

Preparation of REVAL files from two line differential protection terminals (REL 561 or REL 551) for evaluation in Mathcad® environment

1 Introduction

Evaluation of disturbance records from REx 5xx protection, control and monitoring terminals is well supported by REVAL evaluation software. There are cases when protection engineer would like to make deeper analyze of disturbance records, especially different recorded analog signals. Many times harmonic analyze is of interest as well as calculation of different quantities, which is in general not supported by REVAL evaluation tool.

Mathcad® from Mathsoft Engineering & Education, Inc. is a valuable tool for such purposes. This article presents the basic steps and gives the most important information on how to prepare the REVAL files for use by Mathcad® software and how to import the relevant information (in form of COMTRADE files) in Mathcad® documents.

2 Preparation of REVAL files

Disturbance records on operation of both REL 561 (551) terminals for the same fault should be saved in PC, and open one after another with the same REVAL window. An example for files L_SIDE.reh and R_SIDE.reh is presented in Figure 1.

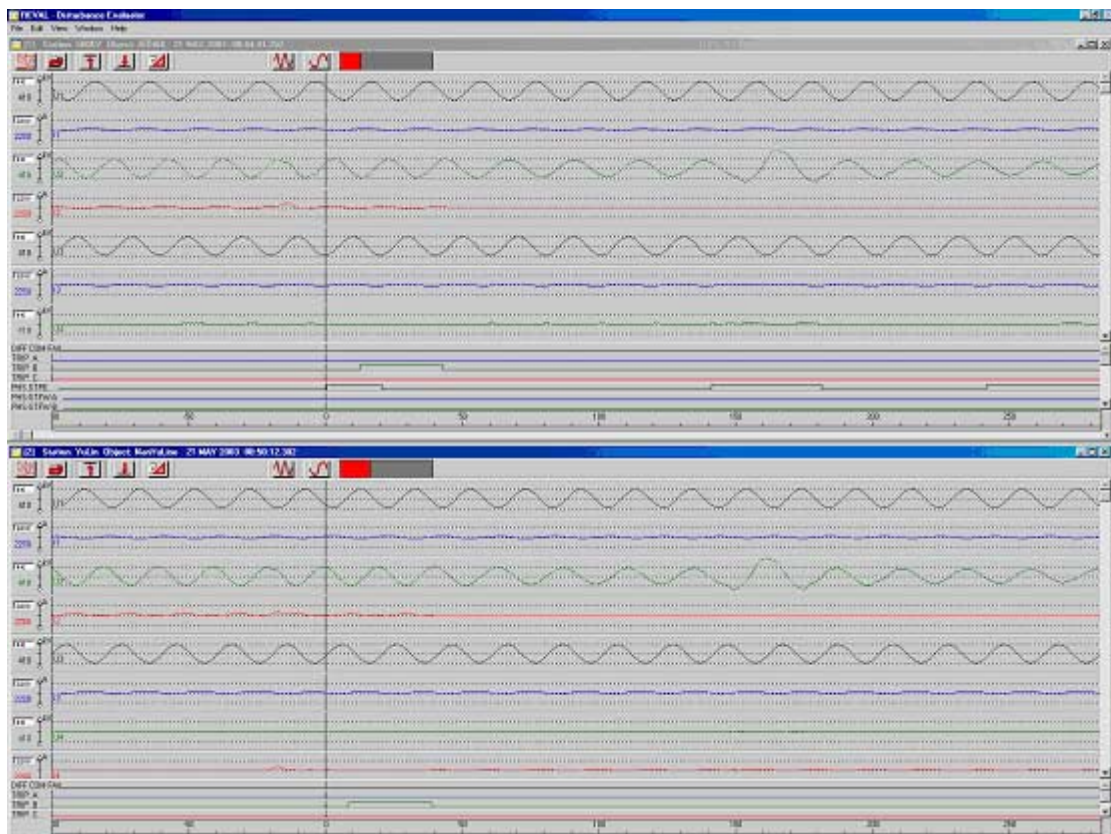


Figure 1: Two disturbance records from two REL 561 terminals within the same REVAL window

Press "Window" in REVAL and select "Merge" action. The selection window as presented in Figure 2 appears. Just select OK and REVAL will automatically merge all analogue and binary signals in one common presentation window. Analogue signals from first record appear on the top, following by analogue signals from the second record, all binary signals from the first record and binary signals from the second record.

Within this merged record select now the same types of analogue signals, which have significantly expressed a certain change, like the begging of fault or similar, which is common for both terminals.

Appearance of residual current or voltage as a big changes in phase currents or voltages at both line ends can be selected in many cases. Figure 3 shows a zoomed presentation of residual currents for the case from Figure 1. Observe that it is possible to move different signals close to each other by dragging them and dropping to the selected position. Measure the time between big changes in both signals. In case of Figure 3 it shows 4ms.

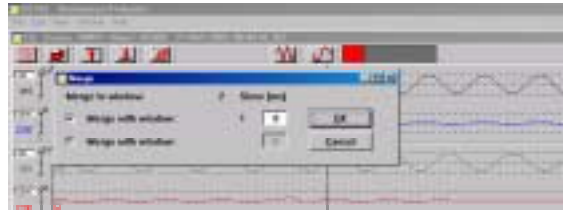


Figure 2: After pressing "Merge" an auxiliary window appears in REVAL tool

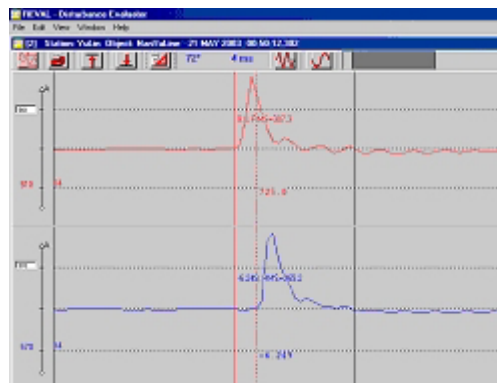


Figure 3: Comparison of residual currents from both REL 561 terminals for the same line fault.

Close the REVAL window and do not save the result. Open the same two files in REVAL again and execute the "Merge" command. In "Merge" window enter the measured time difference (4ms in our case) into the "Skew" window and press OK. In new merged file both signals start at the same moment, as presented in Figure 4. Under File menu in REVAL select "Save as" and under file type select "Comtrade". In corresponding window type the name of new file (in our case L_R_SIDE.CFG) and press OK.

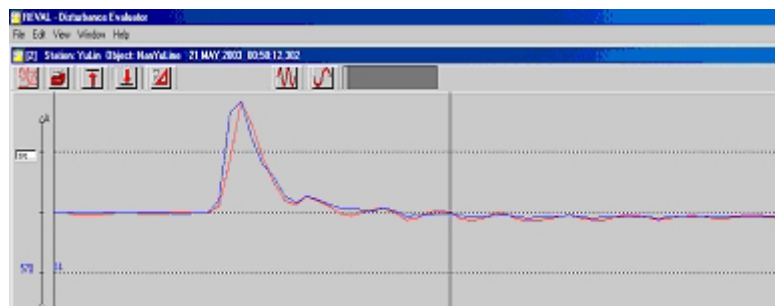


Figure 4: Signals of residual currents after "Skew" adjustments secures that all analogue signals from both terminals are adjusted to the same reference time

3 Adjustment of the saved Comtrade file

Two COMTRADE files are formed by saving, L_R_SIDE.CFG and L_R_SIDE.DAT. Mathcad® cannot read directly the L_R_SIDE.CFG file. It is for this reason necessary to simply rename it under file manager to L_R_SIDE.txt. Older versions of Mathcad® read this file automatically as a text file, but Mathcad 11 reads some parts as strings. It is for this reason necessary to open this *.txt file in Notepad and change the (generally second) row with information on number of signals (total, analogue, binary) to numbers only. Remove A from number of analogue signals and D from number of binary (digital) signals. Save the file under the same name.

4 Reading the COMTRADE files in Mathcad® document

Open the Mathcad® document and place the cursor in position, where the *.txt (*.CFG) file will be imported. Go to "Insert-Data-FileInput" and browse to the selected *.txt file. Be sure that you do not select option "use comma as decimal point", because the text file is comma delimited. Press OK and name the information like presented by CFG in Figure 5.

CFG :=



Figure 5: Appearance of imported *.txt file in Mathcad® and naming by CFG

The values imported in this file correspond to COMTRADE format as presented in Figure 6.

Import of single REVAL disturbance records (for example from one distance protection terminal only) follows the same procedure as described above excluding the "Merge" and "Skew" parts.

	1	2	3	4
1	"YuLin"	0	0	0
2	116	20	96	0
3	1	"U1"	0	0
CFG- 4	2	"I1"	0	0
5	3	"U2"	0	0
6	4	"I2"	0	0
7	5	"U3"	0	0

Figure 6: Part of a CFG matrix as it appears in Mathcad

Import the same way also the *.dat file and name it accordingly. After this it is possible to start working with all imported data using different possibilities within the Mathcad software.

For more information please contact: