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Safety Test Solutions

Datasheet | EFC-400 ST-LF-PS

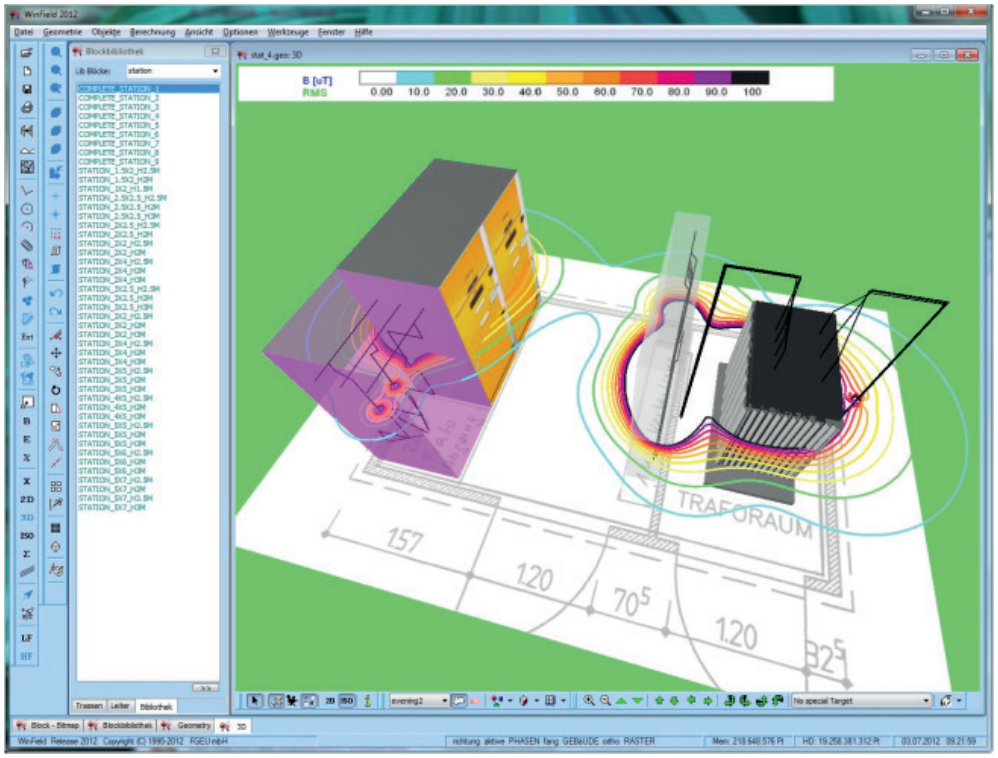
EFC-400® - Simulation Software

Computation of low frequency electric and magnetic fields

Computation according to:
› EN 50413, 26. BImSchV,
› IEC 62232, ICNIRP & EU standards

The EFC-400 software has been specially developed for computing the electric and magnetic fields around energy supply installations. The EFC-400ST (Station) version is the least expensive alternative for computing the magnetic fields of transformer stations or switching substations. The EFC-400LF (Low Frequency) 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 (Plus Sound) 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 website.
› Available as single user hardware key license as well as a multiple user floating network license (see page 8 for more details).



General technical description

Compatibility between the low frequency versions is 100% guaranteed at all times because the user interfaces of EFC-400LF and EFC-400ST are the same. EFC-400PS is based on the field calculation routines and user interface of EFC-400LF, an exchange of data with EFC-400LF and EFC-400ST is therefore ensured.

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.

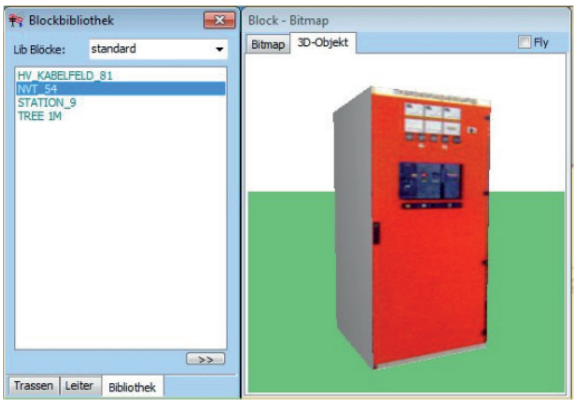


Fig. 1. Component library

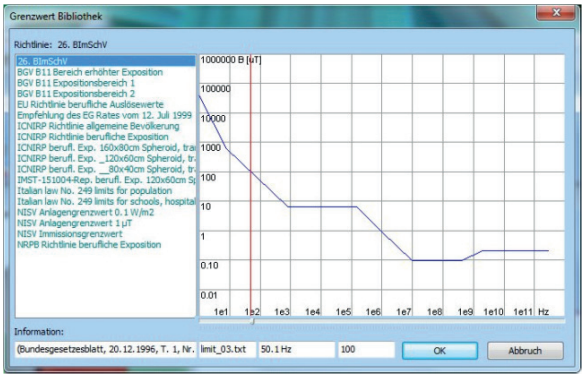


Fig. 2. Integrated limit value evaluation

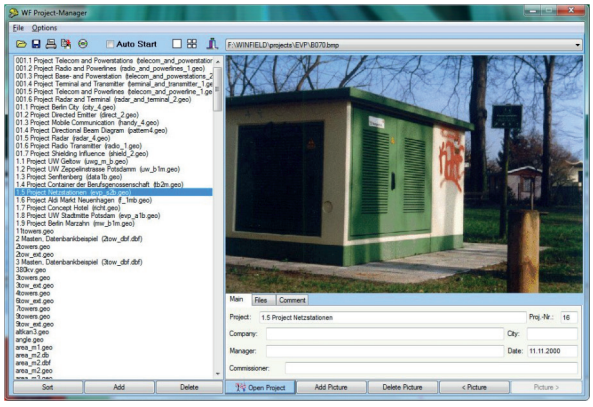


Fig. 3. Project archiving

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.

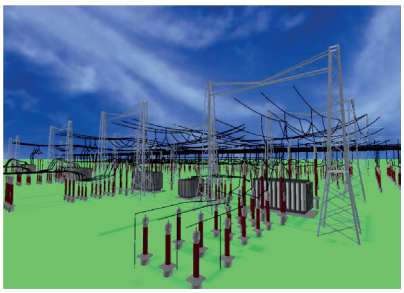


Fig. 4. Magnetic field of a switching substation

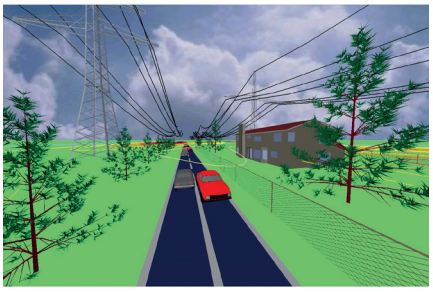


Fig. 5. Field computation with interfering objects

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 eleven 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.

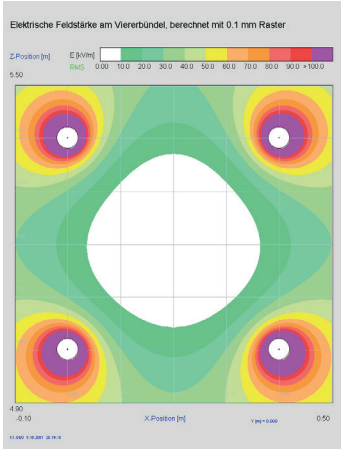


Fig. 6. Four-conductor bundle surface field strength

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.

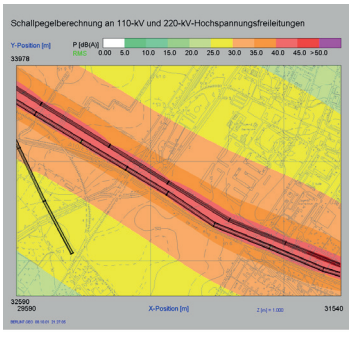


Fig. 7. Noise level computation 1 m above ground

Comparison table

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

* EFC-400EP contains EFC-400TC and EFC400LF
** EFC-400LF includes the full functionality of the EFC-400ST

a Maximum 32,000 x 32,000 calculation points

b Limit value evaluation not possible for dB(A)

Specifications

Computation of electric and magnetic fields

Computation according to EN 50413, 26. BImSchV, ICNIRP and EU standards. Power supply lines – according to EN 50413.

Magnetic field computation
3D calculations of Biot-Savart equation
Calculation of RMS values, 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 4,000,000 conductors
Maximum 600 power supply and overhead lines
Maximum 2,000 masts
Maximum 100 isolated masts
Maximum 200,000 buildings
Maximum 200,000 blocks

Computation
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

Data display
X, Y, Z plot
2D contour line display
3D surface display
Conductor representation
Statistics and histogram functions
Average value, L05, L50, L95 values
Zoom functions
Proportionl view

Special computing features
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

Integrated tools
Editor, Calculator
Paint tool
DXF object filter

Computation of electric field
Up to 1000,000 load segments
Ground effects
Gauss-Jordan or Sparse Matrix Inversion
Effects of masts and buildings

Hardware requirements
Intel multi-core 3 GHz Processor, 4 GB RAM, HD 500 GB free space
Windows® XP, Windows® 7, Windows® 8, Windows® 10, Windows ® 11

Performance features
Maximum 3,000,000 points/second (with 3 GHz CPU)
32-bit runtime version for external computation
Batch job available
Integrated data compression
User interface configuration
User-defined settings for colors
Support of 16, 256 and 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 text format)
Export of 4D color surfaces
Export / import of dBaseTM and ParadoxTM files
Bitmap, WMF, JPG, HTML and CD export

Ordering information

EFC-400 Simulation Software, Hard key License

The hard key (dongle) license is a permanent license that can be used by one user at a time. No need for internet access. Procurement of the 'annual update and upgrade' is not mandatory but highly recommended to get access to all the latest features and bug fixes.

Model and article names	Part number
EFC-400EP, Enterprise – includes the high frequency module and all low frequency (EFC-400PS not included) modules (see separate data sheet)	**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, LF Plus Sound – LF version additionally with "corona" noise simulation	**2900/104/***
EFC-400TC, Telecom., 'language' – high frequency module	**2900/105/***
(*) Add suffix for language version: /E Spanish, /F French, /GER German, /I Italian, /UK English	**/***
Annual update and upgrade on request only	**2900/201/* -/202/* -/203/* -/204/* -/205/***

EFC-400 Simulation Software, Network License

The network license is a subscription license on an annual basis that can be shared by multiple users (concurrent/floating license). The user needs access to the license, via access to the company network (local or via VPN). With local network there is no need for internet access. All updates and upgrades during the subscription period are included.

Validity period of one year (1Y)

Model and article names	Part number
EFC-400EP, Enterprise - Network, 1Y – includes the high frequency module and all low frequency (EFC-400PS not included) modules (see separate data sheet)	**2900/301/***
EFC-400LF, Low Frequency - Network, 1Y – computes transformer station and high tension lines	**2900/302/***
EFC-400ST, Station - Network, 1Y – low frequency limited to transformer station computation	**2900/303/***
EFC-400PS, LF Plus Sound - Network, 1Y – LF version additionally with “corona” noise simulation	**2900/304/***
EFC-400TC, Telecom., ‘language’ - Network, 1Y – high frequency module	**2900/305/***
(*) Add suffix for language version: /E Spanish, /F French, /GER German, /I Italian, /UK English	**/***
EFC-400EP, Enterprise - Network, 1YExtension	**2900/401****
EFC-400LF, Low Frequency - Network, 1YExtension	**2900/402****
EFC-400ST, Station - Network, 1YExtension	**2900/403****
EFC-400PS, LF Plus Sound - Network, 1YExtension	**2900/404****
EFC-400TC, Telecom - Network, 1YExtension	**2900/405****
(**) Current license number must be provided	

Validity period of three years (3Y)

Model and article names	Part number
EFC-400EP, Enterprise - Network, 3Y – includes the high frequency module and all low frequency (EFC-400PS not included) modules (see separate data sheet)	**2900/501/***
EFC-400LF, Low Frequency - Network, 3Y – computes transformer station and high tension lines	**2900/502/***
EFC-400ST, Station - Network, 3Y – low frequency limited to transformer station computation	**2900/503/***
EFC-400PS, LF Plus Sound - Network, 3Y – LF version additionally with “corona” noise simulation	**2900/504/***
EFC-400TC, Telecom., ‘language’ - Network, 3Y – high frequency module	**2900/505/***
(*) Add suffix for language version: /E Spanish, /F French, /GER German, /I Italian, /UK English	**/***
EFC-400EP, Enterprise - Network, 3YExtension	**2900/601****
EFC-400LF, Low Frequency - Network, 3YExtension	**2900/602****
EFC-400ST, Station - Network, 3YExtension	**2900/603****
EFC-400PS, LF Plus Sound - Network, 3YExtension	**2900/604****
EFC-400TC, Telecom - Network, 3YExtension	**2900/605****
(**) Current license number must be provided	

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