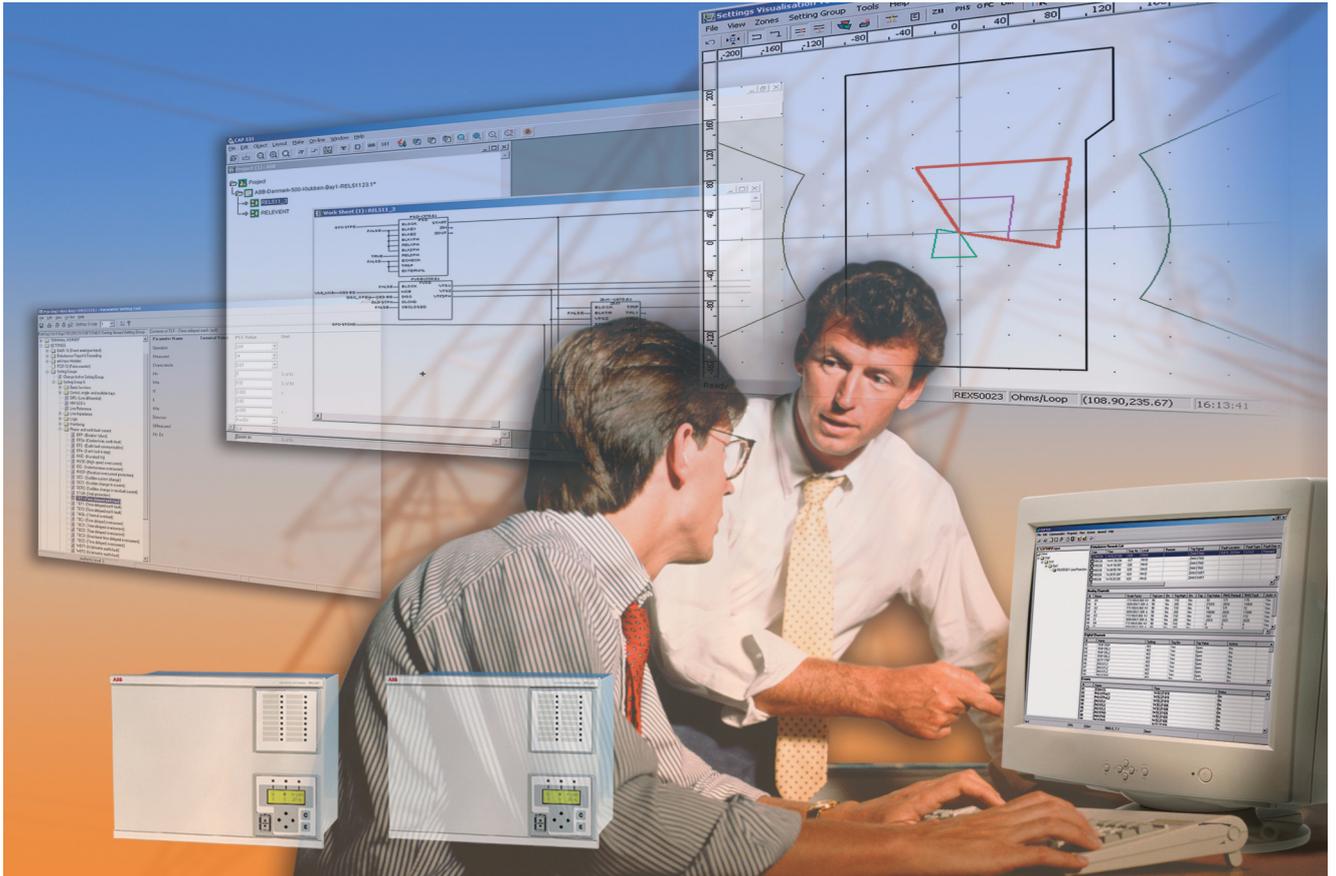


User's Manual

Engineer^{IT} Disturbance Evaluation REVAL



ABB

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Introduction

Welcome to the REVAL disturbance evaluator program. It is a comprehensive tool with a lot of possibilities for evaluating disturbance recordings. The presentation is object directed and different disturbance recordings are presented in separate windows.

REVAL runs under MicroSoft® Windows™ and is created by ABB in Västerås, Sweden.

1 Disturbance recording

Disturbance recording is an effective tool for postfault analysis of the performance of the power system and related equipment when a disturbance has occurred. By promptly detecting any problems and initiating the corrective measures, maximum operating reliability and availability of the power system is achieved.

Disturbance recording also improves the understanding of the behavior of the power system and associated equipment, contributing to design improvements in future installations.

1.1 Product Overview

The ABB concept contains a full range of flexible and functional systems for supervision, protection and control of all parts of the power system in electrical power networks.

REOR 100 is a stand-alone disturbance recorder complete with dedicated data acquisition and recording modules.

RCRA 100, consisting only of a recording module, is used when disturbance recording is utilized as a complementary function to the numerical distance protection REL 100, and the numerical 4-step earth fault protection REL 012.

The RE. 500 series protection terminals can be equipped with an optional disturbance recorder function.

The RE. 216/316 series protection terminals can be equipped with an optional disturbance recorder function.

The SPCR8C27 is a separate recording module for the SPACOM series protection terminals.

The disturbance recorders mentioned above together with REVAL, RECOM, EVECOM, DRCOM, and other SMS software are all part of the modular system within the ABB concept. The object oriented monitoring provides cost effective event and disturbance recording for both local and remote post-fault analysis.

The disturbance recording system comprises the following products:

- For disturbance recording - REOR 100/RCRA 100, RE. 500, RE. 216/316, and SPCR8C27.
- For disturbance collecting - RECOM (for RE. 500 and REOR 100/RCRA 100), EVECOM (for RE.216/316), and DRCOM (for SPCR8C27).
- For disturbance evaluation - REVAL.
- For disturbance analysis - RESDA expert system (for REOR 100/RCRA 100, and RE.500).
- For remote configuration of disturbance recorders - SM/REOR 100 (for REOR 100/RCRA 100), SM/RE. 500 (for RE.500), and SM/SPCR (for SPCR8C27).

The interconnection between the recording units and the evaluation workstations consist of fibre optics and telephone modems.

REVAL is integrated in SMS (Station Monitoring System) and understands the SMS directory structure. However, it is possible to use REVAL separated from the SMS system, provided that the used file types can be identified by REVAL.

Installation

1 About the program

REVAL disturbance evaluator is a program for evaluating disturbance recordings.

REVAL uses windowing technique and is used on an ordinary PC, with the necessary system requirements as listed below.

1.1 System requirements

To use the REVAL program you need:

Hardware

- Computer; 100% IBM compatible PC, 386 processor, or higher
- Diskette drive; One 3 1/2" diskette drive of type HD (1,44 Mb)
- Local hard disk space; Minimum 2 Mb of available disk space
- Work memory; Minimum 4 Mb of extended primary memory
- VGA compatible monitor
- Keyboard
- Mouse
- Printer

Software

- MS-DOS, version 3.1 or higher, when using MS Windows version 3.x,
or;
- MS Windows 95 or MS Windows NT 4.0

Generally speaking, the REVAL program is faster and more efficient the more powerful equipment you are using.

1.2 The README file

One of the REVAL program diskettes includes a README file. This file contains last minute news to the User's Guide, i.e. improvements made after the printing of the User's Guide. The README file is delivered in an uncompressed format and should be read prior to installation.

1.3

Installing REVAL

Depending on which language version of REVAL to be installed, only one or both diskettes is needed for the installation. The installation program informs you whether the second diskette is needed, or not.

The program is delivered in a compressed format. Follow the steps below to decompress and copy all files into a specified directory:

- 1 Insert diskette no. 1 into drive A.**
- 2 Enter File Manager.**
- 3 In the File menu, select Run....**
- 4 On the command line, type A:\setup.exe.**
- 5 Click OK.**

The dialogue box in Fig. 1 is shown.

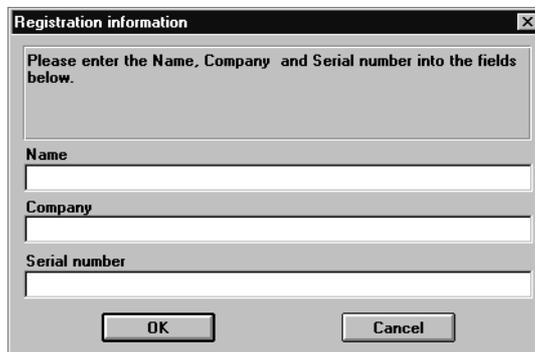
A screenshot of a Windows-style dialog box titled "Registration information". The dialog box has a close button (X) in the top right corner. Inside the dialog, there is a text area with the instruction: "Please enter the Name, Company and Serial number into the fields below." Below this text are three input fields: "Name", "Company", and "Serial number". At the bottom of the dialog, there are two buttons: "OK" and "Cancel".

Fig. 1 The registration information dialogue box.

The name, company and 'serial number' must be entered, otherwise the installation program will not proceed. The 'serial number' can be set to any number.

- 1 Enter your name, the name of your company and the address in the dialogue box.
- 2 Enter the serial number for REVAL.
- 3 Press OK.
- 4 Acknowledge the registration information by pressing Yes, or go back to correct it by pressing No.
- 5 Click to select your Windows version.



Fig. 2 The select installation type dialogue box.

- 6 Press OK.

Copy to the REVAL directory

When you have entered the necessary information, another dialogue box is shown, see Fig. 3.

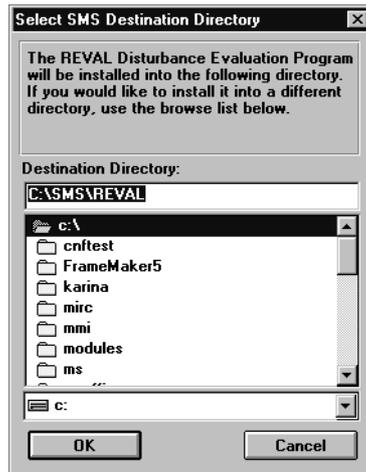


Fig. 3 The destination directory dialogue box.

- 1 Press OK to copy the program to the C:\SMS\REVAL directory, or go to Section “Copy to another directory” to select another directory.



Fig. 4 The language selection dialogue box

- 2 Select the desired language version, e.g. English, when the language selection box is shown.
- 3 Press OK. The files are decompressed and copied onto your hard disk to the selected directory.

- The install program asks if icons should be added to the program manager. Select Yes if you prefer that option, or No if you do not want any icons to be created.

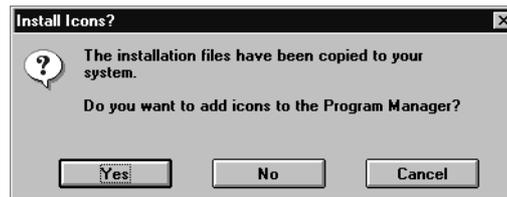


Fig. 5 The install icon? dialogue box.

- If you select Yes, select also in which program manager group the icons should be stored. If an SMS program manager group already exists, the REVAL icon is placed in the existing program manager group.



Fig. 6 The program manager group dialogue box

- Press OK to accept, or select another program manager group from the list, and then press OK.
- The installation is now completed. Press OK.



- Drag the REVAL shortcut icon to the desktop, if desired.

Copy to another directory

Do as follows if you want to place REVAL in another directory:

- 1 Select unit, e.g. C:, see Fig. 7.

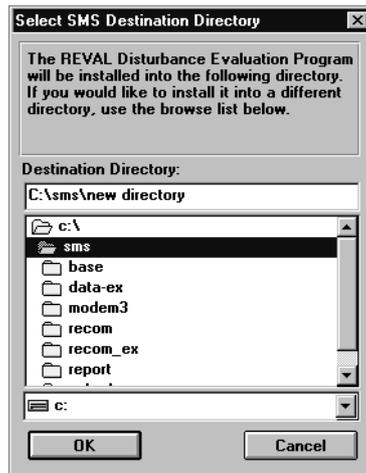


Fig. 7 The set new directory dialogue box.

- 2 Select target folder from the destination list, or type C:\<dirname> on the Destination Directory: line.
- 3 Press OK and continue the installation from point 2 as described in Section “Copy to the REVAL directory”.

1.4

Starting REVAL

When the installation is finished:

- 1 Select the SMS program manager group.
- 2 Double-click on the REVAL icon to start REVAL.

For detailed information on how to handling REVAL, see Chapter “Operation”.

Operation

This chapter presents all possibilities offered by the functions in REVAL. The menus that form the REVAL user interface are presented with an explanation of the contents and how to operate them.

1

Overview

REVAL has the following features:

- Window presentation
- Mouse operation for easy navigation
- Time, amplitude and phase angle measurement
- Zooming time scale
- Making independent magnitude scaling of signals.

REVAL can present one, two or three different disturbance recordings, each in separate windows. Each recording contains multiple analog and digital signals.

REVAL can also make printouts of the disturbances.

When presenting the signals, REVAL performs an automatic scaling of each signal. This means that every signal is presented with an individual amplitude scale. The scale of the vertical axis is graded to produce a good estimation in primary values. The automatic scaling is performed when presenting the disturbance on the screen, and when making a printout. REVAL also features equal scaling, which means that all signals with the same unit gets the same scaling, giving an improved overview of the disturbance.

A special feature of REVAL is the merge function. This function combines two or three disturbance recordings into one merged recording.

When included in the disturbance recording, REVAL displays the frequency graph. Frequency recording is an optional function in the disturbance recorders REOR 100/RCRA 100. Frequency is presented as the 11th channel in REVAL.

REVAL can read and write disturbance files of several formats. Accepted formats are:

- REVAL - REOR 100/RCRA 100 (ver. 3.0), and the disturbance recorder function in the RE. 500 terminals, Appendix 5.3.
- COMTRADE, Appendix 5.4.
- EVE - REOR 100/RCRA 100 (ver. 2.2), and the disturbance recorder function in the RE. 216/316 terminals, Appendix 5.5.

REVAL has also the possibility to save disturbance files in an user-specified ASCII format. This means that files evaluated by REVAL can be imported by other mathematical tools for further analysis. The appropriate file format for the following mathematical programs can be directly selected when saving a file:

- DADiSP[®], Appendix 5.5.
- MATLAB[®], Appendix 5.6.

1.1

The SMS structure

The file structure shown in Fig. 1 is used if REVAL cooperates with SMS.

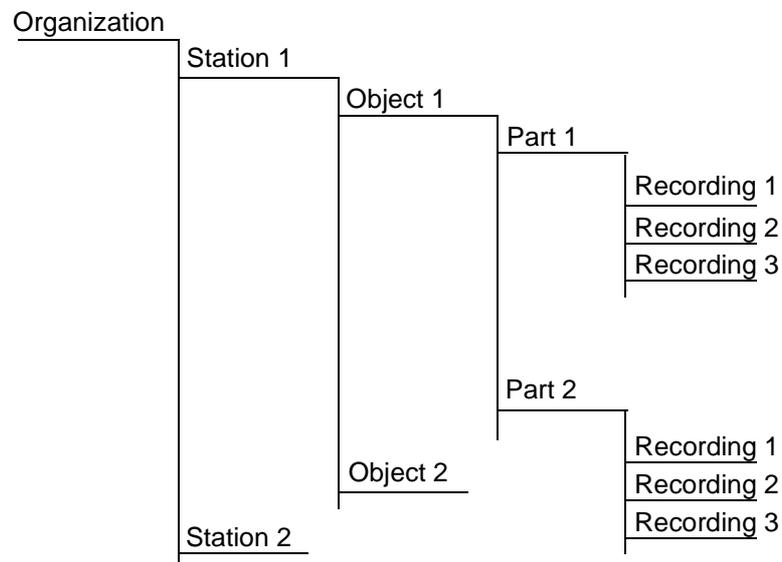


Fig. 1 The SMS file structure.

1.2

RECOM functions

Although REVAL is a stand-alone program, it also includes possibilities to cooperate with the RECOM disturbance collection program, when the latter is installed on the PC. The following functions are then available:

- Selection of the directory last used by RECOM when starting REVAL. This means that when a disturbance file is collected by RECOM, the user will when opening the file in REVAL be routed directly to the correct directory.
- Automatic printout. When RECOM is used in automatic polling mode it can also initiate an automatic printout via REVAL. For this purpose, the printout routines in REVAL are used (REVAL is started with the additional **-p** parameter), but the program does not have to be opened (active) on the PC.

These functions are initiated by RECOM and are described in Ref. 1, see Chapter “Reference publications”.

1.3

The REVAL disturbance window

REVAL presents graphical data windows, containing the analog and digital signals of one disturbance recording, on the screen or in a printout. Each data window contains one, two or three merged disturbance recordings. REVAL handles disturbance recordings comprising a maximum of 33 analog (including frequency signals) and 144 digital signals.

The analog and digital signals are displayed in separate parts of the screen and can not be mixed. The separate screen parts are individually scrollable vertically, while the horizontal scrollbar applies to both screen parts. The border between the analog and the digital window can be moved, thus allocating more screen space for the analog or the digital signals.

The graph displays the signals in channels. Normally, one signal is displayed per channel. A channel defines the amount of space allocated for the contained signals. The signals are clipped when the magnitude of the signal becomes too large for the channel space. Analog channels can be resized by the user, whereas digital channels cannot be resized.

The user can move several analog signals into one channel, thus creating groups of signals. Signal groups are useful when performing comparisons of several signals, or to increase the number of visible signals on the screen.

When a signal does not contain interesting information, it can be hidden (made invisible) from the screen to make room for more signals. The hidden signals can be made visible again by the user.

1.4 The REVAL disturbance recording

One REVAL disturbance recording consists of the following parts:

- Header part.
- Data part.
- Comment part (optional).

The REVAL format is described in Appendix 5.3.

1.4.1 The disturbance header

A disturbance recording includes a header part. The header part contains information about the disturbance recorder configuration and the triggering event.

Depending on the original file format the disturbance header file may contain more or less information.

- In the REVAL format, the header information is produced by the disturbance recorder, i.e. the REOR 100/RCRA 100 (ver. 3.0), or the RE. 500 series protection terminals.
- The EVE format gets the information from the parameter file PLOT.TXT.
- The COMTRADE format stores the header information in the configuration file (.CFG).

The header is displayed upon user request in a separate text window, called header window, which can be scrolled and printed, but not edited.

1.4.2 The disturbance data

The disturbance data part contains all sample values for the different signals.

1.4.3 The disturbance comment (optional)

The user may append comments to disturbance recordings. The disturbance comment is displayed in a separate window upon user request. REVAL creates a new comment part when necessary, i.e. if a comment part not already exists.

It is also possible to include the information from the header part in the comment part.

2 Fundamentals of REVAL

2.1 Man - machine communication (MMC)

The REVAL MMC cooperates with the SMS file structure and runs under MS Windows. Every action is supported by mouse operations which facilitates flexible and effective communication.

The presentation is object levelled and each window represent one disturbance recording.

2.2 Templates

A template is used for storing a standard way of presenting a disturbance recording. A template can be saved and loaded by the user on request. The user may load different templates for every open disturbance window.

A template stores the signal grouping, the colours, the visibility and the linetypes used for displaying the signals. Also the size of each analog channel is stored in a template.

The standard template (NORMAL.TPL) cannot be changed. It allocates one signal to each channel and makes all signals visible.

The template is connected to the unit where the disturbance recording is located. This means that every disturbance recording within the same unit will be presented with the template selected for this specific unit.

2.3 Merging disturbances

The merge function gives the user the possibility to combine two or three different disturbance recordings into one logical disturbance file. The merge operation can be done with files originating from different objects, i.e. different directories. Different file types can be merged, the only requirement is that the different sample frequencies involved must be even divisible, e.g. 1000 Hz and 500 Hz.

There are two different ways of performing a merge operation, either manual or automatic merging.

2.3.1 Manual merging

The manual merging of disturbance files is initiated by the merge command in the Menu bar. The merge command is not valid if only one window is open. Two or three windows are needed to perform the operation.

First, the user must decide which window to use as reference window. The active window is always regarded as the reference window.

REVAL presents a dialogue box where the user can enter the time skew between the two recordings.

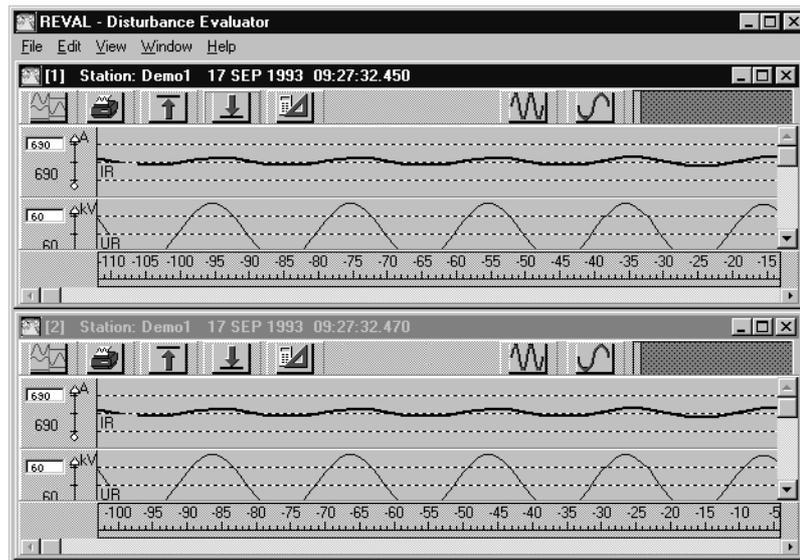


Fig. 2 The merge function.

Fig. 2 shows two disturbance files with a time skew of 20 ms. This means that the recording in window 2 started 20 ms after the disturbance in window 1.

If the recordings are to be presented with the trigger time in window 1 as reference, the user must enter the time skew of 20 ms in the merge dialogue box.

If no value for the time skew is entered, REVAL presents the signals from the disturbance in window 2, 20 ms delayed compared to the signals from window 1.

After the merging, all signals belonging to the merged windows are placed in the same window. This makes it very easy to compare different signals.

2.3.2

Automatic merging

This function is only valid for files of the REVAL format.

The function is used when there are different files within the same object with the same name. REVAL automatically merges the files into a logical disturbance recording. The automatic merge function is initiated from the open dialogue box, by selecting the “Automatic merge (REVAL)” checkbox.

The automatic merge function is performed when the user is located on the Object or Station directory level in the SMS structure. When a disturbance file is to be opened and the checkbox for the automatic merge function is activated, all sub directories (unit directories) within the object are searched for the file name. All units, containing the same file name, are opened and the files are concatenated into one disturbance recording. The automatic merging of disturbance recordings is thus completely determined by the names of the files.

If the trigger time differs between the files, REVAL uses the “earliest” disturbance as the main recording and merges the other recordings according to the time skew between them.

If the time skew between any two of the recordings is longer than 100 ms, REVAL merges the files with the time skew set to zero, i.e. the trigger time is equal for the different recordings.

The maximum number of disturbance recordings per object is three when using the automatic merge function. If the number of recordings with the same name exceeds three, the first three recordings found are merged.

3 Basic operation

In this chapter, an example is given on how a disturbance recording can be presented and evaluated to describe the basic operation of REVAL.

For further information of the different commands and possibilities, see Chapter 4 “Extensive operation”. In this chapter every used command and mouse action is explained in text and figures.

3.1 General Information

For efficient work you need a mouse to point at specific objects on the screen. For alphanumeric inputs you use the keyboard. Some important terms used in this manual are described below.

3.1.1 Terms and actions

Term	Action
Point	Move the mouse until the cursor points at the selected place.
Click	Press and release the left mouse button.
Double-click	Click twice in rapid succession.
Drag	Press the left mouse button, point, then release the button.
Select a signal	Point at the signal and click.
Deselect a signal	Place the cursor inside a channel but not pointing at a signal, and click.
Move one directory level upwards	In the directory list box, click at the alternative with two dots (..).
File/Open	This phrase means: "Select the Open command from the File menu". Commands and references to items in dialogue boxes are printed in bold typeface.

3.1.2

Toolbar commands

A toolbar is located above the signal area in the disturbance window. Seven buttons are available, with the following functionality:

	The command moves the visible screen area so that the trigger point of the disturbance is placed in the middle of the screen.
	The part of the disturbance graph which is visible on the screen is printed, i.e. the printout is a "screen shot".
	The splitbar between the two window parts can be moved either upwards or downwards.
	This command presents the instantaneous and the RMS values of the signals, together with time and phase angle measurement.
	The part of the disturbance, that is shown on the screen, can be either compressed or expanded.

The toolbar can be hidden from the screen, or made visible, by selecting **View/Toolbar**. All functions that are available in the toolbar are also available in the View menu.

If you need special guidelines when working with REVAL, the Help command in the Menu bar is always available. The Help function is also initiated if you press the **F1** keyboard button.

3.2

Starting REVAL and opening a disturbance window

When the program is started, the first screen contains the name of the program and the ABB-logo.

1 Press OK

2 The copyright declaration and the licence information are added, as shown in Fig. 3.

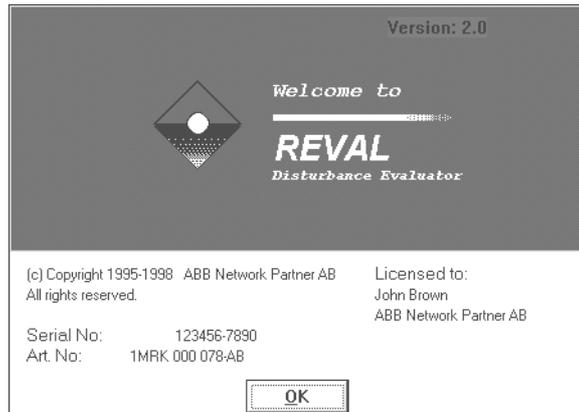


Fig. 3 The ABB copyright screen.

3 Press OK to show the REVAL program window.



Fig. 4 The REVAL program window.

- 4 Select File/Open. The open dialogue box, see Fig. 5, is presented to select which disturbance to open. You can also change directory and file type in the shown list boxes.
- 5 Select the REH file type in the list box.
- 6 Go to the directory ...\\REVAL\\EVENTS in the Directory: list box.
- 7 Open the disturbance 94120146.REH, by double-clicking on the file name.

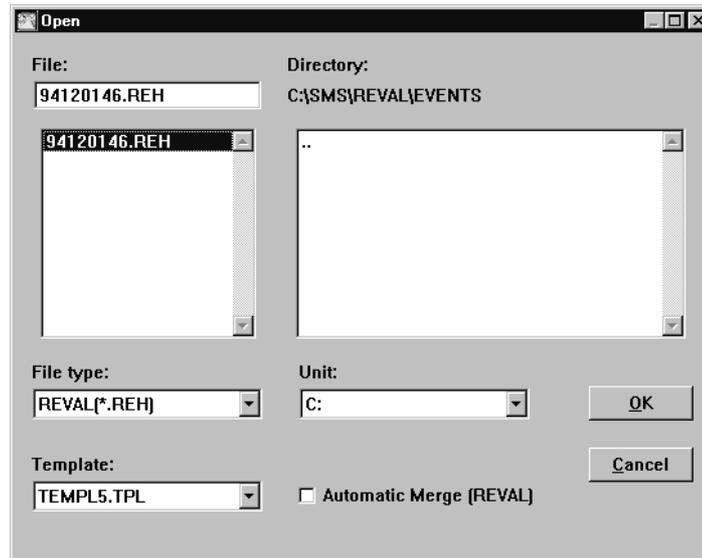


Fig. 5 The open dialogue box.

8 This opens the disturbance window of the chosen file, see Fig. 6.

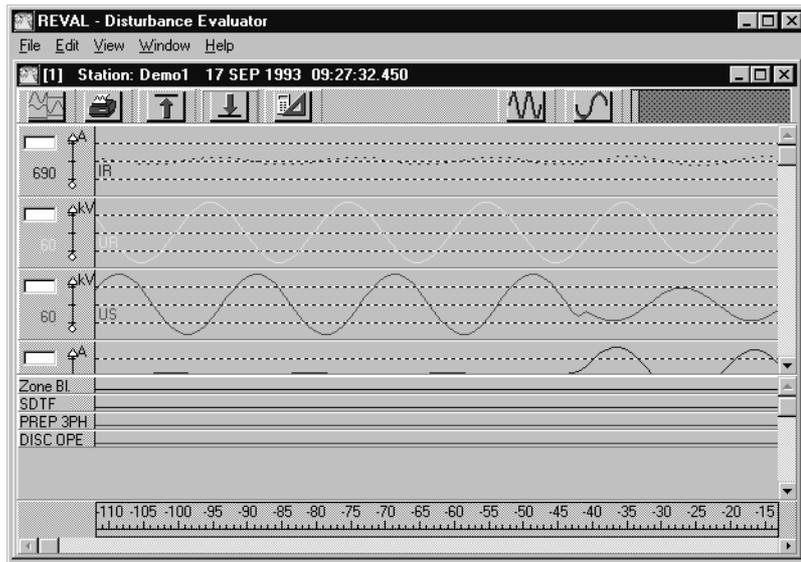


Fig. 6 The REVAL disturbance window.

3.2.1

Changing the Time Scale

When opening a file, the window shows the leftmost part of the disturbance graph.

- 1 Click on the horizontal scrollbar at the bottom of the window to move the visible part of the disturbance. This makes it possible to study different parts of the recording.
- 2 A vertical solid line indicates when the disturbance recorder was triggered, i.e. the trigger point. This line indicates the zero (0) time.
- 3 Another way to easily find the trigger point of the disturbance is by using View/Go to Trigger Point.
- 4 This can also be initiated from the Toolbar. Press Go to Trigger Point button, which is the leftmost button in the Toolbar.

To go to a specific time in the disturbance **View/Go to Time** can be used.

- 1 Select View/Go to Time.
- 2 Enter the time 100 (ms).
- 3 Press OK.

This moves the visible screen area so that the entered time, i.e. 100 ms, is placed in the middle of the screen.

- 1 Select View/Home to move the visible screen area to the leftmost point of the disturbance graph, as when you opened the file.
- 2 Use the two scaling buttons in the Toolbar to change the time scale in order to show a larger part of the disturbance, or to make a detailed study of a specific part.
- 3 Expand the signals by pressing Zoom In, which is the right one of the two buttons. The size of the visible disturbance part is indicated by the zoom indicator at the right in the Toolbar. The light grey area shows which part of the disturbance that is shown on the screen.
- 4 Press Zoom Out to restore the screen as it looks like in Fig. 6.
- 5 Press Zoom Out three or four times to make a larger part of the disturbance visible on the screen.

The number of samples to be shown now exceeds the number of pixels of the screen, i.e. the resolution of the screen. When this happens the zoom indicator turns red to notify the user that the presentation of the signals may be distorted.

Zoom can also be used to change the time scale. In this case the amount of the total disturbance file to be shown on the visible screen area is entered as a percentage of the total disturbance.

3.2.2

The amplitude scale

The amplitude scale is indicated by the value displayed in the square to the left of the amplitude axis. The value indicates which level the dotted horizontal line corresponds to. The amplitude value of a signal can be changed as follows:

- 1 Click on the white square holding the amplitude value of signal UR.
- 2 Enter a new value which is smaller than the current value.
- 3 Press Enter. REVAL presents the new graph of the signal. Since you entered a smaller value than the original, the graph will automatically be clipped.
- 4 To view the whole signal again, enter the original value.
- 5 To allocate more space for an analog channel, click at the arrow head of the amplitude axis of the analog channel containing the UR signal. This allocates more space for this specific channel.
- 6 To allocate less space, click at the bottom square of the amplitude axis of the same channel.

3.2.3

Changing the window

The analog and digital channels are scrolled separately using the vertical scrollbar of each window.

The size of the whole disturbance window is changed by dragging the border of the window.

The ratio between the analog and the digital window can be changed by using the toolbar buttons **Splitbar Up** and **Splitbar Down**.

3.2.4

Initiating the measuring function

The measuring function can be activated either by selecting **View/Measure**, or pressing **Measure** in the Toolbar. In this example, press **Measure**.

- 1 Click once on Measure to make the window look like in Fig. 7.

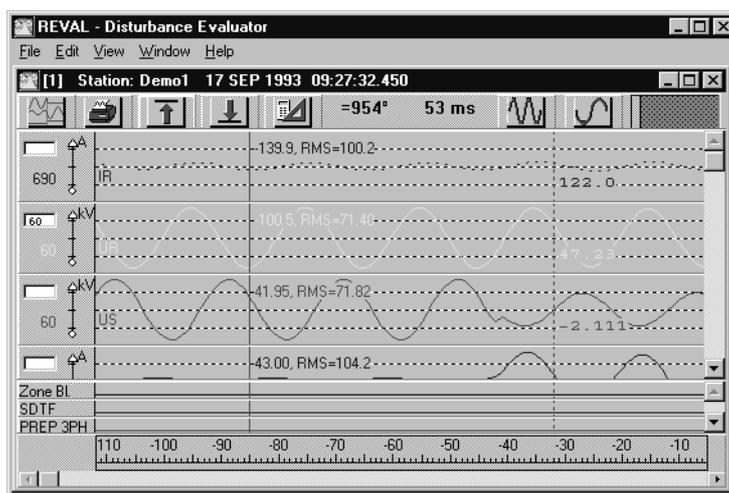


Fig. 7 The measuring function.

Two vertical lines are visible in the window, one solid called the reference line, and one dashed called the measuring line. Each of the two lines can individually be moved to a desired place using the mouse.

Next to the reference line and next to the signal in front in each channel, the instantaneous value and the RMS value are displayed. Next to the measuring line the instantaneous value is displayed.

Two values are displayed in the toolbar, the phase angle and the time between the two lines.

2 Point at either of the lines, drag the cursor to a new location and release the button. The new values are now displayed on the screen.

If the measuring function is activated, the measured values are included in the printout.

3 Exit the measuring function by pressing Measure once again.

3.2.5**Editing Signals**

Several editing functions are available when a signal is selected.

- 1 Select the UR signal by clicking on it. The signal is highlighted when selected.**

3.2.5.1**Changing colour of a signal**

- 1 Select Edit/Colour. A list box is presented with all selectable colours.**
- 2 Select a colour by double-clicking in the list box.**

3.2.5.2**Moving a signal**

Moving a signal from one channel to another is done by dragging the signal to its new location. A signal can also be placed between two existing channels. In this case a new channel is created in which the signal is placed.

- 1 Drag a signal to a place between two channels. The cursor changes type to indicate the border between two channels.**

3.2.5.3**Changing linetype of a signal**

The linetype is used to identify a signal, e.g. when using a printer without colours.

- 1 Select Edit/Linetype.**
- 2 Select which linetype to use for the signal in the list box, and double-click.**

3.2.5.4**Hiding/Showing a signal**

To make the selected signal invisible on the screen:

- 1 Select the UR signal by clicking on it.**
- 2 Select Edit/Hide.**

To make a hidden signal visible again:

- 1 Select Edit/Show. This makes a pop-up list appear, where all the hidden signals are listed.**
- 2 Double-click on the UR signal in the list box.**

3.2.5.5**Changing signal in front**

- 1 Move the UR signal to the channel below.**
- 2 Click in the grey area where the amplitude axis is located for the channel.**

The signal in the front is now placed in the back, and the second signal is placed in the front instead. This is indicated by the colour of the signal name, and the colour of the reference value.

3.2.6**The Template**

The template is connected to the directory level for the opened disturbance file. This means that every disturbance recording within the same unit is presented with the template you have chosen for this specific unit.

3.2.6.1

Loading template

If you want to change to another template while you are working with a disturbance window:

- 1 **Select File/Load Template. The load template dialogue box is presented on the screen, see Fig. 8.**

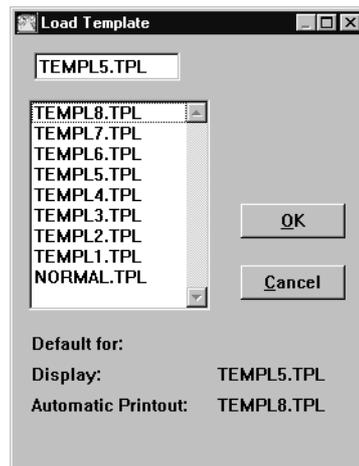


Fig. 8 The load template dialogue box

The two lines **Default for: Display:** and **Automatic Printout:** are not changeable in this dialogue box. They are merely shown as an information which templates that are specified for the actual unit. If you want to change these settings:

- 2 **Select template TEMPL1.TPL and confirm by pressing OK. Since you now have edited the current template, you must first answer the question if you want to continue, although the current template is not saved. If you have made changes to the template NORMAL.TPL, you will not get this question. NORMAL.TPL cannot be changed and hence, the changes will not be saved.**
- 3 **Press Yes. The disturbance file is now presented with the chosen template.**

3.2.6.2

Editing the template

You can edit the template you are currently using:

1 Select Edit/Template. The template dialogue box appears, see Fig. 8.

The following parameters are changeable:

- The **name** of the signal
Changes to this field are not saved in the template, but are shown on the screen and when printed.
- The **height** of the channel
Only changeable for analog channels.
- The **colour** of the signal
- The **linetype** representing the signal
- The **visibility** of the signal
Indicates if the signal is shown or hidden.

Also the channel number is part of the template. The channel number can only be changed by moving the signals in the disturbance window. The number is however presented in the template dialogue box.

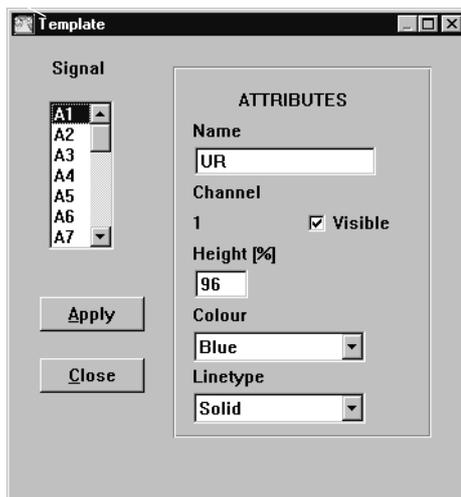


Fig. 9 The template dialogue box.

2 Make some changes in the template and confirm by pressing Apply.**3 Press Close when you are ready.**

The disturbance window is now presented with the new settings.

3.3**The comment part**

- 1 Select View/Comment to show the comment window. The window can be edited, and you can write your own comments.**
- 2 Press Close to exit the comment window.**

3.4**The header part**

The header part presents information regarding the recording. This information is not changeable.

- 1 Select View/Header to show the header window.**
- 2 Press Close to exit the header window.**

3.5

Printing disturbances

3.5.1

Making printouts

- 1 Select File/Print to make printouts of the disturbance file you are evaluating.
- 2 The print dialogue box is presented in which you select which part of the disturbance you want to print, see Fig. 10.

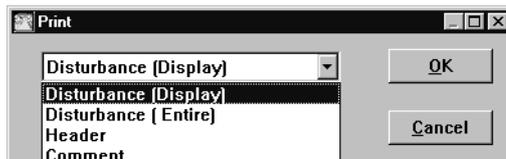


Fig. 10 The print dialogue box.

The Print dialogue box enables the user to select one of the following printouts:

Disturbance (Display)

The part of the disturbance graph which is visible on the screen is printed, i.e. the printout is a “screen shot”. The Print Display command can also be initiated from the Toolbar.

Disturbance (Entire)

This alternative prints the entire disturbance recording consisting of the Comment part, the Header information and the disturbance graph. All signals that has been selected to be visible in the Template will be printed out. All samples of the signals will be printed and the time scale per printed page will be the same as selected on the screen.

Header

The Header information of the current disturbance window is printed.

Comment

The Comment part of the current disturbance window is printed.

Template

Prints a list where all signals are presented regarding the colour, linetype etc.

An example of a header printout and a disturbance display printout are shown in Appendix 5.1.

To make a printout of the complete disturbance file:

- 3 Select the **Disturbance (Entire)** alternative and confirm by pressing **OK**.

After that you are returned to the disturbance window.

3.6

Merge Disturbances

REVAL can combine two or three disturbance recordings into one logical recording. The recordings you want to merge must be opened.

- 1 Select **File/Open** and open the 94120146.REH file.
- 2 Select **Window/Tile** to make the two disturbances sharing the screen as shown in Fig. 11.
- 3 Click in window 1 to make the disturbance in window 1 the active one.

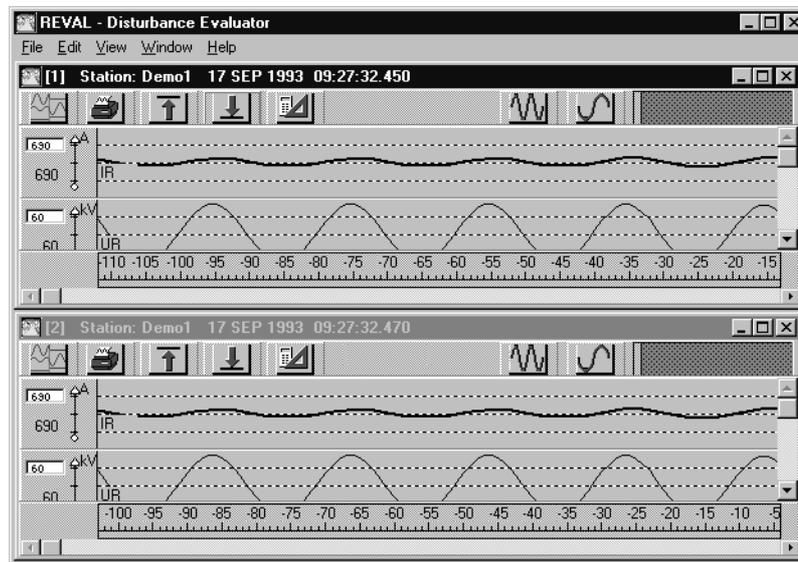


Fig. 11 The screen with two opened windows.

- 4 Select **Window/Merge** to show the merge dialogue box, see Fig. 12.

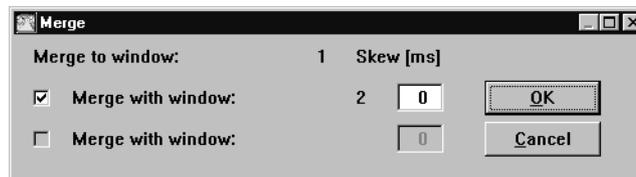


Fig. 12 The merge dialogue box.

The dialog box asks which time skew to use.

The time skew between the two windows is 20 ms, i.e. the recording in window 2 was started 20 ms after the recording in window 1.

- 5 Enter the value 20 in the line for the time skew of window 2.
- 6 Press OK. The merged disturbance window is presented on the screen, containing all the signals of the two original windows.

3.7

Saving

File/Save as... is used when you have merged different disturbances and want to save the merged disturbance, or when you want to save a disturbance under another name. **Save As...** is also used when converting a file to another format, see Chapter 3.8.

- 1 Select **File/Save as...**
- 2 A dialogue box is presented as in Fig. 13, where you can choose in what name and where to save the merged disturbance.

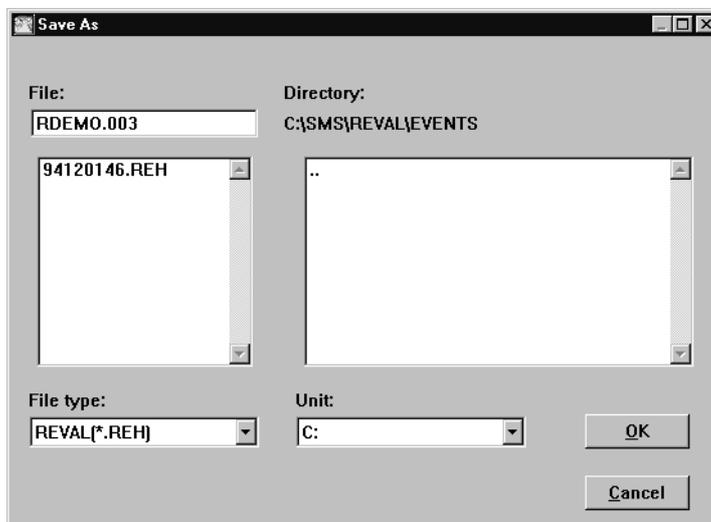


Fig. 13 The Save as... dialogue box.

- 3 Enter the name *RDEMO.003* to save the file in.
- 4 Press OK.
- 5 It is also possible to save the template you are currently using:
- 6 Select File/Save Template to show a dialogue box as shown in Fig. 14. In this box you can save the template you are currently using.

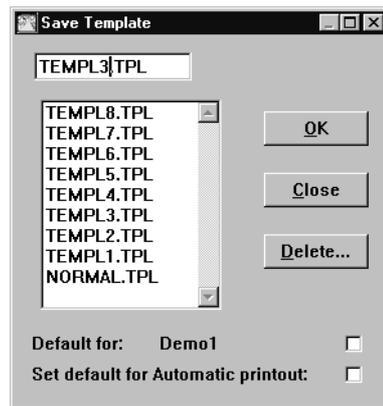


Fig. 14 The Save template dialogue box.

- 7 Enter the name to save the template in, e.g. *TEMPL3.TPL*, and confirm by pressing OK.
- 8 Close the disturbance window by double-clicking on the Close box in the upper right corner of the window.

3.8

Convert Disturbances

REVAL can convert files to different formats. The predefined formats, also described in the Appendix, are:

- REVAL, Appendix 5.3
- COMTRADE, Appendix 5.4
- EVE, Appendix 5.5
- DADiSP[®], Appendix 5.5
- MATLAB[®], Appendix 5.6

The convert operation is done by saving a disturbance file to the desired format. To convert a disturbance file from the REVAL format to the COMTRADE format, do as follows:

- 1 **Select File/Open.**
- 2 **Go to the directory ...\\REVAL\\EVENTS in the Directory: list box.**
- 3 **Select the File type: list box, and select the REVAL format.**
The File: list box lists all files of the REVAL format that belong to the present directory.
- 4 **Open the 94120146.REH file.**
- 5 **After the disturbance window is opened, select File/Save As. The Save As dialogue box is opened, see Fig. 13.**
- 6 **Select the COMTRADE format in the File type: list box.**
- 7 **Enter the name you want to save the converted file in, e.g. 94120146.CFG.**
- 8 **Confirm by pressing OK.**

Now you have performed a convert operation between REVAL and COMTRADE. The original REVAL file remains, and a new file of the COMTRADE type is created.

3.9

Converting to ASCII format

REVAL can convert files to a user defined ASCII format. The convert operation is done by saving a disturbance file to the desired format. To convert a disturbance file from the REVAL format to an ASCII based format suitable, for example, for an Microsoft[®] EXCEL[™] spreadsheet, do as follows:

- 1 **Select File/Open.**
- 2 **Go to the directory ...\\REVAL\\EVENTS in the Directory: list box.**
- 3 **Select the File type: list box, and choose the REVAL format.**
- 4 **The File: list box lists all files of the REVAL format that belong to the present directory.**
- 5 **Open the 94120146.REH file.**
- 6 **To select the signals to be included in the converting operation, select Edit/Template.**
- 7 **Set all signals to be included in the ASCII file to visible, and leave the other not visible.**
- 8 **Press Apply and then Close.**
- 9 **Rearrange the signals so that they are shown on the screen in the same order as they are to be saved in the new format.**

Only the time span of the disturbance file that is shown in the visible screen area will be included in the convert operation.

- 10 Use View/Zoom and View/Go to Time to select the appropriate time span.
- 11 Select File/Save As... to show the Save As... dialogue box.
- 12 Select ASCII format in the File type: list box.
- 13 Enter the name you want to save the converted file in, e.g. 94120146.XLS.
- 14 Confirm by pressing OK. The Save As - options dialogue box will be shown, see Fig. 15.

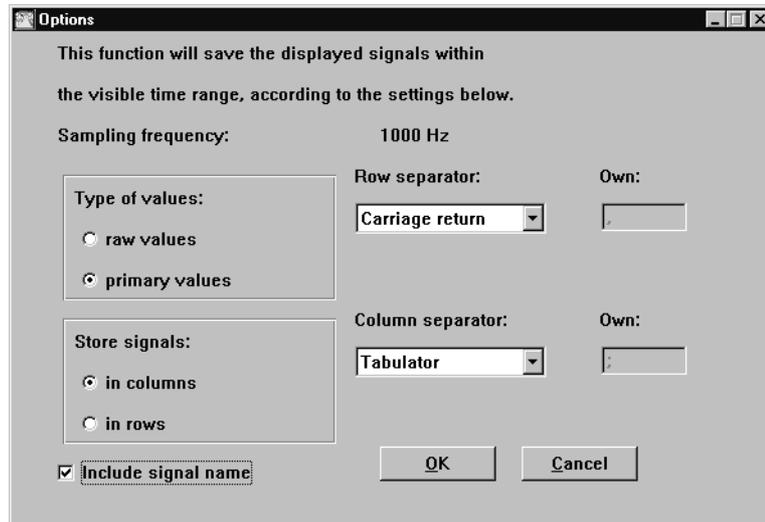


Fig. 15 The Save As - options dialogue box.

- 15 In the Type of values: box select primary values.
- 16 In the Store signals: box select in columns.
- 17 In the Row separator: list box select Carriage return.
- 18 In the Column separator: list box select Tabulator.
- 19 Check Include signal name in the checkbox.
- 20 Confirm by pressing OK.

You have now performed a converting operation between REVAL and an ASCII format. The original REVAL file remains, and a new file that can be opened by EXCEL is created. When presented in EXCEL the values of one signal will be shown in one column, starting with the signal name in the first row and then the primary values of each sample for the defined time span will follow.

Please note that REVAL uses a point (.) as decimal symbol and not a comma (,). This can be changed in the Control Panel in the Windows program manager on your PC system. Refer to the Windows manual.

3.10 Closing the disturbance window

When you want to close a disturbance window, you can either double-click in the upper right corner of the disturbance window, or select **File/Close**.

If any changes to the template has been done since the last saving, REVAL asks whether the template should be saved or not before closing.

REVAL also checks if the disturbance has been merged. If so, REVAL asks whether the disturbance should be saved or not.

3.11 Exiting REVAL

File/Exit terminates REVAL and returns you to the Windows Program Manager.

If any template has been changed since last saved, REVAL asks whether to save the changes or not before exiting.

REVAL also checks whether any open window is merged. If so, REVAL asks if you want to save before exiting.

4

Extensive operation

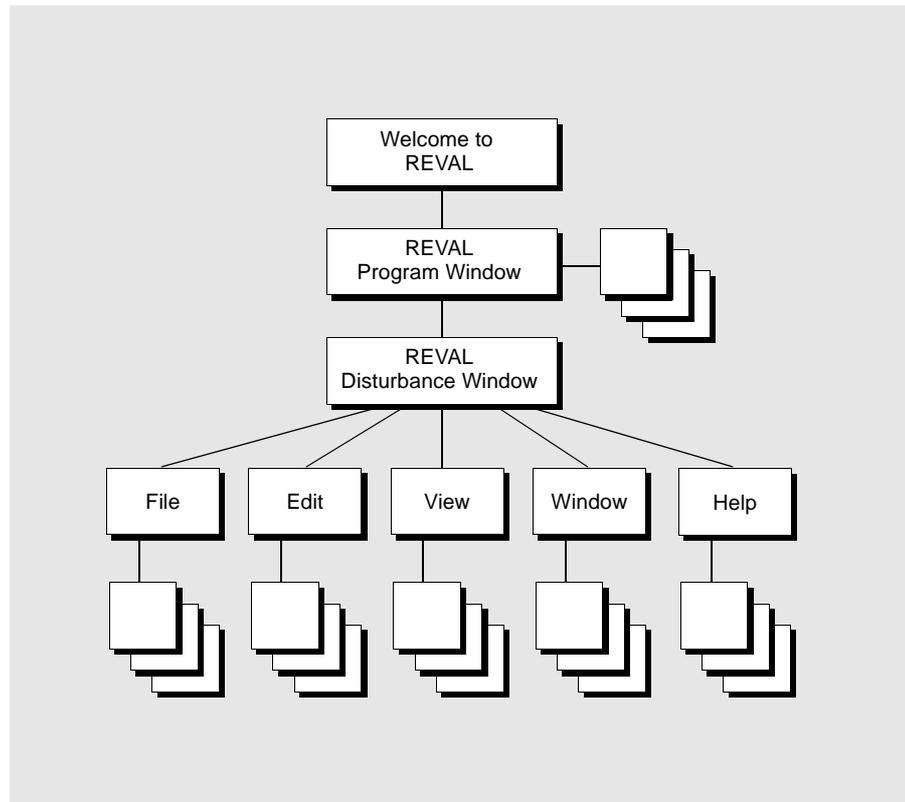


Fig. 16 The structure of the program.

The structure of the REVAL program is shown in Fig. 16. In the following pages the content of the different windows will be shown along with a detailed explanation on how to operate them.

4.1

The ABB copyright screen

When the program is started, the first screen contains the name of the program and the ABB-logo. When pressing **OK**, the copyright declaration and the licence information are added as shown in Fig. 17.

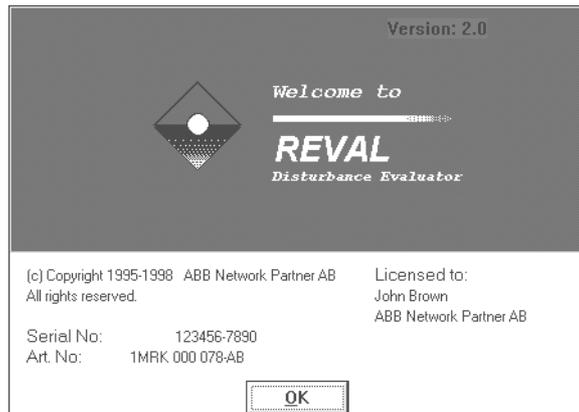


Fig. 17 The ABB copyright screen.

4.2

The REVAL program window

The REVAL program window is a standard application window, consisting of the following parts:

- **Program caption bar**
This is located at the top of the screen and contains the name of the program.
- **Close button**
Double-click on the **X** in the upper right corner to close the program.
- **Window Resize button**
In the upper right corner, a window resize button is placed.
- **Program hide button**
Click on the – in the upper right corner to hide the program temporarily. It can be activated again from the Windows taskbar.
- **Menu bar**
The menu bar offers a number of commands which are explained in the following chapters.

The REVAL program window is shown in Fig. 18. The program window is empty when REVAL is started.



Fig. 18 The REVAL program window.

4.2.1

The menu bar

Commands which are not possible to select at certain times are disabled (greyed) in the menus.

4.2.1.1

The file menu

The File menu contains functions needed for handling disturbance and template files, such as open a disturbance file, or print a file.

The following commands are available in the file menu:

File/Open

- 1 **Select Open... to open a disturbance window. The open dialogue box appears prompting you to enter or choose a disturbance to be opened (from the list boxes provided), see Fig. 19.**
- 2 **Select the File type: list box to present the files of a certain format.**
- 3 **If desired, select a specific template to use from the Template list box.**

The checkbox **Automatic Merge** is used if you want to merge files automatically when opening a disturbance window. The function is valid only for the REVAL file type and is further described in Chapter 2.3 “Merging disturbances”.

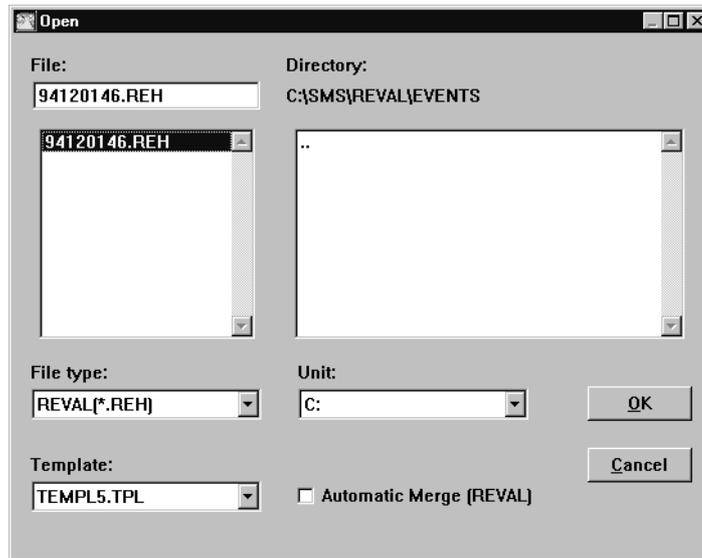


Fig. 19 The open dialogue box.

File/Close

- 1 Select Close to close the disturbance window which is the active window, or click the Close box in the upper right corner of the disturbance window.
- 2 If the used template has been changed, select YES or NO in the presented message box to either save the template, or not.
- 3 If a merge operation has been made without being saved, select YES or NO in the presented dialogue box to either save the new disturbance file, or not.

File/Save as

- 1 Select **Save as ...** to save a disturbance in another name, or to perform a converting operation. A **Save As** dialogue box, see Fig. 20, is shown to enable selection on where and how to save the disturbance.
- 2 Select the desired format for converting the disturbance files from the **File type:** list box showing the supported formats. A conversion between two different formats is performed when the disturbance is saved to another format than the original.

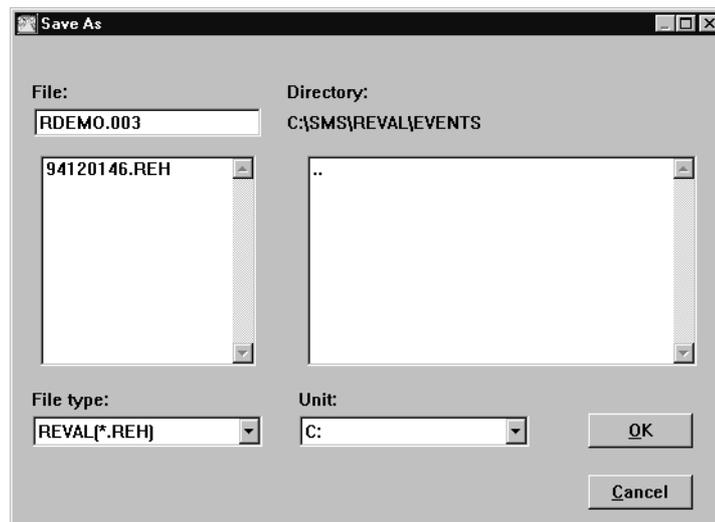


Fig. 20 The Save As dialogue box.

File/Save as - options

If the file type in the **Save as** dialogue box is set to ASCII, the **Save as-options** dialogue box, see Fig. 21, is shown to let the user specify the exact format of the ASCII file. The following information can be entered:

- **Type of values:**
Select whether the raw values (which are not necessarily equal to the secondary values) or the primary values shall be stored.
- **Store signals:**
Select if the samples belonging to one signal shall be stored in columns or rows.
- **Row separator:**
Select the row separator to one of the predefined types, or to the user defined stated in the **Own:** box.
- **Column separator:**
Select the column separator to one of the predefined types, or to the user defined stated in the **Own:** box.

- **Include signal name:**

Select if the signal names shall be included in the file, or not.

The sampling frequency of the stored ASCII file is the same as for the original file. All signals that has been selected to be visible in the template is included in the file. Only the time span shown in the disturbance window is stored in the file.

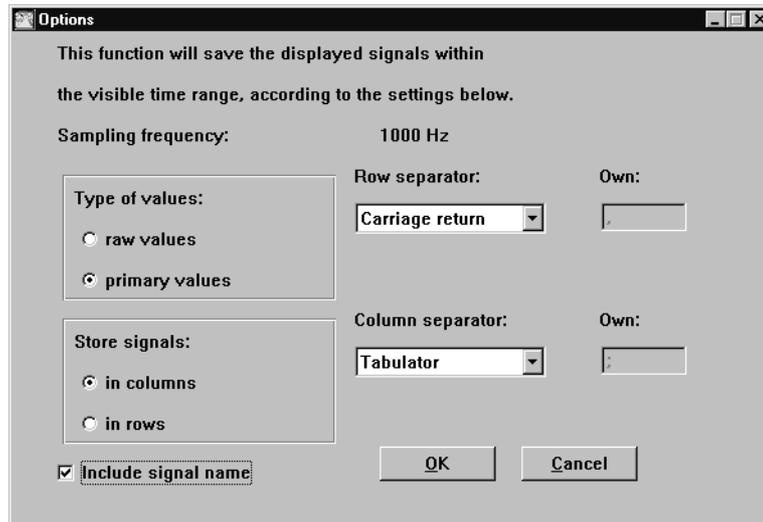


Fig. 21 The save as - options dialogue box.

File/Delete

- 1 Select Delete to present a dialogue box, see Fig. 22, in which the desired disturbance can be deleted. When OK is pressed, a warning box is shown.
- 2 Press OK in the warning box to delete the disturbance. The Delete function does not delete disturbance files, with the same name, belonging to other units within the same object.

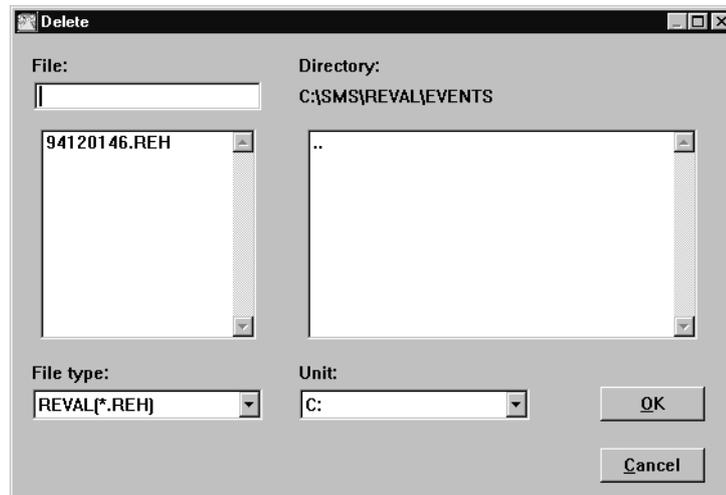


Fig. 22 The delete dialogue box.

File/Load template

- 1 Select Load template to change the currently applied template.
- 2 A dialogue box is shown, see Fig. 23, from which the desired template can be selected.

As an information to the user, the default template used by the automatic printout function and the default template for the display are identified. These two lines are changeable in the **Save template** dialogue box, see below.

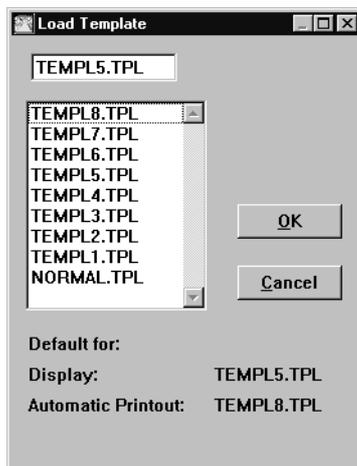


Fig. 23 The load template dialogue box.

File/Save template

- 1 **Select Save template to save the currently used template. A dialogue box, see Fig. 24, is shown**
- 2 **Enter the name of the new template.**
- 3 **Use the Default for: check box to set the default template used for the unit where the disturbance recording is located.**
- 4 **Use the Set default for Automatic printout: check box to set the default template used by the automatic printout function for the unit where the disturbance recording is located.**
- 5 **Press Delete to delete a specified template. If a template which is used as default for a station, is deleted, the station will be presented with the template NORMAL.TPL the next time the recording is activated.**

The default template for automatic printouts and for the display can be set in different directory levels. If a template is set as default at the Station level, all disturbances belonging to the station will have the chosen template as default.

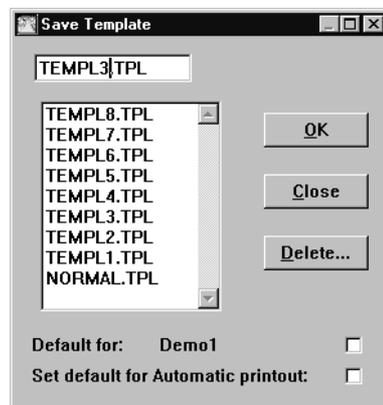


Fig. 24 The save template dialogue box.

File/Print setup

When installing REVAL, the default printer defined in the Print manager is connected to REVAL as the default printer.

Select **Print setup** to select the printer, and to make changes of the printer configuration, see Fig. 25. Any changes of the printer configuration will only affect the printouts from REVAL.

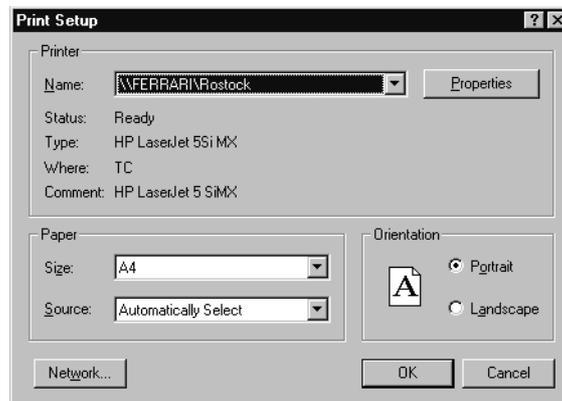


Fig. 25 The print setup dialogue box.

File/Automatic print setup

This command is used for defining the printers which are to be used by the automatic printout function. One or two printers can be defined. The automatic printout function printouts the disturbance on both printers, if defined. The printout includes both the header and the entire disturbance graph. This means that the printout format is the same as the manually initiated **Print entire**, except the time scale, which is fixed in the automatic printout.

The automatic printout function is initiated by RECOM Scheduler, and is described in Ref. 1, see Chapter .

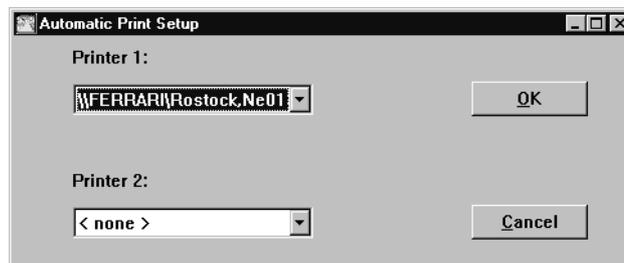


Fig. 26 The automatic print setup dialogue box.

4.2.1.2

File/Print

- 1 Select Print to show the print dialogue box, see Fig. 27.
- 2 Select the desired part of the disturbance in the active window to printout from the list.
- 3 Press OK to start the printout, or Cancel to leave the print dialogue box. The printouts are printed on the printer specified by the Print setup command, see above.

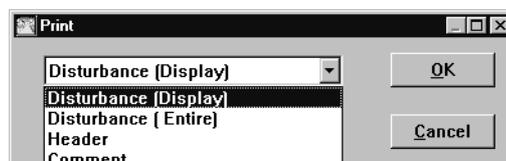


Fig. 27 The print dialogue box.

The Print dialogue box enables you to select one of the following printouts:

- **Disturbance (Display):**
Prints the part of the disturbance graph which is visible on the screen, i.e. a “print screen” copy. **Print display** can also be initiated from the Toolbar.
- **Disturbance (Entire):**
Prints the entire disturbance recording consisting of the comment part, the header information and the disturbance graph. All signals that has been selected to be visible in the template are printed. All samples of the signals are printed and the time scale per printed page is the same as selected on the screen.
- **Header:**
Prints the header part of the active disturbance window.
- **Comment:**
Prints the comment part of the active disturbance window.
- **Template:**
Prints the template currently used in the active window. The printout results in a list, where all the signals are presented.

An example of a header printout and a disturbance display printout are shown in Appendix 5.1.

File/Print list

Prints a list of all disturbance files of a specified file type belonging to the directory specified in the print list dialogue box, see Fig. 28.

1 Select which file type to print in the File type: list box.

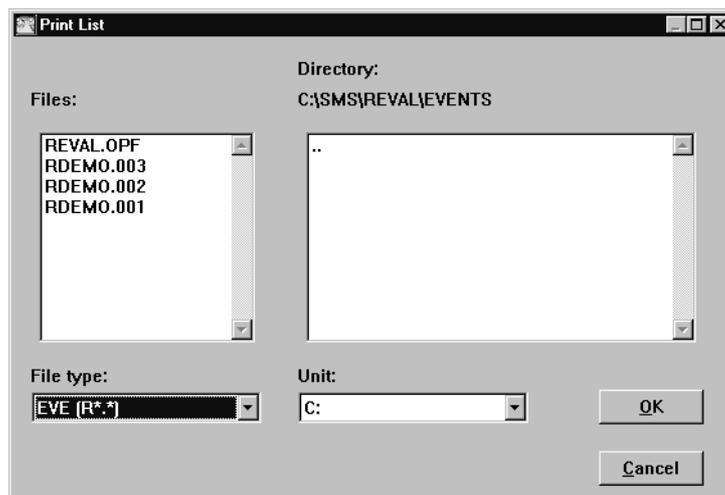


Fig. 28 The print list dialogue box.

File/Exit

- 1 Select **Exit** to leave the REVAL program.
- 2 If the template has been changed since last saved, select **YES** or **NO** in the dialogue box to determine whether the template should be saved, or not.
- 3 If a merge operation has been made without being saved, select **YES** or **NO** in the dialogue box to determine whether to save the new disturbance file or not.

4.2.1.3

The edit menu

This menu contains functions for editing signals in a number of ways. The following commands are available in the edit menu.

Edit/Undo

- 1 Select **Undo** to undo the latest editing action performed on the screen. **Undo** is valid for the following commands:
 - Hide
 - Show
 - Colour
 - Linetype

Edit/Hide

- 1 Select **Hide** to make the selected signal invisible on the screen. If a channel becomes empty, it is removed from the screen and any channel below is moved up to fill the gap. **Hide** is only available when a signal is selected, otherwise this selection is disabled.

Edit/Show

- 1 Select **Show** to show a dialogue box with a list of all hidden signals, see Fig. 29.
- 2 Make the signals visible by double-clicking on the name of the chosen signal in the signal list, or press **OK**.
When a hidden signal is made visible, the signal is displayed according to the position in the currently used template.

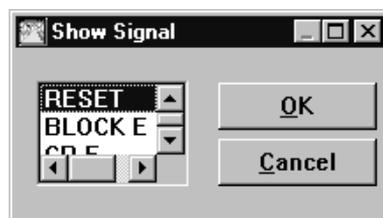


Fig. 29 The show dialogue box.

Edit/Colour

- 1 Select **Colour** to change the colour of a selected signal. If no signal is selected, the choice is disabled.
- 2 A list box is shown, see Fig. 30. A colour is selected by double-clicking on the colour in the list, or press **OK**.

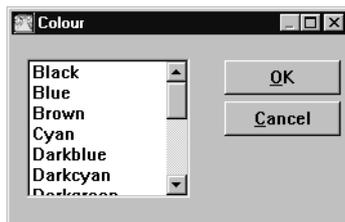


Fig. 30 The colour dialogue box.

Edit/Linetype

Different linetypes are useful as signs of identification when using a printer without colour.

- 1 Select **Linetype** to change the linetype of a selected signal. If no signal is selected, the choice is disabled.
- 2 A list box, see Fig. 31, is shown. Select a linetype by double-clicking on the selected linetype in the list, or press **OK**.

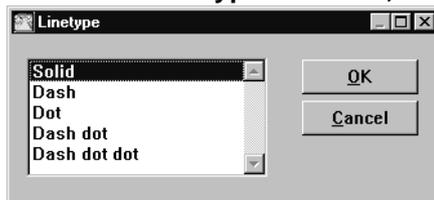


Fig. 31 The linetype dialogue box.

Edit/Template

- 1 **Select Template to display the currently used template for the disturbance file.**
- 2 **In the Template dialogue box the settings currently used for each signal are shown, see Fig. 32. Fields that are grey cannot be edited.**
- 3 **The following data about the signals in the disturbance can be changed:**
 - **The name of the signal:**
The name field is not a part of the template, but is shown as an information to the user. Changes to this field are not saved in the template, but are shown on the screen and when the disturbance is printed. The original name remains in the template when the file is opened the next time.
 - **The channel number:**
Describes in which channel position the signal is placed. The channel number can not be altered in this dialogue box. To change the channel number the user has to move the signals in the disturbance window. The channel number is however part of the template.
 - **The height of the signal:**
Expressed in% of maximum height. This choice is only changeable for the analog signals.
 - The colour of the signal.
 - The linetype representing the signal.
 - **The visibility of the signal:**
Indicates whether the signal is shown on the screen or not.

The different settings that are changeable in the template are connected to the signal names A1-A33 and D1-D144, not to the names Ur, Us, Ut etc. This means that if you change the colour of signal A3 to, e.g. green and save your template, signal A3 will be green for every disturbance file you are evaluating when using this specific template.

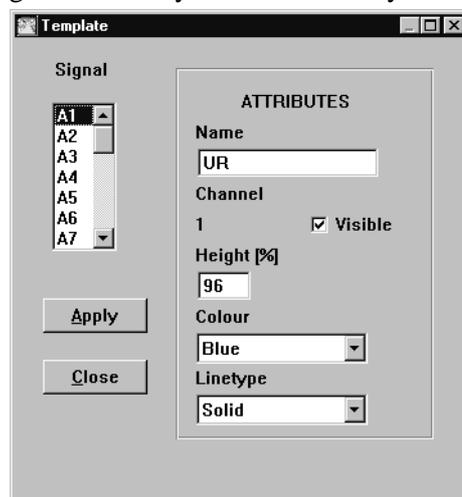


Fig. 32 The template dialogue box.

4.2.1.4

The view menu

This menu enables changing the presentation of the screen such as scaling the disturbance and activating the measuring function. The commands are described below.

View/Comment

Comment invokes an editor which presents the comment part corresponding to the active disturbance. The user may freely add or delete text. The text is stored in a separate file, using the appropriate file name extension.

The header information can be included in the comment part, by selecting **File/Include header** in the comment window. In this case the information can be freely edited. This will not affect the header information of the disturbance recording, i.e. the header part will keep its original text.

View/Header

Header presents the header information for the active disturbance in a text window, see Fig. 33. Depending on the format of the disturbance file, the contents of the header differs. The header information cannot be changed.

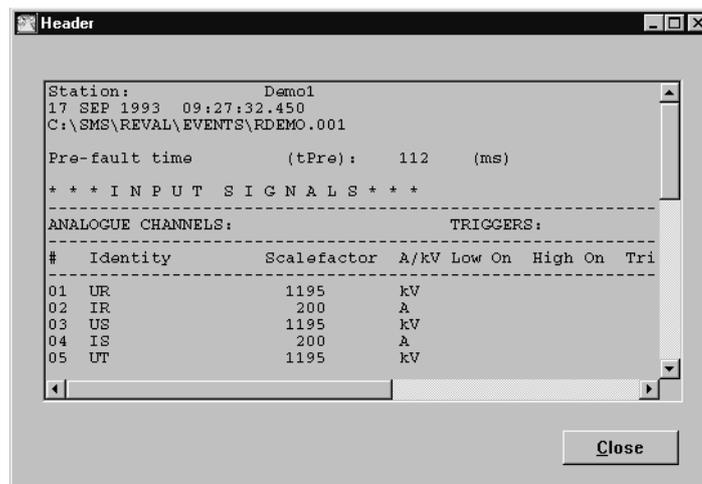


Fig. 33 The header window

View/Home

- 1 Select Home to move the visible screen area to the leftmost point of the disturbance graph. This is useful when using the horizontal scrollbar.

View/Go to trigger point

- 1 Select **Go to trigger point** to move the visible screen area so that the trigger point of the disturbance is placed in the middle of the screen. Normally, this is a much faster way of finding the trigger point than using the horizontal scrollbar. **Go to trigger point** can also be initiated from the **Toolbar**.

View/Go to Time

- 1 Select **Go to time** to move the visible screen area to the time entered in the **Go to time** dialogue box shown in Fig. 34. The time entered in milliseconds is placed in the middle of the screen.

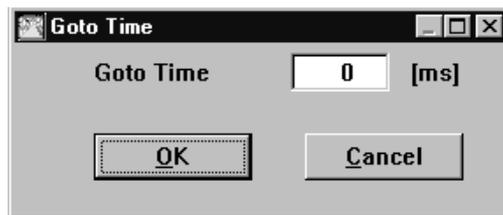


Fig. 34 The go to time dialogue box.

View/Zoom

- 1 Select **Zoom** to show a dialogue box, see Fig. 35, in which the part of the total disturbance to be displayed on the visible screen area can be entered. The zoom factor is entered in percentage of the total disturbance.

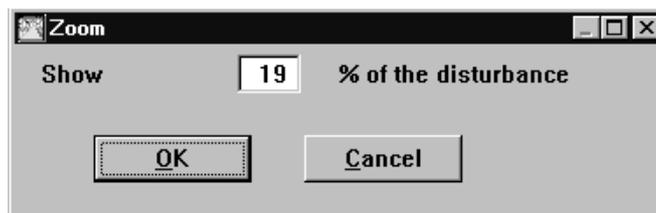


Fig. 35 The zoom dialogue box.

View/Zoom in

- 1 **Select Zoom in to expand a small part of the disturbance to fit into the visible screen area. This enables a close examination of a specific part of the disturbance.**
- 2 **Zoom in can also be initiated from the Toolbar.**
- 3 **Scaling is performed step by step.**
- 4 **The reverse function is activated by Zoom out (see below).**
- 5 **If the measuring function is active when pressing Zoom in, one or both of the vertical lines may be placed outside the visual area. The measuring lines are made visible again by re-activating the measuring function, i.e by pressing Measure twice.**

View/Zoom out

- 1 **Select Zoom out to present a larger part of the disturbance graph in the visible screen area.**
- 2 **Zoom out can also be initiated from the Toolbar.**
- 3 **The reverse function is activated by Zoom in (see above).**
- 4 **If a larger part of the disturbance is shown on the screen, the number of samples to be shown may exceed the number of pixels of the screen, i.e. the resolution of the screen. When this happens the zoom indicator in the upper right corner of the disturbance window turns red to notify the user that the presentation of the signals may be distorted.**

View/Measure

Selecting **Measure** results in that one solid and one dashed vertical line is shown in the graphic area, see Fig. 36. The solid line is a reference line, and the dashed line is a measuring line. Both lines are moveable:

1 Move a line by positioning the cursor on the line. Hold down the mouse button and drag the line to desired position. Release the mouse button. The line is placed at the nearest measurement sample.

2 The following data is presented on the screen:

- For each channel, the RMS value and the instantaneous amplitude value of the signal in front are presented next to the reference line.
- Next to the measuring line, the instantaneous value of each signal in front is presented.
- The time and angle between the lines are displayed in the Toolbar of the window.

One full cycle, centered around the reference line, is used to calculate the RMS value.

In normal case, the RMS value is calculated without any approximation. However, if the ratio between the sample frequency and the line frequency is not even, the RMS value is interpolated.

If the line frequency is included in the disturbance, the instantaneous value is presented next to the two lines. The graph is presented centered around the line frequency.

An alternative way to activate the Measuring function is to press the **Measure** button in the Toolbar.

The Measuring function is active until **Measure** is selected again in the view menu, or until the **Measure** button is pressed once more. When activated, the measured values are included in the printouts.

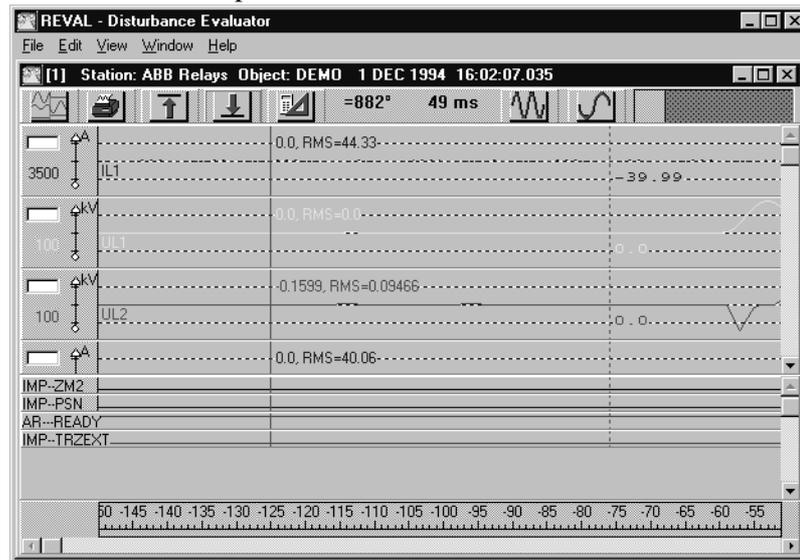


Fig. 36 The REVAL disturbance window with the measuring function active.

View/Toolbar

Toolbar presents some of the different menu commands as buttons. These buttons are presented in Chapter 4.3. One toolbar is connected to each window.

- 1 The toolbar is activated by selecting **Toolbar** in the view menu.
- 2 By selecting **Toolbar** again, the toolbar is hidden from the window.

View/Scale

The scale of the signals can be set to be either equal or individual. Equal scale means that all signals with the same unit will be set to the same scale. This improves the overview of the total disturbance.

Individual scale means that each signal is maximized in the available channel area. This improves the measurement and the analysis of each signal.

After having selected any of the two alternatives, the scale of each signal can be changed individually.

View/Grid

Grid/On activates a vertical grid of dotted lines on the screen as shown in Fig. 37. The grid lines are drawn each 10, 50, 100 and 500 milliseconds, depending on the time scale and the selected zoom factor. When activated, the grid is included in the print-outs.

The grid is deactivated when **Grid/Off** is selected.

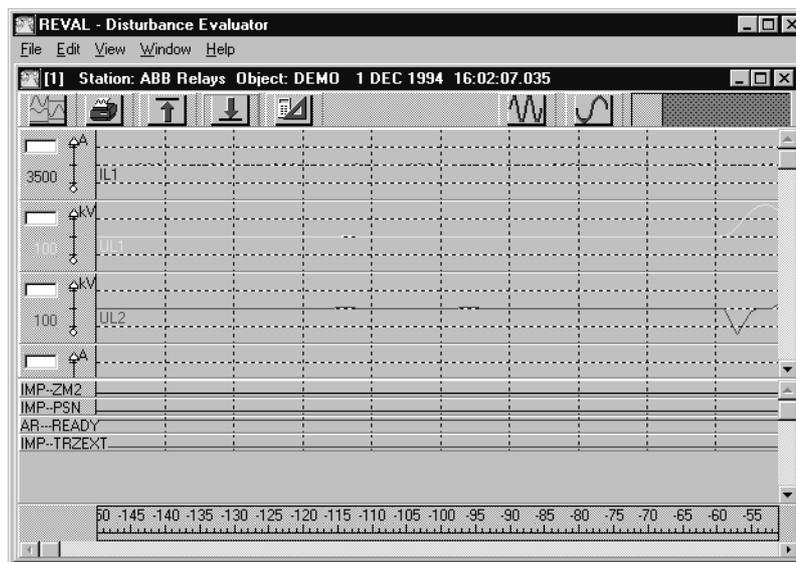


Fig. 37 The REVAL disturbance window with the grid function active.

View/Splitbar Down

Splitbar Down allocates more space for the analog channels, i.e. the splitbar between the analog and the digital channels is moved downwards. **Splitbar Down** can also be initiated from the Toolbar.

View/Splitbar Up

Splitbar Up allocates more space for the digital channels, i.e. the splitbar between the analog and the digital channels is moved upwards. **Splitbar Up** can also be initiated from the Toolbar.

4.2.1.5

The window menu

The window menu enables different window operations such as swap between the opened disturbance windows.

The following commands are available in the Window menu.

Window/Merge

Merge is used to combine two or three disturbance recordings into one logical recording.

- 1 **Select Window/Merge.**
- 2 **The Merge dialogue box is presented, see Fig. 38.**
- 3 **Selects which windows to be merged.**
- 4 **If desired, fill in the time skew in ms between the different disturbance windows.**
If no value for the time skew is entered, the disturbances are merged without any consideration of the time skew.
- 5 **After merging, REVAL presents the merged disturbance in one disturbance window according to the time skew between the different recordings, instead of two or three windows.**

For further information see Chapter 2.3 “Merging disturbances”.

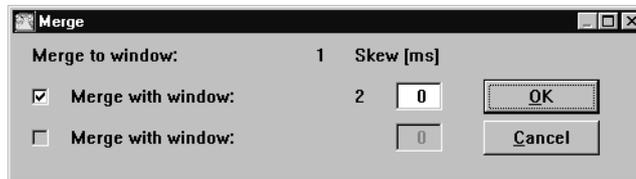


Fig. 38 The merge dialogue box.

Window/Tile

Tile splits the screen between the opened disturbance windows and enables studying of two or three disturbance recordings at the same time, see Fig. 39.

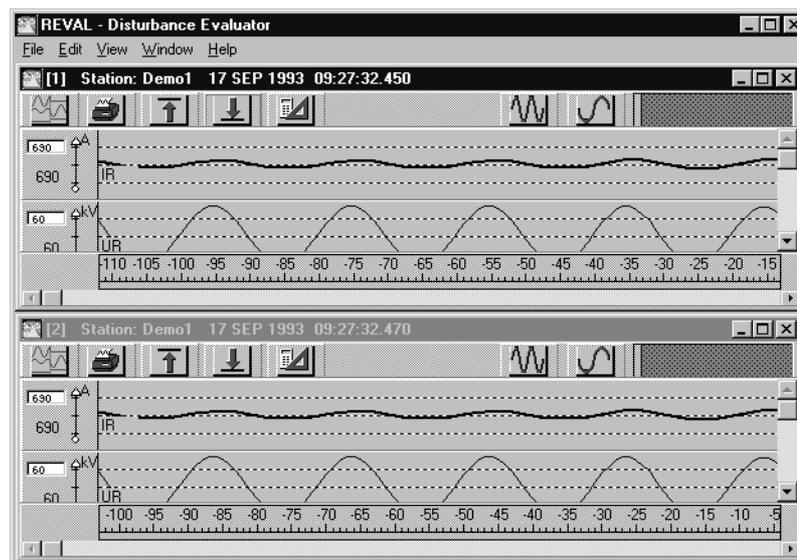


Fig. 39 The screen after the tile command.

Window/Disturbance 1

This command makes the disturbance in window 1 the active one, i.e. the disturbance is shown on top of the other windows.

Window/Disturbance 2

This command is only valid if there are two or three windows opened at the same time, and makes the disturbance in window 2 the active disturbance.

Window/Disturbance 3

This command is only valid if there are three windows opened at the same time, and makes the disturbance in window 3 the active disturbance.

4.2.1.6

The help menu

Selecting **Help** from the menu bar give access to a help system, available at any point in the program. The help system presents guidelines on how to handle the program in all situations.

The following commands are available in the help menu.

Help/Index

Index presents all the different subjects that it is possible to get information about.

Help/Menu commands

Menu commands give information on all the commands in the Menu bar.

Help/Using Help

Using help provides guidelines on how to use **Help**.

Help/About REVAL

About REVAL gives information about copyright and the REVAL version number.

4.3 The disturbance window

The disturbance window is a standard document window with scroll bars, size buttons and a close box as shown in Fig. 40.

REVAL can have up to three disturbance windows open at the same time. Each disturbance window contains one disturbance recording. The disturbance is displayed according to the associated template.

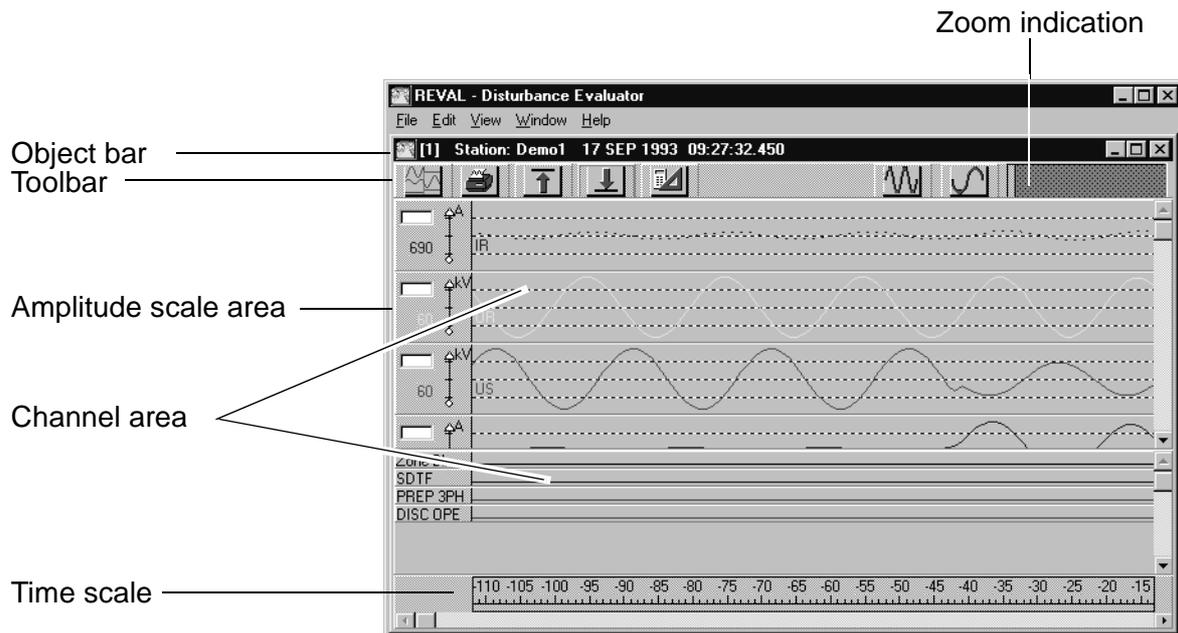


Fig. 40 The REVAL disturbance window.

The disturbance window consists of the following parts.

4.3.1 The object bar

The object bar is placed below the menu bar. It contains:

- The number of the window
- The station name:
The name of the station in which the object is located.
- The object name:
The name of the object in which the unit is located.
- Date and time:
When the recording of the disturbance was made.

4.3.2**Amplitude scale area**

In the leftmost of the window area there are amplitude scales (for analog signals only), one for each channel. They are graded so that a good estimation of the amplitude of the signals can be made (in primary values). The unit of the measured data is also displayed in this area.

The value represent the magnitude value of the dotted horizontal line.

4.3.3**Channel area**

The channel area is where the signals are displayed. The area is divided into two separate windows. The upper window contains the analog channels, and the lower window contains the digital channels. These windows are individually scrollable in the vertical direction, but have a common scroll bar for horizontal scrolling.

If the line frequency is included in the disturbance recording, the graph is presented in an analog channel centered round the line frequency. Frequency recording is an optional function in the disturbance recorders REOR 100/RCRA 100. The frequency is presented as the 11th channel in REVAL.

4.3.4**The time scale**

Above the horizontal scroll bar a time scale is shown. It is graded so that a good estimation of timing conditions is possible. When the time range is altered, the scale alters accordingly. A vertical solid line, indicating when the recording was initiated, i.e. the trigger point, is presented when the disturbance is shown on the screen.

Every change in the sampling rate during the registration is indicated by a dotted vertical line. Information about the changes is available in the header part of the disturbance.

4.3.5**Zoom indication**

In the upper right corner, below the object bar, a zoom indicator is located. The zoom indicator shows how much of the total disturbance graph that is presented in the window.

The zoom indicator is normally gray. However, if a larger part of the disturbance is shown on the screen, the number of samples to be shown may exceed the number of pixels of the screen, i.e. the resolution of the screen. When this happens the zoom indicator turns red to notify the user that the presentation of the signals may be distorted.

4.3.6

The Toolbar

In the Toolbar, which is located above the analog signals, there are shortcut buttons available for the following functions. All of these functions are also available in the view menu.

Go to Trigger Point



Moves the visible screen area so that the trigger point of the disturbance is placed in the middle of the screen.

Print Display



The part of the disturbance graph which is visible on the screen is printed., i.e. the printout is a “print screen”.

Splitbar Up and Splitbar Down



The splitbar between the two window parts can be moved either upwards or downwards.

Measure



Presents the instantaneous and the RMS values of the signals, together with time and phase angle measurement. When activated, the measured values are included in the printouts.

Zoom Out and Zoom In



The part of the disturbance that is shown on the screen can be either compressed, or expanded.

4.3.7

Actions initiated by the mouse

4.3.7.1

Changing the magnitude scale of an analog signal

The value indicates which level the dotted horizontal line for the signal corresponds to. The value can be changed by clicking on the white square, holding the actual value of the scaling. This enables entering a new value into the square.

The signal is rescaled accordingly and is clipped if the value of the signal exceeds the space allocated for that channel.

To present the signal in original size again, enter the original value in the square, or select **Edit/Template** and enter 100% on the line for the signal height.

4.3.7.2 **Changing the channel space**

Change the space allocated for a channel by clicking on the magnitude scale of an analog channel.

- 1 **Click at the arrow head to expand the channel.**
- 2 **Click at the bottom square to compress the channel.**
- 3 **The surrounding channels are moved, giving the expanded or compressed channel the required amount of space.**

4.3.7.3 **Selecting a signal**

- 1 **Select a signal by clicking on the chosen signal. The selected signal is highlighted and clearly marked on the screen.**
- 2 **To deselect a signal, place the cursor inside a channel without pointing at a signal, and click.**

4.3.7.4 **Moving a signal**

- 1 **Move a selected signal vertically by holding the mouse button depressed while moving the cursor. The signal can be moved to two destinations:**
 - to a place between two channels.
This inserts a new channel at the position and places the signal in that channel. The cursor indicates, when it is placed between two channels.
 - to an already existing channel (analog signals only). This creates signal groups.

4.3.7.5 **Change the signal in front**

When using a signal group, the name and the scale of one signal are presented. This is the signal which is at the front in the signal group. By clicking in the scale field of a signal group, the first signal is placed in the back and the second signal is placed at the front, and so on. The name of a signal is placed just to the right of the scale field, displayed with the same colour as the signal itself. Also the magnitude value belonging to the front most signal is displayed with the same colour as the signal itself.

5

Appendix

5.1

The printout of a disturbance

```

Station:          STN 1
Object:           OBJ 1
Unit:             REX5xx   1 DEC 1994  16:02:07.035

```

```

Recording number:  46
C:\SMS\REVAL\EVENTS\94120146.REH
CT-earth:        In
Time synchronization: None

```

```

Pre-fault time      (tPre):  150   (ms)
Post-fault time 1   (tP1):  299   (ms)
Post-fault time 2   (tP2):    0   (ms)
Max. Post-fault time (tLim): 1000 (ms)

```

```

Pre-fault:         U (average RMS) = 102 kV
                   I (average RMS) = 38 A

```

```

Trig signal:       IMP--PSN
Transmission accuracy: 100 %
Fault location:    Not applicable
Line frequency:    50 Hz

```

```

* * * I N P U T S I G N A L S * * *

```

ANALOGUE CHANNELS:			TRIGGERS:				RMS:			CHANNEL:	
#	Identity	Scalefactor	A/kV	Low	On	High	On	Trig Value	Pre	Fault	Active
01	UL1	220/0.110	kV	90	No	110	No	-64	83	81	Yes
02	IL1	2000/1	A	50	No	200	No	1460	33	2288	Yes
03	UL2	220/0.110	kV	90	No	110	No	-69	58	128	Yes
04	IL2	2000/1	A	50	No	200	No	50	36	86	Yes
05	UL3	220/0.110	kV	90	No	110	No	181	35	127	Yes
06	IL3	2000/1	A	50	No	200	No	-50	46	106	Yes
07	U4	220/0.110	kV	90	No	110	No	36	28	54	Yes
08	IN	2000/1	A	50	No	200	No	1450	21	2140	Yes
09	U5	220/0.110	kV	90	No	110	No	0.0	0.0	0.0	Yes
10	I5	2000/1	A	50	No	200	No	0.0	0.0	0.0	Yes

EVENT CHANNELS:		TRIGGERS:			
#	Identity	Setting	On	Value	Trig
01	IMP--ZM2	NO	Yes	Open	
02	IMP--PSN	NO	Yes	Open	Yes
03	AR---READY	NO	No	Open	
04	IMP--TRZEXT	NO	No	Open	
05	FIXD-OFF	NO	No	Open	
06	FIXD-OFF	NO	No	Open	
07	FIXD-OFF	NO	No	Open	
08	FIXD-OFF	NO	No	Open	
09	FIXD-OFF	NO	No	Open	
10	FIXD-OFF	NO	No	Open	
11	FIXD-OFF	NO	No	Open	
12	FIXD-OFF	NO	No	Open	
13	FIXD-OFF	NO	No	Open	
14	FIXD-OFF	NO	No	Open	
15	FIXD-OFF	NO	No	Open	
16	FIXD-OFF	NO	No	Open	
17	FIXD-OFF	NO	No	Open	

Fig. 41 The disturbance header

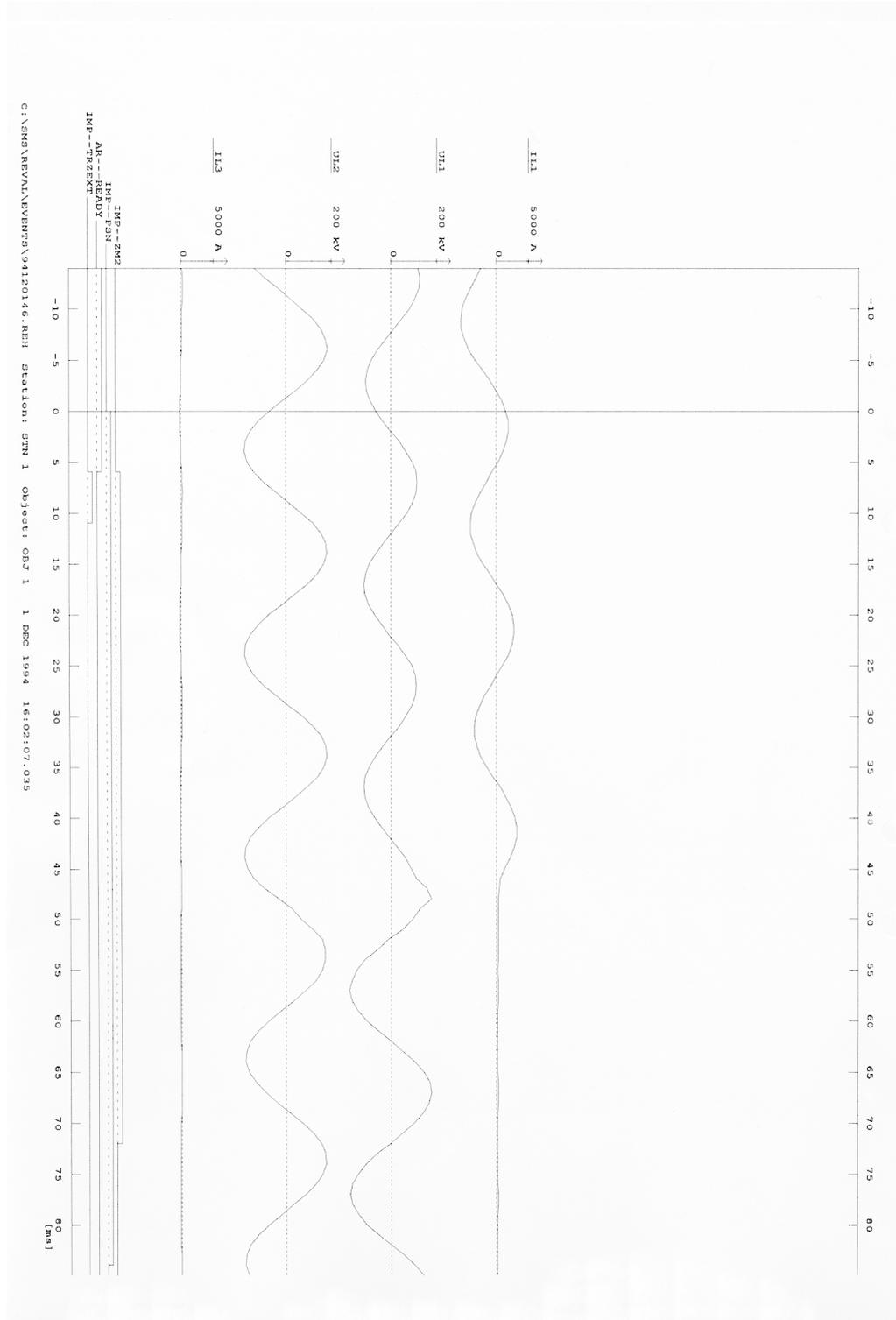


Fig. 42 The disturbance graph

5.2

The REVAL.INI file

The REVAL.INI file contains the lines presented in the following table:

RECOM_DIR=	Specifies the home directory of RECOM in the SMS structure. This is required when performing automatic printouts from RECOM using REVAL.
RECOM_FILE=	Specifies the name of the file (within the directory RECOM_DIR) which contains the last used RECOM directory.
TMPL_DIR=	Specifies the directory where the template files are located.
HELP_DIR=	Specifies the directory where the help texts are located.
AUTOPRI1_NAME=	Specifies the name of the first printer to use, when using the function "Automatic printout".
AUTOPRI2_NAME=	Specifies the name of the second printer to use, when using the function "Automatic printout".
AUTOPRI1_PORT=	Specifies the port of the first printer to use, when using the function "Automatic printout".
AUTOPRI2_PORT=	Specifies the port of the second printer to use, when using the function "Automatic printout".
DEF_DIR=	Specifies the last selected directory in REVAL. Will be used when no RECOM_FILE is available.
DEF_FILE_TYPE=	Specifies the last selected file type in REVAL. 1 = EVE, 2 = REVAL, 3 = COMTRADE, 4 =ASCII, 5 = DADiSP, 6 = MATLAB
DEF_DRIVE=	Specifies the last selected drive in REVAL. 1 = A, 2 = B, 3 = C etc.
EQUAL_SCALE=	Specifies whether equal or individual scaling of the signal shall be used.
INCLUDE SIGNAL NAME=	Specifies whether the signal names shall be included or not when saving the file in ASCII format.
TYPE OF VALUE=	Specifies whether to store the raw values (which are not necessarily equal to the secondary values) or the primary values, when saving the file in ASCII format.
SAVE SIGNALS=	Specifies whether to store the signals in the disturbance file in columns (by value) or in rows (by signal), when saving the file in ASCII format.
ROW SEP=	Specifies the row separator specified by the user, when saving the file in ASCII format.

VALUE SEP=	Specifies the value separator specified by the user, when saving the file in ASCII format.
ROW SEPARATOR=	Specifies the last selected row separator, when saving the file in ASCII format. 1 = Tabulator, 2 = Space, 3 = ; , 4 = Carriage Return, 5 = Own:
VALUE SEPARATOR=	Specifies the last selected value separator, when saving the file in ASCII format. 1 = Tabulator, 2 = Space, 3 = ; , 4 = Carriage Return, 5 = Own:
PRIM_FMT=	Specifies the format of the primary values, when saving the file in ASCII format. Should normally be “ %f “ which means that REVAL follows the format as in the C function “PRINTF” .
RAW_FMT=	Specifies the format of the raw values, when saving the file in ASCII format. Should normally be “ %ld “ which means integer.
PRI_HEIGHT=	Specifies font height. Default value=12.
PRI_WIDTH	Specifies font width. Default value=8.
PRI_WEIGHT	Specifies font weight. Default value=0.
PRINT_DIG_FIRST	Specifies whether to print digital signals first or last. Yes=first, No=last.
PRINT_CONTINUOUS	Specifies printing to use either continuous paper feed, or single sheets. Yes=continuous, No=single.
PRINT_DIG_AS_LINE	Specifies whether to represent the state of digital signals as steps, or shifting from dotted to solid lines. Yes=dotted, No=steps.

5.3

The REVAL format

The REVAL format consists of three different files belonging to the same event. Each of the three types carries a different class of information:

- **Comment file (*filename.TXT*)**

The comment file is created by the user. The data is intended to be printed and read by the user. The user can include any information in any format desired.

- **Header file (*filename.REH*)**

The header file contains among other things, information about the station and information regarding the trigger point. The file is generated by the disturbance recorder REOR 100 / RCRA 100 (ver. 3.0), or the disturbance recorder function in the RE. 500 series protection terminals.

- **Data file (*filename.REV*)**

The data file is a binary file and contains all the sample values in a compressed format. The file is generated by the disturbance recorder REOR 100 / RCRA 100 (ver. 3.0), or the disturbance recorder function in the RE. 500 series protection terminals.

5.4

The COMTRADE format

The COMTRADE format consists of three different files belonging to the same event. All of them are ASCII files. Each of the three types carries a different class of information:

- **Header file (*filename.HDR*)**

The header file is created by the originator of the fault data. The data is intended to be printed and read by the user. The creator of the header file can include any information in any format desired. This file is equivalent to the REVAL comment file (.TXT).

- **Configuration file (*filename.CFG*)**

The configuration file is intended to be read by a computer and must therefore have its data in a specific format. The data in the configuration file is information needed by a computer program in order to properly interpret the transient data.

An example of a configuration file is given below:

```
Station 1 Substation,13<CR,LF>
4,2A,2D<CR,LF>
1,Line 1 Voltage,A,,kV,100.,0.,0.,0,4096<CR,LF>
2,Line 2 Current,A,,kA,100.,0.,0.,0,4096<CR,LF>
1,Trig A,0<CR,LF>
2,Trig B,0<CR,LF>
50<CR,LF>
2<CR,LF>
500,998<CR,LF>
1000,1466<CR,LF>
06/19/92,15:24:36.056451<CR,LF>
06/19/92,15:24:39.005888<CR,LF>
ASCII<CR,LF>
```

- **Data file (*filename.DAT*)**

The data file contains the value of each sample of each input channel. The number stored for a sample is usually the number produced by the device that samples the input waveform. An example of a data file is given below:

```
1,0,003645,006980,0,0<CR,LF>
2,020000,007999,001320,0,0<CR,LF>
.....
.....
..<CR,LF>
```

For further information about the COMTRADE format, see Chapter References, Ref. 3.

5.5

The EVE format

The EVE format is briefly explained below. For further information about the EVE format, see Chapter References, Ref. 3.

EVE consists of an Event data file and a parameter file, PLOT.TXT.

5.5.1 Event Data file

This file is a binary file consisting of two parts:

- **Header part**

The Header part contains configuration information regarding the disturbance. The length of the Header part is 32 bytes plus optional Header extension.

- **Data part**

Following the Header part is the data part. The Data part is arranged into records, where one record contains all data of one channel.

5.5.2 PLOT.TXT

The parameter file contains parameters belonging to the stations where the disturbance recorders are located. The file contains a section for each station. The information in this file is mainly the station names and the signal names. Each section begins with a station number identification line. All following lines up to the next station number identification constitute one parameter section.

The station identification line has the following syntax:

- N : number

The parameter lines follow a common syntax. They all start with a key character in the first column. For REVAL the following parameters are of interest:

- S : { station name, 16 characters }
- D : { digital signal name, 8 characters }
- A : { analog signal name, 8 characters }

For the analog signals there are two switches that are of interest for REVAL:

- /TR { transformer ratio }

The switch /TR describes the value for each U and I signal. The value must be proper real number with decimal point.

For REOR 100 / RCRA 100 ver. 2.2 the following transformer ratios shall be used:

For voltages (kV): $TR = 16 * (\text{Voltage transformer ratio}) / 1000$

For currents (A): $TR = 80 * (\text{Current transformer ratio})$ when $CT_{sec} = 5 A$

For currents (A): $TR = 16 * (\text{Current transformer ratio})$ when $CT_{sec} = 1 A$

- /UN { unit of signal }

The switch /UN is used to assign a unit to an U or an I signal. This value shall be written without kilo, mega, milli etc.

**Note!**

The parameter file *PLOT.TXT* is first searched for at the same directory where the *EVE* file to be opened is located.

If the file *PLOT.TXT* is placed in another directory, the following DOS command must be set, before using the *EVE* format:

- SET EVE=C:*directoryname*

where *directoryname* specifies the name of the directory where the file *PLOT.TXT* is located.

5.6**The DADiSP format**

When selecting the DADiSP[®] format (.DSP) in the “Save As” function, the selected disturbance will be saved in an ASCII format according to the following specification:

- Include signal name: *yes*
- Type of values: *primary values*
- Save signals: *in columns*
- Row separator: *Carriage return*
- Column separator: *Space*

When the .DSP file is created a header part according to the DADiSP[®] format will also be created. This header contains information regarding the signal names, units, number of samples, etc. All characters in the signal names that are invalid in DADiSP[®], e.g. “space”, “:”, and “-”, will be removed in the .DSP file.

For further information please refer to the DADiSP[®] manual.

5.7

The MATLAB format

When selecting the MATLAB[®] format (.MAT) in the “Save As” function, the selected disturbance will be saved in an ASCII-format according to the following specification:

- Include signal name: *no*
- Type of values: *primary values*
- Save signals: *in columns*
- Row separator: *Carriage return*
- Column separator: *Space*

Reference publications

Ref. 1: RECOM Users Guide 1MRK511052-UEN

Ref. 2: EVE Users Manual version 1.0, 1MDU10009-EN.

Ref. 3: IEEE document no. C37.111-1991, IEEE Standard Common Format for Transient Data Exchange (COMTRADE) for Power Systems.

Product:

ABB Automation Technologies AB would appreciate your comments on this product. Please grade the following questions by selecting one alternative per category. Your answer will enable us to improve our products.

How do you grade the quality of the product?

	Excellent				Poor
Total impression	<input type="checkbox"/>				
Useability	<input type="checkbox"/>				
Functionality	<input type="checkbox"/>				
Human-man interface	<input type="checkbox"/>				

Comments: _____

How do you grade the quality of the documentation?

	Excellent				Poor
Total impression	<input type="checkbox"/>				
Layout	<input type="checkbox"/>				
Illustrations	<input type="checkbox"/>				
Readability	<input type="checkbox"/>				
Easy to find	<input type="checkbox"/>				
Content structure	<input type="checkbox"/>				

Comments: _____

Software Registration Form

Program:

This card registers your program and makes you eligible to receive information about future updates.

Name:

Title:

Company:

Dept.

Address:

City:

State:

Zip:

Phone:

Fax:

Program supplied by:

Address:

City:

State:

Zip:

Phone:

Date of receipt of the program:

Program serial Nr:

Fascimile:

Please send this registration card to ABB Automation Technologies AB, Substation Automation, ATCE/SA, Support Line (+46 21 14 69 18).

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Substation Automation
ATCE/SA, Support Line
SE-721 59 Västerås
Sweden**

To be folded

Remove from binder

Tape here

A

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