer

A unit of distance measurement. The Lightning Data Correlation (LDC) feature can be set to calculate distances in kilometers or miles. See Section 4.1.3.

L

LAN

Local Area Network

LDC

Lightning Data Correlation (LDC) is an optional feature of the *USIMaster*© System. Adding this option enables the client to correlate fault data with lightning strike data.

LED

Abbreviation for Light-Emitting Diode, a solid-state light source.

Lightning

An electric discharge that occurs in the atmosphere between clouds or between clouds and ground.

Lightning Overvoltage

The crest voltage appearing across an arrestor or insulation caused by a lightning surge

Lightning Surge

A transient electric disturbance in an electric circuit caused by lightning

Loc

Or Loc. Abbreviation for Location

LOGF

Abbreviation for Logic Filter

LT

Abbreviation for Long Term Fault

M

MAG

Abbreviation for ***Magnitude*** (or instantaneous value) at a selected point on a waveform. See Section 5.

Magnetic Instrumentation, Inc.

The parent company of Utility Systems, Inc. (USI).

MAX

Or MAX. Abbreviation for Maximum

Metafile

A graphics file format (vector or bit map) that can be sent to the Windows Clipboard or to a printer; these files have a ***.wmf*** (Windows Metafile) extension.

Meter

A feature on the Measurement Panels section of the Graphic Signal Processing screen. A meter provides the numerical value of a waveform parameter such as RMS voltage. See Section 5.

Mile

A unit of distance measurement. The Lightning Data Correlation (LDC) feature can be set to calculate distances in kilometers or miles. See Section 4.1.3.

MIN

Abbreviation for Minimum

Modem

Contraction for MOdulator-DEModulator. In common usage, a modem is a bi-directional interface between a computer system and a communications system. In the *USIMaster*© system, modems in the master unit and in the remote units communicate bi-directionally via a telephone system, a LAN/WAN or the internet.

N-O

NC

Normally Closed, describes a type of relay that has closed output contacts when de-energized (OFF state) and open output contacts when energized (ON state).

NO

Normally Open, describes a type of relay that has open output contacts when de-energized (OFF state) and closed output contacts when energized (ON state).

Null Data

Null data is a value that indicates missing or unknown data.

Number of Cycles

To calculate an RMS value of a waveform, the number of cycles (periods) of the measurand waveform to be used in the calculation must be specified. See Section 5.8.

Optocoupler

A four-terminal (sometimes five-terminal) electronic component used to couple signals from high voltage electrical systems to low voltage electronic systems while providing electrical isolation between the two. Also known as an optoisolator, it consists of a light source and a light detector separated by an optically-transparent insulator. Its simplest embodiment uses a light-emitting diode and a photodiode separated by a layer of clear plastic.

Oscillography

1. A record containing sampled waveform data
2. The science of sensing, recording, displaying and analyzing time-varying phenomena.

P

panel

An area on the Graphic Signal Processing screen. See Section 5.1.

pcAnyWhere®

Symantec pcAnywhere© (Host and Remote) is a third-party application supplied to allow remote-control accessibility and file transfer capabilities from the master station PC. It may be used remotely to install software updates, perform maintenance, and diagnostics via dial-up modem or Ethernet (LAN/WAN) communication media. See Symantec.

PDC

Acronym for Phasor Data Concentrator.

Phasor

A phase vector (phasor) is a representation of a sine wave having amplitude (A), phase (θ), and frequency (ω) characteristics that are time invariant. Use of phasors simplifies certain calculations by eliminating time (frequency) terms and leaving only amplitude and phase.

Ping

Abbreviation for Packet Internet Groper. Ping is a computer network administration utility used to test whether a particular host is reachable across an Internet Protocol (IP) network. It also measures the round-trip time for packets sent from the local host to a destination computer, including the time delay in the host computer interfaces.

Use of the ping utility is usually described as pinging a host computer.

PLC

Acronym for Programmable Logic Controller

PMU

Acronym for Phasor Measurement Unit. In the Model 2002/3002 the PMU is an optional feature that can be added into the DME system. This option enables the system to stream calculated Synchrophasor data values. A separate stand-alone hardware unit is NOT required.

Point/Radius

Area Query method for LDC system (Section 4.1.3). See 4 Point method.

Polygon

A polygon is a plane geometric figure bounded by a closed path or circuit composed of a finite number of straight line segments. In the LDC system it is an area query method for correlating lightning strike locations with distribution system structure locations (Section 4.1.3). See 4 Point method.

POP3

POP3 is an abbreviation for Post Office Protocol Version 3. POP is an application-layer Internet standard protocol used by local E-mail clients to retrieve E-mail from a remote server over a TCP/IP connection. Version 3 (POP3) is the current standard.

PT

Acronym for Potential Transformer.

PT Ratio

PT refers to Potential Transformer, a type of instrument transformer used to measure a voltage in an electrical power system. The value entered in this field is the ratio of input voltage to output voltage (turns ratio) of the transformer (e.g. 3000:1). See CT Ratio.

Q-R

Quick Panel

A selectable feature of the ***Graph Setup Group*** screen. See Section 5.2.

QSM

Abbreviation for Quick Summary

Qsum

Abbreviation for Quick Summary

Remote

Synonym for Digital Fault Recorder (DFR), a unit of the Disturbance Monitoring Equipment (DME) system, usually located remotely from the DME host computer.

RFL

Abbreviation for RFL Electronics, Inc. RFL is a manufacturer of communications equipment for the power utility industry.

RMS

Root-Mean-Square

RS-232

RS-232 (Recommended Standard 232) is a standard for serial binary single-ended data and control signals connecting between a Data Terminal Equipment (DTE) and a Data Circuit-terminating Equipment (DCE). It is commonly used in computer serial ports. The controlling standard is Electronic Industries Association (EIA) RS-232C (1969). Current revision is Telecommunications Industry Association TIA-232-F (1997). In the personal computer industry RS-232 has been largely replaced by the USB interface standard. Industrial equipment and PLCs still use the RS-232-C standard port.

S

Sag

A decrease between 0.1 and 0.9 per unit in RMS voltage or current at the power frequency, for durations from a half-cycle to one minute.

Screen

A visual display on a computer monitor is called a screen. *USIMaster*© is viewed on a family of screens, such as: System Configuration screen, Graphic Signal Processing (GSP) screen, USI Master Station screen, etc.

SER

Sequence of Events Recorder, a type of Disturbance Monitoring Equipment used in the USI Disturbance Monitoring System. See Section 3.3.

ServiceMaster

An diagnostic/troubleshooting tool. Access is by System Configuration screen, Automation tab. See Section 4.

Shunt

A resistive device that provides an output voltage proportional to circuit current.

Single Ended

Or 1-ended (q.v.). A type of distance-to-fault calculation. See Section 5.

SMTP/POP3

Simple Mail Transfer Protocol/Post Office Protocol Version 3. SMTP is an Internet standard for E-mail transmission across Internet Protocol (IP) networks (see TCP/IP). User-level applications typically use SMTP for transmission of E-mail messages and POP3 (q.v.) for reception of E-mail messages.

Start/Stop Time

Time Query method for LDC system (Section 4.1.3). See Start Time/Duration method.

Start Time/Duration

Time Query method for LDC system (Section 4.1.3). See Start/Stop Time method.

Surge

A transient wave of voltage, current, or power in an electrical circuit.

Swing Record

Data record captured upon initiation of a DFR trigger containing data for an extended period of time for the capture of potential power swing.

Symantec

Abbreviation for Symantec Corporation, the publisher of Norton pcAnywhere©.

Sync

Abbreviation for Synchronize or Synchronization

Synchrophasor

A phasor calculated from data samples using a standard time signal as a reference for the measurement. Synchronized phasors from remote sites have a defined common phase relationship. See IEEE C37.118-2005 Standard for Synchrophasors for Power Systems, IEEE Power Engineering Society.

T

TCP/IP

The Internet Protocol Suite, commonly known as TCP/IP, is a four-layered set of communications protocols used for the Internet and other similar networks. Two of the most important protocols in the suite are the Transmission Control Protocol (TCP) and the Internet Protocol (IP), hence the common name.

Text/Data Only

An ASCII (q.v.) text format that can be sent to the Windows Clipboard; these files have a ***.txt*** or ***.dat*** extension; they can be viewed or printed by using a word processor.

THD

Abbreviation for Total Harmonic Distortion. See Section 4.2.4.

TR#

Abbreviation for Trigger Number

Transducer

A device that senses a physical phenomenon (e.g., force, displacement, pressure, temperature, electrical current, etc.) and generates an equivalent electrical signal. A sensor.

U

UDP/IP

The Internet Protocol Suite, commonly known as TCP/IP (q.v.), is a four-layered set of communications protocols used for the Internet and other similar networks. Two of the protocols in the suite are the User Diagram Protocol (UDP) and the Internet Protocol (IP), hence the common name.

With UDP, computer applications can send messages (datagrams). Datagrams may arrive out of order, appear duplicated, or go missing without notice. Time sensitive applications often use UDP because dropping of packets is preferable to waiting for delayed packets.

URL

Uniform Resource Locator. In computing, a URL is a Uniform Resource Identifier (URI) that specifies where an identified resource is available and the mechanism for retrieving it. URL is often incorrectly used as a synonym for URI. The best-known example of a URL is the address of a web page on the World Wide Web, e.g. http://www.example.com.

USB

USB (Universal Serial Bus) is a specification to establish communication between devices and a host controller, usually a personal computer (PC). It is a bit-serial bus in general use to connect peripherals such as mice, keyboards, digital cameras, printers, scanners, media players, flash drives, and external hard drives.

USI

Abbreviation for Utility Systems, Inc. See Section 1.

USIMaster©

Utility Systems, Inc. is the owner/producer/licensor of the *USIMaster*© application package. See Section 1.2.

USIRemote©

Utility Systems, Inc. is the owner/producer/licensor of the *USIRemote*© application package. See Section 1.2.

V

Vac

Abbreviation for Volts ac. See Section 4.2.3.

Vaisala

Vaisala, Inc. supplies lightning strike data to *USIMaster*© users by subscription. The optional **Lightning Data Correlation** (**LDC**) feature of *USIMaster*© uses the Vaisala-supplied data to correlate system faults with lightning strikes.

Val

Or Val. Abbreviation for Value

VAR

Abbreviation for Volt-Amperes Reactive, the unit of reactive power

Vector

In mathematics and physics a vector (also known as a Euclidian vector) is a geometric entity endowed with both length and direction. In physics, Euclidian vectors are used to represent physical quantities which have both magnitude and direction, such as force, in contrast to scalar quantities, such as pressure, which have no direction. In the energy distribution industry, a vector represents a magnitude (voltage, current, impedance) and a direction (phase angle with respect to a reference). See Section 5.2.3.

Vert

Abbreviation for Vertical

W-X-Y-Z

WAN

Abbreviation for Wide Area Network

Watt

The unit of power. Named after British engineer James Watt (1736-1819).

WinDFR©

Utility Systems, Inc. is the owner/producer/licensor of the *WinDFR*© application package. See Section 1.2.

WinZip™

An application package offered by WinZip Computing, a Corel company, used to compress files for more efficient storage

Zoom

Used with **In** or **Out** to describe manipulation of a display image to magnify or shrink it

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