



Power System Engineering and Software

On-Line Compliance Verification with DIgSILENT GridCode

DIgSILENT GridCode v2.3

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1. Adding Value to Permanent Monitoring

DIgSILENT has developed a new verification tool called DIgSILENT GridCode. The software has been designed in response to the need to verify whether a conventional or renewable power plant is compliant with local Grid Code interconnection requirements on basis of generating unit tests.

There is a new trend towards verification of requirements at the point of interconnection by permanent monitoring. Often, these registers are simply stored and never used or analyzed or worse are kept in the monitoring device until overwritten by new ones.

In this new optic, DIgSILENT GridCode can now be **integrated into existing monitoring** systems to offer **added value in post-processing** the registered events automatically and **report the compliance** to the person in charge.

Huge benefits can then be extracted for network **operation** and **planning**, not only in a point-to-point analysis but, as the results are stored in a database, important **systemic** and statistic results can be highlighted.

Access to results and reports are very easy via a **web interface**; **Email alarms** can be sent in case of no compliance or important event.

Among many others, DIgSILENT GridCode compliance verification functions are:

Low Voltage Ride Through (LVRT) and High Voltage Ride Through (HVRT): Verification of generator response during balanced and unbalanced event, verification of voltage support requirements during the event and after event clearance, supervision of power plant non-disconnection and/or supervision of active and reactive power recovery according to the user selected grid code.

DIgSILENT GridCode includes the verification of compliance according to the following Grid Codes:

- Australia (NEM).
- China (CEPRI).
- Denmark (EnergiNet).
- ENTSO-e grid code (Types B, C, D for conventional generation, wind power plants, offshore power plants).
Conventional generation, wind power plants, offshore power plants.
- Germany (EEG2009 – SDL+Transmission, Transnet).

- IEC 61400-21 Ed 2.
- South Africa (Eskom).
- Spain (REE).
- England (NGC).
- US (FERC).

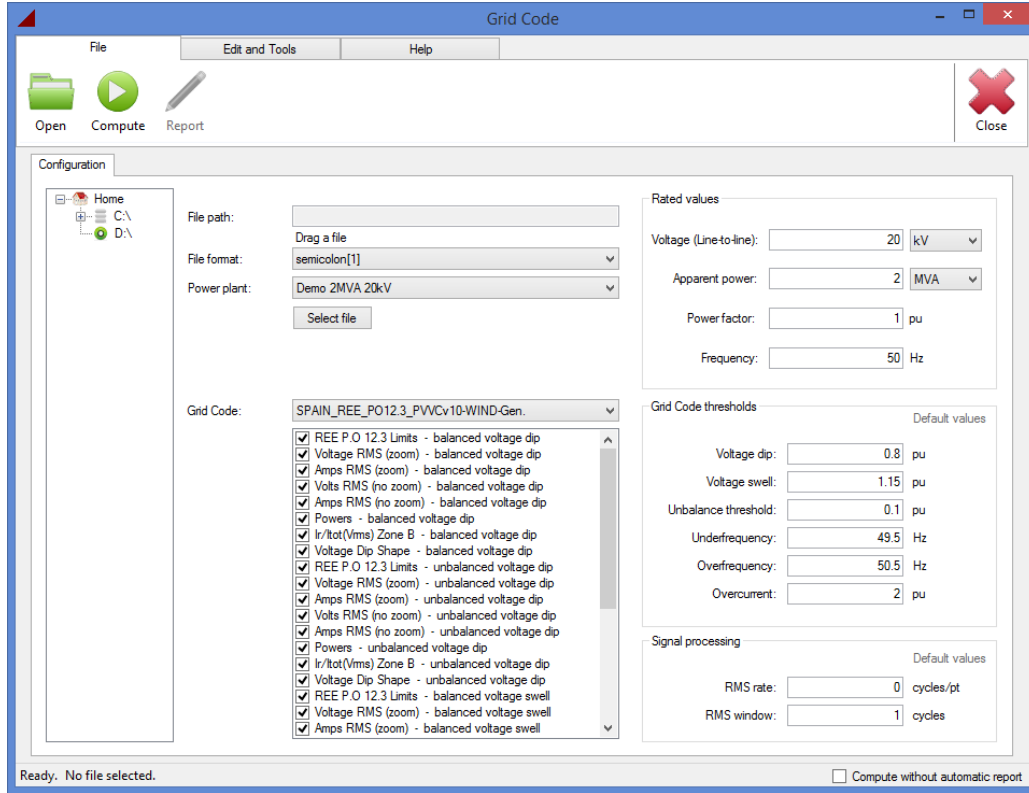


Figure 1. "Check Grid Code Compliance" Tool

2. Automatic On-line Compliance Verification

There is a new trend towards verification of requirements at the point of interconnection by permanent monitoring. In this new optic, DIGSILENT GridCode can now be integrated into existing monitoring systems to offer added value in post-processing the registered events **automatically** and report the compliance to the person in charge.

The automatic “Check Grid Code Compliance” feature implemented in DIGSILENT GridCode allows to automate the grid code compliance analysis.

It runs DIGSILENT GridCode as a Windows Service periodically checking folders for new event records.

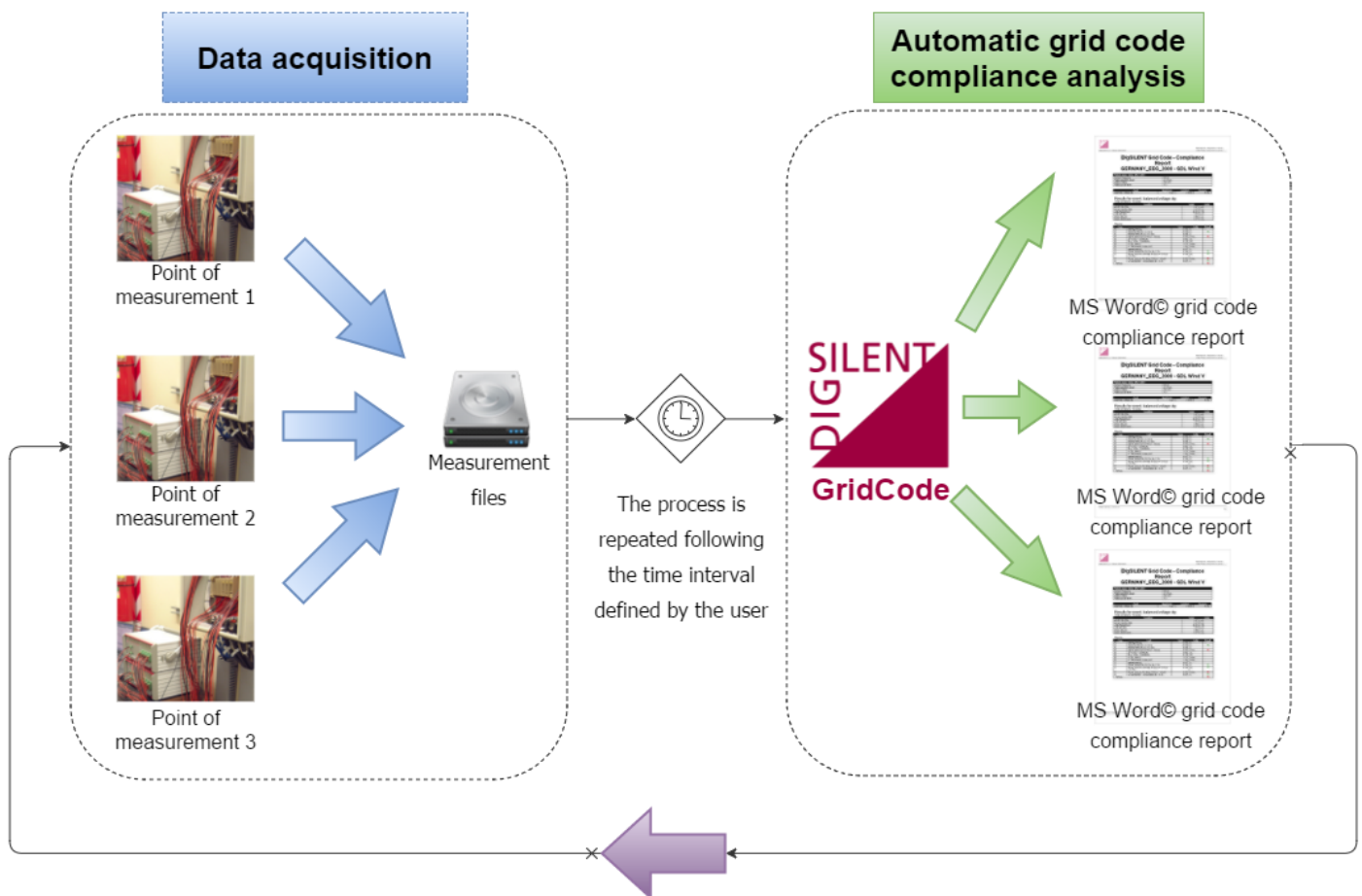


Figure 2. Automatic “Check Grid Code Compliance” process

The sole task that the user has to do is setting up the site parameters:

- Rated values (voltage, power, frequency, etc.) of the signals obtained from the measurement devices.
- File format and measurement channels of the files generated by the measurement device.
- Selection of one of the grid codes included in DIgSILENT GridCode
- Folder where the measurement devices store the event files.

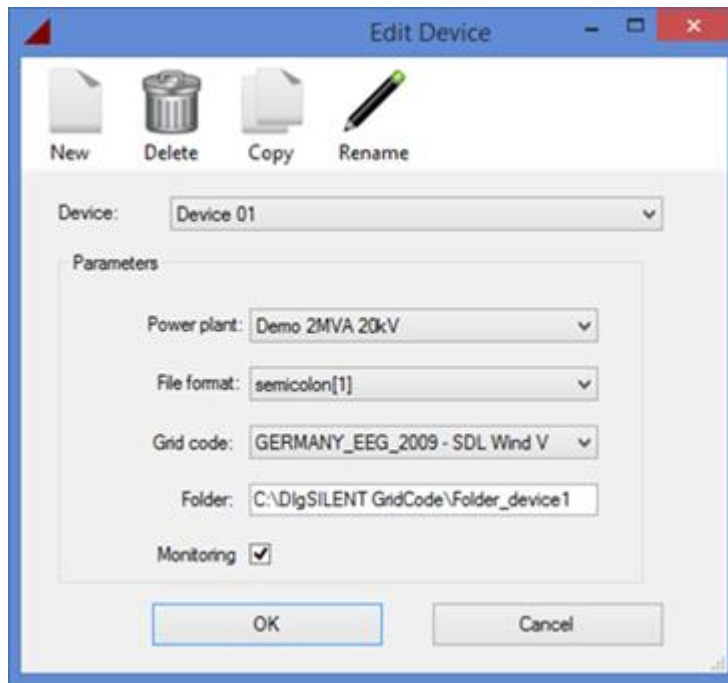


Figure 3. Site definition

This task has only to be performed once as all the site parameters are stored in the database.

DIgSILENT GridCode starts automatically a grid code compliance analysis of the new measurement files and generates a MS Word© report with the results of the analysis. The path to the report and some of the results of the event are stored in the DIgSILENT GridCode's database in order to allow the users to query it through the interface.

Reports can be accessed directly via the application or via web interface.

Type	Magnitude	Duration	Phases	Event date	Analysis date	Report
- SDL Wind V unbalanced voltage dip	0.352525252525252	0.125	B	08/02/2016 17:15:41	17/02/2016 18:37:30	C:\DigSILENT GridCode\Folder_device1\GERMAN
GC balanced voltage dip	0	0.453	A B C	17/02/2016 17:29:32	17/02/2016 18:37:35	C:\DigSILENT GridCode\Folder_device3\UNITED
- SDL Wind V balanced voltage dip	0.221104948388847	0.559	A B C	08/02/2016 16:28:58	17/02/2016 17:36:39	C:\DigSILENT GridCode\Folder_device1\GERMAN
GC unbalanced voltage dip	0.512528586868686	0.288	A	17/02/2016 16:33:15	17/02/2016 17:36:44	C:\DigSILENT GridCode\Folder_device3\UNITED

Figure 4. Events result list

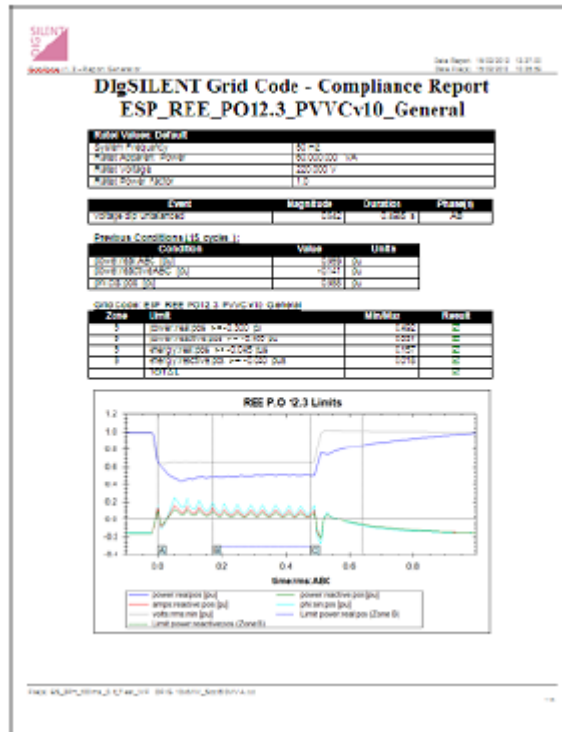


Figure 5. Report

3. Integration in Existing Monitoring System

DIGSILENT GridCode can read and process many different file types (ASCII and binary, COMTRADE, etc.) and therefore **does not require specific measurement devices**; existing devices can perfectly be integrated as long as they can export their files to a folder accessible to DIGSILENT GridCode.

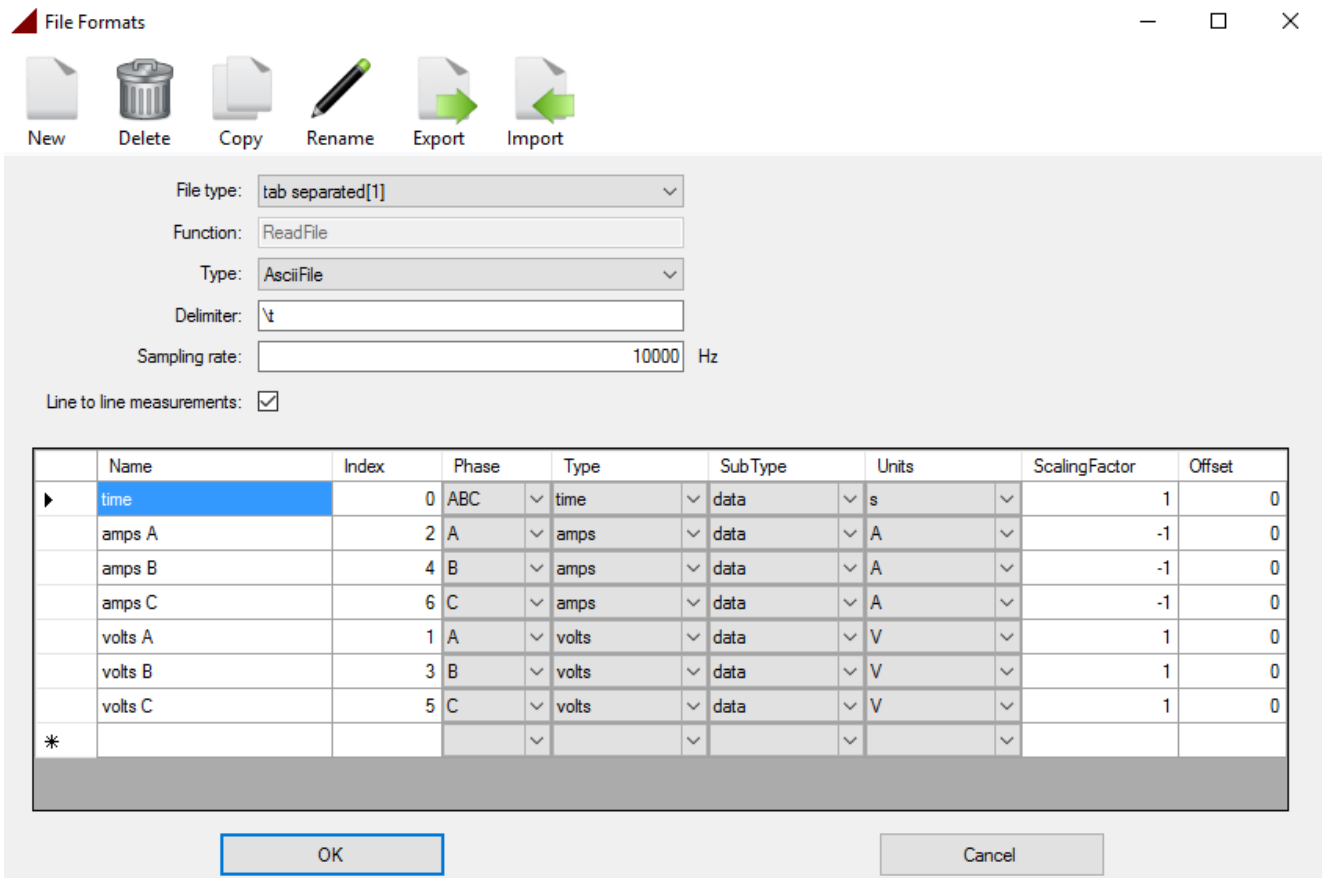


Figure 6. DIGSILENT GridCode File Format Configurator

4. Alarms and Warnings

The “Check Grid Code Compliance” tool is designed to check the behavior of a conventional or renewable power plant during events like voltage dips and the fulfillment of any country-specific requirements.

In case of no compliance, for instance the installation is not injecting reactive current as per requirement, the report will indicate it and optionally an alarm can be sent by email.

It is possible to configure to receive warnings by email every time a new report has been emitted by the system.

5. Systemic Approach and Statistics

All the main results are stored in the database: monthly, annual, site reports can be extracted for statistics and planning.

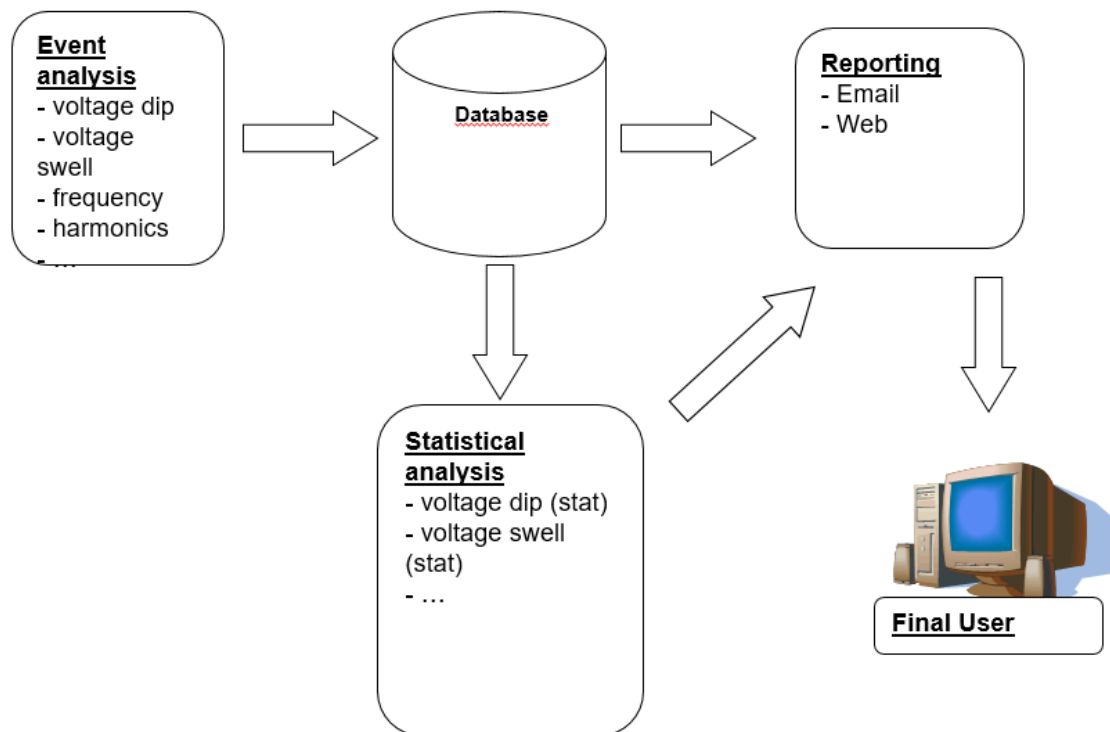
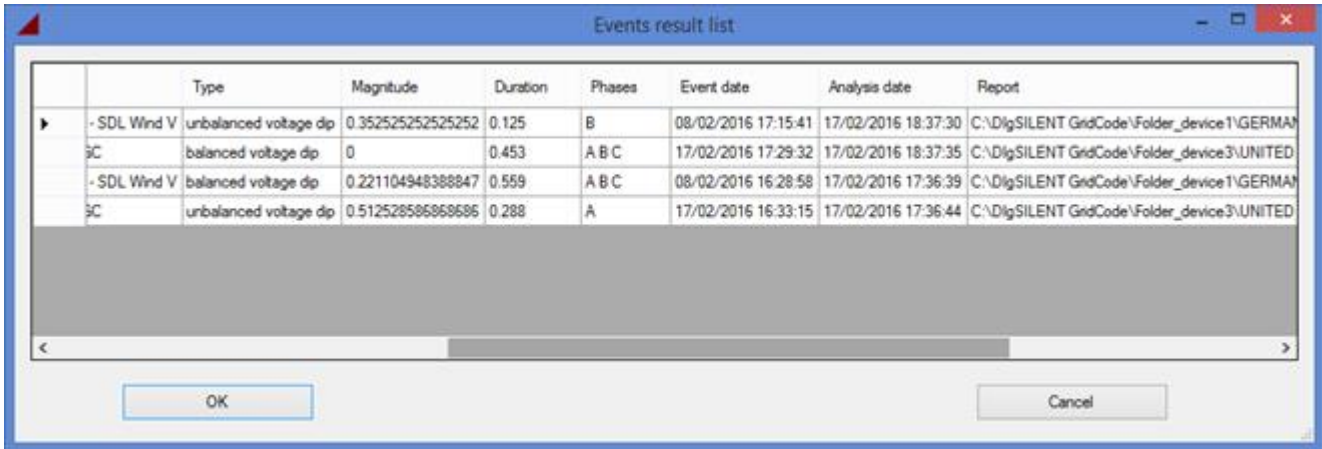


Figure 7. Dataflow and systemic analysis



	Type	Magnitude	Duration	Phases	Event date	Analysis date	Report
▶	- SDL Wind V unbalanced voltage dip	0.352525252525252	0.125	B	08/02/2016 17:15:41	17/02/2016 18:37:30	C:\DIGILENT GridCode\Folder_device1\GERMAN
	gC balanced voltage dip	0	0.453	A B C	17/02/2016 17:29:32	17/02/2016 18:37:35	C:\DIGILENT GridCode\Folder_device3\UNITED
	- SDL Wind V balanced voltage dip	0.221104948388847	0.559	A B C	08/02/2016 16:28:58	17/02/2016 17:36:39	C:\DIGILENT GridCode\Folder_device1\GERMAN
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Figure 8. Events result list

6. System Requirements

The following requirements must be met for the operation of the automatic “Check Grid Code Compliance” feature:

- DIGILENT GriCode must run in a computer under windows vista or higher.
- Microsoft MS Word© must be installed in the computer in order to generate the compliance reports.
- It is necessary to have at least one user logged in the computer to allow the interaction of the service with MS Word©.