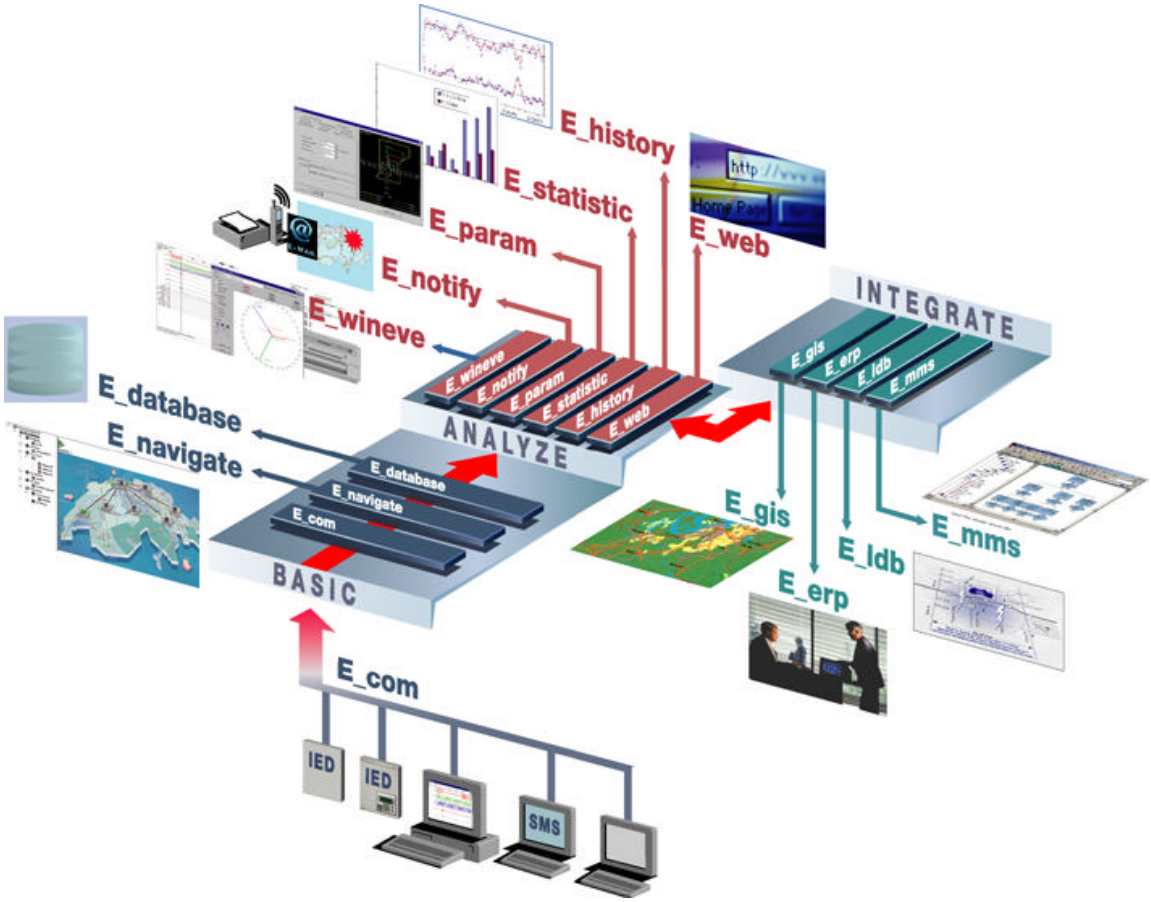
# Power System Monitoring

**1MRB520290-Uen**
Edition April 2002

## E_wineve
## Fault Analysis Software

**Software Manual**



2nd Edition

Applicable for Software Version V1.1



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# Contents

# Introduction

## Foreword

This manual explains the use of E_wineve. E_wineve is a powerful interactive tool for the evaluation and interpretation of event files.

E_wineve can be used for the evaluation of event files from Indactic® 650 and Indactic® 65 fault recorders, as well as from other compatible devices.

E_wineve is a Windows applications. The windows technology, mouse operation and support of your graphics card, printer and plotter is guaranteed by Windows. With Windows, you can execute several programs at once, i.e. you can, for instance, receive an event file with WinCom and at the same time evaluate another event file using E_wineve.

## Version Number

The version identification of this document is:

1.1

The document number is:

1MRB520290-Uen

# System Requirements

At least the following configuration is required:

- Windows NT 4.0 or Windows 95 operating system
- IBM or 100% compatible personal computer
- Pentium processor
- 16 MByte main memory for Windows 95 or
  32 MByte main memory for Windows NT
- Hard disk with at least 10 MBytes of free disk space
- A CD drive for installation
- Graphic card with Windows graphics driver, VGA standard, 640 x 480 resolution
- Color monitor
- Mouse.

If you use E_wineve (and other Windows applications) frequently, we recommend you to choose the best PC which you can afford:

- Fast Pentium processor
- Fast graphics card with Windows accelerator chip, 1024 x 768 resolution
- 17" color monitor, ergonomic refresh rate >= 72 Hz at 1024 x 768 resolution
- More than 32 MBytes main memory (RAM)
- Large and fast disk drive
  (1 GByte, < 12 ms access time, > 2000 kByte/sec)
- Color printer with Windows printer driver, bubble jet or laser technology.

The maths co-processor built in 486 and Pentium processors accelerates the following functions considerably: Fault Location, Merge and Calculations.

For the graphic processing of the signal curves a fast graphics card is more important than the processor . The most important functions for E_wineve are those which draw lines (PolyLine), for which an accelerator chip provides optimised functions.

A 256 color graphics driver is the best choice for E_wineve. True Color is not necessary and only wastes memory.

In comparison with standard Windows applications (e.g. Word), E_wineve requires relatively little main memory. However, if you wish to run several applications at the same time, a shortage of main memory can reduce performance drastically. This is indicated by frequent accessing of the hard disk (disk swapping).

# Variants / Packages

The E_wineve evaluation system is available in the following variants:

1. RelView
2. Professional
3. Expert.

## RelView

The RelView variant is the basic entry level of the E_wineve suite. The package enables the user to view the fault records – analog and digital signals. If desired two or more fault records can be merged and stored as a new file.

## Professional

The Professional variant provides advanced functionality in addition to the features available with the RelView variant.

The package provides manual or automatic one or two terminal fault location possibilities.

Power analysis calculation such as RMS values, impedance, active and reactive power, frequency deviation can be programmed and the values can be displayed as a function of time, alongwith the original analog and digital signals.

## Expert

The Expert variant is an extension of the Professional variant, and provides functionality for quick overview and analysis, and statistical information of system wide faults of the transmission and distribution network.

The additional functionality comprises of selective printout of the fault location report, calculation of the operating times of the switch-gear and the protection equipment, statistical analysis of the fault that occurred in the system over an extended period of time.

# Installation

The installation CD contains an installation program with the file name SETUP.EXE and a number of compressed files. The installation program installs E_wineve. About 5 MBytes of free disk space are required for the complete installation.

In order to install E_wineve, proceed as follows:

1. Insert the installation CD in the CD drive.
2. Start the command "Run" in the Start menu.
3. Type in the following command line: **[CD drive]:\SETUP**
4. Push the OK button.

The installation program will now start from the installation CD.

Among other things, you will be prompted for a directory where E_wineve is to be installed. The installation program tries to find an already installed version of E_wineve (WINEVE.EXE is searched). If there is one, it will suggest this directory. If you confirm, the already existing files in this directory will be overwritten. Other files (or sub directories) are not affected. If you want to keep the old version, please enter another directory. You can choose any directory.

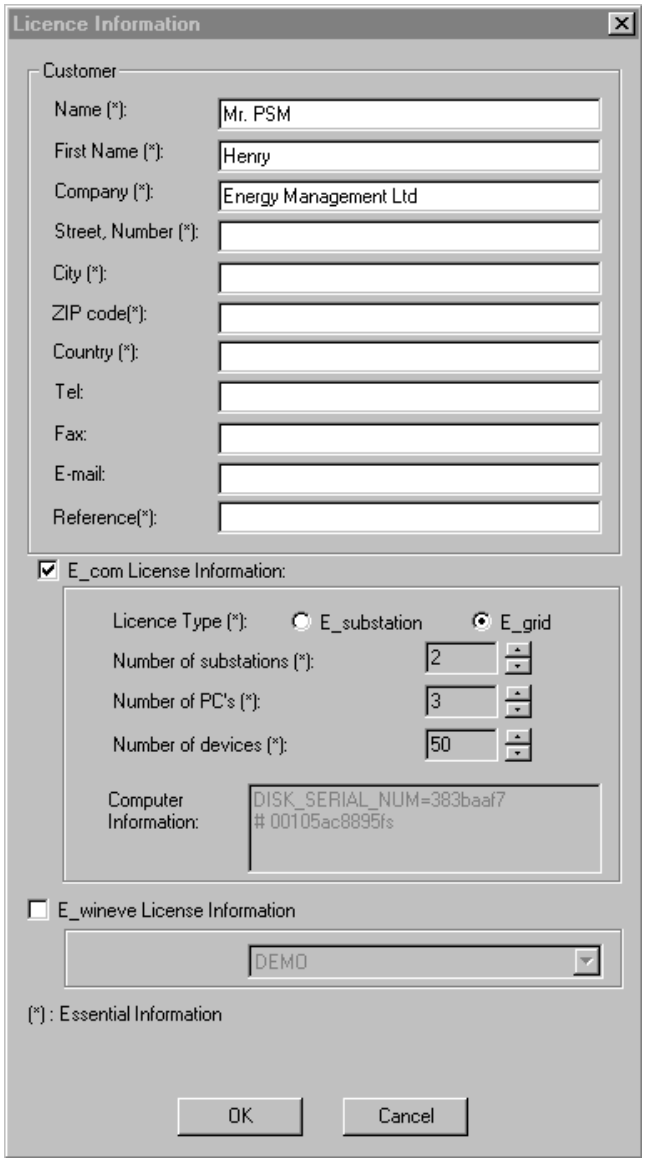
The installation program generates a program group (folder) "E_wineve".

Please pay attention to any README files on the installation CD. These contain recent information which was not possible to include in the written documentation.

The setup process will install E_wineve without valid license information, i.e. the Demo – Version. To obtain a full license for your required functionality see below.

# Getting a valid License

To obtain a full license for your required functionality start E_wineve 1.1. To order a full E_wineve licence, select the menu item **Options/Order a New Licence...** to open the following dialogue:




The licence dialogue is used to request for a licence key for E_wineve or E_com (also part of PSM). Both request information are stored in the same file and a licence key can be requested at once for E_com and E_wineve.

Close the dialogue with **OK**. A file is generated containing the details of the PC (serial number) and its location. Send this file to ABB (sa-lec-support@ch.abb.com).

Licences have to be ordered for other PC's on which E_wineve is installed.

Upon receiving the file with the PC information, ABB generates a licence key, saves it in a file and returns the file to the user. If you give an e-mail address the licence file will be returned to it.

Upon receipt of the licence file, you must copy it to the correct location (installation directory \license) and all the E_wineve functions are then enabled.

All the licensing files are grouped in this directory. There are two files, which contains information for the whole PSM system (in this version for E_wineve and E_com):

| | |
|---|---|
| PSMLicense.key | This license key file contains the licensing information concerning the current version. E_com (as well as E_wineve) starts in the Demo mode, if it cannot find this file, which has to be provided by ABB. |
| PSMLicense.req | This license request file is created when an application has been made for an E_com or E_wineve licence. ABB needs this file to generate a valid licence key. |

# Uninstallation

The installation program of the E_wineve generates an icon "Uninstall E_wineve" in the program group "E_wineve".

In order to uninstall E_wineve, proceed as follows:

1. Select "Uninstall E_wineve" in the program group "E_wineve" from the Start menu.
2. In the "Select Uninstall Method" dialog box, select the option "Automatic" and then click the "Next" button.
3. In the "Perform Uninstall" dialog box, click the "Finish" button.

# General Information

## Menu Bar and Document Window

E_wineve is a Windows application. You can have several document windows open, each of which represents an event file. You can also show the same event file in two or more document windows, e.g. with different time scales. Once you have opened an event file you can open an additional window using Window\New Window.

The information below describes components of E_wineve which are also found in many other Windows applications.

### Title Bar


The title bar is found at the top of each window. The E_wineve main window contains the name of the application and the name of the active document, i.e. the one currently being worked on. The document windows only contain the document name. Dialog windows contain the title of the dialog.

The title bar of the active application and the active document window is colored blue (unless the user has selected another color in the system controls). All other, i.e. non-active windows have a white title bar.

In order to move a window to another position, click on the title bar with the mouse button and, without releasing the mouse button, drag it to the desired position ("Drag & Drop"). Dialog windows can also be moved around in this way.

A title bar can contain the following elements:

Maximize button

Minimize button

Application name

Document name

Restore button

Close button

You will find more information on the buttons in the title bar in the Control Menu section.

### Toolbar


The toolbar appears at the upper edge of the E_wineve main window directly below the menu bar. It allows fast mouse access to a number of the most

frequently used E_wineve functions. When you click on an icon using the mouse, the corresponding menu command is executed. The context-sensitive Help is the only command which is not available in the menu.

In order to switch the toolbar on or off, select the command View\Toolbar.

 File\New

 File\Open

 File\Save

 File\Print

 File\Print Preview

 Edit\Cut

 Edit\Copy

 Edit\Paste

 Tools\Calculations

 Tools\One Terminal Fault Location

 Tools\Two Terminal Fault Location

 Tools\Signal Vectors

 Edit\Compose

 Edit\Decompose

 Format\Color

 Options\Font

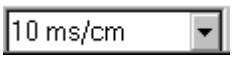
 Format\Markers

 Format\Clipping

 Format\Interpolation

 Format\Amplitude Height

 Format\Axis Height

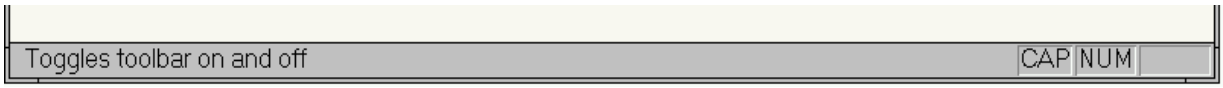


Format\Time Scale

 Help\About E_wineve

 Context-sensitive Help

## Status Bar




The status bar is located at the lower edge of the E_wineve main window. You can switch the status bar on or off using the command View\Status bar.

The left-hand area of the status bar describes the functions of the menus as you move through the menus using the cursor keys. A description is also shown in this area if you hold down an icon on the toolbar. After having read the message, if you decide that you do not wish to execute the function, only release the mouse button once you have moved the mouse away from the icon.

The right-hand area of the status bar shows which of the following keys have been pressed:

| | |
|---|---|
| CAP | The CAPS LOCK key is latched down. |
| NUM | The NUM LOCK key is latched down. |
| SCRL | The SCROLL LOCK key is latched down. |

## Scroll Bars

Keyboard shortcuts:

HOME scrolls horizontally to the extreme left.

END scrolls horizontally to the extreme right.

CTRL + HOME scrolls vertically to the very beginning.

CTRL + END scrolls vertically to the very end.

PAGEUP scrolls upwards by one screen page.

PAGEDOWN scrolls downwards by one screen page.

Scroll bars are displayed along the right-hand and bottom edges of document windows if the document is larger than it can be displayed in the window.

The marker in the scroll bar shows the vertical or horizontal position within the document. The mouse can be used to scroll to any position within the document.

## Document Window

An event file is displayed in the document window. Almost all commands in the menu act either on a selected signal within the document window or on the event file shown in the document window as a whole.

A number of commands can be carried out directly from the document window using the mouse:

Edit\Compose

Edit\Decompose

Edit\Select

Sequence of the signals.

# Password Protection

E_wineve supports an optional password protection. After installation of E_wineve, the password checking is always inactive. The menu command Options\Password allows to activate or inactivate the password checking, or to change the password. If the password checking is active but the password has been lost, then E_wineve must be installed again to reset the password (to inactivate the password checking).

If the password checking is active, E_wineve prompts the user to enter the password when the application starts. The password can only be entered at the application start. Most functions with any write access are locked if the password is unknown or wrong. The locked functions comprise:

File\Save

File\Save As

Parameters\Save Station

Parameters\Save Layout

Options\Password.

Following menu commands open a dialog window, where certain push buttons (e.g. OK) are disabled:

Tools\Calculations

Tools\Batch

Tools\Expert Evaluation

Tools\Time Calculations

Options\Directories.

The language, the font and the page setup can be modified also without knowing the password.

It is not possible to start the batch mode without the password, if the password checking is active. The password is required also if E_wineve is started immediately in the batch mode by choosing the program symbol which is labelled “E_wineve Batch”.

Tools\Calculations and Tools\Time Calculations allow to execute existing formulaes without knowing the password. The creation, modification or deletion of formulaes is disabled.

# Menus

## File Menu

This menu includes all the commands which relate to the event file as a whole. In addition, there is a command for exiting E_wineve and a command for switching to WinCom.

### File\New

Shortcuts:

Toolbar: 

Keyboard: CTRL + N

This command is used to create a new event file in E_wineve. In order to open an existing file, use the command File\Open.

Once you have created an empty event with File\New, you can copy in signals via the clipboard using the command Edit\Paste.

### File\Open

Shortcuts:

Toolbar: 

Keyboard: CTRL + O

This command is used to open an existing event or result file in a new window. In principle, you can have as many files as you wish opened at the same time. However, the Windows resources available, i.e. memory, number of file handles (defined in CONFIG.SYS with the entry FILES), etc., limit the number of open files.

When you close the file dialog box, all settings which you have entered are saved and automatically loaded again the next time you open the dialog box.

If you change the directory in the file dialog, the working directory is changed. The next time you select the dialogs File\Open, File\Save As, Parameters\Import Station or Search in Options\Directories, the (changed) working directory is pre-selected again.

You can switch back and forth between the opened documents using the Window menu. See command Window\1, 2, 3 .... 9.

If you no longer wish to work with an opened document, you can close it using the command File\Close. You can create new documents using the command File\New.

## Dialog box options:

**Path**

Enter the drive, the directory and the name of the file which you wish to open, or select the desired settings using the option “Browse...“. Missing entries are automatically replaced by the old values.

Note: In order to display a list of files with a particular extension, enter an asterisk (*), a full stop and the extension, consisting of three characters, as a file name. If, for example, you wish to see all files with the extension .TXT in a directory, enter *.TXT. The setting which you have selected in the “Files Type“ field automatically replaces the file name.

**Files Type**

Mark the type of file which you wish to open.

EVE (*.*)

COMTRADE (*.CFG)

REVAL (*.REH)

FL-Text (*.FLT)

Text (*.TXT)

All Files (*.*)

Depending on the selection, all files in the current directory which were saved with the corresponding extension are displayed. If “EVE”, “COMTRADE” or "REVAL" is selected, the directory for event files is displayed. If “FL-Text” or “Text” is selected, the directory for result files is displayed. These directories may be changed by the menu command Options\Directories. “All files (*.*)“ displays all files.

“EVE (*.*)“ only displays the files in the event directory which are event files and at the same time activates the time selection and the selection of the stations.

**File Name, St. No., Date, Time**

This list displays files with the extension which you have selected in the Path field. Depending on the choice of file type, when “EVE (*.*)“ is selected, i.e. display of all event files, the relevant station number, date and time are also shown in addition to the file name. It is then possible to specify the period of time for which the event files are to be displayed.

Open the selected file by marking the file and confirming with OK, or by double-clicking on the desired file. There is also a possibility to select several files (with shift of control with mouse click). By pressing OK, **all** these Files are opened simultaneously.

**Stations**

This selection is only available if you have selected the setting EVE (*.*) in the “File Type” combo box.

When the dialog box is opened, a list of all available valid stations which are available in the station directory is created. This directory is pre-selected in the menu option Options\Directories. The stations are represented by the station numbers and station names. Marking a particular station means that only the files

associated with this station appear in the field “File Name, St. No., Date, Time“. Selecting “* All stations“ displays all event files.

**Time selection**

This selection is only available if you have selected the setting EVE (*.*) in the “File Type” combo box.

Activate time selection by clicking the “Enable“ button. Enter the date in the “Date“ field. Accepted formats are: DD.MM.YYYY, MM.YYYY or YYYY. The time period is set automatically, but can be set to any desired value by making appropriate changes in the "Duration" field. The list of files is updated accordingly.

## File\Close

This command is used in order to close all windows which contain the active document. E_wineve suggests you to save changes to the document before closing it. If you close a document without saving it, all changes which have been made since the last time it was saved are lost. Before you close an unnamed document, E_wineve displays the File\Save As dialog box and suggests that you name and save the document.

You can also close a document using the command Control Menu\Close from the Control menu

## File\Save

Shortcuts:

Toolbar: 

Keyboard: CTRL + S

This command is used in order to save the active document under its current name in the current directory and in the corresponding file format. When you save a document for the first time, E_wineve displays the File\Save As dialog box, in which you can give your document a name.

If you wish to change the name, directory or format of an already-existing document before saving it, select the command File\Save As.

The event files generated by WinCom are write-protected by WinCom. These are the original event files, which you should not overwrite or modify. Use the command File\Save As in order to give a modified event file another file name. The event files saved by E_wineve are not write-protected.

If you wish to remove the write-protection, you can use the command File\Properties in the File Manager.

## File\Save As

This command is used in order to save the active document in a particular file format and to name it. Note: In order to save a document under the old name and format and in the old directory, use the command File\Save.

### Dialog box options:

**File Name**

Enter a new file name in order to save a document under a different name or with a different file format. Note: You cannot save a document under the same name with two different file formats.

Use the current name or select one from the list to save a document under an already-existing file name.

**Note:** E_wineve adds the three letter extension which you have specified in the "Save File as Type" combo box.

**Drives**

Select the drive on which you wish to save the document.

**Directories**

Select the directory in which you wish to save the document.

**Save File as Type:**

E_wineve can save (and also read) events in different file formats:

EVE (*.eve; *.evt; re*.*)

COMTRADE (*.cfg)

Text files can be saved with their preselected extension (*.flt or *.txt).

**Note:** E_wineve saves event files only in EVE or COMTRADE Format. REVAL and SOE files are converted to EVE or COMTRADE format.

## File\File Summary

This command is used in order to display the event information for the active document. The event information was originally recorded by the recording station and saved in the event file. It is not possible to modify this information in E_wineve (except the station name).

Detailed information on individual signals is available using the command View\Signal Info. The following file information is displayed here:

**Station Number:**

This number specifically identifies a station. The logical linkage between the event files and the station parameter files takes place by means of this number. The station number is also required for communication with the recording station.

**Station Name:**

Any name can be used as the station name. However, the name of a location is normally chosen which identifies the location of the recording station. The station name is a station parameter and can be modified using the command Parameter\Station.

**Station File:**

File name and directory where the station parameter file is currently stored. The station file directory can be changed in the Options\Directories menu.

**Event Number:**

A continuous number which is automatically assigned to each recorded event by the event recording station. It is possible that "File is truncated" is displayed here. In this case the event recording station aborted the recording due to memory overflow.

**Event File:**

File name and directory where the event file is currently stored.

**Event Date and Time:**

Date and time when the event occurred. The event time is the zero point on the time scale of the curve display. “Trigger time” is used as synonym, although there is a slight difference in meaning. The zero point in the curve display does not necessarily match the occurrence of the trigger exactly. It is correct to say, that the event time is very close by the true trigger time, but they are not necessarily equal.

The event time is displayed with several decimal places after the seconds implying that it is exactly known when the trigger occured (e.g. COMTRADE format down to micro seconds). In fact, the resolution says nothing about the accuracy.

**Duration of Recording:**

Duration of the recording from a certain time before the trigger to a certain time after the trigger. The difference of these two times results in the total duration of the recording.

**Analog Signals**:

Identifies the number of analog signals present in the event file.

**Digital Signals**:

Identifies the number of digital signals present in the event file. The number is always a multiple of 8. Eight digital signals are always combined into a group.

**Sampling Rate**:

The sampling rate is the frequency with which the analog and digital signals are sampled and recorded. The ms/sample is the reciprocal value of the frequency and identifies the time interval between two samples.

**Total Samples**:

The number of samples identifies the total number of samples per signal. All analog and digital signals normally include the same number of samples. If this is not the case, E_wineve displays a warning when opening an event file.

**Scanning Delay:**

The Indactic® 65 fault recorder only uses one A/D converter (analog/digital converter) for several (typically 8) analog signals and rapidly samples all signals consecutively. This is called multiplexing. The change from one analog signal to the next takes place within microseconds. The scanning delay identifies the interval between the sampling of two analog signals.

The Indactic ® 650 fault recorder uses a separate A/D converter for each analog signal. Sampling thus takes place simultaneously and consequently no scanning delay.

**Line Frequency**:

Displays the nominal line frequency (16 2/3Hz, 50Hz or 60Hz) of the monitored lines. The line frequency is a device parameter which can be adjusted on the event recording station. The line frequency is only available with the COMTRADE and the extended EVE file format.

**Trigger Condition**:

The trigger condition identifies the cause leading to an event being recorded:

| | |
|---|---|
| Unknown | Unknown trigger type (e.g. COMTRADE files) |
| Test record | Recording took place as a result of a test command (*.EVT) |
| External signal | External trigger input triggered the recording |
| Digital signal | Digital signal attained the trigger condition |
| Analog limit | Upper limit value exceeded or lower limit value was not achieved |
| Analog limit high | Upper limit value exceeded |
| Analog limit low | Lower limit value was not achieved |
| Analog gradient | Peak value/line period changed faster than setting allowed |
| Line frequency high | Line frequency exceeded upper limit |
| Line frequency low | Line frequency felt short of lower limit |
| Line frequency gradient | Line frequency changed faster than setting allowed |
| Zero-sequence system | Zero-sequence system exceeded upper limit |

Positive-sequence system  Positive-sequence system exceeded upper limit

Negative-sequence system  Negative-sequence system exceeded upper limit.

With gradient trigger and limit trigger, the positive and negative peak value/line period are monitored respectively. With limit trigger, there is a permissible range for the positive and the negative peak values which is defined by an upper and a lower limit value.

**Trigger Signal**:

Displays the name of the signal causing the recording of the event file. The trigger signal is only available with the extended EVE file format.

**Trigger Filter Time**:

Displays the number of line periods the trigger condition has been active until triggering the event recording. This value depends on the trigger type and the station type. For certain trigger types this value could be adjustable, for others it is not. The trigger filter time is only available with the extended EVE file format.

## File\Page Setup

This command is used in order to alter the page margins, the header and footer. The settings chosen here apply to all documents which can be printed with E_wineve. The settings are stored in WINEVE.INI.

### Dialog box options:

**Top:**

Defines the margin between the upper edge of the paper and the header.

**Bottom:**

Defines the margin between the bottom edge of the paper and the footer.

**Left:**

Defines the margin from the left-hand edge of the paper.

**Right:**

Defines the margin from the right-hand edge of the paper.

Depending on the printer or printer driver, inaccuracies may occur in the margins: An upper margin of '0' is often not possible, as the printer cannot print right up to the edge. In such a case, the surrounding border line might not appear on the paper. Select margin 0.1.

You should also check, under the command File\Print Setup, that the selected paper size is actually correct and that you have not confused "A4" and "Letter", for instance.

**Printing Mode: Colors/Grey Scales**

The signal names, curves and measured values are printed in color. This mode is suitable for color printers and plotters. An unsatisfactory result will probably be achieved if black-and-white printers are used.

Generally, the color palette of the printer is smaller than that of the graphic card, e.g. plotters usually only have 6 or 8 different pens or colors. The printer driver adapts the selected colors to the possibilities offered by the printer. It can therefore happen that the printed result differs significantly from the screen output.

Black-and-white printers (e.g. laser printers) are generally capable of outputting grey scales. Their printer drivers convert the colors to grey scales. The result may be better or worse depending on the number of grey scales which the printer or printer driver can output. Under certain circumstances, signals in light colors (e.g. yellow) may not be shown.

**Printing Mode: Black**

The signal names, curves and measured values are printed in black, irrespective of the selected color. This mode is recommended for use with black-and-white printers. The Black mode can also be used for color printers and plotters.

**ABB E_wineve logo**

When activated, an ABB logo appears in the header, on the left.

**Page Number**

When activated, the page number is shown in the centre of the header. The first page to be output always has the number '1'.

**Scale**

When activated, a printed scale is shown in the left of the header. The user can use the printed scale in the printout to measure the amplitude of the signal with help of a conventional ruler.

**Signal Information**

When activated, informations about the sampling rate and the trigger signal are shown in the header.

**User-definable text**

You can enter any text here. This appears, right-justified, in the header. The length of the text is limited to the amount of available space in the header.

**File Name**

When activated, the file name with directory appears, left-justified, in the footer.

**Station Name**

When activated, the station name appears in the centre of the footer. The station name is set using the command Parameter\Station.

**Event Time/Date**

When activated, the time and date of the triggering appears, right-justified, on the footer. On the curve representation, the stated time corresponds to the "0" on the time scale. The current time and date are shown when fault-locator results are printed out.

## File\Print Setup

This command is used in order to select a printer and its connection.

Dialog box options:

**Printer**

Select the printer which you wish to use. You can select the standard printer or one from a list of special printers. Only installed printers are displayed. The printer and printer connections are set up using the Windows system control. You will find information on the installation of printers in the Windows documentation. If you have not yet installed a printer, please consult your printer manual.

**Format**

Select the way in which the signals are to be laid out on the paper. You can print in portrait or landscape format. One or the other format is preferable depending on whether you have a long time scale or wish to print out more signals.

**Paper**

Enter the paper size used by your printer here. Check that the paper size is actually correct and that you haven't for example, confused 'A4' and 'Letter'. The paper formats only differ by millimetres in some cases. The borders are often not reproduced correctly if the wrong paper format is selected. With some printers, it is possible to control the paper feed from different paper trays.

**Options**

This button opens a dialog box where further printer-specific settings can be made. Note: The options and the title of this dialog box change according to the printer which is installed.

## File\Print Preview

Shortcuts:

Toolbar: 

This command is used in order to change to the print preview. The print preview allows you to view the document in the form in which it will appear when printed. One or two pages can be shown in your printing format. No editing is possible in the print preview. The following functions are available in print preview:

**Print**...

Close print preview and open Print dialog box in order to start printing.

**Next Page**

Changes to the following print page.

**Prev Page**

Changes to the previous print page.

**One Page/Two Pages**

Shows one or two whole print pages simultaneously.

**Zoom In**

Shows an enlarged view of a smaller section.

**Zoom Out**

Shows a reduced view of a larger section.

**Close**

Returns from page view to normal view.

## File\Print

Shortcuts:

Toolbar: 

Keyboard: CTRL + P

This command is used in order to control the printing of documents. You can print out a complete document, a single page, several pages or single selected signals.

Save your document (event, station, layout) before printing in order to ensure that no data is lost in the event of an error during printing. The source of faults may also lie with the printer driver or print manager (as well as E_wineve). Printing is resource-intensive, i.e. it places great demands on computing power, main memory and also hard disk memory.

In order to designate a printer and its connection, use the command File\Print Setup.

The appearance of documents which are printed with E_wineve and displayed on the screen depends on the printer used. Before you carry out the final formatting

tasks, you should install a printer and select this in E_wineve. Before printing, check your document using the command File\Print Preview. You can see the whole page in Print Preview.

Apart from a few exceptions, E_wineve displays your document exactly as it will appear in print. If you have selected "page width" on the time scale, the whole recording will be stretched across the available width of the paper. If you have selected a resolution of 10 ms/cm, for example, exactly 10 ms are shown per cm, i.e. a larger or smaller time section is visible on the paper depending on the paper size and format. The beginning of the time section is the same as that currently shown in the window. The end of the time section depends on the paper size, paper format, font size, length of signal names, whether or not measured values are shown, and on the margins selected.

## Dialog field options

**Printer**

Shows the active printer and printer connection.

**Print Range**

Specify which part of the document is to be printed:

| | |
|---|---|
| All | Prints the whole document. |
| Selection | Only prints the selected signals. |
| Pages | Prints the pages which you specify in the fields "From" and "To". |
| From | Enter the first page which is to be printed. |
| To | Enter the last page which is to be printed. |

**Print Quality**

The desired print quality can be selected here. Generally: High print quality requires more time in order to prepare the pages.

**Copies**

Enter the number of copies which you wish to print.

**Setup**

Displays a dialog box in which you can select a printer and printer connection. See command File\Print Setup.

A progress display (page number) appears as the print pages are being prepared and sent to the printer. The Abort button aborts the printing operation.

# File\1, 2, 3, 4

Use the numbers and file names which are displayed in the File menu in order to open the last four documents which were closed. Select the number corresponding to the number of the opened document.

## File\To WinCom

Changes to the application WinCom. WinCom is the communications program for the Indactic® 650 recording station.

If WinCom is not yet in operation, WinCom is first started and then the changeover takes place. If WinCom was not installed in the same directory as E_wineve, the application cannot be found then an error message appears.

## File\Exit

This command is used in order to end your E_wineve session.

You can also do this by selecting the command Control Menu\Close from the control menu. E_wineve will prompt you to save documents which contain alterations which have not yet been saved.

Shortcuts:

| | |
|---|---|
| Mouse: | Click on the button in the control menu. |
| |  |
| Keyboard: | ALT+ F4 |

# Edit Menu

All commands in this menu relate to selected signals. The simplest form of performing the Edit\Select command is to click on a signal with the mouse.

## Edit\Cut

Shortcuts:

| | |
|---|---|
| Toolbar: |  |
| Keyboard: | CTRL + X |
| or: | SHIFT DELETE |

This command is used in order to remove the selected signals from the event file and transfer them to the clipboard. This command is only available when you have selected one or more signals. When signals are cut out and transferred to the clipboard, the contents previously stored there are overwritten.

If you do not wish to display a signal, it is better to use the command Edit\Hide. With Hide, in contrast to Cut, a signal is not deleted from the event file.

The command Edit\Copy is closely related to Cut. What both have in common is that the selected signals are copied to the clipboard. In contrast to Copy, Cut removes the signal from the event.

The signal which has been cut out can be inserted into the event again later on using the command Edit\Paste.

In addition to the logical data of the selected signals, a bitmap graphic of the document window is also copied to the clipboard. You can load this bitmap graphic into the Microsoft Windows Paintbrush graphics program (see Accessories program group), for example, and process it further.

## Edit\Copy

Shortcuts:

Toolbar: 

Keyboard: CTRL + C

or: CTRL + INSERT

This command is used in order to copy signals to the clipboard. This command is only available when you have selected one or more signals. When signals are copied to the clipboard, the contents previously stored there are overwritten.

The command Edit\Cut is closely related to Copy. What both have in common is that the selected signals are copied to the clipboard. In contrast to Copy, Cut removes the signal from the event.

The copied signal can be inserted into the event again later using the command Edit\Paste.

In addition to the logical data of the selected signals, a bitmap graphic of the document window is also copied to the clipboard. You can load this bitmap graphic into the Microsoft Windows Paintbrush graphics program (see Accessories program group), for example, and process it further.

## Edit\Paste

Shortcuts:

Toolbar:: 

Keyboard: CTRL + V

or: SHIFT INSERT

This command is used in order to insert the contents of the clipboard into the event. This command is not available if the clipboard is empty or contains no E_wineve signals.

You can copy a signal into the clipboard using the commands Edit\Cut or Edit\Copy.

Not every signal can be copied into any event. A signal which originates from the same event can be inserted one or more times without any problem.

You can also create an event using the command File\New and copy signals into the new event via the clipboard.

In order to copy a signal from one event into another event, several preconditions must be fulfilled. This does not involve simple copying. The command Tools\Merge is automatically executed.

## Edit\Show

Shortcut:

Keyboard: INSERT

This command is used in order to display hidden signals or to hide displayed signals. This command opens a dialog box with a list of all available signals in the event file. The list also indicates which signals are currently displayed.

You can find out how to change the sequence of the signals in the section "Sequence of Signals".

First mark the signals in the list which you wish to change.

- Clicking with the mouse marks a signal and removes all other markers.
- Clicking and dragging the mouse marks all the signals below.
- SHIFT key and clicking marks all signals in between.
- CTRL key and clicking marks an additional signal.
- CTRL key and clicking on a marked signal removes the marker.

When you click the OK button, the dialog box is closed and all previously marked signals are displayed in addition. However, you can also click the "Show" button which updates the list accordingly and only then quit the dialog box by clicking OK.

You can remove all the signals marked in the list from the display using the "Hide" button. If you only wish to hide displayed signals, it is better to use the command Edit\Hide. In contrast to Show, the Hide command does not open a dialog box.

The "All" button marks all the signals in the list. This is useful, for example, if you only wish to display one or two signals. Select "All", then "Hide" in order to hide all signals, then click on the required signal and "OK".

## Edit\Hide

Shortcut:

Keyboard: DELETE

The Hide command removes the selected signals from the display. This command is only available if you have selected one or more signals.

There are often signals in an event file which were recorded, but which are not of interest for the evaluation. Using the Hide command, you can exclude these from the display without deleting them from the event file.

The Hide command does not delete signals from the event file. They are hidden, i.e. not displayed. If you actually want to delete a signal from the event file, use the command Edit\Cut.

Signals which are hidden can be brought back into the display by using the command Edit\Show.

## Edit\Compose

Shortcuts:

Toolbar: 

Mouse: Drag and drop, see section "Sequence of the Signals"

The Compose command arranges the selected signals on a single axis. This command is only available if you have selected at least two signals on two different axes. The composition of signals can be reversed using the command Edit\Decompose.

If the Compose command is given via the menu or toolbar, all selected signals are combined on the first selected axis.

## Edit\Decompose

Toolbar: 

Mouse: Drag and drop, see section "Sequence of the Signals"

The Decompose command arranges the selected signals on individual axes. Decompose is the reverse function of the command Edit\Compose. The Decompose command is only available if you have selected one or more signals on the axis of which there are other signals.

## Edit\Select

Shortcuts:

Mouse: Clicking with the mouse selects a signal. Other signals are deselected.

SHIFT key and clicking selects all signals in between.

CTRL key and clicking selects an additional signal.

The Select command in the Edit menu opens a dialog box similar to that opened with the command Edit\Show. All displayed signals are shown in a list, and those currently displayed signals are marked.

The selection and deselection of signals by means of the dialog box is inconvenient. Its use is only recommended in exceptional cases.

Much faster, and also more intuitive, is selection and deselection using the mouse. If only one signal is present on an axis, the entire axis height across the whole width of the window is used as the sensitive area. If several signals are composed on an axis, the axis height is divided into individual sections limited by the height of the lettering of the signal names.

## Sequence of the Signals

With the standard layout, the analog signals are displayed first, then the digital signals. The signals are ordered in ascending sequence according to their signal numbers.

An implicit change in the sequence takes place through the commands Edit\Compose and Edit\Decompose. There is no menu command or dialog which only modifies the sequence.

The sequence can be changed using the mouse by means of Drag and Drop. To do this, you must click on a signal and, without releasing the mouse button, drag it to where you would like to position the signal. The mouse pointer changes during dragging. If the pointer is positioned between two axes, the pointer changes to the vertical double-headed arrow.

 If you release the mouse now, the signal which is to be moved is positioned on a separate axis between the two nearest axes. This corresponds to the command Edit\Decompose.

If the pointer is positioned over an axis, the pointer changes to the four-headed arrow.

 If you release the mouse now, the signal which is to be moved is positioned on this axis. This corresponds to the command Edit\Compose.

# View Menu

## View\Toolbar

This command is used in order to display or remove the toolbar. The toolbar contains icons for a number of the most frequently used E_wineve commands, including Open, Copy and Print. A check mark appears next to the menu item if the toolbar is displayed.

You will find more information in the section "Toolbar".

## View\Status bar

This command is used in order to display or remove the status bar. The status bar shows information on the selected command or the program status, as well as the keys CAPS LOCK, SCROLL LOCK and NUM LOCK. A check mark appears next to the menu item if the status bar is displayed. You will find more information in the section "Status Bar".

## View\Upper/Lower Time Scale

This command is used in order to display or remove the upper or lower time scale. A check mark appears next to the menu item if the time scale is displayed.

You can display both time scales, only one or none. The time scales mark the time axis in milliseconds.

If you have switched off both time scales and switch on the evaluation cursor using the command Tools\Values, the upper time scale is automatically switched on. In addition to displaying the time axis, the range of the time scale serves as the sensitive area for the evaluation cursor.

## View\Signal Info

This command is used in order to display certain statistical information on the selected signal. If you have selected several signals, the information on the signal with the lowest signal number appears.

The information relating to the event file as a whole is also available using the command File\Summary.

Most of the information is closely related to the settings selected in the command Parameters\Signal, e.g. signal name, signal type, signal unit, maximum possible measured value.

**Signal Name:**

Selected name of the signal.

**Signal Number:**

The signal number identifies the terminal number on the recording station. This is stored in the event file when the event is recorded. The signal number cannot be changed in E_wineve.

**Signal Type:**

Identifies the type of the selected signal. The following possibilities exist:

Analog

Digital

Current

Voltage.

**Stored in File as:**

This information identifies the data format with which the measurement data for the signal is saved in the file. The data format is set at the recording station. It cannot subsequently be changed in E_wineve. If E_wineve generates new analog signals itself, e.g. by means of calculations, these are generated in the data format "Analog 16 bit linear". E_wineve supports the following formats:

| | |
|---|---|
| Analog 16 bit linear | High precision, 2 bytes/measured value |
| Analog 8 bit linear | Low precision, 1 byte/measured value |
| Analog 8 bit compressed | High precision in range around zero |
| Digital 8 bit linear | 1 byte for 8 digital signals. |

**Signal Unit:**

The signal unit, e.g. "kV" comprises the multiplication factor, e.g. "k" for kilo, and the selected basic unit. The multiplication factor is automatically allocated by E_wineve.

**Full Scale Value:**

Corresponds to the maximum input voltage or current which can still be measured with the existing input and output values for the primary transformer and the source transducer used.

**Maximum Signal:**

Largest value of this signal measured during the entire recording.

**Arithmetical average**:

Sum of all measured values in the entire recording divided by the number of measured values.

**Minimum Signal**:

Smallest value of this signal measured during the entire recording.

**Passages Through Zero**:

With analog signals, the number of passages through zero is stated by the horizontal axis.

**Number of Edges**:

With digital signals, the number of rising and falling signal edges is stated. Each signal edge counts as one.

**Comments**:

If the signal is constant or, in the case of analog signals, nearly constant, this is indicated by the appropriate message, e.g. "The signal is constant. The jitter is less than 1 %."

The same number of measured values should have been recorded from each signal in an event file. If this is not the case, E_wineve issues a message as follows: "Missing measured values. Only 345 of 1000 expected measured values are available."

## View\Center

This command is used in order to centre the visible section around the trigger point. It is only worthwhile using this command with a small time scale, if the '0' in the time scale is no longer visible.

## View\Time Lines

This command is used in order to display or remove the vertical time lines. A check mark appears next to the menu item when the time lines are displayed.

If the time lines are switched off, only the line at the trigger point is displayed as a continuous line running from the upper to the lower time scale. When the time lines are switched on, vertical dotted lines are displayed which connect the scale divisions which are marked with times on the upper and lower time scales.

## View\Line Names

This command is used in order to display the signal names with or without line names. A check mark appears next to the menu item when the line names are displayed.

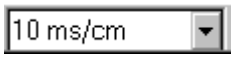
The signals can be assigned to a line using the command Parameters\Line. When the line names are switched on, these are shown before the signal names in the curve representation.

The line names are particularly useful when the event recording contains signals from more than one line.

# Format Menu

## Format\Time Scale

Shortcuts:

Toolbar: 


The menu command Time Scale opens a dialog box in which you can change the time scale. The scale graduation on the horizontal time axis can be adjusted freely within a range from 0.1 ... 1000 ms/cm. It is much simpler to adjust the time scale in the combobox in the toolbar.

In addition, you can display an event file in "page width". With "page width", the event is scaled in such a way that the entire duration of the event can be shown in the window or on one page on paper. This type of representation provides the best overview of the entire event. In default setting, an event is therefore shown in "page width".

In the editable field of the dialog box, you can enter the desired scale directly using the keyboard or increase or reduce it using the control-menu buttons to the right and left. The pre-defined values are 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 10000 or 30000 ms/cm. These are only suggestions. You can enter any value within the range 0.1 to 30000 ms/cm.

The time scale uses the measurement unit ms/cm. 10 ms/cm means that 10 milliseconds of the event recording are shown on 1 cm of paper. On paper, you can measure the time differences using a ruler. This is not possible on the screen, nor is it necessary. To do this, you use the command Tools\Interval Start/End.

## Format\Amplitude Height

Shortcuts:

Toolbar: 

This command is used in order to change the amplitude scale of the selected signals. This command is only available if you have selected one or more signals.

The command opens a dialog box. In the editable field of the dialog box, you can enter the desired scale directly using the keyboard or increase or reduce it using

the control-menu buttons to the right and left. The pre-defined values are 1, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 150, 200, 300, 500, 1000, 5000 or 10000 mm. These are only suggestions. You can enter any value within the range 1 to 10000 mm. The default setting for the amplitude height is 20 mm.

The relationship to the signal unit is shown in the dialog box. 10 kV/mm means that 10 kilovolts are shown on 1 millimetre of paper. Alternatively the full scale value [mm] or the relationship to the signal unit [e.g. kV/mm] can be entered. On paper, you can measure the measured values using a ruler. To do this, you use the command Tools\Values.

You can choose whether the axis height should be adjusted in synchronisation with changes to the amplitude height. See also the command Format\Axis Height.

You can select an amplitude height which is greater than the axis height. It is then possible that the curves of the signals on different axes might overlap. You can prevent this by using the command Format\Clipping to cut off the sections of curve outside of the axis height.

## Format\Axis Height

Shortcuts:

Toolbar: 

This command is used in order to change the height of the axes of the selected signals. This command is only available if you have selected one or more signals.

The axis height is the width of the bands which are available for the signals contained therein. If two neighbouring axes have the same axis height, the axis height also corresponds to the distance between the two axes.

The command opens a dialog box. In the editable field of the dialog box, you can enter the desired axis height directly using the keyboard or increase or reduce it using the control-menu buttons to the right and left. The pre-defined values are 1, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 150, 200, 300, 500 or 1000 mm. These are only suggestions. You can enter any value within the range 1 to 1000 mm. The default setting for the axis height is 20 mm.

In addition to the overall axis height, you can also adjust the symmetry of the axis. A symmetrical layout is certainly practical in the case of a signal with equal positive and negative components. In the case of signals with a direct voltage component, for instance, it can be worthwhile shifting the horizontal axis downwards.

You can specify whether the amplitude height should be adjusted in synchronisation with changes to the axis height. See the section on the command Format\Amplitude Height.

If two signals are combined on the same axis (see command Edit\Compose) and the two signals have different axis heights, the greater of the two axis heights is displayed.

You can select an amplitude height which is greater than the axis height. It is then possible that the curves of the signals on different axes might overlap. You can prevent this by using the command Format\Clipping to cut off the sections of curve outside of the axis height.

## Format\Color

Shortcut:

Toolbar: 

This command is used in order to change the color of the selected signals. This command is only available if you have selected one or more signals.

A dialog box is opened with the command Format\Color. In principle, any color from the True Color palette (16 million colors!) can be selected for each signal. However, there are a number of reasons why you should restrict yourself to the 16 colors which are listed in the dialog box under "Customer Colors":

All VGA graphic cards or VGA graphics drivers support these 16 colors in all operating modes. Some problems may arise with some colors, e.g. the colors of the signal name and signal curve may not be identical when displayed. These problems arise from the restrictions of Windows and the graphics drivers. Despite 256 color mode, only 16 colors are available when drawing lines with the thickness of 1 pixel.

Color printers often only have a reduced color palette available. Even fewer colors are normally available with plotters.

The 16 pre-defined colors are easily distinguishable. You should simply ensure that the selected signal color is different from the background color of the window. Typically, this is the color white. There is a "Control Panel" program in the "Main" Windows program group. You can change the "Window Background" in this program under "Colors". The color which you choose there for "Window Text" is used for the time scale and the axes.

## Format\Markers

Shortcut:

Toolbar: 

This command is used in order to display or remove the markers for the selected signals. A check mark appears next to the menu item when the markers are displayed. This command is only available if you have selected one or more signals.

The markers applied along the signal curves make it easier to distinguish the signals if several signals are combined on one axis. Different symbols are used for the markers. The symbols have the same color as the curve.

The markers are particularly useful if a document is to be printed in black and white.

The following symbols are used:

1. Square
2. Rhombus
3. Upwards-pointing triangle
4. Downwards-pointing triangle
5. Diagonal cross
6. Circle or octagon

7. Left-pointing triangle
8. Right-pointing triangle
9. Cross

One of the above symbols is used for each signal, depending on the signal number. All analog signals with the signal numbers 1, 10, 19 etc. have a square as a marker. Only the first eight symbols are used for the digital signals. Accordingly, all digital signals with the signal numbers 1, 9, 17 etc. have a square as a marker.

The markers are always applied at the point where a sample, i.e. a measuring point, is located. However, depending on the selected time scale and sampling frequency, there are many measuring points per cm, which would make it impossible to mark every measuring point. The minimum distance between two displayed measuring points is 5 mm.

## Format\Clipping

Shortcut:

Toolbar: 

This command is used in order to limit the curves of the selected signals to the axis height. A check mark appears next to the menu item when the selected signal curves are limited. This command is only available if you have selected one or more signals.

This command has no effect if the curve remains within the available axis height. If, on the other hand, you select an amplitude height which is greater than the axis height, it is possible that the curves of the signals on different axes might overlap. You can influence the representation or scale of the vertical axis using the commands Format\Amplitude Height and Format\Axis Height.

The axis height defines a band within which the curve is represented. The Clipping command cuts off the sections of curve outside of this band.

## Format\Interpolation

Shortcut:

Toolbar: 

This command is used in order to include additional reference points on the curves of the selected signals. A check mark appears next to the menu item when the selected signal curves are interpolated. This command is only available if you have selected one or more signals.

The signals are stored in the event file as a result of measurements taken at constant time intervals. In order to show the continuous character of the signals, two consecutive points are connected by a line. In the normal display, a straight line is used to connect points with one another. If interpolation is activated, additional reference points are calculated from the measured reference points. These are connected, in turn by (very short) straight lines.

Interpolation is not carried out if more measured values are available on the time axis than there are screen or printer pixels present. The number of measured values depends on the selected time scale and the sampling frequency of the event file. The effect of interpolation is generally only visible with very small time scales, e.g. 2 ms/cm. The scale graduation of the horizontal axis can be set using the command Format\Time scale.

The so-called Lagrange interpolation algorithm is used. This is a cubic interpolation which works with 32-bit whole numbers. Interpolation does not generally slow down the formation of the picture noticeably. In addition to the calculated reference points, the interpolated curve also contains all the measured reference points. The curve is not smoothed.

**Warning:**

The impression of a smoothly-flowing curve can be deceptive. Like the straight sections, the interpolated sections of curve between the measured reference points are assumptions i.e. may not represent the reality! The curved sections do not always approximate more closely to the truth than the straight sections. There are cases where interpolation fails. The interpolation algorithm which is used cannot recognise discontinuities (e.g. signal edges of a square-wave signal). An over- or undershoot can then be calculated which did not in fact occur.

# Tools Menu

## Tools\Values

This command is used in order to switch the measured value cursor on and off. A check mark appears next to the menu item when the measured value cursor is switched on.

General information on how the different vertical cursors are distinguished from one another and how they are moved using the mouse is included in the section on the command Tools\Interval Start/End.

The measured value cursor appears as a vertical line in the document window, with a rectangular box in the upper and lower time scale. Wherever the measured value cursor cuts a signal curve, a horizontal hair-line is displayed. The current value appears at the right-hand edge of the window at the same height and in the same color as the signal name at the left-hand side of the window.

The current value is displayed in the corresponding physical units as defined using the command Parameters\Signal.

## Tools\Interval Start/End

This command is used in order to switch the interval start cursor or interval end cursor on and off. A check mark appears next to the menu item when the relevant interval cursor is switched on.

There are three cursors in all, which all appear as a vertical line in the document window. These are the measured value cursor, the interval start cursor and the interval end cursor. The three cursors are distinguished by the rectangular box at the upper and lower ends of the cursor.

The cursors can be moved using the mouse. The upper and lower time scales serve as the sensitive area. These can be switched on and off individually using the command View\Upper/Lower Time scale.

In order to move a cursor, the rectangular box in the time scale is clicked with the left mouse button and, without releasing the mouse button, dragged to the desired location ("Drag & Drop"). The time relative to the trigger event is shown in the rectangular box of all three cursors. The time display changes as the cursors are moved.

If you click the mouse anywhere in the time scale, the nearest displayed cursor jumps to that point.

The two interval cursors are used for time measurement. They define the start and end of the time interval. The time difference between the start and end cursor is displayed on the end cursor. The command Tools\Values is used to display current values.

The cursors may be moved to any position within the document window. The start interval cursor may also be moved past the end interval cursor, which means that a negative interval time is displayed.

In addition to being used purely for time measurements, the interval cursors are also used to define the working range for manual fault location. The set times appear in the first dialog box of the command Tools\Manual Fault Location. After completion of manual fault location, the interval cursors show the working range used.

## Tools\Calculations

Shortcut:

Toolbar: 

Using the calculation functions, you can calculate useful new signals from the recorded data. For example, it is possible to calculate power or slip impedance from the measured currents and voltages.

The calculated or newly-generated signals can be displayed in the same way as the signals recorded by the recording stations. “Calculations”, “Fault Location”, “Time Calculations” and “Expert Evaluation” are optional E_wineve extensions. Depending on your license this command may be blocked.

You will find more detailed information in the section "Calculations".

## Tools\Merge

This command is used in order to merge together two opened event files. You can also merge signals which are located in the clipboard into the current document window using the command Edit\Paste.

The Merge command requires that the two event files which are to be merged are open, or that the signals which are to be pasted are located in the clipboard. If this is not the case, an error message will appear.

Often, a fault on a line will be recorded by two recording stations at two different locations, typically at the two ends of the line. It is therefore often desirable for the later analysis of the fault to display the two recordings (or at least some of the signals from these) in the same window, with the same time scale. After merge, these are displayed as if the two events had been recorded at the same time by one recording station.

You will find more detailed information in the chapter Merge.

## Tools\Batch

This command opens the dialog box for batch mode operation. In this dialog box, the operations which are to be carried out in batch mode can be defined and batch mode operation can be started and stopped. The dialog box is also used to display status in batch mode. The duration of batch operation and the number of processed events are displayed.

After starting the program, E_wineve is in interactive operating mode. However, you can also start E_wineve in such a way that the program is in batch mode from the start. See the section "Starting E_wineve in Batch Mode".

You will find more details of how E_wineve works together with WinCom in the section "Batch Synchronisation with WinCom".

The operations which are to be carried out in batch mode can be defined in the upper part of the batch dialog box:

Calculation, execute formula set "Batch" if available

Automatic Fault Location

Expert Evaluation

Print FLT File generated by FL/Expert

Print File in Batch Queue

If no formula with the name "Batch" is defined for a station, no formulae are calculated, even if Calculations is switched on. You should also pay attention to the use of upper and lower-case letters.

“Calculations”, “Fault Location”, “Time Calculations” and “Expert Evaluation” are optional E_wineve extensions. Depending on your license one or more of these functions may be blocked.

The batch mode is disabled if the password has not been entered correctly during the program startup. See chapter “General Information”, Password Protection.

The push button “Expert Setup” opens the Tools\Expert Evaluation dialog window.

The event and result files in the waiting list are shown in the lower part of the dialog box. When WinCom receives an file, this is entered in the waiting list. E_wineve checks the waiting list periodically in batch mode. The duration of the periods or sampling rate can be adjusted within the range 1 to 65 seconds. A setting of 10 seconds, or preferably more, is recommended.

E_wineve is set into batch mode by clicking on the “Start“ button. In batch mode, the name of the button changes to “Stop“. If you operate the button again, E_wineve returns to interactive mode.

As long as the waiting list is empty, E_wineve does nothing. However, as soon as a file is received, the file is opened and displayed with the current settings. After the defined operations have been carried out, the file is closed and the entry removed from the waiting list. The fault location results are saved, but not the event file.

E_wineve then waits until the next event or result file is received. When pressing the “Stop” push button, E_wineve returns to interactive mode.

One mouse click in the waiting list selects or deselects a particular file. If you hold down the shift key and mark two files, all intervening files are also marked. You can mark any files by holding down control and clicking the mouse.

You can open all the marked files in the waiting list using the “Open“ button. Opened files are then removed from the waiting list. The batch dialog remains in the foreground and active.

Using the “Delete“ button, you can delete the marked files from the waiting list without having to carry out the operations. You can also switch off all operations and start batch mode. All files in the waiting list are then opened and closed again.

When pressing the “Minimize” push button, E_wineve window is reduced to icon size.

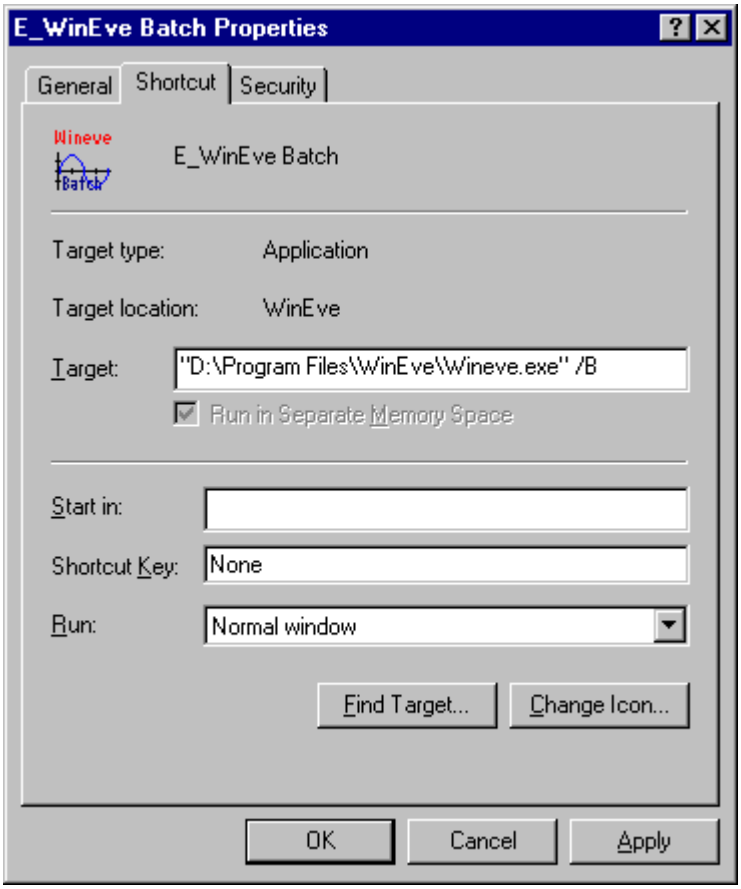
## Starting E_wineve in Batch Mode

The E_wineve application can work in two operating modes. The normal operating mode is the interactive mode, in which the actions which are to be carried out are initiated by the user using the keyboard and mouse.

In batch mode, E_wineve operates without the user doing anything. In batch mode, prepared sequences of actions are carried out automatically as soon as WinCom receives a new event or result file.

With the command Tools\Batch, a dialog box is opened in which the actions which are to be carried out can be prepared and batch mode started.

You can also start E_wineve directly in batch mode. The installation program for E_wineve places two E_wineve icons in the "E_WINEVE" program group. One of the E_wineve icons starts E_wineve directly in batch mode. Both E_wineve icons start the same program. Apart from the different program icons, the two programs differ only in the "/B" on the command line.




You can also copy the "E_wineve Batch" icon into the "Startup" program group. A program in the Startup program group is started automatically when the Windows operating system is loaded. Proceed as follows:

1. Click on the "E_wineve Batch" icon in the "E_WINEVE" program group.
2. Select the command Edit\Copy from the menu.
3. Click on the "Startup" program group.
4. Select the command Edit\Paste from the menu.
5. Select the command File\Properties from the menu.
6. If necessary, select "Change Icon".

## Batch Synchronisation with WinCom

From the viewpoint of the application software (personal computer), WinCom is the producer of events and E_wineve is the consumer. WinCom and E_wineve are two completely independent Windows applications. In terms of multitasking, there is no true intertask communication and no synchronisation.

A very simple process is used in order to inform E_wineve of the receipt of a new event. If WinCom is in batch mode and an event or result file is successfully received, the following occurs: WinCom opens the file

C:\DATA\EVENTS\WINCOM.FIF

and appends a line of text to the file. The WINCOM.FIF file is then closed again. The text line contains nothing other than the name of the file and the name of the directory where the file is stored. WINCOM.FIF can appear as follows, for instance:

C:\DATA\EVENTS\001023.EVE

C:\DATA\EVENTS\002005.EVE

C:\DATA\EVENTS\001024.EVE

In the above example, WinCom has received events 23 and 24 from station 1 and event 5 from station 2.

In E_wineve's Batch dialog box, the content of WINCOM.FIF is displayed in the waiting list. If E_wineve is in batch mode, E_wineve periodically opens the WINCOM.FIF file and checks whether the file is empty. If the WINCOM.FIF file exists and is not empty, E_wineve reads the first text line and deletes this line from the file. E_wineve now attempts to open and process the file stated in the text line.

## Tools\One Terminal Fault Location

Shortcuts:

Toolbar: 


This command is used in order to start the automatic fault location for the current event. A new document window is opened in which the results of the fault location are listed. Example:

Automatic Fault Location FLT3.0/0

One terminal fault location (OTFL) algorithm is used to evaluate fault location

LINE:

Line name = Turgi-Baden

Line length = 20.0 miles

Station A:

1. Event:

Station name = Baden

Station number = 999

Event date and time = 12-Sep-1998 10:05:00.100

Event number = 0

Event file = D:\E_wineve\Data\ab8R0C0g.cfg

Duration of recording = 332.8 ms (-100.0 ms .. 232.8 ms)

2. Trigger:

Type of trigger (0) = Unknown

Trigger signal = ?

3. Fault Location:

Fault type = R - S

Fault duration = 230.2 ms (3.0 ms .. 233.2 ms)

Region with stable impedance, variations <= 0.4 %

Impedance at 122.2 ms = 102.27 Ohm, 67° primary = 39.90 + j 94.16 Ohm

Distance to fault (OTFL) = 16.0 miles (± 0.5 miles)

“Calculations”, “Fault Location”, “Time Calculations” and “Expert Evaluation” are optional E_wineve extensions. Depending on your license this command may be blocked.

One terminal fault location (OTFL) algorithm is used to evaluate the fault location. You must have defined at least one line with the command Parameters\Line. If this is not the case, an error message will appear.

With one terminal fault location, fault location is carried out for all defined lines. If the event file contains faults on more than one transmission line, the calculation is carried out successively for each line. An event file can contain faults on up to ten lines. However, only one fault per line is evaluated.

The working range and short circuit type are selected automatically. You can select these yourself using the command Tools\Manual Fault Location. You can also use one terminal fault location in unmanned operation. See the section on the command Tools\Batch.

You will find more detailed information in the section "Fault Location".

## Tools\Two Terminal Fault Location

Shortcuts:

Toolbar: 


This command is used in order to start the automatic fault location for the current event. A new document window is opened in which the results of the fault location are listed. Example:

Automatic Fault Location FLT3.0/0

Two terminal fault location (TTFL) algorithm is used to evaluate fault location

LINE:

Line name = Turgi-Baden

Line length = 20.0 miles

Station A:

1. Event:

Station name = Baden

Station number = 999

Event date and time = 12-Sep-1998 10:05:00.100

Event number = 0

Event file = D:\E_wineve\Data\ab8R0C0g.cfg

Duration of recording = 332.8 ms (-100.0 ms .. 232.8 ms)

2. Trigger:

Type of trigger (0) = Unknown

Trigger signal = ?

3. Fault Location:

Fault type = R - S

Fault duration = 230.2 ms (3.0 ms .. 233.2 ms)

Region with stable impedance, variations <= 0.4 %

Impedance at 122.2 ms = 102.27 Ohm, 67° primary = 39.90 + j 94.16 Ohm

Distance to fault (TTFL) = 16.00 miles (± 0.12 miles)

Station B:

1. Event:

Station name = Turgi

Station number = 997

Event date and time = 12-Sep-1998 10:05:00.100

Event number = 0

Event file = D:\E_wineve\Data\ab8R0C0h.cfg

Duration of recording = 332.8 ms (-100.0 ms .. 232.8 ms)

2. Trigger:

Type of trigger (0) = Unknown

Trigger signal = ?

3. Fault Location:

Fault type = R - S

Fault duration = 230.7 ms (2.5 ms .. 233.2 ms)

Region with stable impedance, variations <= 0.4 %

Impedance at 123.8 ms = 46.26 Ohm, 67° primary = 18.02 + j 42.61 Ohm

Distance to fault (TTFL) = 4.00 miles (± 0.12 miles)

“Calculations”, “Fault Location”, “Time Calculations” and “Expert Evaluation” are optional E_wineve extensions. Depending on your license this command may be blocked.

Two terminal fault location (TTFL) algorithm is used to evaluate the fault location. This command requires that at least two event files are open. The current file is selected automatically as Station A event. If only two event files are open, the other file is selected automatically as Station B event. If more than two event files are open, a dialog box appears which allows selection of the Station B event. Station A event and Station B event must come from two recording stations at two different locations, typically at the two ends of the line. When you press the "OK" button in the above dialog box, the fault location continues. The fault locator tests if two terminal fault location (TTFL) algorithm can be applied to Station A event and Station B event. If TTFL is applicable, the fault location results for both events are shown. If TTFL is not applicable, an error message will appear, and one terminal fault location algorithm is used to evaluate the fault location of the current event. You can abort a fault-location operation using the "Cancel" button.

This command also requires that you must have defined at least one line with identical line parameters (Line Name, Line Frequency, Line Length, Positive Sequence Impedance, Zero Sequence Impedance, Positive Sequence Capacitance, Zero Sequence Capacitance) in station A event and STATION B event respectively, with command Parameters\Line. If this is not the case, an error message will appear.

With two terminal fault location, fault location is carried out for all defined lines in the current file. If the event file contains faults on more than one transmission line, the calculation is carried out successively for each line. An event file can contain faults on up to ten lines. However, only one fault per line is evaluated.

The working range and short circuit type are selected automatically. You can select these yourself using the command Tools\Manual Fault Location. You can only use one terminal fault location in unmanned operation. See the section on the command Tools\Batch.

You will find more detailed information in the section "Fault Location".

## Tools\Manual Fault Location

This function is used in order to start the manual fault location for the current event. A new document window is opened in which the results of the fault location are listed. Example:

Manual Fault Location FLT3.0/0

One terminal fault location (OTFL) algorithm is used to evaluate fault location

LINE:

Line name = Brugg

Line length = 55.3 km

Station A:

1. Event:

Station name = Turgi

Station number = 65

Event date and time = 23-Feb-1995 9:55:36.840

Event number = 2

Event file = E:\065002.EVE

Duration of recording = 380.0 ms (-198.3 ms .. 181.7 ms)

2. Trigger:

Type of trigger (3) = digital signal

Trigger signal = TRIP R

Manual Fault Location:

Selected kind of short circuit = R - 0

Rel. working interval = -47.0 ... 104.6 ms

| | km | secondary | |
|---|---|---|---|
| Rel. Time | Distance | Z-Ampl. | Z-Angle |
| -47.0 | 9999 | 5107 | 123.9 |
| -46.1 | 9999 | 2652 | 84.1 |
| -45.3 | -8236 | 2060 | 95.6 |
| -44.5 | -7088 | 2142 | 124.5 |

... etc.

| | | | |
|---|---|---|---|
| 8.8 | 7.41 | 1.856 | 83.9 |
| 9.6 | 7.41 | 1.856 | 83.9 |
| 10.5 | 7.40 | 1.855 | 83.9 |
| 11.3 | 7.40 | 1.854 | 84.0 |
| 12.1 | 7.40 | 1.854 | 83.9 |
| 13.0 | 7.40 | 1.853 | 83.9 |
| 13.8 | 7.39 | 1.853 | 83.9 |
| 14.6 | 7.39 | 1.852 | 84.0 |
| 15.5 | 7.39 | 1.852 | 84.0 |
| 16.3 | 7.39 | 1.852 | 84.0 |
| 17.1 | 7.40 | 1.854 | 84.0 |
| 18.0 | 7.40 | 1.855 | 83.9 |
| 18.8 | 7.40 | 1.854 | 83.8 |
| 19.6 | 7.40 | 1.855 | 83.8 |
| 20.5 | 7.40 | 1.854 | 83.9 |
| 21.3 | 7.40 | 1.855 | 84.0 |
| 22.1 | 7.42 | 1.858 | 84.0 |

“Calculations”, “Fault Location”, “Time Calculations” and “Expert Evaluation” are optional E_wineve extensions. Depending on your license this command may be blocked.

If more than one line has been defined, a dialog box first appears which allows selection of the line. You can also select all lines. If no line was defined, an error message will appear. Use the command Parameters\Line to define a line.

You can then define the beginning and end of the working interval in a further dialog box. The times are measured relative to the trigger point of the recording. The entire working interval must be within the duration of the recording. If you have previously switched on and positioned the interval cursors using the command Tools\Interval Start/End, their values are shown as default settings, otherwise the values -50 ms and 50 ms are suggested. If the time of the short circuit or the switch-off time do not lie within the working interval, the results do not indicate the true location of the fault. After leaving the dialog with "OK", the interval cursors are switched on (if they are not already switched on) and positioned according to the selected working interval.

A dialog box for the short circuit type then appears. You can select from the phase-zero short circuits R-0, S-0, T-0 and the phase-phase short circuits R-S, S-T and T-R. If the fault locator finds a true line fault in the previously-defined working interval, a short circuit type is selected as default. You can select the pre-selected short circuit type or a different type.

When you press the "OK" button in the above three dialog boxes, the selected settings are installed and the fault location continues. After leaving the short circuit type dialog, the actual calculation of the location of the fault takes place. The results are output in the form of a table showing the individual distance and impedance results with 24 values per line period within the selected working interval. You can abort a fault-location operation prematurely using the "Cancel" button.

With the commands Tools\One Terminal Fault Location, Tools\Two Terminal Fault Location, fault location is carried out for all defined lines and the selection of the working range and short circuit type takes place automatically.

You will find more detailed information in the section "Fault Location".

## Tools\Signal Vectors

Shortcuts:

Toolbar: 

This command is used in order to show the measured values at a particular time in vector form. A new document window is opened in which signal vectors (amplitude and angle) are displayed.

Example with values before compensation:

Signal Vectors FLT3.0/0

LINE:

Line name = Brugg

Line length = 55.3 km

Station A:

1. Event:

Station name = Turgi

Station number = 65

Event date and time = 23-Feb-1995 9:55:36.840

Event number = 2

Event file = E:\065002.EVE

Duration of recording = 380.0 ms (-198.3 ms .. 181.7 ms)

2. Trigger:

Type of trigger (3) = digital signal

Trigger signal = TRIP R

Signal Vectors:

Rel. time in interval = -50.0 ms

Rel. working interval = -50.0 .. -1.6 ms

| Channel | Amplitude | Angle |
|---|---|---|
| UR | 30.11 | 0.0 |
| US | 30.13 | 0.0 |
| UT | 30.13 | -0.2 |

| | | | |
|---|---|---|---|
| IR | 2.99 | -0.3 | ( = -0.3 Degrees -> UR) |
| IS | 2.98 | -0.5 | ( = -0.5 Degrees -> US) |
| IT | 2.99 | -0.6 | ( = -0.4 Degrees -> UT) |

“Calculations”, “Fault Location”, “Time Calculations” and “Expert Evaluation” are optional E_wineve extensions. Depending on your license this command may be blocked.

This function is required for the compensation of input circuits. Small errors in amplitude and angle measurement can be compensated in order to improve the quality of the fault location results.

If more than one line was defined, a dialog first appears which allows the line to be selected. If no line was defined, an error message appears. Use the command Parameters\Line to define lines.

A dialog follows in which you can enter the relative time within the interval. The time must lie within the recording duration minus the calculation interval. The calculation interval is automatically set to 2.4 line periods. This allows the direct current components to be filtered out. If the time is too close to the end of the recording, a "window error" occurs.

If you have previously switched on and positioned the interval start cursor using the command Tools\Interval Start, its value is shown as a default value. After leaving the dialog with "OK", the interval start cursor is switched on (if it is not already switched on) and positioned according to the selected time.

You will find more detailed information in the section "Fault Location".

## Tools\Time Calculations

Opens a dialog which allows to select a time calculation formula. Once a formula is selected, it can be edited or executed.

“Calculations”, “Fault Location”, “Time Calculations” and “Expert Evaluation” are optional E_wineve extensions. Depending on your license this command may be blocked. Detailed information about time calculations can be found in the chapter Expert Evaluation.

## Tools\Expert Evaluation

This command is used in order to start or configure the Expert evaluation for the current event. A new document window is opened in which the results of the Expert evaluation are listed. See chapter Fault Location Results for more information.

Expert Evaluation FLT3.0/0

One terminal fault location (OTFL) algorithm is used to evaluate fault location

LINE:

Line name = Main Line 'A'

Line length = 205.0 km

Station A:

1. Event:

Station name = FL Test Station

Station number = 1

Event date and time = 23-Jul-1994 17:00:55.130

Event number = 25

Event file = D:\DATEN\EVENTS\RE001.025

Duration of recording = -200.0 ms .. 709.2 ms

2. Trigger:

Type of trigger (3) = digital signal

Trigger signal = TRIP S

3. Fault Location:

Fault type = S - T

Fault duration = 100.8 ms (-10.0 ms .. 90.8 ms)

Region with stable impedance, variations <= 2.7 %

Impedance at 15.8 ms = 50.9 Ohm, 85 Degrees secondary =4.4 + j50.7 Ohm

Distance to fault (OTFL) = 169 km (± 5.1 km)

4. Pre - Fault Values:

| | | |
|---|---|---|
| U (L1) | 101.7 kV | 0° |
| U (L2) | 101.7 kV | 120° |
| U (L3) | 101.1 kV | -120° |
| I (L1) | 0.176 kA | -176° |
| I (L2) | 0.159 kA | -59° |
| I (L3) | 0.154 kA | 66° |

5. Fault Values:

| | | |
|---|---|---|
| U (L1) | 99.06 kV | 0° |
| U (L2) | 83.84 kV | 123° |
| U (L3) | 87.03 kV | -124° |
| I (L1) | 0.207 kA | 86° |
| I (L2) | 1.145 kA | -107° |
| I (L3) | 1.061 kA | -2° |

6. Post - Fault Values:

| | | |
|---|---|---|
| U (L1) | 100.8 kV | 0° |
| U (L2) | 100.7 kV | 120° |
| U (L3) | 100.1 kV | -120° |

| | | |
|---|---|---|
| I (L1) | 0.194 kA | 170° |
| I (L2) | 0.212 kA | -62° |
| I (L3) | 0.229 kA | 70° |

7. Post - Re-close Values:

| | | |
|---|---|---|
| U (L1) | 101.4 kV | 0° |
| U (L2) | 101.4 kV | 120° |
| U (L3) | 100.8 kV | -120° |
| I (L1) | 0.181 kA | 173° |
| I (L2) | 0.150 kA | -66° |
| I (L3) | 0.163 kA | 58° |

8. Time Calculations:

| | | |
|---|---|---|
| Power switch OFF | after 23 ms | during 125 ms |

“Calculations”, “Fault Location”, “Time Calculations” and “Expert Evaluation” are optional E_wineve extensions. Depending on your license this command may be blocked.

You must have defined at least one line with the command Parameters\Line. If this is not the case, an error message will appear.

## Dialog box options:

With the push button “OK” the settings are saved (in WINEVE.INI) and the dialog ends. The selected configuration is also used for later evaluations in the batch mode.

The push button “Execute” starts the Expert evaluation. The results are shown in an own document window. The created FLT file can be saved or printed.

**Fault Location**

Shows the short circuit type (e.g. short circuit on phases S-T), the duration of the short circuit and the distance to the fault with corresponding time and impedance information. Comments on the fault location are also shown if applicable.

For the selection of the fault location algorithm there are two possiblities:

- One Terminal
- Two Terminal

See Tools\One Terminal Fault Location, Tools\Two Terminal Fault Location for more information.

**Pre - Fault Values, Fault Values, Post - Fault Values, Post - Re-Close Values**

Calculates the phase values of the line voltages and -currents previous to, during and after the fault, and after a possible re-closing. All displayed values are effective values.

If the “Fault Location” is switched off and e.g. “Pre-Fault Values” is switched on, the fault location is still executed (but not displayed). The begin and end of the short circuit, being evaluated by the fault location, is required for the calculation of the fault values.

**Time Calculations**

The formula, which were previously written with the time formula editor, are computed and the results are included into the Expert protocol.

For the selection of the time formula there are two possiblities:

- Selected Time Formula
- Formula Name = Line Name

In the first case the same formula name is used for all lines of all stations. The existing formula set names are displayed in a list box. Typically the formula name “Batch” is chosen. For each station a formula with the name “Batch” must be defined.

In the second case a different formula is executed for each line of a station. The formula name corresponds to the line name.

If there is not any formula with the chosen formula name, an error message is displayed in the section “8. Time Calculations”.

**View All Results of a Line if:**

The Expert evaluation is carried out for all defined lines. Normally only this line is of interest, where the fault occured. The options in this section allow to reduce the output to the interesting lines. There are two conditions available, the result of the fault location and the result of the time calculations, which can alternatively be AND or OR combined.

**Fault Location:**

- Failed
- Fault On this Line
- Fault Outside this Line

If the fault location of a line should only be displayed if the fault is locatated *On this Line*, please check the corresponding check mark and uncheck the other two check marks. If the result of the fault location should be still displayed (non regarding the result), please check all check marks.

*Failed* means, that the fault location was not able to evaluate a fault distance. There are several reasons possible: Missing line parameters, not all defined line signals available, no short circuit on this line, etc.

*Fault On this Line* means: The fault location could be evaluated successfully and the fault distance lies inside the defined line length. The line length can be specified in the dialog window “Reference” using the menu command Parameters\Line. The evaluated fault distance is greater than or equal 0 and smaller than the line length +20%.

If the evaluated fault distance is closed by to the line length (-10%..+20%), following message is displayed in the FLT file: “Fault near far substation”

*Fault Outside this Line* means: The fault location could be evaluated successfully, but the fault is located outside the defined line. It is possible that the fault distance is negative (fault location backwards from this line) or is greater than the line length +20% (fault location forwards).

**Time Calculations:**

- Ignore $writeFLT
- AND $writeFLT
- OR $writeFLT

The output can be controlled in dependency of a predefined variable $writeFLT. The time calculation formula can set the variable $writeFLT as follows:

```
tripR := ON ("TRIP R")
IF tripR != LOWINT THEN WRITE ("TRIP R at %d ms\n", tripR)
IF tripR != LOWINT THEN $writeFLT  := 1
ELSE $writeFLT  :=  0
WRITE ("$writeFLT  = %d\n", $writeFLT)
```

If “AND writeFLT” is chosen, both conditions must be fulfilled (e.g. fault distance in range of the line and TRIP R occured). If “OR writeFLT” is chosen, at least one of the two conditions must be fulfilled.

The Expert Evaluation combines the result of the fault location (failed, fault on this line, fault outside this line) with the value of the variable $writeFLT.

If $writeFLT was not set in the time calculation formula, $writeFLT is initialized to 1.

In the time calculation formula $writeFLT should be set to 0 (FALSE) or 1 (TRUE). In principle any values in range -32768..32767 are possible. FALSE and TRUE are interpreted as follows:

AND $writeFLTmeans  AND ($writeFLT > 0)

bzw.

OR $writeFLT  means  OR ($writeFLT > 0)

# Insert Menu

## Insert \ I425 SOE Data

This command is used in order to insert Indactic 425 SOE messages in the current event file

The Insert Indactic 425 SOE Data command requires that there are messages in the SOE file that overlap in time with the EVE file. If this is not the case, an error message will appear. Both SOE and EVE times are interpreted as current local time.

The insertable messages are displayed and the user can choose the desired messages.

# Parameters Menu

## Parameters\Station

This command is used in order to define the station name and station type. The station name can be any name with 1 to a maximum of 32 letters. Normally you choose a station name which identifies the location of the recording station.

The station name is displayed with the command File\File Summary. The station name also appears in the footer of the printed document. The inclusion of the station name in the footer can be selected and deselected in the dialog box which appears with the command File\Page Setup.

The correct selection of the station type is very important. It influences the conversion of the logical data stored in the event file to physical measured values. The transformation ratios differ depending on the station type. If a communication has already taken place with this recording station, the station type is set correctly by WinCom.

## Parameters\Line

This command is used in order to define the line parameters. This dialog box allows the assignment of signals to a line and the definition of other line data. The line parameters are only required for the following commands: Tools\One Terminal Fault Location, Tools\Two Terminal Fault Location, Tools\Manual Fault Location , Tools\Signal Vectors and Tools\Expert Evaluation.

The display of the line names in the document window can be switched on and off using the command View\Line Names. If you neither display line names nor wish to carry out a fault location, you do not need to define the line parameters.

You will find general information on fault location in the section "Fault Location". More detailed information can also be found in the section "Determining Line Data".

As a precondition for fault location, the following signals must be assigned to a line:

| | |
|---|---|
| U-R | Voltage of phase R |
| U-S | Voltage of phase S |
| U-T | Voltage of phase T |
| I-R | Current of phase R |
| I-S | Current of phase S |
| I-T | Current of phase T |

If you wish to take into account the influence of the parallel line when calculating the fault location, the following signals are required in addition:

| | |
|---|---|
| IP-R | Current of phase R of the parallel line |
| IP-S | Current of phase S of the parallel line |
| IP-T | Current of phase T of the parallel line |

or:

IP-SUM Sum current of the parallel line

Further signals are not required for fault location. However, you can assign other signals (including digital ones) relating to the line.

It is important that you should have the most accurate information possible concerning your line data. The more precise the line data are, the better the results of the fault location will be. The line data are principally determined by the geometry of the line or the positioning of the line on the high-voltage pylon and the arrangement of the line wires beneath one another.

If you wish to use two terminal fault location algorithm when calculating the fault location, line length is required in addition.

The influence of capacitance can be ignored if the line is less than 50 km in length.

The algorithm of the fault locator is designed for overhead power lines. The value ranges for meaningful line data are stated below:

| | |
|---|---|
| Positive sequence impedance amplitude | 0.27 to 0.42 Ohms/km |
| Positive sequence impedance angle | 75 to 87 degrees |
| Zero sequence impedance amplitude | 0.6 to 1.2 Ohms/km |
| Zero sequence impedance angle | 65 to 85 degrees |
| Positive sequence capacitance | 9 to 14.5 nF/km |
| Zero sequence capacitance | 5 to 25 nF/km |

However, you can also define values outside of the above ranges. For lines whose characteristic varies from above ranges (e.g underground cable lines), it is possible that the fault location results are not correct. An error message is only displayed if a fatal error such as division by zero has been occurred during fault location.

Positive sequence impedance and zero sequence impedance can be entered in the Impedance dialog. The impedance from phase-to-zero and phase-to-phase are automatically calculated from positive sequence impedance and zero sequence impedance:

$$Zp0 = (2 * z1 + z0) / 3$$

$$Zpp = (z0 - z1) / 3$$

The phase-to-zero and phase-to-phase impedance should only be entered if line symmetries have to be compensated. These values must be entered again after a change to positive sequence impedance or zero sequence impedance.

## Parameters\Signal

Shortcuts:

Keyboard: ENTER

Mouse: Double click on signal in document window

This command is used in order to define the signal parameters of the selected signal. If you have selected several signals, the signal with the lowest signal number is processed.

The signal name can be entered for analog and digital signals. With analog signals, the definition of the primary transformer, the input transformer and correction values are added.

The overall transformation ratio is derived from the values of the primary transformer and the values of the input transformer. This is used for the display of the measured values, e.g. for the command Tools\Values or View\Signal Info.

There are various current and voltage transformers in the Indactic® 65 and Indactic® 650 family. The transformation ratios depend on the station type. The station type is defined using the command Parameters\Station.

The input and output voltage can be entered for the primary transformer. The output voltage generally corresponds to the nominal voltage of the voltage transformer. However, it is also possible to use a 100V voltage transformer with a transformer output voltage of 110V. The same principle applies to current transformers.

If an input transformer which is not standard for Indactic® 65 or Indactic® 650 is used for recording the signals, a signal can be defined as "analog". The "analog" input transformer corresponds to a transformer with a transformation ratio of 1. Instead of input and output voltage or current, the maximum input value must be entered for "analog". The maximum input value corresponds directly to the overall transformation ratio.

Correction values for the amplitude and the angle can also be entered in the signal dialog box. The correction values are only taken into account during fault location. You will find details on this in the section "Fault Location" and under the sub-heading "Compensation of Input Circuits".

## Parameters\Save Station

This command saves the station parameters used for the current event. The station parameters are saved in a file with the name

STnnn.PAR

where "nnn" stands for the station number. The file is stored in the directory which was defined using the command Options\Directories.

The station parameters include all station-, line- and signal-specific parameters. These are the settings entered using the following commands:

Format\Color

Parameters\Station

Parameters\Line

Parameters\Signal

If you have changed, but not yet saved station parameters, E_wineve will ask whether the station parameters should be saved when you close an event file. If you reply the question with OK, the command Parameters\Save Station is executed.

## Parameters\Import Station File

This command is used to import existing station text files of the Indactic® 65 application software.

This command opens a file selection dialog box. You can select a file with the name

PLOT.TXT

or

FLPnnn.DF

where the number "nnn" corresponds to the station number of the current event.

When importing, the current station parameters are overwritten and replaced with the values in the imported station text file. The PLOT.TXT file also contains information on the display sequence. The layout is also altered accordingly.

If you wish to continue to use the imported data, you must save these using the command Parameters\Save Station and, if necessary, Parameters\Save Layout.

If you wish to import both PLOT.TXT and FLPnnn.DF, the sequence in which these are imported is important. The transformation ratios are defined in both files. It is recommended that you import PLOT.TXT first, then FLPnnn.DF.

After importing, you should first make sure that the station type is correct. To do this, use the command Parameter\Station. You should then check the lines and signals using the commands Parameters\Line and Parameters\Signal.

## Parameters\Save Layout

This command is used in order to save the layout for the current event under a layout name. A dialog box is opened in which you can select an existing layout name or define a new layout name. The layout name may be up to 32 letters long.

We recommend that you choose the most meaningful name possible. This makes it simpler to use the layouts again later. You can store up to 10 different layouts per station. In this dialog box, you can also delete a layout if it is no longer required.

A saved layout can be used again later for the current event file or another event file for the same station. To do this, you use the command Parameters\Use Layout.

All layouts for event data for the same station are located in a single file. The layouts are stored in a file with the name

STnnn.LAY

where "nnn" corresponds to the station number. The file is stored in a directory which was defined using the command Options\Directories.

A layout contains the information which relates to the representation of the event in the document window. These are the settings carried out with the following commands:

Edit\Show

Edit\Hide

Edit\Compose

Edit\Decompose

Edit\Select

View\Upper/Lower Time scale

View\Time Lines

View\Line Names

Format\Time Scale

Format\Amplitude Height

Format\Axis Height

Format\Markers

Format\Clipping

Format\Interpolation

Tools\Values

Tools\Interval Start/End

If you have changed the layout and you wish to re-use this layout for other event files for the same station, you must explicitly carry out the command Save Layout. E_wineve does not point out that the layout has been changed when you close an event.

## Parameters\Use Layout

This command is used in order to load a layout from the layout file. A dialog box is opened which displays a list of all existing layouts. In this list, the name of the layout currently being used is highlighted.

E_wineve notes the name of the currently use layout. The next time it opens an event from the same station, the same layout is used.

In the list of layouts there is a pre-defined layout with the name "Default Layout". If no other layout is present or the layout file cannot be opened, the default layout is used.

With the default layout, all existing analog and digital signals are displayed. The display sequence is determined by the signal numbers. The time scale is set to page width, the amplitude and axis height to 20 mm. Time lines, line names, markers, clipping, interpolation and the measured value and interval cursors are switched off.

If you have changed the layout and you wish to re-use this, you must carry out the command Parameter\Save Layout. E_wineve does not point out that the layout has been changed when you close an event.

# Options Menu

## Options\Directories

This command is used in order to define the directories for event-, station-, result-, layout- and formula files in a dialog box.

The corresponding files used by E_wineve are stored in the station-, layout- and formula directory. When an event is opened, the relevant station file in the directory defined here is searched for and loaded. If the station is saved, its station file is stored in the station directory. The same applies to the result, layout and formula files.

WinCom stores the recorded event files in the event directory. When E_wineve is started, the program sets the current working directory to the event directory in the assumption that you wish to evaluate one of these recorded events. When you first select the command File\Open after starting the program, the event directory is already pre-selected. Otherwise, the event directory has no further importance for E_wineve. If you wish to save an event using the command File\Save As you can select any directory.

The result directory is used in the open dialog if one of the text file types is selected. Additionally, the result files generated by E_wineve are saved in the result directory as default.

After the dialog box is opened, the directories currently used are displayed. You can edit the fields containing the directory names directly or select the required directory more simply by using the "Browse" button. An error message appears if you enter a directory which does not exist or to which you have no write-authorisation.

If WinCom is also installed, you can choose whether the same directory should be used for event and station files as for WinCom. If you change the directories in WinCom, E_wineve will also use the changed directories.

The directories are stored in the file WINEVE.INI. If you use the WinCom directories, the event, station and result directories are read from WINCOM.INI.

## Options\Font

This command allows you to change the font, style and type size. You can select one font for the event files and another for the fault location results. The same type is used for all event files or all fault location results.

The same font is used for the entire document. In the case of event files, these are: All signal names and measured values of signals, the upper and lower time scale and the text in the measured value and interval cursors.

## Options\Language

This command allows you to choose the language used in E_wineve. A dialog box appears with a list of all supported languages. This command is blocked when documents are open. You should first close all documents. Only then can you change the language. The language "English" is always available. For other languages, additional language files are required in E_wineve's installation directory.

All menus, dialogs, error- and other messages form the so-called text resources. E_wineve is able to switch over its text resources dynamically. The English texts are located in the executable file of E_wineve. The other languages are stored in separate language files. If an error occurs when loading the language files, the English texts are used. There is a separate Help file for each language.

| | |
|---|---|
| WINEVE.EXE | Executable program with text resources in English |
| WINEVE.CHM | Help in English |
| EVEGER.DLL | Text resources in German |
| EVEGER.CHM | Help in German |

Other languages are supported in the same way as German. If you have little space on your hard disk and you are definitely not going to need certain languages, you can delete the relevant language libraries and help files from the hard disk. However, you should not delete the WINEVE.* files.

**Restrictions**:

The language selection is restricted to E_wineve help and the program components contained in WINEVE.EXE. E_wineve uses a number of so-called common dialogs of the Windows operating system (D:\WINNT\SYSTEM\COMMDLG.DLL). The language of these dialogs is determined by the language of the operating system. With the following commands, the dialogs are displayed in the language of the installed operating system:

File\Open, including a number of error messages

File\Save As, including a number of error messages

Parameters\Import Station File

"Browse" function in Options\Directories

File\Printer Setup including "Options" dialog

File\Print, including printer or print manager-related error messages

Format\Color

Options\Font

With the command Help\Using Help, the Help functions of the Windows help program (HH.EXE) are displayed. The language of the help program is determined by the language of the operating system.

## Options\Password

This menu command allows to change the setup for the password protection, i.e. to activate or inactivate the password checking or to change the password. This command is not available and some functions of E_wineve are disabled, if the password checking is active but the password was not entered when the application started. See chapter “General Information”, Password Protection .

If the password checking is active, then a first dialog appears which prompts you to enter the old password. The password setup can only be changed if this step is passed successfully. This step is skipped if the password checking is inactive. Then another dialog appears where the new password setup can be chosen.

The radio button *No Password Checking* inactivates the password protection. The radio button *Password Checking* together with the new password activate the password protection. A password consists of 1 to 16 characters. All characters are displayed as an asterisk ‘*’ as they are typed into the edit field.

Another dialog appears to verify the new password. Type in the new password again. If the verification is correct, the new password setup gets valid.

## Options\Licence

See chapter " Getting a valid License" for more information.

# Window Menu

## Window\New Window

This command is used in order to open a new window with the same content as the current window. You can open as many document windows as you like, in order to display different parts or views of a document. When you open a new window, this becomes the current window and overlays all other open windows.

If you change the document content in one window (e.g. signal name or color), the changes are effected in all other windows which contain the same document. One practical application of this command can involve displaying the same event in two windows with two different layouts with different time scales, for instance.

## Window\Cascade

With this command, all the windows are arranged overlapping one another. The windows appear in a cascade from upper left to lower right, with the title bar of each window visible.

## Window\Tile Horizontal

This command is used to arrange all open document windows in such a way that they do not overlap on the E_wineve screen. If no more than three windows are open, these are arranged above one another. If more windows are open, a better optimal arrangement is attempted. You can also by using this command make windows visible which are hidden behind other windows.

## Window\Tile Vertical

This command is used to arrange all open document windows in such a way that they do not overlap on the E_wineve screen. If no more than three windows are open, these are arranged next to one another. If more windows are open, a better optimal arrangement is attempted. You can also by using this command make windows visible which are hidden behind other windows.

## Window\Arrange Icons

This command is used in order to arrange the icons (reduced-size windows) along the lower edge of the main window. If the lower edge of the main window is occupied by an open document window, the icons are hidden.

See also: Control Menu\Minimize.

## Window\1, 2, 3, ...9

E_wineve displays a list of the currently open document windows in the lower section of the Window menu. If you select an open window, the document contained in it becomes active. You can open as many document windows as you like. The file name of the current window is marked with a tick in the list of currently open document windows.

# Help Menu

All commands in this menu (except for Help\About E_wineve) use the help program. The help program is not part of E_wineve, but is a component of the operating system. This is the application HH.EXE in the WINDOWS directory.

The help program works only when Internet Explorer 4 or higher is installed.

The command Options\Language switches over the E_wineve help file (*.CHM). The help program itself (e.g. the control-menu buttons and menus) and the help for the Help functions, which you can display using the command Help\Using Help, are displayed in the language of the installed operating system.

## Help\Contents

Shortcut:

Keyboard: F1 Shows context-sensitive help when available

This command is used in order to list the contents of E_wineve Help. From this opening screen, you can call up step-by-step helps on the use of E_wineve and different types of reference information.

If you wish to return to the list of contents from within the help function, click on the "Contents" tab on the left in the help window.

The help key F1 works context-sensitively and differs from the menu command in this respect. The menu command always displays the list of contents, whereas F1 branches directly to a help subject. Only if no corresponding help subject is available is the list of contents displayed.

You can press F1 at any time. When you press the F1 key, help information is displayed on screen on the operation just carried out, on the current dialog or on an error message.

If, for example, you want help on the subject "File\Close", open the "File" menu, move to "Close" using the cursor keys and press the F1 key (instead of ENTER). No file is closed, but help information on "File\Close" is displayed directly.

Context-sensitive help is switched on using the button  or SHIFT + F1.

The mouse pointer changes to an arrow with a question mark. If you now click on a menu command or an icon, the corresponding help information is displayed.

## Help\Search

This menu command is used in order to search for a subject in E_wineve Help via a keyword. Enter a word in the editable field or select one from the list. When you click the "Display" button, all the associated subjects appear. In order to display help on a particular subject, mark the required subject in the list and click the "Display" button.

If you wish to return to the Search dialog from within the Help function, click on the "Index" tab in the help window.

You can also use the context-sensitive help to display help on a menu command.

## Context-sensitive Help

There is no corresponding command in the menu for context-sensitive help, only shortcuts:

Toolbar: 

Keyboard: SHIFT + F1

Use the context help to obtain information on a component of E_wineve. If you click on the icon in the toolbar, the mouse pointer changes to an arrow with a question mark. You then click somewhere in the E_wineve window with the help pointer, e.g. on another icon in the toolbar or on a menu entry. The corresponding help subject is then displayed.

You can also switch the help pointer off again by using the keyboard command SHIFT + F1 or by clicking on the icon in the toolbar.

## Help\Using Help

This command is used in order to display instructions on using Help. Strictly speaking, help for the help program is displayed. The help program is a

component of the Windows operating system and not part of E_wineve. You cannot change its language using the command Options\Language.

## Help\Product Support

### Contact address

E_wineve is the ABB fault analysis software. If you have any queries concerning this product, please contact

ABB Switzerland Ltd
SA LEC Support
CH-5401 Baden
Switzerland

Email: sa-lec-support@ch.abb.com
FAX: ++1 425 928 1513
Phone: +41 (0)844 845 845

### Updates

As a licensee of E_wineve, you will be kept informed of product updates (e.g. new versions of E_wineve), training courses and other events.

### Technical Queries

If you have any technical queries concerning E_wineve, please refer first to the printed user documentation or the on-line help. You may also find README files on the first distribution diskette which contain additional information.

### Defective Software

If you find an error in the software, the on-line help or the printed documentation, or if you have suggestions as to how E_wineve could be improved, please let us know. Your suggestions are very helpful to us in our efforts to improve the product. In the case of a software error, we need the most precise description possible so that we can reproduce the error. We require the following details:

- Exact program designation with version number. See command Help\About E_wineve.
- Language used.
- Installed operating system with version number.
- Type designation of the PC on which the software is installed.
- CPU, main memory available, free space on hard disk.
- Type of graphics card, graphics driver, screen resolution used.
- Printer type and printer driver used.
- The exact wording of error messages which appear on screen.
- A description of what happened, and what you did when the problem occurred.

- Can the behaviour be reproduced? Only on your PC? Only with a particular file?
- If applicable, a description of what you did to remedy or circumvent the problem.

If the problem only occurs with certain event files, please copy these onto a diskette, together with the layout file (.LAY) and station file (.PAR) and enclose this.

## Help\About E_wineve

Shortcuts:

Toolbar: 

This command is used in order to display the E_wineve version number, the copyright information, any installed maths co-processors and the available memory and working memory capacity.

# Control Menu

The (pop up) control menu is displayed when the right mouse key is pressed on the title bar of the main window or when the left mouse key is pressed on the title bar of the minimized document window.



A distinction is made between different types of control menu, depending on the type of window:

Application control for main window

Document control for document window

Dialog control for dialog box

Not all commands are available in all control menus.

## Control Menu\Restore

This command is used in order to show the active window in the size and position which it had before the command Maximize or Minimize was carried out.

Simply clicking on the Restore symbol in the title bar, or double-clicking on the title bar has the same effect as the Restore command.

## Control Menu\Move

When you select this command, a four-headed arrow appears on the screen.

You can now use the cursor keys to move the active window around. This command is not available with maximized windows.

It is simpler to move the window around by clicking on the title bar and moving the mouse without releasing the mouse button.

## Control Menu\Size

When you select this command, a four-headed arrow appears on the screen.

Once the mouse pointer has changed to a four-headed arrow:

1. Press a cursor button (left, right, up or down cursor key) to move the pointer to the window border which is to be moved.
2. Press the cursor key(s) in the direction in which the border is to be moved.
3. Press Enter when the window has reached the required size.

This command is not available with maximized windows.

It is much simpler to change the size of the window around by clicking on one of the corners or borders of the window and moving the mouse without releasing the mouse button.

## Control Menu\Minimize

This command is used to reduce the E_wineve window to icon size. Simply clicking on the Minimize icon  in the title bar has the same effect as the Icon command.

## Control Menu\Maximize

This command is used to enlarge the active window to full screen size. A document window is expanded to the size of the E_wineve window or the E_wineve window is expanded to fill the entire screen. Simply clicking on the Maximize icon  on the title bar or double-clicking on the title bar has the same effect as the Maximize command.

## Control Menu\Close

Shortcuts:

Keyboard: CTRL + F4 closes a document window.

ALT + F4 closes the main window or a dialog box.

Mouse: Clicking on the field of a control menu has the same effect as the Close command.

Note: If you have opened several windows for a document at the same time, the Close command from the Control menu only closes one window. To close all windows at once, select the command File\Close.

## Control Menu\Next Window

| | |
|---|---|
| Keyboard: | CTRL + F6 |
| or: | CTRL + TAB |
| or: | SHIFT + CTRL + F6 |
| or: | SHIFT + CTRL + TAB |

This command is used to move to the next open window. E_wineve determines the sequence of the windows according to the order in which they were opened.

The shortcuts using the SHIFT key move through the open documents in reverse order.

# Fault Location

## Purpose

The fault locator calculates the distance of the fault from the fault recording system in the event of a short circuit. An event file with the recorded fault is required for this purpose, as well as the most precise details possible concerning the lines being examined. The command Parameters\Line is used for this.

The purpose of fault location is the fast, mostly automatic identification of the location of the fault. This eliminates the conventional search for the location of the fault using search vehicles and helicopters. A repair team can be sent directly to the site of the fault location. In this way, time and money is saved and the availability of the system is also increased.

Hard-to-detect damages to insulation on overhead lines can be identified with the aid of the fault locator. A further advantage is greater safety in the event of ground faults in inhabited areas.

## Fault Location Results

Each time the commands Tools\One Terminal Fault Location, Tools\Two Terminal Fault Location, Tools\Manual Fault Location, Tools\Signal Vectors and Tools\Expert Evaluation are called up, a new document window is opened in which the results are listed.

Each time fault location is started, a separate window is opened for the output of the results. You can freely select the font, style, size and color of the type using the command Options\Font.

When you close the fault location window, you will be prompted to save the file. By default the file is saved in the result directory. The result directory can be specified in the dialog Options\Directories. The file name is pre-defined and is composed of the station number "nnn", the event number "xxx" and the file name extension ".FLT".

nnnxxx.FLT

The file name is also shown in the title bar. The command File\Save is not present in the menu bar. However, you can use the command File\Save As. The usual commands in the file menu such as File\Print or File\Print Preview are available.

When you process several fault locations or a fault location and signal vectors with the same event file, the same file name is always suggested. Any existing files are overwritten.

The ".FLT" files are normal text files which you can edit using any word-processing program. The columns of numbers for "Rel. Time", "Distance", "Z-Ampl." and "Z-Angle" are separated by tabulators. This means that it is also possible to import the ".FLT" files into a spread sheet or specialised mathematics

package using an appropriate function. The results can also be represented graphically in these applications.

# Principle of Operation

The fault location data are measured by a recording station connected to the line which is to be monitored, via transformers, at the end of the line. If a short circuit occurs on a line, data recording is started by the line protection system. The trigger signal can be picked up from remote protection systems.

The recording station records voltages and currents on the line and, if required, also on the parallel line, and stores the data in an event file. The voltages and currents are used by the fault locator to determine the defective phase and the impedance in the corresponding measurement loop, and then for calculating the distance to the fault.

In order to calculate the location of the fault, the evaluation system must know the exact line parameters, from which the line impedance is derived. For this purpose, the values required for the calculation process, such as zero impedance and positive impedance of the line, transformation of the input circuits, values for the parallel line, impedances of the power supply etc. are defined during commissioning.

In calculating the distance of the fault from the measurement point, the following fact is used: the lines which are not too long, the imaginary component of the impedance is proportional to the distance between the location of the short circuit and the installation point of the recording station.

When a fault occurs, the voltage and current in the faulty line loop are measured and the impedance of the faulty line calculated. After splitting the impedance into a real component and an imaginary component, the imaginary component of the calculated impedance is put in relation to the imaginary component of the impedance per unit of distance (km or miles) of the fault-free line.

One terminal fault location (OTFL) algorithm uses the data recorded at one end of the line to determine the fault distance, whereas two terminal fault location (TTFL) algorithm uses the data recorded at two ends of the line to determine the fault distance.

The processing in the fault location program can be divided as follows:

a) Selection of operating mode

b) Determination of the working interval relative to the trigger time

c) Reading in the data within the working interval

d) Determining the phases involved in the short circuit

e) Calculation of voltage and current

f) Calculation of impedance from voltage and current in the measurement loop

g) Evaluation of the impedance results and selection

h) Calculation of distance from impedance and line data and output of results

i) Interpretation of results.

**a) Selection of operating mode**

After you have opened an event file, you can select the operating mode using one of the following menu commands:

Tools\One Terminal Fault Location

Tools\Two Terminal Fault Location

Tools\Manual Fault Location

Tools\Signal Vectors

Tools\Expert Evaluation.

**b) Determination of the working interval relative to the trigger time**

The working interval is defined in relation to the trigger time. It starts around 50 ms before the trigger time and has a duration of 100 ms. With manual fault location, you can define the working interval freely.

**c) Reading in the data within the working interval**

The voltages and currents for the working interval which are required for calculation are read in from the recorded data. These are all the voltage and current signals from the relevant line in question and possibly also the current signals from the parallel line.

**d) Determining the phases involved in the short circuit**

The phase selection determines the short circuit type and short circuit time. No phase selection takes place in "Signal Vectors" mode. It detects the current change in all phases. The sensitivity of the phase selection is 0.2 times In (In = nominal current). If the current amplitude principally increases in one phase, a phase-zero short circuit is assumed. If the current amplitude principally increases in two phase, a phase-phase (-zero) short circuit is assumed. If the current increases in all three phases, the phase selection responds as three-phase. The start of the change in current is recorded as the short circuit start (fault time). All further calculations are only carried out within a time range between the short circuit start and 100 ms after this.

**e) Calculation of voltage and current**

In "Signal Vectors" mode, all voltage and currents are calculated. In the other operating modes, only the short circuit voltage and the short circuit current in the measurement loop defined by the phase selection are calculated, taking into account asymmetries and the parallel line. If the input values were recorded with a sampling delay, they are automatically synchronised to the same time by means of interpolation. This is only necessary with the Indactic® 65 fault recorders, which do not sample the input values synchronously. See also the command File\File Summary.

**f) Calculation of impedance from voltage and current in the measurement loop**

The orthogonal components Xr and Xi of the measurement loop values are now calculated for the time when the measurement loop voltage and the current were calculated. The use of the inductive component Xi in the rest of the calculation guarantees that the result is independent of the line resistance, which changes with the temperature, and also independent of the short circuit resistance. At the same time, the input values are filtered, so that the direct current element and signals with frequencies other than the network frequency are heavily attenuated.

**g) Evaluation of the impedance results and selection**

Among the impedance results, a range is searched where these show as little variation range as possible. This is normally the case just before the power switch is opened. In order to obtain the most precise impedance value possible, the result within this range is then averaged.

**h) Calculation of distance from impedance and line data, output of results**

With short lines, the imaginary component of the calculated impedance is proportional to the distance between the location of the short circuit and the installation point of the recording station. With very long lines, the relationship between the positive sequence impedance and distance is no longer linear. By entering the specific capacity (capacity per distance) in the positive and zero impedance system of the line, the fault location takes this non-linearity into account and can calculate the distance correctly.

**i) Interpretation of results**

In "One Terminal Fault Location" and "Two Terminal Fault Location" mode, the impedance and corresponding distance are calculated automatically. The phase selection should correspond with the short circuit display of the line protection system. In the case of two-pole short circuits with ground contact (P-0-P) and three-pole short circuits, all the measurement loops involved in the short circuit can be evaluated. In "Manual Fault Location" mode, the other measurement loops can also be calculated and used to confirm the first result.

If recordings of both ends of the line and their fault location evaluations are available, then more weight is to be given to the end nearest the location of the short circuit.

In cases of high short circuit resistance (a corresponding message is issued), the end which supplies energy is to be given more weight.

In "Manual Fault Location" mode, the area with the most consistent results is to be searched for and preferably an average value determined from 24 results. If the impedance angle is greater, i.e. the short circuit resistance is less, in one area than in others, then this partial area is to be given more weight.

# Compensation of the Input Circuits

The accuracy of the fault location can be improved by compensation of the input circuits. Small amplitude and angle errors which are not noticed on the graphic representation can be compensated and thus no longer affect the fault location. Compensation is simple and can be carried out during normal commissioning of the recording station and the application software.

In the Parameters\Signal_dialog box, you can set the amplitude correction and angle correction for each signal individually.

Known voltages and currents are applied in parallel at all input terminals. All signals can be connected at the same time, or at least the "UR" signal and a further signal. Standard testing devices such as the XS92 or other adequately stable and accurate sources can be used as aids. The voltage amplitude should be around 1/3 of the nominal voltage, the current amplitude should be around 3 * nominal current. Ideally, the voltage signals should be connected parallel to the UR signal and the current signals in series with the IR signal. This means that all voltages are in phase in the recording. The currents are also in phase.

If the XS92 testing device is used, the angle of the ZL and ZQ impedance should be set equal to zero. In this way, phase coincidence (zero phase difference) is also achieved between the voltages and currents (with current transformer connected with neutral point on the bus bar).

Once the input values are connected, a test recording is started at the recording station. This test recording is then evaluated with Tools\Signal Vectors.

Below is an example of compensation for a line.

**1. Feed voltage and current.**

**2. Trigger test event and transmit via WinCom.**

**3. Open event file with E_wineve.**

**4. Completely define line and signal parameters.**

At this point the correction values still remain at 0.

**5. Start Tools\Signal Vectors.**

Example with values before compensation:

Signal Vectors FLT2.0/0

1. Event:

Station name = Turgi

Station number = 65

Event date and time = 23-Feb-1995 9:55:36.840

Event number = 2

Line name = Brugg

Line length = 55.3 km

Event file = E:\065002.EVE

Duration of recording = 380.0 ms (-198.3 ms .. 181.7 ms)

2. Trigger:

Type of trigger (3) = digital signal

Trigger signal = TRIP R

Signal Vectors:

Rel. time in interval = -50.0 ms

Rel. working interval = -50.0 .. -1.6 ms

| Channel | Amplitude | Angle | |
|---|---|---|---|
| UR | 30.11 | 0.0 | |
| US | 30.13 | 0.0 | |
| UT | 30.13 | -0.2 | |
| IR | 2.99 | -0.3 | ( = -0.3 Degrees -> UR) |
| IS | 2.98 | -0.5 | ( = -0.5 Degrees -> US) |
| IT | 2.99 | -0.6 | ( = -0.4 Degrees -> UT) |

The compensation must be carried out very carefully. Special care must be taken to ensure that the lines are connected to the terminals in the correct phase. If, for example, there is a deviation of more than +/- 5 % in the angles, it is essential that the relevant connection be checked. If, after further checking, the measurement is not within the correctable tolerance, the transformer must be replaced. If a channel is seen to indicate 180 degree errors, then the connection of the transformer should be checked, as it is probable that the connections are the wrong way round.

**6. Amplitude and angle correction**

The percentage for the amplitude correction is to be calculated for each signal as follows:

**AmplCorr[%] = AmplSet / AmplMeas - 1) * 100**

URcorr[%] = URset / URmeas - 1) * 100

Example:

URcorr[%] = (30.0 / 30.11 - 1) * 100 = -0.365

UScorr[%] = (30.0 / 30.13 - 1) * 100 = -0.431

UTcorr[%] = (30.0 / 30.13 - 1) * 100 = -0.431

IRcorr[%] = (3.0 / 2.99 - 1) * 100 = 0.344

IScorr[%] = (3.0 / 2.98 - 1) * 100 = 0.671

ITcorr[%] = (3.0 / 2.99 - 1) * 100 = 0.344

The voltage UR serves as a reference when stating the angle. It is therefore always to be connected for compensation. The angle correction is the difference from the UR angle.

**AngleCorr [degrees] = RefAngleMeas - AngleMeas**

URcorr[degrees] = 0.0

UScorr[degrees] = URmeas - USmeas

Example:

URcorr[degrees] = 0.0 - 0.0 = 0.0

UScorr[degrees] = 0.0 - 0.0 = 0.0

UTcorr[degrees] = 0.0 - (-0.2) = 0.2

IRcorr[degrees] = 0.0 - (-0.3) = 0.3

IScorr[degrees] = 0.0 - (-0.5) = 0.5

ITcorr[degrees] = 0.0 - (-0.6) = 0.6

When you have calculated the correction values, you can open the Parameters\Line dialog box, select the relevant signals and, by clicking on the "Signal" button, move directly to the Parameters\Signal dialog box, where you can enter the correction values. As a check, you should then carry out a check evaluation using Tools\Signal Vectors .

Example using values following compensation:

Signal Vectors FLT2.0/0

1. Event:

Station name = Turgi

Station number = 65

Event date and time = 23-Feb-1995 9:55:36.840

Event number = 2

Line name = Brugg

Line length = 55.3 km

Event file = E:\065002.EVE

Duration of recording = 380.0 ms (-198.3 ms .. 181.7 ms)

2. Trigger:

Type of trigger (3) = digital signal

Trigger signal = TRIP R

Signal Vectors:

Rel. time in interval = -50.0 ms

Rel. working interval = -50.0 .. -1.6 ms

| Channel | Amplitude | Angle | |
|---|---|---|---|
| UR | 30.00 | 0.0 | |
| US | 30.00 | 0.0 | |
| UT | 29.99 | -0.0 | |
| IR | 3.00 | -0.0 | ( = 0.0 degrees -> UR) |
| IS | 3.00 | -0.0 | ( = 0.0 degrees -> US) |
| IT | 3.00 | -0.0 | ( = 0.0 degrees -> UT) |

# Determining the Line Data

The accuracy of the fault locator can only be as good as the accuracy of the entered line data, particularly

Positive Sequence Impedance

Zero Sequence Impedance

Mutual Impedance

These data either exist as amplitude and angle or as resistance (real resistance) and reactance (reactive resistance). You can switch between the two types of input in the Impedances dialog box, which you can call up with the command Parameters\Line.

The customer usually obtains the line data from the power line construction company or line-layer. The determination of the line data is not a function of the fault recorder. The line data can either be measured before commissioning or determined using a computer program. Please note that the result of the fault location calculation is only as accurate as the entered line data.

# Expert Evaluation

## Purpose

For further evaluation of the recorded event and generation of a short protocol with consideration of the digital signals the Expert evaluation may be used. With Expert, time calculations basing on the digital signals are possible. The results of these time calculations can be included in the Expert protocol.

As the other fault location results, the result of an Expert evaluation is stored in a text file with filename extension .FLT. The .FLT files are stored in the directory for result files. The FLT-files can be opened again to be displayed or printed at any time.

An Expert evaluation in batch mode is also possible.

## Time Calculations

The menu command Tools\Time Calculations displays a dialog which shows all existing formula sets of the actual stations in a list box.

Select an existing formula or input a new formula set name in the appropriate edit field. Existing formula sets can be deleted. The function Execute allows to view the calculation results in a text window.

The Edit button or a double click on a formula set name calls the time formula editor.

### Time Formula Editor

The time formula editor shows the existing digital signals in a list box. A double click on a list entry inserts the signal name into the formula window (at the current cursor position).

The formula window contains the existing formulas and allows to input new ones. The existing functions can easily be inserted by using the various function buttons.

The edited formulas can be saved. The Close function does also prompt for saving if any changes were made.

Syntax Check allows to proof the syntactical correctness of the formulas. Execute views a text window with the calculation results.

# Calculation Functions

## Principles

All instructions have to be completed within one line. An “IF” statement is valid for the following statement on the same line or for the next instruction line. The same applies to the “ELSE” statement. The setting of brackets for an extension of IF and ELSE statements on more than one line is not allowed.

The constant LOWINT (= -32768) is available to be used in comparisons (see also the description of ON and OFF functions below).

The maximum length of variable names (tokens) is 128 characters.

## Variables

Variables may be used without previous declaration. The number of variables is not restricted. All variables are of type “Integer” and can hold millisecond values in the range -32768..+32767.

Example:

```
alpha := 20
beta  := -415
gamma := LOWINT
time1 := alpha
time2 := time1 - beta
time3 := ON ("PowerInd")
time4 := ON ("D4") + time3
```

## Output function

Outputs are made with the WRITE - function. Syntax:

```
WRITE (“Formatstring” {, Variable})
```

This syntax corresponds to the printf function of the C programming language. The maximum number of variables in one output statement is 3. The format string may contain all control and formatting characters which are known by printf. The most important possibilities are:

```
\n    output of a line feed
\t    output of a tab character
%u    output of an unsigned variable
%d    output of a signed variable
%x    output of an unsigned variable in hexadecimal
notation
```

Example:

```
WRITE ("text\n\ttext\n\t\ttext\n")
WRITE ("Signal PowerInd goes high at %d\n", time3)
WRITE ("Variable gamma = %x Hex\n\n", gamma)
```

leads to following output:

```
text
      text
            text
Signal PowerInd goes high at -20
Variable gamma = 8000 Hex
```

### Signal functions

ON, OFF. Syntax:

```
ON ("Signal")
OFF ("Signal")
```

ON and OFF return the millisecond value of the first rising or falling edge of a digital signal. The values are generally rounded. If no change of the signal state can be detected, the value -32768 (=LOWINT) is returned.

HIGH, LOW. Syntax:

```
HIGH ("Signal")
LOW ("Signal")
```

HIGH and LOW return a BOOLEAN value (TRUE or FALSE) that corresponds to the signal state at the end of the recording. This value may be used in IF statements.

Example:

```
time1_On := ON ("Shutter1")
time1_Off := OFF ("Shutter1")
WRITE ("time1_On = \t%d ms\ntime1_Off = \t%d ms\n\n",
time1_On, time1_Off)
IF HIGH ("Shutter1") THEN WRITE ("Shutter1 high at
end\n")
ELSE WRITE ("Shutter1 low at end\n")
IF LOW ("Shutter2") THEN WRITE ("Shutter2 low at
end\n")
ELSE WRITE ("Shutter2 high at end\n")
WRITE ("\n")
```

### Comparisons

For making comparisons the operators “=“ (equal), “!=“ (not equal), “<“ (less), “>“ (larger), “<=“ (less-equal) and “>=“ (larger-equal) are available. Further the functions NOT, AND, OR and XOR can be used to combine any comparisons.

Example:

```
time1 := ON ("PowerInd")
time2 := ON ("Shutter1")
IF time1 = time2 THEN WRITE ("Equal\n")
IF time1 < time2 THEN WRITE ("PowerInd rises before
Shutter1\n")
IF time1 >= time2 THEN WRITE ("PowerInd rises after
Shutter1\n")
IF HIGH ("PowerInd") THEN WRITE ("PowerInd HIGH\n")
IF LOW ("PowerInd") THEN WRITE ("PowerInd LOW\n")

IF time1 != LOWINT OR time2 != LOWINT THEN
  WRITE ("PowerInd or Shutter1 or both have a rising
edge\n")

IF time1 = LOWINT AND time2 = LOWINT THEN
  WRITE ("PowerInd and Shutter1 have no rising
edge\n")

IF time1 = LOWINT XOR time2 = LOWINT THEN
  WRITE ("PowerInd or Shutter1 have a rising edge (not
both)\n")

IF ON ("PowerInd") != LOWINT AND OFF ("PowerInd") !=
LOWINT THEN
  WRITE ("Puls on PowerInd detected\n")
```

### IF statements

For executing conditional instructions the functions If, THEN and ELSE are available.

Each condition must start with an IF statement and include a THEN branch. The ELSE branch is optional. Stacked IF statements are not allowed.

Example:

```
IF time1 > 0 THEN WRITE ("PowerInd rises after 0
ms\n")
ELSE WRITE ("PowerInd rises before 0 ms\n")

IF time1 <= time2 THEN ok := 1
ELSE ok := 0

IF ok = 1 THEN WRITE ("OK\n")
ELSE WRITE ("OK\n")
```

## Syntax Description

### Description of the Time Formula Syntax

```
program = {ifLine | elseLine | varLine | writeLine}

ifLine = "IF" logicalExpression
         {(AND | OR | XOR) logicalExpression}
         "THEN" (varLine | writeLine | eol)

elseLine = "ELSE" (varLine | writeLine | eol)

varLine = identifier ":=" expression

writeLine = "WRITE" "(" string {"," identifier |
constant} ")"

logicalExpression = [NOT] (logicFunction |
                    expression ("=" | "!=" | "<" | ">"
|
                               "<= | ">=") expression
)

logicFunction = ("HIGH" | "LOW") ("(" paramlist ")" |
                                  "[" paramList "]"  )

paramlist = expression {"," expression}

function = identifier ("(" paramlist ")" | "["
paramlist "]")

factor = ["-"] (number | function | expression)

expression = factor {("+" | "-") factor}

number = {0..9}
```

# Expert Function

The Expert evaluation is a variant of the automatic fault location that partially uses the algorithms of the fault locator and combines it with other functions for calculating the duration of the short circuit and the signal vectors of the line voltages and currents.

The calculation of timings depending on the digital signals can also be configured and included into the Expert evaluation.

The automatic Expert evaluation in batch mode is possible, too. See Tools\Batch.

The menu command Tools\Expert Evaluation displays a configuration dialog which allows to choose the parts of the Expert protocol selectively.

## Principle of Operation

See also: Principle of Operation of the fault location.

The calculation of the Expert data is done corresponding to the scheme described below.

### a) Identification and trigger information

These data are read from the event file and shown in textual representation. The identification information contains station name and number, event time, event number, line name, event file name and the duration of the recording (relative to the trigger time).

### b) Determination of the short circuit phases

As with the automatic fault location the type of the short circuit is evaluated here. The beginning of the rising current is taken as short circuit time. The duration of the short circuit is evaluated from this time till the falling of the short circuit current.

### c) Computation and interpretation of the short circuit impedance

The short circuit location is determined from the computed impedance and the line data. The exact description of this procedure can be found in the chapter Fault Locator\Principle of Operation.

### d) Compensation of the sampling delay

If the event data have been recorded with a sampling delay of the individual channels, it will be compensated before further computation.

### e) Loading of required data

The data of the voltage and current channels are read. If a parallel line is configured, its data are read, too (and also protocolled later on). The data will cover a time range from 5 sampling periods before to 4 periods after the short circuit. Additionally 4 periods are read at the end of recording for evaluation of the post re-close values.

### f) Computation of the phase values and angles

The effective values and the phase angles of the line voltages and currents are computed. The values for the pre- and post-fault values and for the post re-close values are intermediate values over 3 signal periods. The short circuit values (fault values) are intermediate values over the whole duration of the short circuit.

### g) Data output

Depending on the configuration the pre-fault, fault, post-fault and post re-close values are shown. The signals are identified with their configured signal names. The values are shown as physical primary values.

### Restrictions

The following reasons may prevent a computation of the signal values partially or completely:

- if the determination of the short circuit time is not possible (because e.g. the short circuit current was very small or even not existent)
- if the short circuit time is closer than 5 periods at the begin of the recording, the computation of the pre-fault values is not possible
- if the short circuit duration was shorter than 1 period, the computation of the fault values is not possible
- if the end of the short circuit is closer than 4 periods at the end of the recording, the computation of the post-fault values is not possible
- if the end of the short circuit is closer than 8 periods at the end of the recording, the computation of the post re-close values is not possible

# Merge

## Selection of the Files to be Merged

The Merge function combines data which were recorded using disturbance recording systems. This allows a global analysis of these data from different sources but concerning the same fault. The resulting merged document can be further processed using the following functions such as calculation and fault location.

There are two possible ways of performing the Merge function:

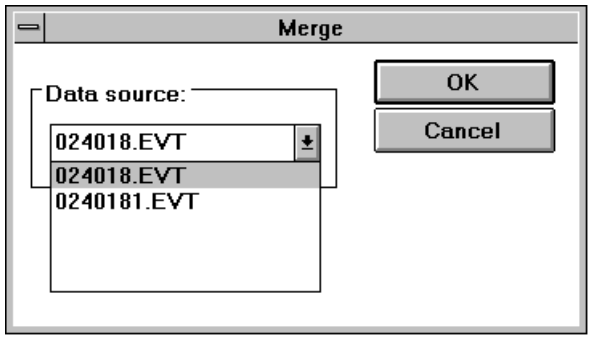
- Using the menu command Tools\Merge
- Via clipboard.

The second data source from which the signals are copied into the active file (first data source) is specified here.

### Using the menu command:

The first data source is determined by the active window. The second data source is represented in one of the other open windows.

- When the menu command is selected, the dialog box for selecting the second data source is displayed. The signals are copied from the second data source into the active document (first data source). A list of the open documents is provided for selection.




"Tools\Merge" dialog box

### Via clipboard:

The first data source is determined by the active window. The second data source is determined using "Copy" and "Paste". To do this:

- Activate second data source window.
- Select the signals which are to be copied to the first data source.
- Copy selected signals into the clipboard using the command Edit\Copy.
- Activate the first data source. Insert the signals in the clipboard into the first data source using Edit\paste.

**Special case**: There is one case where merge via the clipboard operates somewhat differently. If data are copied from clipboard into the same document or an empty document, then the clipboard is copied one to one. In this case, no merge is carried out (the signals do not need to be synchronized); only normal copying and insertion takes place.

## Compatibility Checks

To guarantee the correct and successful merge operation, the following compatibility requirements must be fulfilled:

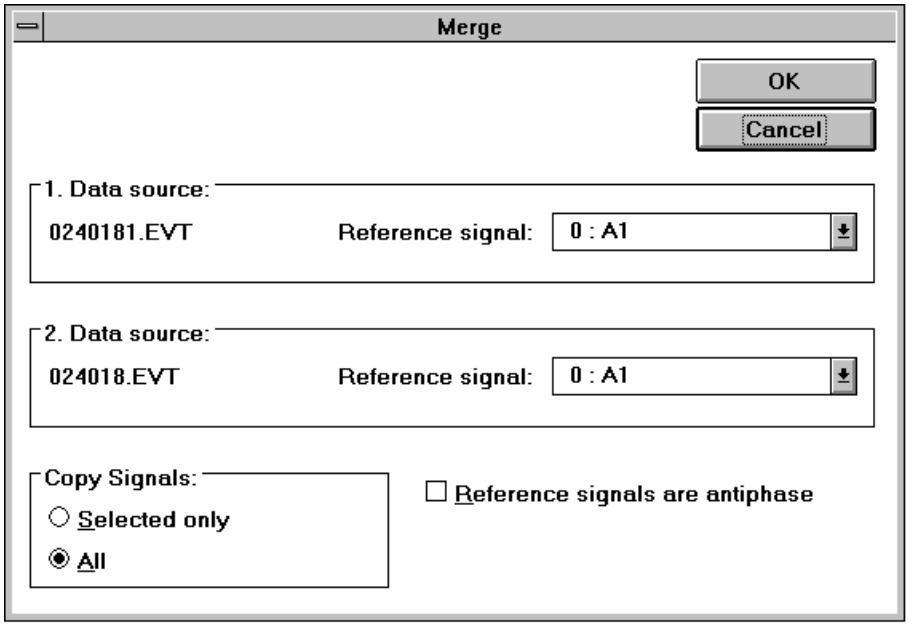
- The sampling frequency of both files must be identical.
- The sampling frequency must be greater than 240 Hz.
- The event time for both files must not differ by more than 5 s.

If these requirements are not fulfilled, merge is aborted with the appropriate error message.

## Selection of the Reference Signals

The signals from the two different files must be synchronized during the Merge operation. The synchronization searches in both files for a specified signal (reference signal) where a discontinuity occurs. All signals are then interpolated and synchronized to this point, i.e. both files are shifted along the time axis until the discontinuities of both reference signals overlap. This produces that section of time for which both files contain data (after being shifted).

This reference signal is selected in the following dialog:




Selection of the reference signals of first and second data sources

- 1st data source reference signal
  Reference signal of first data source.
- 2nd data source reference signal
  Reference signal of second data source.
  If the Merge operation is started via the clipboard, all signals copied into clipboard are marked with a "*" in the reference signal list.
- Copy signals
  **Only selected:** Only the selected signals are transferred from the second data source to the first data source.
  If clipboard is used, the signals which were copied into the clipboard are copied.
  **All:** All signals in the second data source are copied to the first data source.
  If clipboard is used, all signals in the second data source (file from which signals were copied into the clipboard) are copied. In this case, the second data source must still be open.
- Reference signal anti-phase
  This option makes it possible to synchronize the files with a phase shift of 180°.

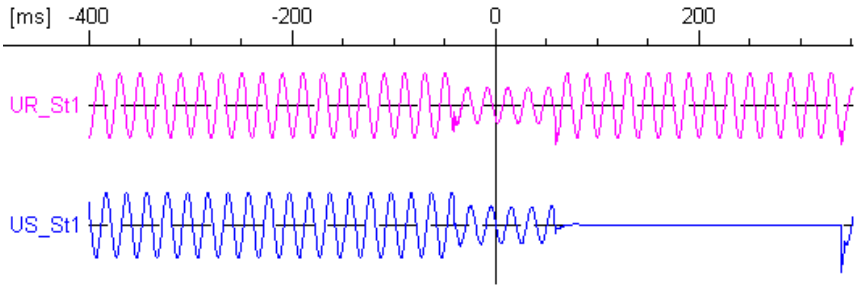
# Merge Procedure

To perform Merge operation follow these:

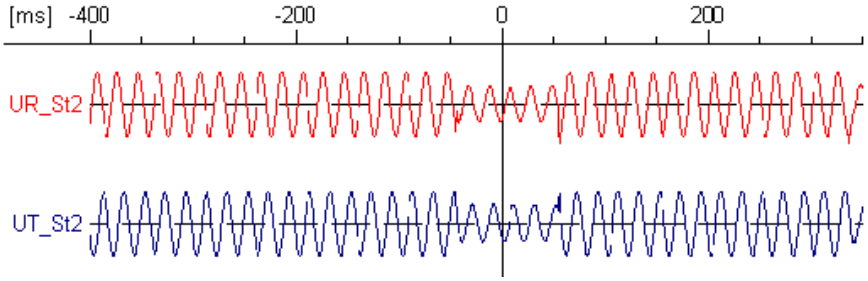
- Calculate the event time of reference signal 1 (first data source).
- Calculate the event time of reference signal 2 (second data source).
- Synchronize both reference signals.
- Signals from the first data source are processed: cut off start and end (if necessary), and interpolate.
- Signals from the second data source are processed: cut off start and end (if necessary), and interpolate.
- Insert results into the first data source.

# Example of a Merge

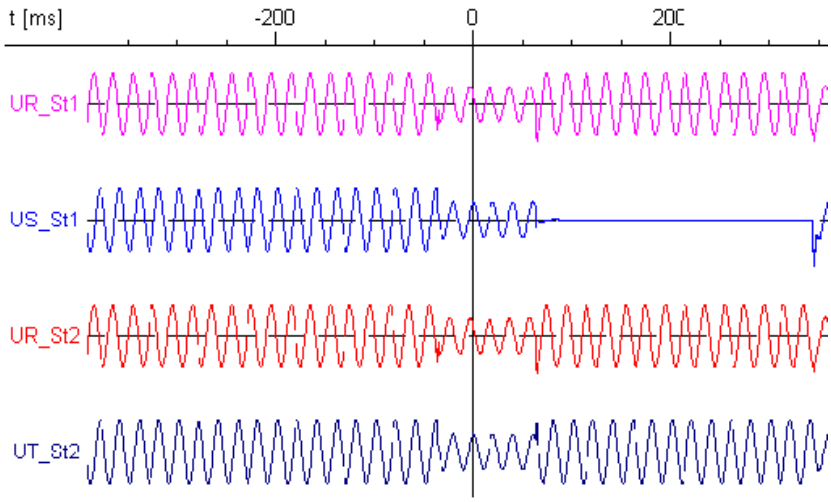
Here is an example in which the signals "UR_St2" and "UT-St2" are inserted (merged) into another document (first data source).



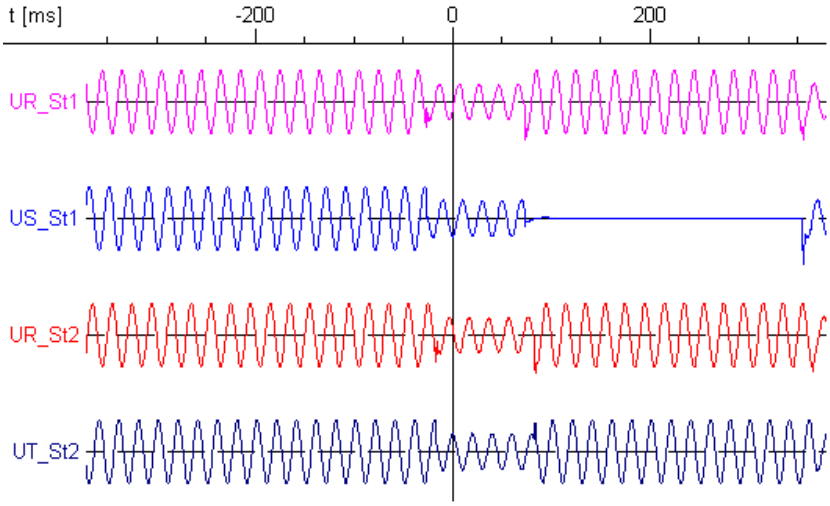

First data source (destination document) prior to merging




Second data source prior to merging




First data source (destination document) after merging, option reference signal anti-phase is not active




First data source (destination document) after merging, option reference signal anti-phase is active

# Error Messages

Messages may be displayed during the Merge operation. The possible messages are listed below with detailed explanations of the possible causes.

`Error occurred when copying the data to the clipboard`

This is a memory problem.
Check whether similar problems occur with other Windows applications. If so, close Windows and restart. Otherwise, please report the problem to ABB.

`Error occurred when opening the clipboard`

This is a memory problem.
Check whether similar problems occur with other Windows applications. If so, close Windows and restart. Otherwise, please report the problem to ABB.

`No event data found in the clipboard`

The data in the clipboard do not belong to Indactic® application software.
Copy the required data into the clipboard once again.

`Error occurred when reading text from the clipboard`

The data in the clipboard do not belong to Indactic® application software.
Copy the required data into the clipboard once again.

`No more global memory available`

This is a memory problem.
Close Windows and restart.

`Signal is too large for the clipboard`

This is a memory problem.
Copy fewer signals into the clipboard. Perform the Merge operation in several steps.

```
You have selected digital signals.
With digital signals, the entire digital
group is affected.
Do you wish to continue?
```

This is a warning message. Digital signals can only be processed in groups.

`Aborted by user`

The Merge operation was aborted by the user. The files are not modified.

`No open event file found which is suitable for merge with ...`

The Merge operation requires that at least one second data source is open.

`There are no analog signals in one of the event files or the clipboard. Merging of the event files is not possible.`

The Merge operation requires at least one analog signal in the first and second file. Without this analog signal, no synchronization of the files is possible.

`... and ... cannot be merged`
`The sampling frequencies are different`

Only files with the same sampling frequency can be merged. Select other files.

`... and ... cannot be merged`
`The difference in the event times is greater than 5 seconds`

The selected files cannot be merged. See event time under "File\File Summary".
Select other files.

`... and ... cannot be merged`
`The sampling frequencies are too small`

The selected files cannot be merged. See sampling frequency under "File\File Summary".
Select other files.

`Merge aborted`
`Error in reading signal ... from ...`

The file from which the signal was read has been destroyed. Select other files.

`Merge aborted`
`No periods found for signal ... from ...`

The reference signal found is not sinusoidal or the amplitude is too small.
Try to use another reference signal or try and increase the amplitude of the signal with a multiplication factor using the command "Calculations" or change the transformation ratio of the signal using the command "Parameters\Signal".

`Merge aborted`
`Period for signal ... from ... is too short`

The signal used consists of too few sample points.
Use other signals.

```
Merge aborted
Detection of the event time for signal ...
from ... is not possible
```

The event time (periods or amplitude jump) of the reference signal could not be found.
Use other reference signals.

```
Merge aborted, programming error
Error occurred during synchronization of
signal ... from ... with signal ... from ...
```

If this error occurs, please report the problem to ABB.

```
Merge aborted
Synchronization of signal ... from ... with
signal ... from ... is not possible
```

The synchronization of the reference signals could not be carried out successfully.
Use other reference signals.

```
Merge aborted
Synchronization of signal ... from ... with
signal ... from ... is not possible
Period integral differs by more than 20%
```

The synchronization of the reference signals could not be carried out successfully.
Use other reference signals.

```
Merge aborted
Synchronization of signal ... from ... with
signal ... from ... is not possible
Period length differs by more than 20%
```

The synchronization of the reference signals could not be carried out successfully.
Use other reference signals.

```
Merge aborted
Synchronization of signal ... from ... with
signal ... from ... is not possible
Maximum period amplitude differs by more than
20%
```

The synchronization of the reference signals could not be carried out successfully.
Use other reference signals.

```
Merge aborted
Synchronization of signal ... from ... with
signal ... from ... is not possible
Minimum period amplitude differs by more than
20 %
```

The synchronization of the reference signals could not be carried out successfully.
Use other reference signals.

# Calculations

## Purpose

The function Tools\Calculations allows new signals to be calculated from existing (recorded or calculated) signals. The existing signals originate from the active document. The new signals are also created in the active document.

New data which are useful to the system operator can be derived, through calculations and logical operations, from data which were recorded with Indactic® 650- or Indactic® 65- systems as well as other compatible devices and stored in files. For example, the effective short circuit power, and thus its effects on the burning-out of switch elements, can be calculated from the measured currents and voltages during a short circuit. Besides, the slip impedance as a function of time (resistance and phase angle) can be derived from the voltage and current data. The following functions are supported:

Simple copying of signals.

Addition, subtraction, multiplication and division of input signals and constants.

Generation of complex results with the aid of the built-in function procedures.

The calculation function works fully interactively, but can also run in a batch mode (see Tools\Batch). The formulae are entered by means of a formula editor which also allows a syntax test.

## Principle of Operation

The function Tools\Calculations allows new signals to be calculated from existing (recorded or calculated) signals. The signals present in the active document serve as input data. Both the signals recorded by the fault recorder and calculated signals can be used as input signals.

A signal is represented as a series of numerical values which represent the signal amplitude as a function of time. The calculation function processes this series of numbers. The calculated output data are stored as new signals. The calculated signals can be processed like all other measurement signals.

The calculation function compensates any sampling delay. A sampling delay is the time displacement in the sampling of the measurement channels. This occurs if a fault recorder uses the same A/D (analog/digital) converter for several channels.

If the signals in an event file were recorded with a sample delay, the time displacement of each signal is first compensated. The sample delay is the delay between the sampling of two analog signals. A really simultaneous sampling only takes place with fault recorders which have a separate analog/digital converter for each measurement channel (e.g. Indactic® 650). A sample delay within the microsecond range occurs if a fault recorder samples several measurement channels in rapid succession using only one A/D converter (e.g. Indactic® 65). This is also referred to as multiplexing.

Any sample delay is shown using the command File\File Summary. After the first calculation, the sample delay for all signals is compensated and the display reads "Scanning Delay: None".

The station parameters (Parameters\Signal command) of the input signals are not taken into account in the calculation. The conversion factors into physical measured values and the basic units are not included in the calculation. A range overflow can therefore occur.

## Syntax Rules

The formulae for calculation are similar to "normal" algebraic formulae. They consist of single terms, operators, function names and parameters. Rounded brackets can also be used to define the sequence of calculation.

Statements are to be written all on one line. Empty lines between the statements are permitted, but have no meaning. A line may also contain comments. Everything which comes after ";" in a line is commentary text.

In some cases, semantic rules restrict the syntax rules or require a certain type of term (e.g. a certain number and type of parameters in the case of functions) in particular places. Expressions are assigned a particular type. This type is either "signal" or "constant". The "signal" type describes a series of instant values which represent a signal as a function of time. A term is a "constant" if it can be calculated simply from numerical values. Where terms are linked, a new type is produced for the result, which corresponds to the "greatest" of the types occurring. In this case, "signal" is greater than "constant".

Certain operations (e.g. multiplications) can result in a range overflow, which can be avoided by means of appropriate measures. See also the section "Number Ranges, Range overflow".

The following examples illustrate the rules:

```
"U_sum" := "U(R)"+"U(S)"+"U(T)"
;Sum of 3 voltage signals
"U_avg" := AVG ("U(R)", "U(S)", "U(T)")
; Average voltage
"P_avg" := SUM ("U(R)"*"I(R)", "U(S)"*"I(S)", "U(T)"*"I(T)")/3
"U_off" := "U(R)"+(8-3*3+2)
; a way of writing "U(R)" + 1
```

All the above formulae are written correctly; whether they are correct in content depends on the station file. They must at least contain signals with the signal names "U(R)", "I(R)", ... in order for the output signals to be calculated. The last example explains the calculation of an expression with priorities. Written with brackets, this would be:

```
((8 - (3 * 3)) + 2)
```

And here is an example containing an error:

```
      "sig" := 3 - 5...
; this is an invalid signal definition!
```

The result of the expression is of the "constant" type; this is not permitted (semantics), although the syntax would have been quite correct.

## Sequence of Calculation

The sequence of calculation follows the same rules which you are familiar with from mathematical formulae. The terms of a formula are calculated in the following sequence:

1. Terms in round brackets from inside outwards.
2. Function calls, e.g. SQRT or SUM.
3. Prefix operators "+" and "-"
4. Multiplication operators "*" and "/"
5. Addition operators "+" and "-"
6. Assignment operator ":="

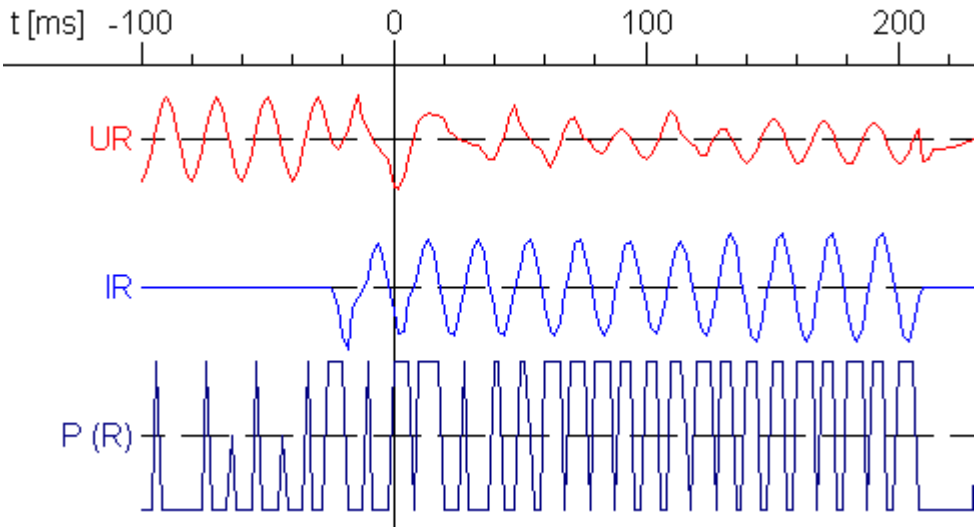
Successive operators of the same priority level are carried out in the normal way from left to right.

## Number Ranges, Range Overflow

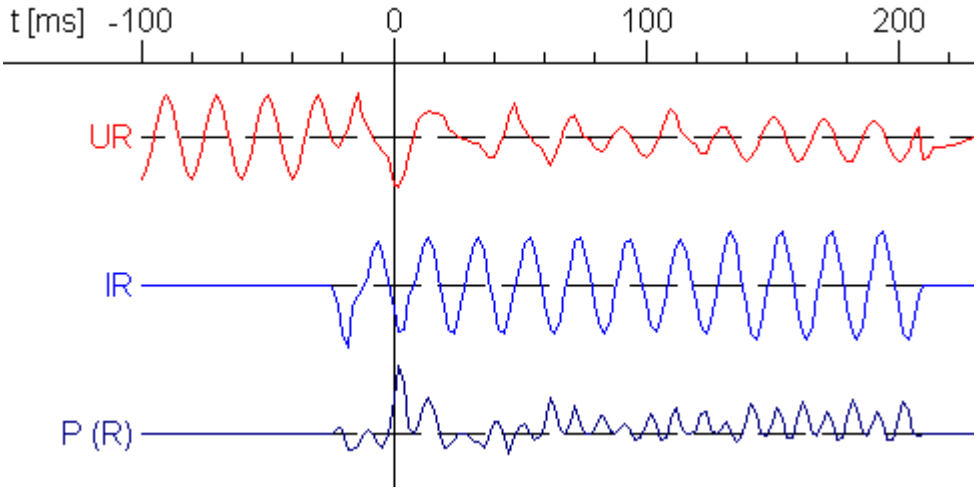
The measurement series of the signals are saved as 16-bit whole numbers in the event file. Therefore, this covers a range from -32768 to +32767. The range of values for valid measured values is limited to +/- 32000. Larger or smaller numbers indicate a range overflow or underflow.

Numbers with floating decimal points, which cover a very large numerical range, are used in all calculations. The result is, in turn, stored as whole numbers within a range of +/- 32000. It should therefore, be ensured, when carlrying out calculations, that the final result is once more within the permissible range. For example, the product of two signals with maximum amplitude results in values which are too large. The calculated product must therefore, be divided by a constant (e.g. 1000) before being output in order to avoid an overflow.

If, for instance, a voltage [V] is multiplied by a current [A] and divided by 1000, this produces a power [kW]. One can also choose a divisor other than 1000. However, the factor 1000 simplifies the calculation of the transformation ratio.




Example of a calculation with overflow: "P (R)" := UR * IR




With limiting factor, without overflow: "P (R)" := UR * IR / 15000

# Select Formula

The calculation for a set of output data are specified in a formula. All formulae for a station are stored in a formula file. The formula file directory can be displayed using the menu command Options\Directories.

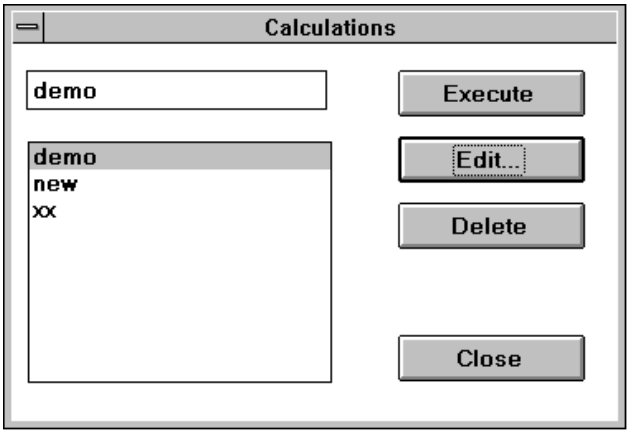
The menu command Tools\Calculations opens a dialogue box which allows the selection of a formula. Depending on the choice of formula and the selected button, the following options are available:

Create and edit a new formula

Edit an existing formula

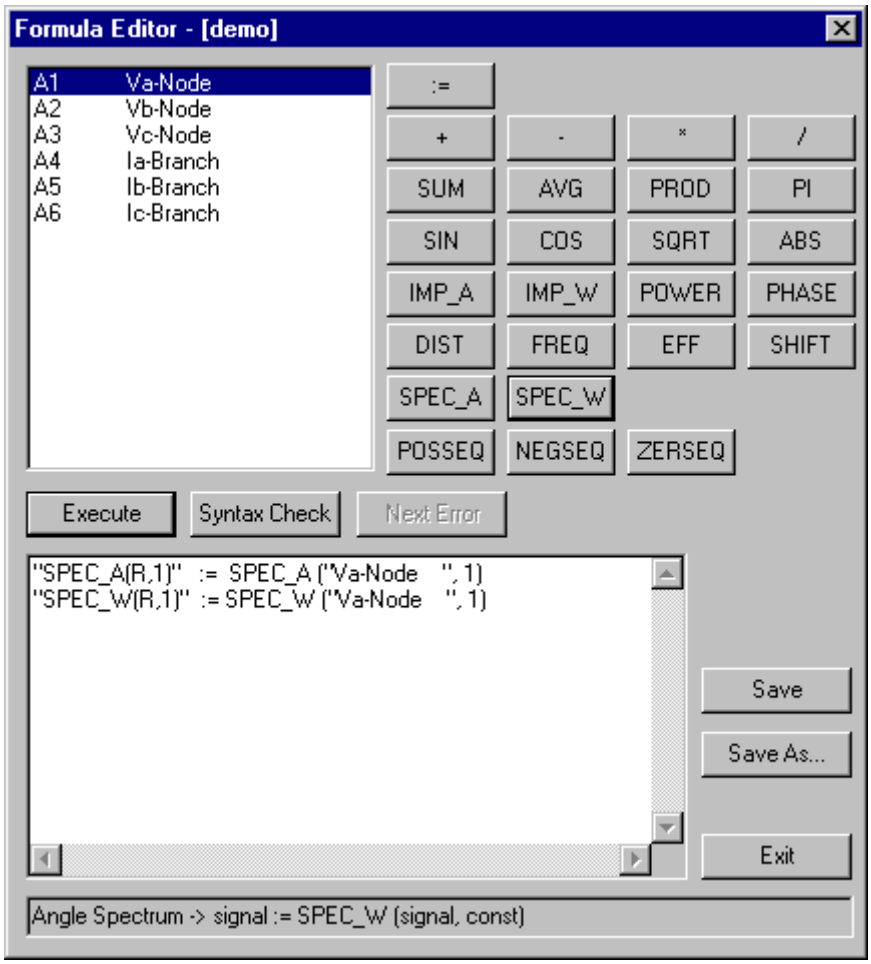
Execute an existing formula

Delete an existing formula.



# Edit Formulae

The formulae are entered in the "Formula Editor" dialog box:




Signal list (field at top left)
: List of the signals present in the event file.
The selected signal name is added to the "edit field" at the cursor position by double-clicking with the left mouse button.

Edit field (field at bottom left)
: Field where the content of the formulae can be edited. The editing functions "Cut" (CTRL+X), "Copy" (CTRL +C) and "Insert" (CTRL +V) can be used in this field.

Function keys
: By clicking the left mouse button, the function name is added to the "edit field" at the cursor position, with a skeleton for the function parameters, and a brief help message is displayed in the status field. The "|" symbol in the status field stands for "or".

Status field
: Brief additional information is displayed in this field.

Execute
: The statements contained in the "edit field" are executed.

Syntax Check
: The syntax of the formulae in the "edit field" is checked for validity. If errors are detected, the first error is marked in the "edit field" and a corresponding text is entered in the status field.

Next Error
: The next error (following "Syntax Check") is displayed.

Save
: The contents of the "edit field" are saved under the formula names.

Save As ...
: The contents of the "edit field" can be saved under different formula names.

Exit
: This dialog box is closed. When closing, you are prompted if you wish to save the changes.

# Execute Formulae

Before a formula is executed, the syntax rules are checked. The formulae for calculating new signal values must be created according to certain rules. On the one hand, these rules determine the form of notation, also called "syntax" and, on the other hand, its meaning, also called "semantics". First the syntax is checked, then the semantics are controlled as the calculation is carried out. The result (left side of ":=") is stored as a new signal. In case of an error (in syntax or semantics), a message is displayed in the status field and the incorrect part of the formula is marked.

# Calculation Functions

In this section, the implemented functions are listed together with their syntax and a brief explanation. Function names may in some cases be abbreviated. All the permitted forms of notation are stated in this section.

## Assignment :=

### Syntax:

```
signal := expression
```

### Explanation:

The assignment operator may only appear once in a line. There must be a signal name to the left of ":=". If a signal with the same name already exists, it will be overwritten.

## Basic Arithmetic Operations + - * /

### Syntax:

See section on Syntax Rules and Sequence of Calculation

### Explanation:

The operators +, -, * and / represent the basic arithmetic operations: addition, subtraction, multiplication and division. The operators calculate the **addition**, **subtraction**, **multiplication** or **division** of the instant values of the individual signals and/or constants. The result is a type corresponding to the "greatest" type present.

Functions used:

Sum SUM and product PROD

Average AVG

## Sum SUM and Product PROD

### Syntax for Sum:

```
SUM (expression1, expression2 ... expressionn)
```

### Syntax for Product:

```
PROD (expression1, expression2 ... expressionn)
```

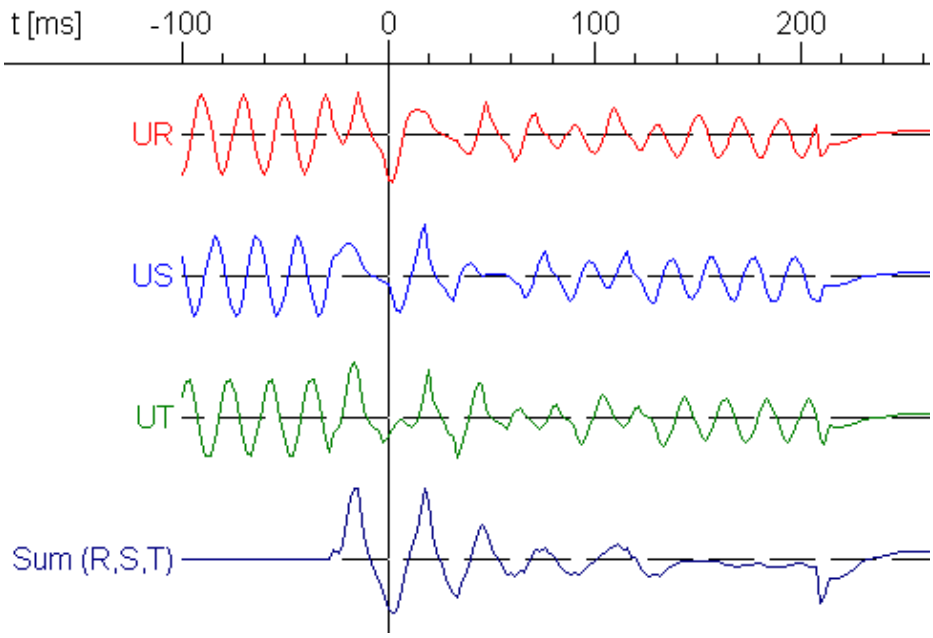
or

```
PRODUCT (expression1, expression2 ... expressionn)
```

### Explanation:

This function calculates the **sum** or **product** of the instant values of the individual signals and/or constants. The functions allow a variable number of parameters, and the parameters may be of any type. The result is a type corresponding to the "greatest" type present.

Function used: basic arithmetical operations +-*/




Example of Sum function:
The signal at the bottom is the sum of the 3 signals above

## Average AVG

### Syntax:

AVG (expression$_1$, expression$_2$ ... expression$_n$)

or

AVERAGE (expression1, expression2 ... expressionn)

### Explanation:

This function calculates the **average** of the instant values of the individual signals and/or constants. The function allows a variable number of parameters, and the parameters may be of any type. The result is a type corresponding to the "greatest" type present.

Function used: basic arithmetical operations +-*/

## Constant PI

### Syntax:

PI

### Explanation:

This constant inserts the value of "Pi" at this point.

## Trigonometric Functions SIN and COS

### Syntax for Sine:

SIN (expression)

or

SINE (expression)

### Syntax for Cosine:

COS (expression)

or

COSINE (expression)

### Explanation:

These functions calculate the sine value or cosine value from the instant values of a signal or a constant. The result is the type which was entered as a parameter. The parameter is to be stated in units of 1/100°, i.e. the value 1 corresponds to 1/100°. The result of one of the angle functions PHASE, IMP_W or SPEC_W can be used as a parameter (angle).

## Square Root SQRT

### Syntax:

```
SQRT (expression)
```

### Explanation:

This function calculates the square root of the instant values of a signal or a constant. The result is the type which was entered as a parameter. In the case of negative values, 0 is produced as a result.

## Absolute Value ABS

### Syntax:

```
ABS (expression)
```

### Explanation:

This function calculates the absolute values of the instant values of a signal or a constant. The result is the type which was entered as a parameter.

## Impedance IMP_A and IMP_W

### Syntax for impedance amplitude:

```
Z (expression1, expression2)
```

or

```
Z_A (expression1, expression2)
```

or

```
IMP_A (expression1, expression2)
```

or

```
IMPED (expression1, expression2)
```

or

```
IMPED_A (expression1, expression2)
```

or

```
IMPEDANCE (expression1, expression2)
```

or

```
IMPEDANCE_A (expression1, expression2)
```

## Syntax for impedance angle:

```
Z_W (expression1, expression2)
```

or

```
IMP_W (expression1, expression2)
```

or

```
IMPED_W (expression1, expression2)
```

or

```
IMPEDANCE_W (expression1, expression2)
```

## Explanation:

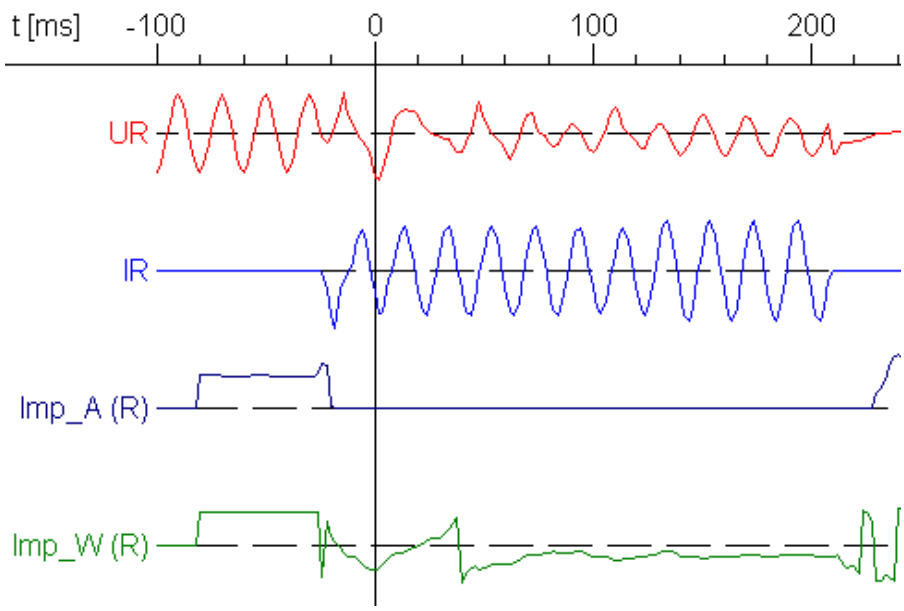
This function calculates the impedance vector from the instant values of the two input signals which are regarded as voltage (expression1) and current (expression2). The vectors (amplitude and angle) are first calculated from the instant values of the individual signals, then their quotient is calculated. This function requires two parameters of the "signal" type; the result is also of the "signal" type.

The amplitude is output from the calculated result of the first group of functions, and the angle from the result of the second group. With the angle function, the result is standardised to the range +/- 180° and output in steps of 1/100°, i.e. the value 1 of the output signal corresponds to 1/100°. The maximum value 32000 of the angle signal thus corresponds to 320°. In order to display the angle correctly, "Basic Unit = °" and "maximum input value = 320" should be selected in the signal parameters for the angle signal.

The period duration of the signal is calculated before this function is executed. If this calculation is not possible, the result is given as "0". This can occur in the following cases:

Signal is not sinusoidal, or the amplitude is too low (difference max-min < 100).

The frequency found is not $16^2/_3$, 50 or 60 Hz.




Example of impedance function:
The lower 2 signals are the impedance calculated from the voltage and current (amplitude, angle)

## Power Vector POWER

### Syntax:

```
P (expression1, expression2)
```

or

```
P_A (expression1, expression2)
```

or

```
POWER (expression1, expression2)
```

or

```
POWER_A (expression1, expression2)
```

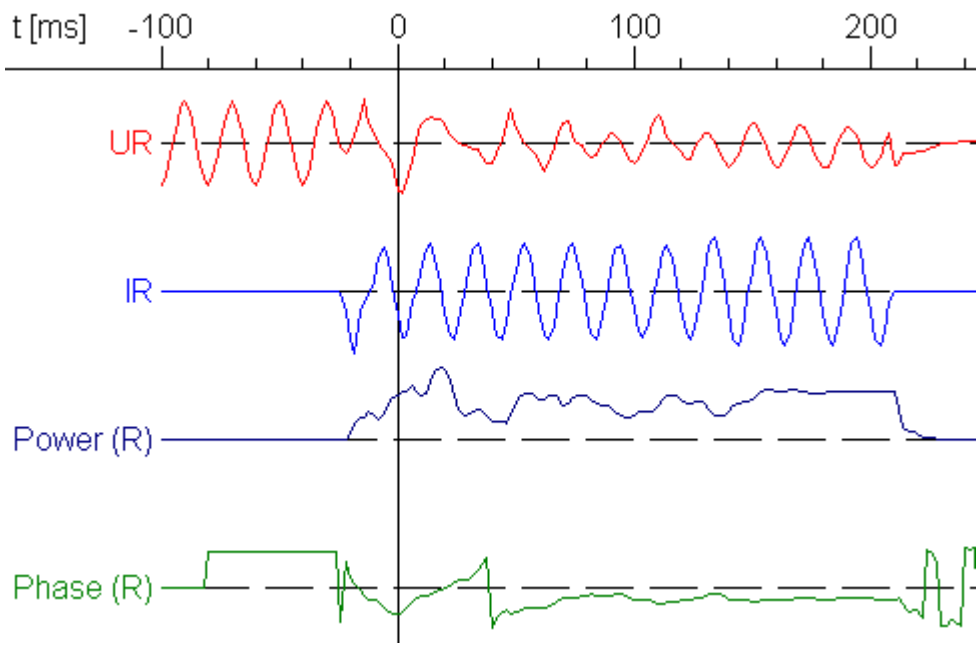
### Explanation:

This function calculates the amplitude of the vector product from the instant values of the two input signals which are regarded as voltage (*expression1*) and current (*expression2*). The vectors (amplitude and angle) are first calculated from the instant values of the individual signals, then their product. This function requires two parameters of the "signal" type; the result is also of the "signal" type.

The period duration of the signal is calculated before this function is executed. If this calculation is not possible, the result is given as "0". This can occur in the following cases:

Signal is not sinusoidal, or the amplitude is too low (difference max-min < 100).

The frequency found is not $16^2/_3$, 50 or 60 Hz.




Example of Power function:
The lower 2 curves represent the power amplitude and phase angle of the voltage and current

# Angle Difference PHASE

## Syntax:

```
PH_W (expression1, expression2)
```

or

```
PHASE (expression1, expression2)
```

or

```
PHASE_W (expression1, expression2)
```

or

```
PHASEANGLE (expression1, expression2)
```

## Explanation:

This function calculates the angle difference from the instant values of the two input signals. The vectors (amplitude and angle) are first calculated from the instant values of the individual signals, then their angle difference is calculated. This function requires two parameters of the "signal" type; the result is also of the "signal" type. The result is standardised to the range +/- 180° and output in steps of 1/100°. In order to display the angle correctly, "Basic Unit = °" and "maximum input value = 320" should be selected in the signal parameters for the angle signal.

## Distortion DIST

### Syntax:

```
DIST (expression)
```

or

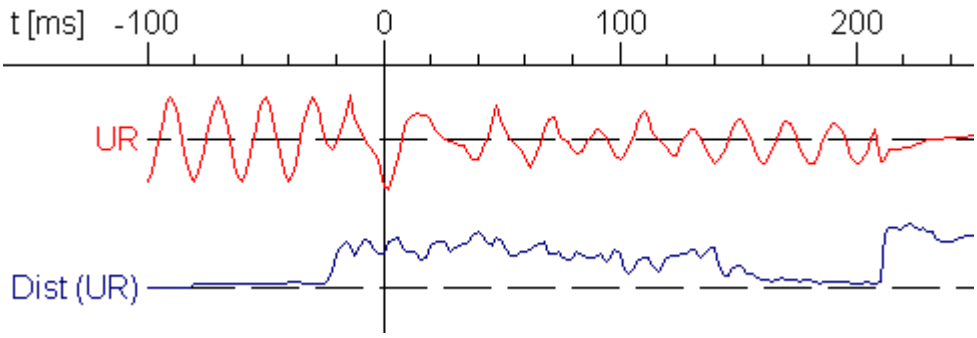
```
DISTORTION (expression)
```

### Explanation:

This function calculates the percentage of harmonics in relation to the overall signal from the instant values of the input signal. This function requires two parameters of the "signal" type; the result is also of the "signal" type. The result is standardised to a range of 100 % and output in steps of 1/100%. In order to display the values correctly, "Basic Unit = %" and "maximum input value = 320" should be selected in the signal parameters for the result signal. The period duration of the signal is calculated before this function is executed. If this calculation is not possible, the result is given as "0". This can occur in the following cases:

Signal is not sinusoidal, or the amplitude is too low (difference max-min < 100).

The frequency found is not $16^2/_3$, 50 or 60 Hz.




Example of Distortion function:
The lower curve shows the harmonic component of the signal above

## Network Frequency FREQ

### Syntax:

```
FREQ (expression)
```

or

```
FREQUENCY (expression)
```

### Explanation:

This function calculates the deviation of the current signal frequency from the network frequency from the instant values of the input signal (voltage or current). This function requires one parameter of the "signal" type; the result is also of the "signal" type. The result is standardised to a range of +/-100 % and output in steps of 1/100%. In order to display the values correctly, "Basic Unit = %" and "maximum input value = 320" should be selected in the signal parameters for the result signal.

## Effective Value EFF

### Syntax:

```
EFF (expression)
```

or

```
EFFECTIVE (expression)
```

### Explanation:

This function calculates the effective value of the signal from the instant values of the input signal (voltage or current), whereby integration is approximated by summation. This function requires one parameter of the "signal" type; the result is also of the "signal" type.

The period duration of the signal is calculated before this function is executed. If this calculation is not possible, the result is given as "0". This can occur in the following cases:

Signal is not sinusoidal, or the amplitude is too low (difference max-min < 100).

The frequency found is not $16^2/_3$, 50 or 60 Hz.

## Shift One Period to the Left

### Syntax:

```
SHIFT (expression)
```

### Explanation:

This function shifts all sample values of a signal by one period in the statement of the start of the signal (i.e. to the left). This function requires one parameter of the "signal" type; the result is also of the "signal" type. The period duration of the signal is calculated before this function is executed. If this calculation is not possible, the result is given as "0". This can occur in the following cases:

Signal is not sinusoidal, or the amplitude is too low (difference max-min < 100).

The frequency found is not $16^2/_3$, 50 or 60 Hz.

The SHIFT function can be used in connection with the vector functions SPEC_A and SPEC_W. The Spectrum function calculates the values from the preceding period. The SHIFT function corrects this shift. See also section on calculation examples.

## Vector SPEC_A and SPEC_W

### Amplitude of a harmonic, syntax:

```
S (expression1, expression2)
```

or

```
SPEC (expression1, expression2)
```

or

```
SPEC_A (expression1, expression2)
```

or

```
SPECTRUM (expression1, expression2)
```

or

```
SPECTRUM_A (expression1, expression2)
```

### Angle of a harmonic, syntax:

```
W (expression1, expression2)
```

or

```
SPEC_W (expression1, expression2)
```

or

```
SPECTRUM_W (expression1, expression2)
```

## Explanation:

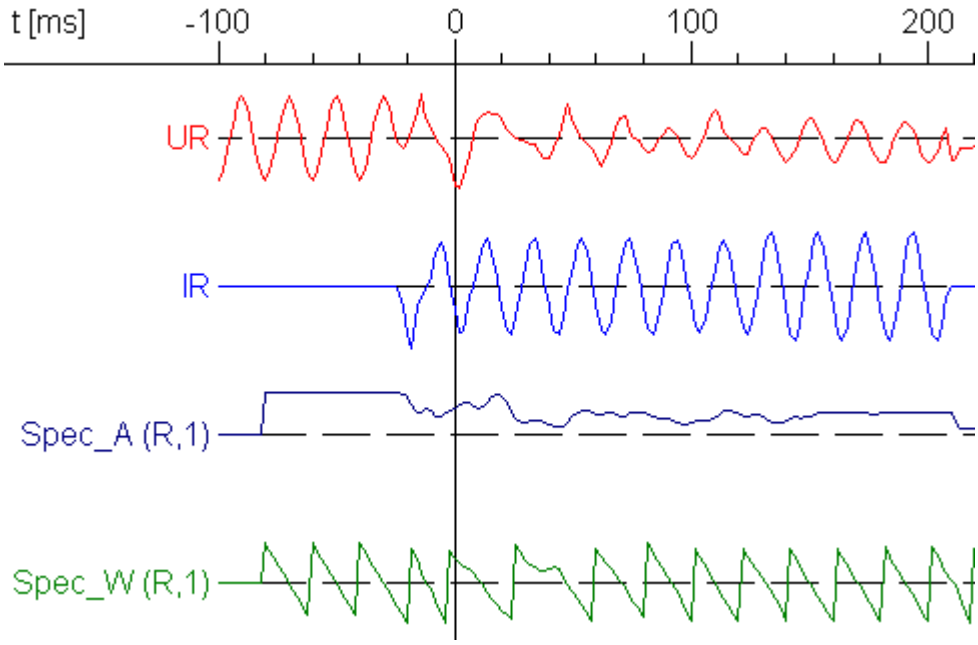
This function calculates the vector of a selectable harmonic (*expression*$_1$) from the instant values of the input signal (*expression*$_2$). This function requires one parameter of the "signal" type and one parameter of the "constant" type (0 ... n); the result is of the "signal" type. The constant n states that the harmonic to be calculated has n times the frequency of the input signal. The direct current component of the signal is calculated with n = 0.

The amplitude is output from the calculated result of the first group of functions, and the angle from the result of the second group. With the angle function, the result is standardised to the range +/- 180° and output in steps of 1/100°. In order to display the angle correctly, "Basic Unit = °" and "maximum input value = 320" should be selected in the signal parameters for the angle signal.

The period duration of the signal is calculated before this function is executed. If this calculation is not possible, the result is given as "0". This can occur in the following cases:

Signal is not sinusoidal, or the amplitude is too low (difference max-min < 100).

The frequency found is not $16^2/_3$, 50 or 60 Hz.




Example of Spectrum function:
The two curves below are the basic components (amplitude and angle) of the top signal

## Positive Sequence POSSEQ

### Syntax:

```
POSSEQ(expression1, expression2, expression3)
```

### Explanation:

This function calculates the real part of the positive sequence.

The positive sequence is one part of the transformation of a three phase system in symmetrical components.

The result is standardised to a range of 100 % and output in steps of 1/100%. In order to display the values correctly, "Basic Unit" and "maximum input value" should be selected similar to those of the input signals in the signal parameters for the result signal.

This function requires three parameters of the "signal" type; the result is also of the "signal" type.

### Possible Errors:

Number or type of parameters not correct.

The period duration of the signal is calculated before this function is executed. If this calculation is not possible, the result is given as "0". This can occur in the following cases:

Signal is not sinusoidal, or the amplitude is too low (difference max-min < 100).

The frequency found is not $16^2/_3$, 50 or 60 Hz.

## Negative Sequence NEGSEQ

### Syntax:

```
NEGSEQ(expression1, expression2, expression3)
```

### Explanation:

This function calculates the real part of the negative sequence.

The negative sequence is one part of the transformation of a three phase system in symmetrical components.

The result is standardised to a range of 100 % and output in steps of 1/100%. In order to display the values correctly, "Basic Unit" and "maximum input value" should be selected similar to those of the input signals in the signal parameters for the result signal.

This function requires three parameters of the "signal" type; the result is also of the "signal" type.

### Possible Errors:

Number or type of parameters not correct.

The period duration of the signal is calculated before this function is executed. If this calculation is not possible, the result is given as "0". This can occur in the following cases:

Signal is not sinusoidal, or the amplitude is too low (difference max-min < 100).

The frequency found is not $16^2/_3$, 50 or 60 Hz.

# Zero Sequence ZERSEQ

## Syntax:

```
ZERSEQ(expression1, expression2, expression3)
```

## Explanation:

This function calculates the real part of the zero sequence.

The zero sequence is one part of the transformation of a three phase system in symmetrical components.

The result is standardised to a range of 100 % and output in steps of 1/100%. In order to display the values correctly, "Basic Unit" and "maximum input value" should be selected similar to those of the input signals in the signal parameters for the result signal.

This function requires three parameters of the "signal" type; the result is also of the "signal" type.

## Possible Errors:

Number or type of parameters not correct.

The period duration of the signal is calculated before this function is executed. If this calculation is not possible, the result is given as "0". This can occur in the following cases:

Signal is not sinusoidal, or the amplitude is too low (difference max-min < 100).

The frequency found is not $16^2/_3$, 50 or 60 Hz.

# Calculation Examples

Here are a number of examples of possible calculation formulae:

```
"Sum(U)" := SUM(UR,US,UT)
;zero voltage vector
"Sum(I)" := SUM(IR,IS,IT)        .
;zero current vector
"P(R)"   := UR * IR / 32000
;power of phase R
"Ptot"   := SUM(UR * IR,US * IS,UT * IT)/ 32000
;total power
"EFF(UR)":= EFF(UR)
;effective voltage value of phase R
"EFF(IR)":= EFF(IR)
;effective instant value of phase R

;DC component of voltage phase R:
"DC(R)"  := 0.5 * SPEC_A(UR,0)

; The following signals reconstruct the signal
; UR from the first five frequency components
; These components are calculated using the
;"SPECTRUM" function.
; The "SPECTRUM" function calculates the values
; from the preceding period.
; The "SHIFT" function corrects this shift.
"UR(f0)"  := SPEC_A(UR,1) * COS(SPEC_W(UR,1))
"UR(2f0)" := SPEC_A(UR,2) * COS(SPEC_W(UR,2))
"UR(3f0)" := SPEC_A(UR,3) * COS(SPEC_W(UR,3))
"UR(4f0)" := SPEC_A(UR,4) * COS(SPEC_W(UR,4))
"UR(5f0)" := SPEC_A(UR,5) * COS(SPEC_W(UR,5))
"Calc_UR" := SHIFT("UR(f0)" + "UR(2f0)"
          + "UR(3f0)" + "UR(4f0)" + "UR(5f0)")
```

# Error Messages

Error messages may be displayed during the processing of the formulae. The possible messages are listed below with detailed explanations of possible causes.

`Selected formula does not exist`

There is no formula with the selected formula name.
A formula should first be edited (defined); only then it can be executed.

`Cannot open formula file "..."`

The file "..." cannot be opened for read- or write-access.
Check the validity of access authorisations for the directory where this file is located (see "Options\Directories" menu).

`Cannot open temporary formula file "..."`

The temporary file required for the modified formula cannot be opened.
Check the validity of access authorisations for the temporary directory in Windows (see autoexec.bat "set temp = ..." file).

`Formula "..." cannot be calculated`

The execution of the selected formula was not successful.
In order to localise the error in the formula, perform a "syntax check" from the formula editor.

`Error in reading the data for the formula "..."`

The input signal could not be read when processing a formula.
In order to localise the error in the formula, perform a "syntax check" from the formula editor.
Check whether the input signal is present in the event file.

`Error in writing the data for the formula "..."`

The output signal could not be saved when processing a formula.
Check whether the output signal is valid. Is the number of the output signal not too large?

`Unexpected internal error`

If this error occurs, please call ABB and report the error code.

`Not enough parameters defined`

The specified function expects further parameters at the point where the cursor is positioned. Refer to Help for the corresponding function in question (F1).

`Too many parameters`

The specified function expects fewer parameters at the point where the cursor is positioned. Refer to Help for the corresponding function in question (F1).

`Factor expected`

The specified parameter must be of the type signal or constant (number), or must be calculated from a signal.

`Expression is not a signal`

An output signal (result of the formula) must be of the signal type, a constant expression is not permitted.

`Signal parameter expected`

The entered parameter must be of the signal type, a constant expression is not permitted.

`Constant parameter expected`

The entered parameter must be a constant expression, an expression of the signal type is not permitted.

`( Left-hand bracket expected`

A parameter list beginning with a bracket is expected at the point indicated (after a function name).

`) Right-hand bracket expected`

A bracket is expected as the end of the parameter list at the point indicated.

`"] Right-hand bracket expected`

An opening bracket "[" must be followed by a closing bracket "]".

`:= was expected`

The assignment symbol ":=" is expected between the output signal (result) and the calculation formula.

`Signal already exists`

The specified output signal already occurs in the formula list; signals must be uniquely identified.

`Input signal is used as output signal`

An input signal has been specified as an output signal.

`Input signal is not available`

The signal specified for calculation in the formula cannot be found in the input file.

`Output signal is not available`

The signal specified as the result of a formula cannot be created.
Check the validity of the output signal name.
Check whether another signal number is still free.

`Invalid name for resulting signal`

The entered result signal is not permitted.

`Incorrect keyword found`

A keyword, i.e. an operator (+,-,*,/), a function name, a bracket or a signal name is expected at the point indicated. Has a function name been used as output signal, or has an input signal not been defined yet?

`Incorrect letter in formula`

The letter entered is invalid.

# Glossary of Terms

## COMTRADE

COMTRADE is an abbreviation for a standardised data format which is also supported by E_wineve (writing and reading). The complete name of the standard is: IEEE Standard Common Format for Transient Data Exchange for Power Systems. Its number is IEEE C37.111-1991.

An event in COMTRADE format consists of a configuration file (e.g. 22_08_95.CFG) and a data file (e.g. 22_08_95.DAT). A third file with relevant commentary (e.g. 22_08_95.HDR) is optional. All files are text files (DAT file can also be binary).

The samples of the different signals are separated from one another in the DAT file by commas. The DAT format is therefore, suitable for further processing of an event in another application (e.g. Spread Sheet).

## EVE

EVE is a file format which is supported by E_wineve. Files having this file format typically have the file name extension EVE (e.g. 022005.EVE for the 5th event of the station 22). There is another file name convention which is also in use (e.g. RE022.005). Although the file name convention is different, the file format is identical.

The EVE file format is also known as “Indactic” format because Indactic® 650 and Indactic® 65 fault recorders create such event files. The EVE file format is a highly optimized file format for transferring and storing event data. The event data is compressed by the fault recorders (not by the Indactic® 650 Application Software running on the PC). Main purpose for compressing the event data is to reduce the transfer time for loading the sampled data from the fault recorders to the evaluation station. Additionally, the EVE file format saves disk space. The file size of an event saved in EVE file format is about 5 to 20 times smaller than in COMTRADE format.

The Indactic® 650 and Indactic® 65 fault recorders allow to adjust the compression ratio. The compression is not lossless. Accuracy is lost when increasing the compression ratio. For more information see the WinCom documentation: Data Reduction Parameters, Compression Tolerance.

## SOE

SOE is a file format which is supported by E_wineve. Files having this file format typically have the file name extension SOE (e.g. Aa990812.soe).

The SOE file format is written by Indactic® 425 fault recorders.

E_wineve cannot read an entire SOE file. SOE files contain too many messages over a too long period of time to fit in a EVE file. The insertable and user-selected messages of an SOE file can be inserted in the current EVE file.

## Imaginary Component

Inductive or capacitive component (reactance) of an impedance.

## IndBase

IndBase together with E_wineve and WinCom form the Indactic® 650 Application Software. IndBase allows the statistical analysis of fault location result files created by E_wineve. See the IndBase documentation for more information. IndBase is only available with the Expert distribution of the Indactic® 650 Application Software.

## Orthogonal Components

Imaginary and real component of the impedances, voltages and currents represented as right-angled co-ordinates.

## Positive Sequence Impedance

Is the impedance which exists with symmetrical load of the cable.

## Real Component

Ohmic component (resistance) of an impedance.

## REVAL

REVAL is a file format which is supported by E_wineve. Files having this file format typically have the file name extension REH (e.g. 97101000.reh).

An event in REVAL format consists of a header file (e.g. 97101000.reh) and a data file (e.g. 97101000.rev). Both files are binary files.

## Sampling Delay

The Indactic® 65 fault recorder only uses one A/D converter (analog/digital converter) for several (typically 8) analog signals, in that it samples all signals in rapid succession. This is known as multiplexing. The change from one analog signal to the next takes place in microseconds. The sampling delay is the time between the sampling of two analog signals.

The Indactic® 650 fault recorder uses a separate A/D converter for each analog signal. Sampling is thus simultaneous and consequently no sampling delay.

## Scroll Bar

Appears on the right and/or lower margin if the document which is to be displayed cannot be shown to its full extent in a vertical and/or horizontal direction.

## Short Circuit Time

Time relative to the trigger time where the fault locator detects a rise in current by >= 0.1 * nominal current and possibly also a voltage drop.

## Short Circuit Type

Describes the phases affected by a short circuit. Phase-zero short circuits such as R-0, S-0 or T-0 are possible; also phase-phase short circuits such as R-S, S-T, T-R or R-S-T. Phase-phase-zero short circuits R-S-0, S-T-0, T-R-0, R-S-T-0 are also possible.

## Shutdown Time

Time, measured from the trigger time, which elapses before the power switch(es) is/are opened in the event of a short circuit.

## Trigger Signal

Signal which triggers the recording of an event file at the fault recorder. Often the trigger signal is a digital signal which is normally activated by the protective system after a fault has been detected.

## Trigger Time

The trigger time defines the time when a trigger condition is fulfilled, e.g. the raising edge of a digital signal. “Event time” is used as synonom, although there is a slight different in meaning. “Event time” is the zero point on the time scale of the curve display as well as in all calculations carried out by the fault locator. The zero point in the curve display does not necessarily match the occurrence of the trigger exactly. It is correct to say, that the event time is very close by the true trigger time, but they are not necessarily equal. Anyway, for the evaluation tools (Fault locator, Merge) it is not a big issue, because they work on line periods and not on micro seconds.

## WinCom

WinCom together with E_wineve and IndBase form the Indactic® 650 Application Software. WinCom is the communications program of the Indactic® 650 Application Software. WinCom transfers the recorded event files from the Indactic® 650 and Indactic® 65 fault recorders to the PC. WinCom allows to configure the fault recorders (e.g. trigger condition). See the WinCom documentation for more information.

## Working Interval

The section of a recording from which the data for the calculations with the fault locator are obtained. Generally 50 ms before to around 50 ms after the trigger time.

## Zero Sequence Impedance

Impedance of the zero system. It has only significance in three-phase systems with back flow via neutral line or earth current.

# Index

## R



## S



## T



## V



## W



## Z

Delete data

**Notification Form for Errors in this Document**

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We constantly endeavour to improve the quality of our **technical publications** and would like to hear your suggestions and comments. Would you therefore please fill in this questionnaire and return it to the address given below.

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**Concerns publication:** 1MRB520290-Uen (E_wineve V1.1)

Have you discovered any mistakes in this publication? If so, please note here the pages, sections etc.

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Utility Automation
Software Support Group / Dept. UTASS
Bruggerstrasse 71a
CH-5401 Baden

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| | | | | |
|---|---|---|---|---|
| Unit/ System: | ❑ REC 316*4 | SW Version: | ❑ REC 216 | SW Version: |
| | ❑ REG 316*4 | SW Version: | ❑ REG 216 | SW Version: |
| | ❑ REL 316*4 | SW Version: | ❑ HMI | SW Version: |
| | ❑ RET 316*4 | SW Version: | ❑ other: | SW Version: |

Problem: ❑ Program error (unit/system) ❑ Program error (HMI /PC)
❑ Error in manual ❑ Suggestion for improvement
❑ other:

Can the error be reproduced at will? ❑ yes ❑ no

Particulars of hardware and software (unit/system configuration including jumper positions, type of PC etc.):

Problem located? ❑ yes ❑ no
Suggested changes enclosed? ❑ yes ❑ no

The following are enclosed (floppy with settings etc.):

❑ Floppy ❑ Unit/system settings, file name:
❑ other:

**Description of problem:**

Customer: Date:

Address:

Please contact: Phone: Fax:

**DESCRIPTION OF PROBLEM:** (continuation)

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Week: Name: Position: Consequence:

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It is scarcely possible for the instructions to cover every eventuality that can occur when using technical devices and systems. We would therefore request the user to notify us directly or our agent of any unusual observations or instances, in which these instructions provide no or insufficient information.

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**ABB Switzerland Ltd**
Utility Automation
Brown Boveri Strasse 6
CH-5400 Baden / Switzerland
Phone +41 58 585 77 44
Fax +41 58 585 55 77
E-mail substation.automation@ch.abb.com

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