POWERFACTORY

# PowerFactory 2021

## Technical Reference

**Measurement File**
ElmFile

PF2021

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# Contents

# 1   General Description

The Measurement File (*ElmFile*) is used for reading data from a file during calculation. The data read can be accessed using output signals *y1..y24*. A typical application is to read measured data from the file and set active and reactive power of a load. The values read from the file can be re-scaled with a proportional factor and an offset. The approximation between two consecutive values is by default linear, however can be disable to be consider as constant values.

There are two different file formats for the Measurement File model. These are the Measurement File and the COMTRADE file. In the following 'data file' denotes either the measurement or the COMTRADE file.

## 1.1   Measurement File Format

The measurement file is a simple ASCII file with a column for every variable. Therefore the file is editable with every ASCII editor. Although the file format is not a common standard it can easily be created using the export functions of spreadsheet programs. Here are the first lines of a measurement file.

```
5
-0.020000    0.000000    0.000000    0.000000    0.000000    0.000000
-0.010000    0.000000    0.000000    0.000000    0.000000    0.000000
0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
0.005500    0.435995    0.001297    0.898800    1.139681    6.691059
0.012597    0.448618    0.004374    0.896480    1.643522    6.769249
0.022597    0.472649    0.009146    0.891938    1.646332    7.113850
```

The file format must fulfil the following criteria:

- Variables are stored in columns

- Number of variables is set in the first line (excluding time)

- First column is time

- Columns are separated by blanks, tabstops or commas

- Number of columns is constant

- No empty lines

- Decimal separator is always '.' independent of system settings or language

- Numbers in floating point or scientific notation

- No digit grouping symbols in numbers

- The number of characters in a line must not exceed 1024

Unlike the COMTRADE file the measurement file does not need a configuration file. Only data values and the number of columns are stored in the measurement file. No additional data like variable names or date and time can be stored in the measurement file.

***Note:*** The *ASCII Result Export* command has the option to export *Measurement Files*.

## 1.2   COMTRADE File

COMTRADE is the abbreviation for 'Common format for transient data exchange'. This is a standard file format for exchanging data between programs or measurement systems. There are several revisions of the standard, the COMTRADE file import is based on the following revisions:

- IEEE C37.111-1191

- IEC 60255-24; First Edition 2001-05

The data is always defined by two files. These are the data file and the configuration file. The configuration file stores information like date and time of measurement, signal names, signal types (analog or digital), ratio of transducers and more. The data file contains just numbers with the measured data. To read and calculate the values from the data file the configuration file is required always. Both, the configuration and the measurement file, shall have the same filename differing only by extensions that indicate the type of the files. Both files should be stored in the same directory. Therefore it is not required to specify the name of the configuration file in *PowerFactory*. The name is created automatically from the name of the data file. The file extension are:

- *cfg: Configuration file

- *.dat: Data file

The corresponding configuration file for a data file named 'sample1.dat' is 'sample1.cfg'. For a more detailed information about the COMTRADE standard please refer to the standards listed above.

*Note:* Like the data import described here the command *ASCII Results Export* has the option to handle COMTRADE files.

## 1.3   Operation

### 1.3.1   Basic

Values are read from the data file during simulation and are assigned to the output signals *y1...y24*. The following plot is an example for a signal which was read from a data file:
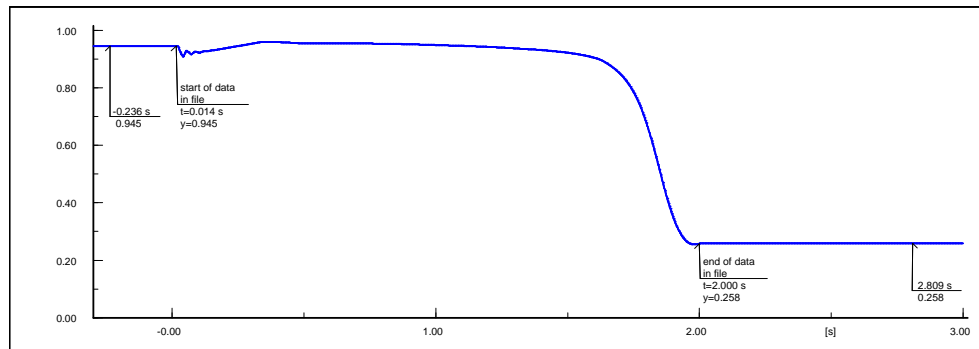
Figure 1.1: Plot file input

Table 1.1: Special cases and their causes

| Special Case | Caused by |
|---|---|
| Output is always 0 | Selected variable *index (icol)* exceeds number of variables.<br>Or in case of reading a measurement file:<br>The number of variables defined in the first line of the file is smaller than the number of columns excluding time column. |
| Output is constant up to a certain simulation time | Starting time of simulation is smaller than time stamp of first sample in data file. See figure 1.1 |
| Output is constant after a certain simulation time | Simulation time exceeds time of last sample in data file. See figure 1.1 |
| The following error message is displayed: DIgSI/err - time-axes in measurement-file filename must be strong monotonous (line n)! | Consecutive lines in the data file with identical or decreasing time stamps were found. The simulation will continue but the error message has to be confirmed. |
| The data file can't be overwritten after using it in a *PowerFactory* calculation | The data file is still used by *PowerFactory* for calculation. Reset the calculation to release the file. To reset press either the icon *Reset Calculation* or choose *Reset Calculation* from the Calculation item in the main menu. |
| The output is the expected value multiplied by a factor. | COMTRADE files according to standard IEC 650255-24 only:<br>'P or S' ('prim') is set to 'P' but the expected values are secondary.<br>'P or S' ('prim') is set to 'S' but the expected values are primary. |

### 1.3.2   Conversion from Data File to Output

A data file contains several variables. They are linked to the output signal using the variable *icol*. The first column in the table of the dialog box specifies the variable index in the data file. The variable *index* starts with 1.

Measurement files only: The first column in the file is the time, therefore the variable index is

equal to (column number -1).

Every single variable can be scaled using the following formula:

$$y_i = a \cdot x_i + b$$

with:

- $y_i$: output value (y1..y24)
- $a$: scaling factor (parameter a in table)
- $x_i$: value read from file
- $b$: offset (parameter b in table)

*Note:* Do not confound the parameters and with the parameters used in the analog channel definition of the COMTRADE configuration file. They are completely independent from the values set in the table.

**Primary and secondary values in COMTRADE standard IEC 650255-24:** Configuration files according to COMTRADE standard IEC 650255-24 store information about the voltage or current transformer ratio for analog channels. A primary and a secondary transformer ratio is stored in the configuration file. An identifier in the configuration file indicates if the value read from the data file is a primary or secondary value. Using the indicator and the ratios a primary or secondary value can be calculated. Please refer to the COMTRADE standard for more information.

The column P or S (parameter *prim*) in the table specifies if the output is to be the primary or the secondary value. *prim* is completely independent of the identifier in the configuration file.

# 2 Input/Output definition of the Dynamic Model

The output signals are named from *y1* to *y24*. The assignment from the column in the file to the output signals *y1-y24* is user defined (*icol*). Therefore it is possible to read measurement or COMTRADE files with more than 24 columns or variables.

# 3 Example Configuration

In the example the active and reactive power of a load are defined by a measurement file. P and Q of the load are set using the input signals *Pext* and *Qext*. The output signal *y1* of the measurement file model is connected to *Pext* of the load. *y2* is connected to *Qext*. P and Q of the load are set to 0 in the Load Flow calculation to get the same load like in the measurement file when starting the simulation.

The simulation result is shown in figure 3.2, where can be seen that the output power from the load correspond to the defined signals in the *ElmFile*.
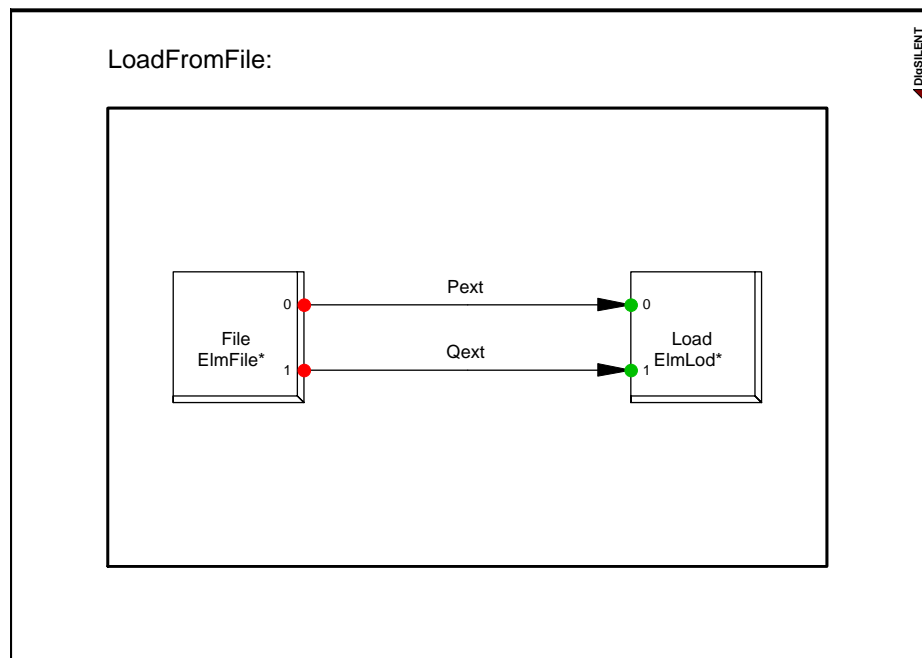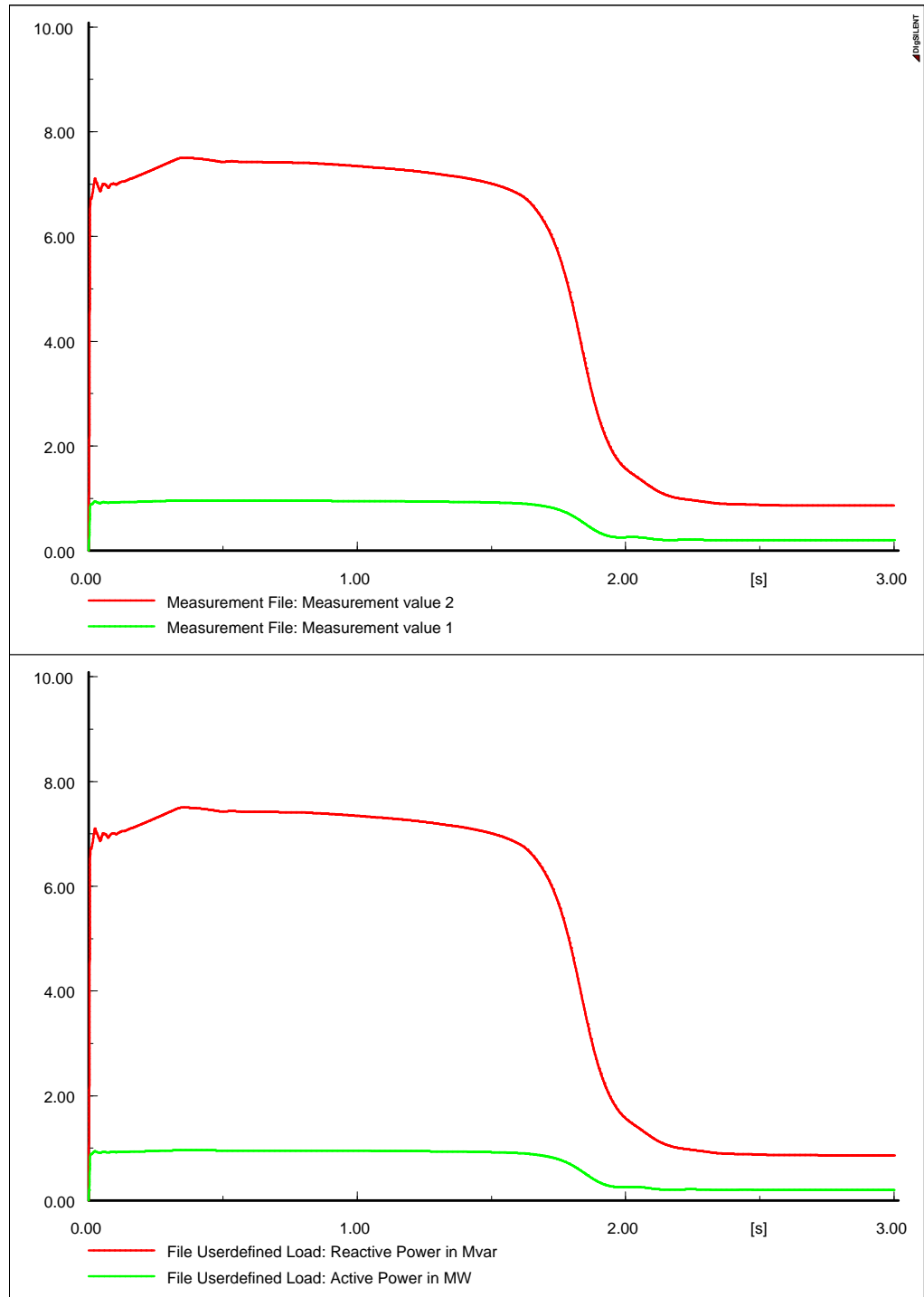
Figure 3.1: Block diagram

Figure 3.2: Plot P/Q

# A   Parameter Definitions

Table A.1: Measurement File Parameters

| Parameter | Description | Unit |
|-----------|-------------|------|
| loc_name | Name | |
| iopt_imp | Import from | |
| f_name | Filename | |
| outserv | Out of Service | |
| icol | Column j | |
| afac | Factor a | |
| bfac | Factor b | |
| prim | P or S (COMTRADE IEC 650255-24 only) | |
| tini | Time index | |
| approx | Approximation | |

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