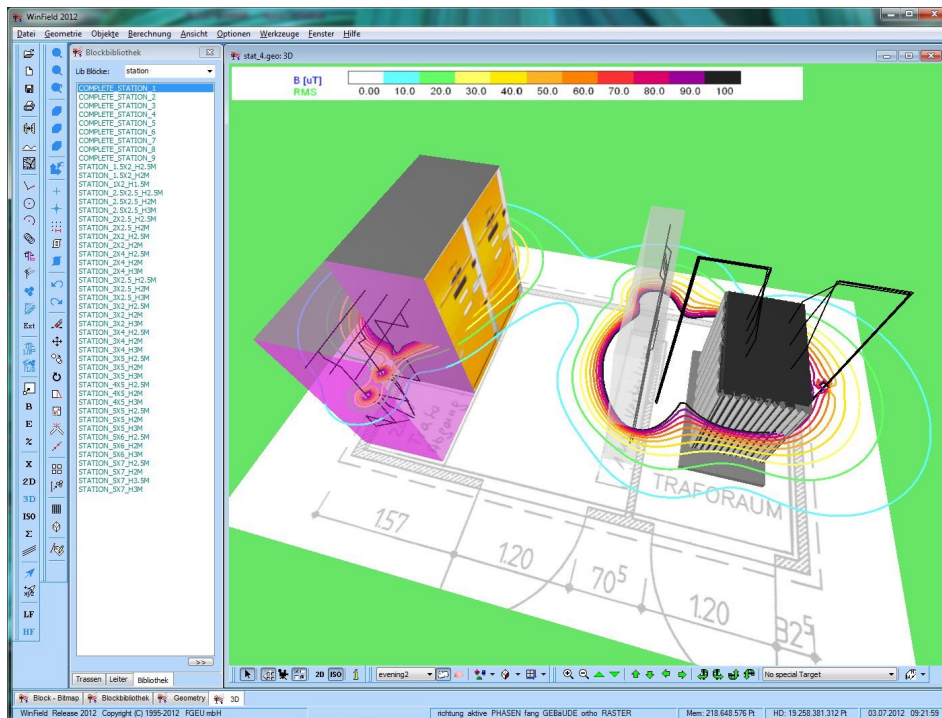


# EFC-400<sup>®</sup> - Simulation Software

## Computation of low frequency electric and magnetic fields

The EFC-400 software has been specially developed for computing the electric and magnetic fields around energy supply installations. The EFC-400ST version is the least expensive alternative for computing the magnetic fields of transformer stations or switching substations. The EFC-400LF version is capable of computing the electric field strength of overhead cables with up to 1000 sections as well as the magnetic flux density. EFC-400PS additionally allows computation of noise emissions and RF interference levels due to corona discharges.

- › Industry standard for low frequency simulation since 1995
- › Maximum strength performance from calculation speed, ease of use, and the practically unlimited number of network elements
- › Maximum cost-effectiveness in use, as users can create and import the necessary network elements themselves
- › Principal users: Energy suppliers and their planning departments, consulting engineers, railroad companies and network regulation authorities
- › Import and interpolation of measurement data
- › All network elements are visible: 3D display → “What you see is what you get”
- › Worldwide user references available from the Narda homepage



## General technical description

Compatibility between the different EFC-400 LF versions is 100% guaranteed at all times because the user interfaces of EFC-400 and "EFC-400 Station" use the same source text.

### 1. Secure investment

Users benefit from the fact that the application has been tried and tested over many years in practical use, so there is no risk in choosing

"EFC-400". The wide distribution of the software ensures long-term development and technical support. Many power utility companies attest to the stability and effectiveness of the product, particularly since the two-year warranty includes a guarantee that EFC-400 delivers the advertised performance.

### 2. Individual network element construction

Users can adapt "EFC-400" to suit individual requirements without being dependent on services provided by the manufacturer. New elements can be added to the basic libraries within a few minutes if this becomes necessary, although the libraries contain more than 5,000 objects. Additional libraries can be accessed free of charge.

If a specific type of element is unavailable, it can be constructed using CAD and saved in the library for later use.

### 3. Module clarity

Because EFC-400 is a construction program, there are no "black boxes": Each element can be edited at will. This means that traceability is always possible for any third party, since they can check the construction and make printouts of the results using the license-free runtime version. EFC-400 does not use any modules that it does not generate itself or which it does not understand.

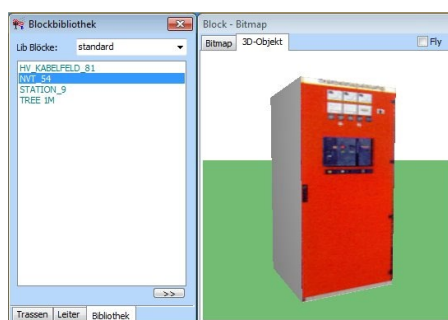


Fig. 1. Component library

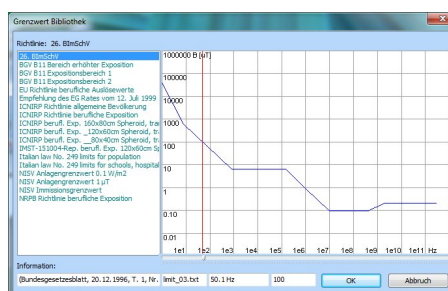


Fig. 2. Integrated limit value evaluation

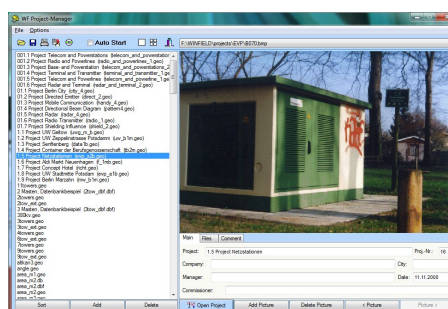


Fig. 3. Project archiving

## Description of Version EFC-400LF

### 1. Simulation of high-tension routes

To simulate high-tension routes, users simply have to select masts and system configurations from a library. If the route is changed, e.g. by moving mast positions, the conductor path is automatically corrected.

### 2. Provision for phase and frequency

Field sources of different frequencies (0 - 30 kHz), such as the overhead wires for long-distance or urban railroads, can be processed with correct phase. Comparison with measured data is possible, with optional interpolation.

### 3. Dynamic memory

The number of simultaneous computation points is only limited by the capacity of the hard disk, and the fast computation speed provides performance that is otherwise only available from workstations. The program includes export interfaces for DXF format or ASCII tables to allow further processing of the data with presentation, statistics and CAD systems.

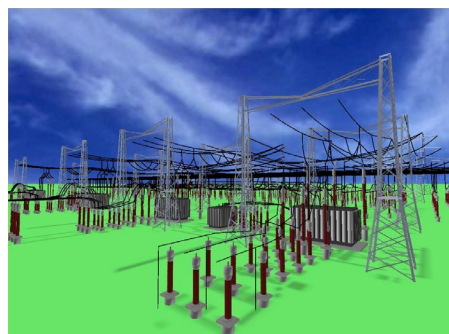


Fig. 4. Magnetic field of a switching substation



Fig. 5. Field computation with interfering objects

## Description of Version EFC-400PS

### 1. Computation of surface field strengths

In addition to computing the ground field strength, EFC-400PS also determines the surface field strengths at 100 points on the surface of every conductor or part conductor segment. These precise surface field strengths serve as the entry data for calculating the noise and RF levels, whereas traditional methods only estimate the surface field strengths using “rule of thumb” formulas.

The six methods used for computing levels correspond to different sources, all of which are based on empirical analysis, and can be user selected. The noise level is determined on the basis of the partial conductor method using the selected formula, in that the noise potential is calculated by scalar addition of the spatial distributions of all the individual segments.

### 2. Representation of noise level at any location

The method used can handle any arrangement of conductors, taking the slack span into account. The procedure is able to cope with the orientation, spacing and surface field strength of each individual segment.

The results are shown as contour lines, just like the electric field strength. The noise level can be read off for every point beneath an overhead cable or within a transformer substation. The results converge towards a limit value as the number of segments increases in the same way as the computation of electric field strength.

The method is implemented for AC and DC.

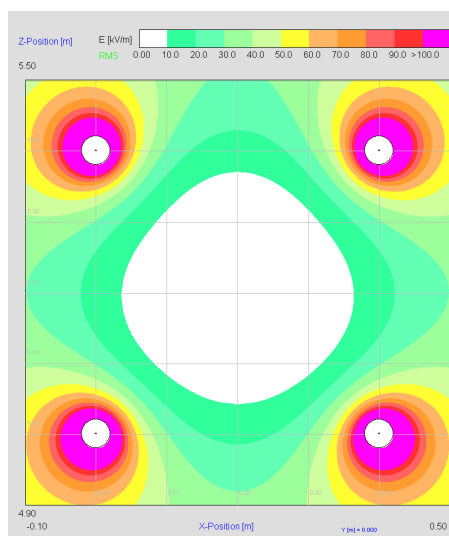


Fig. 6. Four-conductor bundle surface field strength

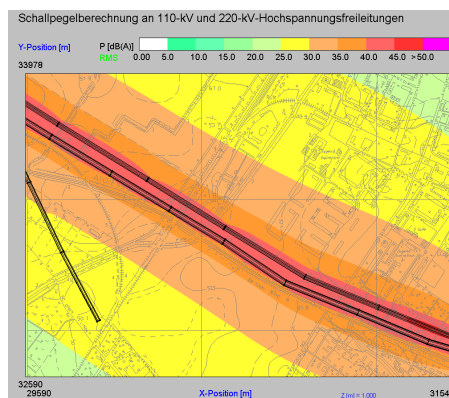


Fig. 7. Noise level computation 1 m above ground

## Comparison table

Product description	EFC-400EP Enterprise	EFC-400LF Low frequency	EFC-400ST Station	EFC-400PS Plus sound	EFC-400TC Telecom
Calculation methods	E, H, B, S, dB(A)	E, B	B	E, B, dB(A)	E, H, S
Frequency range	0 - 300 GHz	0 - 30 kHz	50 - 60 Hz	0 - 30 kHz	1 kHz - 300 GHz
Calculation area <sup>1</sup>	Unlimited	Unlimited	150 m x 150 m	Unlimited	Unlimited
Limit value evaluation in % <sup>2</sup>	•	•	•	•	•
Measurement data processing	•	•	•	•	•
Phase optimization	•	•		•	

## Computation of electric and magnetic fields

Computation according to EN 50413, 26. BImSchV, ICNIRP and EU standards

Power supply lines – according to VDE 0848

Magnetic field computation
Calculation of RMS and peak values and components
Time-dependent field components
Automatic computation of ground conductor currents
Slack span height by classification of segments
Frequency range 0 to 30 kHz
Geometric objects
Maximum 2,000,000 conductors
Maximum 100 power supply and overhead lines
Maximum 1,000 masts
Maximum 100 isolated masts
Maximum 200,000 buildings
Maximum 200,000 blocks
Computation types
Maximum 32,000 x 32,000 points
Computation along a straight line in space
Computation across an area in space
Z axis profile series
Dynamic interpolation of data points
Test according to Kirchhoff's law
Object editing
Clear, simple entry of geometric data
Move, rotate, and insert functions for geometric data
Reusable conductor sections
Poly-line elements, coils, etc.
Library with mast and railroad profiles

<sup>1</sup> Maximum 32,000 x 32,000 calculation points

<sup>2</sup> Limit value evaluation not possible for dB(A)

<b>Data display</b>
X, Y, Z axis diagrams
2D contour line diagrams
3D surface diagrams
Conductor representation
Statistics, histograms
Average, L05, L50, and L95 values
Zoom function
<b>Support for power supply lines</b>
Mast library
User defined masts
Automatic mast segmentation
Replacement of masts in lines
Editing of mast types in lines
System voltage or individual phase voltage
Entry of AL/St/CU conductors
Phase optimization
Conductor temperature taken into account
<b>Integrated tools</b>
Editor, calculator
Paint tool
DXF object filter
<b>Computation of electric field</b>
Up to 100,000 load segments
Ground effects
Gauss-Jordan or Sparse Matrix Inversion
Effects of masts and buildings
<b>System requirements</b>
Intel multi-core 3 GHz Processor, 4 GB RAM, HD 50 GB free space
WIN XP™, Win 7™, Win 8, Win 10
<b>Performance</b>
Maximum 3.000.000 points/sec (Pentium™, 3 GHz)
32-bit runtime version for external computation
Batch job available
Integrated data compression
User interface configuration
User defined colors
Supports True Color graphics

Data interface
Upload of terrain profiles
Import of experimentally determined data
Import of maps in DXF, PCX, JPEG, BMP and TIFF formats
DXF export of contour lines, shadings and geometric bodies
ASCII export (EXCEL™ readable format)
Export of 4D color surfaces
Export / import of dBase™ and Paradox™ files
Bitmap, WMF, JPG, html and CD export

## Ordering information

Model and article names	Part number
EFC-400EP ENTERPRISE – includes all low frequency and high frequency modules	2900/101/*
EFC-400LF LOW FREQUENCY – computes transformer station and high tension lines	2900/102/*
EFC-400ST STATION – LOW FREQUENCY – Limited to transformer station computation	2900/103/*
EFC-400PS PLUS SOUND – Version LF additionally with "corona" noise simulation	2900/104/*
EFC-400TC TELECOM – High frequency module	2900/105/*
(* ) Add suffix for language version: /E Spanish, /F French, /GE German, /I Italian, /UK English	/*
Annual update and upgrade on request only	2900/201 /202 /203 /204

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